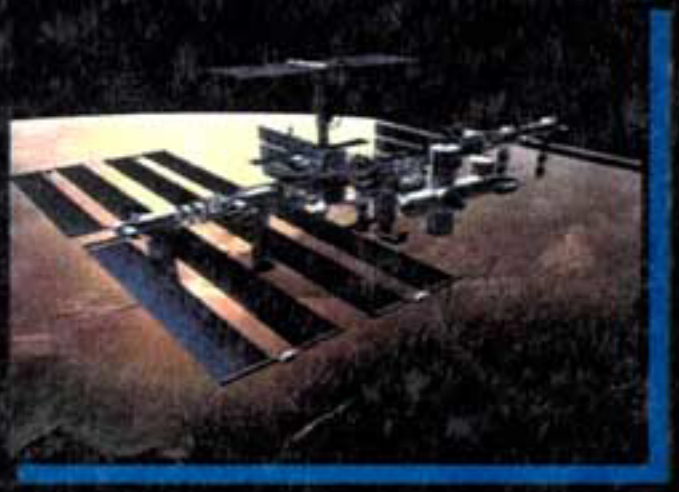


Health Surveillance/Maintenance in the Workplace

An Occupational Health Continuing Education Series

March 5 - August 31, 1999

NASA SEMINAR SERIES

HEALTH SURVEILLANCE / MAINTENANCE IN THE WORKPLACE –

Perspectives in the United States and Selected Countries

Presentation Location: Room CD61, NASA Headquarters, 300 E Street, S.W., Washington, D.C.
Live Video Teleconferencing: 14 NASA Centers; Yale University; Uniformed Services University of the Health Sciences (USUHS); Institute for Biomedical Problems, Moscow; Russia; Institut Europeen de Telemedicine,Toulouse, France
Live Internet: Connection: Multicast supporting network systems
Continuing Education: CME, CNE, and ACHE offered through USUHS Continuing Health Education Department; and certification maintenance points from the American Board of Industrial Hygiene
Seminar Moderating - Catherine Angotti, R.D., L.D., Occupational Health Program Executive, Office of Health Affair, OLMSA/NASA HQ
Course Director - Wing T. Chan, Ph.D., S.M., Sr. Public Health Officer, Office of Health Affairs, OLMSA/NASA HQ

Session 1:

Date/Time - March 5, 1999 (Friday, 900–1230)

Opening Remarks - Arnauld Nicogossian, M.D., M.S., Associate Administrator, Office of Life and Microgravity Sciences and Applications, NASA HQ

Seminar Introduction - Wing T. Chan, Ph.D., S.M., Sr. Public Health Officer, Office of Health Affairs, OLMSA/NASA HQ

Title - **"Workplace Health Surveillance/Maintenance in the United States"**

(1) Federal Perspective

Speaker – Michael J. Hodgson, M.D., M.P.H., Sr. Scientist Office of the Director, National Institute for Occupational Safety and Health (NIOSH), Washington Office

(2) Corporate Perspective

Speaker – Benjamin Ramirez, M.D., M.P.H., FACOEM, Associate Medical Director, Du Pont Company, Wilmington, Delaware

Session 2:

Date/Time - March 19, 1999 (Friday, 1030-1230)

Title - **"Overview of Workplace Health Surveillance/Maintenance and Other Specific Issues in Japan, Russia, and China"**

(1) Japan

Speaker - Heihachiro Arito, Dr. Med. Sci., Director, Div. of Hazard Assessment, National Institute of Industrial Health, Ministry of Labor, Japan

(2) Russia

Speaker – Vladimir Subbotin, M.D., Deputy Director, Institute for Medicine of Labour, Moscow, Russia
Albert Nechaev, Ph.D., Chief Scientist, State Research Center of Russian Federation, Institute for Biomedical Problems, Moscow, Russia

(3) China

Speaker – Jun -Yao Li, M.D., Sr Scientist/Professor, Chinese Academy of Medical Sciences and the Peking Union Medical College, Beijing, China

Session 3:

Date/Time – April 8, 1999 (Thursday, 0930-1230)

Title - **"Overview of Workplace Health Surveillance/Maintenance and other Specific Issues in Canada, and France"**

(1) Canada

Speaker – Robert F. Whiting, Ph.D., Sr. Project Manager , Canadian Center for Occupational Health and Safety, Hamilton, Ontario, Canada

(2) France

Speaker – Michel Lavollay, M.D., Counsel for Health Affairs, Embassy of France, Washington, D.C.

Session 4:

Date/Time - May 3, 1999 (Monday, 1030-1230)

Title - **"Women Health and Susceptibility Screening in the Workplace"**

(1) Women Health Policies/Programs

Speaker – Wanda Jones, Ph.D., Deputy Assistant Secretary for Health (Women Health), Dept. of Health and Human Services, Washington, D.C.

(2) Women Health Risk Assessment

Speaker – Suzanne Haynes, Ph.D., Assistant Director for Science, Office on Women 's Health, Dept. of Health and Human Services, Washington,

DC.

(3) Age / Sex / Genetic Susceptibility Screening (scientific merit and informed consent basis)

Speaker – Arnauld Nicogossian, M.D., M.S., Associate Administrator, OLMSA/NASA, HQ

Session 5:

Date/Time - May 14, 1999 (Friday, 1000-1130)

Title - **"Joint Commission International Accreditation of Healthcare Delivery Systems"**

Speaker - K.Tina Donahue, MM, RN, President, Joint Commission Resources, Inc., Oakbrook Terrace, Illinois

Session 6:

Date/Time – June 7, 1999 (Monday, 1030-1300)

Title - **"Injury Treatment and Disease Management "**

(1) New Trend

Speakers - Arjun Chanmugam, M.D., Clinical Director/Assistant Professor, Dept. of Emergency Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland

James Nichols, Ph.D., Director, Point of Care Testing; Associate Prof. Clinical Chemistry Division, Johns Hopkins U

(2) Workers Compensation and Americans with Disability Act

Speakers - Christopher Holland, M.D., M.P.H., Asst Professor, Dept. of Preventive Medicine, USUHS, & President, Occupational / Environmental Medicine Inc;
Paul Healey, M.D., M.P.H., Sr. Area Medical Director, U.S. Postal Service, NE Region, Connecticut;
Peggy Mastroianni, Associate Legal Counsel, Equal Employment Opportunity Commission

Session 7:

Date/Time – June 24, 1999 (Thursday, 1030 – 1300)

Title – **"Overview of Workplace Health Surveillance/Maintenance and Other Specific Issues in Germany"**

Speakers – Giso Schmeisser, M.D, Head, Section "Company Doctors", Central Bureau of Industrial Accidental Insurance, Sankt Augustin, Germany

Edith Perlebach, Ph.D., Head, Occupational Health Dept., Central Bureau of Industrial Accidental Insurance, Sankt Augustin, Germany

Title – **"Workplace Health Surveillance/Maintenance Program at NASA"**

Speaker – William Barry, M.D., M.P.H., Manager, Agency Occupational Health Program, Kennedy Space Center, NASA

Session 8:

Date/Time –July 6, 1999 (Tuesday, 0930-1200)

Title - **"Aerospace Medicine and Workplace Hazard"**

(1) Overview of Aerospace Medicine and Workplace Hazard

Speaker - Richard S. Williams, M.D., M.P.H., FACS, Director, Office of Health Affairs,OLMSA/NASA HQ

(2) Agency Space Medicine Program at NASA

Speaker - Roger D. Billica, M.D., Chief, Medical Operations Branch, Space and Life Sciences Directorate, Johnson Space Center, NASA

(3) Astronauts Longitudinal Study

Speaker - Mary Wear, M.P.H., Ph.D. candidate, Supervisor, Epidemiology Section, Johnson Space Center, NASA

Session 9:

Date/Time – July 23, 1999 (Friday, 1330-1600)

Title - **"Environmental and Occupational Hazards"**

(1) Biological (bloodborne pathogens, TB, other pathogenic agents ...)

Speaker - Deborah Wilson, Dr. P.H., Chief, Occupational Safety /Health Branch, National Institutes of Health, Bethesda, Maryland

(2) Physical (lightning and electrical shock, stress in extreme environment, ionizing and non-ionizing radiation including laser...)

Speaker s – Virgil Casini, Occupational Safety & Health Manager, Division of Safety Research, NIOSH, Morgantown, W. Virginia
Jeffrey Pfoutz, Laser Safety Physicist, Center for Health Promotion and Prevention, U.S. Army

(3) Chemical (hydrazine, monomethyl hydrazine, isocyanates, dimethyl ethoxysilane, epoxy resins, acrylonitrile, methylene dianiline....)

Speaker - James M. Boiano, M.S., CIH, Div. Of Surveillance, Hazard

Evaluation & Field Studies, National Institute for Occupational Safety and Health, Cincinnati, Ohio

Session 10:

Date/Time – August 9, 1999 (Monday, 1300-1400)

Title – **"Patient Safety and Health Care"**

Speaker – Charles R. Denham, M.D., President & CEO, Health Care Concepts, Inc., Austin, Texas

Session 11:

Date/Time – August 16, 1999 (Monday, 1030-1200)

Title - **"Nutrition / Nutritional Supplement: An Alternative Approach for Health Maintenance in the Workplace"**

Speakers– Catherine M. Angotti, R.D., L.D., Occupational Health Program Executive, Office of Health Affairs, OLMSA/NASA HQ
Scott M. Smith, Ph.D., Research Nutritionist, Life Sciences Research Laboratories, Johnson Space Center, NASA

Session 12:

Date/Time - August 31, 1999 (Tuesday, 1030-1230)

Title - **"Emerging Trends and Policy of Workplace Health Surveillance/ Maintenance in the 21st Century"**

Speaker - Arnauld Nicogossian, M.D., M.S. , Associate Administrator, OLMSA/NASA HQ

Health Surveillance/Maintenance in the Workplace –
Perspectives in the United States and Selected Countries

Session 1—Workplace Health Surveillance/Maintenance in the United States
March 5, 1999

Ms. Cathy Angotti, Program Executive for Occupational Health, introduced the fifth in a series of continuing education programs sponsored by NASA's Occupational Health Program, Office of Health Affairs (OHA), in cooperation with the Uniformed Services University of the Health Sciences (USUHS).

Dr. Arnauld Nicogossian, Associate Administrator of NASA's Office of Life and Microgravity Sciences and Applications, welcomed the guest speakers and made a few introductory remarks. About a year and a half ago, a series of seminars pertaining to health issues was initiated. He thanked Ms. Angotti and Professor Chan who have been moving these activities forward. The numbers of activities have been increasing, and NASA and USUHS are starting to explore additional avenues for expansion, including the European Institute of Telemedicine. OHA has been working to provide goals, direction, and continuing education programs in the area of improving skills and bringing topics of interest to people in occupational health and space medicine. All NASA Centers are connected live, as well as the Moscow Institute of Biomedical Problems and USUHS. NASA Headquarters is experimenting at this session with using the Internet to connect Headquarters personnel with the conference through their desktop PCs.

Dr. Nicogossian briefly reviewed the recently sponsored course on Bioethics, which was held October 23 - December 8, 1998. Six category one Continuing Medical Education (CME) credits were granted; eight Continuing Nursing Education (CNE) credits; and eight credits from the American College of Healthcare Executives (ACHE). Eighty-five individuals sent in written applications for educational credits; NASA participants applying for education units were located at Ames, Headquarters, Kennedy, and Stennis. At least thirty people who did not apply for credits participated in Moscow and here at Headquarters. Over the next several months, the educational series will address health surveillance/maintenance, globalization of health education, women's health, new concepts in injury treatment and disease management, medicine of the aerospace workplace, environmental and occupational hazards, nutrition and alternative approaches for health maintenance, and emerging trends and policies. Dr. Wing Chan from UHUHS, who has been the coordinator of the program since the beginning, has recently joined NASA as a senior public health official.

Dr. Chan elaborated on the continuing education seminar series. In the past, NASA has been using the Videoconference Telecommunications System (ViTS) for transmission of the lectures to NASA Centers, Russia, USUHS, and Yale, with videotaping and subsequent publication of proceedings. The first series (in July 1997) was on Occupational Health Policies, Programs, and Research in the United States; the second was on Public Health Policies, Program, and Research in the United States—a Federal Perspective, with participation by the Centers for Disease

Control, the Food and Drug Administration, and the National Institutes of Health; the third series included international coverage—an Overview of Public Health Policies, Programs, and Research in Seven Foreign Countries and Their Comparison with Those in the US. The fourth seminar was an Overview of Bioethics in the U.S. and selected Countries (France, Germany, Canada, Japan, Russia, China, and India). Future seminars are planned in 2000 on the topics of Emerging Diseases (including infectious diseases) and Aging. These continuing education programs offer CME credits, CNE credits, and credits from the ACHE. In addition, from this session onward, NASA has applied for continuing certification maintenance points from the American Board of Industrial Hygiene. Other initiatives in the education outreach program include using the Internet for worldwide transmission and Internet 2 for live transmission to Network universities, NASA centers, and other government agencies. Dr. Chan briefly introduced this series. Session 1 (this session) is on workplace health surveillance/maintenance in the United States; the second session and third sessions (March 19 and April 8) will extend the topic to cover workplace health surveillance/maintenance and other specific issues in selected partner countries (Japan, Russia, and China; and Canada, Germany, and France); the fourth session (May 3) will address women's health and susceptibility screening in the workplace; session five (May 14) presents the Joint Commission International accreditation of healthcare delivery systems; session six (June 7) will be on injury treatment and disease management; session seven (June 24) overviews workplace health surveillance and maintenance programs in Germany and at NASA; session eight (July 6) will focus on aerospace workplace hazards and medicine; the ninth session (July 23) is on environmental and occupational hazards; session ten (August 9) discusses patient safety and health care; session eleven (August 16) will be on nutrition and nutritional supplements; and the last session (August 31) will be a wrap-up by Dr. Nicogossian on emerging trends and the policy of workplace health surveillance/ maintenance in the 21st century.

Federal Perspective

The first speaker was Dr. Michael J. Hodgeson, currently Senior Scientist in the Office of the Director at the National Institute for Occupational Safety and Health (NIOSH), who presented a Federal (and NIOSH) perspective on health surveillance and maintenance. NIOSH was established by the Occupational Safety and Health Act (OSHA) of 1970 to conduct research (both basic and applied), make recommendations, provide technical assistance, and train occupational safety and health professionals. NIOSH has not had a substantial increase in funding in parallel with the NIH, although the annual burdens (in billions of dollars) of occupational disease and injury are greater than AIDS, Alzheimer's, circulatory disorders, and cancer. Because of the discrepancy between the estimates of the burdens of occupational disease and injury the real spending, the Director of NIOSH has developed the National Occupational Research Agenda (NORA), which generated twenty-one priorities among a series of external stakeholders, both federal and non-federal, and which reflect a high concurrence among the various stakeholders. They consider both our current and emerging needs, including the "consensus" important topics. NORA has three groups of topics—disease and injury, work environment and workforce, and research tools and approaches. The list of disease and injury is widely known in the occupational health and safety community. There are great weaknesses in our ability to count these over time. Traumatic injuries have the best surveillance systems.

Workforce and environment are major issues. The workforce and the work environment are changing. Organization of work and work stress are major problems for the emerging workplace. In the workplace, many of the cancer research methods are inadequate. For many of the exposures, finding assessment methods that are sensitive enough to average exposures and exposures over time are very important. A major topic of controversy is risk assessment methods. The social and economic consequence of workplace illness and injury in the burden of disease document that NIOSH is developing is a major topic. NIOSH feels that surveillance research methods by themselves are 70 to 80 years behind where surveillance and modern health research are.

There are three important lessons: (1) case-based and rate based surveillance serve two different purposes; (2) scrutiny at the individual, plant, organizational, and national levels require different methods and provide different answers; and (3) for each of these level of scrutiny, the methods are often inadequate. Dr. Hodgeson focused on the definitions and goals of surveillance, medical surveillance, public health surveillance, and a model system framework within an industry. The Federal definition of surveillance is the ongoing systematic collection of data for planning, implementation, and evaluation of pubic health practice. It must be linked to preventive action to be effective. One of the big issues is how to link intervention to the measurement. This requires commitment at different levels of the organization. In all of the surveillance work, there is recognition that surveillance may be case-based or rate-based. Case-based surveillance is that which uses individuals as the outcome, e.g., count event, bodies, adverse effects, etc. Rate-based surveillance has a denominator and we look at changes in numerator over denominator over time. Case-based surveillance serves a variety of purposes; it can be done at the plant level, at a public health agency level, e.g., at the state agency level. There is both Federal and non-federal medical surveillance. There are the Federal OSHA standards that mandate surveillance, and there are the appropriate professional level activities. There are 450 substances for which there are medical surveillance guidelines. The paper cited by Dr. Hodgeson (Murthy, JOEM, 1995; 37:170-184) distinguishes between mandated and professionally appropriate medical surveillance. Dr. Hodgeson noted some of the ones that use spirometry, and think about spirometry as medical surveillance. The Federal standards that mandate medical spirometry surveillance include the asbestos standard, the standard on coal tar pitch volatiles, the cotton dust standard, formaldehyde, and methylene chloride. The coal standard under MSHA requires no spirometry (it requires x-ray surveillance), but NIOSH has a project that suggests that spirometry might also a useful event.

There are stages of data collection, data recording, data evaluation, and intervention. The usual components for such medical standards are hazard identification, identifying target organ toxicity, selection of tests, defining action criteria, standardization of testing, performance, developing a standardized interpretation system, development of confirmation approaches, work fitness, notification, follow up diagnostics procedures, linking biological monitoring to exposure assessment and exposure control, and record keeping. With regard to spirometry in any of the standards that OSHA had listed, one must recognize that there are some problems. The single oldest objective medical test (developed in the 1850s) has a certain amount of day to day and

before/after shift variability (3-4%). There may be 15% variability year-to-year. The annual expected decline from aging is in the range of 1-2%. There are issues around individuals vs. group data and stability, and how clinical data is interpreted. In general, there are lots of medical judgments that have to be made. When we look at newer standards that mandate medical surveillance, things are left increasingly up to the professional judgment of the systems that set up medical surveillance. OHSA recognizes that occupational health is practiced by teams, and those vertically integrated systems include teams include a broad range of professionals. A fair amount of professional judgment needs to be involved. Occupational health practice is not regulated in any formal way. If we think of one of the OSHA standards that is currently under design, the metal working fluids standard, many may know that there have been a number of presentations to the metal working fluids standards committee. We recognize that the diseases associated with metal working fluids are quite difficult to diagnose in the occupational setting, e.g., hypersensitivity pneumenitis (HP) and asthma. How do we easily make a diagnosis? NIOSH put out a criteria document on metal working fluids, which said to use spirometry on the usual things, and use judgment to make a diagnosis. Dr. Hodgeson cited a study by Rose and Trice, which looked at an outbreak of HP among lifeguards. Over half of the patients with symptoms had decreased exercise tolerance, but none of the static tests. The sensitivity of chest x-rays is about 20%. NIOSH recommends traditional testing, but recognizes that it is not very sensitive in identifying HP. Regarding the issue of asthma, the question is: are there criteria to link asthma to the workplace? The answer is yes, and there are four criteria. If patients have more than one of four criteria, there is reason to worry about work-related asthma. Except for data on spirometry and noise, there are almost no mathematical models to look at individual data. On an individual level, medical surveillance is concerned that the group surveillance/Federal perspective may not be as useful or as useful or as encompassing as one would like.

If one goes to public health surveillance, what are the Federal agencies' views? Four agencies do surveillance of groups—NIOSH, the Bureau of Labor Statistics (BLS), OSHA, and the National Center for Health Statistics. In the mid 1980's, there was a broad review of occupational health surveillance. The National Academy of Sciences found that the occupational health surveillance system lags behind other systems by about 70 years. Until 1996, there had not been much progress made in health surveillance. NIOSH's response to this review was to develop a five-pronged approach to surveillance: (1) establish a survey coordination group for strategic plan development; (2) develop a more robust estimate of the burden of disease; (3) address better surveillance methods at the Fed level; (4) provide funding for research methods under this year's round of NORA grants; and (5) develop an integrated Federal systems surveillance document to summarize all of the surveillance systems. Dr. Hodgeson presented a few of the surveillance system currently active at NIOSH, and discussed one of these—the Adult Blood Lead Surveillance System. Many physicians recognize this as a model of one kind of laboratory-based surveillance. It relies on active reporting of routinely collected lead data. One of the weaknesses of a national reporting system is that there is no automatic follow-up, and the reported data is not always acted upon. The National Traumatic Occupational Fatality Survey is a national survey that follow-ups from the fatal accident investigation system. It only captures about 80% of the census of fatal occupational injuries that the BLS collects, but since the 1980's NIOSH has

been collecting data on each occupational fatality in the U.S., and conducting an investigation of the kinds of injuries that lead to fatalities. This has led to a number of national warnings that certain kinds of hazards are easily preventable. NIOSH publishes documents every several years summarizing injury surveillance. The National Electronic Injury Surveillance System (NEISS) is a system that was piggybacked onto the Consumer Product Safety Commission Survey of 66 emergency rooms that looks at the kinds of injuries that lead to emergency room visits. These are different from the kinds of injuries that lead to fatalities, and those that wind up being reported under the Workmen's Compensation System. The National Occupational Mortality Surveillance System is an automatic reporting of death certificates (from 28 states), and automatically codes lifetime occupations. The Sentinel Event Notification System for Occupational Risk (SENSOR) has been around since 1990, developed from a technique established in the 1930's around maternal and fetal mortality in the New York Health Department. At NIOSH, after a series of workshops, SENSOR was established with a series of case definitions for a series of different conditions, e.g., asthma, carpal tunnel syndrome, etc. The case definitions are things of much controversy. A number of states were selected as model programs. SENSOR is a case-based reporting system; i.e. individual cases of asthma are reported. The system consists of voluntary reporting, site visits with follow-up, and NIOSH notification. One of the workplace concerns is the indoor environment. Although engineering standards exist and there are a number of hygiene approaches to indoor air, there is no uniform national satisfactory solution. A number of consensus standards have been proposed, but nothing is being developed. In looking at the SENSOR system, for the three years of data (1993-1995), 7-8% of the asthma cases reported to NIOSH were attributed to buildings. In the two states that have the most physician interests—Massachusetts and Connecticut—the rates are closer to 25% for the last two years. NIOSH had done a series of health hazard evaluations on buildings. In buildings with moisture problems, there is a fivefold rate of chest tightness and difficulty with breathing.

The next agency—BLS—conducts an annual survey (a stratified random survey) of 38 participating states by SIC codes with no identifiers. Part 1 has SIC codes and broad outcomes; Part 2 has detail on individual data. On the bases of this data, BLS estimates disease frequency and rates, and there are some experimental approaches to developing state estimates. The BLS survey includes trend data on occupational illnesses (1972 - 1996). There was a tenfold increase in repetitive trauma illnesses from 1972 - 1994. Within industry, there has been considerable effort in fixing this problem since the early 1990's, and since 1994, there has been a decrease in the number as well as in the rate of repetitive trauma illnesses. Separately from NIOSH and BLS, OHSA puts out standards that sometimes have medical surveillance components. OHSA has its own need for data, and tried an initiative (struck down by the courts in 1994) to target "bad actors." There are some alternative approaches under the voluntary protection program whereby people provide their own rates and work with OHSA to reduce those rates. Other surveillance systems national in scope but not Federal include: the Workers Compensation National Model System (since discontinued); the insurance industry surveys; state-based non-Federally funded programs similar to SENSOR; and Sentinel Health Events approaches within organizations and clinical providers.

Dr. Hodgeson presented a model system that the NIOSH has helped develop around health care workers. Within the health care industry, surveillance can serve as a quality tool. NIOSH partnered with another Federal agency to develop an occupational safety and health quality index to have benefits for individual workers and let the agency as a whole recognize how their units were working. The structure was to develop metrics in economics, e.g., lost time claims and workers compensation costs, vaccination, tuberculosis, and violence prevention. There was a series of workshops and meetings to develop quality indicators for blood borne pathogens (bbp). It included training documentation/compliance, needle stick tracing/reporting, protective devices, rate of bbp exposures from failure to follow universal precautions, and the number of needle stick injuries. On the basis of the quality indicators, the organization put together an integrated occupational health and safety monitoring program that it uses nationally, and there will be surveillance data this year which will be used in evaluations. In summary, surveillance at the Federal level is a many splendored thing. It is antiquated but improving, and improving at different rates of speed in different places. Overall, surveillance can be tremendously useful.

Questions/answers:
KSC: The repetitive trauma decline and the feed back loop are interesting data. Are efforts going on to study what has been done in the repetitive trauma arena that might be applicable to some of the other NORA agenda target areas, e.g., the educational campaigns, the involvement of industry, etc.? Is anyone looking at the ergonomics side and applying it elsewhere?
Dr. Hodgeson: The 21 teams are doing so much independently that it is hard for any one person to know everything that is going on. There are a number of surveys in process. The NORA liaison committee is doing a survey to look at what resources different members have allocated to NORA topics, e.g., what corporations are spending on ergonomics research in house and on education and training. At the local level, I am unaware of what corporation has done what, although there are a number of corporations looking at intervention strategy. There is no systematic summary of this data.
KSC: It is interesting to note the decline in the absence of a regulatory front on that area of concern. Something is driving it.
Dr. Hodgeson: OSHA has proposed a series of ergonomics interventions for years, beginning with the meat-pacing guidelines. OSHA has been trying to do an ergonomics standard, and within the professional community, the solutions have been out there for some time. NIOSH has a lesson from the asphalt partnership. About six years ago, OSHA thought about passing a standard on asphalt and regulating it as a carcinogen. There was a fair amount of controversy, and industry, DOT, and OSHA met and came up with a paver redesign that reduced exposures by about 80%, and made the problem far more acceptable very quickly. The interest in regulating asphalt as a carcinogen may have generated the partnership to take some action. The solutions have come without regulatory threat, but the increase in ergonomics issues is clearly documentable beginning in the mid1980's, and at that time it was very difficult to get labor and management to see eye to eye on this. Although action may be happening without regulation, it is happening within a "regulatory environment."

Dr. Chan: Are all the BLS statistics based on medically confirmed as work-related cases?
Dr. Hodgeson: External validity with national data systems is a major issue. This is one of the strongest arguments for case-based surveillance. A first issue is: how valid is the data in the "200 logs?" Most feel that the 200 logs are poor in term of data quality. Far more interesting is how the rates estimated by these systems compare to rates of "real" data. There are relatively few data that answer this question. NIOSH funded a health services research grant to see what proportion of things that people called work-related upper extremity pain were actually filed as Workers Compensation claims, and which were accepted in the Workers Compensation System. Only about 20% of things people experience as work-related hand and arm pain led to filed claims; an even smaller proportion led to accepted claims. The 80-90% of claims that might be solvable might have real solutions that could lead to resource savings. Interventions applied resulting in about a 30% decrease in claims. NIOSH is currently collecting data with two Health Maintenance Organizations looking at the incidence rate of occupational asthma and the underdiagnosis of occupational asthma. There is a similar opportunity to intervene.

Corporate Perspective

Dr. Benjamin Ramirez, Associate Medical Director at DuPont, discussed the corporate perspective on workplace health surveillance and maintenance. He described the history and culture of safe and health in DuPont, discussed the preventive focus of the workplace health surveillance and maintenance programs in DuPont, and discussed the elements needed to ensure consistent application and the success of a workplace health surveillance and maintenance program. In 2002, DuPont will be 200 years old. The company was established in 1802 near Wilmington, Delaware, by a French immigrant, Eleuthere Irenee du pont de Nemours, to produce blackpowder. From the very beginning, DuPont has been concerned about safety. In the early 1900's it was not uncommon to have explosions in a business that handled explosive material. Corporate Safety Policies were established in 1914. Corporate medical policies were established in 1915. In 1915, by action of the Executive Committee, the Corporate Medical Division was formally established. Periodic physical examinations of employees were started. Dr. George Gehrman, the first Medical Director, was a pioneer in occupational medicine in the U.S. DuPont because a chemical company early in the century, and it was discovered that workers exposed to certain chemicals were developing tumors. In 1935, DuPont established the first industrial laboratory for toxicology and industrial medicine. More than fifty years ago, DuPont developed the first alcoholism rehabilitation program in the U.S. This program evolved into an employee assistance program, which is broader than alcoholism. DuPont's hearing conservation program was started in 1954. Another first was DuPont's epidemiology program, including a cancer registry, which began in 1956. In the early 1980's there was a trend to promote health and educate employees about health issues. DuPont initiated a health improvement program in 1984. In 1992, the Integrated Health Care (IHC) organization was created to design, communicate, and implement a comprehensive revision of the health care benefit. Employees receive routine physical exams and preventive health care benefits through their personal doctors.

Dr. Ramirez addressed how DuPont maintains a culture of safety and health among all employees. Over the years, many corporation policies have addressed many aspects of safety, health, and the environment. The corporation developed an umbrella policy in 1994—the DuPont Commitment to Safety, Health, and the Environment. He emphasized three elements from the umbrella policy: the highest standards of performance—business excellence; the goal of zero injuries, illnesses, and incidents; and management and employee commitment and accountability. To help maintain the culture of safety and health, in 1995 a Discovery Team of 30 employees was chartered to define a path to achieve sustainable improvement in safety while simultaneously building business value. The team interviewed more than 1000 employees, customers, vendors, business partners, and community members about their attitudes about safety and what could be done to improve it. It found a dozen attributes that the best sites shared: commitment from management; integration of safety and health in business plans; varied and regular communication; work processes and systems reflecting a team orientation; great attention to operating discipline; varied and regular auditing; investigation of deviations; continual training; varied measurements and metrics; visible recognition and rewards; personal responsibility, and inclusion of safety, health, and environmental professionals as integral members of the business. The best manufacturing sites have these attributes. The Team was revived last year to ensure continuing improvement in safety performance during periods of major organizational change, and to develop a process or set of processes to engage current and future senior leadership who will be leading major change efforts. Out of the Team, two questions were developed for senior leadership (relevant to the NASA organization): What are the primary factors that, if left unattended, will result in increased injuries and incidents? What must each of us as leaders do differently to ensure continuing progress towards zero injuries (during a period of sustained and accelerated business and organizational change)? Leaders in industry and government need to ask themselves these questions if they want to prevent injuries and incidents.

Dr. Ramirez discussed the preventive focus of safety and health maintenance in DuPont. There are three levels of prevention: primary prevention—prevention of the occurrence of disease or injury; secondary prevention—early detection and intervention, preferable before the condition is clinically apparent and has the aim of reversing, halting or at least retarding the progress of a condition; and tertiary prevention—minimizing the effect of disease and disability by surveillance and maintenance aimed at preventing complications and premature deterioration. In the most recent decades, industry is focusing more on secondary and primary prevention. For primary prevention, DuPont focuses on engineering controls, education and training, administrative controls, and personal protective equipment. In all of the manufacturing facilities, DuPont has this primary focus. As technology has improved, the on-site routine medical examinations became more comprehensive. Also, the frequencies of the exams changed; initially, they were provided to all employees every year. As the medical field improved, the frequency of the exams changed based on age. In 1994, DuPont began the managed care program, and the general health exams are now provided by the family physician of the employees. The DuPont medical facilities are now focused on primary prevention. Dr. Ramirez described some primary prevention daily activities: agent-specific biological monitoring (e.g., dimethylformamide);

education about appropriate use of personal protective equipment; education on government standards and company policies; ergonomic audits and survey; counseling on international business travel; immunizations (e.g., for international business travel); performing wellness assessments; and counseling on personal health/lifestyle issues (based on the wellness assessments). Some secondary prevention daily activities include: agent-specific medical surveillance (e.g., hearing conservation, fire brigade, chemical-specific, etc.); ergonomic interventions; drug testing for cause and follow-up of rehabilitation cases; and promoting the use of DuPont's Preventive Health Benefit regarding personal health (e.g., well-baby assessments, mammography, pap smears, prostate exams, sigmoidoscopy, etc.). Some tertiary prevention daily activities include: first aid of medical treatment of an on-the-job injury or illness; ergonomic referrals; co-management of cumulative trauma disorders; referral to the Employee Assistance Program; on-site consultation and referral for acute health problems; monitoring blood pressure; and dressing changes, suture removal, etc. There are other activities performed by DuPont that do not fit into the traditional prevention model, e.g., short-term disability case management.

Dr. Ramirez discussed the elements needed to ensure consistent and successful health maintenance programs. First, all of the health care personnel must have a clear understanding of their mission. The DuPont vision is optimum health and wellness for the people of DuPont (employees and dependents), including physical, mental, and social health. DuPont has developed some principles related to the behavior and expectations of health care personnel. These include: providing the best services and programs in the most cost-effective way; continuous improvement; tailoring the best practices to a diverse global workforce, complying with the local ethical, legal, cultural, and medical requirements; ensuring that preventive Integrated Health Services are available to all employees appropriate to their needs and the needs of the business; and providing the business with health metrics and outcomes that demonstrate the value-added by Integrated Health Services to the business and the employees. Traditionally, in occupational medicine, the number of interactions has been counted. This is transactional, and does not address whether or not the interaction makes a difference. Assessment must go beyond merely counting. Another element that must be in place to ensure success of the health maintenance program is the need to focus on the complete individual—physical, mental, and social health. In the past, occupational medicine has focused primarily on the physical part of the employee. DuPont employees are expected to work in teams, and social health becomes very important. Dr. Ramirez briefly mentioned some other changes at DuPont that may have applicability to other organizations. DuPont has gone from an U.S. company to a global organization. Employees may encounter health issues that may not be occurring in the U.S. Another significant factor is downsizing. DuPont has gone through many changes, losing many thousands of employees, and this has put considerable stress in the organization. This has an impact on people. Sometimes restructuring (changing programs, changing focus, etc.) stresses people and has an impact on health surveillance and maintenance. In the 1800's DuPont was an explosives company; in the 20th century it was a chemical company; it is now shifting into life sciences. This has several implications—the need for well-trained medical personnel; and new technologies that may involve new occupational hazards (e.g., the repetitive trauma issues associated with using computers).

DuPont has 51 manufacturing sites with medical offices. Currently, there are about 70 nurses, seven full time physicians, four Physician Assistants, employee assistance counselors, and a whole team of health care providers. Traditionally the program was physician-based; one of the changes has been a shift from a physician-based medical program to a nurse-based medical program. This requires a lot of training and development for nurses and other health care personnel. Dr. Ramirez briefly mentioned some DuPont products, some of which are used in the space industry.

Questions/answers:
KSC: Regarding the shift to primary prevention—has there been any analysis to date on the impacts of this, particularly where employees get medical care outside of the on-site facilities (changes in cost, etc.)? If not, are there any plans to do analysis to see if this has been effective as an early diagnostic tool?
Dr. Ramirez: With respect to primary prevention, this has been an evolution. DuPont has a lot of programs prior to OHSA requirements. In the 1990's DuPont outsourced the general physical health examinations in order to focus on primary prevention. With respect to impact—one of the reasons this was done was that the cost of health care for general health was increasing each year. In the early 1990's, the cost of health care was about $ 500 million per year for the U.S. corporation. The prediction was that this would increase to $1 billion by the late 1990's. This prompted a look at what could be done to control health care costs, and managed care was introduced. The cost has been stationary. The managed care carriers keep track of the use of the health care benefits, and DuPont has those numbers. DuPont does not yet have the data on whether there has been a decrease in general exams as a result of going to managed care. The carrier is expected to promote the health care benefit and encourage the employees to take advantage of it.

NASA SEMINAR SERIES
March 5, 1999

WORKPLACE HEALTH SURVEILLANCE/MAINTENANCE IN THE U.S.

A CORPORATE PERSPECTIVE

Benjamin Ramirez, M.D., MPH, FACOEM
Associate Medical Director
DuPont Company

WORKPLACE HEALTH SURVEILLANCE/MAINTENANCE IN THE U.S. A CORPORATE PERSPECTIVE

- Will describe the history and culture of Safety and Health in DuPont
- Will discuss the preventive focus of workplace health surveillance and maintenance programs in DuPont
- Will discuss the elements needed to ensure consistent application of workplace health surveillance and maintenance

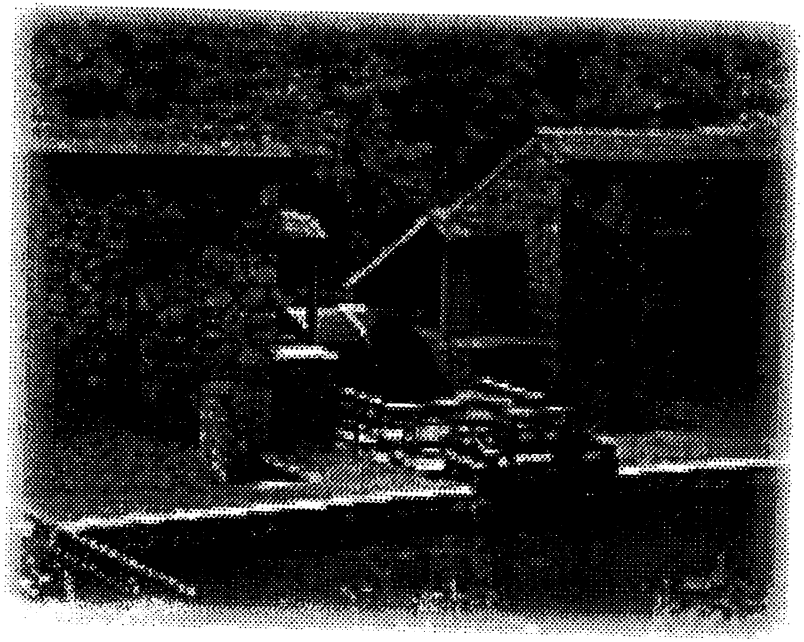
Benjamin Ramirez, M.D., MPH, FACOEM

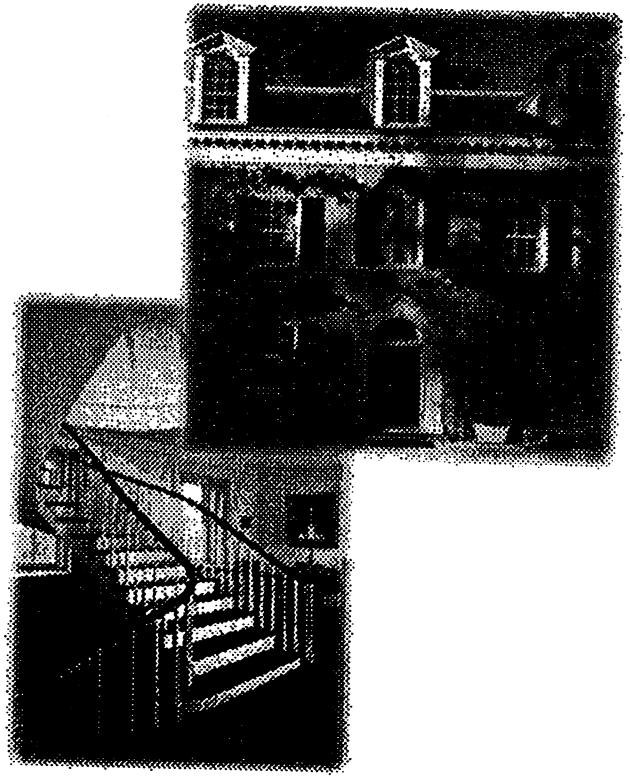
HISTORY - SAFETY

- DuPont is one of the oldest continuously operating industrial enterprises in the world.
- The company was established in 1802 near Wilmington, Delaware, by a French immigrant, Eleuthere Irenee du pont de Nemours, to produce blackpowder.
- From the very beginning, DuPont has been concerned about safety...
- Corporate Safety Policies were established in 1914

Beginnings.....

Our founder,
E. I. du Pont de Nemours





Benjamin Ramirez, M.D., MPH, FACOEM

HISTORY - HEALTH

- Corporate medical policies were established in 1915.
- In 1915, by action of the Executive Committee the Corporate Medical Division was formally established. Periodic physical examinations of employees were started.
- George H. Gehrman, M.D. was DuPont's first Medical Director

HISTORY - HEALTH

- 1935 - The Haskell Laboratory for Toxicology and Industrial Medicine was established.
- 1942 - The first industrial alcoholism rehabilitation program was developed.
- 1954 - DuPont's Hearing Conservation Program was started.
- 1956 - The first industrial epidemiology program to include a cancer registry was begun.
- 1984 - Introduction of Health Horizons, the DuPont employee health improvement program was initiated.
- 1992 - The Integrated Health Care (IHC) organization was created to design, communicate, and implement a comprehensive revision of the health care benefit.

1994 - The Du Pont Commitment Safety, Health and the Environment

- Highest Standards of Performance, Business Excellence
- Goal of Zero Injuries, Illnesses and Incidents
- Goal of Zero Waste and Emissions
- Conservation of Energy and Natural Resources, Habitat Enhancement
- Continuously Improving processes, Practices and Products
- Open and Public Discussion, Influence on Public Policy
- Management and Employee Commitment, Accountability

1994 - The Du Pont Commitment Safety, Health and the Environment

- **Highest Standards of Performance, Business Excellence**
  .....We will strengthen our businesses by making safety, health and environmental issues an integral part of all businesses activities and by continuously striving to align our businesses with public expectations.

- **Goal of Zero Injuries, Illnesses and Incidents**
  We believe that all injuries and occupational illnesses, as well as safety and environmental incidents, are preventable, and our goal for all of them is zero. We will promote off-the-job safety for our employees.

  We will assess the environmental impact of each facility we propose to construct and will design, build, operate and maintain all our facilities and transportation equipment so they are safe and acceptable to local communities and protect the environment.....

- **Management and Employee Commitment, Accountability**
  .....Compliance with this commitment and applicable laws is the responsibility of very employee and contractor acting on our behalf and a condition of their employment or contract. Management in each business is responsible to educate, train and motivate employees to understand and comply with this Commitment and applicable laws.....

Benjamin Ramirez, M.D., MPH, FACOEM

1995 DISCOVERY TEAM

- Company chartered a "Discovery Team" of 30 employees from around the world to define a path to achieve sustainable improvement in safety while simultaneously building business value.

- The team interviewed 1,000 employees, customers, vendors, business partners and community members about their attitudes about safety and what could be done to improve it.

- Found a dozen attributes that the best sites shared.

1995 DISCOVERY TEAM ATTRIBUTES

- Demonstrated Commitment from Management
- Integration of safety and Health Activities in Business Plans
- Varied and Regular Communication
- Work Processes and Systems reflect a Team Orientation
- Great Attention to Operating Discipline
- Varied and Regular Auditing
- Investigating Deviations
- Continual Training
- Varied Measurements and Metrics
- Visible Recognition and Rewards
- Personal Responsibility
- Safety, health and Environmental Professionals are Integral Members of the Business

DISCOVERY TEAM 1998

- **PURPOSE**

  Ensure continuing improvement in safety performance during periods of major organizational change

- **PRODUCTS**

  A process or set of processes to engage current and future senior leadership who will be leading major change efforts.

- **THERE IS A CONSTANT**

  "... although our businesses and organizations will change, our commitment to DuPont's core values will not."

  Chad Holliday April 6, 1998

DISCOVERY TEAM 1998

ORGANIZATIONAL CHANGE

Q. What are the primary factors that, if left unattended, will result in increased injuries and incidents?

Q. What must each of us as leaders do differently to ensure continuing progress towards ZERO injuries (during periods of sustained and accelerated business and organizational change)?

PREVENTION LEVELS

- **PRIMARY PREVENTION**
  Preventing the occurrence of disease or injury
- **SECONDARY PREVENTION**
  Early detection and intervention, preferably before the condition is clinically apparent, and has the aim of reversing, halting or at least retarding the progress of a condition
- **TERTIARY PREVENTION**
  Minimizing the effects of disease and disability by surveillance and maintenance aimed at preventing complications and premature deterioration

PRIMARY PREVENTION FOCUS

- ENGINEERING CONTROLS
- EDUCATION AND TRAINING
- ADMINISTRATIVE CONTROLS
- PERSONAL PROTECTIVE EQUIPMENT

EVOLUTION

From On-Site Routine Comprehensive Medical Examinations

to

- Focus on Primary Prevention
- Improved Work-Related Health Assessments
- Personal Health care by Family Physician

PRIMARY PREVENTION
SOME DAILY ACTIVITIES

- Agent-Specific Biological Monitoring (e.g. Dimethylformamide, etc.)
- Education about appropriate use of Personal Protective Equipment (Hearing Protector, Respirator, etc.)
- Education on Government Standards and Company Policies
- Ergonomic Audits and Surveys
- Counseling on International Business Travel
- Immunizations (e.g. Tetanus, International Business Travel, etc.)
- Performing Wellness Assessments
- Counseling on Personal Health/Lifestyle Issues

SECONDARY PREVENTION SOME DAILY ACTIVITIES

- Agent-Specific Medical Surveillance (e.g. Hearing Conservation, Fire Brigade, Chemical-Specific, etc.)
- Ergonomic Interventions
- Drug Testing for cause and follow-up of rehabilitation cases
- Promoting use of Du Pont's Preventive Health Benefit regarding personal health (Well-Baby Assessments, Mammography, Pap Smears, Prostate Exams, Sigmoidoscopy, etc.)

TERTIARY PREVENTION
SOME DAILY ACTIVITIES

- First Aid or Medical Treatment of an On-the-job injury or illness
- Ergonomic Referrals
- Co-Management of Cumulative Trauma Disorders
- Referral to Employee Assistance Program
- Disability case Management
- Personal Health - On site Consultation and Referral for acute health problems
- Monitoring Blood Pressure
- Dressing changes, suture removal, etc.

GLOBAL VISION
HEALTH SERVICES

Optimum Health and Wellness for the People of DuPont

Benjamin Ramirez, M.D., MPH, FACOEM

GLOBAL MISSION

In partnership with the Businesses and Employees, Integrated Health Services provides leadership, guidance, support and delivery of quality health programs and services.

In A Way That values people by supporting and facilitating the optimal and continual development of:

- **Physical and Mental Health among DuPont people,**
- **Healthy working environments that will achieve the goal of zero occupational injury/illness.**

So That DuPont maximizes its competitive potential through healthy, energetic and productive people.

Benjamin Ramirez, M.D., MPH, FACOEM

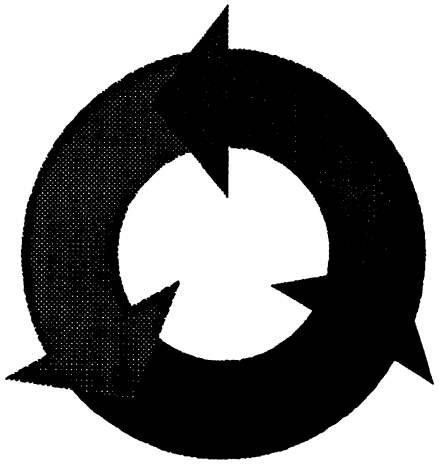
GLOBAL PRINCIPLES
HEALTH SERVICES

1. We will provide the best services and programs in the most cost-effective way responding to the changing needs of the businesses and their people, aligned around our global vision/mission.
2. We will continuously improve by leveraging, integrating, networking and communicating internally and externally to capitalize on the best available expertise.
3. We will recognize that best practices need to be tailored to a diverse global workforce, complying with local requirements (ethical, legal, cultural, medical).
4. We will ensure that <u>preventive</u> Integrated Health Services (occupational medicine, employee assistance programs, personal health) are available to all DuPont employees in a manner appropriate to their needs and the needs of the businesses.
5. We will provide the businesses with health metrics and outcomes that demonstrate the value-added by Integrated Health Services to the businesses and their people.

Benjamin Ramirez, M.D., MPH, FACOEM

FOCUS ON COMPLETE INDIVIDUAL

Physical, Mental and Social Health



Benjamin Ramirez, M.D., MPH, FACOEM

COMPANY CHANGES

- GLOBALIZATION
- DOWNSIZING
- RESTRUCTURING
- LIFE SCIENCES

U.S. HEALTH SERVICES ORGANIZATION

- Out of all U.S. Manufacturing Sites, 51 have Medical offices

- 70 Nurses, 7 Full-time Physicians, 4 Physician's Assistants, Employee Assistance Counselors, Part-time Contract Physicians

PRODUCTS

- Teflon® resins
- SilverStone® non-stick finish
- Lycra® brand spandex fiber
- Stainmaster® stain-resistan carpet
- Dacron® polyester fiber
- Kevlar® brand fiber
- Corian® solid surface material
- Mylar® polyester films
- Tyvek® spunbonded oleofin fabric
- Coolmax® and Cordura® textile fibers

WORKPLACE HEALTH SURVEILLANCE/MAINTENANCE IN THE U.S. A CORPORATE PERSPECTIVE

- Described the history and culture of Safety and Health in DuPont
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Benjamin Ramirez, M.D., MPH, FACOEM

A FEDERAL PERSPECTIVE ON SURVEILLANCE

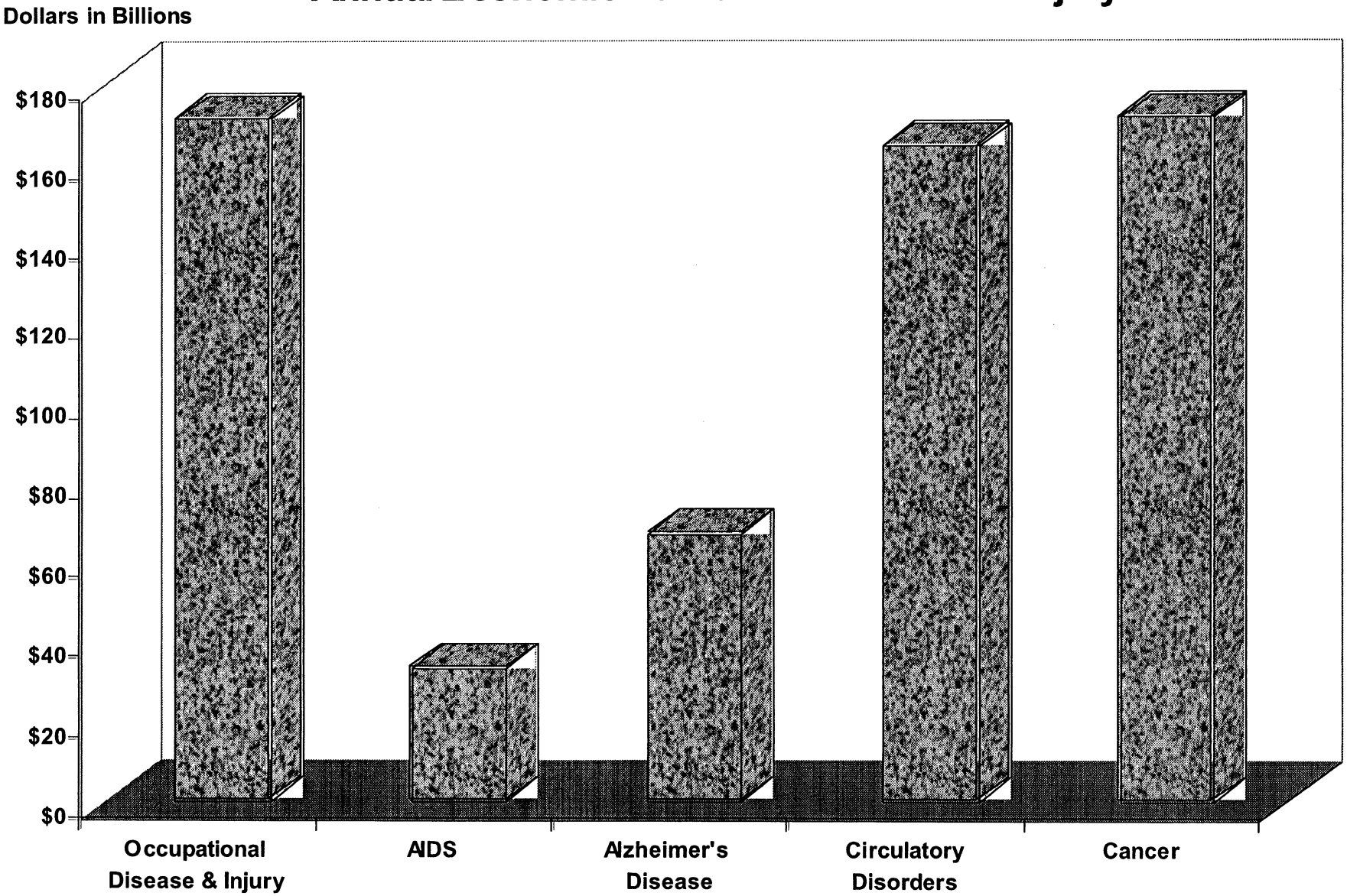
Michael Hodgson, MD, MPH

National Institute for Occupational Safety and Health

NIOSH

- Established by Occupational Safety and Health Act of 1970 to:
  - Conduct research :
    - Basic (Laboratory) and Applied (Workplace)
  - Make recommendations
  - Provide technical assistance
  - Train occupational safety and health professionals

Annual Economic Burden of Disease and Injury



The 21 Priorities

- Reflect high concurrence among stakeholders
- Consider current and emerging needs
- Exclude important topics
- Unranked, in three categories

Disease and Injury

- Allergic and Irritant Dermatitis
- Asthma and Chronic Obstructive Pulmonary Disease
- Fertility and Pregnancy Abnormalities
- Hearing Loss
- Infectious Diseases
- Low Back Disorders
- Musculoskeletal Disorders of the Upper Extremities
- Traumatic Injuries

NORAS021

Work Environment and Workforce

- Emerging Technologies
- Indoor Environment
- Mixed Exposures
- Organization of Work
- Special Populations at Risk

NORAS022

Research Tools and Approaches

- Cancer Research Methods
- Control Technology and Personal Protective Equipment
- Exposure Assessment Methods
- Health Services Research
- Intervention Effectiveness Research
- Risk Assessment Methods
- Social and Economic Consequences of Workplace Illness and Injury
- Surveillance Research Methods

NORAS023

LESSONS

- Case-based vs rate-based surveillance serve different purposes
- Scrutiny at individual, plant, organization, and national level require different methods and provide different answers
- Methods are often inadequate

OUTLINE

- Definitions and goals of surveillance
- Medical surveillance
  - Federally mandated (OSHA...)
  - Other
- Public Health Surveillance
  - Federal systems
  - Other systems
- Model system

DEFINITIONS

- Ongoing systematic collection of data for planning, implementation, and evaluation of public health practice
- Must be linked to preventive action to be effective
- May be case-based or rate-based

MEDICAL SURVEILLANCE

Mandated (OSHA) versus appropriate

[Murthy, JOEM 1995;37:170-184]

asbestos, CTPV, cotton dust, formaldehyde, methylene chloride,...

vs

coal (MSHA)

data collection	data recording
data evaluation	intervention

MEDICAL SURVEILLANCE COMPONENTS

- Hazard identification
- Target organ toxicity
- Selection of tests
- Action criteria
- Standardization of testing
- Performance
- Interpretation
- Confirmation
- Work fitness
- Notification
- (Diagnosis)
- Exposure
- Record keeping

MEDICAL SURVEILLANCE - PFTs

Variability

- Day-to-day/before/after shift: 3-4%
- Year-to-year: 15%
- Annual expected decline: 1 - 2%

Individual vs group data: stability

Cotton dust example

MEDICAL SURVEILLANCE

Methylene chloride standard:

- left up to professional judgement

Metal working fluids:

- Diagnostic criteria/sensitivity of tests
  - Rose 1998: CXR 10%, HRCT 45%
  - Hodgson 1999: CXR 20%, HRCT 44%

Asthma

FEDERAL AGENCIES

National Institute for Occupational Safety and Health

Bureau of Labor Statistics

Occupational Safety and Health Administration

National Center for Health Statistics

NAS 1987: 70 years behind because no coordinated national system

NIOSH RESPONSE

- Surveillance coordination group: strategic plan development
- Burden of disease estimates
- Surveillance methods NORA Implementation team
- Grant funding
- Integrated federal systems surveillance document

FEDERAL SURVEILLANCE SYSTEMS: NIOSH

- Adult Blood Lead Surveillance (ABLES)
- National Traumatic Occupational Fatality survey (NTOF) - FACE
- National Electronic Injury Surveillance System
- National Occupational Mortality Surveillance System (NOMSS)
- Sentinel Event System for Occupational Risk (SENSOR)

SENSOR: Asthma

Established 1990

Case definition

Selected states as model program

Case-based reporting

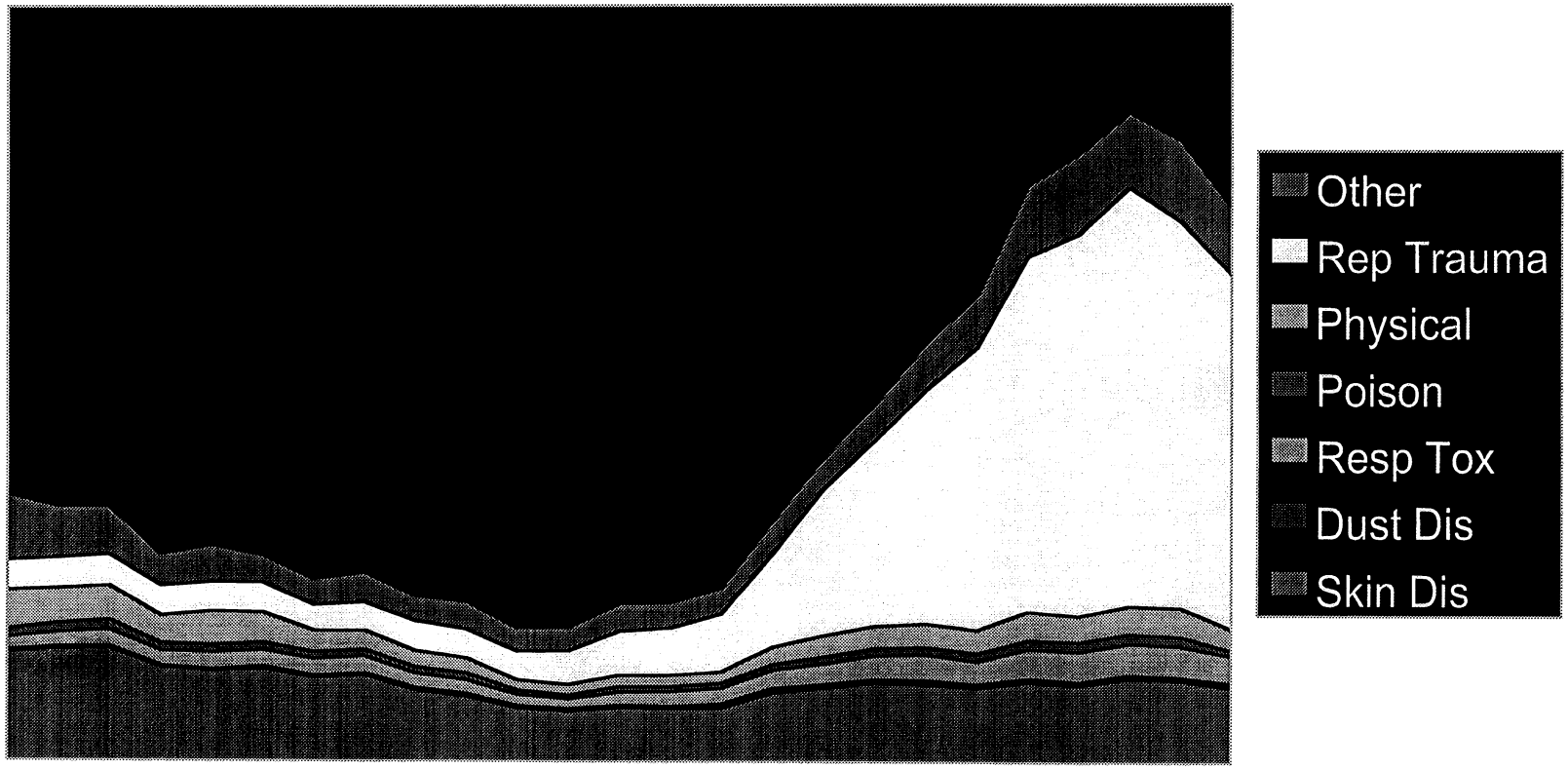
- voluntary reporting
- site visits with follow-up
- NIOSH notification

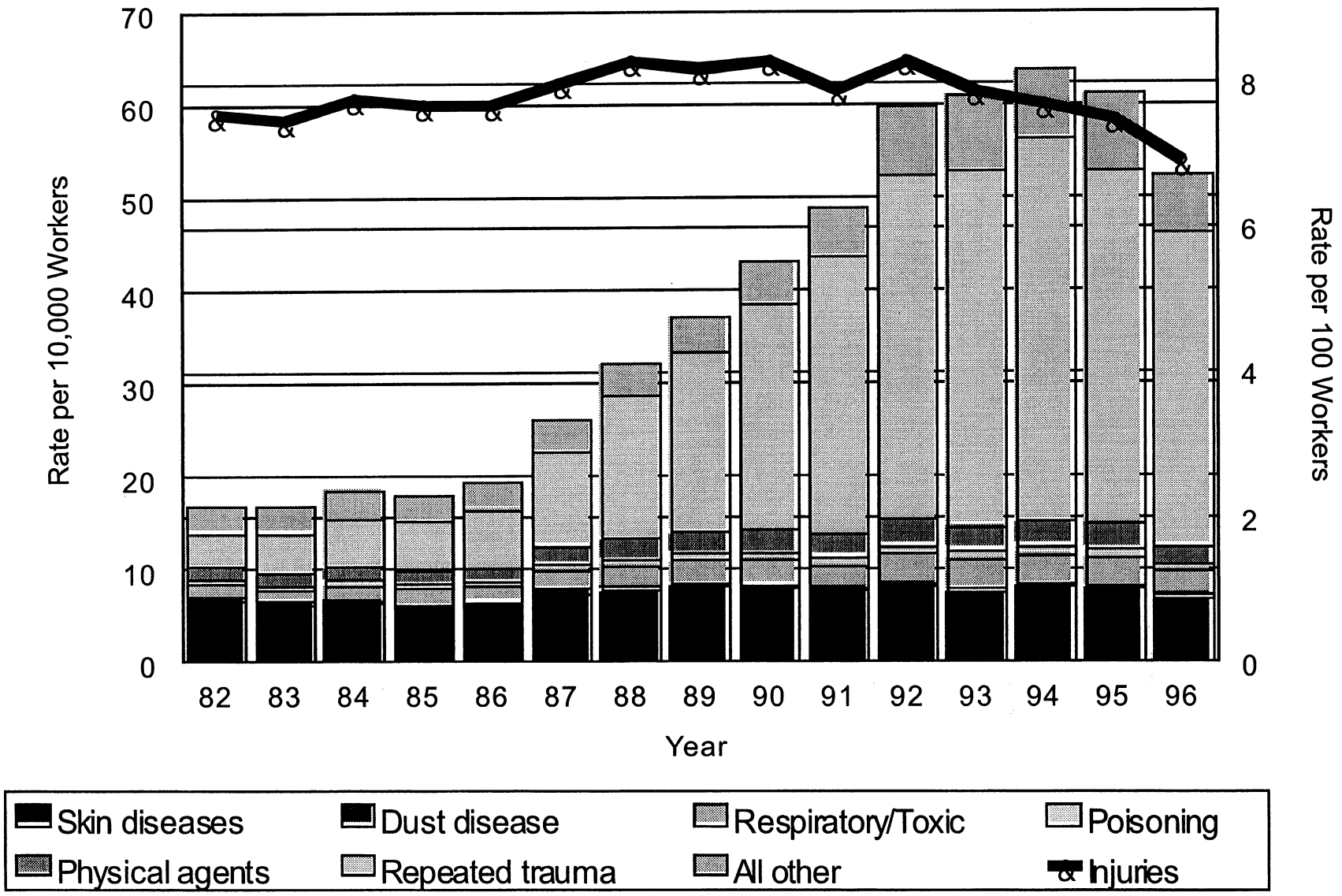
Year	1993	1994	1995
B-r asthma	0.8	0.7	0.8

BUREAU OF LABOR STATISTICS

- Annual survey: stratified random survey of 38 participating states by SIC codes, no identifiers
- Part 1 vs part 2
- National estimates of disease frequency and rates
- "Experimental" state estimates
- also: Current Population Survey for NCHS

Occupational Illnesses, 1972-1996




70
60
50
40
30
20
10
0
Rate per 10,000 Workers
8
6
4
2
0
Rate per 100 Workers
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
Year
Skin diseases
Dust disease
Respiratory/Toxic
Poisoning
Physical agents
Repeated trauma
All other
Injuries

OSHA Data Initiative

Need for targeted data for enforcement vs BLS anonymity

1994 Initiative

80,000 sites per year, 50% resampling

OSHA 200 log/BLS Part 1

OTHER SYSTEMS

Workers Compensation: national model system

Insurance industry: economics, risk rating

State-based, non-federally funded similar to SENSOR

OTHER NIOSH/FEDERAL SURVEILLANCE ACTIVITY

- ID epidemiology -> hospital QA
- Surveillance as a quality measure
- NIOSH partnership with another federal agency
  - Occupational Safety and Health Index
  - Model System
  - Management strategy/rewards

HEALTH CARE WORKER OCCUPATIONAL SAFETY AND HEALTH INDEX (HCW-OSHI)

- Economics
  - Lost time claims reduction in %
  - Workers compensation costs in %
- OEBBP
- Vaccination
- Tuberculsis
- Violence prevention

HCW-OSHI: OEBBP

- Training documentation/compliance
- Needle stick tracking/reporting
- Protective devices
- Rate of BBP exposures from failure to follow universal precautions
- Number of needle stick injuries

HCW-OSHI: Vaccination

Hepatitis B: % (>90%; 50%) high risk employees offered vaccine

Varicella: % (>90%; 50%) offered vaccine

Influenza: % (>90%; 50%) offered vaccine

Vaccine awareness: % (>90%; 50%) offered vaccine

HCW-OSHI: Tuberculosis

Training: % (>90; 50%) offered training

Conversions: number of conversions

Tuberculosis skin testing (new employees, annual)

HCW-OSHI: Violence Prevention

Written policy in place

Work site analysis performed

Education program: % (>90; 50%)

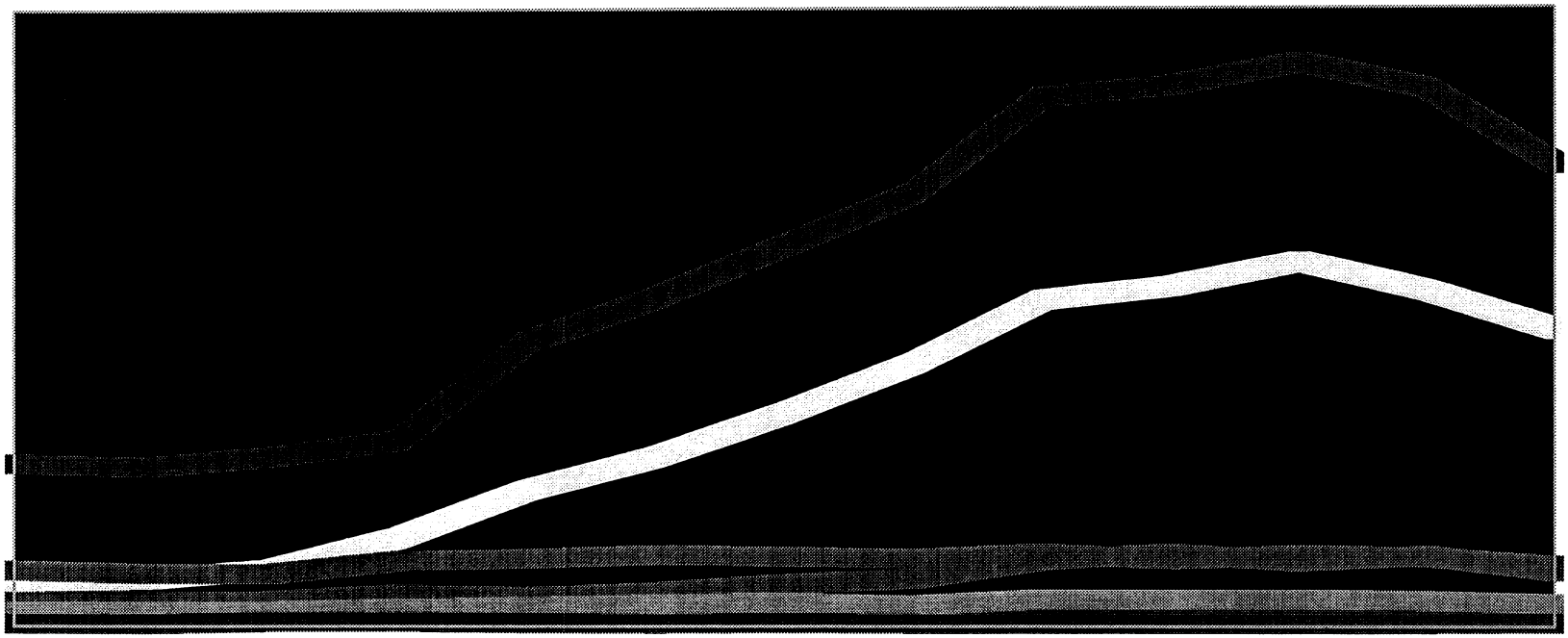
SUMMARY

Surveillance is a many splendoured thing

Surveillance is antiquated but improving

Surveillance can be trmeondously useful

Occupational Illness Incidence Rates, 1984-1996



Skin Dis | Dust Dis | Resp Tox | Poison
Physical | Rep Trauma | Other Dis | Total Dis

Occupational Illness Incidence Rates, 1984-1996

CONFERENCE TITLE:
Health Surveillance/Maintenance in the Workplace - Perspectives in the United States and Select Countries (Session 2, March 19, 1999)

ERGONOMICS OF WORKPLACE

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I. INTRODUCTION

In a human-machine system an operator can realize his/her capabilities only by interaction with hardware. Solving the problem of striking a balance between human abilities and equipment capacities is the essence of ergonomic support for such systems.

The main objective of ergonomic support is realization of measures, methods and means to:

- ensure high efficiency of human-machine system,
- preserve the operator's health, and
- maintain his/her work capacity.

The basic stages of ergonomic design are:

- assignment of ergonomic requirements and parameters,
- their realization in the course of hardware design,
- checking hardware characteristics for conformity with ergonomic requirements,
- defects elimination, and
- system manufacturing.

Standards, handbooks, literary data, results from investigations, etc. are the basic sources of information on ergonomic requirements and parameters. The following systems of Russian State Standards may be quoted as an example:

- The System of Standards on Ergonomic Requirements and Ergonomic Support,
- The "Man-Machine System" Standards,
- The System of Standards on Labor Safety, etc.

II. WORKPLACES ERGONOMIC DESIGN

A workplace is defined as a space containing means of depicting information, controls, consoles, seats, and other hardware needed by a human-operator (or a group of operators) to perform their functional tasks.

Workplace design must take into account the specific nature of the operator's tasks; the anthropometric, biomechanical, psychological and physiological characteristics of an operator; sanitary and hygienic norms;safety requirements; and technical aesthetics.

The workplace itself must provide the following:

- sufficient space for equipment to be placed and serviced; work tasks to be performed, and to enable the operator(s) to move;
- the necessary physical, visual, and acoustic connections between the operator(s) and the equipment;
- a clear view of the displays and accessibility to controls;
- permissible values of ambient variables, and protection from the harmful effects of occupational factors, if any; and
- conditions for the rapid occupation or abandonment of the workplace in emergencies.

In the geometrical computations of workplace components and the reach of controls, the range of values chosen for various anthropometric variables has traditionally been from the 5th to the 95th percentiles.

Maintaining appropriate relationships between work-related movements of the operator and the direction in which the controlled object moves, or changes in relevant parameters, can improve reaction and decision time. Therefore, the natural, direct relationships between directions of motion should be exploited as much as possible (Table 1).

Table 1. Association between controlling movements and the reactions of the controlled object

Reactions of the controlled object	Controlling movements
Activate, start, increase, open, up, forward, to the right	Upward, to the right, forward, clockwise, pull toward the operator
Deactivate, stop, decrease, close, down, back, to the left	Downward, to the left, backward, counterclockwise, push away from the operator

As a rule, operator receives much information from various displays and signals that deal not with actual objects, but rather with information models. The concept "information model" is defined as a set of data on the controlled object functioning and the state of the environment. With this information, operator analyzes the current situation, makes decisions, and executes control actions.

Information models must be congruent with tasks objectives and human capabilities to assimilate and analyze information, and should reflect graphically relationships and connections of the objects and processes being controlled that support an understanding of the situation and its perception as a single whole. In designing information interactions, it is essential that the information should provide some idea of the previous, current, and predicted state of the parameters, and should not require additional recoding for identification and processing.

Implementing information model involves the use of various devices for depicting information, e.g., indicators, signals, displays, and so on. The choice of the requisite means is based on the tasks that are to be performed with the information and on human sensory capacities.

Vision, hearing, and proprioception are particularly important for the execution of functional tasks.

Visual displays are typically used to:

- present quantitative and qualitative data;
- monitor correspondence of controlled values to required values;
- track or follow a target;
- display one's position in a plane or space (e.g., navigational instruments).

Presentation of audio information is used:

- for emergency messages, since hearing, unlike vision, cannot be "deactivated" spontaneously;
- when the visual channel is overloaded; and
- when the operator is performing work that demands movement.

Controls exist to transmit actions from an operator to the machine. Selecting the type of control it is necessary to take into account:

- the function of that control in the system;
- the control's importance and frequency of use;
- the accuracy, speed of adjustment, and forces that must be applied to the control;
- the ease of recognition of the control itself and its position in its working mode; and
- the feasibility of using the control while wearing special clothing.

The direction in which the control is displaced should correspond with the expected response of the controlled object or indicator. This association is best supported if it is based on habitual sensorimotor skills.

To evaluate the efficiency of the ergonomic decisions different methods are used depending on the stage of system design. For example, during the early stages, when the feasibility of various design configurations for workplaces is being assessed, priority is given to computer modeling and use of scale models. At later

stages, when information is available on equipment composition and dimensions, full-scale cabin mock-ups can be used.

III. PSYCHOPHYSIOLOGICAL STATE AS THE FACTOR OF OCCUPATIONAL RISK

But even very well designed workplace does not guarantee complete success of operator's performance. The point is that in designing a human-machine system it is very difficult to take into account the whole range of situations and factors affecting it which may appear during its operation. As the results of numerous investigations show, these factors may negatively affect the operator's psychophysiological state, diminishment of his/her work capacity, etc. For example, we have found significant correlation between the psychophysiological state of space crew members and the errors in their performance.

In other words, it is legitimate to consider unfavorable changes in psychophysiological state as a factor of occupational risk. Therefore, working out methods of evaluating operator's functional state is very important.

In this context, we shall consider briefly 2 methods worked out by the specialists of the Institute for Biomedical Problems to monitor crew members' functional state in space flight.

The former is described in detail in the book "Conception of Health and Problems of Norm in Space Medicine" by Academician A.I. Grigoriev and Professor R.M. Baevsky (Moscow, 1998). The suggested approach is based on the main principles of the adaptation theory and the homeostasis doctrine. The concept of the health is considered by the authors as the ability of the body to adapt to environmental conditions. Decreasing adaptive potentials, and consequently functional reserves of the body due to prolonged strain of the body's regulatory systems is one of the key risk factors determining the health level.

On the basis of cardiac rhythm variability analysis, which is used to evaluate human functional state, the authors worked out the health classifier they named "traffic lights". The green color is equal to physiological norm. Yellow indicates the necessity to give more attention to one's health. Red means the need to take serious measures in relation to the health. This method was widely used in practical health care for mass prophylactic examinations.

Another method was presented in our paper "Methodological Approach to Study of Cosmonauts Errors and Its Instrumental Support" (Acta Austronautica, Vol. 42, Nos. 1-8, 1998, pp. 331-338). Within the framework of this approach, cosmonaut's psychophysiological state (PPS) is considered to be an integral characteristic that reflects a system response of human body to the combined effect of flight factors. A special feature of the suggested method is that indirect sources of information are used to evaluate PPS (supervision of the crew members during TV sessions, content analysis of their radio contacts, etc.). Such character of primary data determined the necessity of employing the expert methods for PPS evaluation.

General behavior, motor activity, speech and sleep disturbances, mood, emotional reactions, deprivation phenomena, and etc. are used as indicators of crew members PPS. Each indicator is characterized by its own set of diagnostic symptoms ranked on a 7-point scale in relation to the degree of manifestation of unfavorable PPS alterations. According to these scales, the symptoms with the highest psychophysiological cost have the highest rates.

As an example, the diagnostic symptoms and their rates for the "MOOD" indicator are presented in Table 2 (1 - absence of unfavorable alterations, 2-3 - slight, 4-5 - mean, and 6-7 - high degree).

Table 2. Diagnostic symptoms for the "MOOD" indicator and their rates.

Diagnostic symptoms for the indicator "MOOD"	Rate
Even, corresponds to current and coming events	1
Mainly even, episodes of negative attitudes to onboard events	2
Episodes of unstable mood, related to current work results, general condition, etc.	3
Unstable, doesn't affect work activity	4
Unstable, affects practical and behavioral activity	5
Long-term positive or negative mood that doesn't correspond to onboard situation and events	6
Appreciable forms of euphoric or depressive mood	7

The integral parameter of psychophysiological state reflecting the level of a crew member's "psychophysiological discomfort" is calculated by adding up the rates of all separate indicators.

In our view, the suggested approach enables us to consider simultaneously the spectrum of possible PPS impairments, and to express them in quantitative values.

IV. CONCLUSION: MAIN DIRECTIONS IN THE DEVELOPMENT OF ERGONOMIC SUPPORT FOR THE OPERATOR'S PERFORMANCE

These directions include:

- purposeful collection of the data on operator's performance during his/her job;
- standardization of ergonomic requirements and parameters;
- ergonomic data bases design;
- working out simulation models of human-machine systems.

Health Surveillance/Maintenance in the Workplace –
Perspectives in the United States and Selected Countries

Session 2—Workplace Health Surveillance/Maintenance and Other
Specific Issues in Japan, Russia and China
March 19,1999

Ms. Cathy Angotti introduced the second session in this fifth series of continuing education programs sponsored by NASA's Occupational Health Program, Office of Health Affairs (OHA), in cooperation with the Uniformed Services University of the Health Sciences (USUHS). Worldwide. Ms. Angotti announced that today's session is now available on the Internet. She introduced the three guest speakers, Dr. Jun-Yao Li, Senior Scientist and Professor at the Chinese Academy of Medical Sciences, Peking Union Medical College, Beijing, China, Dr. Vladimir Subbotin, Deputy Director of the Institute for Medicine of Labor, Moscow, Russia, and Dr. Albert Nechaev, Chief Scientist at the State Research Center of Russian Federation, Institute for Biomedical Problems, Moscow, Russia.

China

Dr. Jun-Yao Li provided an overview of Workplace Health Surveillance/Maintenance and discussed Two Population Nutrition Intervention Trials in China. Workplace health problems have long been part of human history. Sporadic incidents similar to today's workplace health problems have been documented. Descriptions of rock-crushing-related "lung damage," symptoms of occupational lead poisoning, and preventive measures to prevent asphyxiant toxication, particularly at mining worksites, were recorded during the Song Dynasty (1000 BC) and the Ming Dynasty (the 14-17th century). Since the founding of the People's Republic in 1949, the goal of the Government's health programs has been to provide care to every member of the population, including all workers, and to make maximum use of limited health-case personnel, equipment, and financial resources. Emphasis has been on preventive rather than curative medicine on the premise that preventive medicine is "active" while curative medicine is "passive." So far, the health-care system has dramatically improved the health of the people, as reflected by the remarkable increase in average life expectancy from about 32 years in 1950 to 69 years in 1985. In the 1950s to 1960s, occupational health surveillance/maintenance consisted of: a curative occupational medicine for workers suffering from occupational diseases and work-related diseases or injury; industrial hygiene for work environmental monitoring and assessment of control engineering; and industrial toxicology assaying for chemical toxicity. Since the late 1970s, following economic reform and the policy of opening the country, workplace health surveillance/maintenance has been expanded to include: identification evaluation, prevention and control of occupational hazards at work in the same way as they have been adopted in most of the industrialized countries. Gradually, the concept of workplace health surveillance/maintenance has been expanded to cover not only the prevention of traditional occupational diseases and the work-related disorders with the help of occupational hygiene, medicine, and industrial toxicology, but also the ergonomic aspects of work environment and work organization.

Dr. Li presented the current situation in China. China, though still a developing country, has advanced in great strides with regard to both industrialization and economic reform. There exists an intimate two-way relationship between health and development. Rapid economy development has meant considerable occupational health and safety problems. The official list of verified occupational diseases includes: 51 occupational poisonings; 12 cases of pneumoconiosis; 6 physical agent-induced occupational diseases; 3 occupational communicable; 7 occupational dermatoses; occupational eye diseases (3); occupational ear, nose, and throat diseases (2); occupational tumors (8); and other occupational diseases (7). These 99 occupational diseases were reported as compensable diseases after being diagnosed by an authorized medical agency. Of these verified diseases, the majority is attributed to different kinds of pneumoconiosis and chemical poisonings. Dr. Li discussed pneumoconiosis in China. The number of workers exposed to dust were 12 million. Accumulated cases of pneumoconiosis (by 1996) were 524,759. About 74.3% (390,085) are still alive. There are about 520,000 suspected silicosis cases. New pneumoconiosis cases total about 8,000 - 9,000 per year. The most common workplace occurrence of pneumoconiosis were coal mining industries (45.05%), followed by metallurgical industries (12.90%) and manufacturing of construction materials (8.9%). There were 3906 cases (7743 patients) of acute occupational poisoning (1991-1996), which consisted of carbon monoxide (29.7%), organophosphate pesticides (16.8%), chlorine (9.3%), and hydrogen sulfide (7.3%). Chronic occupational poisoning totaled 10,923 cases. The causes were lead, benzene, trinitrotoluene, manganese and its compounds, and mercury compound. The most common workplaces were metallurgical, chemical, machinery industries, Small Scale Industries (SSIs), and the light and coal mining industries. Noise-induced hearing loss totaled 1,375 cases. Other chronic occupational poisonings included chemical burns, metal fume fever, asthma, extrinsic allergic alveolitis, and byssinosis.

Health care is provided in both rural and urban areas through a three-tiered system. Rural areas have the following: one village medical center (two barefoot doctors/1000); two township health centers (out-patient clinics (10-30 beds) for about 10,000 to 30,000 people; and three county hospitals (serving 200,000 to 600,000 people). Urban areas facilities include: one factory and neighborhood health station; two district hospitals, and three municipal hospitals. Based on the principle of "three-tier prevention," the network of occupational services and its management have been established at various levels of governmental health agencies—state-owned industries, which have an in-plant service system for occupational health, providing work environmental monitoring, health surveillance, emergency services and routine medical care. The system of reporting verified occupational diseases facilitates the provision of emergency service and data collection, and stimulates feedback on the prevention of occupational diseases.

Apart from the central databank on occupational diseases and injuries maintained under the Ministry of Health and Ministry of Labor, People's Republic of China, information sources on workplace health surveillance/maintenance are available at provincial and municipal levels. The information is also provided and disseminated from journals periodically published at state, regional, and industrial levels. The teaching curriculum in Occupational Health Services (OHS) has been developed to meet the needs of undergraduate, graduate and on-the-job refresher

training. There are 34 academic faculties at schools of public health offering courses in OHS and 20 medical universities offering Master's or Doctorate degree training. On-the-job training is frequently offered in the form of short-term courses on a variety of topics. Public TVs also broadcast the related courses.

A variety of legislative regulations for OHS have been issued by both State and local level governments so far—the Regulation on Prevention of Silica Dust in Enterprises (1956), the Health Standards for the Design of Industrial Premises (1979), the Regulation of Work Safety for Mining Industries (1982), the Rules of the Management of Verified Occupational Diseases (1984), the Act on Silicosis Prevention (1987), the Rules on Occupational Health Services for Town- and Village-owned Enterprises (1987), and the Labor Laws of PRC (1991) and the Occupational Disease Control Act (1996) are recognized as the fundamental legislation. Enforcement of these regulations and the enhancement of periodic workplace health inspections and monitoring are carried out by the Health and Anti-epidemic Station at various levels in China. The compliance rate of workplace occupational hazards with national occupational exposure limits increased in State-owned enterprises from 51.4-63% in 1986-1989 to 65.6-68.3% in 1991-1995. However, the coverage rates were not high enough and often varied widely. This is particularly true in SSIs (<10%).

There are three new challenges on workplace health surveillance/maintenance in China—the problem arising from the transitional period; occupational health problems in SSIs; and hazard transfer in multinational enterprises. New challenges are emerging from the transition of the national economy to a market-oriented economy. Many State-owned enterprises are suffering from growing pains in that they are losing the budget necessary of OHS activities. More than 39% of workplaces have airborne dust levels not in compliance with the national occupational exposure limits aiming to eliminate silicosis, and new cases of silicosis may emerge soon. SSIs are playing a key role in the country's transition to a market-oriented economy. With the rapid spread of economic reform, there has been a proliferation of SSIs in rural China. Their national industrial output exceeds the output of state-owned enterprises, employing more than 129 million. However, outdated technology, limited capital resources, and lack of awareness of OHS have put workers in SSIs at a great risk. There are a number of occupational health problems in SSIs—a large number of fatal accidents; a high rate of fatal accidents in town and village-owned mines, particularly coal mines; poor working conditions, including the low rate of clearance of national safety standard on levels of dust, chemicals, and noise; low rate of coverage of medical examination of workers exposed to hazards; serious underreporting of occupational accidents and diseases; and a large number of migrant workers in hazardous workplaces. There is lack of a comprehensive OHS law to extend adequate protection to SSI workers. Most of the old rules by industry ministries were issued without coordination and do not address the protection of SSI workers. There is a lack of OHS inspectors in labor bureaus at various levels and a limited technical capacity to provide practical guidance. Also, there is a lack of coordination between the bureaus concerned in inspecting and supervising. More strategic inspection planning is needed based on an analysis of accident data and hazard information.

The globalization of industry is becoming a new challenge to developing countries. The increasing export of hazardous industries from some investing countries or regions has resulted in rising costs for treating industrial wastes and a worsening situation of occupational health in developing countries. With economic reform and the opening of China, a variety of joint ventures financed with foreign capital have sprung up since the 1980s. An investigation in Shanghai showed that 62.8% of the total number of 1,407 multi-national investigated were defined as industries with hazardous materials or production processes. Of these, 14.2% of the 239,995 workers were exposed to various kinds of occupational hazards. Another survey from Shenzhen, Guangdong Province showed that overtime hours and exposure to much high levels of hazards than stipulated by the occupational exposure limits have been serious problems in multinational enterprises. As a result, acute and chronic poisonings had occurred among workers at multi-national enterprises in the region. The number of organic solvents poisoning accidents has grown remarkably in recent years.

Owing to liberalization of trade, free movement of capital and increased efficiency of information communications, economies have gradually become globalized. These changes have substantially altered the base for economic activities and have brought both benefits and obstacles with regard to development of workplace health surveillance/maintenance. While traditional occupational health hazards in industrialized countries have gradually been brought under control, numerous new challenges of OHS are posed by the recent trends in global economies, new technologies, and demographic developments. Psychological stress, the occupational health of aging and female workers, as well as new information technologies-related visual and cognitive are particular problems in the industrialized world. Developing countries and countries in transition simultaneously face both the traditional industrial hazards (such as serious and fatal accidents) and those of modern working life. Therefore, the most successful strategy for workplace health surveillance/maintenance should be a comprehensive, multidisciplinary, promotion-oriented, and development-oriented approach, including the maintenance and promotion of workers' health and work ability, health and safety in the workplace, and organization of work (management cultures).

Dr. Li discussed Vitamins and Minerals in Cancer—the nutrition intervention trials in Linxian, China. The most frequent causes of death in China (1990-1992) were diseases of the respiratory systems, cancer, cardiovascular diseases, and injuries, poisonings, and accidents. From the 1970's to the 1990's, there were changes in causes—cancer and cardiovascular diseases increased, and communicable diseases decreased. The most frequent cancer deaths are: stomach, liver, lung, and esophagus. China has the highest rates of esophageal cancer in the world, for both male and female. Stomach cancer is more numerous in central China and the coastal areas. Esophageal cancer mortality is greatest in the Hunan and Linxian provinces. Linxian Province has the highest mortality rate of esophageal cancer in the world. Dr. Li showed the incidence of the esophageal cancer in Linxian 1984-1985, and the process of development of epithelial dysplasia and cancer of the esophagus. There is a period of about four years from severe dysplasia to early cancer, and about four years from early cancer to advanced cancer. Etiologic clues in Linxian are: multiple nutrient deficiencies (riboflavin, vitamins A and C, zinc); pickled vegetables and moldy

food; silica in millet; nitrosamines; fungal infections; and hot liquids. To test the hypothesis, multivitamin/mineral supplementation was made in the dysplasia trial. Twenty-six different kinds of vitamins and minerals were tested. Four groups of micronutrients were also included. A fractional factorial design was used for the dysplasia trial. The dysplasia trial compliance was assessed biochemically over the six-year intervention period, and was compared with the baseline general population trial. Results were obtained after five to six years for the two trials. Only one group in the general population trial achieved a reduction (9%) in total cancer mortality—the group which received the B-carotene/vitamin E/selenium supplement. There was a 21% reduction in stomach cancer mortality. There was not any effect during the first two years, but increasing effect after that point. There was also a lower incidence of lung cancer mortality in the group receiving the B-carotene/vitamin E/selenium supplement. The incidence of mortality from cerebrovascular death was much lower in the supplement group, beginning early in the intervention process.

Questions/Answers:
HQ (Dr. Nicogossian): How do you implement Occupational Health programs in China? Are there special inspectors? Do you have educators and doctors involved? What is the infrastructure?
Answer: The number one level is the factory and the neighborhood station. From the central government, neighborhood inspectors go to monitor the factory environment and identify the problem. After the medical agency diagnoses the problem, it will send some specialists to address the occupational problem. There is a system at different levels.
HQ: Do you also apply occupational health and safety life we do in the United States, e.g., different buildings? Are different types of workers subjected to health and safety standards, e.g., office workers?
Answer: Yes, but there is a greater problem is with the SSIs as noted.

Russia
Professor Vladimir Subbotin presented his paper in Russian, which was translated in English for this session. He spoke on behalf of the Institute for Medicine of Labor, which is the chief organization in Russia in charge of Occupational Health, and is Russia's only institution closely cooperating with the World Health Organization (WHO). Dr. Subbotin noted a number of very important events during the 15 years of the WHO. The Institute of Health recently celebrated its 25th anniversary. Russia also marked its 300th anniversary of the history of labor medicine an labor protection. It has been two years now since the UN Secretary General spoke on the priority of labor medicine. But regretfully, despite all of the causes for celebration, there are still serious problems in the area of occupational health and labor protection. Currently, the number of employees in Russia is 71.8 million (48% of the able-bodied population). The number of those employed is 91%. From 1990-1997, the numbers of those employed decreased by 10 million, from 75 million to 65 million. In accordance with official statistics, 70% of the population live under conditions of acute psychological and nervous stress. Apparently, there is a phenomenon called "socio-phobia." This has had an adverse impact on labor conditions and on

the health of workers. Economic reform and changes in the structure of ownership have led to drastic changes in the distribution of employees. While formerly, state ownership accounted for nearly 100%, it is currently only 29%. Private enterprises account for 52%; other forms of ownership account for 19%. It is extremely difficult to carry out monitoring of private enterprises for compliance of health criteria. Currently, more than 60% of the facilities do not meet the existing sanitary and hygienic standards. The main adverse factors are dust, noise and vibrations, and the micro-climates of the workplace. The main cause of these problems are inadequate technological processes and problems with the design of equipment, inadequate sanitary and technological standards, and the absence of individual means of protection. As for the distribution of hazardous factors by industry, coal industry accounts for 43%, followed by metallurgical industries (39%). The coal industry poses the greatest problems, both technical and economic. In light of this, the health of the workers is declining. While industrial deformatism has stabilized and is declining, this is attributable to production slump (down to 80%) and the closing of production facilities, whereas the dynamic of occupational diseases has been causing serious concerns.

From 1986 to the present, the disease rate has grown fivefold. The coal industry and the ferrous and non-ferrous industry has accounted for the lions share in the increase in diseases. In the coal industry in particular, the occupational disease rates have increased dozens of times. This trend has caused serious concerns to the Russian government. The process of restructuring in the coal industry and the closure of many mines has left able-bodied as well as disabled workers without work. In order to compensate for the loss of working ability and the harm to health, it is essential to decide on the legal status of the coal industry. The worsening economic conditions in the country have led to the worsening of medical protection and the quality of medical services provided to the workers in general and the coal workers in particular. The absence of preventive measures has caused a situation where people who undergo medical checks are immediately classified as disabled persons. Currently only 50% of the workers employed in the coal industry are covered by regular medical checks. This has created a situation where disability is diagnosed during the medical check, and this has become a very serious problem. It has caused serious economic losses due to the fact that the enterprise has to pay compensation to the worker for the loss of working capacity.

Occupational diseases present a much more serious problem than traumas. The incidence of occupational disease is greater than traumas by a number of times. Among the workers who have been classified as disabled, 70-80% work underground. At the moment, over the period of two to three years, 10,000 - 12,000 cases of occupational diseases are registered in Russia per year. In accordance with the estimates of WHO experts, the incidence of occupational diseases in Russia are as follows: over 89,000 cases of exposure, with 21,000 cases of morbidity. This difference is attributable to different approaches to occupational diseases. In Russia, there is a list of occupational diseases under which a worker does not need to prove the connection between his disease and his occupation. Cardiovascular disease can be considered to be an occupational disease if a worker manages prove the link between his occupation and the disease. Currently, our science is trying to resolve these problems of occupationally caused diseases. Even through

we do experience difficulty in this respect, because the temporary loss of working capacity is not registered at adequate levels. Dr. Subbotin showed a chart of diseases that have caused incapacity. The improvement in some diseases over the past twelve years is not caused by changes in the preventative system, but by social factors that are not industrial in nature. Still, labor medicine finally accepted the risk concept that it had previously rejected, and apparently we are working on the degree of industrial causes of disease depending on the factors of production. Depending on relative risk, it can vary from zero to nearly 99%. This will enable us to approach the category of industrially cause diseases depending on the incidence of production factors.

Economic reform requires drastic change in our legislative framework, including the areas of labor protection and health surveillance at the workplace. Last year, the Russian Parliament adopted the law for the mandatory social insurance from accidents and occupational diseases which concludes and formalizes the concept of industrial risk and which maintains the level of industrial and professional mobility and the cost of maintenance and insurance in these areas of the economy. This transfer to insurance inspires hope that it will make it possible to use economic leverage to improve the working conditions of the people and their health. This law categorized all branches of the Russian industry into a number of categories depending on risk. In particular, there are fourteen classes of occupational risk, from minimum to maximum. For example, the minimum occupational risks are posed by the health industry and communications, whereas the maximum level is encountered in the coal industry, the metallurgical industries, and logging. Currently, our Institute has done much of our research in the area of the economic assessment of the causes of occupational diseases and controls. However imperfect the system of concentration might be, the economic losses are still quite considerable. The coal industry alone spent 1 trillion rubles (one billion rubles in new prices) on all sorts of services such as prevention, medical checks, rehabilitation, and the payment of compensation. Of this amount, the compensation for lost wages accounted for 73%.

In conclusion, let me say a few words on how to overcome this situation. First, introduce a comprehensive system of standardized clinical evaluations in cooperation with WHO; create the methodology of the assessment occupational risk and take steps to forecast occupational diseases. For that goal to be achieved, we need to improve our methodology of determining rates and to forecast diseases on the basis of those deficient dependencies. For this reason, in our legislation and labor codes, we need to draw from the experience of other countries, in particular in the area of workplace health surveillance and maintenance. Most of all, we need a state program targeted at the improvement of the economic conditions of the country in general and the working population in particular. The items cited in the presentation were taken from the official report, "The Report on the Epidemiological Situation in the Russian Federation." This report raised a number of problems in connection with improvement of health measures for the population. In our effort to overcome the negative consequences of this situation, I am pinning my hopes on the cooperations of our colleagues who have helped us with their experiences.

Questions/answers

HQ (Dr. Nicogossian): How do you conduct the education process for the workers and the occupational care providers?

Answer: I can divide my answer in two parts: the training of specialists and the training of workers who work in hazardous conditions. For specialists in labor and occupational medicine, we have epidemiological faculties at our medical institutes. Labor protection specialists are trained at technical institutions of higher learning. This the reason why our system of labor protection is different from other systems. We differentiate between doctors and the technical specialists who ensure that safety standards are observed. The doctors exercise control over enterprises or other facilities from the Ministry of Health. As far as technical inspectors are concerned, they represent a plethora of organizations such as the mining industry surveillance committee, the Russian labor conditions committee, and a number of trade union organizations, etc. They also provide training to workers on matters of safety standards. Workers are trained at each enterprise when they first come to the enterprise, then on an annual basis, and as they work in a hazardous situation. At each enterprise, there are specialists who have certificates who train workers in labor safety standards. After insurance comes into force, we expect the training of insured workers will be completely different. It is envisioned that a network of training centers will be set up to help workers assess occupational risk and the consequences. It will also be linked to the system of employment contracts.

Dr. Albert Nechaev discussed ergonomic design, the factors of occupational risk, and the emergence of the development of ergonomic support for the operator's performance. The main objective of ergonomics support is realization of measures, methods, and means to ensure the high efficiency of the human-machine system, preserve the operator's health, and maintain his/her work capacity. The basic stages of ergonomic design are: assignment of ergonomic requirements and parameters; their realization in the course of hardware design; checking hardware characteristics for conformity with ergonomic requirements; defects elimination; and system manufacturing. Standards, handbooks, literary data, results from investigations, etc. are the basic sources of information on ergonomic requirements and parameters. Russian specialists employ the following basic systems of state standards: the System of Standards on Ergonomic Requirements and Ergonomic Support; the "Man-Machine System" Standards; and the System of Standards on Labor Safety. A workplace is defined as a space containing means of depicting information, controls, consoles, seats, and other hardware needed by a human operator to perform functional tasks. Workplace design must take into account the specific needs of the operator's tasks—the anthropometric, biomechanical, physiological, and psychological characteristics of an operator; sanitary and hygienic norms; safety requirements; and technical aesthetics. The workplace itself must provide the following: sufficient space for equipment to be placed and serviced, work tasks to be performed, and to enable the operators to move; the necessary physical, visual, and acoustic connections between the operator and the equipment; a clear view of the displays and accessibility to controls; permissible values of ambient variables and protection from harmful effects of occupational factors, if any; and conditions for the rapid occupation or abandonment of the workplace in emergencies.

Dr. Nechaev discussed the association between controlling movements and the reactions of the controlled objects. As a rule, the operator receives much information from various displays and signals that deal not with actual objects, but rather with information models. The concept "information model" is defined as a set of information about the parameters relating to controlled object functioning and to the state of the environment. With this information, the operator analyzes the current situation, makes decisions, and executes control actions. Implementing information models involves the use of various devices for depicting information, e.g., indicators, signals, displays, etc. The choice of the requisite means is based on the tasks that are to be performed with the information and on human sensory capacities. Visual displays are typically used to present quantitative and qualitative data; monitor correspondence of controlled values to required values; track or follow a target; and display one's position in a plane or space (e.g., navigational instruments). Presentation of auditory information is used for emergency messages, when the visual channel is overloaded, and when the operator is performing work that demands movement. Controls exist to transmit actions from an operator to the machine. In selecting the type of control, it is necessary to take into account the following: the function of that control in the system; the control's importance and frequency of use; the accuracy, speed of adjustment, and forces that must be applied to the control; the ease of recognition of the control itself and its position in its working mode; and the feasibility of using the control while wearing special clothing. The direction in which the control is displayed should correspond with the expected response of the controlled object or indicator. This association is best supported if it is based on habitual sensorimotor skills. To evaluate the efficiency of the ergonomic decisions, different methods are used depending on the stage of system design.

Even the very well designed workplace does not guarantee complete success of the operator's performance. The point is that in designing a human-machine system, it is very difficult to take into account the whole range of situations and factors affecting it which may appear during its operation. As the results of numerous investigations show, these factors may negatively affect the operator's psychophysiological (PPS) state, diminishment of his/her work capacity, etc. For example, we have found significant correlation between the PPS of space crew members and the errors in their performance. In other words, it is legitimate to consider unfavorable changes in PPS as a factor or occupational risk. Therefore, working out methods of evaluating an operator's functional state is very important.

In conclusion, Dr. Nechaev discussed the main directions in the development of ergonomic support for the operator's performance. These directions include: purposive collection of the data on operator's performance during his job; standardization of ergonomic requirements and parameters; ergonomic data bases design; and working out simulation models of human-machine systems.

During an extension in the session, Dr. Nechaev presented two methods worked out by the specialists of the Institute for Biomedical Problems to monitor crew members' functional state in space flight. The former is described in detail in the book "Conception of Health and Problems

of Norm in Space Medicine" by Academician A.I. Grigoriev and Professor R.M. Baevsky (Moscow, 1998). The suggested approach is based on the main principles of the adaptation theory and the homeostasis doctrine. The concept of health is considered by the authors as the ability of the body to adapt to environmental conditions. Decreasing adaptive potentials, and consequently functional reserves of the body due to prolonged strain of the body's regulatory systems is one of the key risk factors determining health level. On the basis of cardiac rhythm variability analysis, which is used to evaluate functional state, the authors worked out the health classifier they named "traffic lights." The green color is equal to physiological norm; yellow indicates the necessity to give more attention to one's health; red means the need to take serious measures in relation to the health. This method was widely used in practical health care for mass prophylactic examinations. Another method was presented in our paper "Methodological Approach to Study of Cosmonauts Errors and Its Instrumental Support." Within the framework of this approach, cosmonaut's PPS is considered to be an integral characteristic that reflects a system response of the human body to the combined effect of flight factors. A special feature of the suggested methods is that indirect sources of information are used to evaluate PPS (supervision of the crew members during TV sessions, content analysis of their radio contacts, etc.). Such characterization of primary data determined the necessity of employing the expert methods of PPS evaluation. General behavior, motor activity, speech and sleep disturbances, mood, emotional reactions, deprivation phenomena, etc., are used as indicators of crew members PPS. Each indicator is characterized by its own set of diagnostic symptoms ranked on a 7-point scale in relation to the degree of manifestation of unfavorable PPS alterations. According to these scales, the symptoms with the highest psychophysiological cost have the highest rates. Dr. Nechaev presented an example of the diagnostic symptoms and their rates for the "mood" indicator. The integral parameter of PPS reflecting the level of a crew member's "psychophysiological discomfort" is calculated by adding up the rates of the separate indicators. This approach enables us to consider simultaneously the spectrum of possible PPS impairments, and to express them in quantitative values.

Questions/Answers:

Due to time constraints on the videoconference session despite the extension, Ms. Angotti indicated that further questions for either Dr. Subbotin's or Dr. Nechaev's should be sent directly to them.

HEALTH STATUS OF WORKERS OF THE RUSSIAN FEDERATION
(trends and determining factors)

Health is the first and foremost human need which determines a person's ability to work and the harmonious development of personality. It is the principal prerequisite for a person's self-affirmation and happiness and for the further development of human society. Social progress would be unthinkable without providing for a high level of health in its citizens. Socioeconomic development is determined not only by productive capacity and the nature of production relationships, technical equipment and the professional training for workers but also depends to a great extent on the general public's health.

The social significance of workers' health and of actions taken to protect it is growing as never before.

The health status of workers has a separate position among the various population groups, since it is just this segment of society which establishes the basis for the society's economic welfare.

According to data from the State Commission on Statistics (Goskomstat) of the Russian Federation (RF), the size of the economically active population in Russia in 1997 was 71.8 million (48.7% of the total population). Its level of employment was 91.1%.

The employed population declined from 75.3 million to 65.4 million, i.e., by almost 10 million people, for the period from 1990 to 1997.

Analysis of the condition of the workers attests to catastrophic deterioration in recent years. The social problems of recent years have been reflected especially sharply in the status and dynamics of job-related illness. While a decrease in the levels of job-related illness was observed up to 1985 (Fig. 1), a trend towards a rise in these figures was noted beginning in 1985, with 1991 marking its peak. Job-related illness in recent years has remained at the 1991 level , with minor fluctuations (Fig. 2). The rate was 2.32 for every 10 thousand workers in 1997 and exceeded the average level for all of Russia in individual industries.

It is known that job-related illnesses and accidents on the job are the consequences of unsatisfactory and hazardous working conditions. One can see from the government report "Concerning the Sanitation and Epidemiological Situation in the Russian Federation in 1997" that downward trends in working conditions persist in almost all branches of industry and agriculture, despite the decrease in production volume. The unstable operation of industrial enterprises, their lack of funds and the lack of economic incentive for employers have resulted in a sharp decrease in the scope of efforts towards improving work conditions. Comprehensive plans for improving conditions and protecting labor and sanitation and health improvement measures are being implemented at a level of only 50-60%. The use of obsolete technologies continues, and the depreciation of basic production facilities amounts to more than 50% at many enterprises and 60-70 and even 80% in certain areas. Almost one in five workers works under conditions which fail to conform to industry-wide sanitary and hygienic standards. The level of air pollution by dust, aerosols, vapors and gases, including class 1 and 2 hazardous substances, remains consistently high.

Labor conditions in the coal industry, nonferrous and ferrous metallurgy, machine building, the construction industry, the lumber and woodworking industries and the agricultural industrial complex remain extremely unfavorable, as before.

Most coal enterprises have no effective means for combating dust. The coal dust concentration exceeds the maximum allowable concentration (MAC) by a factor of 2 to 150 in drilling, loading and transporting of coal. Most of the cutter-loaders, drilling machines, electric locomotives and hand electric drills fail to meet hygiene standards: vibration parameters exceed the maximum allowable level (MAL) by a factor of 5, while noise levels exceed the MAL by 20-30 dBA. The cabs of excavating machines, as a rule, are not equipped with air conditioners, effective heating systems or noise or vibration protection devices.

Many mines lack arrangements for drying, dust removal and laundering of work clothes, the phototherapy and inhalation therapy facilities and dispensaries are being closed, and the underground hot food system has broken down completely. Due to inadequate funding, practically no sanitation measures are carried out at the health stations. The picture is similar at enterprises in other industries. The greatest number of people (63%) working under unfavorable conditions are employed at privately owned enterprises; this situation requires special attention from labor protection services and public health agencies.

Working conditions for women are still extremely unsatisfactory. According to data from Goskomstat RF, 49% of women were employed in various sectors of the national economy in 1997. The proportion of women employed in unfavorable working conditions remains high: more than 20-40% for certain regions of the country. Women make up almost one-fourth of patients with job-related illnesses identified annually. This figure reaches the following levels in individual branches of the economy: 80.5% in light industry; 74.6% in the textile industry; 40.5% in the electrical industry; 35.2% in the construction industry; 33.9% in agriculture; 32.6% in heavy machine building (see Table 21, page 41, of the government report).

The fact that no stable reduction in the rate of job-related illnesses among women was observed for the main sectors of the economy from 1993 to 1997 deserves particular attention. The high proportion of job-related illnesses among women of childbearing age is cause for alarm. The frequency of illnesses among pregnant women is increasing.

According to data from compulsory medical examinations, between 28 and 50% of women suffer from various chronic illnesses (hypertension, gastrointestinal diseases, diseases of the osteomuscular system, etc.).

The problem of improving labor conditions for pregnant women remains an urgent one. With rare exceptions, performance and attendance standards are not relaxed for women during pregnancy, and the women are not transferred to work which does not involve contact with harmful industrial factors.

Due to the breakdown of the medical and public health support system for workers (medical aid stations, physician and paramedic health stations), prophylactic measures for preventing and reducing the incidence of both general and job-related illness have deteriorated significantly. The level of coverage for workers with periodic medical

examinations has declined by 30-50%, which is related to the fact that the question of who is to pay for the periodic medical checkups (the employer or the compulsory medical insurance fund) has not yet been settled on a national scale.

One can see from Fig. 3 that despite the unsatisfactory labor conditions, industrial accidents are showing some tendency toward a decline, while job-related illness, as stated above, exhibits a rising trend.

Especially intense growth is observed in the coal industry; as one can see from Table 1, the level of job-related illness increased by a factor of 1.7 in the last 2 years alone in this industry, by a factor of 2.2 in heavy machine building, 1.6 in transportation machine building, and 1.3 in ferrous metallurgy. As one can see from the same table, the following industries still have overwhelming morbidity levels in 1997, as in previous years: the coal industry (81.1 for every 10,000 workers), heavy machine building (25.3), nonferrous metallurgy (11.8), power generating and transportation machine building (11.0), ferrous metallurgy (10.8) and other machine building industries (5.7 - 7.5 for every 10,000 workers).

The rate of increase in the incidence of job-related illness was most pronounced in 1995; the levels of job-related morbidity as compared to 1998 increased by a factor of 9.9 in the coal industry, 2.2 in the textile industry and almost 2 in the metallurgy and machine building industries.

For the last 6 years alone, 68,841 people were diagnosed as having a job-related illness for the first time. Such a rapid annual increase in job-related morbidity in the leading branches of industry is difficult to explain solely on the basis of deteriorating labor conditions over the last six years, since chronic job-related illnesses (which account for 95.8%) show up, as a rule, 10-20 years after initial contact with a harmful industrial factor.

This pattern is related mainly to a rate of lost wages and pensions suffered by the workers in these industries which is higher than that of other categories of workers, and to the enactment of the new regulations for workmens' compensation as a result of job-related illnesses (in 1992) embodied in the Federal Law "Concerning Compulsory Social Insurance against Accidents in the Workplace and Job-related Illnesses," which substantially increase the total amount of compensation for damages in the event of job-related illness. The introduction of these regulations has sharply increased the incentive for establishing a connection between diseases and jobs, even in cases with early symptoms of illness which scarcely affect an employee's ability to perform work.

The list of job-related illnesses (toxic effects) confirmed by the Russian Federation Ministry of Public Health (MPH RF) (Order No. 90 dated 14 March 1996) includes more than 600 forms of job-related pathology, each of which has its own specific features in its clinical presentation and progression. In addition, there is an extensive list of general diseases, covering practically all classes of diseases, which are associated with medical contraindications for particular types of activities in contact with specific harmful factors of the industrial environment and the labor process.

This means that harmful work factors may not only be the cause for developing job-related illnesses but may also act as the pathogenic mechanism for the development and progression of general diseases which do not fall into the job-related category.

Diseases of the respiratory organs from the effects of dust and aerosols were the leading diseases within the structure of job-related morbidity in 1997 at 31.0% (Fig. 4).

The following also account for significant proportions: diseases from the effects of vibration - 24.4%; noise - 16.4%; physical overwork and excessive strain on individual organs and systems - 15.2%; chemical agents - 8.9%; biological agents - 3.3%.

The distinguishing feature of job-related diseases is the high incidence of disability in connection with them (more than 50%) and the prolonged period of disability (10-20 years or more), which increases their social significance. This is especially important inasmuch as disability in job-related diseases often occurs in conjunction with the retention of overall fitness for work, since the sole basis for referral to medical-social review (MSEK) is contraindication for continuing work in contact with industrial hazards. The confirmation of this is the fact that in the initial assignment of patients with job-related pathology to disability status, group 3 disability is established in more than 80% of the cases, while the proportion of group 3 disabilities does not exceed 20% in general diseases.

An assessment of the costs associated with early diagnosis (periodic checkups), review and medical prophylaxis of job-related illnesses, with treatment and medical rehabilitation of patients, and with payment for the numerous preferences and compensations performed by specialists from the Scientific Research Institute of Labor Medicine of the Russian Academy of Medical Sciences indicated that the amount of these costs to individual enterprises amounts to from 7 to 60% of the labor compensation fund. It is quite obvious that such payments into the medical and social insurance funds means inevitable bankruptcy for many enterprises.

There has been a trend in recent years towards an increase in the chronic forms of diseases among workers and an increase in their severity, as attested to by data on morbidity with temporary loss of fitness for work (TLF). In the presence of an observable decline in the figures for cases and days of inability to work (Fig. 5), the average duration of disease with temporary loss of fitness for work (Fig. 6) is increasing steadily. This attests to the fact that patients are slow to seek help for severe forms of advanced illnesses. Unfortunately, industry statistics on disease with TLF have been eliminated, although for several decades the statistics served as an informative indicator of the health status of workers and were widely used for justifying preventive measures. We believe that the issue of reinstating these statistics at industrial enterprises and for the branches of the economy as a whole must be raised.

One can see from Table 2 that in contrast to the figures for cases of the loss of fitness for work, morbidity for the adult population (according to visits to medical institutions) for recent years (1994 to 1997) shows a rising trend for most classes of diseases.

The increase in the chronic nature and severity of pathology are reflected in the figures for disability, in which a steady increase has also been characteristic in recent

years (Fig. 7). The maximum figure for primary assignment to disability status of 91.1 for every 10,000 members of the population was recorded in 1995. It should be noted for the sake of fairness that the increase in the incidence of disability was promoted by the introduction of various social preferences for disabled workers of group 2 during the 90s and active visits to medical institutions and social support agencies to determine the degree of loss of fitness for work during the socioeconomic downturn, mainly for people of retirement age.

Thus, according to data from the Institute for review and the working fitness of the disabled for 1996, persons of retirement age made up 55.4% of those first recognized as disabled, while this figure was only 13.4% in 1989.

Tighter requirements must be imposed on health protection for the workforce employed under the conditions of economic rebirth and in the presence of a decline in the Russian population; the limited supply of workers results in the need for lengthening work hours and for enhancing employee fitness for work. In connection with this, one of the basic tasks in the study of medical demographic processes is to identify causes which contribute to significant labor losses as a result of morbidity, disability and premature death.

Analysis of the death rate of the population of the RF (Fig. 8) attests to a catastrophic increase in mortality for the period from 1990 to 1994, when the death rate for the entire population increased by 40.2%, while the death rate for the working age population increased by 59.2%. Despite the fact that a somewhat declining trend in mortality, both in the overall population and in the working age population, was observed in the following years from 1995 to 1997, the present death rate significantly exceeds the mortality rate for the population of economically developed countries and for working age people amounts to 633.2 for every 100,000 persons of working age. Figures on the mortality rate for working age people for the period from 1991 to 1997 increased for all basic causes: diseases of the circulatory system (from 138.7 to 175.9), accidents, toxic effects and trauma (from 183.5 to 230.0), diseases of the respiratory organs (from 18.0 to 26.9), diseases of the digestive organs (from 15.8 to 27.0), and infectious and parasitic diseases (from 11.9 to 26.0), primarily tuberculosis (from 10.1 to 23.3) for every 100,000 persons of working age (Table 3).

One can see from Fig. 9 that the mortality rate for the Russian population from diseases of the circulatory system, as well as from infectious and parasitic diseases, exceeds analogous figures recorded in Great Britain, Germany, Norway, Finland, Japan and the United States by a factor of 2 or more. An even greater disparity in the mortality figures between Russia and the countries listed is observed in the analysis of mortality rate from accidents, murder, suicide and other external effects. The fact that the mortality rate from malignant tumors for the Russian population does not differ significantly from the rate for the countries listed is worthy of notice.

One can see from Fig. 10 that the death rate from suicide increased from 34.2 to 56.9 for every 100,000 persons of working age for the 2 years from 1991 to 1994 alone, while the death rate from murder increased from 23.0 to 46.8, and the rate for accidental

alcohol poisoning increased from 16.4 to 53.0; the rates remain at a high level, despite a downward trend.

In comparative analysis, the fact that the age factors for the death rates of men exceed those of women by a factor of 2 – 3, and sometimes more, is noteworthy. This pattern is conditioned, on the one hand, by the high rate of employment of men in jobs which are arduous and hazardous to life and health. On the other hand, men are less acclimated to altered socioeconomic conditions, as indicated by the mortality rates from suicide, the frequency of which among men, according to 1997 data, is 7.1 times higher than among women. For the period from 1990 to 1995, the rate of death from suicide increased by a factor of 1.7 for men, while the rate of death from the same cause increased by a factor of 1.2 for women. During the succeeding years beginning in 1996, some decline was observed in this figure. Alcohol abuse, to which, as is well known, the male population is more prone, is also quite often the cause not only of accidents at home and on the job but also of serious illnesses affecting various organs and systems, leading to premature death.

According to data from Goskomstat RF, the per capita sale of alcoholic beverages reached 9.31 liters in 1995 and 7.5 liters in 1997, while according to data from the Russian Public Health Association, the average per capita use of alcohol reached 13 liters in 1995. The situation is considered hazardous when alcohol use reaches 8 liters, according to World Health Organization (WHO) criteria.

The number of patients with alcohol psychoses taken for dispensary medical supervision has grown severalfold in recent years (by a factor of 5 in 1995 as compared to 1990).

Participation in armed conflicts and the deterioration of the national situation have promoted an increase in violent causes of death among the able-bodied population. Under the conditions of a low birth rate, the high mortality rate for persons of working age, which coincides in most cases with reproductive age, may lead to a future shortage in labor resources and a decline in the country's defensive capability due to the decreased strength of mobilized population groups.

One can see from the data presented that the need to counteract high mortality levels due to specific causes goes far beyond the ability, resources and responsibilities of the public health field and represents a field for inter-industry integration activities with the participation of law enforcement agencies, social services and local government agencies.

Health as a category characterizing physical, mental and social well-being is defined by a complex set of factors: socioeconomic status, working and living conditions, the condition of the public health system and the effectiveness of its operations, the state of the environment, heredity, etc.

The role of working conditions as a factor exacerbating mortality among workers of the basic professions in machine building and electric power generation, at manganese mines and in the tire and other industries (Tables 4-6) is shown by the results of epidemiological research performed at the Scientific Research Institute of Labor Medicine of the Russian Academy of Medical Sciences.

In recent years, however, as a result of the massive drop in production and forced work stoppages, the duration of the effects of industrial factors has been reduced in many industries. Accordingly, the weight of job and environmental factors among the other risk factors impacting health statistics for workers has declined temporarily.

Comprehensive analysis of the possible causes for the negative trends in worker health in the RF has made it possible to conclude that these trends are associated primarily with the deterioration in socioeconomic conditions, the change in lifestyle, the sharp decline in the general public's standard of living, the deterioration of medical aid, the breakdown in the principles of preferential service to industrial workers, the preventive orientation of labor protection and the health status of workers.

Reform of economic relationships, the emergence of various forms of ownership, including private enterprise, the change in pricing conditions, and other changes in the system of business and economic relationships are inevitably accompanied by rising levels of unemployment.

In a state governed by laws, employment is the most important aspect of the social welfare of an individual, since it reflects not only his need for work but also the degree to which and conditions under which this need is satisfied. The right to work is manifested primarily in improved economic status for the individual employed in the labor process.

In the current economic situation, unemployment in Russia is becoming an acknowledged phenomenon. Just as important a problem under the conditions of economic crisis and the drop in production is hidden underemployment, the characteristic symptoms of which include low worker income, underuse of workers' skills and low productivity. A series of studies have demonstrated convincingly that unemployment leads to an increase in morbidity and mortality from poverty-related diseases. Emotional stress and psychosomatic illness can be the direct result of the loss of work or the fear of losing it.

Studies by American and Australian scientists have demonstrated convincingly the direct dependence of morbidity and mortality on the level of unemployment under conditions of economic decline. Not only the loss of a job but also the expectation of dismissal can result in damage to physical as well as mental health.

According to a statement by the authors of a paper from the Organizational Committee of the Pirogov Congress of Physicians (Moscow, 1995), more than 70% of the Russian population lives in a state of prolonged mental, emotional and social stress, which causes an increase in the frequency of depression, reactive psychoses, severe neuroses and psychosomatic disorders, alcoholism and drug addiction.

Specialists use the concept of "quality of life," which includes the socioeconomic, political, cultural and environmental circumstances under which the population group in question exists, to characterize various aspects of the life of specific strata or groups within the general population. Working and living conditions, nutrition, rest, the management of the service sphere, public health and education are important components of the quality of life. The health of the general public serves as the clearest and most comprehensive indicator of the conditions and quality of life. Numerous studies have

confirmed the close relationships between health statistics and the level of socioeconomic development.

The responsibility of the state for protecting and strengthening the health of its citizens, as an integral condition of the level of social life, is embodied in the Constitution of the RF and the principles of RF legislation on the protection of public health and conforms to the generally accepted principles and standards of international law. In this connection, the protection of health among the "principles of legislation" refers to the combination of measures of a political, economic, legal, social, cultural, medical, sanitation and hygiene, and anti-epidemic nature intended to protect and strengthen the physical and mental health of every individual, support his long and active life and provide him with medical aid in the event of illness.

The critical state of the demographic situation in Russia and the health status of its population attest to the fact that the guarantees in the area of health protection for Russian citizens are not presently being adhered to by the government. Suffice it to say that the life expectancy of the population of the RF has decreased in recent years at a rate unheard of throughout the world. As a result, life expectancy for men reached 60.8 years in 1997, and life expectancy for women reached 72.9 years, which is much lower than corresponding figures not only for economically developed nations but also for many developing nations. The life expectancy at birth is, for example, 77 years at birth in Japan, 76 years in Sweden and Canada, 75 years in the Netherlands, Israel, Switzerland, Norway and Greece, and 74 years in the United States and Great Britain.

According to data from Goskomstat RF, out of 62 countries in Europe, Asia, America, Australia and Oceania, in only 3 countries is the average life span of men lower than in Russia.

The life expectancy for women in many countries (Japan, Austria, Greece, Belgium, Italy, Norway, the Netherlands, Switzerland, Canada, the United States, Finland, France, Australia, Sweden, etc.) reaches or exceeds 80 years.

Social and demographic policy in Russia for long-term government programs must be aimed primarily at raising the socioeconomic level of the national population, preventing mortality, especially among working age individuals, reducing morbidity and increasing the average life span of the population.

The following proposals for improvement of working conditions were set forth in the government report "Concerning the Sanitation and Epidemiological Situation in the Russian Federation in 1997."

1. Accelerate the adoption of the federal laws "Concerning the Introduction of Revisions and Additions to the Principles of Legislation of the Russian Federation on Labor Protection," "Concerning Compulsory Social Insurance against Accidents in the Workplace and Job-related Illnesses," and "Concerning Industrial Safety."

2. Include an article on the compulsory drawing-up of collective agreements reflecting measures for the protection of labor and the improvement of working conditions by all enterprises, regardless of their form of ownership, in the federal law on collective agreements.

3. Make legislative provision for the following:

– an economic mechanism for stimulating employers to provide safe and healthy working conditions;

– a system for the control of labor protection in accordance with the new economic and labor relationships;

– financial responsibility of the employer for job-related illness, job-related toxic effects and worker disability;

– preferential tax status for enterprises recording no injuries or accidents and for automating and modernizing production and operating processes;

– the introduction of a contract system in hiring for hazardous industries, with the working conditions to be reflected in the contracts;

– a system of economic preferences and incentives for enterprises and design organizations for the purpose of the production and implementation of operating processes which are safe and low-risk for man and the environment;

– legal responsibility of the executive government agencies of Russia for the state of labor protection and industrial accidents;

– the imposition of fines against legal entities for violating labor protection and labor hygiene requirements;

– the duty to conduct certification of production facilities, regardless of the forms of ownership or the type of operations, after the establishment of differentiated deadlines for certification procedures in different sectors of the economy;

– the elimination of discrepancies in article 23 of the law of the RF "Concerning the Sanitary and Epidemiological Welfare of the Public" and article 13 of the "Principles of Legislation of the Russian Federation on the Protection of Labor" in regard to the sources of funding for preliminary medical examinations upon starting work and periodic checkups.

4. The Ministry of Labor of Russia:

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OVERALL ADULT MORBIDITY (18 YEARS AND OLDER) PER 100,000 POPULATION OF THE RESPECTIVE AGES IN THE RUSSIAN FEDERATION

CHARACTERISTICS	1994	1995	1996	1997
Total	**103,400.3**	**105,346.0**	**105,176.1**	**107,498.3**
Infectious and parasitic diseases	4362.9	4613.4	4748.6	4821.7
Tumors	3246.2	3306.9	3474.8	3402.6
Diseases of the endocrine system, nutritional disorders, disruption of metabolism or immunity	2776.6	2821.2	2979.7	3116.9
Diseases of the blood and	325.2	365.5	396.5	436.6
Mental disorders	5194.6	5200.0	5153.3	5074.3
Diseases of the nervous system and sense organs	12,660.1	12,968.2	13,491.6	13,647.0
Diseases of the circulatory organs	13,546.8	13,894.6	14,385.4	14,687.2
Diseases of the respiratory organs	21,101.8	21,357.9	19,664.9	21,918.2
Diseases of the digestive organs	9580.2	9733.0	9382.3	9155.0
Diseases of the urogenital system	6393.0	6774.4	7211.8	7397.2
Complications of pregnancy, birth and the postnatal period	2698.8	2785.1	2986.5	3002.4
Diseases of the skin and subcutaneous fat	4932.1	5040.3	4894.5	4629.7
Diseases of the osteomuscular system and connective tissue	8026.3	8150.6	8606.7	8721.4
Congenital anomalies	95.8	97.9	107.5	115.3
Symptoms, traits and	161.0	156.9	163.9	156.1
Traumas, toxic effects	9513.9	9349.3	8889.8	8623.9

WORKING AGE MORTALITY RATE BROKEN DOWN BY MAIN CLASSES OF CAUSES OF DEATH

(NUMBER OF DEATHS PER 100,000 WORKING AGE POPULATION)

Causes of death	1991	1992	1994	1995	1996	1997
			Total population			
			Men and women			
Total deaths from all causes, including the following:	502.4	581.4	840.8	798.5	710.0	633.2
Diseases of the circulatory system	138.7	156.5	245.2	224.1	198.6	175.9
including acute myocardial infarction	17.8	17.3	19.6	17.9	16.8	15.9
Accidents, poisoning and trauma, including the following:	183.5	228.8	326.7	311.3	272.2	239.0
Accidental poisoning with alcohol	16.4	25.9	53.0	41.4	33.3	25.8
All types of transportation accidents	40.0	39.7	37.4	34.4	29.7	27.7
Suicide	34.2	41.2	56.9	56.1	53.0	49.1
Murder	23.0	34.1	46.8	44.2	37.9	33.5
Tumors	102.8	103.2	104.6	101.5	97.2	93.2
including malignant tumors	101.2	101.5	102.9	99.9	95.6	92.4
Diseases of the respiratory organs	18.0	21.2	41.0	38.6	32.6	26.9
Diseases of the digestive organs	15.8	19.7	34.5	35.5	31.3	27.0
Infectious and parasitic diseases	11.9	11.8	23.3	24.9	26.6	26.0
including tuberculosis (all forms)	10.1	11.9	19.3	21.2	23.7	23.3

Table

DEVELOPMENT OF MALIGNANT TUMORS AMONG WORKERS IN THE WOODWORKING INDUSTRY (SAWDUST, FORMALDEHYDE)

	Respiratory organs	Digestive organs	
	Men	women	Women
SOR	1.75	1.64	1.63

Table

DEATH SOR FROM VARIOUS DISEASES AMONG WORKERS OF THE ANTIMONY INDUSTRY

	Hypertension		Urinary system		Esophagus Stomach Duodenum		Myocardial infarction, 10 years or more on the job	
	men	women	men	Wome n	men	women	men	women
SOR	1.9	3.01	2.08	8.92	2.48	35.41	9.65	6.75

Table

DEATH SOR FROM MALIGNANT TUMORS AMONG WORKERS OF THE MERCURY INDUSTRY

	All localizations		Cancer of the intestine		Stomach cancer		Lung cancer	Breast cancer
	men	women	men	women	men	women	men	women
SOR	1.3	3.74	2.55	11.03	1.6	4.74	1.82	3.20

Ranking of individual industries according to statistics on job-related illness in 1995-1997 (for every 10,000 workers)

Item	Industry	1995	1996	1997
1	2	3	4	5
1	Coal industry	48.1	55.6	81.1
2	Heavy engineering industry	11.4	15.3	25.3
3	Nonferrous metallurgy	12.5	16.4	11.8
4	Power engineering industry	14.4	15.3	11.1
5	Transportation machinery industry	6.8	14.1	10.9
6	Ferrous metallurgy	8.6	9.3	10.8
7	Machine tool and tool engineering industry	5.8	8.5	7.5
8	Petroleum machinery industry	5.0	3.2	6.9
9	Construction and road machinery industry	9.1	9.1	6.5
10	Automobile industry	4.6	5.6	6.5
11	Tractor and farm machinery industry	11.7	6.3	5.6
12	Chemical machinery industry	1.4	2.9	4.7
13	Chemical industry	2.6	3.3	4.2
	Figures for the RF	1.89	2.32	2.32

PAST AND PRESENT

- 50th Anniversary of WHO – Golden Jubilee (7 April 1948)
- 75th Anniversary of the Labor Medicine Institute of the Russian Academy of Medical Sciences (NIIMT RAMN) – Diamond Jubilee (1923)
- 70th Anniversary of the nation's first list of job-related illnesses (1928)
- 150th Anniversary of the handbook on workers' diseases in Russia (1847)
- 300th Anniversary of labor medicine (1st Congress on the history of labor medicine in Rome in October of this year)
- Third year of the WHO Global Strategy "Labor Medicine for All"
- Second year of the declaration of Kofi Annan, Secretary General of the United Nations, on the priority of labor protection and labor medicine for socioeconomic development
- Year of the WHO "Safe Motherhood" campaign

Number working under unfavorable working conditions (% of total workers) and job-related morbidity rates (for every 10,000 workers) as of the start of 1997[♦]

Sectors of the economy	Total working under poor conditions	Under the effects of industrial				Job-related illness index
		Noise	Vibration	Dust	Gases	
Industry	21.3	9.8	2.0	6.9	6.1	2.3
Including:						
Coal	43.4	14.5	7.6	26.8	5.0	92.1
Nonferrous metallurgy	30.9	11.7	3.5	13.1	12.6	16.4
Ferrous metallurgy	39.1	20.5	3.2	17.3	7.8	9.3

♦ - from the government report "Concerning the Health Status of the Population of the Russian Federation," Moscow, 1997.

Assigned disability status in the coal industry of Russia (according to industry statistical data)

Years	Total	Causes, number (people)	
		Accidents	Job-related illness
1996	1884	494	1390
1997	1668	582	1086

The 1668 people receiving disability status in 1997 were made up of the following:

Engineering and technical personnel	*- 119 (7.1%) (including 74 mine foremen);*
Underground workers	*- 1325 (79.4%);*
Surface workers	*- 109 (6.5%);*
Dressers	*- 13 (0.8%).*

According to estimates by WHO experts (1996), annual job-related morbidity in Russia should be as follows:

- Detection rate – 89,980 cases;
- Death rate – 21,080 cases.

Total losses of years of working life (WHO, 1996) are as follows:

poor nutrition	15.9%;
general sanitation and drinking water	6.8%;
occupational factors	2.7%;
air pollution	0.5%.

Degrees of occupational connection of health disorders depending upon relative risk (E. I. Denisov, 1998)

Item	Degree of connection	Relative risk RR	Etiology factor EF, %
(0)	None*	0 < RR < 1	0
1.	Low**	1 < RR < 1.5	Less than 33
2.	Medium**	1.5 < RR < 2	33 – 50
3.	High**	2 < RR < 3.2	51 – 66
4.	Very high**	~~3.2 < RR < 5~~	67 – 80
815100	Almost total***	RR > 5****	

* the difference with the control is not reliable ($p > 0.05$);

** the difference with the control is reliable ($p < 0.05$), and the feature is considered *statistically significant*;

*** the same, and the feature is considered a *determining* factor [BME, v. 23, p. 255, 1984];

**** values EF = 90, 95 and 99% correspond to the values RR = 10, 20 and 100.

Costs associated with damage to health from accidents and occupational diseases at coal enterprises

Years	Total	Causes and costs (millions of rubles)	
		Accidents	Trauma and job-related illness
1995	610.3	257.1	353.2
1996	653.0	83.4	569.6
1997	850.8	217.5	663.5

The breakdown of costs for compensation for damage to health as a result of occupational illness:

1. Allowances for VUT-1 - 12.8 million rubles - 4.0%
2. One-time allowance - 41.6 million rubles - 12.8%
3. Compensation for lost wages - 237.8 million rubles - 73.3%
4. Rehabilitation - 18.5 million rubles - 5.7%
5. Pain and suffering - 6.4 million rubles - 2.0%
6. Other - 7.2 million rubles - 2.2%

Total: 324.3 million rubles

OCCUPATIONAL RISK CATEGORY

(The law "Concerning compulsory social insurance against accidents in the workplace and job-related illnesses," 1998)

- the level of occupational accidents, job-related morbidity and insurance expenses accumulated in the sectors (sub-sectors) of the economy)

Occupational risk categories for sectors (sub-sectors) of the economy

Occupational risk Category	Integrated index
1	Ir < 0.05
2	0.05 < Ir ≤ 0.15
3	0.15 < Ir ≤ 0.25
4	0.25 < Ir ≤ 0.35
5	0.35 < Ir ≤ 0.45
6	0.45 < Ir ≤ 0.55
7	0.55 < Ir ≤ 0.65
8	0.65 < Ir ≤ 0.75
9	0.75 < Ir ≤ 0.85
10	0.85 < Ir ≤ 0.95
11	0.95 < Ir ≤ 1.15
12	1.15 < Ir ≤ 1.45
13	1.45 < Ir ≤ 4.0
14	4.0 < Ir ≤

> 12% of FOT

PROPOSALS

- **Introduce a combined system for the evaluation of occupational illnesses: a list and an overall definition of occupational illness (system 3 according to International Labor Organization Convention No. 121);**
- **Establish a procedure for the assessment of occupational risk and revise the form of the health and sanitation characteristics of professions to include the prediction of job-related diseases of the basic classifications.**

PROSPECTS

Research:

- **development of risk methodology;**
- **forecasting of health disorders based on dose-effect relationships.**

Practical work:

- **development and implementation of a risk management system;**
- **implementation of certification of work areas and review of labor protection and labor medicine.**

Legal support:

- **development of social insurance law (medical insurance and insurance against job-related illness), and transition from labor law to social law.**

PROPORTION OF MEN AND WOMEN EMPLOYED UNDER UNFAVORABLE AND HAZARDOUS WORKING CONDITIONS
(as a percentage of the total worker population of the respective sex in the industry in question)

	At enterprises and organizations in			
	industry	construction	transportation	communications
Working under conditions which fail to comply with health and sanitation standards				
Men	26.2	9.9	12.2	5.3
Women	14.9	5.8	4.9	2.3
Working under conditions of high: levels of noise, ultrasonics and subsonics				
Men	11.7	2.1	6.2	1.2
Women	6.9	0.9	2.2	1.3
High level of vibration				
Men	3.0	1.2	3.1	0.7
Women	0.6	0.2	0.8	0.1
High dust content of the air of the work area				
Men	9.2	2.9	1.6	0.5
Women	4.2	2.0	0.7	0.2
High gas content of the air of the work area				
Men	7.6	3.9	3.3	1.5
Women	4.2	2.1	1.2	0.1
High level of non-ionizing radiation				
Men	0.7	0.1	0.1	0.4
Women	0.2	0.0	0.1	0.0
High level of ionizing radiation				
Men	0.3	0.1	0.2	0.0
Women	0.1	0.1	0.1	0.0
Employed in heavy physical labor				
Men	4.1	4.0	1.3	0.4
Women	1.0	3.1	0.4	0.1
Working on equipment which fails to comply with safety requirements				
Men	1.0	0.2	0.3	0.1
Women	0.4	0.1	0.1	0.0

Overview of Workplace Health Surveillance/Maintenance and Two Population Nutritional Intervention Trials in China

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HEALTH SURVEILLANCE/MAINTENANCE IN THE WORKPLACE

Workplace health surveillance/maintenance problems have long been part of human history. Tracing back to ancient China, sporadic incidents similar to today's workplace health problems have been documented. For example, description of rock-crushing-related "lung damage", symptoms of occupational lead poisoning, and preventive measures to prevent asphyxiant intoxication, particularly at mining worksites, were recorded during the Song Dynasty (1000 B.C.) and the Ming Dynasty (the 14-17th Century).

Since the founding of the People's Republic in 1949, the goal of Government's health programs has been to provide care to every member of the population, including all workers, and to make maximum use of limited health-care personnel, equipment, and financial resources. The emphasis has been on preventive rather than curative medicine on the premise that preventive medicine is "active" while curative medicine is "passive". The health-care system has dramatically improved the health of the people, as reflected by the remarkable increase in average life expectancy from about 32 years in 1950 to 69 years in 1985.

To meet the topical needs of industrialization, occupational health services in the 1950s-1960s consisted of a curative occupational medicine for workers suffering from occupational diseases and work-related diseases, industrial hygiene for work environmental monitoring and assessment of control engineering, and industrial toxicology assaying for chemical toxicity.

By the late 1970s, following economic reform and the policy of opening the country, the structures and activities of occupational health were further developed to include identification, evaluation, prevention and control of occupational hazards at work in the same way as they have been adopted in most of the industrialized countries. Gradually, the concept of occupational health has been expanded to cover not only the prevention of traditional occupational diseases and the work-related disorders with the help of occupational hygiene, occupational medicine and industrial toxicology, but also the ergonomic aspects of the work environment and work organization, as well as primary health care for general health problems.

Therefore, we now have a clearer understanding that health surveillance/maintenance in the workplace is the process of monitoring the health

status of worker populations to gather data on the effects of workplace exposures and using the data to prevent illness or injury. The purpose is for the recognition, evaluation and control of work-related diseases where working conditions, together with the general environment of living, play a role in causation and which are susceptible to control by means of timely preventive measures taken by appropriate occupational health services integrated with primary health care. This holistic approach strives towards the WHO's global goal of "Occupational Health for All", and will eventually be beneficial to the sustainable economy growth and social development of the nation.

CURRENT SITUATION

Leading causes of occupational diseases

China, though still a developing country, has advanced in great strides with regard to both industrialization and economic reform. There exists an intimate two-way relationship between health and development. Rapid economy development has meant considerable occupational health and safety problems. According to statistics, occupational lung diseases, as a whole, rank at the top of occupational health problems, accounting for more
than two-thirds of all verified occupational diseases. They are followed by chemical poisonings, occupational skin damage, physical agent-related disorders and occupational cancers.

Statistics on occupational health problems

The official list of verified occupational diseases includes i) Occupational poisonings (51); ii) Pneumoconiosis (12); iii) Physical agent-induced occupational diseases (6); iv) Occupational communicable diseases (3); v) Occupational dermatoses (7); vi) Occupational eye diseases (3); vii) Occupational ear, nose and throat diseases (2); viii) Occupational tumours (8); and ix) Other occupational diseases (7).

The 99 occupational diseases listed above were reported as compensable diseases after being diagnosed by an authorized medical agency. Of these verified diseases, the majority is attributed to different kinds of pneumoconiosis and chemical poisonings.

Pneumoconiosis

With a huge population of 1.2 billion, the number of workers exposed to dust in China may total as many as 12 million. Silicosis has long been the most common, and the most serious, occupational health problem. By 1996, the accumulated cases of pneumoconiosis in this country were 524,759; 390,085 (74.3%) of these people are still alive. Moreover, an additional 520,000 workers exposed to dusts were suspected of having silicosis. The annual number of new

cases of pneumoconiosis reaches 8,000-9,000, although it has shown a slight decline since 1987. This decline may be attributable to under-reporting from small-scale industries.

The highest occurrence of pneumoconiosis was found to be in coal mining industries, which account for 45.05% of total cases, followed by the metallurgical industry (12.9%), the manufacture of construction materials (8.9%), and machinery (5.0%), non-ferrous metallurgical (3.7%), SSIs (3.7%) and the railway construction (2.7%) industry.

Occupational poisonings and other occupational diseases

Acute occupational poisonings

Official statistics list 3,906 acute occupation-related chemical accidents involving 7,743 intoxicated patients during 1991-1996. The ratio of patients per accident increased from 1.6:1 to 2.0:1, indicating that more patients were suffering from chemical accidents.

Carbon monoxide is the leading cause of acute occupational poisoning accounting for 29.7% of cases, and followed by organophosphate pesticides (16.8%), chlorine (9.3%), and hydrogen sulphide (7.3%). Carbon monoxide and hydrogen sulphide were proved again to be the two leading causes of fatal acute occupational poisoning, accounting for about 80% of the fatal cases.

Chronic occupational poisonings

The total number of reported cases of chronic occupational poisonings during 1991-1995 came to 10,923. Lead was still ranked as the top cause of chronic occupational poisonings, followed by benzene, trinitrotoluene, manganese and its compounds, and mercury compounds.

Among nearly 30 types of industry, the metallurgical, chemical, and machinery industries, small-scale industries, and the light and coal mining industries accounted for 78.8% of the occupational chronic poisonings.

In addition, there were 3,129 cases of noise-induced hearing loss (mainly in the textiles and machinery industries); 1,375 cases of occupational dermatoses; and a total number of 1,023 cases of all other occupational diseases, including chemical burns, metal fume fever, occupational asthma, occupational extrinsic allergic alveolitis and byssinosis.

Provision of occupational health services

Network of occupational health services

Based on the principle of "three-tier prevention", the network of occupational health services and its management have been established at various levels of governmental health agencies, starting in the mid-1950s. An in-plant service system for occupational health, providing work environmental monitoring, health surveillance, emergency services and routine medical care, has also been set up in the majority of State-owned industries.

The system of reporting verified occupational diseases facilitates the provision of emergency service and data collection, and stimulates feedback on the prevention of occupational diseases.

Information sources

Apart from the central databank on occupational diseases and injuries maintained under the Ministry of Health and Ministry of Labor, People's Republic of China, information sources on occupational health and safety are available at provincial and municipal levels. For example, the database entitled "Chemical Safety and Emergency Management" has been set up and is available on CD-ROM disks revised annually by the Institute of Occupational Medicine, Shanghai Chemical Industry.

The information disseminated on occupational health and safety relies on journals periodically published at state, regional and industry levels. Of these, the Chinese Journal of Preventive Medicine, Chinese Journal of Industrial Hygiene and Occupational Medicine, China Journal of Industrial Medicine, and China Safety Sciences and Technology are recognized to be the leading journals in this field in China.

Education and training

The teaching curriculum in occupational health has been developed to meet the needs of undergraduate, graduate and on-the-job refresher training. Among the total of 142 medical universities or medical colleges, there are 34 academic faculties at schools of public health offering courses in occupational health and industrial toxicology. About 20 medical universities and the Institute of Occupational Medicine, Chinese Academy of Preventive Medicine offer specialized training leading a Master's and/or Doctorate degree on occupational health, occupational medicine or industrial toxicology. On-the-job training is frequently offered in the form of short-term courses on a variety of topics, such as occupational epidemiology, occupational health services and management for SSIs, chemical safety and regulatory issues, industrial toxicology, etc. To meet even broader needs, televised courses on occupational health, broadcast once a week on the Chinese TV, have been offered under the guidance of the Ministry of Health since the 1980s. In addition, two WHO Collaborating Centers for Occupational Health have been designated since the 1980s; one is situated in the Institute of Occupational Medicine, Chinese Academy of Preventive

Medicine, Beijing and the other in the School of Public Health, Shanghai Medical University, Shanghai. These two centers have played vital roles in providing education and training, in the promotion of scientific research, and in providing information consultation in the field.

Legislative regulations and health inspection

The Chinese government started paying special attention to occupational health and safety on the basis of Mao Zedong's philosophy "Health and safety for people at work, and work performed along with health and safety" as early as in the mid-1950s. With rapid national industrialization, a variety of legislative regulations for occupational health and safety have been issued, in a piecemeal fashion, at both State and local levels. The Regulation on Prevention of Silica Dust in Enterprises (1956), the Health Standards for the Design of Industrial Premises (Standards TJ 36-79)(1979), the Regulation of Work Safety for Mining Industries (1982), the Rules of the Management of Verified Occupational Diseases (1984), the Act on Silicosis Prevention (1987), the Rules on Occupational Health Services for Town- and Village-owned Enterprises (1987), and the Labour Law of People's Republic of China (1991) are recognized as the fundamental legislation. Furthermore, the Occupational Disease Control Act (1996) is one of the most comprehensive local regulations adopted by the People's Congress of Shanghai Municipality.

Enforcement of the above regulations and enhancement of periodic worksite health inspections and monitoring, which are conducted by the Health and Anti-epidemic Station at various levels, have been key factors improving workplace health and safety. For example, stimulated by the relevant regulations, the compliance rate of workplace occupational hazards with national occupational exposure limits increased in State-owned enterprises from 51.4%-63.0% in 1986-1989 to 65.6%-68.3% in 1991-1995. However, the coverage rates of environmental monitoring and health surveillance were not high enough and often varied widely. This is particularly true in SSIs, where, e.g. the rate of periodical medical examination for exposed workers in the rural area of Beijing may be as high as 61.0% while it was 7.7% in the less developed area of Anhui Province.

NEW CHALLENGES ON OCCUPATIONAL HEALTH

Problems arising from the transitional period

New challenges may arise from the transition of the national economy to being market-oriented. During the present period of the transition, many State-owned enterprises are suffering from growing pains in that they are losing the budget necessary for OHS activities. For example, according to statistics, airborne dust levels at more than 30% of worksites have not been in compliance with the national occupational exposure limit aiming to eliminate silicosis; this means that

new cases of silicosis may emerge. In responding to the ILO/WHO Global Strategy on the Elimination of Silicosis, a Symposium on the Strategy for Prevention and Control of Silicosis was held at Shanghai Medical University. Three main issues were targeted: i) proper definition for the strategy meeting the challenges posed by China's rapid industrialization and economic transition; ii) formulation of a nationwide network providing technical, organizational, and legislative support conducive to creating a healthy and safe work environment and better health surveillance for dust-exposed workers; and iii) putting prevention first as the principle of the strategy, based on a consensus of the pathologically incurable but preventable nature of silicosis.

Occupational health problems in small-scale industries

With the rapid spread of economic reform, since the late 1970s there has been a proliferation of town-owned and village-owned enterprises, known as small-scale industries (SSIs), in rural China. Unfortunately, in most rural areas, occupational health services for SSIs are basically given a lower profile, and the integration of occupational health with primary health care has not been widely recognized or implemented. At the same time, the low level of production technology, limited capital resources, and lack of awareness of occupational and environmental health issues have placed workers in SSIs at a greater risk.

An extensive study conducted in suburban areas of Shanghai confirmed the constrained situation of health services in SSIs. Therefore, it is imperative that the concept of integrating occupational health with primary health care becomes an approach that is applied widely.

Hazard transfer in multinational enterprises

The globalization of industry is becoming a new challenge to developing countries. The increasing export of hazardous industries from some investing countries or regions has resulted in rising costs for treating industrial wastes and a worsening situation of occupational health in developing countries.

With economic reform and the opening of China, a variety of joint ventures financed with foreign capital have sprung up since the 1980s. Much of this investment comes from multinational corporations, many of which bring a corporate experience of occupational safety and health and a commitment to environmental protection along with their industry and technology. But a number of investments in global industry are made with little or no consideration for these social costs.

An investigation in Shanghai showed that 62.8% of the total number of 1,407 multinational enterprises investigated were defined as industries with hazardous materials or production processes. Of these, 14.2% of the 239,995 workers included in the study were exposed to various kinds of occupational hazards,

including physical agents (49%), chemical substances (32%), silica dust (18%), and infectious pathogens (1%). Another survey from Shenzhen, Guangdong Province showed that overtime hours and exposure to much higher levels of hazards than stipulated by the occupational exposure limits have been serious problems in multinational enterprises. As a result, acute and chronic poisonings had occurred among workers at multinational enterprises in the region. The following newspaper quotes illustrate these: "At least 53 female and three male workers aged 16-26 were poisoned by a neurotoxic agent, N-hexane, while working for a Shenzhen-based joint venture that produces liquid crystal display panels used in pagers and notebook computers". "The number of organic solvents poisoning accidents has grown remarkably in recent years, usually involving foreign-invested companies". "An average of 100 people a year have fallen victim to industrial poisoning, killing nine victims a year on average in Guangdong". "China's Labour Law requires that enterprises using poisonous or hazardous substances must report to local medical and labour inspection agencies, and inform workers of risks and take appropriate precautionary measures". Unfortunately, "fewer than 10 percent of enterprises registered in Guangdong follow the procedures" (China Daily, 1996).

The United Nations must take a much stronger lead in preventing hazardous technology transfer, and international efforts from ILO, WHO, UNEP, NGOs working together with academic institutions are called for in order to ease the situation.

Segregation of occupational safety and occupational health

Occupational safety is the professional specialty concerned with the prevention and control of work-related injuries and other similar harmful events. In China, work injuries have been ranked as one of the top occupational health and safety problems for some types of industry, such as construction. In Shanghai, according to statistics, 295 construction workers were killed in 1995; 165 in 1996.

However, in China, the administrative system of occupational accident prevention and control is independent from the system responsible for occupational health. This segregation of occupational safety from occupational health may have negative effects. Further efforts are urged to narrow the gap between the two.

FUTURE PERSPECTIVES

Messages from the Sixth National Conference on Occupational Medicine

The Sixth National Conference on Occupational Medicine, a sequential meeting convened every five years, was held from 12-15 May 1998 in Dalian, China. It attracted more than 450 participants who presented 740 papers pertaining to 11 sub-fields of occupational medicine: i) dust and pneumoconiosis; ii) chemicals and occupational poisoning; iii) physical agents and ergonomics; iv) industrial

toxicology; v) occupational epidemiology; vi) occupational tumours; vii) occupational health for women; viii) environmental and biological monitoring; ix) industrial hygiene and personal protection; x) management of occupational health services; and xi) occupational nursing.

Seventeen keynote presentations were made by Chinese participants, who included speakers from Taiwan and Hong Kong, and by foreign guests. The presentations shared up-to-date knowledge and methods on macro-viewpoints of occupational services and management, and micro-viewpoints of molecular toxicology, ergonomics and occupational medicine, reflecting our common interest in occupational health as we approach the new century.

Training and education has the following goals:

i) To renew attitudes, and to upgrade knowledge and skills in occupational health and safety among professionals at various levels

ii) To develop the curriculum for workers and to produce teaching materials on occupational health and safety for them

iii) To implement the concept of the healthy workplace by disseminating the healthy workplace concept and by promoting a holistic approach of "workplace health promotion" instead of the traditional occupational health in narrow sense

iv) To link occupational health with sustainable development of the national economy conducive to better harmonization of work, health and safety, an improved ecological system, and economy growth.

Strengthening policies and legislation

For example, a comprehensive regulation on the "Occupational Diseases Control Act" was adopted by the Shanghai Municipal People's Congress in1996, which is a great step forward in the legislative containment of occupational diseases. The existing national policies and regulations on occupational health and safety will be further enforced through implementation of the local Act.

NEW TRENDS IN OCCUPATIONAL HEALTH SERVICES

In the 1990s, economies have become globalized, owing to liberalization of trade, free movement of capital and increased efficiency of telematic communications. These changes have substantially altered the base for economic activities and have brought both benefits and obstacles with regard to development of occupational health.

Some research data indicate that despite its positive impact on the growth of world trade, globalization has widened the gap between the rich and the poor at

two levels: between countries and within countries. A universal minimum standard of occupational health and safety, such as the ILO Conventions No. 161 on Occupational Health Services and No. 155 on Occupational Safety and Health, is therefore needed, to stimulate actions and to provide all countries with guidance in meeting the reasonable basic requirements of health and safety at work. Some examples can be cited where relaxation in regulation and enforcement (deregulation) has led to rapid increases in risks and to economic loss even in industrialized countries.

NUTRITION INTERVENTION TRIALS IN LINXIAN

Linxian, a rural county located at the border of Henan, Hebei, and Shanxi provinces in north-central China, has the world's highest rates of esophageal and cardia cancers **(Table 1)**. The survey showed that the cumulative death rates to age 75 in Linxian exceed 30 per cent for males and 20 per cent for females, respectively, surpassing the highest in the world for this cancer. Reasons for the exceptionally high rates of esophageal and cardia cancers are unknown. Previous studies in Linxian and other high-risk areas of China indicate that smoking and drinking--the major determinants of esophageal cancer in western societies--may play some role in China, but relatively minor ones; both the excessive ingestion of nitrosamine-contaminated fermented and moldy foods and the inadequate consumption of fruit, vegetables, and some micronutrients--riboflavin, vitamin A and C, zinc, selenium, molybdenum, and others may be the prominent risk factors for esophageal cancer in Linxian and China.

Table 1. INCIDENCE OF THE ESOPHAGEAL CANCER IN LINXIAN, CHINA, 1984-1985

	Male	Female	Both Sex
Population	838,617	829257	1,667,847
New cases	1,492	1,047	2,539
Crude Rate*	177.91	126.26	152.23
Age-Adjusted Rate**	276.16	166.67	216.02
Truncated Rate***	411.26	258.74	333.60
Cumulative Rate****	35.43	21.65	28.08

*Per 100,000; ** Age-Adjusted by World Standardized Population, per 100,000; *** 35-64 yrs (per 100,000); **** 0-74 yrs (%)

The extraordinary risk for esophageal cancer, low dietary intake of several nutrients, and administrative considerations favorable for implementation of a large clinical trial combined to make Linxian a desirable setting in which to test a cancer etiological hypothesis or chemoprevention strategy.

Two randomized, placebo-controlled trials were carried out from 1984 to 1991 in Linxian to test the hypothesis that dietary supplementation with vitamins and minerals may reduce the incidence and mortality of esophageal and cardia cancers in this high-risk area. Both the Dysplasia Trial and the General Population Trial were double-blind, placebo-controlled intervention using different

design that enrolled individuals from the precancerous lesion (cytologically-demonstrated dysplasia) subjects and the general population of the high-risk area. In this presentation, I am going to describe the updated results from two nutrition intervention trials and discuss something about the dietary and nutritional hypotheses in esophageal and cardia carcinogenesis.

BACKGROUND AND PROGRESS

The details of the procedures and preliminary results of two nutrition intervention trials have been separately described in the previous published reports (1-17). In brief, **The Dysplasia Trial** was a precancerous lesion intervention trial which primary objective was to evaluate the effect of multiple-vitamin and -mineral supplements on esophageal/gastric cardia cancer incidence and mortality in Linxian residents with a previous cytological diagnosis of esophageal dysplasia. In addition, the effects of the supplements on other common disease prevalence and death, as well as on regression or progression of esophageal dysplasia were also examined. This was a double-blind, placebo-controlled intervention. 3,318 subjects with cytological evidence of esophageal dysplasia who took intervention agents were included in this trial from May 1985 to May 1991 in a two-arm design that provided participants either two Centrum (Lederle Laboratories, Inc.) tablets containing 25 different vitamins and minerals at doses ranging from 1-3 times the U.S. Recommended Daily Allowances and one 15 mg β-carotene capsule (Haffmann-LaRoche, Inc.) daily or matching placebos **(Table 2)**.

Table 2. DAILY DOSES AND TYPES OF MICRONUTRIENTS IN THE SUPPLEMENTS FOR DYSPLASIA TRIAL*

Vitamin/mineral	Compound	Dose
Beta carotene		15 mg
Vitamin A	Acetate	10000 IU
Vitamin E	Di-alpha tocopherol acetate	60 IU
Vitamin C	Ascorbic acid	180 mg
Folic acid		800 μg
Vitamin B_1	Thiamine mononitrate	5 mg
Vitamin B_2	Riboflavin	5.2 mg
Niacinamide		40 mg
Vitamin B_6	Pyridoxine HCl	6 mg
Vitamin B_{12}	Cyanocobalamin	18 μg
Vitamin D		800 IU
Biotin		90 μg
Pantothenic acid	Calcium pantothenate	20 mg
Calcium	Dibasic calcium phosphate	324 mg
Phosphorus	Dibasic calcium phosphate	250 mg
Iodine	Potassium iodide	300 μg
Iron	Ferrous fumarate	54 mg
Magnesium	Magnesium oxide	200 mg
Copper	Cupric oxide	6 mg

Manganese	Manganese sulfate	15 mg
Potassium	Potassium chloride	15.4 mg
Chloride	Potassium chloride	14 mg
Chromium	Chromium chloride	30 µg
Molybdenum	Sodium molybdate	30 µg
Selenium	Sodium selenate	50 µg
Zinc	Zinc sulfate	45 mg

*Participants received two multivitamin, multimineral tablets (Centrum; Lederle Laboratories, Inc.) and one beta carotene capsule (Solatene; Hoffmann-LaRoche, Inc.) or matching placebo daily.

In the Fall of 1984, subjects with cytological evidence of severe dysplasia identified during a mass balloon cytology screening examination conducted in the Autumn of 1983 had baseline examinations (questionnaire, physical examination, endoscopy, blood and toenail sample collections, and blood pressure reading). Eligible participants were then randomized and started taking intervention agents in May 1985 **(Table 3)**.

Village physicians visited participants monthly throughout the trial. During each visit they distributed new pill bottles, counted and collected unused pills, and inquired about health status. A sample of participants also provided blood and urine samples quarterly throughout the trial for biochemical assessment of compliance.

Table 3. DYSPLASIA TRIAL PARTICIPANT CHARACTERISTICS **BY TREATMENT GROUP**

	Placebo Group		Supplement Group	
Participant characteristic	No.	%	No.	%
No. of participants*	1661	50	1657	50
Age at beginning of intervention, y				
<50	537	32	545	33
50-59	743	45	717	43
≥60	381	23	395	24
Sex: Male	731	44	730	44
Female	930	56	927	56
Cytology in 1983**: Dysplasia 1	1302	78	1243	75
Dysplasia 2	359	22	414	25
Education: None	685	41	719	44
Some	968	59	930	56
Tobacco (ever smoke cigarettes regularly >6 mo)				
No	1176	71	1172	71
Yes	477	29	477	29
Alcohol (any use past 12 mo): No	1359	82	1328	81
Yes	294	18	321	19
Pickled vegetable (any use past 12 mo in winter or spring)				
No	1484	90	1481	90

Yes	169	10	168	10
Moldy food (any use past 12 mo)				
No	1321	80	1333	81
Yes	332	20	316	19
Family history of esophageal/stomach cancer				
No	958	58	947	57
Yes	695	42	702	43

* Data missing on 16 participants for education, tobacco, alcohol, pickled vegetables, moldy food, and family history. ** P = 0.02 for difference in distribution of dysplasia category by treatment group.

Incident cancers and deaths were identified through several methods (including symptoms and deaths reported to village physicians, a county wide cancer registry, and cytological and endoscopic screening surveys of participants) that assured essentially complete ascertainment of these events among participants. Cancer diagnoses were confirmed by an International Endpoints Review Committee composed of U.S. and Chinese physician experts in the areas of clinical gastro-enterology, pathology, cytology, and radiology. There was essentially no less to follow-up.

In October 1987, at the midpoint of the Dysplasia Trial, a series of examinations were conducted to evaluate potential endpoints considered to be intermediate in the carcinogenesis process. A repeat balloon cytological examination was offered to all participants and an endoscopic examination and blood collection were performed on a sample. Analyses of samples collected during these examinations have included assessment of esophageal cytology, histology, cell proliferation, and DNA-content as well as measures of immune function and other studies.

In the Spring of 1991, at the end of intervention for the 6 year Dysplasia Trial, end of trial questionnaire were administered, blood samples were taken, blood pressure reading, cytologic and ophthalmologic examinations were offered to all living trial participants, and endoscopic examinations were performed on a sample.

The General Population Trial was a double-blind, placebo-controlled intervention which primary objective was to evaluate the effect of multiple-vitamin and -mineral supplements on esophageal/gastric cardia cancer incidence and mortality in the general population of Linxian. A secondary objective was to examine the effect of those supplements on mortality from other causes of death in this population. This trial used a more complicated fractional factorial design to allow simultaneous evaluation of four separate factors: vitamin A plus zinc, riboflavin plus niacin, vitamin C plus molybdenum, and β-carotene plus vitamin E plus selenium **(Table 4)**. There were 29,584 individuals recruited as trial participants from the general population of Linxian who took intervention agents between March 1986 and May 1991 **(Table 5)**.

Table 4. TYPES AND DAILY DOSES OF MICRO-NUTRIENTS BY **TREATMENT FACTOR IN THE GENERAL POPULATION TRIAL**

Factor	Micronutrients	Dose per day
A	Retinol (as palmitate)	5000 mg
	Zinc (as zinc oxide)	22.5 mg
B	Riboflavin	3.2 mg
	Niacin	40 mg
C	Ascorbic acid	120 mg
	Molybdenum (as molybdenum yeast complex)	30 μg
D	Beta-carotene	15 mg
	Selenium (as selenium yeast)	50 μg
	Alpha-tocopherol	30 mg

Baseline screening of subjects for participation in the General Population Trial was carried out in the Spring of 1985. These examinations included a questionnaire, physical examination, blood pressure reading, blood and toenail sample collection; In addition, the balloon cytologic and endoscopic examinations were performed on a sample. Following randomization, participants first received pills beginning in March 1996.

Methods of pill delivery, assessment of compliance, and ascertainment and confirmation of endpoints were identical to those used in the Dysplasia Trial.

Table 5. GENERAL POPULATION TRIAL PARTICIPANT CHARACTERISTICS

Participant characteristics	*All participants*	Range for individual treatment groups
No. of participants*	29 584	3677-3709
Age at start of intervention, y		
<50	42%	42%
50-59	35%	34%-35%
≥60	23%	23%-24%
Sex		
Male	45%	44%-45%
Female	55%	55%-56%
Education		
None	40%	39%-41%
Any	60%	59%-61%
Tobacco (ever smoke cigarettes		
Regularly >6 mo)		
No	70%	70%-71%
Yes	30%	29%-30%
Alcohol (any use past 12 mo)		
No	77%	76%-77%
Yes	23%	23%-24%
Pickled vegetable (any use past		

12 mo in winter or spring)		
No	91%	90%-92%
Yes	9%	8%-10%
Moldy food (any use past 12 mo)		
No	82%	81%-83%
Yes	18%	17%-19%
Family history of esophageal or Stomach Cancer		
No	68%	68%-69%
Yes	32%	31%-32%

* Data missing for variables other than age and sex on 104-109 participants, depending on the characteristic.

In the Spring of 1991, at the conclusion of intervention for the 5 1/4-year General Population Trial, questionnaires and physical examinations (including blood pressure readings) were administered to all participants. In addition, blood samples were taken and cytologic and ophthalmologic examinations performed on about 10% of living participants, and endoscopic examinations were carried out on a smaller sample.

Finally, preliminary data on endpoints from the Trials have also been obtained for the 21 month post-intervention period to determine if there was a persistence of the beneficial effects observed during the Linxian Nutrition Intervention Trials after cessation of intervention and to further evaluate potential delayed effects, beneficial or harmful, of the interventions on total and cause-specific mortality and cancer incidence.

UPDATED RESULTS

Dysplasia Trial The trial was successfully concluded in May 1991 and articles describing the design, methods, participant characteristics, and compliance (1-2) and the main intervention findings (1,3-6) have been published. Compliance during the trial as estimated by pill counts was excellent, with 88% of the subjects taking over 90% of their pills. Biochemical assessment confirmed the excellent compliance **(Table 6)**. A total of 324 deaths, including 176 attributed cancer, occurred during trial **(Table 7)**. Incident cancers identified during the trial numbered 448, with 96% occurring in the esophagus or stomach **(Table 8)**. Results showed that in the supplemented compared to the placebo group the risk of total mortality was 7% lower, esophageal cancer mortality 16% lower, stomach cancer mortality 18% higher, esophageal/gastric cardia cancer mortality 8% lower, and cardiovascular mortality 38% lower. Although none of these differences were statistically significant, there was general suggestion of benefit, and longer follow-up may be more informative regarding effectiveness of this supplementation on cancer and other diseases.

Table 6. DYSPLASIA TRIAL COMPLIANCE ASSESSED BIOCHEMICALLY OVER 6-YEAR INTERVENTION

Analyte	Baseline*				During intervention				P**
	Placebo		Supplement		Placebo		Supplement		
	No	Mean	No	Mean	No	Mean	No	Mean	
Retinol, µg/dL of plasma	47	40.65 (14.36)	46	42.71 (13.64)	216	40.72 (13.42)	209	63.05 (17.59)	.0001
Riboflavin, EGR Activation coefficient#	50	1.69 (0.27)	45	1.67 (0.29)	293	1.53 (0.35)	284	1.13 (0.23)	.0001
Ascorbic acid, mg/dL of plasma	45	0.60 (0.44)	43	0.62 (0.54)	283	0.63 (0.41)	281	0.92 (0.40)	.0001
Beta carotene, µg/dL of plasma	47	10.26 (5.17)	46	10.73 (6.10)	216	11.41 (15.87)	209	119.06 (86.83)	.0001

- Baseline nutritional assessment conducted in September 1984; Mean (Standard Deviation in parenthesis) was adjusted for season; ** *P* values are from *t* tests of difference between placebo and supplement during intervention; # EGR = erythrocyte glutathione reductase. Lower EGR coefficient indicates higher riboflavin status

A number of evaluations of the effect of supplementation on intermediate endpoints have also been conducted as part of this trial and support the general notion that the supplements were beneficial. Among 396 trial participants who received an endoscopic examination of the esophagus and stomach at the end of the trial in 1991, 97 (25%) were found to have dysplasia or cancer, including 47 (12%) with invasive cancer (7). Nearly all of these subjects were asymptomatic, indicating early disease. Although significant treatment group differences were not seen, the supplemented group had 14% fewer premalignant and malignant lesions and 21% fewer cancers. A similar reduction in overall dysplasia and cancer was seen among treated subjects who were endoscoped in 1987, although there was no difference in cancer alone (10,

Table 7. NUMBERS, RATES, AND RRs OF DEATH BY CAUSE AMONG THOSE RECEIVING VITAMIN/MINERAL SUPPLEMENTATION VERSUS PLACEBO IN THE DYSPLASIA TRIAL

	Placebo		Supplement			
Cause of death	No.	Rate*	No.	Rate*	RR**	95% CI
Total	167	17.4	157	16.3	0.93	0.75-1.16
Cancer	89	9.3	87	9.0	0.96	0.71-1.29
Esophageal	44	4.6	38	3.9	0.84	0.54-1.29
Stomach	35	3.6	42	4.4	1.18	0.76-1.85
Cardia	32	3.3	34	3.5	1.04	0.64-1.69
Noncardia	3	0.3	8	0.8	2.68	0.71-10.11
Esophageal/cardia	76	7.9	72	7.5	0.92	0.67-1.28
Other	10	1.0	7	0.7	0.71	0.27-1.87
Cerebrovascular	35	3.6	22	2.3	0.62	0.37-1.06
Other	43	4.5	48	5.0	1.12	0.74-1.69

* Rate per 1000 person-years; ** RR adjusted for age, sex, commune, and initial grade of dysplasia.

Table 8. NUMBERS, RATES, AND RRs OF CANCER INCIDENCE AMONG THOSE RECEIVING VITAMIN/MINERAL SUPPLEMENTATION VERSUS PLACEBO IN THE DYSPLASIA TRIAL

	Placebo		Supplement			
Type of cancer	No.	Rate, %*	No.	Rate, %*	RR**	95% CI
Total	221	13.3	227	13.7	1.01	0.84-1.22
Esophageal	128	7.7	123	7.4	0.94	0.73-1.20
Stomach	81	4.9	96	5.8	1.17	0.87-1.58
Cardia	77	4.6	82	5.0	1.05	0.77-1.43
Noncardia	4	0.2	14	0.8	3.54	1.17-10.76
Esophageal/cardia	205	12.3	205	12.4	0.98	0.81-1.19
Other	12	0.7	8	0.5	0.67	0.28-1.65

* Cumulative incidence. ** RR adjusted for age, sex, commune, and initial grade of dysplasia.

20). Tritiated thymidine, a measure of cell proliferation, was evaluated in 1987 in 512 endoscoped patients (5,22). Although there was no difference in the total labeling index, supplemented subjects had a lower proportion of labeled cells in the upper epithelial layers, indicating a more confined proliferation zone. An analysis of cytology findings showed that the participants who were supplemented were significantly more likely to revert to non-dysplastic cytology at both 30 and 72 months **(Table 9, 10, 11, 12, 13)** (6,18,19). Results from intermediate endpoint evaluation from the Dysplasia Trial have recently been summarized (14).

Finally, the effect of intervention on non-cancer endpoints has also been examined. Stroke mortality was significantly reduced (48%) in males **(Table 14, 15)**, as was the prevalence of hypertension (57%) **(Table 16)** (13,17). Examinations carried out at the end of the intervention showed a reduction of 36% in the prevalence of nuclear cataracts for persons aged 65-74 years (8). However, other types of cataracts were not affected **(Table 17)**.

Table 9. NUMBER OF SUBJECTS AND CANCER AND ESTIMATED CUMULATIVE RISK OF ESOPHAGEAL CANCER BY TIME 2 (T2) AND BY THE END OF STUDY (T3) FOR CATEGORIES DEFINED BY TREATMENT GROUP AND INITIAL DYSPLASIA GRADE

Number in category	RX-1[1] 1243	PL-1[2] 1302	RX-2[3] 414	PL-2[4] 359
Cancers by T2*				
Number observed	79	67	53	49
Cumulative %	0.08	0.07	0.14	0.16
Cancers by T3**				
Number observed	141	141	78	68
Cumulative %	0.15	0.14	0.23	0.23

[1] RX-1 indicates vitamin and mineral supplementation group and grade 1 at the start of the study; [2] PL-1 indicates placebo group and grade 2 at the start of the study; [3] RX-2 indicates vitamin and mineral supplementation group and grade 2 at the start of the study; [4] PL-2 indicates placebo group

and grade 2 at the start of the study; * T2 indicates repeated cytologic examination time (October-December 1987) subsequent to commencement of the intervention; ** T3 indicates repeated cytologic examination time (March-May 1991) subsequent to the commencement of the intervention.

General Population Trial This trial was also completed in May 1991 and articles describing the methods (1-2) and main results (1,4,9) have been published. Compliance during the trial was excellent as assessed by monthly pill counts (86% of all participants took over 90% of their pills) and quarterly biochemical assessments **(Table 18)**. A total of 2,127 deaths, 792 (37%) due to cancer, occurred among participants during the trial. Significant reductions in total mortality (9%), total cancer mortality (13%), and stomach cancer mortality (21%) were observed among participants who received the combination of β-carotene plus vitamin E plus selenium **(Table 19)**. Recipients of vitamin A plus zinc also had a significant reduction in noncardia stomach cancer mortality (41%), but this was countered by a nonsignificant increase in cardia cancer so that, overall, there was no

Table 10. OUTCOMES AT T2 AND T3 BY TREATMENT AND INITIAL DYSPLASIA GRADE

	Probability* of state J** or less			
Category	J = 0	J ≤ 1	J ≤ 2	J ≤ 3
Time 2				
RX-1	0.33 (0.014)	0.68 (0.014)	0.83 (0.011)	0.92 (0.008)
PL-1	0.30 (0.014)	0.69 (0.014)	0.85 (0.011)	0.93 (0.007)
RX-2	0.29 (0.023)	0.58 (0.025)	0.77 (0.021)	0.86 (0.017)
PL-2	0.20 (0.022)	0.52 (0.027)	0.74 (0.023)	0.84 (0.019)
Time 3				
RX-1	0.46 (0.016)	0.69 (0.015)	0.81 (0.012)	0.85 (0.011)
PL-1	0.41 (0.016)	0.68 (0.015)	0.81 (0.012)	0.86 (0.011)
RX-2	0.39 (0.026)	0.61 (0.026)	0.72 (0.024)	0.77 (0.022)
PL-2	0.34 (0.028)	0.55 (0.029)	0.68 (0.027)	0.77 (0.023)

* Standard errors in parentheses. ** J = 0, no dysplasia; J = 1, grade 1 dysplasia; J = 2, grade 2 dysplasia; J = 3, near cancer; J = 4, cancer.

Table 11. TIME-SPECIFIC AND COMMON ODDS RATIOS* FOR THE EFFECT OF TREATMENT ON OUTCOME

	J = 0	J ≤ 1	J ≤ 2	J ≤ 3
Time 2	1.26 (1.16-1.46)	1.06 (0.90-1.22)	0.93 (0.76-1.11)	0.95 (0.72-1.18)
	$P = 0.005$	$P = 0.46$	$P = 0.48$	$P = 0.68$
Time 3	1.21 (1.02-1.40)	1.10 (0.93-1.28)	1.05 (0.86-1.24)	0.98 (0.78-1.17)
	$P = 0.020$	$P = 0.23$	$P = 0.62$	$P = 0.84$
Common	1.23 (1.08-1.37)	1.08 (0.95-1.21)	0.99 (0.84-1.14)	0.95 (0.77-1.13)
	$P = <0.001$	$P = 0.21$	$P = 0.93$	$P = 0.58$

* Odds ratios are (ODDS J ≤ j | RX)/(ODDS J ≤ j | PL); 95% confidence interals in parentheses; *P*-values beneath estimates; J indicates which category an individual is in at a given time, J = 0, no dysplasia; J = 1, grade 1 dysplasia; J = 2, grade 2 dysplasia; J = 3, near cancer; J = 4, cancer.

benefit for these supplements on stomach cancer mortality. Although patterns for cancer incidence were generally similar to those seen for mortality, the reduction in esophageal cancer (14%) among persons taking riboflavin plus niacin was stronger in the incidence data and approached significance **(Table 20)**. Recent analyses stratified by age and gender indicate that the reduced cancer mortality observed for β-carotene plus vitamin E plus selenium was seen primarily in those less than 55 years old and in females (9). An evaluation of the effect of intervention on premalignant and early malignant lesions was performed on 391 subjects endoscoped at the end of trial. Although the number of endpoints was small, the pattern suggested that persons who received either retinol plus zinc or β-carotene plus vitamin E plus selenium had less dysplasia and/or early cancer (10).

Table 12. CUMULATIVE TRANSITIONAL PROBABILITIES IN THE T2 TO T3 INTERVAL

	Probability of J* or less at time 3			
	J = 0	J ≤ 1	J ≤ 2	J ≤ 3
J state at T2-treated group				
J = 0	0.60 (0.026)	0.81 (0.021)	0.90 (0.016)	0.94 (0.013)
J = 1	0.49 (0.026)	0.78 (0.021)	0.89 (0.016)	0.93 (0.013)
J = 2	0.38 (0.036)	0.69 (0.035)	0.87 (0.025)	0.93 (0.020)
J = 3	0.32 (0.048)	0.55 (0.050)	0.75 (0.044)	0.83 (0.038)
J state at T2-placebo group				
J = 0	0.52 (0.028)	0.81 (0.022)	0.91 (0.016)	0.94 (0.014)
J = 1	0.45 (0.025)	0.74 (0.022)	0.88 (0.017)	0.92 (0.014)
J = 2	0.28 (0.034)	0.63 (0.034)	0.81 (0.028)	0.91 (0.021)
J = 3	0.23 (0.043)	0.58 (0.052)	0.75 (0.045)	0.86 (0.037)

J indicates which category an individual is in at a given time, J = 0, no dysplasia; J = 1, grade 1 dysplasia; J = 2, grade 2 dysplasia; J = 3, near cancer; J = 4, cancer.

Table 13. RATES* OF CANCER IN THE T2-T3 INTERVAL GIVEN J STATE AT START OF INTERVAL

J** State at T2	RX group	PL group
J = 0	16.7 (3.5)	16.0 (3.7)
J = 1	17.5 (3.6)	19.5 (3.7)
J = 2	18.8 (5.3)	24.9 (5.9)
J = 3	47.2 (5.9)	37.8 (6.2)

- Rates are per 1,000 person years and are estimated by assuming a constant hazard of cancer in the 42-month interval. Standard devision is shown in parentheses. The test statistic for trend is the sum of Jonckheere's (Hollander and Wolf, 1973) distribution free test statistic within each treatment group. The two-sided test for trend obtained from the exact permutation distribution yielded p = 0.002.

** J indicates which category an individual is in at a given time, J = 0, no dysplasia; J = 1, grade 1 dysplasia; J = 2, grade 2 dysplasia; J = 3, near cancer; J = 4, cancer.

Table 14. CAUSE-SPECIFIC MORTALITY RATES BY TREATMENT GROUP IN THE DYSPLASIA TRIAL

	Placebo		Supplement			
Cause of death	No.	Rate*	No.	Rate*	RR	95% CI

Cancer	89	9.3	87	9.0	0.96	0.71-1.29
Cerebrovascular	35	3.6	22	2.3	0.62	0.37-1.06
Other	43	4.5	48	5.0	1.12	0.74-1.69
Total	167	17.4	157	16.3	0.93	0.75-1.16

Deaths per 100,000 person years

Table 15. RELATIVE RISKS OF STROKE ASSOCIATED WITH PRE-TREATMENT VARIABLES IN THE DYSPLASIA TRIAL*

	RR	95% CI	P-Value
SBP per 5 mm Hg	1.21	1.15-1.24	0.00
DBP per 5 mm Hg	1.25	1.16-1.32	0.00
AGE per 5 years	1.90	1.55-2.34	0.00
BMI	1.00	0.88-1.11	0.94
DRINK	0.43	0.16-0.94	0.03
SMOKE	1.00	0.48-2.12	0.99

* Estimates when each pre-treatment variable is entered separately into a Cox model stratified on sex and treatment group.

Table 16. ODDS RATIOS[1] FOR SUPPLEMENTS EFFECT ON END-OF-TRIAL OUTCOMES IN THE DYSPLASIA TRIAL

Sex	Outcome	Prevalence		Odds	95% CI	p-value
		Placebo	Supplement	Ratio		
Males[2]	High systolic	4.1	6.1	1.22	0.71-2.09	0.46
	High diastolic	5.7	4.8	0.74	0.44-1.23	0.25
	High both	14.3	7.2	0.43	0.28-0.65	0.02
	Alive with cancer	10.7	11.9	0.96	0.67-1.40	0.84
	Stroke death	3.2	1.4	0.36	0.16-0.83	0.02
	Other death	13.0	13.5	0.89	0.62-1.27	0.52
Females[3]	High systolic	10.0	9.0	0.89	0.62-1.29	0.55
	High diastolic	5.0	6.3	1.28	0.82-2.01	0.28
	High both	19.1	18.6	0.92	0.68-1.24	0.57
	Alive with cancer	8.3	8.5	1.02	0.70-1.50	0.90
	Stroke death	1.7	1.6	0.74	0.31-1.74	0.49
	Other death	6.4	6.5	1.00	0.65-1.53	1.00

[1] Model includes terms for age, baseline SBP, baseline DBP, and body mass index. The reference group is people who are alive and free of cancer, systolic hypertension, and diastolic hypertension at the end of the trial. [2] P = 0.001 for overall test of significance of treatment group. [3] P = 0.86 for overall test of significance of treatment group.

The prevalence of nuclear cataract was significantly lower (41%) in persons who received riboflavin plus niacin compared to those who did not **(Table 21)**. The benefit was limited to persons 65-74 years old who had a 55 % reduction. There was no effect on cortical cataracts and although posterior subcapsular cataracts represented only about 3% of the total cataracts seen, there was an increase in this type cataract in the riboflavin plus niacin group(12 versus 7 cataracts) (8).

Besides, there were 31 deaths attributed to lung cancer in the General Population Trial. Risk of lung cancer mortality was reduced by 45% (p=0.11) among those receiving the β-carotene plus vitamin E plus selenium supplements (11). Three nonfatal lung cancer were diagnosed, all among those in the supplemented group **(Table 22)**.

Table 17. TREATMENT EFFECT ON PREVALENCE OF NUCLEAR, CORTICAL, OR POSTERIOR SUBCAPSULAR CATARACT AMONG PARTICIPANTS AGED 45-74 YEARS IN THE DYSPLASIA TRIAL*

Cataract type	Treatment	No. of Subjects	No. (%) of subjects with cataract	Odds ratio (95% CI)
Nuclear**				
All ages	*M*	1058	71(6.7)	0.80
	P	1083	89(8.2)	(0.57-1.12)
Subjects (aged 45-64 y)	M	800	31(3.9)	1.28
	P	821	25(3.0)	(0.76-2.14)
Subjects (aged 65-74 y)	M	258	40(15.5)	0.57
	P	262	64(24.4)	(0.36-0.90)
Cortical	M	1058	375(35.4)	1.05
	P	1083	371(34.3)	(0.88-1.26)
Posterior subcapsular	M	1058	26(2.5)	1.41
	P	1083	19(1.8)	(0.75-2.67)

*CI indicates confidence interal; M, multivitamin/mineral; P, placebo. ** Significant heterogeneity of effect by age: $X^2 = 5.49$ (1 df); P = 0.02. Age-stratified analysis also presented.

Table 18. COMPLIANCE ASSESSED BIOCHEMICALLY OVER THE FIVE YEAR INTERVENTION IN THE GENERAL POPULATION TRIAL

Factor	Baseline[1]			During intervention			P[2]
	No.	Mean	SD	No.	Mean	SD	
			Retinol (μg/dL, plasma)				
A	47	35.7	8.8	479	54.0	16.0	.0001
No A	60	35.5	13.1	419	43.0	14.9	
			Riboflavin (EGR activation coefficient)[3]				
B	56	1.73	0.34	747	1.19	0.25	.0001
No B	51	1.78	0.40	745	1.44	0.31	
			Ascorbic acid (mg/dL, plasma)				
C	49	0.15	0.13	730	0.81	0.47	.0001
No C	49	0.25	0.29*	740	0.54	0.41	
			Beta carotene (μg/dL, plasma)				
D	47	5.9	5.2	443	85.5	78.5	.0001
No D	60	6.8	5.8	455	12.0	15.0	

[1] Baseline nutrition assessment conducted in May 1985; values adjusted for season.
[2] P values are for t tests of factor versus no factor during intervention.
[3] EGR = erythrocyte glutathione reductase. Lower EGR activation coefficient indicates higher riboflavin status. *P value for C versus no C at baseline = .03

Although the small numbers of events preclude detailed evaluation by subgroup, the reduction in risk associated with supplementation was greater among the 30% (almost all men) of the participants who smoked cigarettes than the 70% who were nonsmokers. While clearly not definitive, the Linxian findings provide additional relevant data for evaluation of the potential effect of vitamin supplementation upon lung cancer risk.

Preliminary Results from Post-intervention Followup Data Based on preliminary reports, estimated numbers of post-intervention deaths through October 1994 (3.5 years post-intervention) is 2,077, including 745 from cancers (345 from esophagus, 187 from gastric cardia, and 85 from noncardia). Preliminary analyses on endpoints from the General Population Trial indicate that the total mortality and total cancer mortality reductions seen for β-carotene plus vitamin E plus selenium are no longer evident, but that the stomach cancer mortality reduction is even greater than during the trial. This observation is of particular interest because the benefit observed during the trial did not appear for stomach mortality until approximately 24 months after the start of intervention (4), suggesting the possibility that there may be a similar lag period following cessation of intervention during which benefit persists.

Table 19. RELATIVE RISKS AND 95% CONFIDENCE INTERVALS (CIs) OF DEATH BY CAUSE ACCORDING TO VITAMIN/MINERAL FACTOR IN THE GENERAL POPULATION TRIAL

		Factor*			
Cause of Death	Number	A	B	C	D
Total	2127	1.00	0.97	1.01	0.91
		(0.92-1.09)	(0.89-1.06)	(0.93-1.10)	(0.84-0.99)
Cancer	792	0.97	0.98	1.06	0.87
		(0.85-1.12)	(0.85-1.13)	(0.92-1.21)	(0.75-1.00)
Esophageal	360	0.93	0.90	1.05	0.96
		(0.76-1.15)	(0.73-1.11)	(0.85-1.29)	(0.78-1.18)
Stomach	331	1.03	1.00	1.09	**0.79**
		(0.83-1.28)	(0.81-1.24)	(0.88-1.36)	(0.64-0.99)
Cardia	253	1.22	1.03	1.07	0.82
		(0.95-1.56)	(0.80-1.30)	(0.84-1.37)	(0.64-1.04)
Noncardia	78	**0.59**	0.94	1.17	0.72
		(0.37-0.93)	(0.60-1.47)	(0.75-1.82)	(0.46-1.14)
Esophageal/ Gastric cardia	613	1.04	0.95	1.06	0.90
		(0.89-1.22)	(0.81-1.11)	(0.90-1.24)	(0.77-1.05)
Other	101	0.94	1.24	0.98	0.80
		(0.64-1.39)	(0.84-1.84)	(0.66-1.45)	(0.54-1.18)
Cerebrovascular	523	0.99	0.93	1.04	0.90
		(0.84-1.18)	(0.79-1.11)	(0.88-1.24)	(0.76-1.07)
Other	812	1.04	1.00	0.94	0.96
		(0.91-1.20)	(0.87-1.14)	(0.82-1.08)	(0.84-1.11)

*A = retinol, zinc; B = riboflavin, niacin; C = vitamin C, molybdenum; and D = beta carotene, vitamin E, selenium.

DISCUSSION

It is well known that cancer is a kind of commonly seen and frequently occurring disease which seriously harms the health and life of human being; It has now already become major cause of deaths of residents in many countries and regions. According to an estimation of the World Health Organization (WHO), there were at least 7.6 million new cases of cancer identified each year and the life of at least 5.1 million people around the world is deprived by cancer. A recently completed new death survey in 26 provinces, municipalities and autonomous regions in China showed that cancer has already become the second underlying cause of deaths among both urban and rural Chinese residents; the number of deaths caused by cancer in these areas accounted for 20.59% and 17.12% of the total deaths in the corresponding areas, respectively. Since the etiology and carcinogenic mechanism of human cancer have not yet been well illustrated and lack of methods for early diagnosis and measures of cure, the case fatality rate of cancer is the highest and its threat is the greatest as compared with the other common diseases. Therefore, conquering the difficult medical problem of cancer as soon as possible has become an imperative demand and common wish of human being.

Table 20. RELATIVE RISKS AND 95% CONFIDENCE INTERALS (CIs) OF CANCER INCIDENCE ACCORDING TO VITAMIN/MINERAL FACTOR IN THE GENERAL POPULATION TRIAL

Type of Cancer	Number	Factor*			
		A	B	C	D
Total	1298	1.00 (0.89-1.11)	0.95 (0.85-1.08)	1.06 (0.95-1.18)	0.93 (0.83-1.03)
Esophagus	640	1.07 (0.92-1.25)	0.86 (0.74-1.01)	1.06 (0.91-1.24)	1.02 (0.87-1.19)
Stomach	539	0.96 (0.81-1.14)	1.04 (0.88-1.23)	1.10 (0.92-1.30)	**0.84 (0.71-1.00)**
Cardia	435	1.02 (0.85-1.24)	1.07 (0.88-1.29)	1.07 (0.90-1.29)	0.85 (0.70-1.02)
Noncardia	104	0.73 (0.49-1.08)	0.92 (0.63-1.35)	1.21 (0.82-1.78)	0.82 (0.56-1.20)
Esophageal/ Cardia	1075	1.05 (0.93-1.19)	0.94 (0.83-1.06)	1.06 (0.94-1.20)	0.94 (0.84-1.06)
Other	119	0.80 (0.56-1.15)	1.09 (0.76-1.56)	0.92 (0.64-1.32)	0.88 (0.62-1.27)

* A = retinol, zinc; B = riboflavin, niacin; C = vitamin C, molybdenum; and D = beta carotene, vitamin E, and selenium.

According to reports in literature, considerably large scale screening for chemopreventive agents for prevention of cancer has been organized and carried out in many countries of the world, which have proven that considerable number of compounds can markedly inhibit the growth of cancer in cell culture system and in animals; these compounds include phenols, indoles, aromatic

isothiocyanates, coumarins, steroids compounds and proteinase inhibitors. However, all these substances have certain toxicity, there is a great risk when they are taken by the general healthy population for a long period of time. Therefore, these substances could neither pass preclinical toxicological evaluation so far, nor be approved to get into clinical trial or be used in intervention studies in human population; furthermore, nothing can be mentioned about applying them in practical prevention of cancer.

In order to find out highly effective, low toxicity cancer chemopreventive agents, scientists have shifted their attention during the recent 10 years to investigate the relationship between nutrition and cancer, thereby to identify the cancer-preventive vitamins and minerals from the micronutrients necessary to human physiology, so that the goal of preventing cancer and other diseases can be achieved via adjustment of constitution of the daily diet and intake of specific nutrients having the preventive effect, or through taking vitamin and mineral supplements.

Table 21. TREATMENT EFFECT ON PREVALENCE OF NUCLEAR CATARACT AMONG PERSONS AGED 55 TO 74 YEARS, GENERAL POPULATION TRIAL (N=1851)[1]

Treatment[2]	Estimated proportion of subjects with cataract		Prevalence	
	Treatment	Placebo	OR	(95% CI)
A	0.120	0.151	0.77	(0.58-1.02)
B	0.107	0.169	**0.59***	(0.45-0.79)
Aged 55-64 y#	0.058	0.058	0.99	(0.62-1.59)
Aged 65-74 y#	0.213	0.378	**0.45***	(0.31-0.64)
C	0.121	0.150	0.78	(0.59-1.04)
D	0.146	0.125	1.19	(0.90-1.59)

[1] Subjects aged 45 to 54 years were omitted since the prevalence of nuclear cataract in this age group was only 0.5% (seven of 1398). CI indicates confidence interal.
[2] A = retinol, zinc; B = riboflavin, niacin; C = vitamin C, molybdenum; and D = beta carotene, vitamin E, and selenium. * P<0.001 # Significant age and treatment B interaction in logistic regression analysis; age-stratified results are also presented.

Table 22. RELATIVE RISK OF LUNG CANCER MORTALITY (1986-1991) AMONG INDIVIDUALS SUPPLEMENTED WITH β-CAROTENE, VITAMIN E, AND SELENIUM IN THE GENERAL POPULATION TRIAL

Supplement	**Person-year of observation**	**No. of lung cancer deaths**	**RR**	**95% CI**
No	**74,749**	**20**	**1.00**	**--**
Yes	**75,024**	**11**	**0.55**	**0.26-1.14**

During the past 10 years or more, extensive explorations were carried out for such possibilities both in China and abroad. It was found up to now that some

vitamins and minerals at medication doses do have cancer-preventive effects in vitro and in animal experimental systems; these findings are also supported by the results of epidemiological surveys, but their real effects have not been confirmed by clinical trials or field intervention studies in human population.

There has been growing interest over recent years in the possible use of nutrients--particularly antioxidant nutrients--to inhibit the development of cancer in people who already have precancerous lesions. Most research in this field has focused on oral leukoplakia (a precursor of oral cancer) or cervical dysplasia (a precursor of cervical cancer). Little attention has been devoted to cancer of the esophagus or its likely precursor, esophageal dysplasia. The preliminary results in the Dysplasia Trial showed that multi-vitamin/mineral recipients had lower total mortality (7%), esophageal cancer mortality (16%), and stroke mortality (38%). Although none of these differences were statistically significant, there was general suggestion of benefit of multi-vitamin/mineral supplementation. The updated intermediate endpoints evaluations indicated that multi-vitamin/mineral recipients had 14% fewer premalignant and malignant lesions and 21% fewer cancers from endoscopic examination. Tritiated thymidine labeling analyses showed that the supplemented subjects had a lower proportion of labeled cells in the upper epithelial layers, indicating a more confined proliferation zone that intervention confered. And cytology findings showed that the recipients of intervention were significantly more likely to revert to non-dysplastic cytology at both 30 and 72 months. The parallel nature of the results in mortality and reversal rates of precursor suggests that the protective effect of multi-vitamin/mineral supplementation seems plausible and this may not be a chance finding. Besides, the updated analysis also confirmed that stroke mortality, as well as prevalence of hypertension and nuclear cataracts were significantly reduced in the multi-vitamin/mineral supplemented group. Therefore, the Dysplasia Trial provides important support for the hypothesis that vitamin and mineral supplements may help prevent the risks of cancer, stroke, hypertension, and nuclear cataracts in humans.

In the General Population Trial, reduction in total mortality and in cancer mortality and incidence, especially for stomach cancer, were observed over a 5 1/4-year period for the nearly 15,000 individuals who received daily supplements containing β-carotene plus vitamin E plus selenium. The updated analyses for the 21 month post-intervention period indicate that the observed benefit for total and cancer mortality is reduced but that the benefit for stomach cancer remains or even greater than during the trial. As mentioned before, this preliminary result is of particular interest because the benefit observed during the trial did not appear for stomach cancer mortality until approximately 24 months after the start of intervention, suggesting the possibility that there may be a similar lag period following cessation of intervention during which benefit persists. Although pattern for cancer incidence were generally similar to those seen for mortality, the reduction in esophageal cancer (14%) among persons taking riboflavin plus niacin was stronger in the incidence data and approached significance. Recent

analyses stratified by age and gender indicate that the reduced cancer mortality observed for β-carotene plus vitamin E plus selenium was seen primarily in those less than 55 years old and in females. An evaluation of the effect of intervention on premalignant and early malignant lesions indicate that persons who received either retinol plus zinc or β-carotene plus vitamin E plus selenium had less dysplasia and/or early cancer. Besides, the prevalence of nuclear cataract was significantly lower (37%) in persons who received riboflavin plus niacin compared to those who did not. The findings from the General Population Trial also provide support for the hypothesis that intake of specific micronutrients may inhibit cancer and some common disease development.

However, findings of a protective effect of β-carotene, vitamin E, and/or selenium are not completely consistent with the recently published results from CARET, ATBC, and the Physicians' Health Study (CancerNet News January 1996). The Alpha-Tocopherol, Beta-Carotene Cancer Prevention Trial (ATBC) was carried out by NCI in collaboration with the National Public Health Institute of Finland which purpose was to test if vitamin supplements of 50 mg α-tocopherol and 20 mg β-carotene would prevent lung and other cancers in a group of 29,133 male smokers in Finland. This trial results showed that 18% more lung cancers were diagnosed and 8% more overall deaths occurred in study participants taking β-carotene. In the β-carotene and retinol efficacy trial (CARET), after an average of 4 years of receiving supplements, 28% more lung cancers were diagnosed and 17% more deaths occurred in participants taking β-carotene (30 mg) and vitamin A (25,000 IU) than in those taking placebos. Neither of these studies showed a benefit from taking supplements. The Physicians' Health Study was completed at the end of 1995 and also showed no benefit or harm in people taking β-carotene supplements for more than 12 years. In both the ATBC study and CARET, participants with the highest levels of β-carotene in their blood, measured before the study began, went on to have fewer lung cancer. These results are consistent with the possibility that a different compound or compounds in foods that have high levels of β-carotene may be responsible for the protective effect of dietary β-carotene seen in epidemiological studies. Because these are studies of pills, not food intake, it should be stressed that the study results do not change the results of studies that show that eating a variety of fruits and vegetables each day remains a good way to reduce the risk of some cancers. The contradictory results each other from the foregoing studies and the Linxian trials should be considered and interpreted carefully. The Linxian trials indicated that there was a differential effect between mortality from stomach cancer (21% reduction) and other cancers (20% reduction) versus esophageal cancer (4% reduction), suggesting that the effect may vary by site and/or cell type. Recipients of vitamin A plus zinc also had a significant reduction in noncardia stomach cancer mortality (41%), but this was countered by a nonsignificant increase in cardia cancer so that, overall, there was no benefit for these supplement on stomach cancer mortality. It should be indicated that the risk of lung cancer mortality was reduced by 45% ($p=0.11$) among those receiving the β-carotene, vitamin E, and selenium supplements in Linxian Trials. While clearly not definitive, the Linxian findings

provide additional relevant data for evaluation of potential effect of vitamin supplementation upon lung cancer risk. More important is that participants in Linxian trials were from a relatively remote, rural area of China with a marginally deficient in a number of nutrients. Even after supplementation, their blood levels of β-carotene and vitamin E merely reached or even lowered than those of population in rich developed countries. Thus, the preventive benefit of micronutrient supplementation might be only conferred for the micronutrient-deficient cohort but not for the rich people.

Animal experimental studies have demonstrated that β-carotene, vitamin E and selenium has definite inhibitory effects on the occurrence of cancer induced by ultraviolet radiation, oral cancer induced by dimethyl benzanthracene and colon cancer induced by dimethylhydrazine although there were some studies that provided different results from which no inhibitory effects could be revealed (22,23); moreover, these vitamins could even enhance the carcinogenicity. Vitamin E has been shown to inhibit nitrosamine-induced esophageal cancer in mice (24).

The use of the above mentioned vitamins and minerals alone in animals showed more or less inhibitory effects to different extents on certain types of cancer cells, but these effects have not been proven by clinical trials or intervention studies in human population. The final conclusions have not been definitely established.

Only a few observational studies have evaluated so far the relationship between supplementation of vitamins and minerals and the risk of developing cancer, but no any report of randomized clinical studies are available which demonstrate that supplementation of β-carotene, vitamin E or selenium have the protective effects against the risk of developing esophageal or gastric cancer. In a U.S. hospital-based study (25) of 133 male esophageal cancer patients, risk was 50% lower among users of vitamin E supplements. A 50% reduction in risk of oral cancer also was reported among users of vitamin E supplements in a national study (26) that enrolled over 1,000 American patients.

Several clinical trials have shown beneficial effects of β-carotene or vitamin E on precancerous lesions. In a 20 month randomized trial in Uzbekistan (27), daily doses of 40 mg of β-carotene together with weekly supplements of 100,000 IU of retinol and 80 mg of vitamin E were associated with endoscopically determined regression of chronic esophagitis (although the effect was not statistically significant) and with a significant reduction in oral leukoplakia. Several other trials (28-30) have also reported reversals in oral leukoplakia, thought to be a precursor to oral cancer, following supplementation with β-carotene or vitamin E. Furthermore, β-carotene combined with retinol lowered the frequency of buccal micronuclei among betel chewers in the Philippines (31), while β-carotene alone reduced the prevalence of micronuclei in the sputum of smokers in the Netherlands (32).

No other randomized clinical trials have reported on the effects on esophageal or stomach cancers of supplementation with β-carotene, vitamin E or selenium. In the only reported cancer trial (33), daily 50 mg β-carotene supplementation was not found to be effective in inhibiting second primary basal or squamous cell skin cancers among patients with nonmelanoma skin cancer. As mentioned above, there were no enough numbers of endpoints identified in the three clinical trials (CARET, ATBC, and the Physycians' Health Study) for evaluating the effects of β-carotene, vitamin E and/or selenium supplementations on esophageal or stomach cancers.

The mechanisms by which β-carotene, vitamin E and selenium inhibit cancer development are not clear, but might involve their antioxidant properties (22). These compounds, especially β-carotene, can quench free radicals and protect against oxidative damage to DNA. The nutrients also inhibit the endogenous formation of N-nitroso compounds, some of which are potent carcinogens in animal experiments and are suspected risk factors for stomach and esophageal cancers in human populations, including Linxian's (34, 35). β-carotene, vitamin E and selenium may also possess immunologic and other properties that influence carcinogenesis (16).

Thus it can be seen that despite the scientists of many countries of the world have extensively explored the cancer-preventive effects of dietary vitamins and minerals during the recent 10 years and have achieved great progresses, there are still no any reliable evidence showing that these vitamins, minerals and the combinations consisted of them could reduce the incidence and mortality of human cancer or other commonly seen diseases. To finally demonstrate the dietary and nutrition hypothesis in esophageal carcinogenesis and provide feasible approaches with scientific evidences to prevention and control of human cancer and other common diseases, large-scale randomized clinical trials and intervention trials in population remain to be continued and expanded so that definite conclusions can be obtained.

SUMMARY

The updated results from two nutrition intervention trials described here are interesting and exciting. To the best of our knowledge, this is probably the first randomized population trial in the world showing a positive correlation between dietary supplementation of specific vitamins/minerals and reduction of the mortality and incidence from human cancer as well as mortality and prevalence from some commonly seen diseases. Although there exist some inconsistencies with the results from a number of clinical trials in the developed countries, like CARET, ATBC, and The Physycians' Health Study, the Linxian trials provide a hopeful sign that vitamin/mineral supplementation may lower the risk of certain cancers and common diseases and suggest lines of further research to confirm the protective effects of specific micronutrients. Although intervention ceased in the summer of 1991, continued follow-up of the Linxian participants and

repeatedly analyze the updated results for the 5 year post-intervention period are on going, which primary objectives are to evaluate potential delayed effects, beneficial or harmful, of the interventions on total and cause-specific mortality and cancer incidence as well as to determine if there was a persistence of the beneficial effects found in the course of the intervention trials (i.e., lower prevalence of cytologic dysplasia, hypertension, cataracts and stroke mortality in the Dysplasia Trial; and lower total mortality, cancer mortality, and stomach cancer mortality and incidence for those who received β-carotene plus vitamin E plus selenium as well as the reduced esophageal cancer incidence and lower prevalence of cataracts associated with riboflavin and niacin in the General Population Trial). In order to finally demonstrate if supplementation of vitamins and minerals could reduce incidence and mortality of human cancer and to provide feasible approaches with scientific evidences to prevention and control of human cancer and other common diseases, large-scale randomized clinical trials and intervention trials in population remain to be continued and expanded so that definite conclusions can be obtained in the near future.

Health Surveillance/Maintenance in the Workplace – Perspectives in the United States and Selected Countries

Session 3—Workplace Health Surveillance/Maintenance and Other Specific Issues in Canada and France

Ms. Cathy Angotti introduced the third session in this fifth series of continuing education programs sponsored by NASA's Occupational Health Program, Office of Health Affairs (OHA), in cooperation with the Uniformed Services University of the Health Sciences (USUHS). Worldwide, this session is available on the Internet. Ms. Angotti introduced the guest speakers, Dr. Robert Whiting, Senior Project Manager for Health and Safety Products and Services, Canadian Center for Occupational Health and Safety (CCOHS); and Dr. Michel Lavollay, Counselor for Health Policy Analysis, Bilateral and Multilateral Project Development, Embassy of France in Washington, DC.

Canada

Dr. Whiting described some of the special features of the occupational health and safety system in Canada, aspects of its history, and where occupational health and safety is going in Canada. Health and safety in Canada has been undergoing a great deal of change recently. There has been considerable emphasis on innovation, in particular changes in the structure of the compensation system in Canada, which has become more prevention-oriented in recent years. Decentralization and an enhanced sense of personal responsibility are altering the safety culture, with improved results.

Canada is unusual in that occupational health and safety is completely a provincial responsibility—there is no national structure that develops and/or enforces health and safety regulations. This provincial structure dates back to the original terms of confederation in which health was maintained as a provincial responsibility. There are fourteen jurisdictions, each of which has its own health and safety laws. There is one federal jurisdiction (not a national jurisdiction), which covers workers that are employed in federal undertakings (federal government, military, and national enterprises). There are ten provincial jurisdictions, varying from the large provinces such as Ontario with about four to five million workers, to provinces such as Prince Edward Island with only a few tens of thousands of workers. In addition, there are three territories. All of these have their own compensation boards and operate independently. As a consequence, there is a high level of innovation. Under the parliamentary system, the party in power has the authority to establish laws, and the system of developing laws can varying depending upon the philosophy of the party in power. There is a higher rate of unionization in Canada—about double that of the U.S. Unions, individually and collectively, have been more involved in occupational health and safety. When laws are developed on a tripartite basis, they seem to be more representative of all of the groups in society and are less subject to controversy. The aspect of universal Medicare has meant that the medical aspect of health and safety has been somewhat downplayed. Individual physicians are often the front line for occupational health and safety. Another important aspect of the Canadian system is the

public compensation system—there is a single compensation system in each jurisdiction, funded by the employers of that province or territory, and all workers benefit from the system. Lastly, there is the internal responsibility system, which is increasing the level of individual responsibility.

The CCOHS was established in 1978 as a national center. The CCOHS is a hybrid organization that is based entirely on serving workers and jurisdictions, rather than developing or enforcing laws. The Center is one of the Canadian experiments in tripartitism (a board comprising representatives from government, industry, and major labor organizations). The Center has survived various changes in policy and approach since 1978. Some funds are received from the federal government, but most of the funds come through cost recovery (sales of products, projects on behalf of national and international groups, etc.). The major role of the Center is to promote occupational safety and health through information, and it is the major Canadian body for delivery of occupational health and safety information in electronic form. CCOHS services include: inquiries service (answers to specific questions); occupational safety and health answers on hundreds of occupational health and safety topics; electronic information products; and publications. The largest single group of inquirers are employers (about 40%). Many of the answers prepared in response to commonly asked questions are put on the Web site. Electronic information products are on CD-ROM, e.g., a large database of Material Safety Data Sheets (MSDS), Canadian health and safety legislation, and standards. "OSH for Everyone" is being launched—it is information about various hazards and how to deal with accidents, agencies, etc. In addition, safety guides are prepared on various topics, e.g., office ergonomics, violence in the workplace.

Dr. Whiting discussed some of the changes that have been occurring in occupational health and safety. The Ministries of Labor across Canada are the bodies that pass laws and regulations and enforce them. Previously, occupational health and safety was seen as a professional activity and as primarily done by the Ministry of Labor. As a result, the Ministry had a lot of advisors/experts and put a lot of emphasis on prevention (with less emphasis on enforcement). In the past few years, this has changed radically. The advisory and information aspects have been removed from the Ministries in favor of making them primarily involved in developing and enforcing legislation. They now have the ability to target high-risk operations. In Alberta, inspection has been privatized. A lot of the former advisory role of the Ministries is coming into the Workers Compensation Boards (WCBs). Previously, the WCBs were primarily insurance agencies (compensation, rehabilitation, payments, etc.). In 1980, British Columbia and Quebec combined the roles of legislation, inspection, prevention, research, and information into one agency. Now, a majority of the WCBs have combined roles, and information is more readily shared. Also, it is becoming common for the WCBs to fund research and prevention organizations. Ontario has gone further than any other province with respect to safe workplace associations, each of which deals with a particular industry sector. These are all funded by the WCB in Ontario. Part of the funds paid by the employer to the WCBs are given to these associations. The plan is to have the safe workplace associations become the front line. At this

point, there is not any indication of how successful this approach will be, since this is a new initiative and many of the associations have existed for only a year or less.

With respect to occupational medicine in Canada, it is seen as being weak or in a depressed situation. Occupational medicine has a very proud history in Canada—many of the greatest discoveries related to occupational medicine have occurred in Canadian industries. However, medical practitioners and medical testing are not part of the occupational health and safety law; it is entirely at the discretion of the employer or the inspector. The same can be said of occupational health surveillance in Canada—there are few legal provisions for record keeping or reporting of injuries. For example, only three provinces require reporting of occupational disease by a physician, and data is not easily retrievable from the systems. There is more discussion in the professional literature on surveillance systems for the 21st century, but very little on what is available now. However, there is a general feeling that the situation is improving. WCB injury rates have declined substantially since the 1980s. Many provinces have reductions of 20% to 60% over five years. Interprovincial statistics are not comparable, but the trends seem to be reliable. The causes for this decline are not clear, but could include a wider use of the experience rating process, changing culture and attitudes, more use of safety equipment, and improved equipment.

The main feature of the Canadian system is the internal responsibility system. The name comes from a report published in 1976 regarding workers in uranium mines in Ontario. One of the main factors for the failure to discover and treat cancers was the lack of knowledge and responsibility at the individual workplace. This has been the focus of the health and safety philosophy across Canada. Under Canadian law, there are legal rights and responsibilities for employers, supervisors, workers, and health and safety committees. The employer is primarily accountable for the health and safety in the workplace, but supervisors and workers can be held personally responsible. The employer is responsible for taking all reasonable precautions to provide a safe workplace, to train employees, to appoint competent supervisors, to provide and maintain safety equipment, to report all critical injuries, to provide information on all hazards and dangers, to establish a joint health and safety committee in the workplace, and to establish and maintain a workplace health and safety policy. Dr. Whiting briefly discussed substances abuse policies in Canada. There is very limited application, and there has been a great deal of resistance to substance abuse policies. Recently, there were some legal decisions that dealt with the policies of two large employers in Canada who proposed testing new employers, random testing, and self-declarations. Similar policies have been used in the U.S. The Canadian courts have determined that these sorts of policies are not legal in Canada because of the need to balance the risks of the individual with the risks of society as a whole. The companies had to prove that there was a risk that had to be dealt with and that procedures were necessary to do so. The courts held that a policy must relate to the specific job position and the individual.

Supervisor and managers must ensure that workers act safely and use protective equipment, and must advise workers of hazards and take all reasonable precautions for protection of workers. They must be competent—have knowledge, experience, and education with respect to health and

safety. The concept of worker's responsibility is unusually strong in Canada. They must work safely in compliance with legislation, use protective equipment as directed by the employer, and must report hazards and dangers. Workers have the right to know the hazards of the workplace and to participate in safety activities. They have the right (obligation) to refuse unsafe work. There are legal procedures to protect workers that report an unsafe condition. Joint Heath and Safety Committees are an important part of the process of internal responsibility. Any workplace with 20 or more employees must have a health and safety committee, and at least 50% of the participants must be non-management and appointed by the workers (not management). The Committee is responsible for inspecting the workplace, identifying hazards, recommending corrective actions, advising the employer, and assisting in resolving work refusals. Most problems are resolved at the level of the Health and Safety Committee. Along with the Health and Safety Committee, a Health and Safety Plan is necessary for every workplace with six or more employees. It includes written policies, procedures, and records (training and information, inspection, etc.)

The concept of due diligence is almost unique to Canada—it means doing everything that needs to be done, and is the only legal defense if an accident occurs. It applies just as much to a worker as it does to an employer. "Competent person" is defined as one who is qualified through knowledge, training, and experience; familiar with legislation; and aware of health and safety hazards of the work. One of the consequences of having this system in place is a process of certification. Every workplace must have two "certified" members—people who have been specially trained on occupational health and safety. The certified workers have a legal right and responsibility to stop work wherever they detect an unsafe situation. One of the most positive safety developments is the concept of "safe communities." It is a voluntary, community-based program, started by Paul Kells. It reaches down to small businesses that are often not touched by an occupational safety and health program. It focuses on local action, issues, leadership, and expertise. The Safe Communities Foundation provides expertise to get the process going at a local level. The frequency of accidents is reported as much lower in these safe communities.

A new agency in Canada is the Institute for Work and Health in Toronto. Medical practice, surveillance, and rehabilitation are being rejuvenated. It is funded by a combination of public and private sector agencies. The Institute's role is conduct research into factors influencing workplace health disability. Its goal is to evaluate and improve rehabilitation services and to provide information to stakeholders. The Institute is conducting research on health workplaces—what are the characteristics; how can they be improved. The Institute is producing a flood of research reports and there should be a great deal of information on surveillance and management systems in the near future.

Questions:
HQ: Regarding supervisor and manager responsibility—Can the supervisor or manager be held responsible in all of the jurisdictions?
Answer: It is effectively true in all of the jurisdictions; it is enforced more in Ontario where the Internal Responsibility System is given more emphasis. It is not unusual for a supervisor to be

held responsible in situations where he has allowed a safety violation to continue, has not intervened to discipline a worker who was doing something unsafe, or has failed to give instruction. It is unusual for a worker to be charged; he would only be charged if it could be shown that the worker deliberately or negligently did something that he knew was unsafe and concealed it; e.g., a worker who continues to use a piece of unsafe equipment in spite of knowing it was unsafe, and failed to report it.

HQ: As Canada has changed its Workers Compensation System so that there is more emphasis on compensation, rehabilitation and prevention, has there been any significant reduction in the cost?

Answer: Almost all of the provinces have reported reduced injury costs. There is a great deal of optimism about finding out what is causing the reduction and do more of it, e.g., improving the safety culture along with increased understanding about the environment.

HQ: Regarding the decline in the rate, how is this established?

Answer: It is the number of injuries per worker hours per year.

HQ: Regarding the WCB, does each province have its own Board?

Answer: Yes, each province has its own Board; it is funded entirely by the employers of that province. It is partly a political body and partly a body in which the employers have a role to play. Each Board is able to set its own policies, but there is a degree of coordination. Policies are generally set by case law, but there are different approaches.

HQ: With respect to the worker injury rates, do you have parallel statistics on occupational diseases?

Answer: The rates of diseases have also declined, although it is harder to get a figure on all of those. Overwhelmingly, the most common disease is dermatitis, which has gone down.

KSC: Regarding rates going down and the difficulty in establishing a random drug-testing program, has there been any information gathered within Canada as to drug use in accidents and workers compensation?

Answer: One of the aspects which has made the use of drug-testing more restricted has been the statistics which show a much lower rate of drug use in Canada, and a much smaller involvement in workplace accidents. Part of the court findings in the case of the two companies was that they failed to show that alcohol or drug abuse had been a factor in their workplaces or in comparable workplaces in Canada. Therefore, the courts found that the programs went too far. The programs must be more individualized.

HQ: I am still puzzled about the court approach and the data presented to the court. Obviously, there was a group of people who were using drugs or alcohol, albeit small, and there was another large group free of alcohol and drugs, and there were accidents in both groups. When the comparison was made between the two groups, accounting for sample size and other differences, was there any evidence that there was a higher rate of accidents in the group that was under the influence of drugs or alcohol? Was the data there?

Answer: The data was there, but I have not read deeply enough into the data provided by the companies, beyond the information published in the number of articles about these cases. The incidence was very low, and the amount of effort going into the policy seemed disproportionate to the benefits. I cannot comment on the statistics of specific accidents. A large part of the argument in the court case was based on the rights of workers not to be discriminated against.

The courts have advocated handling situations on a case-be-case basis. Supervisors and managers should be trained to recognize and deal with impairment.

France

Dr. Michel Lavollay presented a few basic elements of the French health system, which influences the way occupational health and workplace-related health issues are considered in France. The population in France is about 58.5 million, more women than men. The French population is aging (more than the U.S.)—in 1970, 33% of the population was under 19 and 22% was over 60; thirty years later, 25% of the population is under 19 and 26% is over 60. Birth rates are higher than Europe but lower than the U.S.; death rates are similar. Both marriages and divorces are lower in France. France is slightly ahead of the U.S. in life expectancy, both male and female. With respect to the health system in France, the state-controlled, department of health and social affairs has responsibility to ensure that needs are met. More and more the health responsibilities are devoluted to the regions. Health services are a combination of public and private services. The backbone is the public hospitals. There is a network of private physicians—more than 95% have signed contracts with the state and are included in the National Insurance scheme. Parallel to this is a network of private hospitals, small clinics, labs, etc. which have signed contracts with the state to follow rules about rates and insurance reimbursements. About 98.5% of the population are covered through "social security." All employers and employees are under a legal obligation to provide insurance and to be insured. It usually covers between 70% and 80% of outpatient costs, 80% of in-patient costs, and 100% of any "serious disease." About 84% of the population buy into additional insurance that covers the out-of-pocket expenses. Overall, the French benefit from a very comprehensive system that provides freedom of choice and easy access to specialty treatment and emergency care. In terms of costs, the annual total health expenditure is about $150 billion, which represents about 9.6% of GDP. France has the highest expenditure in Europe. The U.S. spends $1.1 trillion (13.5% of GDP). In the distribution of health expenditures, public health expenditures are about 85% of the total envelope (45% in the US). Private insurance in France is about 3% and out-of-pocket expense is about 1%.

As with the rest of heath care, occupational health is under the responsibility of the State and in its implementation, combines regulatory and control structure with private structures and mechanisms within the workplace. The costs of occupation health and health-related accidents and disease in the workplace represents about 10% of the overall health expenditure (1% of GDP). The rates of increase have been about 2.5% increase per year over the past few years. There are three pillars to the system: (1) the responsibility of the employer; (2) the department of labor; and (3) the department of health. By law, every employer has a responsibility to establish in-house or through a joint corporate service the provision of: occupational health services and of nursing services depending on the number of employees and the time spent by a physician each month conducting his medical exams and activities; and Hygiene and Security Committees (employers with more than 50 employees) to review all issues of worker health and security as well as general working conditions. The Committee may also request changes in working conditions or the environment outside the workplace. More and more the emphasis is

being put on prevention, and the European Union is taking over and establishing regulations, particularly in the area of occupational health hazard, e.g., asbestos and lead. The second part of the system is under the authority of the department of labor. Whenever an issue in the workplace has been reported, inspectors may be dispatched to review the situation and can conduct unannounced visits. If there is no resolution of an issue, a legal procedure may be started. A High Commission formulates the policies on health and security issues in the workplace for the Prevention of Occupational Hazards, with membership from government, employer representatives, employee representatives, and experts. Standards are also formulated through the National Agency for the Improvement of Working Conditions, with the same type of membership. The third element of the system is under the authority of the department of health. The National Health Insurance Administration covers 15 million salaried workers in 2 million structures. It is responsible for compensation for work-related accidents and illnesses. It functions through the regional funds that are involved in prevention activities in training. It also has authority for the National Institute for Research and Security, which is the basic instrument for conducting research in any area of occupational health and developing standards. Apart from this basic national system under the social security systems, there are specific systems for the transportation sector and other sectors.

In summary, more and more, emphasis is being put on prevention and on risk assessment under the thrust of the European community. There is more of a tendency to link the well being of the employee to his social circumstances and the environment. This is more of a human-resource development approach than technical intervention for narrowly defined health intervention. There is also an emphasis on research and setting standards across the board. Over the past 20 years, the workforce has increased 15%, but accidents have decreased 29%, major accidents 37% and deaths 52%.

Dr. Lavollay discussed his experiences with occupational health in a particular area—HIV and AIDS. From the experience in industrialized countries, occupational health has a crucial role in allowing a better acceptance of the HIV infection in our societies. In France, after a first period of fear and rejections, a combination of a mobilization of activist groups, human resource services, and government led to the definition and implementation of policies that were compassionate and allowed the definition of clearly compassionate attitudes toward the HIV epidemic. The first phase of reactions was very counterproductive, socially and economically; very early on, a link was established between the social comparative and the economic comparative. Not so in developing countries—in developing countries we are confronted with the most serious threat in the past few centuries. Life expectancy (a basic indicator of development) has started to reverse—most countries in sub-Saharan Africa will be reverting back to the levels of the 1960s. We are still not looking at how to respond to this in an economic and social sense. Mechanisms were available to establish and implement policies in industrialized countries; this is not the case in developing countries. For instance, in developing countries, occupational health is almost non-existent. There are drugs available that are making HIV infection manageable with more individuals integrated into society and productive, but in the developing world it is the opposite. The gap is growing and is getting worse through the

introduction of these treatments. We must start thinking through some of the social issues to respond to the magnitude of challenges of HIV.

Questions:
KSC: Regarding the U.S. rate of infant mortality, what could you suggest to us to improve this rate?
Answer: There is a high level of acceptance of these types of situations in the U.S., not just child mortality, but the high rate of teenage pregnancy and the high rate of uninsured people, particularly children. This raises a fundamental question about the capacity the market has to respond to these types of issues. Is it private industry's responsibility to establish primary health care centers that are accessible in cheap enough for the poor to come to them? In the U.S., there is a political refusal of proposals to establish government-controlled services; until there is a change in the political will to address the issues, the problems will not be solved. With respect to the uninsured, not only has the recent period of tremendous economic prosperity not benefited that group, but also that group is increasing. The rates of increase are higher today than they were three years ago.
KSC: You indicated that in the U.S., workers' compensation is about $6.5 billion; in France it is $36 billion. Are there any plans in France to reduce this amount?
Answer: The figure of 36 billion is in francs, which brings it back to about $6 billion.
HQ: It appears that the social consciousness of the U.S. accepts the status quo. Is there a way for the U.S. to reverse the trend without pursuing social security or social medicine?
Answer: With a rising awareness of the difficulties that are generated by a health system that is too expensive, inflation too high, and distribution unfair, U.S. politicians started thinking through the types of solutions that could be applied. In the late 1980s and early 1990s, there was a consensus among politicians that those issues should be addressed. However, when it came down to the actual plan, the health reform projects failed. What happened after that shows that the country did not want such a plan. Was it because Americans didn't want it, or was it because the political and industrial lobbies that mobilized against the plan were effective in barring the plan? It was both—there was a lot of uncertainty in the U.S. during that time about what people wanted. The types of campaigns that the industry put forward, e.g., loss of freedom of choice, have actually come to pass through market forces, i.e., the expansion of HMOs. We are now in a reverse situation where 75% of Americans are insured under an HMO system, which is loss of freedom in a sense. Now, there may be more of a readiness on the part of politicians to look further, but it will not happen easily. It will probably happen through consensus mechanisms, i.e., a patient bill of rights. It is a slow process, and may not necessarily be translated into political will. If one looks at the onset of social security in the U.S., America was coming out of a major crisis. There was an intention to add health insurance to the system, but the complete package was blocked. The Second World War was a phase of prosperity for the U.S., whereas most of the social policies in Europe came out of the war.
HQ: Regarding alcohol in the workplace, and the social acceptance in certain countries, how do you relate alcohol consumption and workplace safety?
Answer: It is a big debate now in France politically. The Minister of Health has come forth forcefully on the issue of alcoholism and the necessity to address it as a medical problem. France

has the second or third highest rate of alcoholism in the world; at the same time, France is a country where there is a tremendous denial to address alcoholism as a condition that individuals suffer from. The effort now is to try to make it more of a public issue, and define it as an illness that can be treated. Recently, people dealing with occupational health issues have been introducing campaigns on alcohol treatment in the workplace. On this issue of alcoholism, France is behind other countries; physicians are not trained to address alcoholism as a medical problem, although this is changing rapidly.

HQ: From your perspective, how are the U.S. policies on alcohol in the workplace viewed in Europe?

Answer: They are viewed as effective, e.g., using community-based programs, recovering alcoholics, etc.

HQ: Regarding the Hygiene and Security Committee, you said that it reviewed all issues related to health and that it could impact a worker's environment outside the workplace. How does it impact outside the workplace?

Answer: If the Committee were aware of the production by the workplace of emissions that would be detrimental to the outside environment, they would have something to say about it.

WORKPLACE HEALTH SURVEILLANCE, MAINTENANCE & OTHER ISSUES IN CANADA

Presentation at NASA

by

Robert Whiting, PhD

Canadian Centre for Occupational

Health and Safety

April 8, 1999

TOPICS

- Organization of OH&S in Canada
- About CCOHS
- Trends:
  - Rapid change
  - Innovation, experimentation
  - Combine compensation/prevention
  - Decentralization
  - Personal responsibility
  - Safe Communities
  - Organizational research
  - Proliferation of safety organizations
  - Improving results(?)

ORGANIZATION OF OCCUPATIONAL HEALTH AND SAFETY IN CANADA

- 14 jurisdictions
  - 1 federal (not national)
  - 10 provinces
  - 3 territories

- Characteristics:
  - parliamentary system
  - higher unionization
  - universal medicare
  - public compensation systems
  - internal responsibility system
  - tri/bipartite consultation

CANADIAN CENTRE FOR OCCUPATIONAL HEALTH AND SAFETY (CCOHS)

- Established in 1978
  - national centre
  - tripartite (governments, industry, labour)
  - national and international roles

- Federal departmental corporation
  - cost recovery: products, services, projects, federal and provincial funding, and donations.

- Mandate:
  - promote occupational health & safety
  - focus on practical information
  - specialize in electronic delivery (CD-ROM, Internet, Intranet, diskette)

CCOHS PRODUCTS AND SERVICES

- Inquiries Service
  - free to all Canadians
  - answer specific questions
- OSH Answers
  - free on the CCOHS web site
  - answers on hundreds of OH&S topics.
- Electronic information products
  - primarily CD-ROM and WWW
  - practical information: MSDS, CHEMINFO, Canadian legislation, etc.
  - OSH For Everyone
  - international projects: ACGIH, NIOSH, ILO, IPCS (INCHEM and INTOX)
- Publications
  - safety guides

MINISTRIES OF LABOUR

(eg. Ontario & Alberta)

- Previously:
  - Emphasis on prevention.
  - Develop and enforce legislation
    - less emphasis on enforcement.
  - Laboratories & analytical services.
  - Libraries & information services.
  - Inspection & advisory services.
  - Conduct & fund research.

- Now:
  - Develop and enforce legislation
    - much more emphasis on enforcement
    - target high risk operations.
  - Inspect and prosecute.
    - Alberta has privatized inspection

WORKERS COMPENSATION BOARDS (WCBs)

- Previously:
  - Compensation.
  - Rehabilitation.
  - Exception - British Columbia and Quebec combined roles: legislation, inspection, prevention, research, information.

- Now (majority):
  - Compensation & rehabilitation.
  - Prevention.
  - Work closely with enforcers.
  - Fund research.
  - Fund safety organizations/programs.

SAFE WORKPLACE ASSOCIATIONS

(Ontario)

- Construction
- Education
- Electrical & Utilities
- Farm
- Forestry
- Health Care
- Industrial Accident Prevention
- Mines and Aggregates
- Municipal
- Pulp and Paper
- Retail and Service
- Transportation
- Workers Health and Safety Centre

* Office of the Employer Adviser
* Office of the Worker Adviser
* Workers clinics

OCCUPATIONAL MEDICINE IN CANADA

Before 1967

- Traditional pattern
  - preplacement and periodic exams, medical monitoring, protective removal.

After 1967 (Universal Medicare)

- Weakened releationship with employers, workers and families.
- Corporate downsizing
- Independent clinics
- Some workers clinics established.

OCCUPATIONAL HEALTH SURVEILLANCE

- Few legal provisions

  Ontario: designated substances (1980s)

  Quebec: - high risk industries

  - services delivered through designated hospital programs

- Only 3 provinces require reporting of occupational disease

  - data not easily retrievable.

- Linkages not in place:

  occupation/industry - exposures - disease

WORKPLACE INJURY STATISTICS IN CANADA

- WCB injury rates have declined substantially since 1980s
- Many provinces have reductions of 20% to 60% over 5 years.
- Interprovincial statistics not comparable, but trends seem reliable.
- Causes not clear
  - experience rating
  - changing culture and attitudes
  - more use of safety equipment
  - improved equipment

INTERNAL RESPONSIBILITY SYSTEM

- Legal principle underlying Canadian OH&S
- Rights and responsibilities for employers, supervisors, workers, and health & safety committees.
- Joint responsibility. Employer accountable.
- Supervisors and workers can be held personally responsible.
- Promote: Safety culture
  Best practices
  Due diligence

INTERNAL RESPONSIBILITY SYSTEM

EMPLOYER

- Take all reasonable precautions to provide safe workplace.
- Train employees.
- Appoint competent supervisors.
- Provide & maintain safety equipment.
- Report all critical injuries.
- Provide information on all hazards & dangers.
- Establish a joint health and safety committee.
- Establish & maintain a workplace health and safety policy.

SUBSTANCE ABUSE POLICIES

- Restricted in Canada
- Policies proposed by two large corporations
  - test new employees
  - random testing
  - self-declaration of problems
- Concerns:
  - safety-sensitive positions
  - criminal activity
- Courts found companies acted in good faith, but were unable to prove significant risk and justify procedures.
- Policies harmed some employees unnecessarily and were excessively rigid and not directly connected to job performance.
- Requirements:
  - target high risk positions
  - prove policy is reasonably necessary

INTERNAL RESPONSIBILITY SYSTEM

SUPERVISORS & MANAGERS

- Ensure workers act safely.
- Ensure workers use protective equipment.
- Advise workers of hazards.
- Take all reasonable precautions for protection of workers.

* Supervisors & managers must be competent: knowledge, experience & education.

INTERNAL RESPONSIBILITY SYSTEM

WORKERS

Responsibilities

- Work safely in compliance with legislation.
- Use protective equipment as directed by employer.
- Report hazards and dangers.

Rights

- Right to know.
- Right to participate.
- Right to refuse unsafe work.
  - legal procedures & protections
- Right to protective reassignment (Quebec).

INTERNAL RESPONSIBILITY SYSTEM

JOINT HEALTH & SAFETY COMMITTEES

- Required in workplaces with 20+ employees.
- At least 50% non-management.

Responsibilities

- Inspect workplaces (monthly).
- Meet regularly.
- Identify hazards and obtain information.
- Recommend corrective actions.
- Advise employer.
- Assist in resolving work refusals.

Rights

- Receive information.
- Be consulted.
- Time paid by employer.

INTERNAL RESPONSIBILITY SYSTEM
WORKPLACE HEALTH & SAFETY PLAN

- Key to due diligence defence.
- Required in most workplaces
  (eg. 6+ employees in Ontario)

Components

- Written policies, procedures, records.
  - Management commitment.
  - Training & information.
  - Inspection & measurement.
  - Enforcement & discipline.
  - Record keeping.
  - Actions of health & safety committee.

DUE DILIGENCE

* The only legal defence if an accident occurs.

- The level of judgement, care, prudence and action reasonably expected of a competent person.
- Meet industry standards.
- To demonstrate due diligence, employer must implement a complete plan.
- Can apply to employer, supervisor & worker.

COMPETENT PERSON

- Qualified through knowledge, training and experience.
- Familiar with legislation.
- Aware of health and safety hazards of the work.
- Supervisors must be competent.
- Some workers must be competent
  eg. confined spaces, blasting, live power lines, lifting devices, mobile equipment.

CERTIFICATION

(Ontario)

- Each Health and Safety Committee must have at least 2 certified members:
  1 management, 1 non-management.
- Certification - demonstrate competency.
- Certification training:
  1. Basic: law, hazard identification, investigation, resources.
  2. Workplace specific
- Training standards established by WSIB.
- Rights and responsibilities
  - can stop work

SAFE COMMUNITIES

(Paul Kells)

- Voluntary, community based program.
- Reduce personal, social and economic costs of accidents and injuries.
- Focus: Local action
  Local issues
  Local leadership
  Local expertise
- Participants: businesses, clubs, local government, health services, police, fire, schools, etc.
- Issues: homes, traffic, schools, sports, crime, construction, small business, etc
- Awareness, change attitudes & behavior
- Safe Communities Foundation
  - funded by private sector sponsors.
  - support and guide the local process
- Promising results

INFLUENCING ATTITUDES TOWARD WORKPLACE ILLNESSES AND INJURIES

(CCOHS)

* Reviewed >200 studies worldwide

- Successful approaches:
  - influencing attitudes
  - combine positive and negative reinforcement
  - empowerment
  - targeted training
  - management support & accountability
  - community support & attitudes
- Unsuccessful approaches:
  - controlling behavior
  - negative reinforcement alone
  - positive reinforcement alone
  - safety contests

INSTITUTE FOR WORK AND HEALTH

(www.iwh.on.ca)

- Roles:
  - Research factors influencing workplace health and disability.
  - Evaluate and improve rehabilitation.
  - Provide information to stakeholders.
- Research:

1. Healthy workplaces
   - methods to define and measure.
   - methods to improve health.
   - what works - tools for employers & others.
   - focus on musculoskeletal injuries & stress.
2. Health services and rehabilitation.
3. Compensation system.
   - factors which affect behavior.
   - improve evidence-based procedures.
   - evaluate incentives.
4. Management and analysis of data.

OVERVIEW

POPULATION AND HEALTH IN FRANCE

POPULATION:

In 1997

58.494.000

Men: 28.477.000
Women: 30.017.000

The French population is aging

In 1970:

33.1% < 19
22.69% > 60

in 1997:

25.9% < 19
26.83% > 60

M Lavollay
French Embassy Washington
4-8-99

HEALTH INDICATORS:

France as compared to EU and to the US (1997)

Country	Rate per 1000 inhabitants				Infant mortal.	Life Expect	
	Birth	Death	Wdng	Div		M	I
France	12.5	9.1	4.4	2	4.9	73.9	81
EU	10.7	10	5.1	1.8	5.6	74	80
USA	15.5	8.8	8.9	4.4	9	72	79

M Lavollay
French Embassy Washington
4-8-99

Health System in France

Structure of the System:

State controlled, department of health and social affairs has responsibility to ensure that needs are met.

More and more the health responsibilities are devoluted to the regions.

Heath services: a combination of:

- a backbone of public hospitals which are the centers of excellence
- private physicians (>50% gp) most of which have signed a contract with the state system guarantying rates and reimbursement of prescriptions
- a network of private hospitals, nurses, labs etc... which have similarly signed contracts with the state.

Health insurance:

98.5 % of population covered through "social security" (16.5% Uninsured in the US),

All employers and employees are under a legal obligation to provide insurance and to be insured. Usually covers between 70 and 80 % of out patient costs, 80 % of in patient costs and 100% of " serious diseases" i.e. cancers....

84% of the population buys into additional insurance which covers the deductibles.

OVERALL THE FRENCH BENEFIT FROM A COMPREHENSIVE SYSTEM IN WHICH THEY HAVE:

- **FREEDOM OF CHOICE**
- **EASY ACCESS TO SPECIALTY TREATMENT AND EMERGENCY CARE**

NATIONAL HEALTH EXPENDITURES

APPROX 150 BILLION $US
REPRESENTING 9.6 % OF GDP

US: 1.1 TRILLION $US
13.5 % OF GDP

M Lavollay
French Embassy Washington
4-8-99

DISTRIBUTION OF HEALTH COSTS:

Public: 85% (US 45 %)
Private: 15%

Social Security: 73.9%
(National Health Insurance Scheme)

Local Administrations: 0.9%

Complementary schemes: 7.1%

Private insurance: 3.1%

Mutual funds: 1.7%

Out of pocket: 13.3%
(20% in the US)

OCCUPATIONAL HEALTH

As with the rest of health care, occupational health is under the responsibility of the State and in it's implementation combines public regulatory and control structures with private structures and mechanisms within the work place

What are the costs?

Work related accidents and health problems:

39.6 billion FF (7 billion $US) to which one could add 36 billion ff (6.5 billion $US) in work impairment related compensations.

Represents approximately 10% of the 786 billion ff (150 billion $US) total health related expenditures and 1% of GNP

MECHANISMS: 3 FOLD

1. RESPONSIBILITY OF THE EMPLOYER:

By law every employer has a responsibility to establish in house or through a joint corporate service the provision of:

- **OCCUPATIONAL HEALTH SERVICES and of nursing services depending on the number of employees and the time spent by a physician each month conducting his medical exams and activities. For corporations with more than 500 employees.**

- **HYGIENE AND SECURITY COMMITTEES "CHSCT":**

Over the past 15 years employers with more than 50 employees have had to establish an in house CHSCT or Committee for Hygiene, Security and Working Conditions.

The mandate of this CHSCT is to review all issues of worker health and security as well as general working conditions, the occupational health physician is member ex officio of the CHSCT.

The CHSCT may request changes in working conditions as they might affect the workers health and security or the environment outside the work place. It can request expert advice which must be paid for by the employer.

More and more the emphasis is being put on prevention and more and more the european community is taking over and establishing regulations which are becoming applicable in all EU countries, particularly in the area of occupational health hazards such as asbestos or lead.

2. UNDER THE AUTHORITY OF THE DEPARTMENT OF LABOR:

- **Inspectors:**

However enforcement can be necessary and when the CHSCT has not been able to change a situation, federal inspectors can be called upon who can in turn trigger a legal action if an employer still does not comply with their injunctions. The matter would then be dealt with in court using the " Code du Travail" as the reference which defines employer responsibilities.

- **Policies:**

Formulated by:	**High Commission for the Prevention of Occupational Hazards**
Membership:	**Government** **Employer representatives** **Employee representatives** **Experts**

- **Standards:**

Formulated by: **National Agency for the Improvement of Working Conditions**

Membership:
Employers (6)
Employees (6)
Government (4)
Experts (2)

3. UNDER THE AUTHORITY OF THE NATIONAL HEALTH INSURANCE ADMINISTRATION:

Covers 15 million salaried workers in 2 million structures

-National Fund for the prevention of work related accidents

-Regional funds: prevention activities and training,

-National Institute for Research and Security: research and standard setting

OVERALL:

- EMPHASIS ON PREVENTION
- RISK ASSESSMENT: SOCIAL, ENVIRONMENTAL
- HUMAN RESSOURCE DEVELOPMENT APPROACH
- INCREASED ROLE OF RESEARCH AND STANDARDS
- EUROPEAN NORMS AND REGULATIONS
- SPECIALIZATION: SECTORAL NEEDS (AIR/SPACE)
- IMPROVEMENTS: (20 YR PERIOD)

WORKFORCE:	+ 15%
ACCIDENTS:	- 29%
MAJOR ACCIDENTS:	- 37%
DEATHS:	- 52%

The case of HIV AIDS

In industrialized countries, occupational health mechanisms have played an important role in defining social perceptions and acceptance of HIV and AIDS.

After a first phase of fear, stigmatization, rejection, which was analyzed as counterproductive, knowledge and reason lead to the formulation and deliberate implementation of compassionate policies, with an understanding that the social and economic imperatives were complementary.

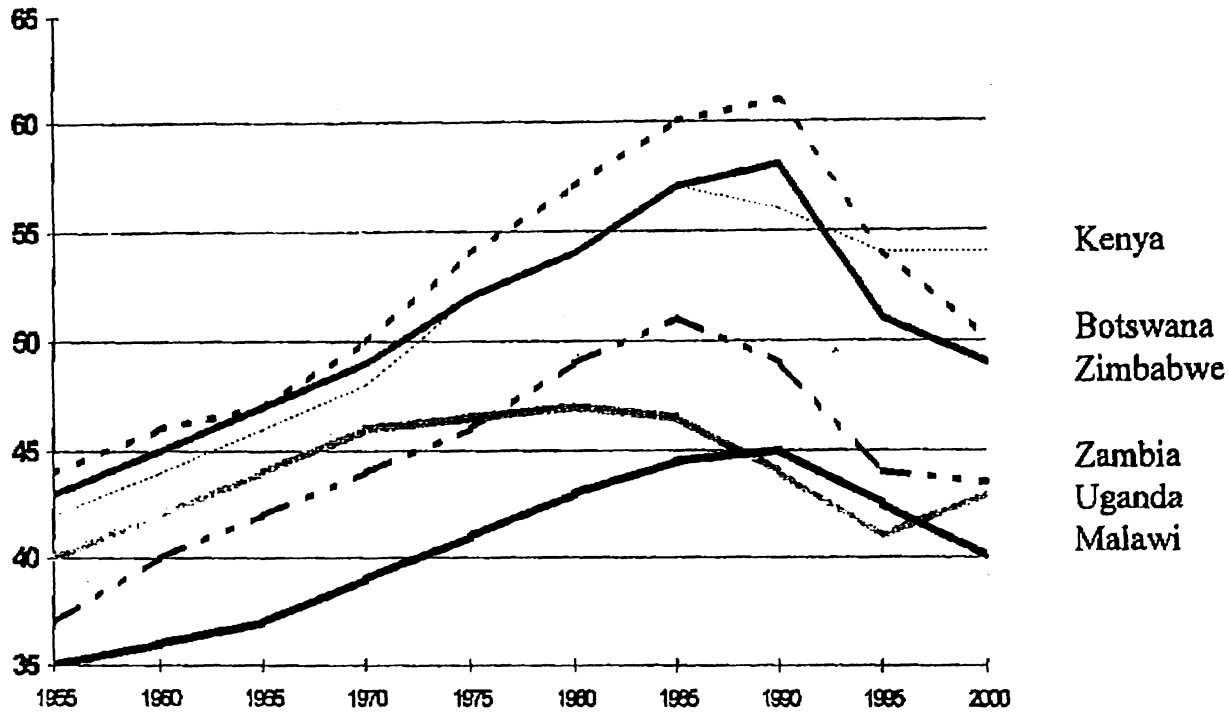
Sadly, this is not the case in most developing countries: the gap between industrialized-rich countries and the rest of the world is growing even faster now that therapeutic means are allowing clinical management of HIV infection.

40 years of development gains are being erased.

95% of the 20 million Africans infected today do not know about their infection.

Technology and the market can not solve everything.

Projected figures for life expectancy at birth in certain countries of Sub-saharan Africa



(from the 1980s onward, the epidemic is of massive proportions)

Health Surveillance/Maintenance in the Workplace

Session 4 – WOMEN'S HEALTH IN THE WORKPLACE
May 3, 1999

Ms. Cathy Angotti introduced the fourth session in this fifth series of continuing education programs sponsored by NASA's Occupational Health Program, Office of Health Affairs (OHA), in cooperation with the Uniformed Services University of the Health Sciences (USUHS). Worldwide, this session is available on the Internet. Ms. Angotti introduced the guest speakers, Dr. Wanda Jones, Deputy Assistant Secretary for Women's Health for the Department of Health and Human Services (HHS), and Dr. Suzanne Haynes, Assistant Director for Science for the Office of Women's Health, Department of Health and Human Services.

Dr. Jones explored the development of women's health and workplace conditions as interlocking issues, and looked at some of the challenges as this century ends and another begins. Women in the workforce are a relatively new phenomenon in the history of this nation, and we are just now beginning to understand health benefits and the risks that come with women's new economic power. A century ago, a woman was lucky to live past her 48th birthday; tuberculosis, infectious diseases, and childbearing were major threats to a woman's life. A woman's health was viewed mainly in the context of her reproductive organs. Childbearing and keeping the home were the only calling for women a century ago. Since the turn of the century, women have gained an extra 30 years of life and a lot of education. While medical advances such as antibiotics were important factors contributing to the bonus years, much of the credit goes to public health advances like improved sanitation and nutrition and the development of a public health infrastructure. Now, women's life expectancy in the U.S., which used to equal men's, surpasses men's by about seven years—79 years vs. 73 years. Women now have plenty of years to have their children, education, and careers as well, but the marketplace has struggled to adjust.

The history of women in the workplace has paralleled the history of NASA. In 1961, the nation watched as Project Mercury took its brief ride to the heavens; coincidentally, another revolution was taking place on Earth—women were introduced to the first birth control pill. The birth control pill was only the beginning for massive changes in women's lives. When women began to have reproductive choices, many of them chose an education before having children, and the percentage of American women completing a high school education increased sharply between 1970 and 1995. White women are still far more likely to finish high school than other minority groups, but the gap is closing. There is other encouraging news. There have been dramatic increases in women who have completed four or more years of college. Over the past 30 years, the percentage of college graduates has doubled among white women, doubled among Hispanic women, and almost tripled among black women. Women now earn 57% of all bachelors' degrees, compared to only 43% in 1970 and 24% in 1950. By 2008, women will outnumber men in both graduate and undergraduate programs. There are many reasons for this, including current low unemployment rates that encourage young men to forego college for available jobs, and the demand for computer skills which can mean good pay without a college degree. The feminine

parade into America's colleges parallels the growing proportion of women in the workforce in the last 40 years. In 1950, some 29% of American workers were women, compared to 40% in 1994. By 2006 one in two people entering the workforce will be a woman. The Woman's Bureau in the Labor Department reports that 99% of American women will work for pay at some point in their lives. However, the gender gap in wages has been stubborn. In 1995, women had lower incomes than men did at all ages at all levels of education in all racial and ethnic groups. The gap now stands at about 74 cents to the dollar earned by men; that translates to an average of about $137 less pay per week. Unlike the alarmist predictions of 19th century physicians that going to work could be bad for the health of women, we now know that for both men and women, those who are currently employed face better health than those who aren't. Some of those reasons are obvious, such as better socioeconomic status and better access to health care and health insurance. However, women who are employed are less likely than men to have insurance through their employers; they are more likely than men to rely on public health coverage. About 16% of American women have no health coverage at all. Despite economic advances, 15% of women over age eighteen are poor, compared to 10% of men. Socioeconomic status is a powerful determinant of health status, reminding us of the intertwining relationship between health and the workplace.

Let's take a look at the future and what this linkage might be: by the year 2030, the number of American women past 65 will double (representing 1 in 4 women vs. 1 in 5 today). This has tremendous health and work implications—e.g., how to keep up skills and maintain employment in the later years. By 2030, 1 in 5 American women will be Hispanic, 1 in 8 will be African-American, 1 in 11 will be Asian, and 1 in 100 will be Native American. By 2050, non-Hispanic white women will represent barely half of the U.S. adult female population. Because of changing demographics and other trends underway in the nation, there are implications for health and health status. The increasingly fast-moving, high tech work world demands tremendous energy and commitment. One-fourth of American adults view their jobs as the number one source of stress in their lives. What women have gained is not without great challenges and risks. Having "mom" in the workplace raises issues for children and a new kind of stress for women, as well as issues for employers. In 1991, nearly 40% of the working women had children under 18 years. The increase in full-time employment is greater for mothers with young children than for mothers with older children. Women are now faced with the challenges and stresses of juggling career, motherhood, and often the care of aging parents at the same time. Those without consistent financial resources find it overwhelming. This brings new mental health issues to both family and work life. While both men and women face mental health issues throughout their lives, 90% of those diagnosed with clinical depression are women. Women's mental health needs must be addressed in the workplace and in workplace coverage.

There are many other hazards for women at work—now, in their reproductive years and beyond, women are exposed to many of the same health hazards as men. Women were excluded from some occupations because there were presumed to be some hazards to them. Yet, potential reproductive hazards to men were overlooked if not outright ignored. Fortunately, this has changed for the better safety and health of all. Currently about one-fourth of working women

report that they have been exposed to harmful substances at work. Workers in white-collar occupations report the lowest likelihood of exposure. The Labor Department reports that of those men and women who say they are exposed to harmful substances or radiation in the workplace, only about three-fourths say that protective gear is available, and only about three-fourths of those report they use the gear all or most of the time. Among those who are exposed to harmful substances, one in ten men say they don't use protective gear; one in four women say they don't. The reasons given were that it is uncomfortable or that it interferes with their job. It prompts us to ask if we are designing gear that is appropriate for a woman's shape and physiology. What about exposure to secondhand smoke at work? About 12% of women and 10% of men report that they work at sites that do not restrict smoking. What about jobs that have regular physical stress on the body? Although men have more of these jobs, more than 35% of women report having a job the requires repeated bending, twisting, and reaching activities at work. Safety precautions and policy, as well as training must meet women's physiological needs. With respect to violence in the workplace, the workplace itself can be quite violent due to domestic problems, theft, and crime. For both men and women, homicide has surpassed machine-related death in the workplace in this decade.

The Federal government has initiated a number of very effective programs to improve the quality of life for women and men at work, including apprenticeship opportunities, child care services, sensitivity training for employers around work and family issues, nutrition education, and violence in the workplace awareness programs. The Woman's Bureau in the Department of Labor has a number of programs that promote a more equitable workplace. The Bureau was formed in 1911 after the famous Triangle Shirtwaist Factory fire, in which 146 women and girls died in a New York City sweatshop loft. The Bureau may be the oldest women-focused non-health program in the U.S. Almost two-thirds of the adult population is employed, and the workplace has become an important vehicle through which information on health promotion can be provided. Many companies have risen to the challenge with on-site wellness programs.

The National Institute for Occupational Safety and Health (NIOSH) at the Centers for Disease Control and Prevention has workplace information as part of its mission. Since its creation in 1970, NIOSH has seen workplace fatalities fall by 78 %. The mission of NIOSH includes surveillance and research, and they have recently launched their national occupational research agenda. Examples of some of the issues that they are examining include female flight attendants and whether they are at increased risk of breast and other cancers; it also addresses flight attendant exposure to cosmic ionizing radiation, as well as cabin-air quality, alteration of circadian rhythm, and any adverse outcomes from these or other exposures. They are also examining breast cancer incidents in a variety of occupations that have exposure to potentially harmful substances, and are looking at ergonomic studies of repetitive muscular-skeletal work (people who do repetitive keyboard tasks, factory lines, etc.), and best practices to prevent back injuries and to return people to full functionality. They are also looking at workplace violence issues and the utility of various data sets in both monitoring and assessing workplace violence, as well as using those data to better inform the various prevention efforts underway. NIOSH's concerns

will determine the effect of a variety of exposures on reproductive health for both men and women, including looking at female workers exposed to jet fuel, dry cleaning materials, etc.

The U.S. Public Health Service, Office on Women's Health has spent two years developing the National Women's Health Information Center—a toll-free phone number (1-800-994-woman) and Website (4woman.gov) gives women the opportunity to get reliable health information from a single source. Hotlinks have been established to men's health subjects and to a number of other sites. The availability of the Internet through the job site is another way for health information to be provided to both women and men. The government can also set up model programs, e.g., a mentoring program for women in medicine. Four national Centers of Excellence in women's health have been designated to serve as mentoring models. On the issue of violence, the Secretary of HHS has set up a model program in the Department. Guidelines have been created to help employees be sensitive to violence issues, and every year there is violence awareness fair at HHS Headquarters. We are now collecting better data on workplace hazards and threats to the health of working women, but there is still a significant gap in research as to how the hazards may affect men and women differently, both physically and emotionally.

With the Institute of Medicine, the Department is also beginning to explore a project to look at the fundamental tenants of gender-based medicine—a necessary need to take a look at sex differences, in both biological phenomena as well as some of the gender-based differences in biomedical and behavioral issues that affect health. While research and programs continue, we must keep in mind the comparison of health by gender and work status is complicated by many variables, including access to health insurance, differences in social roles and expectations of women and men, and the increasingly diverse cultures represented by the workforce, and, in fact, by physiological gender differences. Research may seem at times to be tedious and take far too long, and achieving the answers will not be easy; but with good science, ingenuity, innovation, and hard work, a lot can be accomplished in a short period of time.

Questions:
KSC: Has any benchmarking been done with women in the military involved in diversified activities, to compare it with the civilian sector?
Answer: Yes, the Department of Defense has undertaken some musculo-skeletal, some protective equipment, and some workplace stress sorts of research. I could find out more for you and make that available to you.
HQ: Regarding the 40% of women with children under 18 years of age—does this account for some of the female absenteeism in the workplace?
Answer: Yes, it can account for some absence of women from the workplace. Many child-care settings will not take a child that has a fever or has other problems, and when there is no family nearby or some other support system in place, many mothers feel as though they have no choice but to stay home. Single parents of either sex with a sick child without an accommodating child-care setting can have problems and this likely contributes to absenteeism in the workplace.

Dr. Haynes discussed the major health issues in the workplace, including injuries, cancer, repetitive motion, and stress. One of the topics requested for this talk was discussion of an instrument for surveying women's health in the workplace. In researching this topic, Dr. Haynes discovered that currently, there really is no universal instrument. Every industry develops a survey instrument based upon the problems that they anticipate and the mix of their employees. Dr. Haynes shared some of the major problems that women are having in the workplace. Survey instruments have been used to form statistics. The National Center for Health Statistics has developed a number of instruments that have been very helpful. Depending on the company and exposures, it is an individualized issue for women's health.

Dr. Haynes pointed out some facts on women workers. By 2005, about half of the women will be working outside the home, but the percentages are much higher for younger women—70% between the ages of 20 and 54. Divorced women work the most. Women have made substantial progress in obtaining jobs in the managerial and professional specialties, but most women are not in these higher level jobs at this time. Most women work full-time; women who work part time are often multiple jobholders. The largest occupational group for women is technical sales and administrative support (over 24%). A large percentage (over 10%) of women are employed in service occupations, such as janitorial work. Major issues for women in the workplace include: injury, reproductive effects, cancer, violence, stress, and protective equipment problems.

About 20% of women report repeated trouble with the neck, back, or spine. Carpal tunnel syndrome is a small percentage, but drives women to disability. The major cause of back pain in the workplace is not accident—it is repeated activity. This often causes women to change jobs (10-15% of the time). With respect to injury episodes, the biggest report among women in the workplace is strain or sprain. The part of the body most injured is the back and the hand, wrist or fingers. Women are more likely to have this type of injury than men are, even doing the some job are. More women than men may experience musculo-skeletal injuries to the wrist, hand, arm, and shoulder caused by child-care responsibilities. There may be an interaction between the work and the home. Over 63% of blue-collar women are spending more than four hours a day bending, reaching, and lifting. Large proportions of women in blue-collar and service occupations are involved in strenuous activity.

Substances or agents that affect the reproductive health of women or men or the ability of couples to have children are called reproductive hazards. Radiation, some chemicals, certain drugs (legal and illegal), cigarettes, some viruses, and alcohol are examples of reproductive hazards. Other reproductive hazards include: cancer treatment drugs, certain ethylene glycol, carbon disulfide, lead, ionizing radiation, and strenuous physical labor. There are a wide variety of occupations in which workers can be exposed to these hazards. Employers are encouraged to move women into non-exposed situations while they are pregnant, and return them to their jobs later. About 5% (white collar workers) to 6.5% of workers (agricultural) report exposure to radiation at work; a large percentage of blue-collar and farm workers, as well as service workers report exposure to harmful substances. There is growing literature on the effects of pesticides, sunlight, and fuels on cancers. Cervical cancer rates need to be monitored. Manufacturing

industries have a number of substances that have been implicated in various types of cancers. In the service industries (cosmetology, dry cleaning, food service, and health care), there are high exposures to hazardous substances on hands and arms (dermatitis) among service and blue-collar workers.

With respect to the issue of protective gear for employed women, two-thirds to three-fourths of women say there is protective gear in the workplace, but only three-fourths of those who have it actually use it. For blue-collar women, 25% say the never use protective gear. The biggest reasons given include its is not needed, it is uncomfortable, or it interferes with job performance. In looking at the specifications for designing protective gear, the Department of Energy and the Department of Defense spent a great deal of time designing gear (respirators, suits, gloves, and footwear) from facial measurements. At the smaller facial sizes (3-4), there is a wider difference between the average length of the arc in men and women. At the larger sizes, the differences tend to disappear. Respirators designed with these specs result in gear that has a greater misfit at the smaller sizes for women. There is a new NIOSH regulation that says gear must be fitted properly, but there are no specific measurements for women per se, and the range is clearly different.

With regard to stress on the job, 40% of women surveyed by Northwestern National Life report very stressful jobs. Other similar surveys by the Families and Work Institute and Yale University also reported large percentages. A large number of studies published over the past 15 year's show that high demand jobs with low control increase the risk of cardiovascular disease. If employees in high demand jobs are given more control, e.g., control their pace or workload, the stress is reduced. Stress also leads to musculo-skeletal disorders, psychological disorders, workplace injury, suicide, cancer, ulcers, and impaired immune function. Currently, the highest rates of occupational fatalities are due to homicides, and it is higher in women than men. In analyzing victimization by type of work setting, 61% occur in private companies, 30% in government, and 8% among the self-employed. Government workers make up only 18% of the workforce, so these workers have a disproportionate share of these types of occupational fatalities. Studies have shown that a stranger is more likely to victimize, but a high percentage is also due to acquaintances.

Women can take action to protect themselves: store chemicals in sealed containers; wash hands after contact with hazardous substances; avoid skin contact with chemicals; if chemicals contact the skin, follow the directions for washing in the MSDS; participate in safety and health education; learn about proper work practices; and use personal protective equipment. It takes a lot of work to make sure that protective gear fits women. The employer also needs to work with women about home contamination from workplace hazards, e.g., change out of contaminated clothing before going home; store street clothes in a separate area of the workplace, wash contaminated clothing separately, etc.

Questions:

HQ: How does the distribution of selected health conditions compare with men, e.g., back injuries?
Answer: Women in general had greater than or equal to the reported conditions than men did. Women tend to have more injuries in the workplace than men.
HQ: In the area of stress, there has a study where saliva was taken from employees first in morning and just before leaving. Both men and women showed high cortisols in the morning; however, women showed much higher coritsols before leaving work. To what extent is this due to working plus coping with everything else?
Answer: The same results were found in a large study in Volvo workers Sweden; women's level of cortisol doesn't go down until late in the evening.
HQ: With respect to multiple jobs, did the study/survey include homemaker as one of the "jobs?"
Answer: No; the survey only addressed jobs outside the home. Multiple jobs may be due to average low wages to earn a living salary. Full-time government women often work a second job.
HQ: Is there any way to acknowledge part-time workers for health coverage?
Answer: I don't know of any; it is a problem.
HQ: Based on your lecture materials, can one come up with general guidelines for surveillance and maintenance of women's health, since there are factors that are unique to women's health problems?
Answer: It would be worth looking into investing in a generic form. What employers want is a "question bank" to pick and choose from. We recently did this in the case of breast cancer. This year, there will be a set of core questions for breast cancer, e.g., a family history module, an exposure module, etc. The solution is to come up with a package of questions, e.g., modules, that an employer can choose from. It may be worthwhile considering acceptable modules relating to back injury, stress at work, etc.
ARC: Where are you finding carbon tetrachloride in the cleaning industry? This was outlawed some years ago.
Answer: The data comes from studies done prior to removal of this substance from the workplace. Hopefully it is not there anymore.

Dr. Arnauld Nicogossian, NASA Associate Administrator for the Office of Life and Microgravity Sciences and Applications, discussed age, gender, and genetic screening in the workplace. He addressed the following topics: malignancies (epidemiological consideration and age and gender variability); principles of screening; occupational risks; and ethical and legal issues. The cancer incidence and death for men is highest in prostate and lung cancer, and for women it is breast and lung, followed by colon/rectum in both groups. Potential susceptibility markers for cancer are: MLH1/MSH2 for colon, ovaries, and endometrium; BRCA1/BRCA2 for breast, ovaries, and prostate; p53 for sarcoma, breast, bone, brain, lung, leukemia, and Li-Faumeni; RB1for reinoblastoma; WT1 for Wilms Tumor; NF1 for Glial tumors; APC for colon; AT for stomach pulmonary, ovary, lymphoma, breast, and leukemia; VHL for renal; and RET for multi-endocrine. We do not know a lot about which genetic marker will actually affect which type of organ. Carcinogenesis is a stepwise process. It occurs through mutations or irreversible DNA

structure changes in cancer-related genes. Greater than 5 genes must be mutated in adults and as low as 2 in children. Germline mutations are inherited and represent one or more cancers, but fortunately this has low incidence. The environment can stimulate carcinogenesis. The process starts with cell signaling. There are markers in the body called promoters and inhibitors. Promoters are FGF (fibroblast), IGF (insulin), and PDGF (platelet derived). Inhibitors are TGF-B (transforming), interferon, and interleukin-6. Affecting the blood system are IL1 to IL14, G-CSF, GM-CSF, erythropoietin, and thrombopoietin. The receptor and a Protein-Tyrosine kinase initiate a cell cycle. The first step is reproduction of DNA. Once DNA is synthesized, phase G2 proceeds. About 80-90% of deaths are caused by somatics mutation caused by environmental factors. Hereditary breast cancer syndrome is present in 5-10% of women. One in 3000 harbors a mutated hereditary gene; one in 600 has predominantly BRCA1 genes; 85% of the carriers have cancer by age 70. Both genders carrying this gene have a 10% increase in risk for colon cancer, and men have a slight increase for prostate cancer. BRCA2 is site specific and 30% of families with mutation have this gene. One percent of women younger than 40 have a p53 mutation; 50% at 30, and 90% by 60. About 5-10% of colorectal cancer is inherited. FAP is less than 1%. The HNPCC normal polyp rate with rapid transformation is another variant. There are over 26,000 cases of ovarian cancer, with nearly 14,000 deaths. The mean age is 62; 75% seen are at an advanced stage; 25% are curable with surgery. Ultrasound improves detection. With respect to prostate cancer, most men over 50 harbor histology evidence of prostate cancer. White males are at greater risk. About 300,000 cases per year are discovered, and there are about 42,000 deaths. Rectal evaluation is insensitive; PSA is excellent, but the guidelines for interpretation are confusing, particularly for elevated levels.

Reproductive health is a major concern. About 1000 chemicals affect animals, and there are 4 million that are of concern. In men, the results are lowered, abnormal, and altered sperm number, shape, transfer, and hormone performance. Types of exposures include lead, radiation, plastics, welding, mercury vapors, radar, toluene, cpd., ethylene glycol monoethyl ether, etc. Screening principles for occupational hygiene is particularly important. Environmental monitoring is a must. There must be awareness and biological testing of complex mixtures: oils, tars, carbon, pitches, and creosote. Body fluid screens for these materials should be considered. DNA studies are more controversial. Individual susceptibility must be considered and should include both the work and the home environment. Individual susceptibility screening includes family history, occupational exposure history, clinical examination, psychological examination, and imaging (X-rays, MRI, Doppler and Color enhancement, and examination of body fluids for specific markers).

Genetic screening is attractive with the genome project advances. Epidemiological studies are lagging behind the knowledge. Intervention studies and guidelines are also lagging, although primary studies and guidelines are well established for lung, skin, cervix, colon, and rectum. Secondary intervention includes screening tests for early detection; tertiary intervention is intervention to limit complications. Chemoprevention (aspirin, non-steroid drugs, etc.) is controversial at best. There are a number of ethical issues. Voluntary and informed consent are essential, and includes family involvement. Tests must be high quality, reliable, and repeatable.

The standard of testing offered by many companies is not consistent. There must be adequate interpretation and use of the test; there must be adequacy and availability of counseling, and the ability to provide remedial action. Education and responsibility of the patient are important. There are not a great number of legal provisions. Title I of the Americans with Disabilities Act is enforced by the EEOC. The Health Insurance Portability and Act protects health insurance. Fourteen states have some laws against genetic discrimination in the workplace. Title VII of the Civil Rights Act of 1964 provides some protection against age and sex testing. The AMA Counsel on Ethical and Judicial Affairs does not currently support workplace screening, although this organization reserves the right to change its position. The American College of Occupational and Environmental Medicine says that genetic testing should not be performed on current or prospective employees unless it is clear that the genetic trait directly affects job performance or exposes the person to a higher risk than necessary. It also states those insurability decisions by employers or others should not be based on genetic status.

Questions/comments:
Dr. Haynes: It is interesting to talk about what is going on in the prevention mode for men and women with these genes who have no symptoms of disease.

Dr. Nicogossian: We have always been able to diagnose before we have been able to treat; what we are seeing is another scenario where technology is outpacing our capacity to interrupt or affect the system. More aggressive and effective search and prevention programs are needed, as opposed to diverting more funds for treatment.

Dr. Haynes: One of the sad stories is the use of double mastectomies for prevention; although it is a fairly drastic step, it is becoming more common. Men are taking vitamin E to prevent prostate cancer, and there is not a lot of literature to support that; the nutrition and cancer literature is pretty dreadful in term of positive findings. Exercise is more actually more positive for breast cancer prevention than diet.

AWomen=s Health Policies and Programs in the Workplace@
Remarks by Wanda Jones, Dr. P.H.
At the NASA Seminar Series: *Health Surveillance/Maintenance in the Workplace*
NASA Headquarters, Washington D.C.
May 3, 1999

Introduction

---It is a pleasure to be part of this important Seminar Series....and to explore with you the interlinking relationship between health and the workplace. I congratulate NASA for its commitment to improving the lives of American women here on the ground as they help our nation reach for the stars.

---Today I=d like to explore the development of women=s health and workplace conditions as interlocking issues. Also---a look at the challenges we face as one amazing century ends and another one begins.

Some history

---Because women in the workforce is a relatively new phenomenon in the long history of our country, we are just now beginning to understand the health benefits and risks that come with their new economic power.

---A hundred years ago, a woman was lucky to live past her 48th birthday. Tuberculosis, infectious diseases, and childbirth were the greatest threats to her life.

---Yet, ironically, a century ago, a woman=s health was viewed mainly in the context of her reproductive organs. Menstruation was considered a disability, something that made women too frail for work, or even for academic study. Childbearing and keeping the home were her only calling. The medical literature of the 19th century is loaded with grand pronouncements from doctors, claiming that the rigors of study and employment could actually harm a woman=s physical condition, and therefore her ability to have children.

---But since the turn of the last century, women have gained an extra thirty years of life, and a lot of education! While medical advances like the introduction of antibiotics were important factors contributing to these bonus years, much of the credit goes to public health advances -- like improved sanitation and nutrition, and the development of a public health infrastructure to increase access to health services like prenatal care and immunizations. And thanks to some courageous women who dared to risk it all and take the first step..women slowly began to make their way into higher education.

DEMOGRAPHIC TRENDS

---Now women=s average life expectancy in the United States, which used to equal men=s, now surpasses men=s life expectancy by about seven years (79 vs 72 years).

---Women now have plenty of years to have their children and have an education and careers as well, but the marketplace has struggled to adjust.

---In fact, the history of women in the workplace somewhat parallels the history of NASA. In 1961 the nation watched as Project Mercury=s Freedom 7 took its brief ride to the heavens, making Alan Shepherd America=s first man in space. Coincidentally, another revolution was taking place here on earth: America=s women and women around the world were introduced to the first birth control pill.

---When women began to have reproductive choices... many of them chose an education before having children.

---The percentage of American women who have completed a high school education increased steeply between 1970 and 1995. White women are still more likely than minority women to finish high school, but that gap is closing.

---Other encouraging news: there have been dramatic increases among women who have completed four or more years of college. In that same time period (1970-1995,) the percentage of college graduates doubled among white women (8% -21%), doubled among Hispanic women (4-8%) and almost tripled among black women (5%-13%)!

---A recent cover story in the news magazine U.S.News and World Report pointed out that women now earn 57% of all bachelor's degrees, compared to 43% in 1970 and 24% in 1950. By the year 2008, women will outnumber men in undergraduate and graduate programs. It=s happening so fast, it has prompted one analyst to conclude that if the trend continues at this pace, the graduation line in the year 2068 will be all female!

---There are many reasons for this, of course, including current low unemployment rates that encourage young men to forgo college for available jobs, and the demand for computer skills can mean good pay without a college degree.

---But the feminine parade into America=s colleges parallels the growing proportion of women in the work force in the last 40 years. In 1950 29% of American workers were women,..compared

to 40% in 1994. By the year 2006, one in every two people entering the work force will be a woman. The Women=s Bureau in the Labor Department reports that an astonishing 99% of American women will work for pay at some point in their lives.

---Even so, the gender gap in wages has been stubborn. In 1995, women had lower incomes than men at all ages, at all levels of educational attainment, and in all racial and ethnic groups. That gap now stands at about 74 cents to the dollar earned by men. That translates to an average of $137 less pay a week.

---Unlike alarmist predictions of 19th century physicians that going to work would be bad for the health of women, we now know that for both men and women, those who are currently employed fare better than those who aren=t. Some of these reasons are obvious: better socioeconomic status, and better access to health care and health insurance.

---But women who are employed are less likely than men to have health insurance through their employer (52% vs. 73%) and are more likely than men to rely on publicly-funded health coverage

---About 16 percent of American women have no health coverage at all

---Given those facts, that $137 a week gap in the pay of men and women takes on real significance: it could easily pay for a woman=s health insurance policy.

---Despite economic advances, 15 percent of women over age 18 are poor, compared to 10 percent of men, and there are also extremely wide variations in poverty rates among women by race/ethnicity.

---Clearly, socioeconomic status is a powerful determinant of health status once again reminding us of the intertwining relationship between health and the workplace.

Future Trends

---This linkage will get even stronger in the next century, as we experience dramatic population shifts.

---**(Aging Population)** By the year 2030,the number of American women past the age of 65 that will double...and will represent one in four American women! The number of women living over age 85 is expected to triple

...health and caregiver implications...work implications: how do we keep up their skills,

to keep them employed? And are second and third careers, professional careers, a possibility?

---**(Racial/Ethnic Trends)** By the year 2030, one in five American women will be of Hispanic heritage, one in eight will be African-American, one in eleven will be Asian, and one in 100 women will be American Indian or Native American.

---In fact, by the year 2050, non-Hispanic white women like me will represent barely half of the adult female population in America. Clearly, the new millennium will bring about a redefinition of the concept of Amajority@.

CHALLENGES BROUGHT BY CHANGING DEMOGRAPHICS

Mental Health

---So women are entering the new millennium with improved educational, health and employment status. And they have a new face...older, and glowing with shades of color. But the increasingly high-tech, fast-moving work world demands tremendous energy and commitment. One-fourth of American adults view their jobs as the number #1 stressors in their lives. So what women have gained is not without great challenges and risks.

---Clearly, having Amom@ in the workplace raises issues for children, and a new kind of stress for women. In 1991, nearly 40% of the working women had children under 18 years. The increase in full time employment is greater for mothers with young children than for mothers with older children.

---Women are now faced with the stress of juggling career, motherhood, and often the care of aging parents. While many women manage their complicated lives valiantly and successfully, others, particularly those without consistent financial resources, find it overwhelming.

---And that brings new mental health issues to both family and work life. While both men and women face mental health issues throughout their lives, 90% of those diagnosed with clinical depression are women. With the challenges of their multiple roles in society, and their disproportionate risk of depression, women=s mental health needs must be addressed in the workplace.

Exposure to Harmful Substances and Work Conditions

---There are, of course, many other hazards for women at work. Women who work full time are likely to spend a great deal more awake time at work than at home. Now, in their reproductive

years and beyond, women are exposed to many of the same health hazards as men.

---23% of currently working women indicate they have been exposed to substances at work they believe are harmful if they were breathed or placed on the skin. Not surprisingly, workers in white collar occupations reported the lowest likelihood of exposure.

---Exposure to workplace hazards, stresses, or strains traditionally has been thought to pose a greater risk to women because of their childbearing. But any risks the same exposures may have posed to the reproductive hazards of men were thought to be minimal, if they were acknowledged at all. Thankfully, the workplace has become safer for women and for men, as a result of a variety of federal efforts.
---Interestingly, the Labor Department reports that of those men and women who say they are exposed to harmful substances or radiation in the workplace, three-quarters say protective gear is available. Of those, however, only three-quarters report they use the protective gear all or most of the time. Among those workers, one in ten men never use the equipment, but one in four women say they don=t use it. Reasons given were that it is uncomfortable or interferes with their job.We must ask if we are designing protective gear that is appropriate for a woman=s shape and physiology.

---What about exposure to second hand smoke at work? About the same numbers of men and women, 12% of women (10% of men)report that they work at sites that do not restrict smoking.

---And what about jobs that require regular physical stress on the body? Although men have more of these jobs, more than 35% of women report having a job that requires repeated bending, twisting and reaching activities at work. When women are willing to take on these jobs, we must ensure that safety precautions, policies, and training meet their physiological needs.

---And let me digress a moment here to talk about violence in the workplace. When a woman goes to work, the violence that threatens her at home might follow her there. In the years 1980 to 1992, 2000 women were killed in the workplace. Countless more were assaulted. In fact, for both men and women, homicide surpassed machine related deaths at the workplace in this decade. This is a frightening phenomenon, but also an opportunity.

FEDERAL INITIATIVES AND RESEARCH

Quality of Life and Career

---The Federal government has initiated some very effective programs to improve the quality of life for women at work including apprenticeship opportunities, child care services, sensitivity training for employers, nutrition education, and some violence in the workplace awareness programs.

---The Women=s Bureau in the Department of Labor has a variety of programs to promote a more equitable workplace. (Bureau was formed in 1911 after the famous Triangle Shirtwaist Factory fire, in which 146 women and girls died in a New York City sweatshop loft.)

Information/NWHIC

----Because almost two-thirds of the adult population is employed, the workplace has become an important vehicle through which information on health promotion could be provided. Many companies have risen to the challenge with on-site wellness programs.

---The *National Institute for Occupational Safety and Health* (NIOSH) at the Centers for Disease Control and Prevention has workplace information as part of its mission. Since its creation in 1970, NIOSH has seen workplace fatalities fall by 78%.
---My office, the US Public Health Service=s Office on Women=s Health, spent two years developing the National Women=s Health Information Center...(www.4woman.gov or 1-800-994WOMAN) to give women all over the country an opportunity to get reliable health information from a single source. We have had more than two million web site hits since its launch last November. Time of most frequent use: weekdays during work hours. Availability of the internet on job...if used responsibly... is another way to provide health information to women.
Model Programs

---**Mentoring:** And the government can set up model programs. For example, because we believe that women=s health will be better served as more women physicians rise to positions of leadership in their own workplaces...academic medical institutions... we have instituted a mentoring program to help them get there.. We have designated four National Centers of Excellence in Women=s Health that will service as mentoring models...not just to promote women into the ranks of leadership, but also to level the playing field for both promising young women and men in medicine.

---**Violence:** On the issue of violence, Secretary Donna Shalala has set up a model program right in the Department of Health and Human Services. We have created guidelines to help employees be sensitive to violence issues, and every year we have a Violence Awareness Fair right at DHHS headquarters.

Research

---We are now collecting better data on workplace hazards and threats to the health of working women. But there is still a significant gap in research as to how these hazards might affect men and women differently...both physically and emotionally.

---Research on Agender-based@ medicine underway (IOM report)

---The mission of NIOSH includes surveillance and research through NORA...the *National Occupational Research Agenda.*

Some examples of NORA research:

---Are female flight attendants at increased risk for breast and other cancers?

---assessing flight attendant exposure to cosmic ionizing radiation, cabin air quality, alteration of circadian rhythm(possible adverse reproductive outcomes?)

---Breast cancer incidence in a variety of occupation with exposure to potentially harmful substances

---Ergonomic studies for repetitive musculoskeletal work
---Best practices/Back injury prevention program

---Workplace Violence: research into utility of various data sets

---affect of a variety of exposures to reproductive health, including female workers exposed to jet fuel and dry-cleaning materials

Closing

---While the research and programs continue, we must keep in mind that the comparison of health by gender and work status is complicated by many variables, including access to health insurance, and by difference in social roles and expectations of women and men in the increasingly diverse cultures now represented in the workforce. Research will at times seem be tedious and answers will not be easy.

---We can take some inspiration from the 70-thousand men and women at NASA. When the agency was established by law in 1958...who would have imagined that only 11 years later, the Eagle would land on the moon? Our nation is grateful to NASA for its national leadership and vision, in good times and bad, on the ground and out in space, and for showing us that with good science, ingenuity, innovation and hard work, a lot can happen in a short time. Those of us in women=s health will remember that as we cross into a new century.

Thank you.

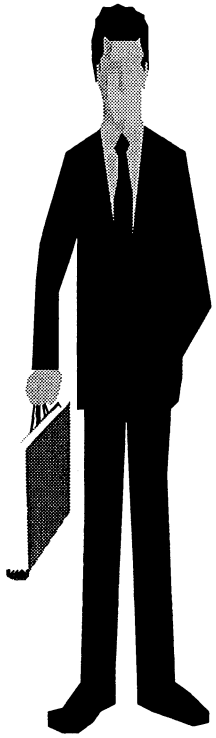
AGE, GENDER and GENETIC SCREENING IN THE WORKPLACE

ARNAULD NICOGOSSIAN

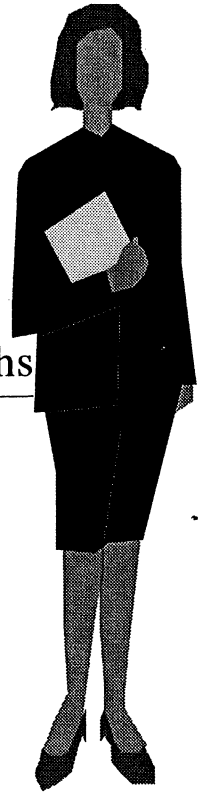
MAY 3, 1999

TOPICS TO BE DISCUSSED

- Malignancies
  - Epidemiological Considerations
  - Age and Gender Variability
- Principles of Screening
- Occupational Risks
- Ethical and Legal Issues



Cancer Incidence and Death



	Incdn.	%	Deaths
Prostate	29		13
Lung	15		32
Colon/Rectum	10		9
UT	9		3
Lymphoma	5		4
Melanoma	4		?
Leukemia	3		4
Other	25		33

	Incdn.	%	Deaths
Breast	30		16
Lung	13		25
Colon/Rectum	11		11
Endometrium	6		2
Ovaries	4		5
Lymphoma	4		4
Cervix	2		<2
UT	2		?
Melanoma	3		?
Other	25		29

Adapted from Landis SH:CA Cancer J.Clin 1998,48:6-29

Potential Susceptibility Markers

- MLH/MSH2 Colon,ovaries,endometrium
- BRCA1/BRCA2 Breast,ovaries,prostate
- p53 Sarcoma,breast,bone,brain, lung,leukemia,Li-Faumeni
- RB1 Retinoblastoma
- WT1 Wilms Tumor
- NF1 Glial Tumors

Markers(cont'd)

• APC	Colon
• AT	Stomach,pulmonary, ovary,lymphoma, breast,leukemia
• VHL	Renal
• RET	Multi-endocrine

Carcinogenesis

- Carcinogenesis is a stepwise process
- Occurs thru mutations or irreversible DNA structure changes in CA related genes
- >5 genes must be mutated in adults and as low as 2 in children
- Germline mutations are inherited and represent one or more CA

Carcinogenesis

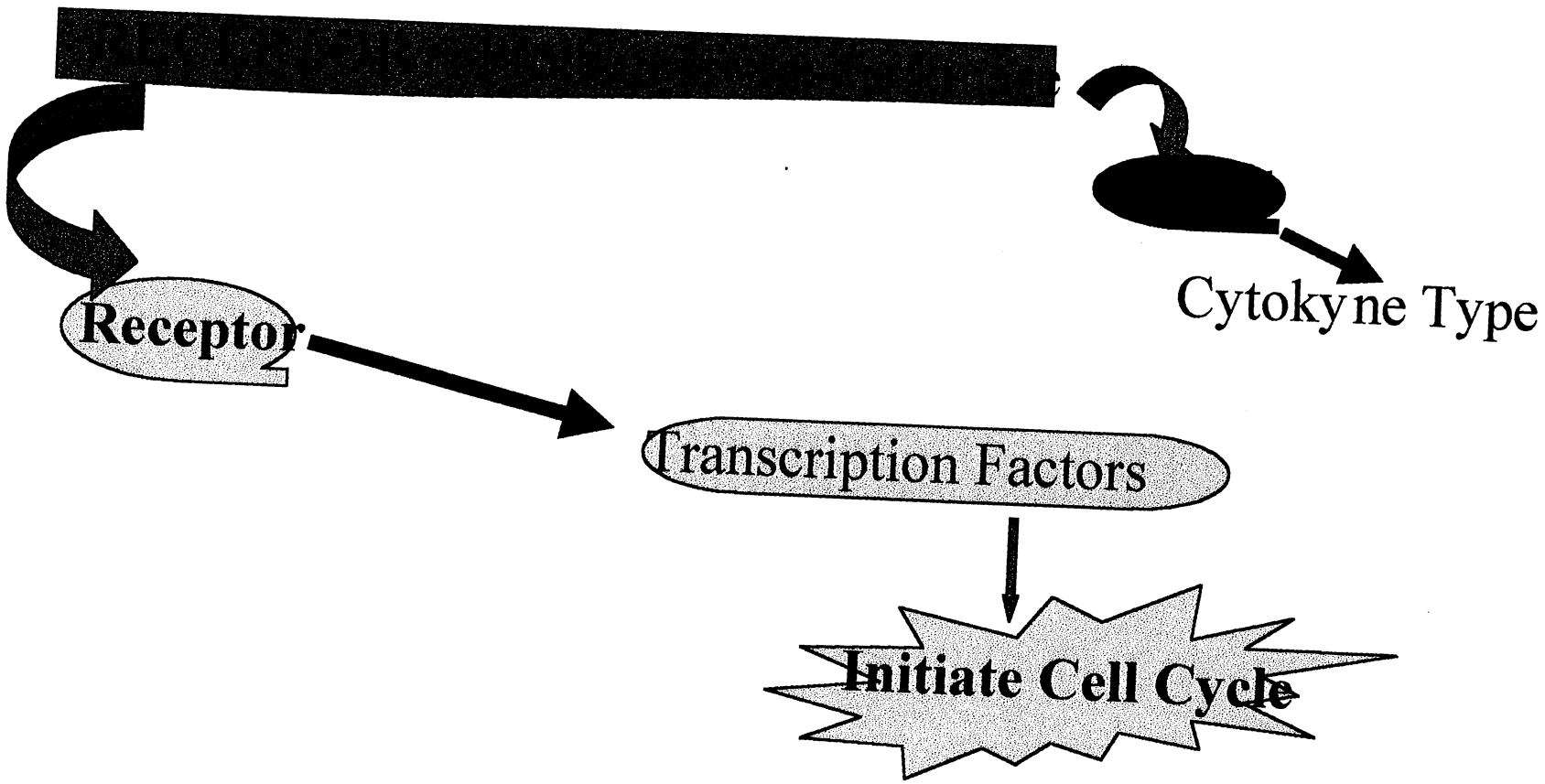
- Somatic mutations
  - after birth
  - each division has a low risk
  - affected cell & progeny
  - environment
- Germline mutations
  - affects many cells & progeny
  - low incidence

Cell Signaling

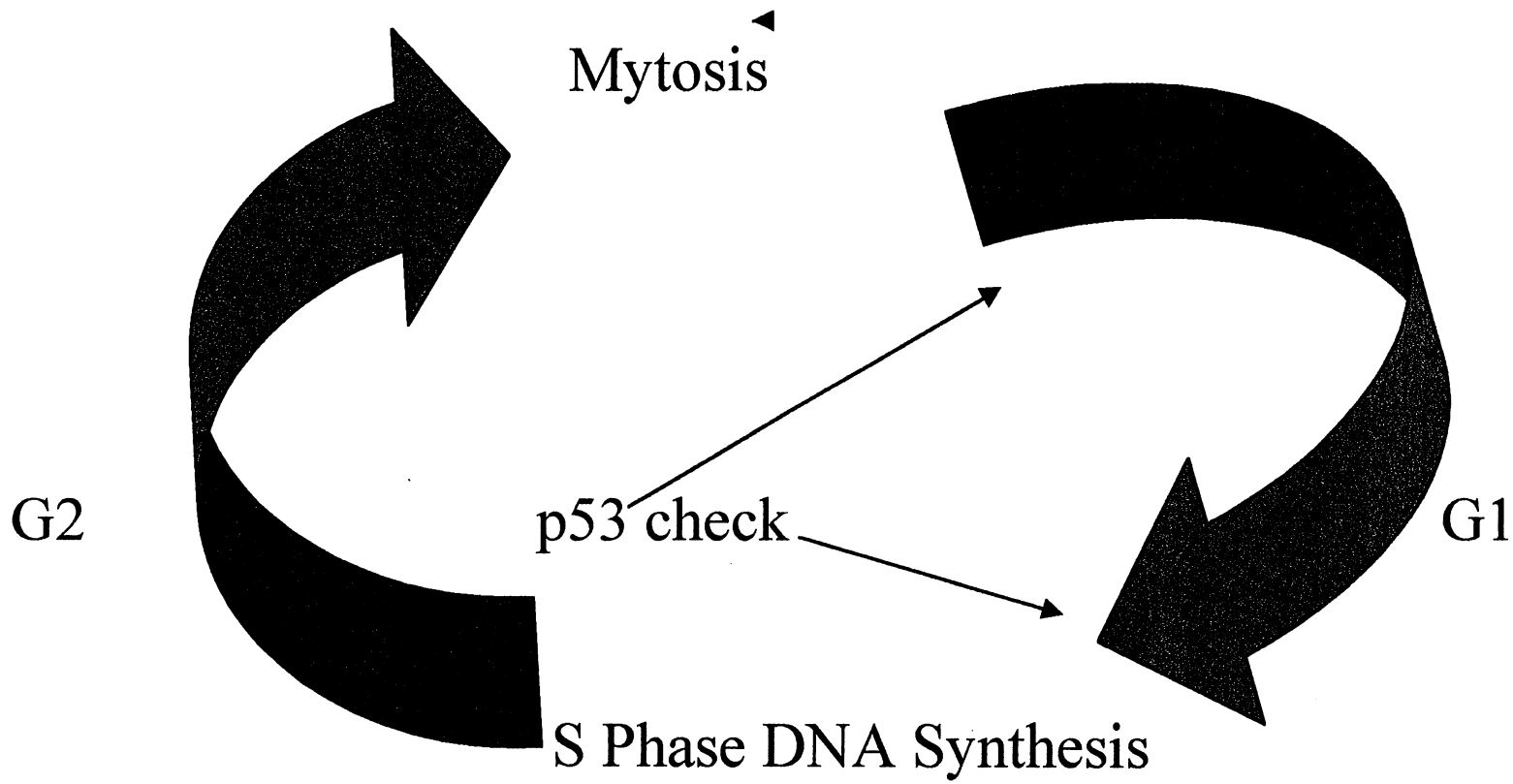
- Promoters:
  - FGF(Fibroblast)
  - IGF(Insulin)
  - PDGF(Platelet derived\
- Inhibitors:
  - TGF-ß (transforming)
  - Interferon
  - Interleukin-6

- **Affecting Blood System**
  - IL1 to IL14
  - G-CSF, GM-CSF
  - Erythropoietin
  - Thrombopoietin

Cell Signaling



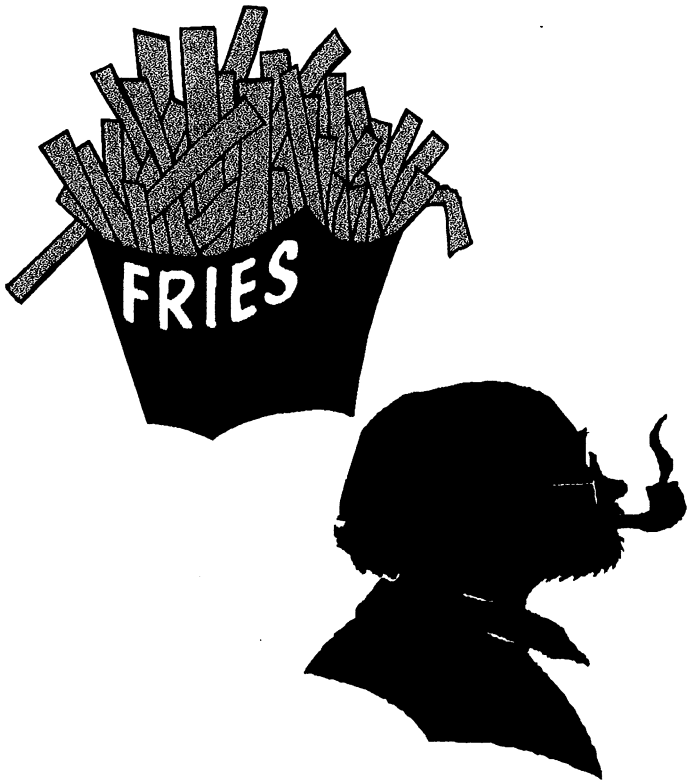
Regulation of Cell Cycles



p53 over expression = carcinogenesis

Environmental Factors

- 80 to 90% of deaths
- Somatic mutations of susceptible genes by:
  - DNA damage
  - alteration of cell death
  - proliferation of cells
  - increased baseline risk



Hereditary Breast CA Syndrome

- 5 to 10 % of women with CA
- 1 in 300 harbors a mutated hereditary gene
- Predominantly BRCA1 genes
  - autosomal dominant(breast and ovary)
  - 1 in 600
  - 50% of all cases
  - 85% of carriers have CA by age 70
  - both gender have 10% increase in risk for Colon CA. Men have slight ↑ in prostate CA

Breast CA

- BRCA2
  - Site Specific
  - Autosomal dominance with sex limitation
  - 30% of families with mutations
  - Female carriers with 85% of lifetime risk
  - men have 6% risk of breast CA
- 1% of Women younger than 40 have a p53 mutation(50% at 30 & 90% by 60 years)

Colorectal Cancer

- 5 to 10% inherited, autosomal dominant
- FAP is less than 1%
  - >100 polyps before age 20(common @ 10)
  - CA by age 40
  - APC gene located at 5q21
  - Attenuated FAP Synd. with flat polyps less than 100 & CA @ age 55
- HNPCC normal polyp rate with rapid transformation.Genomic instability w. many CA sites

CA of the Ovaries

- Over 26000 cases
- Nearly 14000 deaths
- Mean age 62
- 75% seen with advance stage
- 25% curable with surgery
- Pelvic exams(67% mass 4x6cm)
- CA 125 useful
- Ultrasound improves detection

Prostate CA

- Histology evidence in most men >50years?
- 300000 cases and 42000 deaths
- White male at greater risk
- Rectal evaluation is insensitive
- PSA test is excellent. Guidelines are confusing

Workplace Hazards

- Reproductive Health
  - 1000 chemicals affect animals & 4M of concern
  - in men lowered,abnormal & altered sperm number,shape,transfer & hormone performance
  - type of exposures: lead,radiation,plastics,welding,mercury vapors,radar,toluene cpd.,ethylene glycol monoethyl ether, etc...

Screening Principles

- Occupational Hygiene:
  - Environmental monitoring
  - Awareness and biological testing of complex mixtures: oils, tars,carbon,pitches & creosote
  - body fluid screen
  - DNA studies
  - individual susceptibility

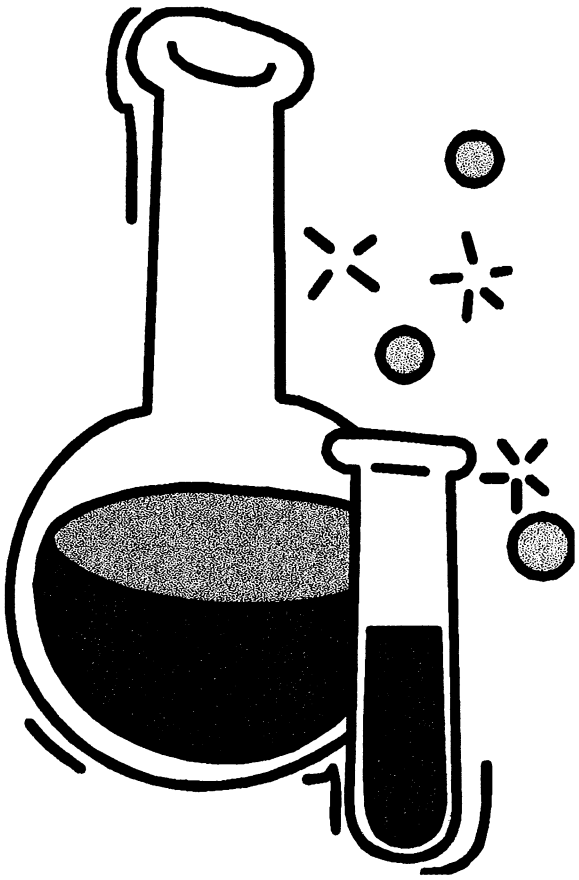
Individual Susceptibility Screening

- Family History
- Occupational exposure history
- Clinical examination
- Cytology/pathology
- Imaging
  - X-rays
  - MRI
  - Doppler+Color enhancement
  - Body fluids examination for specific markers

Special Considerations

- Genetic screening is attractive with the genome project advances
- Epidemiological studies lagging behind
- Intervention studies and guidelines:
  - Primary(lung,skin,cervix,colon & rectum)
  - Secondary(screening test for early detection)
  - Tertiary(intervention to limit complications)
- Chemoprevention is controversial

Chemoprevention



- ASA & NSAID inhibit prostaglandine synthesis
- Agonist and antagonists such as lutheinizing release hormone for Prostate CA
- Antioxidants: vit.C, E, ß-carotene, estrogen

Ethical Issues

- Voluntary & informed consent
- Family involvement
- Reliability,quality and repeatability of tests
- Interpretation and use
- adequacy and availability of counseling
- Ability to provide remedial action
- Education and taking responsability

Legal Considerations

- Title I of the Americans With Disabilities Act enforced by EEOC
- Health Insurance Portability and Act
- 14 states have some laws against genetic discrimination in the workplace
- Title VII of the Civil Rights Act of 1964
- AMA Counsel on Ethical and Judicial Affairs does not currently support work place screening

Genetic Screening in the Workplace

- American College of Occupational and Environmental Medicine Position Statement
  - Genetic testing should not be performed on current or prospective employees unless it is clear that the genetic trait directly affects job performance, …..
  - Insurability decisions by employers or others should not be based on genetic status

Health Surveillance/Maintenance in the Workplace

Session 5 – JOINT COMMISSION INTERNATIONAL ACCREDITATION OF HEALTHCARE DELIVERY SYSTEMS
May 14, 1999

Ms. Cathy Angotti introduced the fifth session in this fifth series of continuing education programs sponsored by NASA's Occupational Health Program, Office of Health Affairs (OHA), in cooperation with the Uniformed Services University of the Health Sciences (USUHS). Worldwide, this session is available on the Internet. Ms. Angotti introduced the guest speaker, Ms. K. Tina Donahue, President of the Joint Commission Resources (JCR), Inc., Illinois.

Ms. Donahue discussed the Joint Commission International Accreditation (JCIA) services and the potential positive impacts that health care organization accreditation standards can have on health care delivery systems. The purpose of the discussion was to shed light on the trend toward internationalization of health care standards and the accreditation tool. The international work was started by the parent organization—the Joint Commission on Accreditation of Healthcare Organizations, based in Chicago. The JCIA is the largest U.S. health care accreditor, as well as the world's largest accreditor. It is accrediting 20,000 organizations of every kind every three years. About 25 years ago, the international community noted that the JCIA had considerable influence in the U.S. as a steward of quality, and looked to the JCIA for information on how to improve health care quality in other countries. For a long time, they have been providing information to the international community about the benefits of health care standards and how they can be used to improve care. As time went on, the Commission began to get a significant increase in requests for more information about standards and how to do accreditation. The Commission researched the causative factors of these requests, and made a decision to invest resources in providing information in a more professional and business-like manner. Like the situation in the U.S., other countries were concerned about quality of health care and increasing costs. Economics was the primary cause of this phenomenon. This causes one to think about the social effects (social health care systems) and access of care as well as quality. A decision point is reached when health care professionals and decision-makers think the health care system is in jeopardy, and the subject enters the political arena resulting in legislation and regulatory involvement. These changes lead to market changes. Many countries around the world are investigating privatization of their health care systems. With market changes, people begin to look outside the country for tools (accreditation) that other countries may be using to control cost and improve quality. The other tool (not discussed today) is a managed care model.

Other countries have accreditors. There are six established accreditors—Australia, Canada, New Zealand, South Africa, the United Kingdom, and the U.S.; most of these base their standards on the JCIA standards. South Africa is the newest, and bases its standards on the U.K. standards. The Commission standards have been periodically updated, and have moved from a department-specific focus to a functional focus. This is key to development of international standards. Taking a functional approach to evaluating health care facilities and delivery makes it much easier

for the evaluators to adapt standard across settings and countries. The newest accreditors are the Czech Republic, Korea, Lithuania, Netherlands, Poland, Spain, and Taiwan. The Czech Republic and Poland accreditors were initiated with U.S. Agency for International Development (USAID) assistance. With their funding, the JCIA worked with those countries to help them establish their systems. The Polish system began as a private entity, but are seeking government support. The Czech Republic system did start as a Ministry of Health function, but they decided to move the system into the private sector where it is thriving. In Spain, the system comes from a private entity, which has been up and running for about a year with three accredited facilities. There are ten to twelve emerging accreditors. The use of standards for evaluating and improving care is growing.

JCIA has provided services in a significant number of countries. It has been doing accreditation since 1951. The best product of service regarding accreditation will come from collaboration between the experts in accreditation and the in-country health care experts. The intention is to transfer the JCIA knowledge around the world. With respect to organization, JCR is a subsidiary of the Joint Commission on Accreditation of Healthcare Organizations. JCIA is a Division within JCR, and delivers the accreditation services. There is also a separate educational arm—the Joint Commission Worldwide Consulting. The JCIA looks to the international community for help in developing the international accreditation system. It is meant to function in two different ways—(1) in collaboration with an in-country accreditor, and (2) accreditation directly from JCIA with a partner in the country who is well versed with the country's issues and problems. There is an International Task Force with fourteen representatives and two representatives from the International Society for Health Care Quality (ISQua). ISQua has developed international principles and standards, and these were incorporated into the JCIA accreditation process. The components of the initiative consist of principles for accreditation services, and principles for standards (scope, focus, and content; country/culture-specific; application to a broad range of capability). The next part of the project will be development of a framework for accreditation, and this is now in the testing process. The JCIA will soon be developing an accreditation decision mechanism. It will be training some international surveyors this year and working on methods for continuous improvement. Before the initiative is launched, JCIA will have developed measures of success to assure that the accreditation services are meaningful and effective. In addition, a research agenda is planned. One of the disadvantages in being a long-standing accreditor in the U.S. is that it is difficult to prove that applications and use of standards make a positive difference in health care delivery. Through international work, JCIA has an opportunity to address this question with the assistance of USAID. Research proposals for Zambia and South Africa have been accepted by USAID for funding. From these projects, JCIA will have data prior to standards, during the process of implementation, and afterwards.

Ms. Donahue discussed the standards chapters for hospitals and other similar care facilities. This framework is meant to be international applicable and adaptable. Section I includes patient-centered standards—access to care and continuity of care; patient and family rights; assessment of patients; care of patients; and patient and family education. Section II includes Health Care Organization Management Standards—quality management and improvement; governance,

leadership, and direction; facility management and safety; staff qualifications and education; management of information; and prevention and control of infections. There is no separate chapter for a medical staff or a nursing component. This is because the international task force emphasized the fact that integrated delivery of care or multi-disciplinary team delivery would be a much stronger message if the standards for all professionals were embedded in these chapters. This set of standards addresses in a general and specific way concerns about quality of medical staff and competence across the board in a way that is applicable in every country. One of the obvious questions is: How are these standards going to be applicable around the world? It is not just the standards themselves that are universally applicable—it is the framework. The chapters and the main standards are generally applicable; JCIA will have "equivalencies" which allows hose applying the standard to accommodate cultural and resource differences without compromising the basic intent.

Ms. Donahue discussed the credibility of the standards. The JCIA aim was to try to get as much input as possible into the international applicability of these standards. To do this, field-testing was used. The standards were mailed to key people in groups whose input was important, and comment on the standards and their international applicability was received. The most meaningful input came from the focus groups in Latin America, the Middle East, Western Europe, the Asia-Pacific rim, and Africa. Each group ranged in number from 6 to 25 people, and was conducted in a uniform fashion. The set of standards will be published for the first time (as a preview) in July 1999. The actual publication of the book (full set with all components) is currently anticipated for the August/September 1999 timeframe. With regard to the internationality of the standards—these are meant to be applicable in developing countries as well as developed countries. JCIA determined which standards in each chapter were absolutely core—these will be designated as such in the book. According to accreditation policies, in order to become accredited, a hospital must meet the intent of the core standards. This is to get as many organizations as possible committed to the use of standards for continuous improvement. Decisions about accreditation are provided on a scale of one to ten; five is the core accreditation. Another important factor in international accreditation relates to the fact that there are a lot of issues around health care improvement. Not all countries have a way bring the issues together and focus efforts on patient improvement. Based on JCIA experience, coordinating performance measurement with physician/health professional credentialing and education, with the practice of evidence-based medicine, with business management, with the use of practice guidelines, with cost control, with patient satisfaction and quality assurance, can improve patent care. The accreditation standards are one tool that can be used to focus all of this effort toward improving patient care.

In conclusion, Ms. Donahue emphasized the purpose and importance of health care professionals. No matter what tool is used to improve patient care, all involved need to be focused on doing what is best for the patents.

Questions/comments:

HQ: Could you elaborate on the countries where work has been done and positive impact has been seen?
Answer: Some work has been done in Kurkistan with the Ministry of Health to set up accreditation standards for hospitals. This country has very few resources, and hospitals are rural. For example, two of the standards were: one patient to a bed and clean water available 24 hours a day. The outcome was a decrease in infection rates. Another example in a developed country is in Spain. The Spanish hospitals had never been amenable to use of the medical staff privileging standards, which involves physicians in quality management and improvement. JCIA worked with a medium-sized, acute care facility in the suburbs of Barcelona over a two-year timeframe. Over this period, the hospital was able to go from a group of physicians who were not going to measure the quality of care, to a group of physicians who are committed and dedicated to measuring performance because they have seen improvement in patient care, e.g., decrease in post-operative infection rates. In addition to getting a continuing education function in place, they have a system of measurement in which they worked together with nurses and other heath care professionals. They have been able to see improvement in both patient and employee satisfaction and other positive impacts on patients.

KSC: Have you had any experience in coordinating accreditation efforts between countries?
Answer: Regarding two countries coordinating, in the central and eastern European project, JCIA worked with four countries—Hungary, Poland, the Czech Republic, and Romania on the accreditation system. They have similar frameworks. Representatives from the countries visited the US, and JCIA technical specialists visited them. There were regional meetings that enabled education in an efficient fashion. Everyone learned from each other, including JCIA. Americans have learned a considerable amount about health care delivery and evaluation. The benefit for the countries was not just an opportunity to compare health statistics, but to learn about the various problems and causes of specific population health problems and health and patient processing outcomes within hospitals. The outcome of the work was not a regional accreditation system. Each has its own system, but in each set of standards is embedded a core set of international standards. The key to moving health care improvement forward worldwide is to have an internationally credible set of health care standards that one can either use as is, take and embed in, or take and adapt. JCIA will be looking for uniformity in professional health care competence, and safe provision of care. Another example is the work NASA is doing on the International Space Station with various groups around the world.

HQ: The Joint Commission domestically is voluntary, but there are strong patient satisfaction and financial incentives for an organization to seek accreditation. This is tacitly approved of by the government with the disbursement of Medicare funds. Do you see the same sort of financial and government forces aligning to support accreditation internationally?
Answer: When we assist a country with accreditation, one of the important components is support from key stakeholders in the health care system, and one of those is the government. JCIA encourages countries to get the support of the government. However, there are some cautions regarding a government-run accreditation program. Accreditation is no simple task; it should be done objectively in an unbiased fashion in order to have credibility and value. Many of

the governments have created a distance-separate entity to provide accreditation services to downplay the political process in accreditation. In other countries where the government is not quite as committed, the challenges are greater. In those countries, the facilities and organizations that are committed to accreditation have altruistic intentions, but the driver in most cases is competition, and accreditation is one way to demonstrate to users of services that the organization has made changes and taken significant steps to improve services for patients. Incentives vary from country to country. The key to successful and sustainable accreditation function in a country is that the right incentives are in place, particularly that the key stakeholders (the payers) are committed. A lot of education needs to be done about the benefits of accreditation and the use of standards. Commitment to accreditation initially is not absolutely necessary to see patient improvement; rather, just having standards to refer to has resulted in patient care and systems improvement. Once these standards are consistently applied, more obvious outcomes are visible.

JSC: Re staff qualifications—in the international environment, each country has its own mechanisms for staff credentialing. What experience do you have with approaching credentialing from an international perspective?
Answer: It has been a major challenge. The standards will address what systems are necessary, but they always defer to local legislation and requirements. Where there are none, JCIA has embellished the standards to include requirements and the systems that are needed to accomplish the objective. One of the major hurdles is that in many countries there are no requirements for continuing education for physicians. In the case of Spain, working together as a team, JCIA was able to communicate to the users of the standards the value of continuing education. They made a commitment themselves to it, and once they got into the team approach of evaluation and continuing education, they recognized the value and now cannot do without it. Continuing Education is such an important part of delivery of care there now that the health care providers are voluntarily going around to various groups in Europe to speak on how the standards have improved the system.

KSC: How does your accreditation relate to OSHA and their needs?
Answer: The standards defer to local requirements. If OSHA requirements are in effect, the standards defer to those. The standards are written in a way that in a U.S. or U.S.-like facility, they are complementary to OHSA and EPA rules. The international standards appropriately defer to local law.

HQ: How flexible are your international standards?
Answer: The flexibility is in the process and application. The standards are not changed from facility to facility during the survey. However, the process is dynamic; as the system is implemented, more will be learned and changes will be made to improve the system. For singular application, standards will not be changed. There are measurable characteristics that will help the surveyor determine the degree to which the organization has met the spirit of the standards. In addition, we will have written equivalencies for certain regions of the world. The equivalency is an alternative method to meet the spirit of the standard. These will facilitate the flexibility of the

standards. The areas in the most need of flexibility are the patients' rights, ethical issues, and safety management areas. Another example of improvement is in patient and facility safety. The last chapter of the standards speaks specifically to safety. These have been a tremendous help and guide to delivery sites that do not have local regulatory body for safety. It has also helped those who do have local regulations in terms of better safety. There have been improvements in fire safety awareness of the staff, the physical plant, and the handling and use of patient medications.

For a set of the standards Contact:

Joint Commission on International Accreditation
One Lincoln Center
Suite 1340
Oakbrook Terrace, Illinois 60181

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Fax: 630-268-7405
E-mail: jci@qhr-jci.com
Website: http://www.jcwc.com
JCAHO: http://www.jcaho.org

For more information or to witness a debate on the usefulness, cost-effectiveness, and political importance of accreditation, there is will be a Joint Commission world symposium in Barcelona, Spain, July 8-10, 1999. There will be experts from around the world at this symposium to debate issues around international accreditation and the usefulness of health care standards. More information can be obtained from the above sources.

JOINT COMMISSION RESOURCES, INC.

1

K. Tina Donahue, MM, RN

Joint Commission
Worldwide Consulting

Joint Commission
International Accreditation

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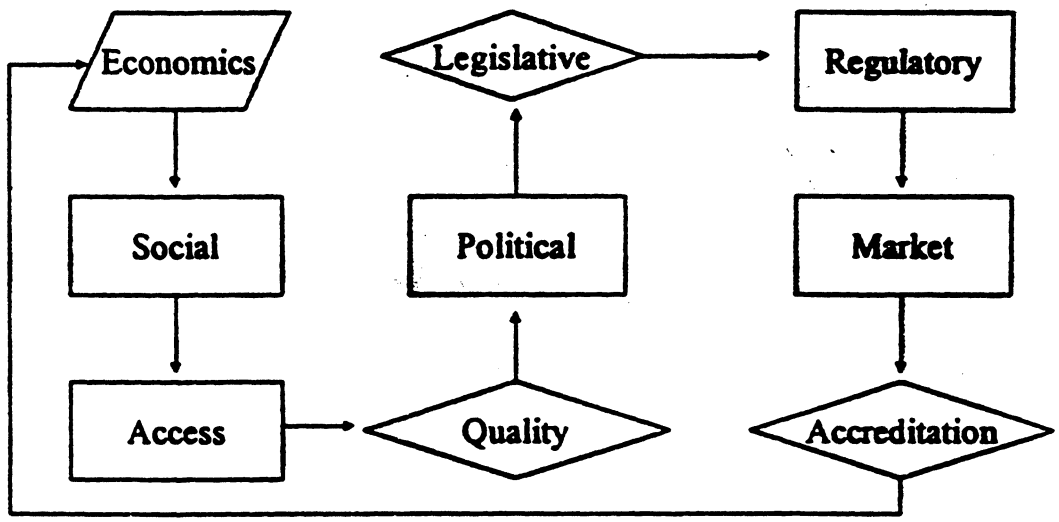
REFORM CHANGE PROGRESSION



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ESTABLISHED ACCREDITORS

- Australia
- Canada
- New Zealand
- South Africa
- United Kingdom
- United States

NEW ACCREDITORS

- Czech Republic
- Korea
- Lithuania
- Netherlands
- Poland
- Spain
- Taiwan

EMERGING ACCREDITORS

- 10-12 Countries

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4

JCI has provided services in these countries:

Albania
Argentina
Bahamas
Brazil
Chad
Chile
Colombia
Croatia
Czech Republic
Dominican Republic
Ecuador
Egypt
El Salvador
France
Fiji
Gabon
Germany
Guatemala
Hungary
Ireland
Italy
Jordan
Kazakhstan
Krgyzstan
Kuwait
Lebanon
Mexico
Netherlands
Nicaragua
Philippines
Poland
Romania
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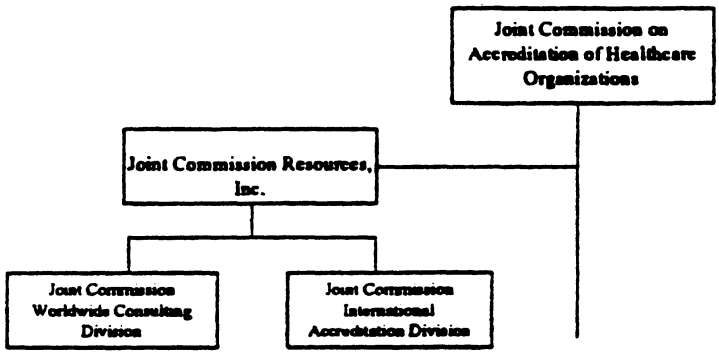
ORGANIZATION STRUCTURE
INTERNATIONAL ACCREDITATION SERVICES
WORLDWIDE CONSULTING SERVICES



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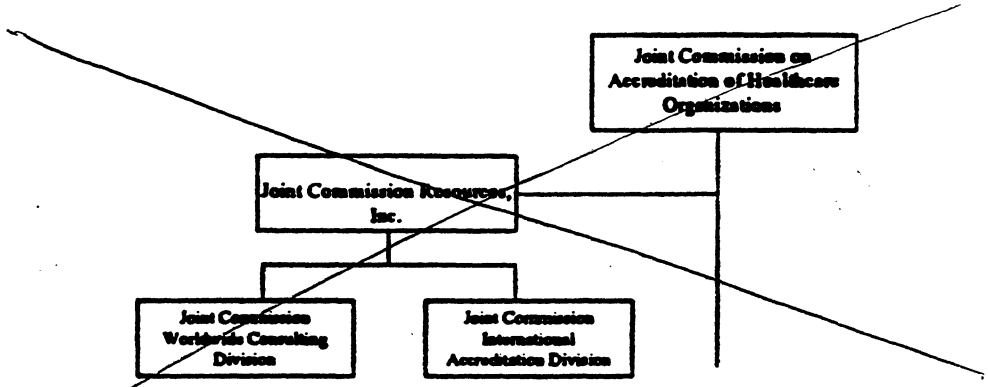
ORGANIZATION STRUCTURE
INTERNATIONAL ACCREDITATION SERVICES
WORLDWIDE CONSULTING SERVICES



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JOINT COMMISSION INTERNATIONAL PRINCIPLES AND STANDARDS TASK FORCE

14 World Region Representatives
2 ISQua Liaisons

- 2 Middle East
- 2 Africa
- 2 Western Europe
- 2 Central and Eastern Europe
- 2 Latin America and Caribbean
- 2 North America
- 2 Asia Pacific Rim
- 2 ISQua

6

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INTERNATIONAL ACCREDITATION COMPONENTS

1. Principles for accreditation services
2. Principles for standards and standards
   - scope, focus, content
   - country/culture-specific
   - application to broad range of capability

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INTERNATIONAL ACCREDITATION COMPONENTS (CONTINUED)

3. Framework for international accreditation
4. Pre-survey and on-site survey processes
5. Accreditation decision mechanisms

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INTERNATIONAL ACCREDITATION COMPONENTS (CONTINUED)

6. International surveyors
7. Testing standards/survey processes
8. Methods for continuous improvement of accreditation services

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INTERNATIONAL ACCREDITATION COMPONENTS (CONTINUED)

9. Measures of success
10. Research agenda

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JOINT COMMISSION INTERNATIONAL ACCREDITATION STANDARDS FOR HOSPITALS

- Section I: Patient-Centered Standards
  - Access to Care and Continuity of Care (ACC)
  - Patient and Family Rights (PFR)
  - Assessment of Patients (AOP)
  - Care of Patients (COP)
  - Patient and Family Education (PFE)

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JOINT COMMISSION INTERNATIONAL ACCREDITATION STANDARDS FOR HOSPITALS (continued)

- Section II: Health Care Organization Management Standards
  - Quality Management and Improvement (QMI)
  - Governance, Leadership, and Direction (GLD)
  - Facility Management and Safety (FMS)
  - Staff Qualifications and Education (SQE)
  - Management of Information (MOI)
  - Prevention and Control of Infections (PCI)

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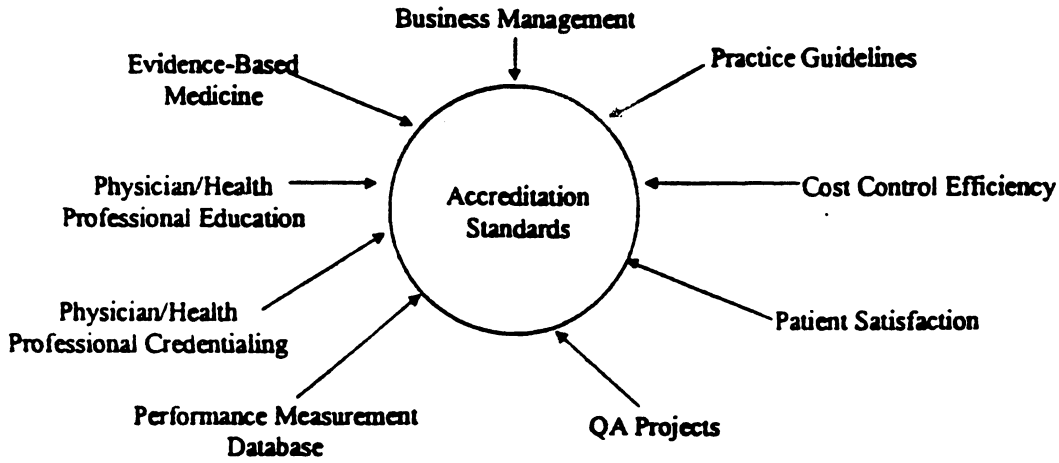

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DO WHAT IS BEST FOR PATIENTS!

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Health Surveillance/Maintenance in the Workplace

Session 6 – INJURY TREATMENT & DISEASE MANAGEMENT—NEW TREND; WORKERS COMPENSATION & AMERICANS WITH DISABILITY ACT
June 7, 1999

Dr. Wing Chang introduced the sixth session in this fifth series of continuing education programs sponsored by NASA's Occupational Health Program, Office of Health Affairs (OHA), in cooperation with the Uniformed Services University of the Health Sciences (USUHS). Worldwide, this session is available on the Internet. Dr. Chang introduced the first of the two teams of guest speakers: Dr. Arjun Chanmugam, Clinical Director at Johns Hopkins University and Dr. James Nichols, Director of Point of Care Testing at Johns Hopkins University.

Dr. Chanmugam introduced the topic—New Trends of Injury Treatment and Disease Management. He covered the following issues: information technology; telemedicine; wound management; and point of care testing. Information technology is one of the primary forces in medicine today. Information technology expenditures totaled about $15 billion in 1998, but there is a disparity between information technology expenditures in medicine and other industries—only about 1.5% - 2% of the medical budget versus about 10% of the budget in other industries. There will be a substantial increase in technological advances as funding increases. Issues associated with these advances will include: the evolution of the electronic patient record, which brings on a host of other issues, including privacy and right of access; consolidation of information technology systems to a uniform information platform; and data transfer and retrieval. These issues have several implications. As an example, about 20-30 years ago, there was recognition that hypertension needed to be controlled in order to reduce morbidity and mortality. A series of studies were done in the 1980's. When the data was examined around 1985, it was found that the then current treatment was actually causing increased morbidity and mortality. It was only by analyzing the data that medicine was able to recognize this. Data management is central to outcome measures.

Advances will also give rise to evidence based medicine, which is using data to make rational clinical decision about patient care. The systematic approach for identifying, retrieving, evaluating, classifying, and synthesizing scientific data will be very important in the practice of medicine in the next millennium. Dr. Chanmugam discussed several new technologies. Cardiovascular Magnetic Resonance Imaging (MRI) is a noninvasive means to assess the vascular system and to screen for coronary artery disease. It can be used for myocardial tagging and diagnosis of breast cancer.

Another issue is telemedicine. Telemedicine is a mechanism to exchange clinical data over long distances. In general, it developed because of the absence of the availability of needed expertise. It also provides infrastructure for centralized command and control. Telemedicine is also being used as an advanced means of communication. Current technology allows for specialty consultation. Currently, most of the consultation occurs on low bandwidth communication links,

and because of this there is limited interactivity, which results in limited capability. However, it is highly accessible. Teleradiology, currently in the early stages of development, is the ability to view studies from a remote location. The other issue is manipulation of the data to get the best results. Unfortunately, the current low bandwidth transfer time is too long to be efficient. However, the ability to send compressed data over long distances increases specialty accessibility. The capability of image enhancement is greatly increased when data can be manipulated, and this technology will be used more in the future. Dr. Chanmugam discussed the development of telesurgery, specifically laparaoscopic cholecystectomy. This procedure is minimally invasive, and patients tend to do better after the surgery. The complication rate is also decreased. The outcomes appear to be equivalent to the traditional "open procedures." However, there is a significant learning curve in using the laparoscope, and many surgeons have limited experience despite the large public demand. What are the learning tools associated with this technique? There is a lack of adequate mentoring, and the expertise gap needs to be bridged. The advantage of telementoring is that the availability of minimally invasive procedures that require skilled competencies can be increased. The patient can be assured that an operator who is very skilled in the procedure supervises the provider. The first generation telementoring experiment utilized fiber-optic cable, 1000 feet apart. Twenty-three procedures were performed with minimal complications. It used real-time video, audio, and telestration. In addition, there was a remote robotic arm to control the laparoscope. The second generation involved a remote and operative site 3.5 miles apart, using a single T1 point-to-point communications link. Seven procedures were performed. In addition to the first generation features, there was electrocautery for tissue cutting/hemostasis by the remote operator. The Automated Endoscopic System for Optimal Positioning (AESOP) is a medical robot that holds the camera and allows precise control of the video image. It frees the surgeon's hands to cut, suture, and suction, and reduces fatigue. The next generation was a lap adrenalectomy with a 5000 mile difference between the remote and operative site, using 3 ISDN, and including the features of the first and second generation. Using the AESOP robotic control, they were able to accomplish the procedure with minimal complications.

The future of telemedicine is an evolving technology, which is only in the infancy stage. It will be dependent upon advances in computer hardware and graphics, and the speed of data transmission that is the biggest challenge. Both physicians and society must demonstrate clinical utility scientifically so that telemedicine will gain acceptance.

With respect to wound management, one of the issues is wound closure. It can occur by primary closure (the wound closes itself), secondary closure (help provided in bringing the two skin edges together), and delayed primary closure (the wound is packed and closed at a later date. There are four methods of closure today: absorbable sutures, non-absorbable sutures, skin staples, and skin taping. Lately, there has been a new development in tissue adhesives—2 octyl cyanoacrylate (trade name—Durmabond). It gives good cosmetic results, is well tolerated, and is economic to use. However, some people believe it may increase infection rates. Also it is non-absorbable and if it gets in the wound it stays there. There have been no long-term studies of its toxicity. The question is whether this an advantage to skin tape, which appears to be underutilized. Skin tapes

could work equally effectively without any of the potential problems associated with Durmabond.

Finally, Dr. Chanmugam discussed biochemical markers. A marker is a measurement of circulating mediators, cell responses, or physiologic parameter that tells us what is happening with a disease process. It identifies patients with disease, helps to predict outcomes, aids in the timing and targeting of therapeutic intervention, and helps to determine the pathogenesis of the disease. Markers have been around for awhile. For instance, almost any disease will have some kind of marker. From 1995 to today, there have been about 69,000 articles dealing with biomarkers. Clearly, this is an expanding area for research. Ultimately, when these markers are well elucidated with great reliability, tests can be obtained at the bedside as well as remotely.

Questions:
KSC: With respect to new technology, it seems that virtual surgery techniques seem possible.
A: Yes, we are now in a phase where we are just learning what these techniques can be, which can increase telementoring.
HQ: Re Cardiovascular MRI—this is in an investigative phase now. Where is it being performed? Do you feel it will be cost effective? How does one access this technology?
A: CMRI is still in its research phase, although some institutions are utilizing it for clinical basis. Johns Hopkins is one. As CMRI becomes more accepted and clinically applicable, the manufacturing cost should come down. Johns Hopkins is also using MRI for cerebrovascular disease. We do not yet know all of its applications.
HQ: How would you envision telemedicine in space flight?
A: There are probably two components. Should someone in space become injured or ill, using markers for a screening process to determine the presence or absence of disease is one aspect. Also, people with some specialized training will be able to treat a large number of diseases and/or injuries with a telementoring presence of an expert on the ground providing back-up support.

Dr. Nichols addressed Point-Of-Care (POC) testing. This is diagnostic testing conducted close to the site where clinical care is delivered. It is referred to by a number of different terms—near-patient, decentralized, ancillary, bedside testing, etc. It refers to care done at the bedside, at a room on the ward, or on a mobile cart. POC is being done in outpatient clinics, physicians' offices, aboard aircraft and cruise ships, etc. A number of biomarkers are being done by POC. Virtually any test that can be put onto a portable cart can be moved closer to the patient-focused unit. A survey in 1994 showed that there were many advantages to POC: turnaround time, patient satisfaction, decreasing length of stay, increased visibility of laboratory testing, cost, back-up, etc. However, some disadvantages were accuracy, calibration, precision, and the complexity of training non-lab personnel to do the testing. Quality issues are the primary problem with POC testing. In the wrong hands, it can lead to the wrong results. The greatest complaints are associated with patient-operated glucose monitoring devices. The complexities with POC include both testing and management. Information management is a major problem with POC testing. Added to this is the issue of putting the testing into an environment over which there may be insufficient control. The Joint Commission on Accreditation of Healthcare

Organizations (JCAHO) has developed requirements for policies and procedures for POC testing. In terms of management, the computerization of these devices has been instrumental in pulling together the requirement for both meeting regulations as well as providing important data for outcomes measures and management of patients. The test result trail is needed for patient management. Data management will have multiple applications in the future, both in meeting regulatory compliance and for in-home testing. The capability of this data management allows the home person to download results over the Internet to the clinician. The devices in the U.S. must be under a pathologist director or laboratory supervisor. The director may be in some remote location to review the performance data. In terms of medical informatics, there are more global applications. Tracking of clinical resources is important. The problem with data management is that over half of POC testing does not have computerization yet. For devices with computerization, the result is available immediately, but if there is intermittent downloading, it may not be transmitted for hours to days, and the view is retrospective rather than on going and real-time. Currently, there is no standard for data collection, transmission, or reduction. Also, current utilization of the data is still rather primitive. In the Johns Hopkins Cardiovascular Diagnosis Laboratory, POC testing improved wait times over the core laboratory, but not significantly. Significant changes occurred only after the unit workflow was reorganized to optimize the use of POC testing results.

POC testing is an expanding delivery option due to increased pressure for faster results. Despite its convenience, POC testing does not alone assure the outcome. The POC test must be linked with the lab data from the laboratory system, along with clinical outputs from the patient record, and bring all of that data into a common database with which the PC or laptop can interact. This is what will be happening over the next 5-10 years—an interactive database that has data from the lab together with data from all of the remote sites together with electronic patient record data. The newer devices have computerization that allows data capture and transmission. It is this data that will assist in proving that the quality is there. Smarter databases will be available soon to integrate electronic data and help manage patient outcomes.

KSC: One of the problems with POC is the quality of care and medical liability.
A: This is an interesting complexity. In certain practices, POC has become standard (glucose meters, for example), but on the other hand, the quality of those results must be questioned. Does it really improve patient outcome? The literature is somewhat scant for glucose meters. Over the next couple of years, outcomes type research will be done to assess the benefit of the new technology.

KSC: One of the other issues is the human factors aspect of operation of the devices. Some of them require quite a bit of training, and with the large number of people who may have to use them; it can become quite difficult. Home care can be challenging. Obviously, the first line of defense is to provide a robust device to provide accurate and useful information. How can one get real-time review of the accuracy of information being collected by home testing without adding cost and complexity to the system?

A: A lot of the engineering of the devices is becoming more fail-safe, but the devices can still be misused. The human factors element is still significant. This must be handled through education. Data review is a limitation in the field now, and home care use can be very expensive. It is much more cost effective in a physician's office.

HQ: What is the accuracy of these real-time devices compared to lab testing?
A: It depends on how the devices are used. Glucose meters are becoming very lab comparable in terms of precision and accuracy when used appropriately. The problem is other patient-care factors—the environment, multiple hands using the device, etc.
HQ: Are the devices certified or approved by any professional institutions?
A: yes, the FDA approves them all, and currently the CDC is classifying them in terms of complexity. When they come into an institution, the institution must do the device validation and the documentation.

Before beginning the second half of this session, Dr. Nicogossian introduced Dr. Kathie Olsen, the new NASA Chief Scientist. Dr. Chang introduced the second team of speakers: Dr. Christopher Holland, Assistant Professor of Preventive Medicine, USUHS; Dr. Paul Healey, Area Medical Director, US Postal Service/NE; and Ms. Peggy Mastroianni, Associate Legal Counsel, EEOC.

Dr. Holland discussed the Americans with Disabilities Act (ADA) and Workers' Compensation (WC). They are different pieces of legislation, but both come together as legislation that addresses medical employability. ADA supersedes conflicting state WC laws but not the Federal Employees Compensation Act (FECA). FECA is the Federal program that provides WC to Federal employees. Each state has its own state laws to provide WC to other employees. ADA went into effect in 1992 for all employers with 25 or more employees and in 1994 for employers with 15 or more employees. The discriminatory provisions were included in the Rehab Act in 1992. In terms of history, Germany and Great Britain had passed WC laws by the late 1890's. Early WC laws were struck down by the Supreme Court. By 1917, NY was able to pass a similar program that was upheld by the Supreme Court, and during the 1920's most of the U.S. states passed WC programs. FECA covers all Federal employees; ADA covers employers with 15 or more employees and refers to "Qualified Individuals With Disability" (QIWD). WC is a no fault system. An employee who is injured does not have to prove he/she is injured due to no fault of his own. They employer is indemnified, and the employee is guaranteed income and medical benefits. Under ADA, there is a system that does require fault—an employee must charge and prove discrimination by the employer. The claim can be anything from non-intentional discrimination to intentional discrimination to malicious discrimination. Remedies can include punitive damages and can involve criminal charges. WC is meant to be a temporary program to provide income and medical benefits. ADA specifically refers to long-lasting medical conditions, which do not have to relate to work-related activities. The WC process is very specific and defined; under ADA, the process is not clearly defined. Under WC the employee must submit specific required forms and submit medical documentation in a timely manner; under ADA the employee must acknowledge a medical condition, provide medical information (when

necessary), and request accommodation. The requirements are not as clearly scripted under the law. Under WC, the employer must work with the treating physician. Under ADA, an employer may work with the treating physician to develop an accommodation strategy, but in some cases the physician may not have a role at all. With respect to return to work, under WC the returning employee does not necessarily have to perform the former job; the employer can fashion an alternative job as long as it is within the capabilities of the employee. Under ADA, the employer must provide reasonable accommodation, but having provided that accommodation, the employee should be capable of performing all the essential functions of their job. If the employer has an existing vacant "light duty" position, and if the individual qualifies for that position, they may be offered it. Under WC, the physician indicates the date that the employee can return to work, but the employer decides when and under what circumstances the employee returns to work. Under ADA, the physician provides information about the functional abilities of the employee and the employer must provide reasonable accommodation. Ultimately it is the employer who determines what accommodation is reasonable to allow the individual to perform the essential functions of the job. WC is narrowly focused on its mission, and does not address the applications process, promotion, training, other benefits, drug testing, etc. ADA does address these issues. With respect to medical records, the employer has access to medical information when a WC claim is filed. The ADA contains rules of confidentiality and provides specific guidance on various types of examinations. Fitness for duty exams must be narrowly defined and job-necessary.

Ms. Mastroianni discussed the ADA legislation—when and how ADA applies to people who have workplace illnesses and injuries, applicants with WC history, incumbent employees, and reasonable accommodation. All of these issues have been addressed in the enforcement guidance on ADA and WC, which is on the Website www.eeoc.gov. ADA coverage applies only to QIWD. This is a big issue for employers—figuring out when ADA applies. After ADA was passed, there was a tendency to add an ADA claim to WC claims, but not all of these workers had coverage under ADA. FECA covers traumatic injury (some of which may rise to the level of disability). In order to have a disability, one must have a physical or mental impairment that substantially limits a major life activity. "Impairment" is one of the few parts of ADA that requires medical evidence to show that there is a physical or mental disorder. In addition, the impairment must substantially limit a major life activity. There is no single definitive list of major life activities; Congress, in the legislative history, has recognized the traditional activities: sight, hearing, speech, caring for oneself, doing manual tasks, and working. Courts have been expanding the definition: thinking and concentrating, sleeping, and lifting are also major life activities. "Substantial limitation" is the difficult part of the definition. The individual must be compared to the average person in the general population, and assess whether they are substantially limited in a major life activity. For example, on the major life activity of lifting—is someone who has a bad back substantially limited in lifting if they cannot lift over 45 pounds? The courts have said no to this because the average person in the general population has trouble lifting over 45 pounds; they have said yes to 10 or 15 pounds (the average person in the general population does not have trouble lifting 10-15 pounds). The courts have also ruled on when a person is substantially limited in working. A person is not considered substantially limited if the

only thing the person has trouble with is the current job, boss, etc. Substantially limited in working means in a class of jobs, or a broad range of jobs in various classes, e.g., someone with a back condition who cannot do squatting, lifting, twisting, etc., and who only knows how to do unskilled jobs. Another example is a clerical with carpal tunnel syndrome who cannot type more than 1.5 consecutive minutes, and is excluded from an entire class of clerical jobs. There are other two bases for being covered under ADA—people who have a record of disability, and people who are regarded as having a disability. A record of WC injury is not necessarily a record of disability. The record must be an impairment that substantially limits the individual in a major life activity. It is not enough to have a disability; a person must be a qualified individual with a disability (QWID). The question is: How is it possible for someone to be arguing under one system (WC) that they can't work, and under another (ADA) that they are qualified? It is possible because these systems have different kinds of definitions. WC doesn't deal with the question of reasonable accommodation. To get WC, a person must prove they have a compensable condition as defined by the state statute, usually a loss or reduction of learning power, the inability to perform the work with the same ease, etc. Some conditions are presumed to be so severe they are presumed to qualify for WC, e.g., loss of vision in both eyes. Can someone who has loss of vision in both eyes be a QIWD? Yes, if they get reasonable accommodation that would allow them to perform the essential function of the job. It is possible to be both qualified under ADA and entitled to WC. However, some people can be qualified under one and not under the other.

How does ADA affect what an employer must do in the application process? ADA has rules about what employers can ask people at various stages. In the pre-offer stage (before a conditional offer of employment is made or not made), the employer cannot ask any disability questions, medical history, or perform medical exams. EEOC and the courts have said that inquiries about WC history are inquiries that are disability related, and cannot be asked. Employers also cannot get third parties to get this information. In the post-offer stage, any disability related question can be asked, but it must be done for everyone in that particular job category. This information can be used to withdraw the offer, but the employer must be able to defend the withdrawal (show that the person cannot do the essential functions of job or cannot do them without posing a direct threat to themselves or others). With respect to incumbent workers who are injured on the job and are ready to return to work, ADA does not forbid a fitness exam to return to work. However, the exam must be tailored in scope. If they can do the essential functions of the job, either their old job or another available job, they can return to work with or without reasonable accommodation. "Reasonable accommodation" guidance, issued March 1, is on the Web site. The employee has to request it. Reasonable accommodation includes job restructuring (removal of marginal or non-essential functions of the job or a change in the way essential function are done); reassignment to a vacant position that a person can do; unpaid leave; modified work schedules. The worst thing an employer can do is to do nothing if a request is made. Taking the reasonable accommodation request seriously is the most important thing an employer can do. The employer has the right to get documentation. The employee must provide information about what he/she can and cannot do. There is a generic deadline for reasonable accommodation—expeditiously.

Dr. Paul Healey discussed the basic concepts of the WC and the ADA system. WC and ADA both try to promote employability. FECA is the Federal government's WC system; it provides benefits to all Federal employees who are injured or killed while performing their jobs. A traumatic injury means a condition of the body caused by a specific event or incident, or series of events or incidents, within a single workday or shift. Such conditions must be caused by an external force that is identifiable as to time and place of occurrence and member or function of the body affected. Continuation of Pay (COP) is intended to prevent an interruption of income in traumatic injury cases during the time period it takes for an employee to submit a claim and for the claim to be adjudicated. FECA provides that regular pay must be continued up to a maximum of 45 calendar days. To be eligible for COP, a person must have a job-related traumatic injury, with loss time due to medical treatment or injury. A person must take certain actions for COP to be initiated, e.g., file Form CA-1 within 30 days of the injury, begin losing time from work within 45 days of the injury, submit medical documentation within 10 calendar days, etc. The employee must ensure that the physician specifies work limitations provides an opinion on how soon the employee can perform that or any other offered position. If an employee can resume work, he/she must do so. If the employee cannot return to the former job, but can perform suitable work offered, he/she must do so. When a temporary injury becomes permanent, the ADA requirements may be applied. Dr. Healey provided a list of what constitutes adequate medical documentation under FECA. It is very similar to the requirements for Federal disability retirement and the guidelines noted in the American Medical Association's Guides to the Evaluation of Permanent Impairment. Upon authorizing medical care, the employer should notify the employee regarding her/her obligation to return to work. The employer should make all reasonable efforts to place the employee in the former or similar position; when alternatives are available, the employer should advise the employee of the requirements of those positions. When none are available, the employer must inform the employee of accommodations that can be made to find work. Dr. Healey offered several vignettes to illustrate these points. Ms. Mastroianni noted that the post-offer lasts from the time a person is given a conditional offer, and ends when the person is on the payroll. Pre-placement exams must be in the post-offer period.

Dr. Healey discussed the process for conducting a reasonable accommodation evaluation. The first step is to identify any physical or mental conditions that may be impairing; the second step is to determine whether the impairment is temporary or long lasting. If the condition is temporary, the guidelines are not necessary. If the condition is long lasting, there is a checklist to determine if the individual can be provided reasonable accommodation: (1) Have the essential functions of the position been identified? (2) Can the individual demonstrate the ability to perform the essential functions of the job? (3) Were other sources of possible accommodations considered? (4) Were the individual's suggestions for possible accommodation requested and considered? (5) Was the line supervisor consulted on possible accommodations? (6) Was management consulted on the proposed accommodation and whether it will have an adverse impact on the operation and safety of the individual and/or others? (7) Was management consulted on whether the proposed accommodation would adversely affect the performance

and/or eliminate an essential function? (8) Was management consulted on whether the proposed accommodation would violate the collective bargaining agreement? (9) Can the individual perform the essential functions of the job with a reasonable accommodation?

Ms. Mastroianni noted that if the condition is temporary, ADA does not require reasonable accommodation. If a condition is temporary, it is not considered a disability. A condition is considered substantially limiting if it is severe for more than several months. An employer should be on the lookout for conditions that are chronic or recurring (e.g., depression). These are covered under ADA.

HQ: Is a current chronic alcoholic considered the same as a drug user?
Ms. Mastroianni: Alcoholism and drug use are treated differently under ADA. A current chronic alcoholic is covered under ADA. This does not mean the person can show up under the influence or drink at work. They are subject to the same performance standards and rules. ADA enables time-off for treatment (a form of reasonable accommodation).
HQ: How does ADA protect the employer? If the job must be filled, because the position is a single point of failure, how does it protect the employer and the person hired to replace the person with the disability.
A: The key protection for the employer is that a reasonable accommodation does not have to be done if it poses an undue hardship—a significant difficulty or expense. For example, for a key job that cannot be filled with a temp, there may be an undue hardship to remove the person who has been hired to fill the critical job. Undue hardship protects employers. For a less critical job (clerical), it would be more difficult to show undue hardship.
HQ: How does one reconcile continued stress and mental disability in a work environment that is not going to get better? How do we deal with stress-related conditions in the workplace?
A: Managers can expect that individuals should perform the essential duties of the position; however, if an employee needs to have an accommodation, the employer should consider that. If the employee cannot continue in the current job, the employee can elect to go down the disability retirement process. Stress is not a disability under ADA; however, a diagnosis of post-traumatic stress disorder with evidence that it substantially limits a major life activity, would be a disability. The courts have held that a stress-free environment is not a reasonable accommodation.
HQ: How can the relationship of stress, mental illness, and qualification for WC or ADA be determined?
A: Request adequate documentation, e.g., medical diagnosis and a statement that they cannot perform any significant aspect of the job. This should not go into the ADA area—it is a WC issue. The individual may need to be put into a different work environment, either on a temporary or permanent basis.

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Point-of-Care Testing

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POCT Definition

Point-of-Care Testing (POCT):

Diagnostic testing conducted close to the site where clinical care is delivered.

Point-of-Care Testing Terminology

- Near-Patient
- Decentralized
- Ancillary
- Alternate Site
- Patient Focused
- Bedside
- Satellite
- Peripheral

Point-of-Care Testing Testing Sites

- Bedside
- Room on Ward (Cleaning closet, etc)
- Mobile Cart
- Satellite Lab (Critical Care, OR, ICU)
- Outpatient Clinics
- Physician's Office Lab
- Home Healthcare
- Ambulatory Care - Ambulance, Air, Sea

CLIA '88 Waived Tests

- Urine dipstick (visual or small device)
- Occult Blood
- Ovulation tests
- Urine pregnancy
- pH visual
- Cholesterol
- Fructosamine, Hgb A1C
- FamExam amines
- Microalbumin
- Sed Rate
- Hgb (copper sulfate)
- Hgb by single analyte instruments
- Spun microhematocrit
- Glucose meters (FDA home use devices)
- Prothrombin
- Helicobacter pylori
- StrepA

CLIA '88 Moderate Complexity Tests

- Blood gases (pH, pCO_2, pO_2)
- Electrolytes (Na, K, Cl, Ca, Mg)
- Lactate
- Amylase, Lipase
- Body Fluid pH
- Coagulation (ACT, PT, aPTT)
- CK-MB, Troponin
- Urine Microscopy
- Blood Alcohol
- Toxicology
- Drugs of Abuse Testing
- Renal Function (Creatinine, Urea)
- CBC

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Point-of-Care Testing US Hospital Survey

- Advantages

Turnaround Time	91%
Patient Satisfaction	34%
Length of Stay	21%
Visibility	17%
Cost	15%
Backup	14%
Personnel Requirements	9%

Bickford G. Decentralized testing in the 1990s. Clinics Lab Med 1994; 14: 623.

Point-of-Care Testing US Hospital Survey

- Disadvantages

Accuracy	73%
QC/Calibration	58%
Training Requirements	58%
Precision	57%
Cost	48%
Personnel Requirements	38%
Revenue Control	22%

Bickford G. Decentralized testing in the 1990s. Clinics Lab Med 1994; 14: 623.

Point-of-Care Testing Quality Issues

- Complaints about SMBG devices represent the largest number filed with the FDA for any medical device (by 1993, over 3200 incidents, including 16 deaths). Greyson J. Diabetes Care 1993;16:1306-8.
- Poorly maintained urinometers and blood gas analyzers can act as an infectious reservoir for resistant microbes. Acolet D et al J. Hosp Infection 1994;28:273-86. Rutala WA et al. Am J Med 1981;70:659-63.
- Routine analysis of desktop cholesterol analyzers (British Clinics) demonstrated that 21% of QC samples were > 1mmol/L (39 mg/dL) from the target mean and as many as 16% of patients were misclassified. Summerton AM. Summerton N Public Health 1995;109:363-7.

Point-of-Care Testing Testing Personnel

- Lab staff - MT or MLT
- Nursing - RN or LPN
- Support staff - RT, NSPT, NST, LT
- Clinician - MD or NPT

Point-of-Care Testing Testing Comparability

Home Use	Hospital Use
Single operator	Multiple operators
Serial measurement on one patient	Multiple patients
Ambulant, well patients	Recumbent, ill patients
Capillary use only	Other specimens possible

Nichols JH. Endocrine Metabolism Education 1994;12:326-34

Inservice Training and Continuing

Point-of-Care Testing Management Comparability

Core Laboratory	POCT
Few Instruments	Multiple Devices
Limited operators	Numerous operators
Laboratory trained	Clinically trained
Dedicated to testing	Patient care focused
QC instrument	QC both device and operator

Nichols JH. Endocrine Metabolism Education 1994;12:325-34.

Inservice Training and Continuing

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Johns Hopkins Point-of-Care Testing

- **Advantage Glucose** - 71 sites, 152 meters, 1800 operators
- **HemoCue Hgb** - 11 sites, 26 analyzers, 300 operators
- **Abbott Test-Pack hCG** - 8 sites, 25 operators
- **Bayer Bili-Labstix/Uristix** - 21 sites, 1000 operators
- **Smith-Kline HemOccult** - 14 sites, 1000 operators
- **Smith-Kline Gastroccult** - 10 sites, 500 operators
- **Smith-Kline GastOccult pH**- 15 sites, 750 operators
- **Nitrazine pH** - 5 sites, 100 operators
- **Hydrion pH** - 1 site, 15 operators
- **FemExam pH/Amine Cards** - 3 sites, 100 operators
- **HemoChron/CoaguChek** - 4 sites, 30 operators

POCT Analytical Factors

- Interferences
  - Hematocrit
  - Lipemia
  - Additives and glycolysis inhibitors
  - Reducing substances
- Physiologic factors
  - Fasting state
  - Specimen type (venous, arterial, cap)
  - Oxygen tension
  - Sampling artifacts (line, capillary)
- Technique bias
  - Reaction timing
  - Method of wiping strip
  - Volume of sample
  - Altitude
- Reagent stability
  - Light
  - Temperature
  - Air exposure
  - Humidity

Nichols JH. Endocrine Metabolism Education 1994;12:325-34.

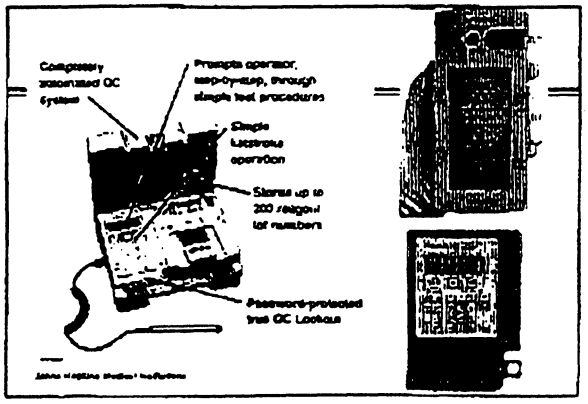
Inservice Training and Continuing

JCAHO Waived Category Guidelines

- Use of result is defined (screen vs diagnosis)
- Supervision and testing personnel identified
- Personnel have adequate training on device, orientation specific to lab needs and demonstrate current, ongoing competency
- Written procedures and policies
- QC - daily or manufacturer's recommendations
- Result trail - Operator, Device and QC

POCT Important Data to Capture

- Date and Time of analysis
- Device ID
- Reagent/strip lot and expiration date
- Control lot and expiration date
- (Control acceptable range?)
- Operator ID
- Patient ID
- Test Result



POCT Data Management Applications

- Regulatory Compliance/PI - Documenting operator competency, device accuracy
- Home Testing - Modem results, remote clinical review (glucose, coagulation (PT))
- Physician's Office - Pathologist Director Review of Performance Data
- Ambulatory Care - Ambulance, helicopter, plane, ship - Remote Consultation

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Medical Informatics

- Patient Care
- Meet Accreditation guidelines
  - Quality Assurance
  - Competency and Accuracy
- Documentation for future reference
  - Legal and Research
- Billing and Recovery (Cost Accounting)
- Utilization and tracking of clinical resources
  - Critical Pathways

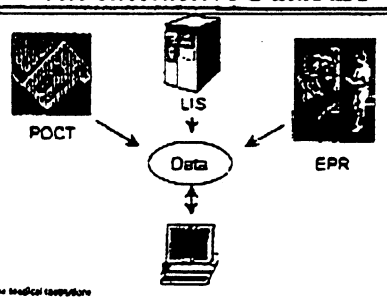
POCT Information Management Current Limitations

- Over half of POCT is manual, visual tests
- For devices with computerization, result is available immediately, but may not be transmitted for hours to days (intermittent versus continuous transmission of results)
- No standard for data collection, transmission or reduction.
- Current utilization of data is primitive.

Hopkins CVDL Outcomes

- Require coag (PT) and renal function (Na, K, Creat, BUN) prior to procedure, remote testing delays patients 171 - 188 mins.
- POCT improved wait times over core laboratory, but not significantly.
- Significant changes only occurred after unit workflow reorganized to optimize use of POCT results; decreased wait times 63 mins for coag ($N=9$, $p = 0.014$) and 47 mins for renal ($N=18$, $p = 0.02$)

The Interactive Database



Point-of-care Testing Summary

- POCT is an expanding delivery option due to increased pressure for faster results.
- Despite its convenience, POCT does not guarantee improved outcome or comparable quality.
- Newer devices have computerization which allows data capture and transmission.
- Smart databases will be available soon to integrate electronic data and help manage patient outcomes.

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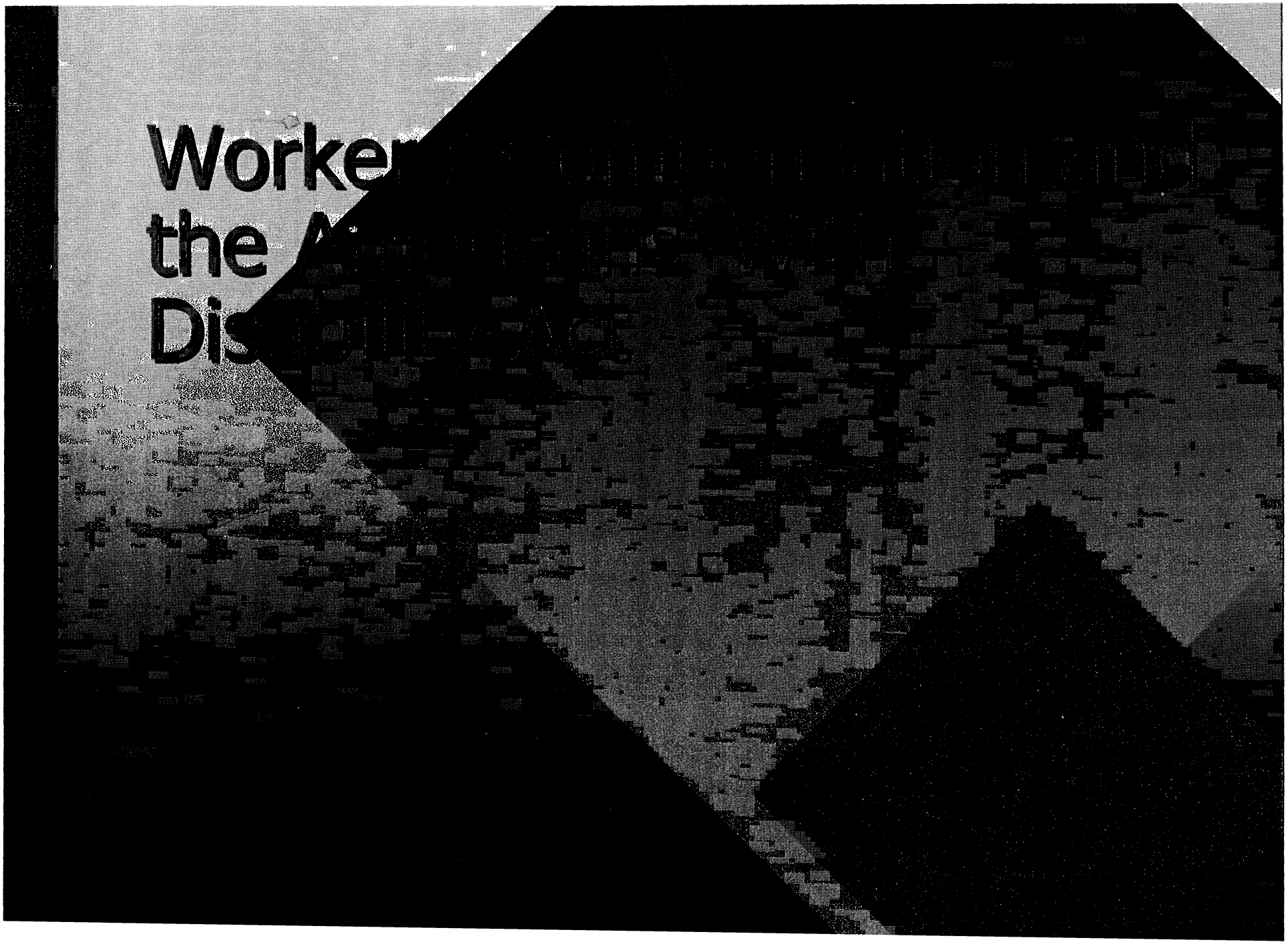


Workers' Compensation and the Americans' With Disability Act

Presented by:
Paul J. Healey, Sr., M.D., M.P.H.
Senior Area Medical Director
U. S. Postal Service
Northeast Area

During the next 10-15 minutes I will introduce some basic concepts of the Federal Workers' Compensation system.

Thereafter, we will try and point out common concepts, even though they may have different effects.

For example, both the Workers' Compensation system and the ADA try and promote employability. However, both systems have different requirements.

Let us start with a basic overview of the Federal Employees' Compensation Act or FECA as it is commonly called. ~~For a more detailed discussion, I would refer you to your local workers' compensation specialists~~.

Workers' Compensation and the ADA

Topics:

1. What is FECA?
2. What is a traumatic injury under FECA?
3. What is Continuation of Pay?
4. What are the employee's and employer's responsibilities?
5. What is adequate medical documentation?
6. Common concepts under FECA and the ADA.

I will cover the following topics:

1. What is FECA?
2. What is a traumatic injury under FECA?
3. What is Continuation of Pay?
4. What are the employee's and employer's responsibilities?
5. What is adequate medical documentation?
6. Common concepts under FECA and the ADA.

Workers' Compensation and the ADA

What is Federal Employees' Compensation Act (FECA)?

The FECA provides benefits to all civilian Federal employees and certain other groups of employees and individuals who are injured or killed while performing their jobs. FECA is the federal government's workers' compensation system.

Workers' Compensation and the ADA

What is a traumatic injury under FECA?

A traumatic injury means a condition of the body caused by a specific event or incident, or series of events or incidents, within a single workday or shift. Such conditions must be caused by an external force, including stress or strain, which is identifiable as to time and place of occurrence and member or function of the body affected.

Workers' Compensation and the ADA

- What is Continuation of Pay (COP)?

COP is intended to prevent an interruption of income in traumatic injury (CA-1) cases during the time period it takes for an employee to submit a claim and for OWCP to adjudicate the claim. For most employees who sustain a traumatic injury, the FECA provides that the employer must continue the employee's regular pay during any periods of resulting disability, up to a maximum of 45 calendar days. 10.200.

Workers' Compensation and the ADA

What conditions must be met to receive COP?

To be eligible for COP, a person must:

1) Have a "traumatic injury" as defined above., which is job-related and the cause of the disability, and/or the cause of lost time due to the need for medical examination and treatment;

2) File Form CA-1 within 30 days of the date of the injury;

3) Begin losing time from work due to the traumatic injury within 45 days of the injury. 10.205.

These are very fact specific inquiries and requirements under the FECA.

Workers' Compensation and the ADA

What are the employee's responsibilities in COP cases?

An employee who sustains a traumatic injury which he or she considers disabling must take the following actions to ensure continuing eligibility for COP. The employee must:

1) Ensure that medical evidence supporting disability resulting from the claimed traumatic injury, including a statement as to when the employee can return to his or her date of injury job, is provided to the employer within 10 calendar days after filing the claim for COP.

Note: Although this process starts the exchange of relevant return to work information, it does not characterize information into marginal or essential functions of the job, as the ADA does. Instead there is a motivation on the part of employers to return employees to any productive work, regardless of whether the work is a marginal or essential function of the job.

2) Secondly, the employee must ensure that the relevant medical evidence is submitted to OWCP, and cooperate with OWCP in developing the claim.

Workers' Compensation and the ADA

What are the employee's responsibilities in COP cases?

(Continuing from the previous slide)

3) Thirdly, the employee must ensure that the treating physician specifies work limitations and provides them to the employer and/or representatives of OWCP.

4) Fourthly, the employee must provide to the treating physician a description of any specific alternative positions offered the employee, and ensure that the treating physician responds promptly to the employer and/or OWCP, with an opinion as to whether and how soon the employee can perform that or any other specific position.

Note: Conceptually, here we see the FECA requiring a sharing and comparing of medical information and the employee's abilities. This is very similar to the employee's burden under the ADA.

Workers' Compensation and the ADA

What actions must the employee take with respect to returning to work?

1) If an employee can resume regular Federal employment, he or she must do so.

2) If an employee cannot return to the job held at the time of injury due to partial disability from the effects of the work-related injury, but has recovered enough to perform some type of work he or she must work. In the alternative, the employee must accept suitable work offered to him or her.

In determining what constitutes "suitable work" for a particular disabled employee, OWCP considers the employee's current physical limitations, whether the work is available within the employee's demonstrated commuting area, the employee's qualifications to perform such work, and other relevant factors. 10.500.

Note: Here we see, under the FECA, a requirement of the employee to return to any type of work the employer has available.

When a temporary work-related injury becomes permanent (or long lasting) the ADA requirements may be applied.

Workers' Compensation and the ADA

What are the requirements for medical reports?

1) Dates of examination and treatment;
2) History given by the employee;
3) Physical findings;
4) Results of diagnostic tests;

This is a laundry list of what constitutes adequate medical documentation under FECA.

It is very similar to the requirements for federal disability retirement.

These requirements are very similar to the guidelines noted in the American Medical Association's Guides to the Evaluation of Permanent Impairment and in the 5 CFR 339.

Workers' Compensation and the ADA

What are the requirements for medical reports (continued)?

5) Diagnosis;

6) Course of treatment;

7) A description of any other conditions found but not due to the claimed injury;

5) Diagnosis;

6) Course of treatment;

7) A description of any other conditions found but not due to the claimed injury;

Workers' Compensation and the ADA

What are the requirements for medical reports (continued)?

8) The treatment given or recommended for the claimed injury;

9) The physician's opinion, with medical reasons, as to causal relationship between the diagnosed condition(s) and the factors or conditions of employment;

8) The treatment given or recommended for the claimed injury;

9) The physician's opinion, with medical reasons, as to causal relationship between the diagnosed condition(s) and the factors or conditions of employment;

Workers' Compensation and the ADA

What are the requirements for medical reports (continued)?

10) The extent of disability affecting the employee's ability to work due to the injury; and,

11) The prognosis for recovery.

10) The extent of disability affecting the employee's ability to work due to the injury; and,

11) The prognosis for recovery.

The evaluation of adequate medical documentation ensures the timely return to appropriate task and duties of a position.

Workers' Compensation and the ADA

What actions must the employer take?

Upon authorizing medical care, the employer should advise the employee in writing as soon as possible of his or her obligation to return to work. The term "return to work" as used here is not limited to returning to work at the employee's normal work site or usual position, but may include returning to work at other locations and in other positions. In general, the employer should make all reasonable efforts to place the employee in his or her former or an equivalent position.

1) Where the employer has specific alternative positions available for partially disabled employees, the employer should advise the employee in writing of specific duties and physical requirements of those positions.

2) Where the employer has no specific alternative positions available for an employee who can perform restricted or limited duties, the employer should advise the employee of any accommodations the agency can make to accommodate the employee's limitations due to the injury. 10.505.

These requirements correlate with the concepts of accommodating the employee and finding work.

At this point let us turn to some vignettes to further clarify these issues.

Vignette #1

25 year old male presents for a post-offer, pre-placement physical examination for a position as a clerk in DOD.

Here we have a 25 year old male who presents for a post-offer, pre-placement physical examination for a position as a clerk in DOD.

Vignette #1 (continued)

Would you explain the concept of a "post-offer, pre-placement physical examination?

Question for Peggy Mastroianni:

Peggy would you please clarify from a legal perspective the difference between the concepts of:

Pre-offer

Post-offer, and

Pre-placement examinations and what is appropriate to discuss during each of these phases.

Vignette #1 (continued)

What do you do when you have someone who presents for a pre-placement physical examination?

Question for Paul Healey:

Next, I would like to focus on what you should expect from a physician who conducts a pre-placement physical examination.

~~Concepts to discuss~~:

You should expect a physician to request and review the Job Description and the physical requirements of the job.

With the Job Description, I review management's description of the tasks and duties of the position. If necessary, I may talk to some current employee's in the job and supervisors.

Next, I review the physical requirements of the job. Then as I conduct a focussed physical examination, I correlate the physical requirements with the applicant's physical findings. I try to resolve any disparities between the requirements of the job and the employee's abilities through an interactive exchange with the employee and management. I do not share medical diagnoses, but rather functional abilities and limitations.

Vignette #1 (continued)

Let us say that this applicant has a history of a back injury 10 years ago, has had no problems for the past 9 years and has been lifting 30-45 pounds without problem for the past 5 years.

Question for Paul Healey on next slide:

Read: Let us say that this applicant has a history of a back injury 10 years ago. He has had no problems for the past 9 years and has been lifting 30-45 pounds without problem for the past 5 years.

Do Not Read: Go to next slide without further commentary.

Vignette #1 (continued)

He has not had any problems with attendance for the past 9 years. How would you evaluate this issue and what do you recommend? Let us presume that there is a lifting requirement of 1-19 pounds on a regular basis, intermittently 20-45 pounds, and rarely 46-75 pounds.

He has not had any problems with attendance for the past 9 years. How would you evaluate this issue and what do you recommend? Let us presume that there is a lifting requirement of 1-19 pounds on a regular basis, intermittently 20-45 pounds, and rarely 46-75 pounds.

Question for Paul Healey on from this and previous slide:

In my evaluation I note that

Concepts/Issues to discuss:

The individual has a history of a resolved medical condition. He currently is able to lift 1-19 pounds on a regular basis and intermittently 20-45 pounds which are both within his lifting restrictions. The 46-75 pound lifting requirement would be considered a marginal requirement of the job. Under the ADA it would be difficult to defend this requirement of the job.

Peggy would you discuss the direct threat to ~~himself~~ the individuals and others issue.

Vignette #2 - Drug Testing

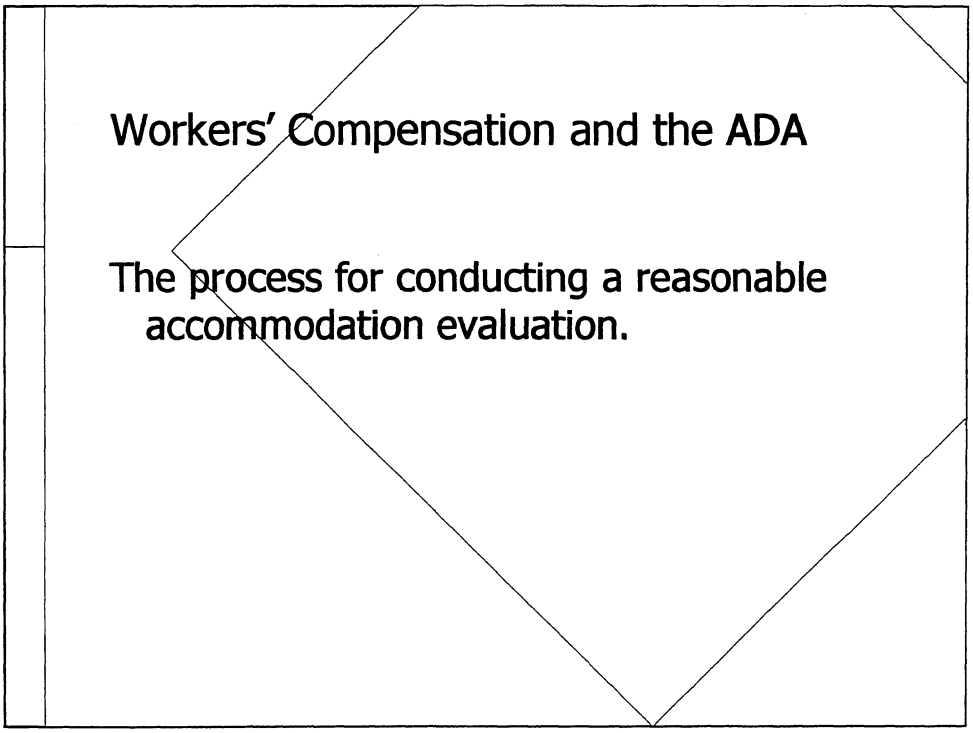
You have an applicant who applies for a job with the Food and Drug Administration. He is offered a job, contingent upon passing a drug test and physical examination. The drug test comes back positive. How does the ADA treat a "current" drug user?

In this second vignette, you have an applicant who applies for a job with the Food and Drug Administration. He is offered a job, contingent upon passing a drug test and physical examination. The drug test comes back positive. How does the ADA treat a "current" drug user?

Concepts to Discuss:

This is an issue of how to deal with the concept of a "Current" drug user. A current drug user means that the use of illegal drugs occurred recently enough to justify an employer's reasonable belief that the applicant's involvement with drugs is an on-going problem. ~~It requires a case-by-case analysis.~~

Current drug users are not protected by the ADA.



Dr. Healey:

Next let us talk about the process for conducting a reasonable accommodation evaluation.

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Step 1: Identify any physical or mental conditions that may be impairing.

The first step is to identify any physical or mental conditions that may be impairing.

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Step 2: Is the impairment temporary or long-lasting.

The second step is to determine if the impairment is temporary or long-~~lasting~~term.

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Step 2a: If the condition is temporary, these guidelines are not necessary.

If the condition is temporary, these guidelines are not necessary. The ADA requires an accommodation for non-temporary conditions. The difficulty arises in defining the difference between a temporary and long-lasting term conditions.

Peggy would you provide us with your approach to distinguishing between the two.

temp v. long-term

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Step 2b: If the condition is long-lasting, we following a checklist format to determine if we can reasonably accommodate an individual. The checklist includes:

If the condition is long-lasting, we follow a checklist format to determine if we can reasonably accommodate an individual. The checklist includes:

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Checklist Item #1: Have the essential functions of the position been identified?

First, ensure that the essential functions of the position have been identified.

It is highly recommend that this process be done prior to a request for reasonable accommodation.

The elements of the essential functions of a job can be drawn from:

1. Position descriptions
2. Other employees
3. Supervisors

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Checklist Item #2: Can the individual demonstrate the ability to perform the essential functions of the job (e.g.: work history or a workplace simulation)?

Next, evaluate whether the individual has or can demonstrate his ability to perform the essential functions of the job, either through the work history or a workplace simulation.

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Checklist Item #3: Were other sources of possible accommodations considered?

Next, we consider possible accommodations. This may necessitate contacting such resources as the Job Accommodation Network (or JAN). OR other organizations.

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Checklist Item #4: Were the individual's suggestions for possible accommodation requested and considered?

This is probably one of the most important items to consider. The individual has had to live with their particular impairment and may have easy, inexpensive solutions. The EEOC and courts expect the reasonable accommodation process to be interactive with the employee.

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Checklist Item #5: Was the line-supervisor consulted on possible accommodations?

The process should also ensure contact with supervisors and managers of the job.

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Checklist Item #6: Was management consulted on the proposed accommodation and whether it will have an adverse impact on the operation and safety of the individual and/or others?

Next: Was management consulted on the proposed accommodation and whether it will have an adverse impact on the operation and safety of the individual and/or others?

This relates to the reasonableness of the accommodation and the direct threat concept we discussed earlier.

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Checklist Item #7: Was management consulted on whether the proposed accommodation would adversely affect the performance and/or eliminate an essential function?

Next, you must ensure that you have consulted with management on whether the proposed accommodation would adversely affect the performance and/or eliminate an essential function of the job.

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Checklist Item #8: Was management consulted on whether the proposed accommodation would violate the collective bargaining agreement?

Next, we review with management the implications of the accommodation on the collective bargaining agreement.

Workers' Compensation and the ADA

Reasonable Accommodation Process:

Checklist Item #9: Can the individual perform the essential functions of the job with a reasonable accommodation?

And lastly, we assess whether the individual can perform the essential functions of the job with a reasonable accommodation.

Chris that is our reasonable accommodation process.

Questions

Years ago, we used to hear supervisors say they did not want their employees back until they were 100% back to normal, or "come back when you don't have any medical restrictions." How has the ADA changed that type of thinking?

Chris needs to have read question.

Question: Years ago, we used to hear supervisors say they did not want their employees back until they were 100% back to normal, or "come back when you don't have any medical restrictions." How has the ADA changed that type of thinking?

Answer: This has to do with the concept of 0 or 100%. In the eyes of management, either an employee can perform all the functions of their job, or they can perform none of them. The ADA has helped managers to see that employees can return to some work, in accordance with their medical limitations.

Under the ADA, employees are expected to perform the essential functions of the job. This is to be contrasted with the FECA which mandates that employers try to return employees to any work they can perform within their medical limitations. Under FECA an employee is required to return to work which is within their medical restrictions.

Stress Syndrome
mental disability
hospitalization

Questions

Employers flustered by the broad definition of disability contained in the ADA sometimes feel as though they are expected to (1) employ anyone who applies for a job and (2) keep every employee on the job despite very serious handicaps. Can you address these twin situations?

The first part of your question requires an employer to identify the essential functions of the job. This is to be distinguished from the marginal, or other non-essential functions of the job. An employer has a right to set the expectations of the job. However, the employer must apply the requirements to current employees, new employees and employees that have medical impairments that affect their ability to perform certain tasks and duties of the position. Additionally, employers are required to consider reasonable accommodations that may allow an employee to perform the essential functions of the job.

Under the ADA, the second part of your question requires an employer to evaluate whether an employee is performing the essential functions of the job, just as he or she might evaluate any other employee. An employer would be required to consider reasonably accommodating an employee.

This is to be contrasted with the FECA which would require an employer to return an employee to work, even with restrictions. However, if the employee is not able to perform the tasks and duties of their position secondary to a work-related event then they may be eligible for the Periodic Roles under FECA.

Questions

Can employers still conduct fitness for duty examinations? If they can, what form need they be to comply with the law?

Chris must have read the question:

Question: Can employers still conduct fitness for duty examinations? If they can, what form need they be to comply with the law?

Answer: Yes, Fitness for Duty examinations can still be conducted. However, they should be pertinent to the physical requirements of the job.

Questions

What is the appropriate role for the occupational physician in these types of discussions and what are the red flags that suggest you may have crossed the line?

Chris must have read the question:

Question: What is the appropriate role for the occupational physician in these types of discussions and what are the red flags that suggest you may have crossed the line?

Answer: An occupational medicine physician's role is to evaluate the medical data and correlate it with the requirements of the job. Additionally, I will recommend some reasonable accommodations.

However, I do not see the role of the physician to identify the essential functions of the job or to make recommendations on whether to hire an individual. These are management responsibilities.

So a red flag might be when a supervisor asks me whether we should hire or fire an individual. That is a management decision that requires an evaluation of the individual's performance, conduct, and attendance.

Questions

Case of an employee who has filed for relief under the ADA. The individual is not currently disabled but his medical records or claim forms show that he had a severe hip and leg fracture which prevented him from working for over 1 year.

Chris needs to ask the question:

Question:Case of an employee who has filed for relief under the ADA. The individual is not currently disabled but his medical records or claim forms show that he had a severe hip and leg fracture which prevented him from working for over 1 year.

Answer: First of all, if this is an employee, that means he his currently employed. Therefore, I would want to ask questions of management and the employee about the basis of the claim. If the employee has been satisfactorily performing the tasks and duties of his position, and only has a history of a disabling condition which no longer affects the performance of his job, then I would think that there is no basis for a claim under the act.

However, if the employer has decided not to retain the employee because of a past medical history of a medical condition then I would advise management that their decision not to retain the employee could be the basis for "regarded as disability" that would be covered under the ADA.

Questions

I once provided some consulting services to a local fire department. While performing an unrelated function I became aware that a clerk who received calls for applications to the firehouse performed a medical screen over the phone. If the caller acknowledged that they had any of 10 or some medical conditions, they were told that they would not be eligible and were not sent an application. What do you think? Assume the firehouse had more than 15 employees.

Chris needs to have read the question:

Question: I once provided some consulting services to a local fire department. While performing an unrelated function I became aware that a clerk who received calls for applications to the firehouse performed a medical screen over the phone. If the caller acknowledged that they had any of 10 or some medical conditions, they were told that they would not be eligible and were not sent an application. What do you think? Assume the firehouse had more than 15 employees.

Answer: First of all, the "more than 15 employees" is a requirement of the ADA. The ADA applies to employers with 15 or more employees.

Secondly, the practice you described is to be frowned upon. It only sets up the employer for the potential of litigation which is not defensible. The ADA requires a more formalized process to document that an employer has adequately conducted an individualized assessment of the applicant and the requirements of the job.

HEALTH SURVEILLANCE/MAINTENANCE IN THE WORKPLACE

Session 7 – Workplace Health Surveillance/Maintenance Program at NASA
and
Overview of Workplace Health Surveillance/Maintenance and Other Specific Issues in Germany

June 24, 1999

Ms. Cathy Angotti introduced the seventh session in this fifth series of continuing education programs sponsored by NASA's Occupational Health Program, Office of Health Affairs (OHA), in cooperation with the Uniformed Services University of the Health Sciences (USUHS). Worldwide, this session is available on the Internet. Ms. Angotti welcomed a new participant to the on-line group—the European Institute of Telemedicine (IET) at the University Hospital of Toulouse, France. The IET was founded on July 10, 1989 as a Public Health Care Center involved in health care, teaching, and research. Several network programs have been developed with the support of the IET. Programs have also been developed with the support of the foreign offices of France and Quebec, Canada. A World Conference on Telemedicine will be held in Toulouse on March 22-24, 1000. Ms. Angotti indicated that a more thorough presentation from the IET would be planned for a future session.

The speakers at the Session were: Dr. William S. Barry, Manager of NASA's Agency-wide Occupational Health Program at the Kennedy Space Center; and Dr. Guiso Schmeisser, Head of the Section for Company Doctors of the Central Bureau of the Industrial Accidental Insurance, and Dr. Edith Perlebach, Head of the Occupational Medicine Department at the Bureau for Industrial Accident Insurance. Drs. Schmeisser and Perlebach broadcast live from Germany.

NASA's Occupational Health Program

Dr. Barry discussed NASA's Occupational Health Program. The mission of the Program is to assure the health and well being of the NASA workforce to maintain NASA's operational capabilities for research, exploration and development of space, and improvement of life on Earth. This is done through the prevention and control of occupational exposures to toxic chemicals and hazardous substances, through the prevention of occupational disease, and through the provision of high quality medical care. NASA has eleven major Centers and four major Program Offices. Health services are provided to a civil service workforce of 17,000, and over40, 000 contractor employees throughout the U.S. Resources to provide these services include 34 civil service professionals and about 330 contractors. KSC has the Lead Center responsibility for Occupational Health Programs, and provides services to eleven NASA Centers. The Biomedical Office at KSC provides administrative support; KSC also has an oversight committee (the Program/Project Management Council) for the activities. The Designated Agency Safety and Health Official (DASHO) at NASA Headquarters (Code U) provides regulatory interface and program advocacy. NASA Headquarters also provides for an Aerospace Medicine and Occupational Health Advisory Subcommittee and an Occupational Health and Safety Executive

Board. Compliance reporting is provided to the appropriate regulatory agencies and there are interagency agreements with other Federal agencies to utilize their specific resources.

In the work setting, the individual can be exposed to chemicals (solvents, composites, paints, cyanides, propellants, photo chemicals, pesticides, and weld fumes), physical agents (noise and vibration, temperature extremes, high/low pressure, ionizing and non-ionizing radiation, industrial and office ergonomic factors), and biological agents (blood-borne pathogens and indoor air microbial contaminants). To monitor the health of the individuals, there are physical examinations, personal protection evaluations, an initial industrial hygiene survey, and safety training for specific areas. Specific job functions within job description mandates a testing designated positions. Because of the critical nature of these jobs, individuals may require drug testing. Occasionally there may be some changes in the work area, which require new regulations or conditions.

Employee health in the U.S. has largely been divided into work related and non-work related areas. To prevent work related problems, there are personal protective devices, hearing conservation, radiation monitoring, vision protection, avoidance of toxic exposures, and ergonomic enhancements. When injuries do occur, they fall under the U.S. Workers' Compensation system. There have been some transition areas between work and non-work, e.g. drug free and smoke-free workplace, the Employee Assistance Program, and the Fitness Program. In the work area, there are regulatory programs for emergency medical treatment and environmental health services. There are also specific exams and certifications that are required. Regulatory programs include blood-borne pathogen protection, the Workers' Compensation Program, and the Drug Free Workplace Program (handled under the Office for Human Resources and Education). Physical examinations traditionally have included medical and occupational history, vital signs, vision testing, blood tests, and urinalysis. Additional examination evaluations can include audiometric testing, pulmonary function testing, electrocardiogram, chest x-ray, specific exposure tests required by regulation or by consensus, stool testing (food handlers), and throat cultures. NASA has worked to remove the barrier between the work related and non-work related areas. NASA wants to ensure that the employee has health care to reduce lost time due to non-work related conditions (cardiovascular disease, aging, cancer, infections, and accidents). In the preventive and wellness areas, Programs include health maintenance examinations, sick call services, Employee Assistance Programs, and Wellness Programs (fitness centers, health education, nutrition education, and risk factor screening). Each of the Centers may vary in terms of their specific wellness services. Preventive medicines and wellness also includes immunizations (Hepatitis B, flu virus) and travel medicine, and health consultation for specific conditions. There are wellness monitoring and screening programs offered specifically for men and women. Mental wellness monitoring is done mostly through the Employee Assistance Program, a Federally mandated program with annual reports to OPM. It is a confidential program that is free to the employee and family. It provides short-term assessment and referrals for follow-up care; it also provides crisis intervention.

To deliver the best possible services, the OHP process involves program enhancement, reporting and metrics, quality assurance, program assessment, and program advocacy. In the area of program enhancement, the OHP provides resources needed by multiple NASA Centers, increases intra-agency occupational health communications, and provides training support. For reporting and metrics, the OHP looks at disease diagnosis and medication interventions, health related incidents, Agency regulatory compliance, Workers' Compensation, and EAP visits/utilization. For quality control, the Program is working with Headquarters towards accreditation of Centers, elaboration of Centers' previous "self assessments", benchmarking liaisons, inter-agency no-cost support agreements, and participation in KSC's survey of program clients. Program assessment includes visits to Centers and consensus on Core Medical Programs (to unify and improve quality at all Centers). Program advocacy includes NASA senior management, the NASA Center Directors, NASA OHP personnel, and outside regulatory agencies.

Occupational Health Care and Surveillance in Germany

Dr. Schmeisser provided a historical overview and background of the fundamental aspects of occupational health care and surveillance in Germany. Occupational medicine has a long tradition in Germany. The first physicians were employed in the chemical industry and they have been working in these positions since the 1860's. By 1876, the first Labor Inspectorate was started in Bavaria, which at that time was a department of the Bavarian Health Center. In 1909, the first trade physician was installed in Germany as a member of the civil service. The first hospital for occupational diseases was founded in 1925 in Berlin. In the same year, the first list of occupational diseases was published by the government, which has been reviewed several times since then. The list now covers 67 occupational diseases under six categories: diseases caused by chemical substances; diseases caused by physical substances; diseases caused by pathogenic germs; diseases of the breathing tract and lungs; dermal diseases; and other causes. Since 1933, the occupational health survey has been mandatory for employers.

The first major principle in the laws and regulations of health surveillance and maintenance is the dualism between the governmental and statutory insurance rate. This means that on one hand, the government (in 1974) passed the national health and safety bill, which describes all of the basic guidelines for the job of every occupation and position, and for the industrial hygienist as well. The bill is addressed to the employer, who is alone responsible to have the best means for an optimum safety and health situation at the workplace. To complete this task, the bill puts the occupational physician and the industrial hygienist as competent advisors at the site. Their advisory capacity is laid down in the bill. It includes all questions of occupational safety and health, especially consultation concerning planning of plant installations; implementation of new substances; selection of body protecting agents; work related physiological, psychological, and ergonomical problems; organization of "first aid;" re-integration of disabled people; assessment of working conditions; and examination of work-related diseases. The employer has to be informed about discovered shortcomings and advised about possible steps to be taken for an improvement of the situation in the factory. Occupational physicians and industrial hygienists are free of directives by other people as long as they fulfill their professional competence. They have to work together with the work council of the company. Some other regulations of the occupational

safety and health field deal with the competencies of the industrial inspectorate of the federal state, which are responsible for health surveillance in the company. They have the right to step into to the factory during working hours, and anytime there is a public safety and order issue. The federal government passed a lot of other regulations in this area, especially those which primarily were requested by the European Union (EU) to standardize safety and health in the member countries. The EU regulations must be passed by all of the member states to become binding in each EU country. The second force in the dual system is the branch-specific system of regulations passed by the almost 100 statutory accident insurances (the Berufsgenossenschaften in Germany). The task and the aim of these regulations are to pre-size the state law with a special look at the branches of their member employers. The Berufsgenossenschaften has passed two major regulations in the field of occupational safety and health. One fixes the amount of time that an occupational physician must spend every year in one company, depending on the number of employees and the hazards that occur in the company. The implementation of this regulation has been ongoing, and should be completed in 2001-2003. The realization of occupational health care for each employee in every small-scale enterprise, step by step, is done by two criteria. First, the larger the small enterprises are, the earlier they are covered by the statutory occupational health care. Second, the more dangerous the hazards are (e.g., the chemical or metal industry), the earlier those companies are covered. The other important regulation passed by the Berufsgenossenschaften deals with the realization of preventive occupational medical examination of employees who are exposed to specific chemical, physical, or biological hazards. In relation to this regulation, 45 principles were laid down for specific preventive occupational medical examinations for employees who are exposed to such hazards. About 85% of the total examinations had no objections. The examinations can only be done by occupational physicians; they also need to have a special authorization, depending on the type of medical examination. This system guarantees standardization in the medical examination procedures as well as in the needed medical technical equipment.

Dr. Schmeisser showed the most frequent reasons for medical examinations in 1997: exposure against infectional risk; working in noise; driving, steering, supervising jobs; and dermal diseases. There are two different types of jobs for occupational physicians—as company doctors at large factories of more than 3000 employees; and as an offeror of medical advice to smaller companies. About half of employees are employed in small-scale enterprises. Those small enterprises were not obliged in the past to use external professional advice, but they will be covered within the next two years. The greatest problem for the doctors concerning this new obligation for those enterprises is to do sufficient and competent work within a very limited amount of time. One option is to be present in a small enterprise every second or third year, particularly with respect to hazards in an administrative area. This is a compromise between the interests of occupational safety and health and the economical aspects of the enterprises (the employer must completely finance the system).

In summary, occupational health surveillance in Germany is based on a dual system of regulation set both by the federal state and the autonomous statutory accident insurances. Both are complementary to one another, as the general laws and by-laws are pre-sized by the branch-

specific regulations of the accident insurance. It is carried out by the Labor Inspectorates of the 16 federal states and by the technical civil service of the statutory accident insurances as well. The surveillance has both a technical and a medical aspect. The technical aspect is carried out by the industrial hygienist, while the medical part is done by occupational physicians, both as advisors to the employer, the employees, and the work council. Responsibility for occupational safety and health remains, on the other hand, that of the employer alone. The Occupational Safety and Health Bill, together with the regulations of the accident insurance, put in competent advisors inside, namely the industrial hygienist and the occupational physician, who complement one another in fulfilling their tasks. Both must minimizes all the hazards for the employees as far as possible.

Dr. Perlebach described the system of occupational health care and surveillance in Germany in relation to other parts of the social security system. Statutory accident insurance has been in existence for the last 110 years. It is one sector of the Social Insurance, which was founded by Chancellor Bismarck. The traditional system was composed of four sectors: the Health Insurance; the Unemployment Insurance; the Pension Insurance, and the Statutory Accident Insurance. Since 1995, a fifth part completes the social security system of Germany—the Long-Term Care Insurance for Disabled People. The German system of social insurances is difficult to understand, even for Germans. Everyone knows about his/her health insurance, but the Statutory Accident Insurance is not well known. One reason may be that it is only financed by the employer, not the employee. This is completely different from the other four sectors of social insurance. If an accident happens at the workplace, or if someone suffers from an occupational disease, that person comes for the first time into contact with the Statutory Accident Insurance. Everyone, as an employee is, by law, insured against the consequences of these events. The Statutory Accident Insurance is not only responsible for the consequences of accidents at work and occupational diseases, but also even for accidents occurring to and from work. The insurance coverage embraces more than compensation in the form of a pension. If it is necessary, there are a variety of possibilities of medical rehabilitation or retraining to move into a new job. The most important aspect that differs from the other sectors of social insurance is the mandate to avoid these events. There is a statutory duty for the employer to use all appropriate means to prevent occupational accidents and diseases and work-related health risks, to provide effective first aid, to ensure the best possible medical, occupational, and social rehabilitation, and to pay benefits to the injured, the sick, or the bereaved family.

Today, there are many risks at different work places that do not yet correspond to the list of occupational diseases, but have to be surveyed. Medical treatment for rehabilitation and the pension for the family in the event of death cause rising costs for compensation for which the employer must pay. Development of some occupational diseases is a long process, often more than 20 years or longer. For example, malignancies due to asbestos may occur after more than 30 or 40 years. This means that employers must pay compensation today for diseases due to working conditions that occurred many years or decades ago. The interrelationships between diseases and working conditions are therefore an important topic in socio-political discussions. Both the Statutory Accident Insurance and the Health Insurance are interested in clarifying these

conditions. The list of occupational diseases is passed from the Ministry of Labor and Social Affairs and is based upon published scientific evidence.

Costs are continuously rising, and the Insurances must find solutions to ease their financial burdens. The government supports cooperation between the Statutory Accident Insurance and the Health Insurance. The aim of the cooperation is not only to come to a consensus about the occupational diseases, but also to cooperate in preventing occupational risks to life and health. To fulfill the law, the first declaration of cooperation was published in 1992; the last version dates from 1997. In the meantime, steps have been taken, but none have been satisfied with the outcome. A few days ago, the government again changed the requirement for the cooperation. The Health Insurance has a new function—it is allowed to be present in the enterprises and to act on its own aims. This includes taking measures for health wellness and promotion programs. Educating people on the adverse effects of certain lifestyles may result in decreasing costs for medical treatment. These measures should complete the preventive aims of occupational safety and health so that it becomes an essential function in the occupational health programs. It is regulated by law that the Health Insurance may finance these programs only with the contributions from the employees. Employers welcome this. On the other side, change will come because of the realization of the European Union (EU). Directives regarding improvement of employee health and safety have been published. The main directive has existed since 1989, but the European states have different kinds of social insurance systems, and there are differing social security standards. This has to be discussed. As consequence of the EU, the national laws have to be adjusted. In the other states, the German Statutory Accident Insurance is not valid, so it will be difficult for Germany to save is traditional system of social insurance. This may mean that the influence of the Statutory Accident Insurance on occupational safety and health will disappear in the next few years.

Questions:

NASA HQ: In regard to the compliance inspection of industry—is this role in the hands of the government or the statutory insurance companies?
Dr. Schmeisser: Both the federal Labor Inspectorate and the Statutory Accident Insurance have a part in surveying the system. They have almost the same rights.

NASA HQ: If there are any violation of the standards identified, are the employers levied a fine for those violations? If so, who levies the fines?
Dr. Schmeiser: Fines are possible, and they may be levied either by the Labor Inspectorate or the Statutory Accident Insurance. On the other hand, surveillance by fines is not the desirable method.

NASA HQ: Did you say that within the purview of the Statutory Accident Insurance, there is an ability to retrain workers that have been injured and cannot return to their former job? Is that part of the Accident Insurance as well?

Dr. Perlebach: Yes, the Statutory Accident Insurance has to pay to retrain them if the person lost his/her job because of occupational disease or accident.
Dr. Schmeisser: The major point is that rehabilitation comes always before any pension is paid; the intention is to rehabilitate people, either for their former job or another job if they are disabled and cannot do their former job. Only if none of this works is an employee eligible to receive a pension from the Statutory Accident Insurance.
NASA HQ: Is there a specific time that you allow to determine if rehabilitation is possible? Or is it a case-by-case evaluation
Dr. Schmeisser: No, there is no time limit. Rehabilitation may take a month or a year; this is not important. The important thing is to get people back to a relatively good state of health.

KSC: Regarding the requirement for a physician to be assigned to a company, depending on size and accident history, is this program been going on for some time? Have metrics been established? Has there been accident reduction? Has it been proven to have an impact on ergonomic injury, for example? If they are not measuring yet, are there plans to do so?
Dr. Schmeisser: We have measured the decrease of occupational diseases and accidents. The measurement done by the contribution fees from the employers. We now can prove that compared to the 1960's, we now have only one-third the accidents that occurred then.

NASA HQ: [to Dr. Barry] Regarding non-work related exposures, to your knowledge, has there ever been a case of a chemical exposure around the house (e.g., yard chemicals) that might show up as an adverse effect in one of our exams?
Dr. Barry: That's a very good possibility, but I do not recall a specific instance at NASA. At a previous company that I was with, we did health surveillance on someone and his liver tests were abnormal; while he did do some printing in the company, it did not seem to be the source. On further information, we found out that he ran his own printing press in the basement of his house without ventilation. It is very likely that someone can have a hobby or second enterprise and get that exposure. It is very difficult to express that. In the U.S., the Workers' Compensation says that where the cause is unclear, it is best to make some objections to the Workers' Compensation and conduct an investigation to see if there are any other contributing factors.

NASA HQ: How does NASA's terrestrial occupational health programs relate to NASA's space occupational health program?
Dr. Barry: JSC manages the space flight program, and they will be at the next session to discuss that. NASA is working to try to make a more flawless interaction in our support.

KSC: I did not recall hearing anything about drug testing. Are they concerned about drug interactions with accidents? Do they have any kind of program? If not, do you thing one is needed?
Dr. Perlebach: Our law does not allow a program for drug surveillance. There is no regulation for control of drugs in the enterprises.

NASA HQ: It was said that in Germany, it is impossible to carry out surveillance for drugs. Could you explain the reason why such law exists? How do you collect your data?
Dr. Schmeisser: This has something to do with the possibility of carrying out screening tests. This intervention into personal rights is not allowed. But if you have a point that someone takes drugs and you are concerned about the danger he presents working under the influence of drugs, then you have at first the possibility to put him off his job for a couple of days; the next step is a close discussion with the occupational physician and his job will ensure that the employee does not present danger for other. It is complicated because individual rights come first.
NASA HQ: So are you saying that you test for cause? That is the only instance in which you test, otherwise it becomes a personal rights issue?
Dr. Perlebach: No, you have to show that he is not able to do his job. You don't have to show that he takes drugs.
NASA HQ: You say that you are not proving your suspicion by objective test?
Dr. Schmeisser: The employer alone remains responsible for safety of all workplaces in his company. His only opportunity is to put someone off the job. As you know, someone who takes drugs will take drugs again, and this puts him in danger of losing his job. He has the chance of coming into contact with the company doctor, and the company doctor has the possibility to help. Under that umbrella, the employee has the chance to get rid of drugs but he has to accept special means to help him.
NASA HQ: How about alcohol? Do you test people for alcohol?
Dr. Schmeisser: Alcohol is the same thing. The only one who has the possibility to test if people act illegally under alcohol is the police. If someone is drunk, the employer has the opportunity and responsibility to put that person off his job; that doesn't make it possible to test him on alcohol.

INSTITUT EUROPEEN DE TELEMEDECINE

L. LARENG - M. SAVOLDELLI

Hôpitaux de Toulouse

Institut Européen de Télémédecine

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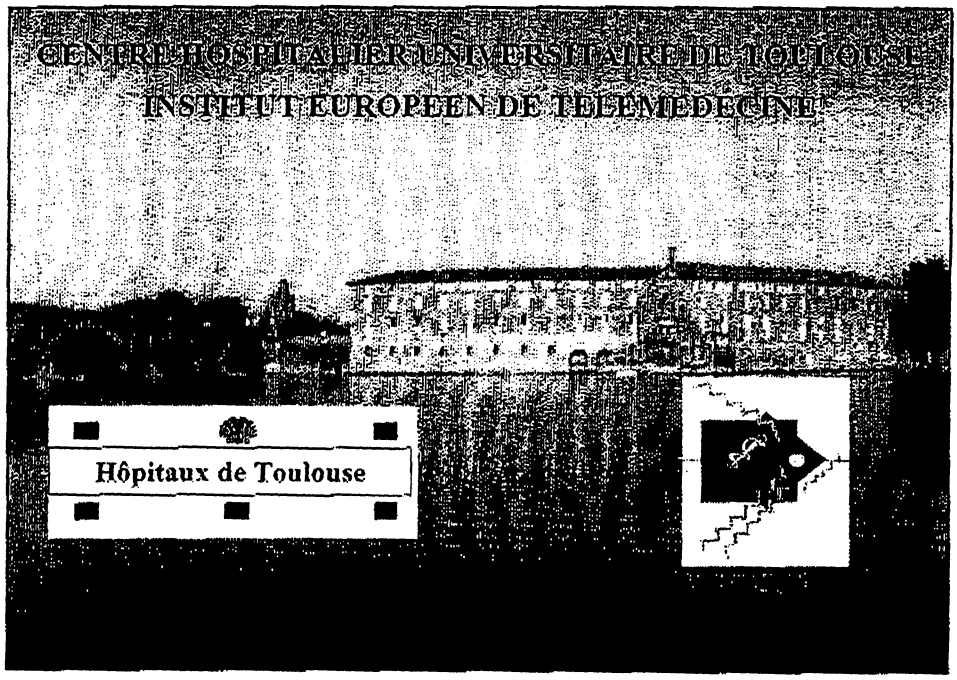
Tel: 33 5 61 77 86 40 Fax 33 5 61 77 86 42 E-Mail : lareng.l@chu-toulouse.fr



INSTITUT EUROPEEN DE TELEMEDECINE
CENTRE HOSPITALIER UNIVERSITAIRE DE TOULOUSE

Activities

Institut Européen de Télémédecine (IET)

University Hospital Structure
Head Office : Hôtel-Dieu Saint-Jacques

Founded on July 10th 1989
Management committee :
24 european members from university, hospital, law, industry

Mission : to promote an foster the development and the use of any technical means and methods facilitating remote medical practice
to improve the quality of Health Care through the optimal use of technical means and medical skills

INSTITUT EUROPEEN DE TELEMEDECINE
CENTRE HOSPITALIER UNIVERSITAIRE DE TOULOUSE

Activities

Centre Hospitalier Universitaire de Toulouse

Public Health Care Centre
Tasks : Health Care, Teaching, Research
Coverage area : Midi-Pyrénées region - 45 382 Km²- 2,5 M inhabitants

- Head Office : Hôtel-Dieu Saint-Jacques
- 6 hospitals : Purpan, Rangueil, Children Hospital, La Grave-Casselardit, Salies, Luchon
- Total amount of Patient admission : 3 340 hospital beds
- Customers : 145 000 in-patients / year
  470 000 out-patients / year
- Human Resources : 9 010 hospital employees
  2 021 medical doctors providing all medical and surgical specialities
- Training : 10 paramedical schools / 1 240 students/year
  428 medicine and pharmacy students during hospital training period

INSTITUT EUROPEEN DE TELEMEDECINE

Main programs:

➔ International level :

Programs developed with the support of EC

MacNet program / 1986-1991: Medical Advice Centres Network
This program involving the Centres in Madrid, Toulouse, Roma, Athens and Lisboa focused on the improvement of medical care at sea.

EurotoxNet program / 1988-1990 : European Toxicological Network
This Program involving thePoison Information Centres in Brussels, Milano, London, Toulouse and Munster has been working to harmonize the measures related to care of poisoned patients in Europe.

SameNet Program / 1991-1992 : Program mainly conducted between Toulouse, Athens and Lisboa and aiming at the improvement of remote medical care

INSTITUT EUROPEEN DE TELEMEDECINE

Main programs:

➔ International level :

Programs developed with the support of EC

ETELNET Program / 1994-1995 : European Telemedicine Network
This program was part of a Public Health scheme and focused on the use of Telemedicine for an innovative approach of coordinated exchanges of information and experience at the european level so as to support prevention and Health Education Programs. In this framework, Telemedicine sessions have been organized by IET between France (Toulouse) and Overseas Departments and Territories, Germany (Hanover), Belgium (Brussels), Spain (Barcelona), Greece (Athens) and Andorra.

WORLD CONGRESS ON TELEMEDICINE for the Development of the Global Information Society for Health : Toulouse, November 30th - December 1st 1995

INSTITUT EUROPEEN DE TELEMEDECINE

Main programs:

➡ International level :

Programs developed with the support of EC

GETS PROGRAM / 1996 : Global Emergency Telemedecine Service
This Project has been conducted in the framework of G7/ 8 Global Healthcare Applications Sub-Project 4 in cooperation with Italy. GETS overall objective consisted in the Feasibility Study of setting up a Universal Multilingual Multidisciplinary and 24-hour Emergency Telemedicine Service.

An overall architecture has been defined for a global and coordinated Emergency Telemedecine Service around the world achieving complementarity and networking of multilingual major Telemedicine Centres on a worldwide scale to cover planetary needs and constituting a generic model of Telemedecine Network Backbone.

TEN TELEMED Program / 1998 : Following GETS Program, the objectives of Ten Telemed focus on facilitating access to a European Network of Centres of excellence . IET takes part in this programme.

INSTITUT EUROPEEN DE TELEMEDECINE

Main programs:

➡ International level / Current programs

Programs developed with the support of EC

GALENOS Program / 1999 : Generic Advanced Low-cost trans-European Network Over Satellite / GALENOS Program is funded by the EC and coordinated by EUTELSAT. This project aims at setting up and developing experimental applications in the framework of Telemedicine by way of satellite.

Further Event

WORLD CONFERENCE ON TELEMEDICINE to be held in Toulouse (France) on 22nd to 24th March 2000 / organized by the « Institut Européen de Télémédecine » under the aegis of the European Society of Telemedicine and the International Society for Telemedicine

INSTITUT EUROPEEN DE TELEMEDECINE

Main programs:

➔ International level :

Programs developed with the support of Foreign Offices of France and Quebec (Canada) / on-going cooperation since 1996

Working sessions / exchanges of experience and information regarding Ethics, Liability and Legal Aspects of Telemedicine

Telemedicine sessions (videoconfrenencing / ISDN 384 Kbits) between University Hospitals of Montreal and Toulouse on various medical specialities : Cardiology, Dermatology, Endocrinology...

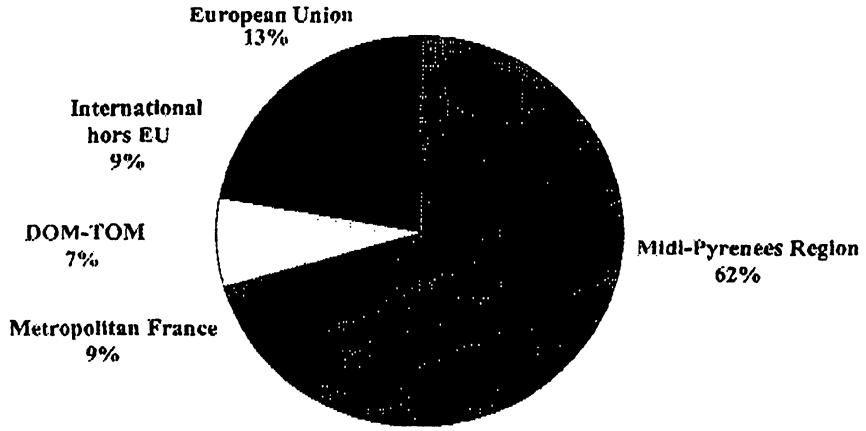
Setting up of the European Society of Telemedecine 1991

Support to Midjan Group (IET co-founder) since 1996/

Organization of Telemedicine sessions with Developing countries with the support of the International Telecommunications Union (ITU) and France-Telecom

INSTITUT EUROPEEN DE TELEMEDECINE
HOPITAUX DE TOULOUSE

Telemedicine sessions (July 1992 - December 1998)
Total Amount 610 Hours

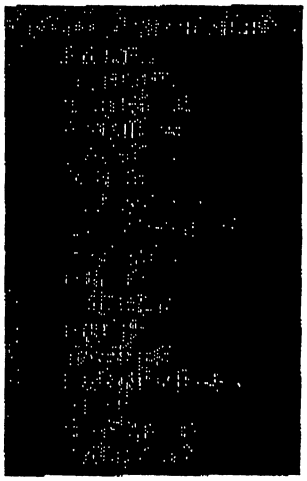


INSTITUT EUROPEEN DE TELEMEDECINE
HOPITAUX DE TOULOUSE

Telemedicine sessions (July 1992 - December 1998)

TOULOUSE

- School
- Center for Disabled
- General Practitionners



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INSTITUT EUROPEEN DE TELEMEDECINE
HOPITAUX DE TOULOUSE

Telemedicine sessions (July 1992 - December 1998)

[redacted]

ATHENS
HANOVER
KÖLN
BRUSSELS
BARCELONA
ANDORRA
VIELLA
LISBOA
ROMA
MILANO
ANCONA
FIRENZE
FLAGSTAFF
HOUSTON

HEIMDAL (North Sea)
MONTREAL
TROIS RIVIERES
MELBOURNE
ADELAIDE
PERTH
RIO DE JANEIRO
RECIFE
BEYROUTH
ABIDJAN
BAMAKO
MIDRAND
DAKAR
TUNIS
SOUSSE

INSTITUT EUROPEEN DE TELEMEDECINE
CENTRE HOSPITALIER UNIVERSITAIRE DE TOULOUSE

Main Programs

➡Regional level :

Setting up a Regional Telemedicine Network to optimize complementarity between Hospitals in Midi-Pyrenees Region (largest region of France : 45 382 Km2, 2,5 M inhabitants).
In the first step, works carried on aimed at networking the University Hospital of Toulouse, theRegional Cancer Centre and the most remote Hospitals in the Region

1993-1995 : Experimental Telemedicine sessions

1996-1998 : Setting up the core of the Regional Inter-Hospital Telemedicine Network linking 7 hospitals

1998 : Experimental Telemedicine links between the University Hospital and some General Practitioners

INSTITUT EUROPEEN DE TELEMEDECINE
CENTRE HOSPITALIER UNIVERSITAIRE DE TOULOUSE
Main Programs

➡Regional level :

Main Telemedicine applications are :
Remote consultations between referring physicians in proximal hospitals and consultant physicans in expertise centres
Staffs between remote medical teams
Multisite on-going training sessions

Medical field : All medical and surgical specialities
Main specialities involved : cardiology, haemato-oncology, radiology, traumatology, neurosurgery, gynecology-obstetrics, pneumology, thoracic surgery, digestive surgery, internal medicine, pediatrics, dermatology, geriatrics, anatomo-pathology...

Telecommunications means / ISDN
Telemedicine equipments / videoconferencing (128 /384 Kbits)and still images transfer equipments

MIDI-PYRENEES REGIONAL TELEMEDICINE NETWORK

Telemedicine and Medical Practice

/ Feedback of 37 months (Apr. 1996 - Apr. 1999)

2 222 Telemedicine medical files

390 hours / utilization

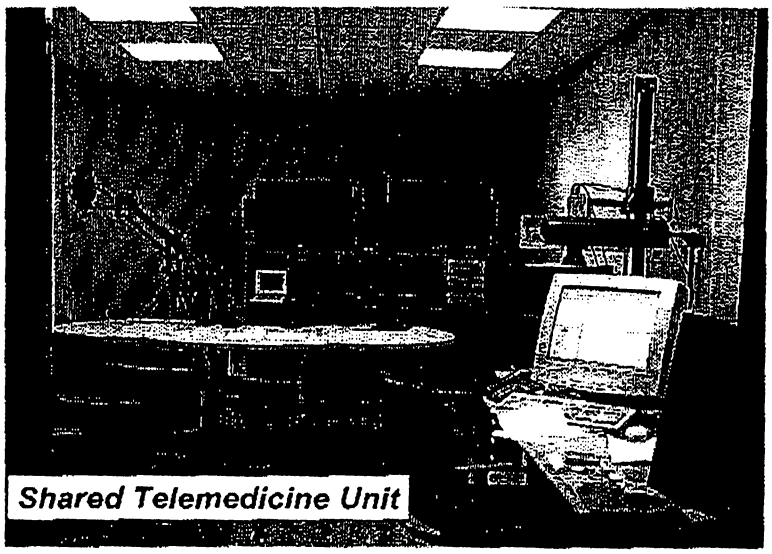
- **Inter-Hospital Telemedicine Network / 2114 medical files over 23 medical and surgical specialities :**

Main specialities involved : 676 cardiology files, 664 Haemato-Oncology files, 450 Radiology files, 123 Traumato-Orthopaedics files, Thoracic and digestive surgery, Angiology, Pneumology, Gynecology-Obstetrics, Neurosurgery , Anatomo-Pathology, Infectious diseases ...

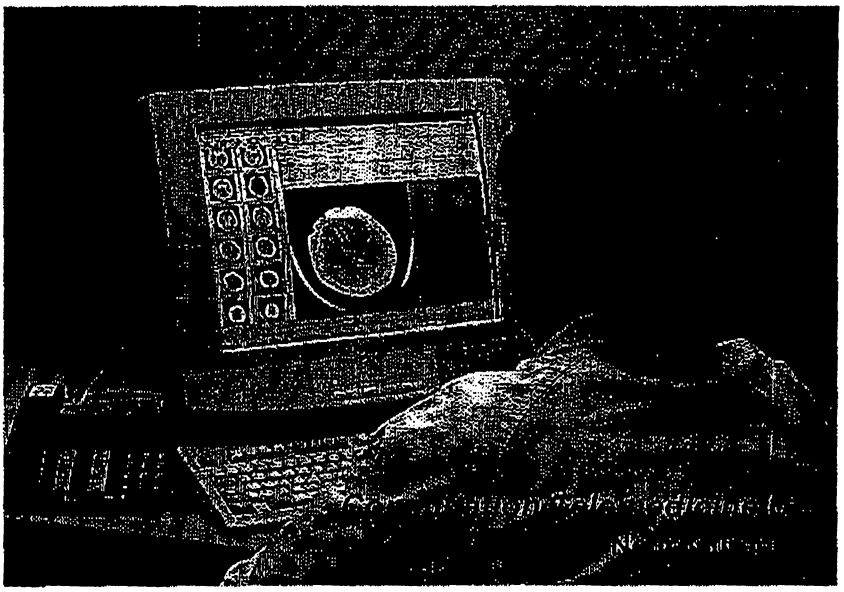
- **Telemedicine Network between the University - Hospital and the City (General Practitioners) :**

108 medical files / 9 months of experimentation

Consultant specialities : Internal Medicine, Geriatrics



Shared Telemedicine Unit



TELEMEDICINE REGIONAL NETWORK

Dedicated to the whole Health Care Professionals Medical Doctors, Nurses, Dental-surgeons, Chemists and Managers

Continuing Education
Organization of Multisite sessions

1 session / month linking 6 hospital sites

- **University-Hospital referential team**
- **Medical meeting gathering Public and Private practitioners**

90 Medical doctors participating / session

TELEMEDICINE AND NETWORK MEDICAL PRACTICE

➡ *MIDI-PYRENEES PROGRAM FEEDBACK / TELEMEDICINE BENEFITS*

- *DEVELOPMENT OF PARTNERSHIP BETWEEN REGIONAL MEDICAL TEAMS FOCUSED ON THE PATIENT*
- *SHARED MEDICAL ADDED-VALUE*
- *PRIVILEGED RELATIONSHIP / THE PROXIMITY PHYSICIAN*
- *THE PATIENT IN THE HEART OF THE NETWORK*

➡ ***Improvement of Quality, effectiveness and security of Health Care delivery***

GROUPEMENT DE COOPERATION SANITAIRE
RESEAU TELEMEDECINE REGIONAL / GCS RTR

Inter-Hospital cooperation new legal form (Edict of 1997)

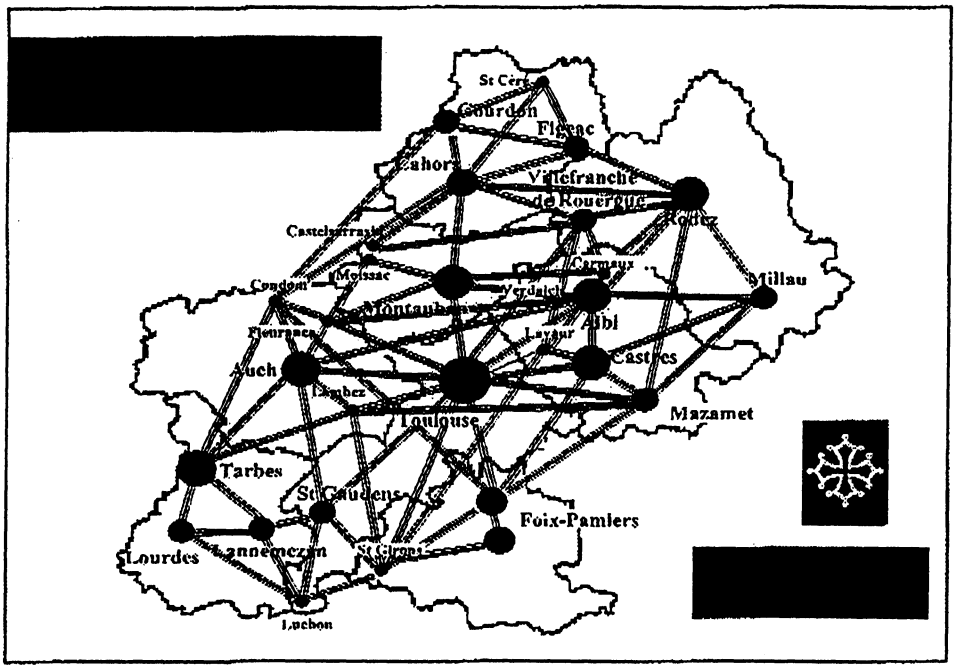
OBJECTIVES AND MAIN PROSPECTS

Developement and coordination of the Regional Telemedicine Network

Gathering main Public and Private Health Care Institutions of Midi-Pyrenees Region / 51 members
(Setting up / September 1998)

Including the participation of the whole Healh Actors :

Midi-Pyrenees Regional Union of « non-hospital » physicians
Paul Sabatier University
Institut Européen de Télémédecine


St Céré
Gourdon
Figeac
Cahors
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de Rouergue
Rodez
Castelsarrasin
Carmaux
Moissac
Condom
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Millau
Montauban
Albi
Fleurance
Lavaur
Castres
Auch
Lambez
Toulouse
Mazamet
Tarbes
St Gaudens
Foix-Pamiers
Lourdes
Lannemezan
St Girons
Luchon

NASA Occupational Health Surveillance /Monitoring

William S. Barry, MD, MPH

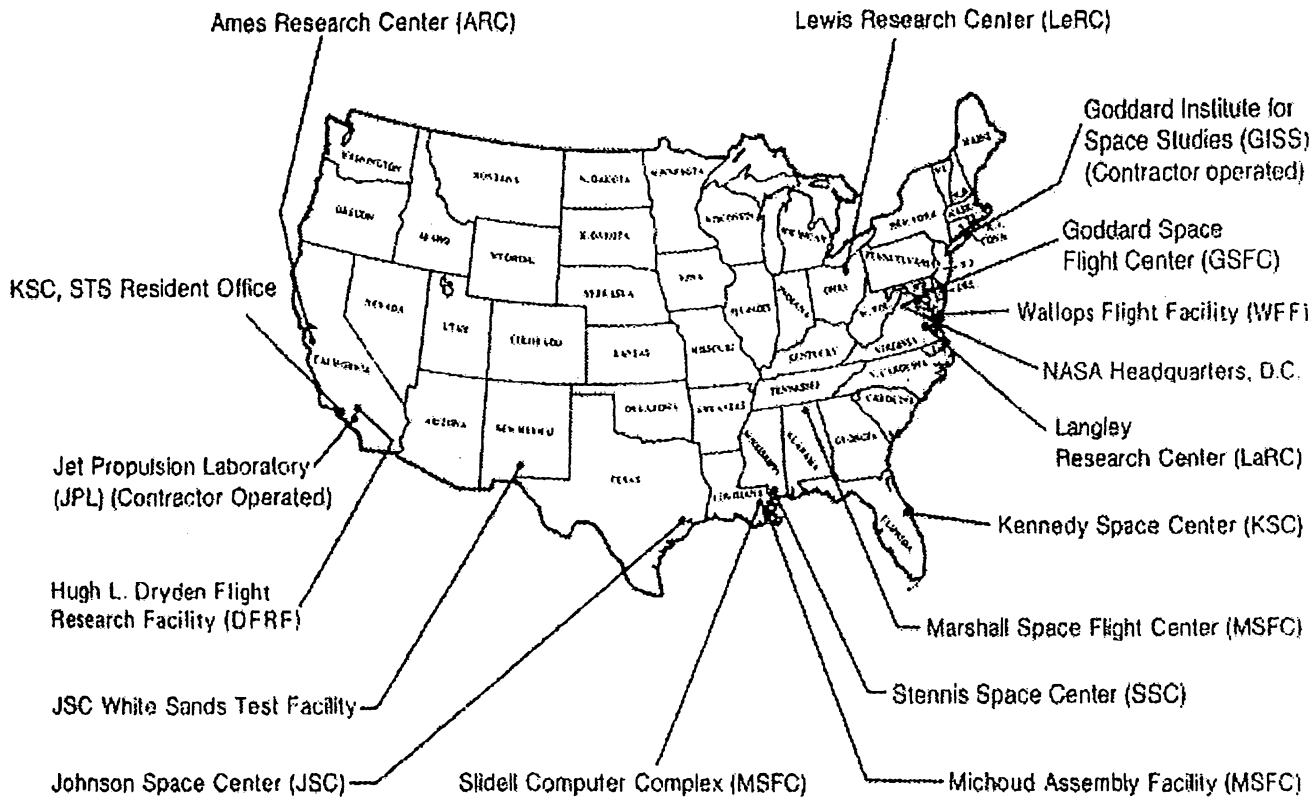
Manager,

NASA Occupational Health Program

June 24, 1999

DEC 07 '99 10:30 FR NASA/OCC.HEALTH

NASA
Major and Component Installations



11 States plus District of Columbia

NASA Occupational Health Program - Resources (Agency Wide)

PERSONNEL

	Medical	Env. Health	Total
• Civil Service	18	16	34
• Contractor	~190	~140	~330
			~364 FTE

MAJOR SUPPORT SERVICE CONTRACTS

- Over nine major Occupational Health Corporations

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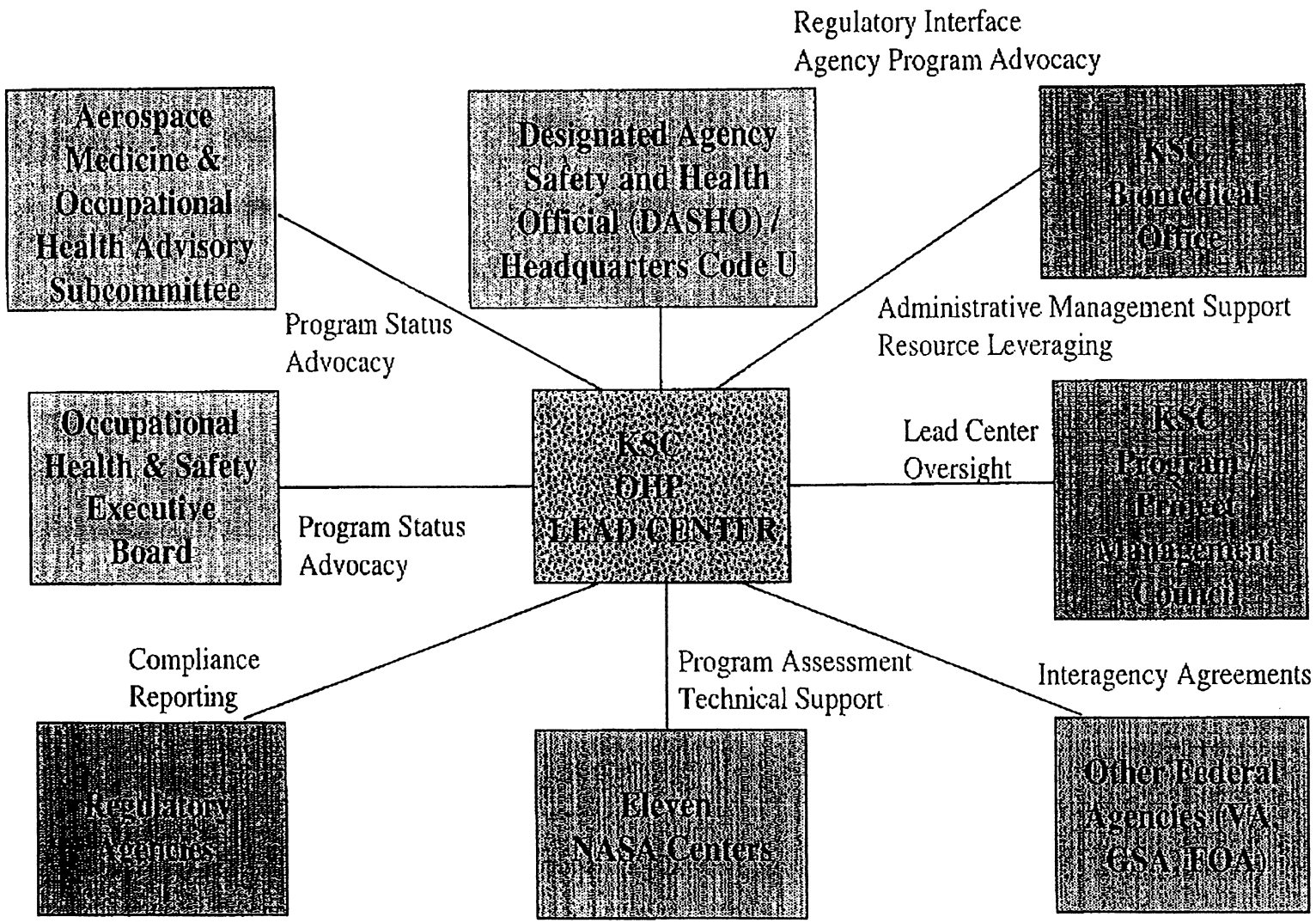
OHP OPERATIONAL SCENARIO
PRIMARY INTERFACES



Work /Position Related Protective Monitoring

Position Description Requires:

- Physical Examination - Pre-placement and Surveillance/Periodic
- Personal Protection Evaluation
- Initial Industrial Hygiene Survey
- Safety Training

Specific Job Function / Certification:

- Test Designated Position

Changes

- Symptoms
- New Potential Exposures
- New Regulations

Occupational Health Program Elements

REGULATORY PROGRAMS

- **Emergency Medical Treatment**
- **Environmental Health Services**
  - Chemical Exposure Monitoring
  - Sanitation/Drinking Water
  - Radiation Safety
  - OSHA Training Requirements
  - Asbestos/Lead Management

Occupational Health Program Elements

REGULATORY PROGRAMS

- **Medical Exams and Certifications (Job Related)**
  - FAA Pilot (Certifications)
  - Laser User
  - Chemical Handlers
  - Animal Handlers
  - Hearing Conservation
  - DOT Driver
  - Self Contained Atmospheric Protective Ensemble (SCAPE) users

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Occupational Health Program Elements

REGULATORY PROGRAMS

- **Blood-borne Pathogen Protection**
  - Hepatitis B Immunizations
- **Workers' Compensation Program**
- **Drug Free Workplace Program (Under Human Resources)**
  - Agency Medical Review Officer

Physical Examinations

Medical & Occupational History

- Review of Symptoms
- Life-style (Smoking) Habits

Physical Examination

- Vital Signs
- Vision Testing
- Emphasis on possible target organ systems

Blood Tests

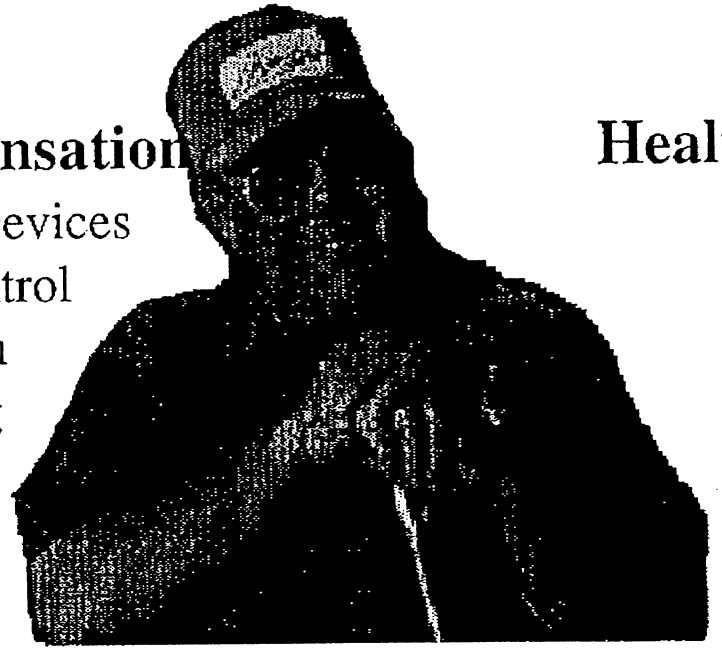
- Blood Chemistry Profile (SMAC)
- Complete Blood Count

Urinalysis

Additional Examination Evaluations

- Audiometric Testing
- Pulmonary Function Test (PFT)
- Electrocardiogram (ECG)
- Chest X-Ray
- Specific Exposure Tests
  - Blood Lead Level (BLL), Zinc Protoporphyrins (ZPP)
  - Cadmium in Blood (CdB), Cadmium in Urine (CdU)
  - Beta-2 Microglobulin in Urine (B2M) for Cadmium
  - Polychlorinated Biphenyl (PCB) levels
  - Acetylcholinesterase
- Food Handlers (Stool Testing)
- Throat cultures

EMPLOYEE HEALTH



Workers' Compensation

Personal Protective Devices
Toxic Exposures Control
Hearing Conservation
Radiation Monitoring
Vision Protection
Ergonomics
Safety

Health Care / Lost Time

Cardiovascular Disease
Obesity Diet
Smoking Fitness
Aging
Cancer
Infections
Accidents

Drug Free & Smoke Free Workplace,
Employee Assistance Programs
Fitness Programs

Occupational Health Program Elements

PREVENTIVE MEDICINE & WELLNESS

- **Health Maintenance Examinations**
- **Sick Call Services**
- **Employee Assistance Programs**
- **Wellness Programs**
  - Fitness Centers
  - Health Education
  - Nutrition Education
  - Risk Factor Screening

Occupational Health Program Elements

PREVENTIVE MEDICINE & WELLNESS

- **Immunizations**
  - Hepatitis B
  - Flu Virus
- **Travel Medicine**
  - Hepatitis A
  - Other immunizations
  - Tuberculosis Skin Testing
  - Travel Information and Kits
  - Emergency Medical & Evacuation Services
- **Health Consultation**

Wellness Monitoring Offerings

Female Tests

- Papanicolaou Test
- Breast Examination
- Mammogram

Male Tests

- Rectal Prostate Examination
- Prostate Specific Antigen (PSA)
- Scrotum and contents

General (Program Specific Eligibility

- Treadmill Stress Test
- Sigmoidoscopic Examination

Mental Wellness Monitoring

Employee Assistance Program

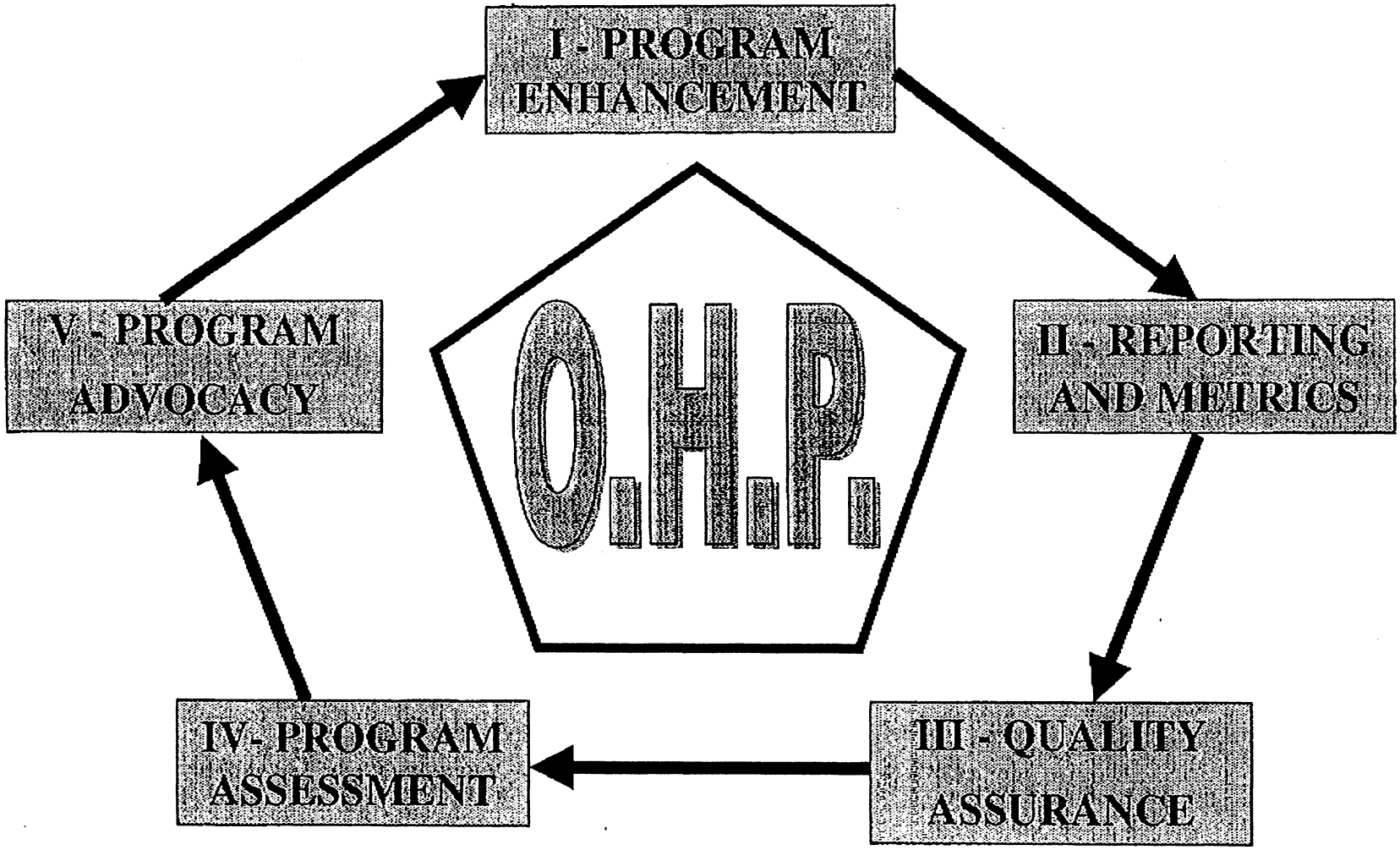
- Confidential unless potential harm to self or others
- Federally mandated program with annual reports to OPM
- Free employee and family counseling
- Short term assessment and referral for follow-up care
- Crisis intervention

Management support

- Management or Medical Referrals for Drug-Free Workplace Program (DRWP)
- Critical Incident/Post Trauma counseling

Training & education on EAP areas

OCCUPATIONAL HEALTH PROGRAM PROCESS



I- Program Enhancement

Provide resources needed by all NASA Centers

- Regulations & compliance updates
- Emergency medical and toxicology information

Increase Intra-agency Occupational Health Communications

- Annual Health conference
- Video (ViTs) teleconferencing
- Consensus building
- Web site enhancements

Training Support

- Web based training courses
- Courses (Ventilation, ergonomics) at NASA sites

II - Reporting & Metrics

Disease Diagnosis and Medical Interventions

Health Related Incidents

- Number of Incidents
- Number of Evaluations of Incidents

Agency Regulatory Compliance

- Number of Regulatory visits
- Number of Regulatory violations/citations

Workers' Compensation

- Number of Workers' Compensation Cases
- Cost of Workers' Compensation Cases
- Lost Time Injury Rate

EAP Visits/Utilization

III - Quality Control

Accreditation of Centers

- Occupational Health Affairs Sponsorship of International Accreditation of Clinic Facilities
- Medical Review Officer Training and Certification

Elaboration of Centers' previous "Self Assessments"

Benchmarking liaisons

Inter-agency No-cost support agreements

- FDA, EPA, VA, GSA, EPA

Participation in KSC's survey of program clients

IV - Program Assessment

Visits to Centers

- Review of Centers' Occupational Health Programs
- Audits of specific areas of concern

Consensus on Core Medical Programs

- Physician availability
- Physical Examinations
- Health Educat. & Wellness
- Employee Assistance Program
- Environmental Health Risk Investigation Services
- Regulatory Compliance
- Clinical Care Services
- Emergency Medical Services
- Traveler Health Services
- Quality Assurance

V - Program Advocacy

NASA Senior Management

- Quarterly status briefings on Agency program needs and performance
- Designated Agency Safety and Health Official reporting on issues and concerns
- Occupational Health & Safety Executive Board
- Aerospace Medicine and Occupational Health Advisory Subcommittee

NASA Center Directors

- Annual Center visits/program reviews

NASA OHP Personnel

- Advocacy for standardized approaches to OH programs

Outside Regulatory Agencies

- Annual reporting and inspection liaison

V - Program Advocacy

Employee Assistance

- Web-based supervisor and personnel training
- National depression Screening

General Health and Wellness

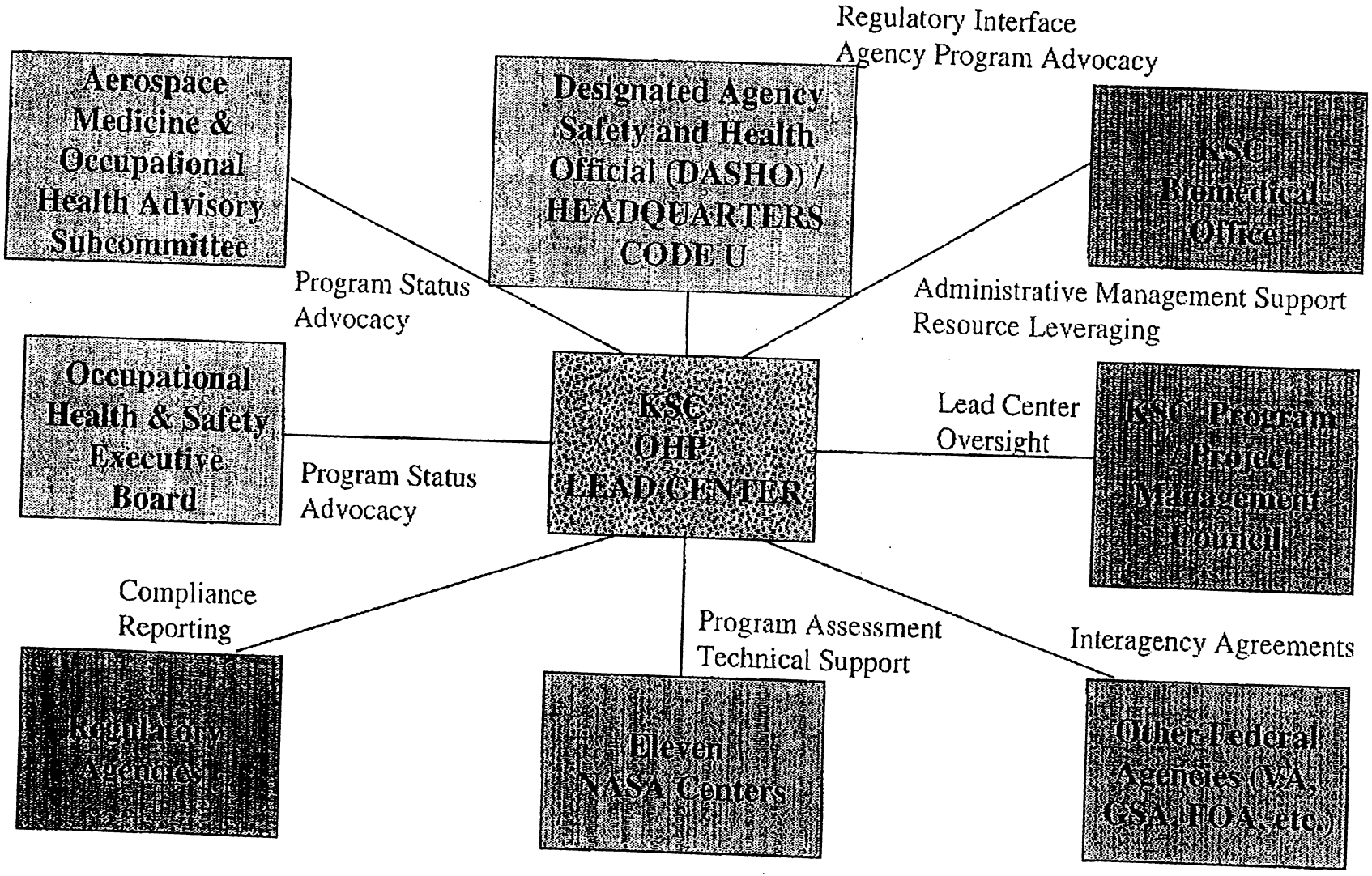
- Speaker on Nutrition at Health Conference

Tuberculosis Awareness and Testing

Cardiovascular Risk reduction

- Program Trial planned for two Centers
  - Smoking cessation
  - Fitness encouragement
  - Nutrition awareness
  - Other Risk Factor reduction

OHP OPERATIONAL SCENARIO
PRIMARY INTERFACES



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Health Surveillance/Maintenance in the Workplace

Session 8 – AEROSPACE MEDICINE AND WORKPLACE HAZARD
July 6, 1999

Dr. Wing Chan introduced the eighth session in this fifth series of continuing education programs sponsored by NASA's Occupational Health Program, Office of Health Affairs (OHA), in cooperation with the Uniformed Services University of the Health Sciences (USUHS). Worldwide, this session is available on the Internet. Dr. Chan introduced the speakers: Dr. Roger Billica, Chief of the Medical Operations Branch at Johnson Space Center (JSC), and Ms. Mary Wear, Supervisor of the Epidemiology Section, JSC.

Dr. Billica discussed NASA's Space Medicine Program, which specifically deals with the human aspects of the space flight program. The purpose of the Space Medicine Program is to support NASA's space flight program by providing comprehensive health care necessary to enable a health and productive crew, ensure mission success, and prevent long-term negative health consequences. It is a broad-based comprehensive approach to health care for space flight. The Space Medicine Program addresses three of the Human Exploration and Development of Space Enterprise (HEDS) objectives of the NASA Strategic Plan: develop biomedical knowledge and technologies to maintain human health and performance in space; ensure the health, safety and performance of space flight crews through space and environmental medicine, and promote knowledge and technologies that promise to enhance our health and quality of life.

Dr. Billica discussed the assumptions used in the formulation of the Space Medicine Program, and the current health risk analysis for space flight. Several assumptions are the starting point. Humans have an ongoing risk of illness and injury in their daily life and at their workplace; space flight presents additional hazards and associated risks to crew health, performance and safety. As a consequence, it is to be expected that illnesses and injuries will occur during space flight, some of which may present significant threat to crew health and performance and to mission success. Maintaining crew health, safety, and performance and preventing illness and injury are high priorities in accomplishing mission success and achieving agency goals. Space flight health care should also meet the U.S. ethical standards of acceptable risk and clinical medicine to the maximum extent possible. The function of Space Medicine within NASA is expected to meet the stated Agency goals for the HEDS roadmap as stated in the 1998 NASA Strategic Plan.

There are several challenges. When you visit your local physician, what you do not see is the massive medical support structure that backs up the health care you receive. But when you fly in space, the same medical support is available only as provided by JSC. Standards, expertise, technology, and methodologies from U.S. health care are applied and adapted to space medicine as appropriate. There are various standards that are applied—the NASA Standard 3000, clinical standards (e.g., AMA), environmental standards (e.g., OSHA, NRC, and EPA), and laboratory standards.

A risk management approach is used with respect to hazards of long duration space flight. There are risks from the space environment (microgravity, radiation, vacuum, space debris), the spacecraft environment (isolation and confinement, noise and vibration, closed life support systems, payloads, propulsion, waste production), and space flight itself (remoteness and passage of time, flight activity, Circadian/schedule changes, communications delay). NASA has taken each of these and has identified the risks, potential impacts and actions. Some of the observed physiological changes from space flight have been: 1-2% loss of bone mass per month; 12-15% reduction in red blood cells and impact on orthostatic tolerance; heart rhythm disturbances; a large increase in standing heart rate at landing; marked decrease in ability to control blood pressure and heart rate post-flight, up to 10 days in recovery; increased risk in kidney stone formation; loss in muscle strength and function; changes to the endocrine system; changes in bone homeostasis; and changes in the sensory/motor performance, visual target acquisition, and balance control. In some cases, adaptations are fairly stable (a normal adaptation to space flight) and don't cause problems until return to a gravity environment. Other changes may continue to progress during flight and may reach a point beyond which they are not healthy and where they may cause problems during space flight. The Space Medicine Program monitors these changes, and provides countermeasures for those that are potentially harmful.

There are problems with illness and injury during flight. It is expected that these events will occur in this type of risky environment. Common events are skin rashes, eye irritations, headaches, backaches, sinus congestion, gastrointestinal disturbances, cuts/scrapes/bruises, fatigue and sleep disturbances, strains/sprains, and post-landing orthostasis and neurovestibular symptoms. Less frequently reported but more significant are: infectious diseases, cardiac dysrythmias, traumas/burns, toxic exposures, kidney stones, psychological stress/illness, pnuemonitis, urinary tract infections, spinal disc disease, and radiation exposure. NASA has looked at in-flight medical events for the period 1988-1995, and has found that almost all of the crewmembers have reported some type of medical event or symptom (excluding space motion sickness) during spaceflight. These breakdown as follows: about 37% were symptoms, signs, and ill-defined conditions; about 19% were respiratory system; about 11% were from the nervous system and sense organs; about 11% from the digestive system; and 9% were problems with the skin and subcutaneous tissue.

There has been a challenge in predicting the incidence of significant illness or injury during space flight. Since there has been such as small experience with space flight, there is a significant statistic if one person has a major problem. NASA has used a predictive model for significant injury or illness during space flight, and has defined significant illness or injury as an event that would require someone to visit an emergency room or be hospitalized by U.W. standards. The method used was an average of space flight data, astronaut longitudinal study data, and analogous populations (submarine crew experience, Antarctic winter-over crew experience, and military aviator database from DOD). The risk of occurrence for a significant illness or injury is about 6% per person year. The subset of the 6% that would require advanced life support (stabilization and emergency transport) is about 2%. This means that for a three-person crew staying in-flight

four months (one-person year), there would be a 6% risk of this type of injury during that increment. This mandates the level of medical care that is provided.

Dr. Billica discussed how the requirements for space flight health care flow from NASA strategic planning and policy. There is a traceability of requirements that starts at the top with the Strategic Plan, flows down to top-level NASA policy statements and work instructions, to health flight requirements, etc., to specific documents for all programs and flight activities. There is a carefully laid out approach to the requirements, and each requires external peer reviews and consultations, as well as programmatic reviews. Dr. Billica discussed the implementation of the program and the approach to in-flight clinical intervention. In order to implement NASA requirements within the Space Medicine Program, we must be able to provide clinical health care, conduct laboratory analysis, perform programmatic and individual risk analysis; conduct a program of preventive medicine; perform clinical outcome monitoring; and establish and update medical standards and requirements. To do these things, we require resources (trained people facilities, and budget), enabling processes that incorporate continual improvement, and the ability to respond to forces of change. In order to do this, NASA has a process of risk management strategy. The first step is to identify hazards and mission parameters, then perform a risk assessment; this leads to a risk analysis (what are the critical issues? what is the cost/benefit ratio of needs versus resources? what is acceptable risk?). As a result of the risk analysis, risk modification is perfumed (e.g., design of a prevention program, medical intervention), and there is a step for verification and validation. Finally, NASA must be able to respond to the forces of change (different missions, updated knowledge and experience, advancing technology, and changing standards of health care). The process is a continual cycle of change, and the program must respond to it. Dr. Billica discussed the functional aspects of the Space Medicine Program that relate to Shuttle, the International Space Station (ISS), and the Exploration Programs—the Flight Medicine Clinic, training, Water and Food Labs, Clinical Laboratory, medical logistics and systems, and a variety of laboratories. The budget for all of this is about $28 million/year. The approach to health care is incremental—for any given mission, the first thing provided is first aid, basic ambulatory health care, and basic life support, then anything specific for a mission. With longer missions (Mir and ISS) additional components have been added—advanced life support, cardiac monitoring and defibrillation, and stabilization and transport capability. What we do not have, but hope to provide in the future is definitive care (autonomous care), long term chronic care, and rehabilitation.

Dr. Billica discussed some of the current space medicine research activities (clinical and operational)—clinical test beds and ground simulations; microgravity investigations (KC-135); Shuttle flight tests; countermeasures development and verification; longitudinal study of astronaut health; space flight health risk assessment; and advanced medical technology. Some of the spin-offs from space flight have been: ultraviolet solar dosimeter; programmable implantable medication system; digital radiography, x-ray imaging, scalp cooler for chemotherapy, biotelemetry and physiological monitoring, ultrasonic skin damage assessment, and bone densitometry. Present medical technology efforts include chronobiology and Circadian rhythm, telemedicine, sterile water and IV fluid production; non-invasive monitoring, technology

miniaturization, remote health care systems, medical computer Informatics, risk management strategies, and environmental monitoring. For the future, the program is looking into areas of remote diagnostics and imaging, extended shelf-life pharmaceuticals, medical computer expert systems, blood replacement products, alternative drug delivery systems, and radiation protection.

Questions:
NASA HQ: We expect significant physiological changes during space flight. Given these changes, there are chances are that the current medical and environmental standards and controls may not be directly applicable. How should we cope with this type of situation?
Dr. Billica: This is a basic issue; NASA does not know everything we need to know. What we do know continues to change. We need to make sure the NASA has in place a program that allows continual improvement and adaptation to new challenges. NASA has developed a life sciences critical pathway that spells out the crucial issues and most important risks. Efforts must be focused on the areas that are determined to be the most critical.

Ms. Mary Wear discussed the Longitudinal Study of Astronaut Health (LSAH), a project mandated by the Space Act of 1959. The purpose of the LSAH is to examine the mortality and morbidity rates of both the astronauts and the civil service employees in comparison to the general population; determine the rate of illness and accidents which require medical care and/or the use of medical equipment and supplies during space travel; and to establish a comprehensive database which will facilitate investigations of health issues as related to specific occupational exposures and health issues in a normal population. The scope of the LSAH focuses on the ground-based medical events in astronauts and comparisons; flight-related medical events in astronauts; medical events in analog populations (submariners); and data management and analysis. The study design was chosen to accommodate the constraint of rare exposure to the space environment. The short-term and infrequent exposure is known to induce various physiological disturbances that are experienced immediately. Delayed health effects will be examined by long-term follow-up. Historical data and concurrently collected data will be utilized. There are two study populations. The first population is the astronauts. All astronauts selected for the manned space program are followed from selection throughout their life spans. To date, 295 astronauts have been selected. (The LSAH does not include payload specialists; however, their in-flight data is included in the database.) The other population is the comparison group, which consists of JSC employees who received a routine physical examination in the JSC Occupational Medicine Clinic during an astronaut selection year. These employees were group-matched to the astronaut classes at a 3:1 ratio by age, sex, and body mass index. To date, 897 comparisons have been selected. There is no statistical difference between the two populations. Data sources for the astronauts include the medical records maintained in the JSC Flight Medicine Clinic (selection physical exams, annual and flight-related physical exams, periodic exams for

illnesses and injuries, and medical debriefs following space flights) and medical records from external sources (private physician visits and hospitalizations). For the JSC employees, data sources include medical records of the routine physical examinations maintained in the JSC Occupational Medical Clinic, and medical records from external sources. The major difference between the two groups is that the astronaut corps is monitored very closely. Data points for the study database will be selected from the electronic medical records. The historical portion of the study is restricted to data already collected. The prospective portion will allow collection of new types of information. Usual patterns of nutrient take and exercise, as well as lifestyle factors, will be added to the database. For follow-up, the baseline exam is the physical exam completed during the selection year of each participant. Annual follow-up physical exams will be completed at the JSC Clinics. Medical records will be obtained from private physicians and for hospitalizations. Death records will include death certificate, and if available, the hospital summary of events leading up to death and an autopsy report. Contact with the population is also maintained through a Newsletter, which keeps people interested and involved in the Study.

There is interest in access to the LSAH data. There are strict protocols regarding access to the medical records. Prior to performing a research protocol, the Principal Investigator (PI) obtains the informed consent to receive medical data. After performing the protocol, the PI requests the subject to sign a medical data release form. To obtain population data from the LSAH, the PI submits a data request that is reviewed by the LSAH Executive Committee; all data requests must be approved by the Executive Committee before release of data. Group data, which is not identifiable, is released. Some of the reports and analyses done by the Epidemiology Section include: consolidation, analysis, and graphs of Phase 1 data from the NASA-Mir program; incidence of thyroid disease in relation to iodine exposure during spaceflight; the prevalence of kidney stones among astronaut corps; analysis of vision data to examine selection standards; a summary of in-flight use of medications to assist in stocking the medical supply kit; age-related trends in physiological and laboratory values; and the incidence of space motion sickness from debriefs. Some of the analyses performed are for operational care; some of the care is very clinically oriented. Sometimes the information is more widely disseminated to the research community. Ms. Wear cited several relevant publications: "Risk of Cancer Mortality among the Longitudinal Study of Astronaut Health (LSAH) Participants," "Incidence of Herniated Nucleus Pulposus among Astronauts and Other Selected Populations," "Design and Current Status of the LSAH," and "Longitudinal Studies of Astronaut Health."

Ms. Wear discussed an analysis performed by the Epidemiology Section on thyroid disease and exposure to iodine. In 1996, one of the physicians noted that one subject in the neutral buoyancy chamber developed thyroid disease. The Epidemiology Section was called upon to examine whether the incidence of thyroid disease is greater in the astronaut corps than would be expected. The Section identified clinical cases of disease in the astronaut corps and in the comparison population. The astronauts had a 4.4% prevalence of clinical thyroid disease; the comparison group had a 3.2% prevalence. In high score analysis, there was no statistical difference between the two populations. Also, there was no difference between men and women

in the astronaut corps. The results were very reassuring; however NASA has made a policy decision to de-iodinate the water before consumption on future flights.

Questions:
KSC: It was mentioned that there was decreased red blood cells and decreased bone density in flight. Have you looked at this with the comparison population, and are they related?
Ms. Wear: The NASA lab researchers have done more work in this area. The LSAH is limited to data in the medical record; research protocols are not part of the LSAH, and this data is not put into the medical record. There is a "wall" between the medical research side and research data, and the operational side at JSC.
KSC: You would show TBC post-flight, right?
Ms. Wear: Yes, this is part of the examination protocol. The Section has been working hard to get data into the database. Much of the analytical work of the Section is driven by questions from others and responds to operational questions.
KSC: The Navy had a 1000 pilot study in the 1960's and 70's. Are they also being used for as a similar grouping?
Ms. Wear: We have talked to them. They are in the process of trying to get their data into a database (much of the data is paper copies in file cabinets). When they get to that point, they would like to talk with NASA. At USUHS, a group has been contracted to collect medical events occurring in submariners, and we have worked with them to shape their questions for an analogous population.

Dr. Nicogossian: The 1000 aviator study (started prior to World War II) has not produced what the original intent of the study was (to determine what makes a good pilot, navigator, etc.). About 200 aviators were lost to action in WWII. Every four years, as military personnel are rotated through, the focus of the study changed, e.g., on smoking, bodily functions, cardiovascular risk factors, etc. That study did not end up with significant outcomes. With respect to the USUHS Study, NASA funded the first phase of the study, but is not funding Phases 2 and 3. There was no objective data gathering associated with the study. Also, there was no significant interest on the part of the Navy to do the study.
HQ: With respect to the thyroid disease study, were antibody levels obtained in your astronaut and comparison populations?
Ms. Wear: They were not part of the regular screening exam, and they have not been doing those. After the issue of iodine exposure came up, that question was raised and the screening for antibodies is now part of the selection examination for the astronaut corps. Starting with the 1998 class, they started doing antibody screening.
HQ: Have you done similar incidence rate analysis for kidney stone cases?
Ms. Wear: No, we have not done that, but it is a good question and it could be done.
HQ: On the thyroid disease cases, do you have any data for levels in iodine in water (for the astronauts as well as the comparison group?
Ms. Wear: We have it for the astronauts; we have it based on the iodine exposure in water consumption on the spacecraft; we don't have it in the background. We have estimates of iodine

in the water from the Apollo program, the Skylab program, and Shuttle. Iodinated water is not used on Mir. A thorough background analysis of iodine exposure was done.

Epidemiology Section

MEDICAL OPERATIONS BRANCH

July 1999

THE LONGITUDINAL STUDY OF ASTRONAUT HEALTH

(LSAH)

PURPOSE

- To examine the mortality and morbidity rates of both the astronauts and the civil service employees in comparison to the general population
- To determine the rate of illness and accidents which require medical care and/or the use of medical equipment and supplies during space travel
- To establish a comprehensive database which will facilitate investigations of health issues as related to specific occupational exposures and health issues in a normal population

SCOPE

- Ground-based medical events in astronauts and comparisons
- Flight-related medical events in astronauts
- Medical events in analog populations, e.g., submariners
- Data management and analysis

STUDY DESIGN

Exposure to the space environment is rare. A cohort study design was chosen to accommodate this constraint. The short-term and infrequent exposure is known to induce various physiological disturbances that are experienced immediately. Delayed health effects will be examined by long-term follow-up. Historical data and concurrently collected date will be utilized.

POPULATION

Astronauts:

All astronauts selected for the manned space program are followed from selection throughout their life spans.

To date, 295 astronauts have been selected.

POPULATION

Comparisons:

The primary comparison group comprises JSC employees who received a routine physical examination in the JSC Occupational Medicine Clinic during an astronaut selection year. These employees were group matched to the astronaut classes at a 3:1 ratio by age, sex, and body mass index at baseline.

To date, 897 comparisons have been selected

DATA SOURCES

Astronaut Data

- Medical records maintained in the JSC Flight Medicine Clinic
  - Selection physical examinations
  - Annual and flight related physical examinations
  - Periodic exams for illnesses and injuries
  - Medical debriefs following space flights
- Medical records from external sources
  - Private physician visits
  - Hospitalizations

DATA SOURCES

JSC Employee Data

- Medical records maintained in the JSC Occupational Medicine Clinic:
  - Routine physical examinations
- Medical records from external sources:
  - Private physician visits
  - Hospitalizations

Data Points

- Data points for study database will be selected from the electronic medical records.
- Historical portion of study is restricted to data already collected.
- Prospective portion will allow collection of new types of information. Usual patterns of nutrient take and exercise, as well as lifestyle factors, will be added to the database.

FOLLOW-UP

- Baseline exam is the physical exam completed during the selection year of each participant.
- Annual follow-up physical examinations will be completed at the JSC Clinics.
- Medical records will be obtained from private physicians and for hospitalizations.
- Death records will include death certificate, and if available, the hospital summary of events leading up to death and an autopsy report.

DATA RELEASE PROCEDURES

- Prior to performing research protocol, PI obtains informed consent to receive medical data.
- After performing protocol, PI requests subjects to sign a medical data release form.
- To obtain population data from the LSAH, PI submits a data request which is reviewed by the LSAH Executive Committee; all data requests must be approved by Executive Committee before release of data.

Epidemiology Section

MEDICAL OPERATIONS BRANCH

July 1999

REPORTS AND ANALYSES

- Consolidation, analysis, and graphs of Phase I data
- Incidence of thyroid disease in relation to iodine exposure during spaceflight
- Prevalence of kidney stones among astronaut corps
- Analysis of vision data to examine selection standards
- Summary of inflight use of medications to assist in stocking SOMS kit
- Age-related trends in physiological & laboratory values
- Incidence of space motion sickness from debriefs

Epidemiology Section

MEDICAL OPERATIONS BRANCH

July 1999

PUBLICATIONS

- Risk of Cancer Mortality among the Longitudinal Study of Astronaut Health (LSAH) Participants. (Aviation, Space, and Environmental Medicine 1998;69:142-4)
- Incidence of Herniated Nucleus Pulposus among Astronauts and Other Selected Populations. (Presented at the 69th Meeting of the Aerospace Medical Association, May 1998)
- Design and Current Status of the LSAH. (Aviation, Space and Environmental Medicine, submitted May 1999)
- Longitudinal Studies of Astronaut Health. (Space Physiology and Medicine, 4th Edition, draft submitted, January 1999)

Incidence of Clinical Thyroid Disease Among Astronauts and LSAH Comparisons

	Cases	Noncases	Totals
Astronauts	12 (4.4%)	258	270
Comparisons	27 (3.2%)	808	835
Totals	39 (3.5%)	1066	1105

Odds Ratio = 1.39 (95% CI = 0.69,2.78)

Chi-Square Probability = 0.349

Health Surveillance/Maintenance in the Workplace

Session 9– Environmental & Occupational Hazards
July 23, 1999

Ms. Cathy Angotti introduced the ninth session in this fifth series of continuing education programs sponsored by NASA's Occupational Health Program, Office of Health Affairs (OHA), in cooperation with the Uniformed Services University of the Health Sciences (USUHS). Worldwide, this session is available on the Internet. Ms. Angotti introduced the speakers: Dr. Deborah Wilson, Chief of the Occupational Safety/Health Branch, National Institutes of Health (NIH); Mr. Virgil Casini, Manager of Occupational Safety and Health, Safety Research Division, National Institute for Occupational Safety/Health (NIOSH); and Mr. Jeffrey Pfoutz, Laser Safety Physicist, U.S. Army Center for Health Promotion and Prevention; and Mr. James Boiano, Chief of the Hazard Section, Surveillance Division, NIOSH.

Dr. Wilson discussed biosafety and infectious diseases. Biosafety is the conduct of work (in a variety of occupational settings) with microorganisms in the safest manner possible. Melded with the conduct of work is the use of appropriate practices, procedures, equipment, facilities, and personnel protective equipment commensurate with the hazard. The most important thing to remember in the practice of biosafety is aimed at interrupting the chain of infection, and this can be done in a variety of ways. The basic links in the chain of infection are those of the agent, the virulence of the agent, the route of exposure, the host susceptibility, and the infective dose that is present. The chain can be interrupted at any of these points and provide adequate worker protection. Biosafety is important today in terms of emerging infections. An emerging infection is one that is newly appeared in a population, or one that existed but is rapidly increasing in incidence or range. Some recent examples of emerging diseases include: HIV/AIDS, Dengue fever, cholera, Rift Valley fever, hantavirus pulmonary syndrome, Lyme disease, drug-resistant malaria, and cryptosporidiosis. Emerging diseases are important across the world and every continent is involved. Several factors cause the emergence of infectious diseases: changes in climate, changes in human action, population movement, and the city itself which provides a gateway for further dissemination. Ecological changes often effect the microbial ecology. Human demographics and behavior are very important. International travel and commerce have a tremendous impact on the spread of infectious disease. Technology and industry, while generally considered to be very positive for humankind, have also introduced situations that encouraged the introduction and spread of infectious diseases. There has been microbial adaptation and change. Probably one of the most important factors is a breakdown in public health measures. The combination of a weakened public health infrastructure, changes in the environment and behavior, and rapidly spreading microbial resistance has resulted in a global crisis in emerging, reemerging, and other communicable diseases. How do we keep abreast of this?

The heart of Biosafety is risk assessment. Some reasonable risk assessment questions to ask include: Does this agent cause a disease in animals or man? Are there public health interventions available? What would be the outcome of an exposure? Has the agent been manipulated in such a

way that the host range for the agent has been extended? Is the host population particularly susceptible? Are large quantities or high concentrations of the agent being used? Is the equipment being used increasing the risk or chance for exposure? Are appropriate treatments readily available in the event of an exposure/infection?

We must remember when doing a risk assessment that the frequency of infection is different from the frequency of disease. Biosafety guidance is readily available: in the NIH/CDC publication *Biosafety in Microbiological and Biomedical Laboratories*; in the World Health Organization (WHO) publication *Laboratory Biosafety Manual*, and *The NIH Guidelines for Research Involving Recombinant DNA Molecules*. We have started to see legislation in the field of Biosafety: the Department of Labor has released OSHA regulation 29 CFR 1910.1030—*Occupational Exposure to Bloodborne Pathogens* (a performance standard); and OHSA regulation 29 CFR 1910.1035—*Occupational Exposure to Mycobacterium tuberculosis*. The WHO provides us with another framework—the risk groups. Risk groups define the types of microorganisms that we may be working with. Risk Group 1 (RG1) agents are not associated with human disease. RG2 agents are associated with human disease, but they are rarely serious or there are preventive or therapeutic interventions readily available. RG3 agents are associated with serious or lethal human disease for which preventive or therapeutic interventions may not be available; RG4 agents are likely to cause serious or lethal human disease for which preventive or therapeutic interventions are not usually available.

Dr. Wilson discussed how the risk groups are married with what is used in the U.S. to define risk groups in terms of facilities, equipment, and practices—Biosafety levels 1-4. The primary equipment barrier system is the Biological Safety Cabinet (BSC). It provides product, personnel, and environment protection. There are guidelines provided by the NIH and CDC that describe combinations of laboratory practices and techniques for the Biosafety levels. These Biosafety levels provide an increasing level of personnel and environmental protection, and provide guidelines for safely in microbiological and biomedical laboratories. Dr. Wilson described Biosafety Level 1, 2, and 3 laboratory facilities and equipment. At Biosafety Level 3, all work with the infectious disease agents is conducted within a BSC. Additional protection for building systems are needed (traps, filters, etc). Biosafety levels are a blending of standard and special practices, safety equipment, laboratory facilities, and the overall building. For more information on Biosafety levels and basics of Biosafety, see the Web site: www.nih.gov/od/ors/ds/pubs/bmbl/index.htm, or the CDC Web page, which contains the newest edition of the CDC publication. Dr. Wilson showed a short video that described Biosafety level 4 at the NIH, which is located in the Maximum Containment Laboratory (MCL). Access is controlled and all workers don positive pressure suits. All work in the MCL is done in teams of two or more. The facility is periodically leak-tested to ensure containment. Each lab contains a BSC, which serves as a primary barrier during the manipulation of biological agents. Equipment is removed through a de-contamination air lock. All liquid waste is chemically de-contaminated in the laboratory. All solid waste is de-contaminated in an autoclave. Workers must leave the laboratory through a de-contamination shower.

Questions:
KSC: How would you deal with establishing Biosafety procedures for novel infectious agents, such as the agent for bovine spongiform encephalopothy? This could be a consideration in our Mars Sample Return program.
Dr. Wilson: We take a very conservative approach to novel infectious agents. To use your example, bovine spongiform encephalopothy does not have an aerosol form of transmission. We would be more concerned about percutaneous injury or mucus membrane exposure. With the Mars samples, you would have to take an extremely conservative approach and assume an aerosol transmission (Biosafety level 3 or 4). There are currently three BL4 government laboratories, and there is considerable interest in this area.

KSC: Of the areas that you mentioned, one is controversial and of interest: Hepatitis C. There are a lot of unanswered questions about transmitting Hepatitis C. What are is your perspective in this area?
Dr. Wilson: Hepatitis C, in my opinion, has the potential to kill far more people than HIV has. It is transmitted easier in the occupational setting. The highest risks are using hollow-bore needles. The evidence for sexual transmission is not well documented, but unlike HIV, we have familial transmission in households where there has been sharing of toothbrushes, razors, etc. There is at least one report in the literature of transmitting Hepatitis C by the use of a cocaine straw. At a recent meeting in Baltimore, at least one hospital presented information on Hepatitis C—when looking at all of their potential exposures in this hospital, 10% of the source patients were positive for Hepatitis C. It was unknown to the patients and the patients' physicians that they were positive. The Pan American Health Organization indicates that in parts of Latin American and the Caribbean there is 4-5% serum positive in the general population. This is much, much higher than HIV. This disease has a great impact on the health care system, the economy, and public health. In this country, the general population has not been given adequate information about Hepatitis C. The CDC recently held a press conference in Washington on their Hepatitis C awareness program. Biosafety level 2 practices and procedures should be followed when handling infectious products. At this time, there is no readily available prophylaxis for Hepatitis C. Prevention is the key.

HQ: Has there been any contamination at Biosafety Level 4? If so, what were you able to do? You mentioned that international travel has changed the landscape of infectious diseases. What are airlines currently doing and what can be done to prevent airborne diseases?
Dr. Wilson: At Level 4, I know of one potential exposure that did not result in infection; at Level 3, there have been exposures. Regarding the airlines, there is some research being done with HEPA filtration and charcoal filters, but most of the prevention would be in the public health domain upon receiving visitors into the country. To be honest, there is very little of that that will actually keep someone out of the country. This represents one of the greatest public health challenges. It will take physicians who are well-trained in infectious and exotic tropical diseases, not only in this country but abroad. For example, there has been a case of transmission of ebola from Zaire to South Africa.

HQ: Is the MCL at NIH the first one ever developed at that scale at NIH?
Dr. Wilson: No, the maximum containment lab at NIH is a renovation. The NIH facility is nominally 2000 sq. ft (smaller than that at CDC). It does not have a resident research program—it was designed as a national resource and is open to the extramural science community for short-term use of a maximum containment facility. There is no requirement to notify NIH or CDC should you choose to build a facility like this; however, there is very little knowledge in the country about building these facilities. Undertaking building one of these facilities should not be taken lightly; they are massive resource drains.

Mr. Virgil Casini provided an overview of the electrical hazards in the workplace, and discussed the problem of occupational electrocution and basic lightening facts and safety. Electrocutions are the fifth leading cause of death in the workplace and accounts for 7% of all occupational fatalities. Electrocution occurs to workers in all occupations and industries. Although workers know that the biggest danger is electrocution, many don't understand electrical hazards. Many people do not think that household current can be fatal, and there are a lot of misconceptions about electricity. Electricity is the flow of an atom's electrons or negatively charged outer particles through a conductor. There are four primary electrical terms: voltage, the fundamental force or pressure that causes electricity to flow through a conductor; resistance (ohms), anything that impedes the flow of electricity through a conductor (the resistance of the human body is 100,000 ohms); current, the flow of electrons from a source through a conductor; and ground, a conducting connection between an electrical circuit or equipment and the earth or some conducting body that takes the place of the earth. There are two types of electrical current: alternating current, which flows back and forth (cycles) through a conductor. It is the most commonly used because it can be stepped up or stepped down by a transformer; and direct current, which flows in only one direction, away from the source. Ohm's law is used to link current, voltage, and resistance mathematically. The flow of electricity increases when voltage increases, and increases when resistance decreases. Voltage causes the current to flow; your body resists the flow of current, and current causes the damage when an electrical injury occurs. There are four types of electrical injury: electrocution (fatal); electrical shock; burns; and falls. Electrical injuries occur when an individual has direct or indirect with electrical energy. The magnitude of the electrical current, the current's pathway through the body, and the duration of the current flow determine the severity of the electrical injury. Causes of death by electrical injury are respiratory arrest, cardiac arrest, burns, and falls.

Mr. Casini described the estimated effects of 60 Hz AC currents. One milliamps (mA) is barely perceptible; 16mA is the maximum current a person can grasp and "let go;" 20 mA results in paralysis of respiratory muscles; 100 mA is the ventricular fibrillation threshold; and 2 Amps results in cardiac standstill and internal organ damage. There are two levels of voltage as described by the National Electrical Code (NEC). Low voltage is less than 600 volts and is common in utilization voltages and produces currents in the mA range. Mr. Casini gave an example of the effects of low voltage under dry and wet conditions. A common factor in low-voltage electrocutions are wet working conditions. High voltage is over 600 volts; this ruptures the human skin, produces currents in the ampere range and causes greater damage to internal

organs. The OHSA regulates electricity at worksites. These requirements (Subpart S of 29 CFR 1910.302 through 1910.399) apply to all electrical installations and utilization equipment regardless of when it was designed or installed. The construction industry is regulated by Subpart K, which details the installation safety requirements for electrical equipment at the job site. The NEC is the practical safeguarding of persons and property from hazards arising from the use of electricity. It serves as the basis for electrical building codes across the U.S. The National Electrical Safety Code (NESC) contains the rules necessary for the practical safeguarding of persons during the installation, operation, or maintenance of electric supply and communication lines and associated equipment. In addition, the NESC contains safe work rules.

One of the ways occupational electrocutions are tracked is through the NIOSH National Traumatic Occupational Fatalities (NTOF) Surveillance System. It is a death-certificate based data system of work-related fatalities dating back to 1980. To be included in the system, the victim must be at least 16 years old. From 1980 to 1994, there were 6,170 electrocutions identified by the NTOF system. Mr. Casini showed the frequencies and rates of electrocution deaths identified in the system by industry, occupation, and age group. The Fatality Assessment and Control Evaluation (FACE) Project is a research program for the identification, investigation, and prevention of fatal occupational injuries through surveillance, on-site investigation, and prevention activities. The FACE project looks at the relationship between the agent, host, and environment in the pre-event, event, and post-event phases. From 1982 through 1994, 224 electrocution incidents were investigated. Construction led in the frequency of electrocution deaths identified by FACE. Most of the deaths occurred in the 25-34 age group. Over half of the low voltage electrocutions were from common household current. Over half of the high voltage electrocutions occurred with equipment contacting power lines. All 224 cases were grouped into five case scenarios: direct worker contact with energized power line (28%); direct worker contact with energized equipment (21%); boomed vehicle contact with an energized power line (18%); improperly installed or damaged equipment (17%); and conductive equipment contact with an energized power line (16%). Direct worker contact can occur across a broad range of industries (power line mechanics, tree trimmers, sign technicians, crane operators, operators of articulating booms, etc.). It can occur with energized equipment or troubleshooting newly installed electrical equipment. In the manufacturing setting, switches are sometimes wired around automatic shut off devices. Conductive equipment contact with overhead power lines usually results in a multiple fatality because of the number of workers needed to move bulky equipment. In the agricultural setting, electrocutions are often associated with grain augers contacting power lines. NIOSH has prepared many electrical publications to address different electrical hazards. One this year was the NIOSH Electrocution Monograph, which has a detailed analysis of national data and the FACE Project. There have been NIOSH alerts on contact with electrical energy, backfeed electrical energy, etc. All of these publications are available on the NIOSH home page: http: www.cdc.gov/niosh/, or by calling 1-800-35-NIOSH.

Mr. Casini discussed some basic facts on lightning strikes. Between 1959 and 1994, there were 3239 fatalities attributed to lightning. The causes of injury can be from a direct strike, currents flowing through the ground, or a sideflash from a nearby object struck by lightning. The current

can reach its peak in 5 microseconds and can be gone in 100 microseconds. The probability of a person being struck by lighting is related to the square of that person's height. A person standing next to a taller object without lighting protection has an increased likelihood of being injured. A tree five times as tall as a person will increase the person's probability of being struck by a factor of 25. Hazardous locations during a lightning storm are under or near trees where ground current or sideflash could cause the injury, near tall conductive objects such as flagpoles, or near small buildings or shelters without lightning protection. A lightning protection system for a building would consist of air terminals, lightning conductors and down conductors, a grounding electrode, and a bonding system. Some basic myths about lightning are: it never strikes the same place twice; someone struck by lightning is electrically charged; rubber tires protect motorists from lightning (actually, the metal body of the car provides the insulation); and no rain means no lightning threat. Cloud to ground lightning poses the most danger to people, but accounts for only 20% of all strikes.

JPL: There was some discussion about use of a telephone during a lightning storm. Do you have some feeling about that?
Mr. Casini: If it was a building without a lightning protection system (e.g., communications not connected to grounds), there is potential for injury.
JPL: For common household voltages, how thick would a rubber glove have to be to provide adequate protection.
Mr. Casini: I don't know under certain condition whether common Playtex gloves would be dielectrically significant enough to prevent that. One pinhole would eliminate protection. These gloves are usually used in a situation where dampness or water is involved. Water would increase the risk of significant injury.

HQ: Of the deaths that occur in the US, is it true that most of them are in Florida or the lightning belt?
Mr. Casini: I'm not sure about that.

JPL: Swimming pools are usually evacuated when there are lightning storms around. What is the validity?
Mr. Casini: I don't know for sure.

Mr. Jeffrey Pfoutz discussed the hazards associated with laser usage. An ionizing source can present a proximity problem. The gaining or losing of electrons is called ionization. Non-ionizing radiation does not have enough energy to create ion pairs. Ionizing radiation has enough energy to create ion pairs. Examples of ionizing radiation include: alpha particles, neutrons, and gamma rays. In particular, he focused on the visible part of the spectrum. Mr. Pfoutz discussed some of the basic parameters of electromagnetic radiation. Electromagnetic radiation is the propagation of energy. Wavelength is the length of one complete wave pattern. The frequency is the number of cycles of a waveform in a unit of time. It is usually measured in hertz (Hz), which is the number of cycles per second. "LASER" stands for Light Amplification by Stimulated Emission

of Radiation. A laser has characteristics different than conventional lighting. A laser is monochromatic (a narrow range of wavelengths, very narrow bandwidth). A laser is coherent (it is in phase), and has a narrow output beam (it doesn't significantly change characteristics over distance). Mr. Pfoutz described the units of measurement associated with non-ionizing radiation (energy, joule, radiant energy, radiant exposure, power, watt, radiant power, irradiance, divergence, and pulse repetitive frequency).

Two organs of the body susceptible to laser radiation are the eye and the skin. Mr. Pfoutz traced the path of light through the eye, and discussed damage mechanisms and resultant injuries. The cornea is susceptible to some laser wavelengths in the far IR and near UV, but is fairly resilient. The lens is susceptible to laser radiation; however, it is more susceptible to long-term occupational exposure to UV radiation (cataract or glaucoma can develop). The major area of susceptibility to damage is the retina. During laser exposure, no image is formed on the retina; all the energy is focused to a pinpoint. This results in a thermal type hazard. Thermal damage occurs when the energy incident on the retina supersedes the ability of the eye's capillary action to dissipate heat. The fovea (a small, critical area of the retina) is the area of the retina where most detailed vision takes place. A laser-produced lesion on the fovea would be catastrophic. Catastrophic injuries to the retina result in loss of vision. There can also be photochemical damage. Photochemical damage is the result of photons incident upon the molecular structure of biological tissue. There are some regulatory standards and documents for laser use and manufacture: ANSI Z136.1 (American, user); FDA 21 CFR 1040 (American, manufacture); ACGIH TLVs (American, user); IEC 825-1 (International, user), and ICNIRP (International, user). The standards set exposure limits based on biological data. These are expressed as Maximum Permissible Exposure Limit (MPE), which is the radiant energy of the laser, and Accessible Emission Limit (AEL), which is radiant energy or radiant power of the laser. Lasers are classified as 1, 2, 3, and 4. Class 1 are non-hazardous lasers or enclosed lasers; Class 2 are low-power visible lasers (laser pointers). There are two types of Class 3 lasers: Class 3A, which is a visible laser, and Class 3B, which is invisible, but poses a more severe hazard. Class 4 are high power lasers; they present a skin hazard, fire hazard, and diffuse reflection hazard. There are specific control procedures for outdoor use of Class 4 lasers. With respect to personal protective equipment, eye protection can protect from the laser beam; however, the specific type of eye protection must be matched with the wavelength of the laser. Laser pointers are a current issue. Momentary classroom laser pointer exposure is safe; forcing a direct stare into the laser beam for more than 10 seconds may possibly cause an eye injury. The real hazard exists from the startle, glare, or temporary flashblindness caused by the laser while performing a critical task, e.g., an aviation maneuver. In summary, non-ionizing radiation in the form of laser light can be potentially hazardous. Lasers can be used safely provided operators are aware of the potential hazards and take appropriate precautions. Laser eye protection must correspond to the wavelength of the laser and must have sufficient optical density.

Mr. James Boiano discussed occupational chemical hazards. His discussion included background information on NIOSH, different exposure assessment approaches and methods to control exposures, and selected chemical agents of interest to NASA. NIOSH was created by the

Occupational Safety and Health Administration (OSHA) Act of 1970. It conducts research and provides recommendations to OSHA. It is part of the Department of Health and Human Services and the Public Health Service. It is also one of the Centers for Disease Control and Prevention. It has research facilities in Cincinnati, Morgantown, WV, Pittsburgh, and Spokane, WA. NIOSH investigates potentially hazardous working conditions as requested by employers or employees; it develops and disseminates methods for preventing disease, injury, and disability. NIOSH develops and evaluates the efficacy of engineering control technologies and conducts research and provides scientifically valid recommendations for protection workers. It also provides education and training for safety and health professionals. Current hazard surveillance activities include occupational safety and health programs; metalworking fluids; new residential construction; farm family health hazards; and a national survey of workplace hazards. Occupational hazards include chemical, physical, ergonomic, biological, safety, and psychosocial hazards. Types of chemical hazards include dusts, gases, vapors, fumes, mists, and fibers. Hazards associated with exposure to chemical agents are safety hazards (explosion, fire) and health hazards (physiological effects, target organ effects, etc.). In terms of health hazards, there can be acute effects (headache, nausea, skin irritation) and chronic effects (cancer, silicosis, asbestosis). In terms of methods to measure exposure to chemical agents, exposures can be assessed qualitatively and quantitatively. The qualitative method is applicable to virtually all chemical hazards. Risks are evaluated and rated according to a combination of factors (toxicity of agent, frequency/duration of exposure, quantity used, proximity of agent to worker, and controls). Risk ranking can be used to establish monitoring priorities. The American Industrial Hygiene Association and the Chemical Manufacturers Association recommend this approach. The more common type of assessment is quantitative—the actual sampling of the worker for chemical agents of concern. It can be used to establish an exposure baseline, assess compliance with health standards, assess the effectiveness of engineering controls, and address complaints. This type of assessment is limited to chemical agents with validated sampling and analytical methods. Ways to control exposures are through engineering controls, administrative controls, or personal protection equipment/clothing. Engineering controls are the preferred method; it reduces the hazard at the source. Personal protection equipment/clothing is the least preferred method. It creates a barrier between the worker and the source. It is often a stressor, and if used improperly may provide little or no protection while imparting a false sense of security.

Mr. Boiano discussed some selected chemical agents of interest to NASA, which include: acrylonitrile, dimethylethoxysilane, hydrazine, monomethyl hydrazine, isocyanates, and epoxy resin systems (ERS). Acrylonitrile is a colorless, pale-yellow liquid with an unpleasant odor, used in the manufacturing of synthetic fibers, plastics, nitrile rubber, chemicals, and adhesives. The odor threshold is 22 ppm; it has a ceiling of 10 ppm. The level of danger is 85 ppm. The primary parts of entry are inhalation and skin. The primary health effects are redness and blisters of skin, tissue anoxia, acute toxicity similar to cyanide poisoning, brain tumors, and lung and bowel cancer. It is considered to be a possible human carcinogen. Dimethyl is a colorless, clear liquid with a pungent odor similar to isopropanol. Its primary use is waterproofing thermal protection systems. The odor threshold is 1 ppm. There are no exposure limits associated with it. The primary route of entry is inhalation. The primary health effects are headache; eye, nose,

and throat irritation; nausea; and vomiting. Its carcinogenesis is undetermined. Hydrazine is a colorless, fuming, oily liquid with an ammonia-like odor. It is used as rocket propellant, a reducing agent, and in the production of herbicides. It has an odor threshold of 3-4 ppm; the OSHA exposure limit is 1 ppm. The primary routes of entry are inhalation and skin exposure. The primary health effects are: eye, nose, skin, and throat irritation; allergic reactions; facial numbness and swelling; CNS and liver toxicity; hepatoxin; hemolytic agent; and severe burns. It is a confirmed animal carcinogen and a possible human carcinogen. Monomethyl hydrazine has similar properties to hydrazine, and is slightly more toxic. It is a confirmed human carcinogen. Common isocyanates include: toluene-2, 4 diisocyanate, methylene bisphenyl isocyanate, hexamethylene diisocyanate, and naphthalene diisocyanate. They are used to produce polyurethane foams and plastics for thermal insulation, adhesives, surface coatings, shoe insoles, and upholstery padding. Isocyanates can produce allergic sensitization of the respiratory tract and skin. It also causes irritation of the eyes, mucous membranes, and skin and can cause possible corneal damage and skin blisters. It is a suspected human carcinogen. The exposure limits are very low. ERS can be divided into five groups: uncured resins; curing agents; reactive diluents; non-reactive diluents; and fillers. They are principally used as protective coatings, but are also used in structural applications. ERS are primarily eye and skin irritants and sensitizers. The toxicity of non-reactive diluents is dependent on the individual solvents used. Fillers can cause pneumoconiosis and eye and skin irritation. Mr. Bioano showed the occupational exposure limits of the selected ERS components. The curing agents (amines) are the most toxic of the ERS because they cause allergic sensitization. NIOSH can be contacted at its Homepage: http://www.cdc.gov/niosh/homepage.html, or by the hotline (1-800-35-NIOSH). NIOSH publications are available upon request.

Questions:

HQ: for Mr. Biano: Among the composites that you discussed, is there any biological monitoring that you would recommend?
Mr. Biano: I can't recommend any specific biological monitoring, but there are a number of sources to obtain this information.

HQ: It was very interesting in the opening of your presentation where you listed the various hazards (chemical, physical, ergonomic, biological, safety, and psychosocial), to note that we are now looking at things like stress in the workplace, and considering it a hazard.
Mr. Biano: In fact, in terms of the national occupational hazards survey that is being planned, other types of stresses, such as psychosocial, will be characterized to get some idea of the magnitude of this hazard.

Biosafety-Beyond the Basics

Deborah E. Wilson, DrPH, SM
Chief, Occupational Safety and Health Branch,
Division of Safety,National Institutes of Health

Infectious disease is one of the few genuine adventures left in the world...

The dragons are all dead and the lance grows rusty in the chimney corner…about the only sporting proposition that remains unimpaired by the relentless domestication of a once free-living human species is the war against those ferocious little fellow creatures, which lurk in dark corners and stalk us in the bodies of rats, mice and all kinds of domestic animals; which fly and crawl with the insects, and waylay us in our food and drink and even in our love.

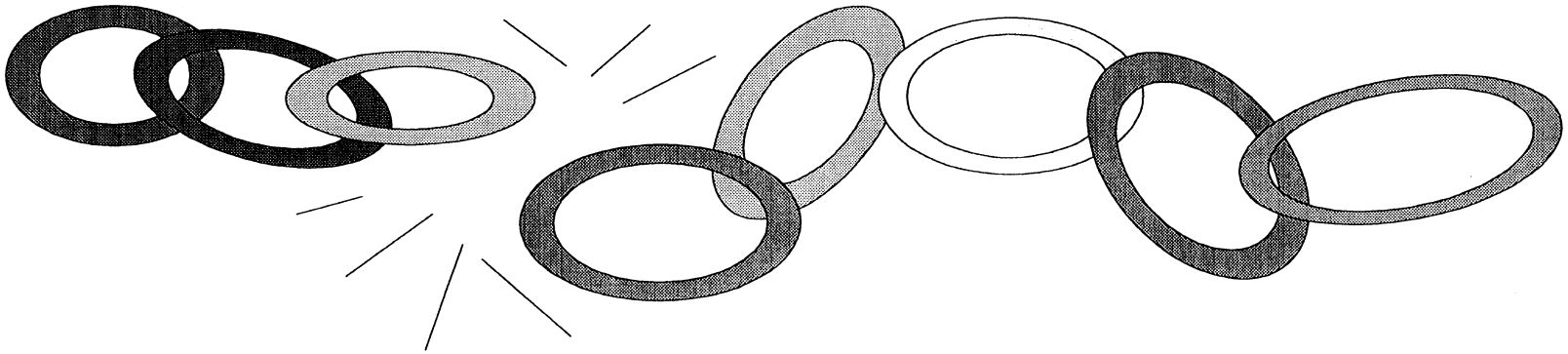
Hans Zinnser, 1935

Biosafety is…

- The conduct of work (in a variety of occupational settings) with microorganisms in the safest manner possible

- The use of appropriate practices, procedures, equipment, facilities, and personal protective equipment commensurate with the hazard

The Chain of Infection



The Links in the Chain of Infection

- Agent
- Virulence
- Route of Exposure
- Host susceptibility
- Infective dose

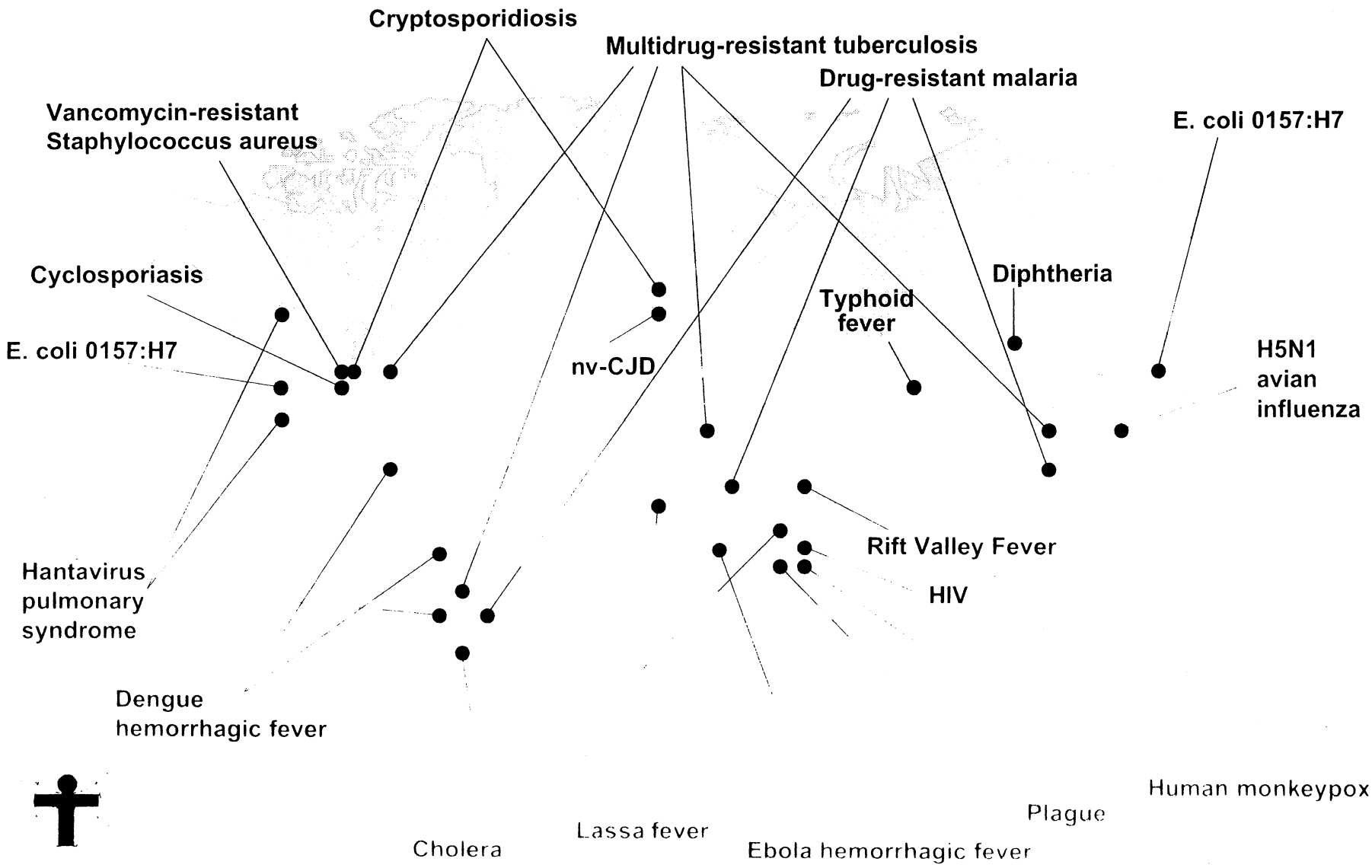
Emerging Infections

- newly appeared in a population
- have existed but are rapidly increasing in incidence or range

Recent examples of emerging diseases

- HIV/AIDS
- cholera (classic)
- cholera (O139)
- Rift Valley Fever
- Hantavirus pulmonary syndrome
- Cryptosporidiosis
- Lyme disease
- Ebola hemorrhagic fever
- drug resistant malaria
- nv-Creuzfeld Jakob Disease
- Dengue/DHF

Examples of new and reemerging diseases.



What causes the emergence of infectious diseases?

- changes in climate
- human actions
- population movement (usually from rural to urban areas)
- city itself provides a gateway for further dissemination (HIV, cholera, dengue)

Factors in the Emergence of Infectious Diseases

- Ecological changes (Schistosomiasis, Rift Valley Fever, HPS)
- Human demographics and Behavior (introduction of HIV, spread of dengue)
- International travel and commerce ("Airport malaria", ratborne hantaviruses, introduction of cholera into South America

Factors in the Emergence of Infectious Diseases

- Technology and Industry (Hemolytic uremic syndrome, transfusion associated hepatitis B, C; CJD and nv-CJD)
- Microbial Adaptation and Change (antibiotic resistant bacteria, antigenic drift)

Factors in the Emergence of Infectious Diseases

- Breakdown in public health measures (resurgence of TB in the USA, cholera in refugee camps in Africa; resurgence of diphtheria in the former Soviet Union)

The combination of a weakened public health infrastructure, changes in the environment and behavior, and rapidly spreading microbial resistance resulted in a global crisis in emerging , reemerging, and other communicable disease

“Nothing in the world of living things is permanently fixed”

Hans Zinnser

Rats, Lice and History, 1935

“Chance favors the prepared mind”

Louis Pasteur

The heart of Biosafety is

Risk Assessment

Reasonable Risk Assessment Questions to Ask

- Does this agent cause a disease in animals or man?
- Are there public health interventions available?
- What would be the outcome of an exposure?
- Has the agent been manipulated in such a way that the host range for the agent has been extended?

Reasonable Risk Assessment Questions to Ask

- Is the host population particularly susceptible?
- Are large quantities or high concentrations of the agent being used?
- Is equipment being used that increases the risk or chance for exposure?
- Are appropriate treatments readily available in the event of an exposure/infection?

[redacted]

[redacted]

show no signs of illness can be compared to the great invisible mass in the sea

Biosafety Guidance is Readily Available

- NIH/CDC publication *Biosafety in Microbiological and Biomedical Laboratories*
- The World Health Organization publication *Laboratory Biosafety Manual*
- *The NIH Guidelines for Research Involving Recombinant DNA Molecules*

Biosafety Regulations

- Department of Labor, Occupational Safety and Health Administration 29 CFR 1910.1030--*Occupational Exposure to Bloodborne Pathogens*
- Department of Labor, Occupational Safety and Health Administration 29 CFR 1910.1035--*Occupational Exposure to Mycobacterium tuberculosis*

Risk Groups

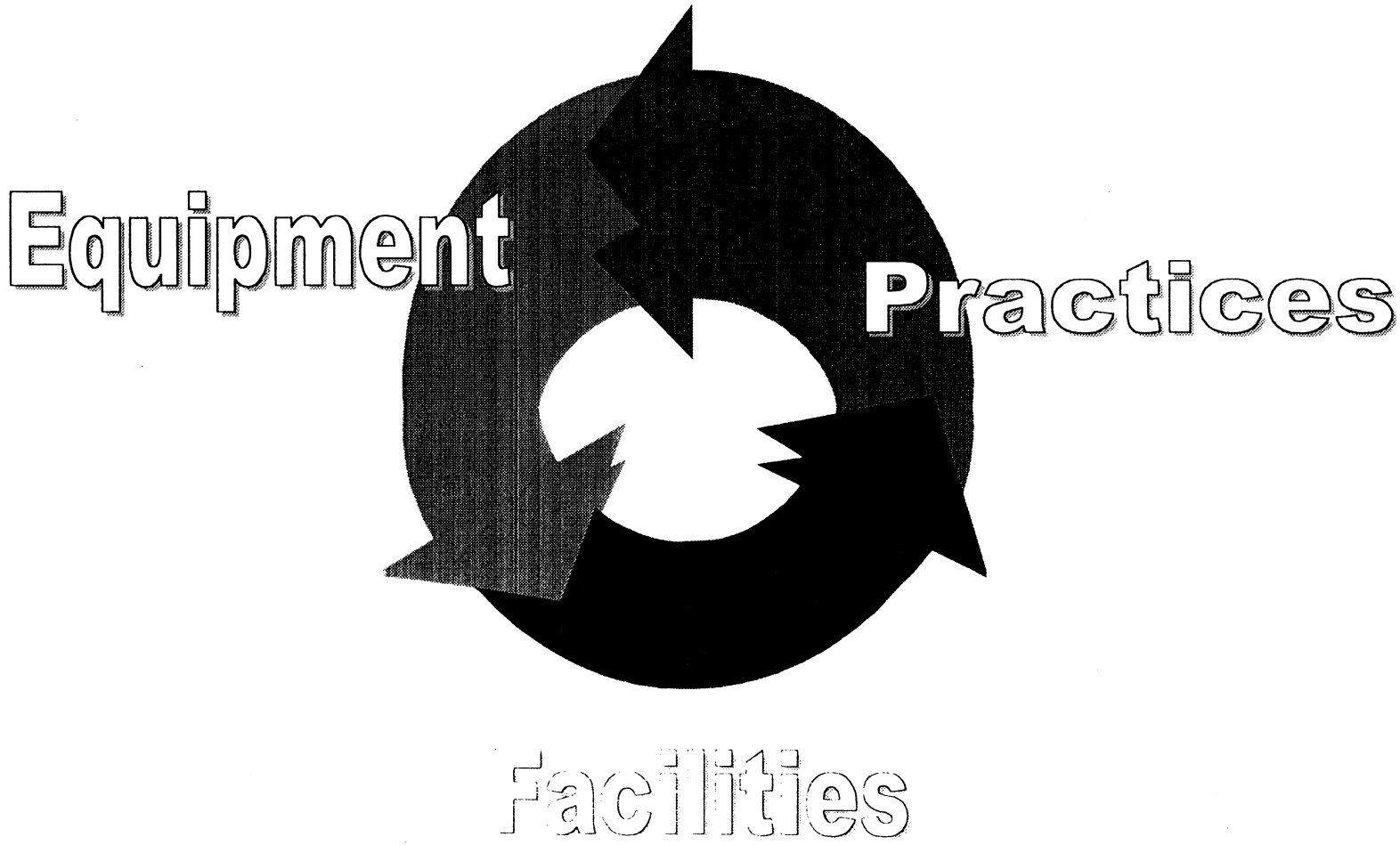
- Risk Group 1 (RG1) agents are not associated with human disease.

- Risk Group 2 (RG2) agents are associated with human disease which is rarely serious and for which preventive or therapeutic interventions are *often* available.

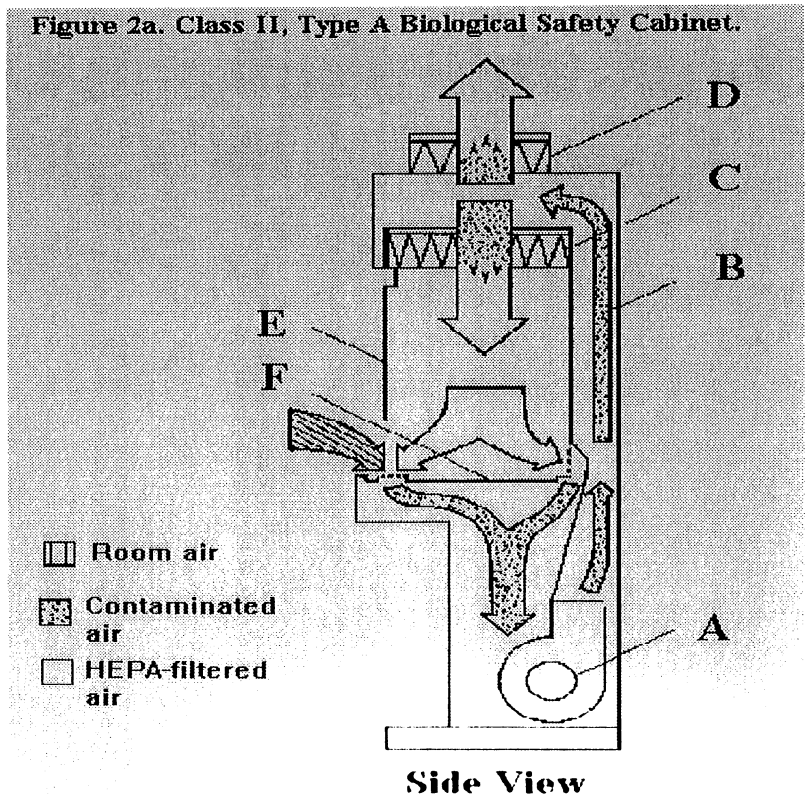
Risk Groups

- Risk Group 3 (RG3) agents are associated with serious or lethal human disease for which preventive or therapeutic interventions *may be* available.
- Risk Group 4 (RG4) agents are likely to cause serious or lethal human disease for which preventive or therapeutic interventions are *not usually* available.

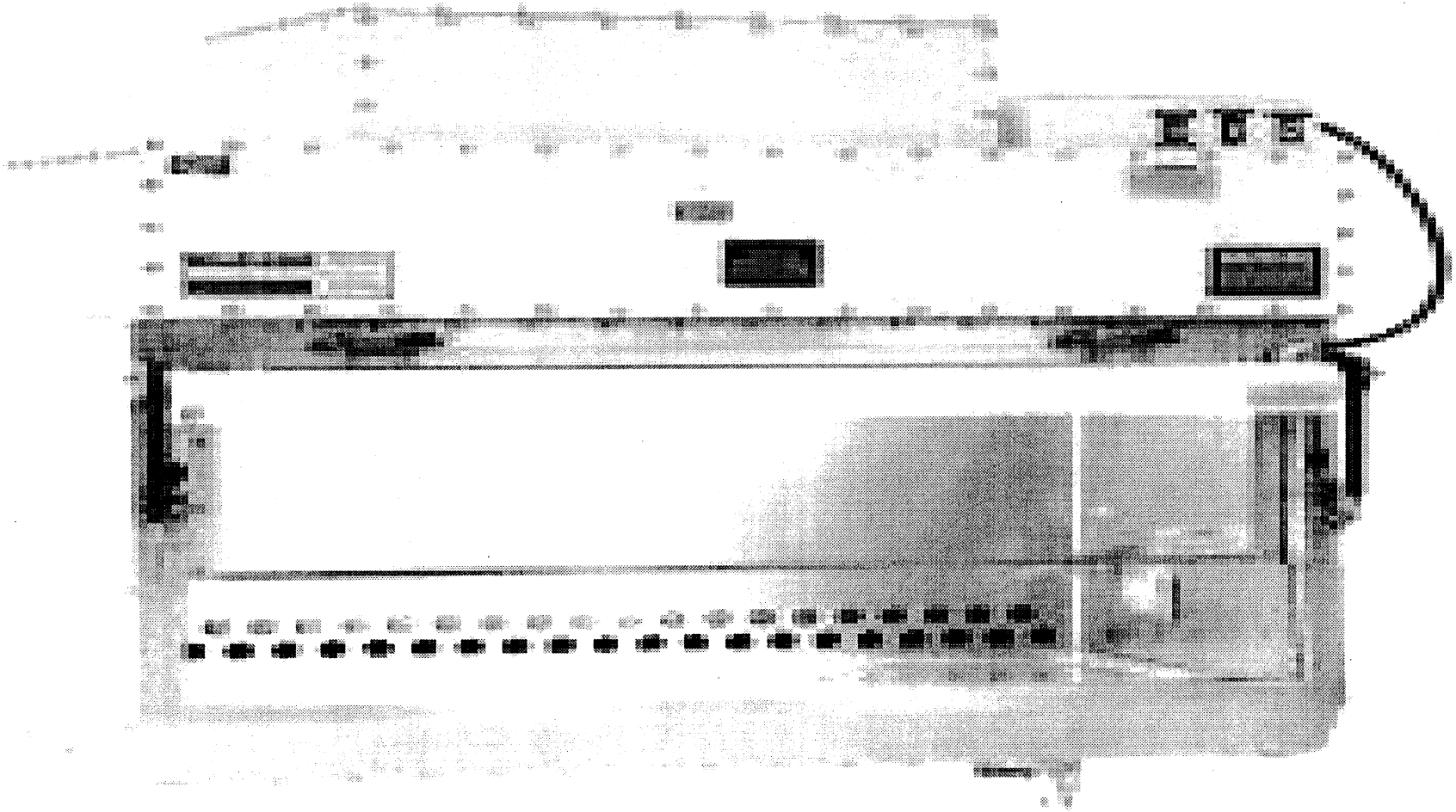
Biosafety Levels 1-4



Primary Barrier Systems



- Class II Type A Biological Safety Cabinet
- Personnel Protection
- Product Protection
- Environmental Protection



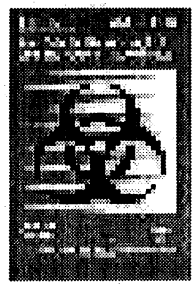
Principles of Biosafety

Introduction

Biosafety Levels 1-3

Guidelines to describe combinations of:

- **Laboratory Practices and Techniques**
  - Standard Practices
  - Special Practices
- **Safety Equipment** (Primary Barriers)
- **Laboratory Facilities** (Secondary Barriers)



Principles of Biosafety

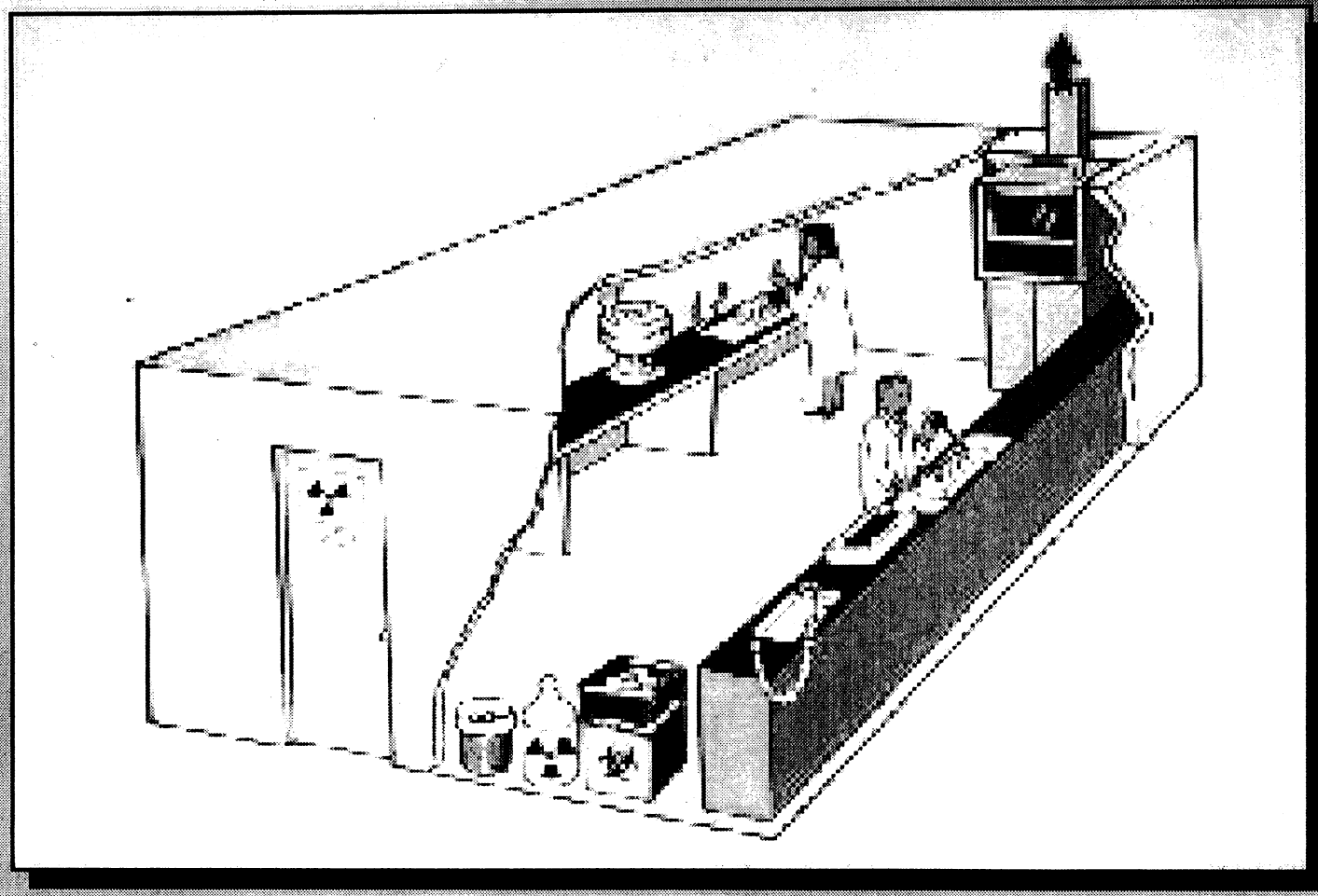
Introduction

Biosafety Levels 1-3 Provide

- Increasing levels of personnel and environmental protection
- Guidelines for working safely in microbiological and biomedical laboratories

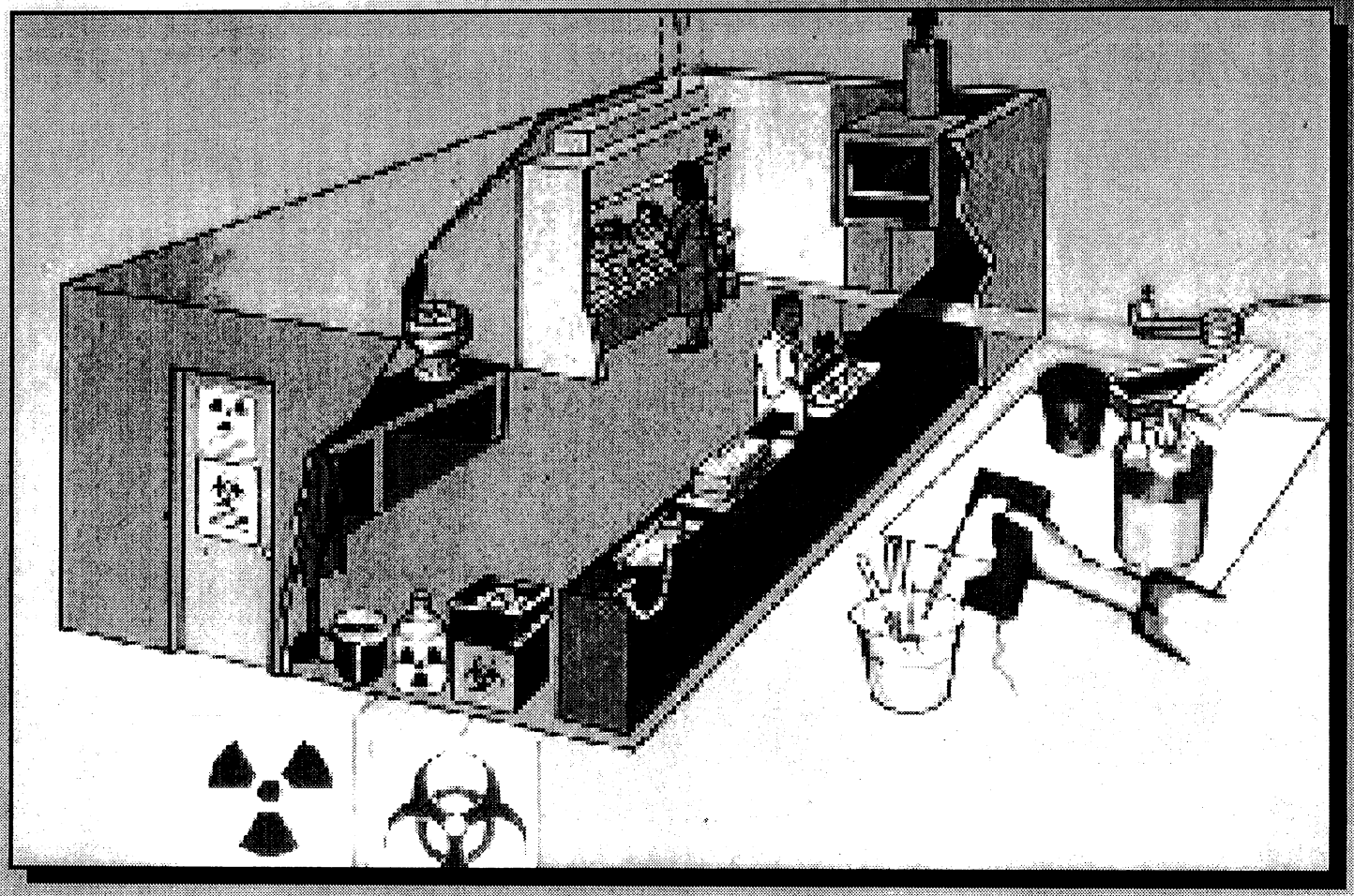
Biosafety Level 1

Laboratory Facilities (Secondary Barriers)



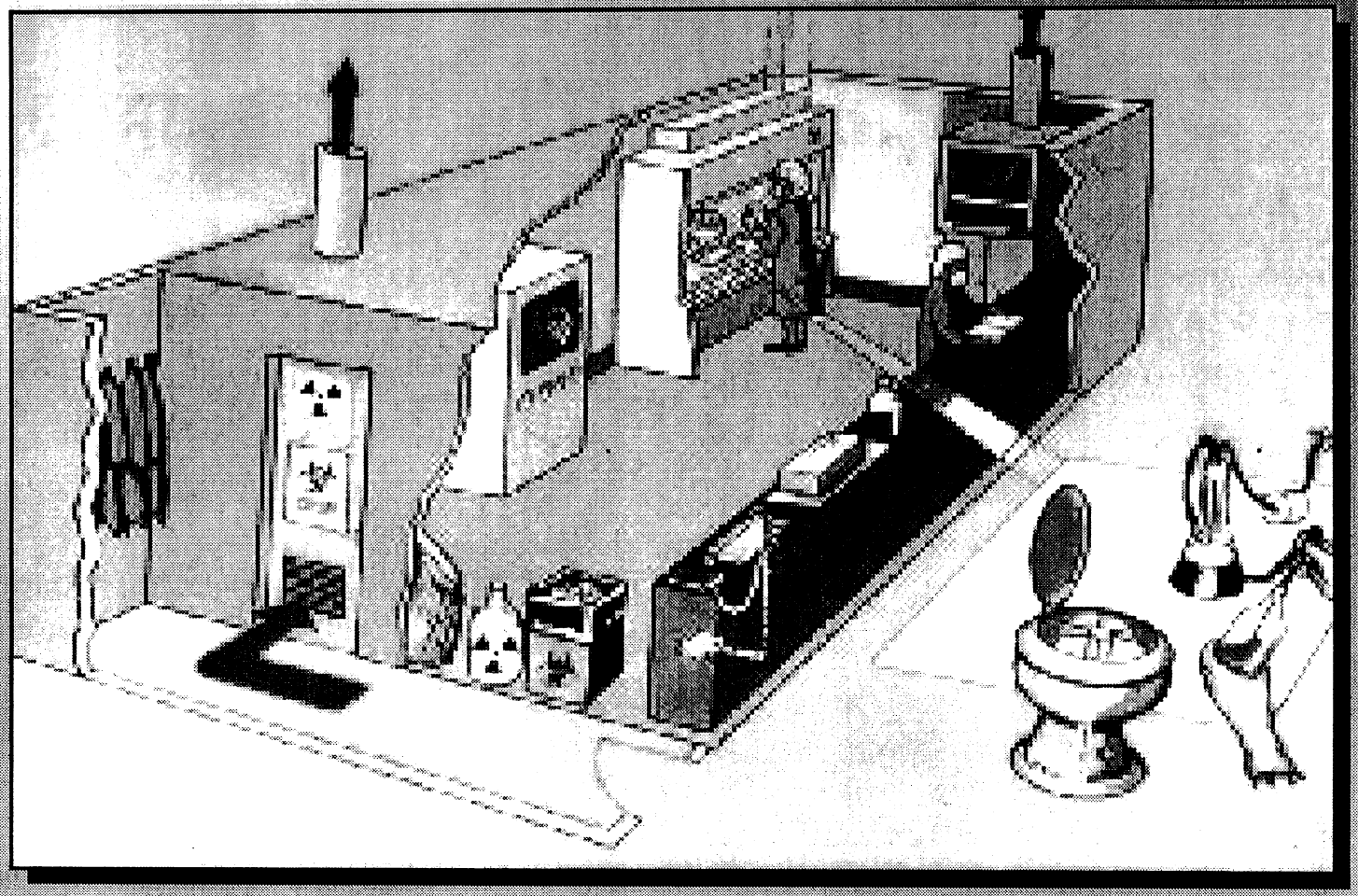
Biosafety Level 2

Laboratory Facilities (Secondary Barriers)



Biosafety Level 3

Laboratory Facilities (Secondary Barriers)



Principles of Biosafety

Summary

BSL 1-3

- Standard Practices
- Special Practices
- Safety Equipment (Primary Barriers)
- Laboratory Facilities (Secondary Barriers)
- Building (Tertiary Barriers)

Internet address for the BMBL

http://www.nih.gov/od/ors/ds/pubs/bmbl/index.htm

LASER/OPTICAL SAFETY

Jeffrey R. Pfoutz
Physicist
U.S. Army Center for Health
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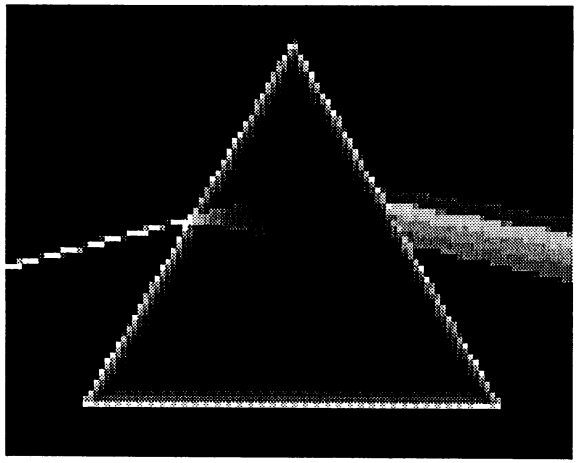
Non-ionizing Radiation

What does it mean?

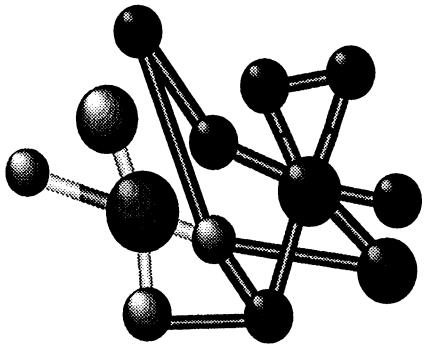
- **Non-ionizing radiation** does not have enough energy to create ion pairs.



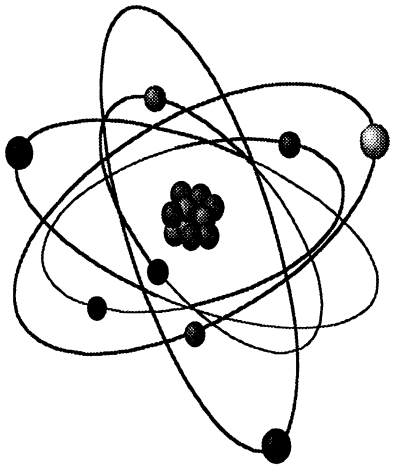
- Examples of **non-ionizing radiation** include:
  - Microwaves
  - Visible light (Lasers)
  - UV
  - Radio waves

Ionizing Radiation

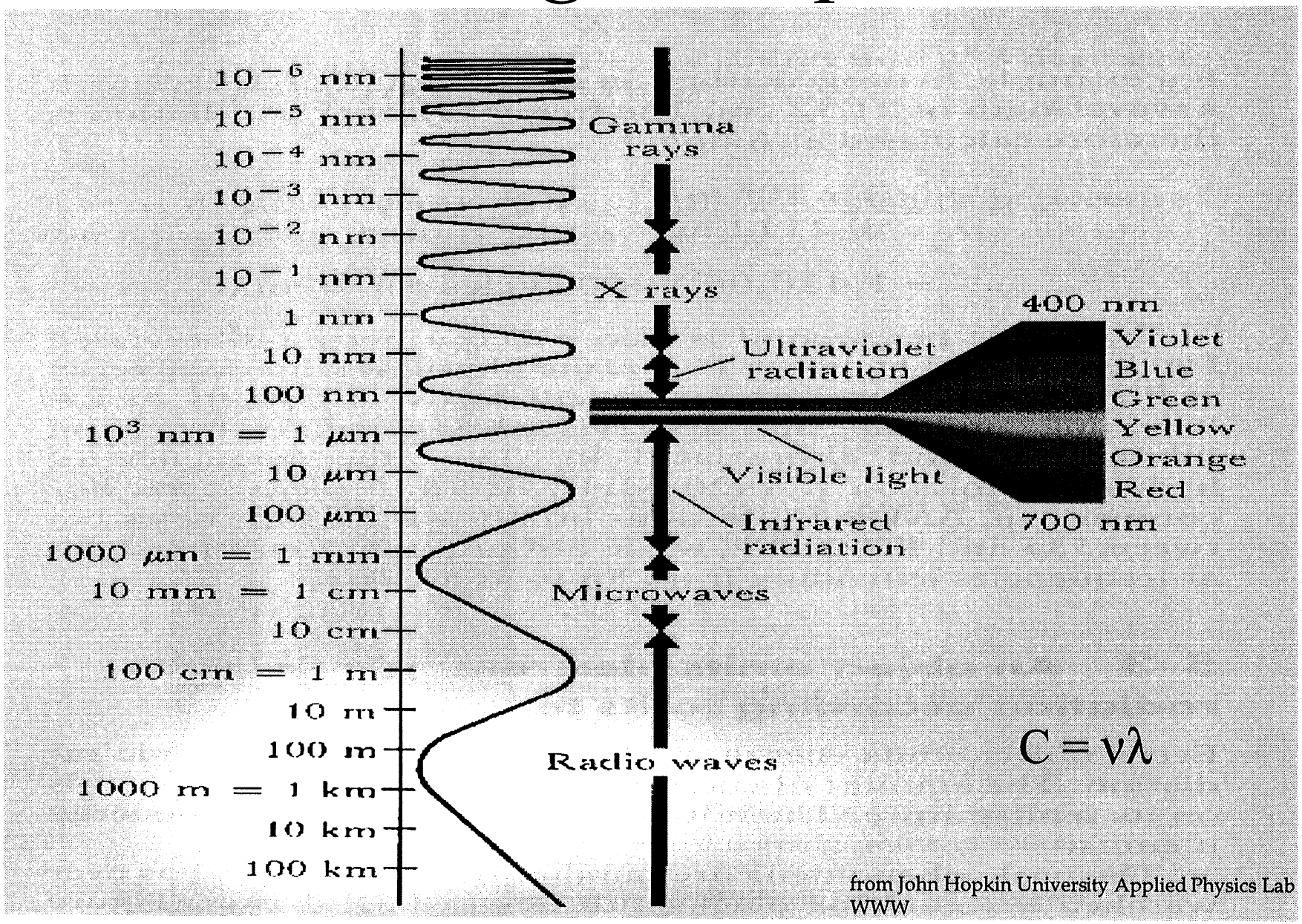
- **Ionizing Radiation** has enough energy to create ion pairs. The gaining or losing of electrons is called ionization.



- Examples of **ionizing radiation** include:
  - Alpha particles
  - Neutrons
  - Gamma Rays



Electromagnetic Spectrum



$C = \nu\lambda$

from John Hopkin University Applied Physics Lab WWW

Basic Parameters of Electromagnetic Radiation

- **<u>Wavelength</u>** λ
- The length of one complete wave pattern.
- [The distance between any two points at corresponding positions on successive repetitions in the wave shape].

<u>Frequency</u> ν

- The number of cycles of a waveform in a unit of time. Usually measured in Hertz (Hz) which is the number of wave cycles per second
- Related to wavelength by the relationship $C=\nu\lambda$

LASER

Lucrative Acquisition Scheme for Expensive Research

LASER

What is a **LASER** and what makes it different from other light sources?

Light
Amplification by
Stimulated
Emission of
Radiation

LASER

- **Monochromatic** (narrow range of wavelengths, very narrow bandwidth).
- **Coherent** (The coherence time of a laser with a 1 MHz bandwidth is about 1 microsecond, effectively pure).
- **Narrow** output beam (divergence is small, ~0.5mm over 1 meter on average).

Units of Measurement

Associated with non-ionizing radiation

- **Energy**
- **Joule is a unit of Energy J**
- **Radiant Energy Q J/Pulse**
- **Radiant Exposure H J/m^2**

- **Power**
- **Watt is a unit of Power W**
- **Radiant Power Φ W**
- **Irradiance E W/m^2**

Units of Measurement

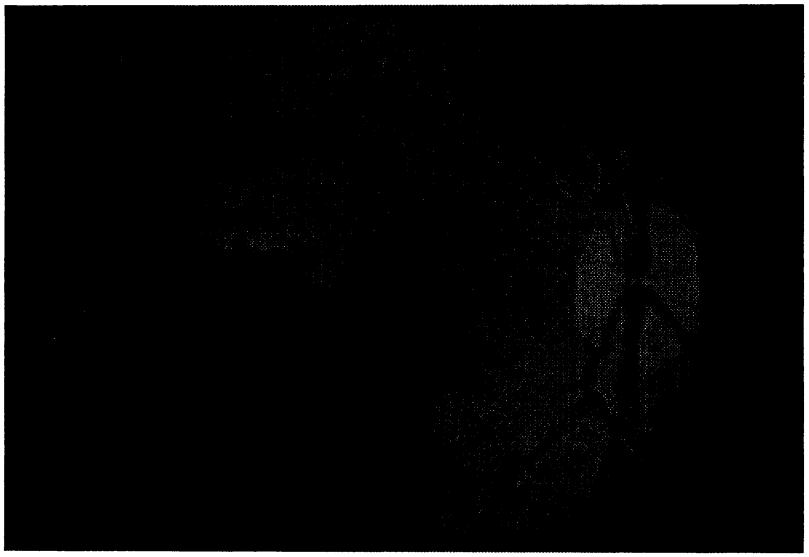
Associated with non-ionizing radiation

- **<u>Divergence</u>:** Angular amount the beam diverges off the optic axis ϕ.
- Measured in radians or milliradians

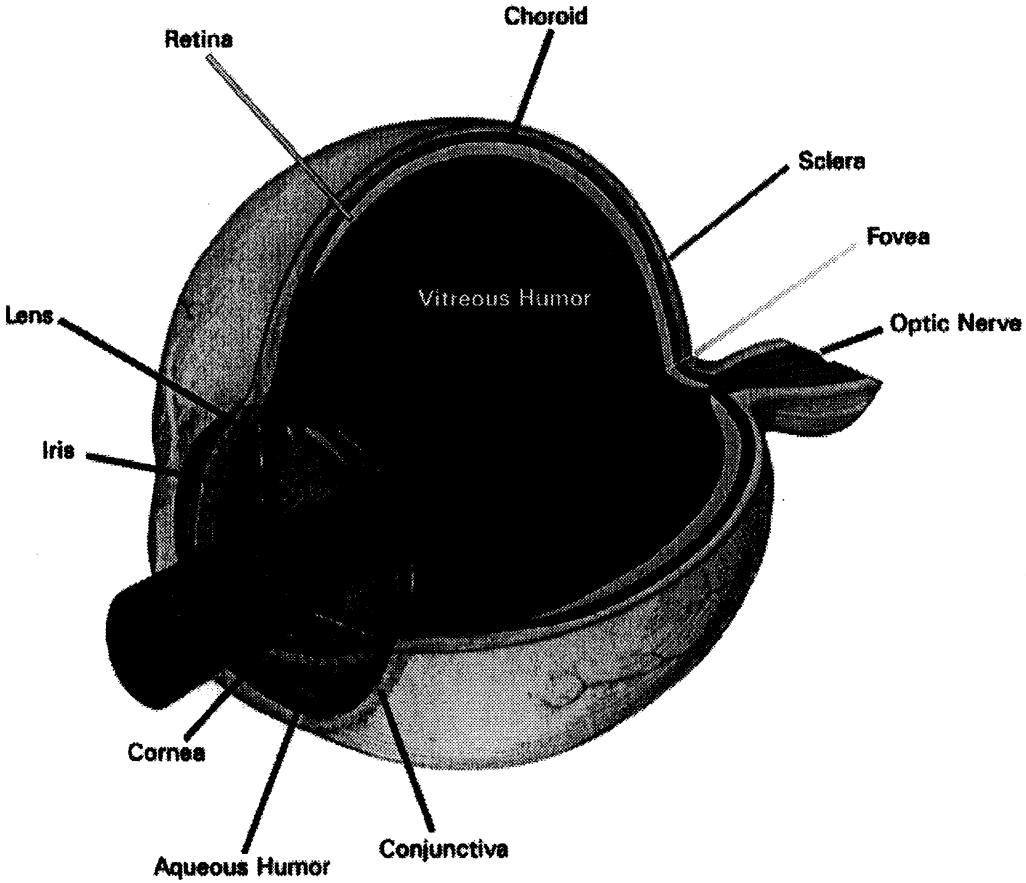
- **<u>Pulse Repetitive Frequency (PRF)</u>: Hz**
- **Pulse Width: s**
- **Exit Beam Diameter a: m**

Biological Effects of Laser Radiation

- Two Organs of the body susceptible to laser radiation…EYE & SKIN
- Path of Light through the EYE
- Physiology of the EYE
- Damage Mechanisms
- Resultant Injuries



THE EYE


Retina
Choroid
Sclera
Fovea
Optic Nerve
Vitreous Humor
Lens
Iris
Cornea
Aqueous Humor
Conjunctiva

PHYSILOGY OF THE EYE

- CORNEA:
- Vulnerable to mid/far IR and lower UV radiation
- LENS: Vulnerabilities to far IR and lower UV similar to Cornea

- Retina
- During normal vision, images are formed on the retina; signals are sent to the brain from photosensitive cells; and vision occurs.
- During laser exposure, no image is formed; all the energy is simply focused to a pinpoint.

PHYSILOGY OF THE EYE
Retinal Components

- Macula: A small region on the retina about the size of the head of a pin.
- The density of photoreceptor cells in this region is much higher than other parts of the retina
- Fovea: An even smaller region within the Macula.
- From this small region, all detailed vision takes place.
- A laser produced lesion on this area would be catastrophic

LASER DAMAGE MECHANISMS

- THERMAL: Thermal damage occurs when energy incident on the retina supercedes the ability of the eye's capillary action to dissipate heat
- PHOTCHEMICAL: Photochemical damage is the result of photons incident upon the molecular structure of biological tissue. The interaction and energy transfer result in rearrangement of the molecular structure.

LASER CONTROL DOCUMENTS

- ANSI Z136.1 (American, user)
- FDA 21 CFR 1040 (American, manufacture)
- ACGIH TLVs (American, user)
- IEC 825-1 (International, user)
- ICNIRP (International, user)

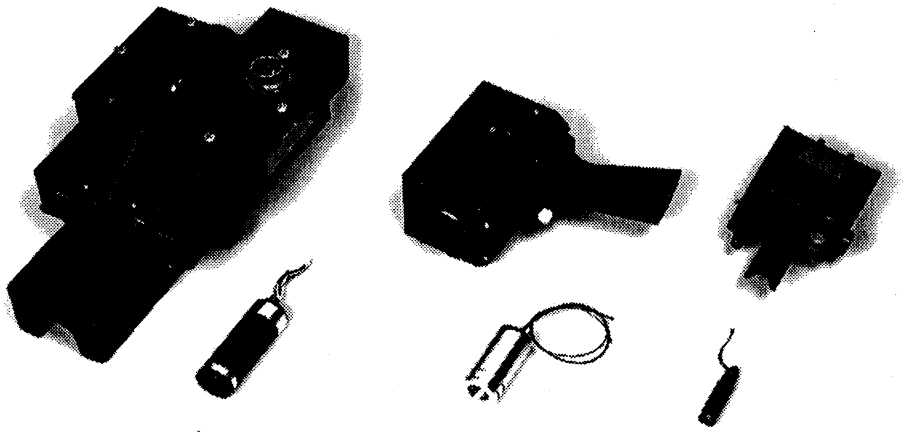
STANDARDS SET EXPOSURE LIMITS BASED ON BIO DATA

- MAXIMUM PERMISSABLE EXPOSURE LIMIT (MPE) energy\power per unit area

- ACCESSIBLE EMISSION LIMIT (AEL) radiant energy or radiant power

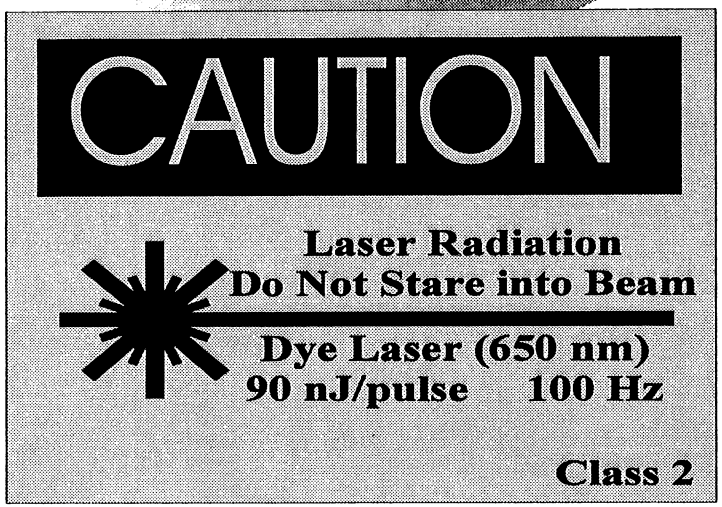
LASER HAZARD CLASSIFICATION

- CLASS 1:
  - Nonhazardous Lasers or Enclosed Lasers
- REQUIREMENTS
  - Labeling
  - Interlocks on case

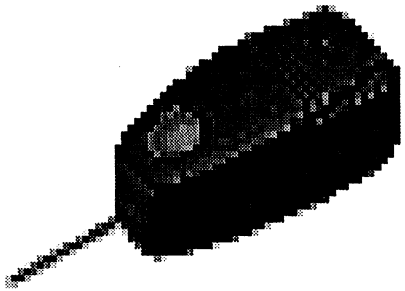


LASER HAZARD CLASSIFICATION

- CLASS 2:
  - Low Power Visible Lasers

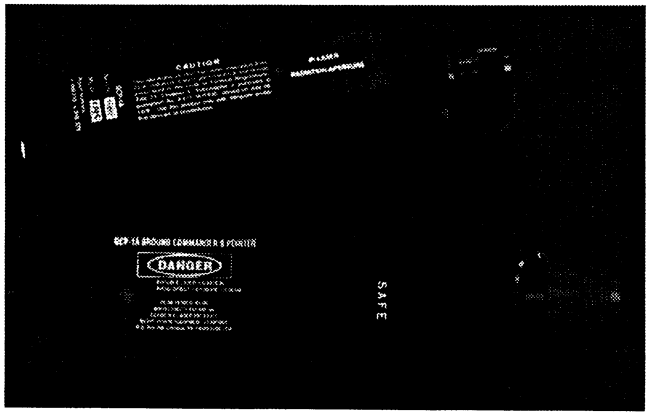


- REQUIREMENTS
  - Warning: Do Not Stare Into Beam



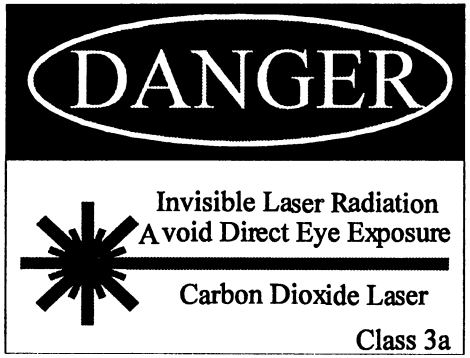
LASER HAZARD CLASSIFICATION

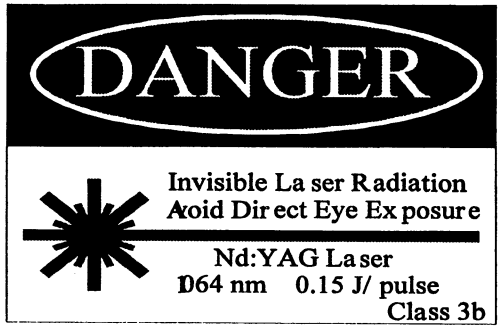
- CLASS 3:
  - Medium Power Lasers
- CLASS 3a Lasers:
  - No real hazard unless the beam is focused
- CLASS 3b Lasers:
  - Direct beam viewing hazard



LASER HAZARD CLASSIFICATION

- CLASS 3 Requirements
  - Equipment labeling
  - Standing operating procedure
  - Eye protectors available
  - Laser backstop
  - No specular reflectors in beam
  - Good room illumination





LASER HAZARD CLASSIFICATION

- CLASS 4: High Power Lasers
  - Skin Hazard
  - Fire Hazard
  - Diffuse Reflection Hazard

LASER HAZARD CLASSIFICATION

- CLASS 4: Indoor Requirements
  - Door interlock
  - Warning lights
  - Countdown
  - Goggles required

LASER HAZARD CLASSIFICATION

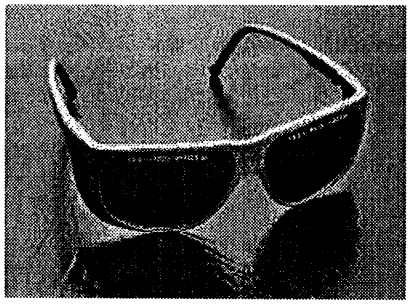
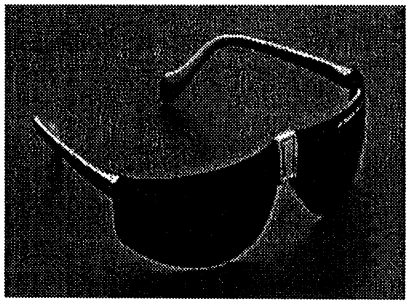
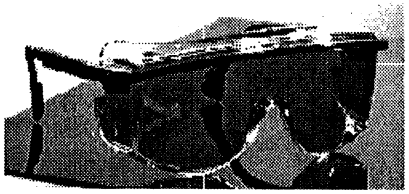
- CLASS 4 Range Controls
  - Operate on an approved laser range
  - Lase only approved targets
  - Use laser backstop or:
  - Control laser beam path out to NOHD
  - Maintain communication to Range Control
  - Maintain communication to target area.
  - Use eye protectors in target area.
  - Eliminate specular reflectors around targets
  - Maintain standard operating procedure.
  - Use warning signs to prevent personnel from entering laser surface danger zone (LSDZ)

LASER HAZARD CONTROL MEASURES

- ENGINEERING
- ADMINISTRATIVE
- PERSONEL PROTECTIVE EQUIPMENT
  - Laser Eye Protection

LASER EYE PROTECTION

- MATCH EYE PROTECTION TO THE WAVELENGHT OF THE LASER
- ENSURE THE EYE PROTECTION IS OF SUFFCIENT OPTICAL DENSITY

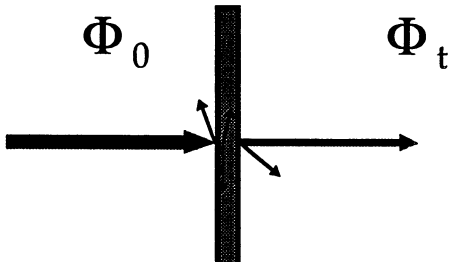




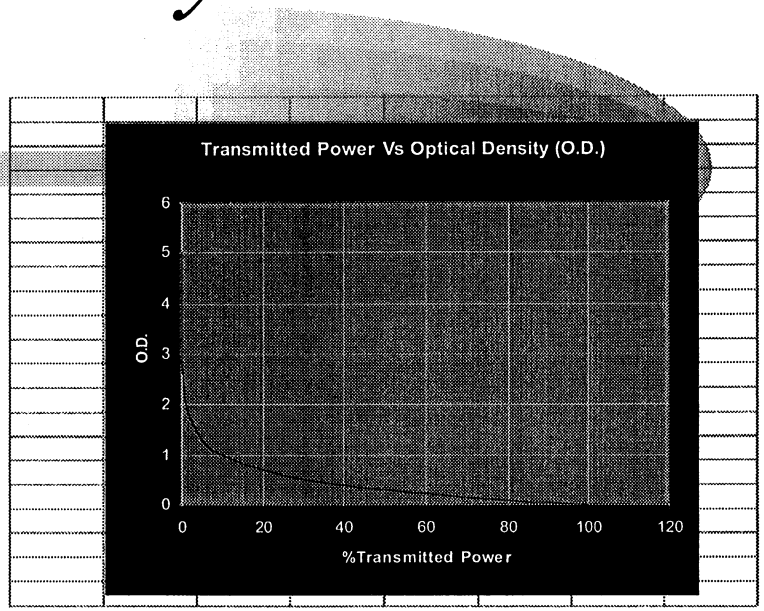
Optical Density

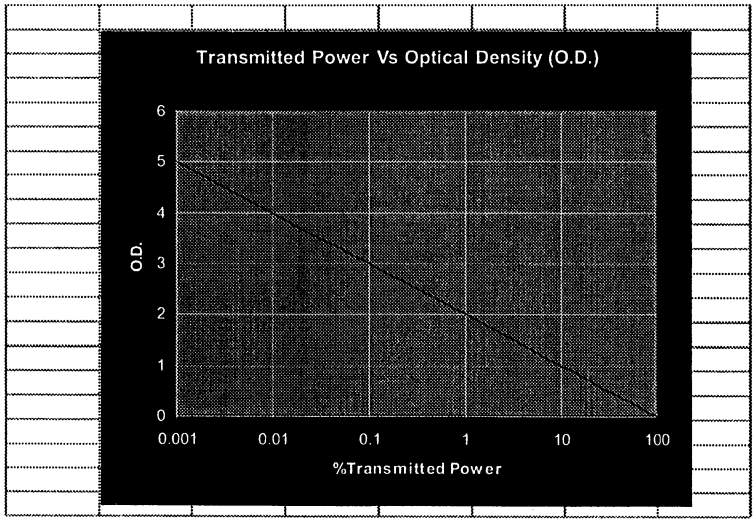
- When Radiant energy strikes an object (such as a glass surface), some of the light is transmitted, some is reflected, and some is absorbed.
- The light stopping power of the object (such as a glass surface) is measured in terms of its optical density.
- O.D.=-Log (Φ_t / Φ_o)

  Φ_0=INCIDENT POWER

  Φ_t=TRANSMITTED POWER







Current Issues in Laser Safety
Laser Pointers

- Momentary classroom laser pointer exposure is safe.
- In most individuals, aversion response, such as blinking and turning away, will terminate accidental classroom laser exposures to less than 1/4 of a second.
- Due to this aversion response, there is no realistic risk of retinal damage from accidentally viewing a Class 3a laser pointer.
- Forcing a direct stare into the laser beam for more than 10 seconds ma,y possibly cause an eye injury.
- ***The real hazard exists from the startle, glare or temporary flashblindness while performaning a critical task.***

SUMMARY

- Nonionizing Radiation in the form of Laser Light can be Potentially Hazardous
- Lasers can be used safely provided operators are aware of the potential hazards and take appropriate precautions
- Ensure laser eye protection corresponds to the wavelength of the laser and has sufficient optical density

Jeffrey R. Pfoutz

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- EMAIL Jeffry.Pfoutz@apg.amedd.army.mil
- http://chppm-www.apgea.army.mil

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Occupational Chemical Hazards

Jim Boiano, MS, CIH
Chief, Hazard Section
Surveillance Branch
NIOSH

National Institute for Occupational Safety and Health
NIOSH

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NIOSH Background

- Created by the OSHAct of 1970
- Headquartered in Washington, DC
- Administrative offices in Atlanta,GA
- One of the Centers for Disease Control and Prevention
- Research facilities
  - Cincinnati, OH
  - Morgantown, WV
  - Pittsburgh, PA
  - Spokane, WA

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NIOSH Mission

- Investigate potentially hazardous working conditions as requested by employers or employees
- Develop and disseminate methods for preventing disease, injury and disability
- Develop and evaluate efficacy of engineering control technologies
- Conduct research and provide scientifically valid recommendations for protecting workers
- Provide education and training of OS&H professionals

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Current Hazard Surveillance Activities

- OS&H Programs
- Metalworking fluids
- New residential construction
- Farm family health hazards
- National survey of workplace hazards (i.e., NOHS, NOES, NOHSM)

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Occupational Hazards

- Chemical (gases, vapors, mists, etc)
- Physical (noise, ionizing and non-ionizing radiation, vibration, heat/cold, etc)
- Ergonomic (repetitive tasks, office work stations, lifting/reaching, etc)
- Biological (bacterial, viral, fungal, etc)
- Safety (energized sources, S/T/Fs, confined spaces, etc)
- Psychosocial (stress, uncertainty, oppressive control, distressing relationships, etc)

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Types of Chemical Hazards

- Dusts (i.e., silica dust, wood dust)
- Gases (i.e., carbon monoxide)
- Vapors (i.e., benzene, methanol)
- Fumes (i.e., welding fumes)
- Mists (i.e., oil mist)
- Fibers (i.e., asbestos)

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Hazards Associated with Exposure to Chemical Agents

- Safety hazards (explosion, fire, etc.)
- Health hazards (physiological effects, target organ effects, CNS effects, etc.)

- Acute Effects
  - headache
  - nausea
  - skin irritation
- Chronic Effects
  - cancer
  - silicosis
  - asbestosis

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Qualitative Exposure Assessment

- Observe and qualitatively evaluate jobs and associated risks to virtually all chemical hazards
- Evaluate and rank risks according to combination of factors:
  - toxicity of agent
  - frequency/duration of exposure
  - quantity used
  - proximity of agent to worker
  - controls
- Risk rankings can be used to establish monitoring priorities

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Quantitative Assessment

- Actual sampling of worker for chemical agent(s) of concern.
- Used to:
  - establish exposure baseline
  - assess compliance with health standards
  - assess effectiveness of engineering controls
  - address complaints
- Assessment limited to chemical agents with validated sampling and analytical methods

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Chemical Hazard Controls

- Hierarchy of Controls
  - Engineering > Administrative > PPE/C
- Engineering
  - Preferred method
  - Reduces hazard at the source
  - Examples include: process change, enclosure and local ventilation.

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Chemical Hazard Controls (Con'td)

- Administrative
  - Reduces exposure, but not the source of the hazard
  - Based on policies and procedures--depends on actions by people and is subject to human error
  - Examples include: job rotation, safe work practices, worker training programs and good housekeeping

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Chemical Hazard Controls (Con'td)

- Personal Protective Equipment/Clothing
  - Least preferred method
  - Barrier between worker and source
  - PPE/C is often a stressor
  - If used improperly may provide little or no protection.
  - Examples include:
    - Respirators
    - Head protection
    - Eye and face protection
    - Hand and foot protection
    - Full-body protective clothing

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Selected Chemical Agents of Interest to NASA

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Chemical Agents

- Acrylonitrile
- Dimethylethoxysilane
- Hydrazine
- Monomethyl hydrazine
- Isocyanates
- Epoxy resin systems
  - 4,4' methylenedianiline

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Acrylonitrile

- Colorless, pale-yellow liquid with unpleasant odor
- Used in manufacturing of:
  - synthetic fibers
  - acrylostyrene plastics
  - ABS plastics
  - nitrile rubber
  - chemicals
  - adhesives
- Odor threshold: 22 ppm
- PEL: 1 ppm; TLV: 2 ppm [skin]; REL: 2 ppm
- Ceiling: 10 ppm (PEL and REL)
- IDLH: 85 ppm

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Acrylonitrile (Con'td)

- Primary routes of entry: Inhalation, skin
- Primary health effects:
  - Causes redness, blisters
  - Tissue anoxia
  - Acute toxicity similar to cyanide poisoning
  - Brain tumors, lung and bowel cancer
  - Attacks cardiovascular system, liver, kidneys, CNS, skin
  - Carcinogenesis:
    - ACGIH: A2
    - NIOSH
    - IARC: 2A

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Dimethylethoxysilane

- Colorless, clear liquid with a pungent odor similar to isopropanol
- Primary use: waterproofing of space shuttle thermal protection systems
- Odor threshold: < 1 ppm
- TLV: 0.5 ppm STEL: 1.5 ppm
- PEL and REL: None
- IDLH: None

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Dimethylethoxysilane (Con'td)

- Primary route of entry: Inhalation
- Primary health effects: headache; eye, nose, and throat irritation; nausea and vomiting.
- Carcinogenesis: Undetermined

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Hydrazine

- Colorless, fuming oily liquid with ammonia-like odor.
- Uses:
  - rocket propellant
  - reducing agent
  - production of blowing agents, herbicides, pharmaceutical synthesis
- Odor threshold: 3 to 4 ppm
- PEL: 1 ppm; TLV: 0.01 ppm [skin]; REL: 0.03 ppm (2 hr ceiling)
- IDLH: 50 ppm

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Hydrazine (Con'td)

- Primary routes of entry: Inhalation, skin
- Primary health effects:
  - Eye, nose, skin and throat irritation
  - Allergic reactions
  - Facial numbness and swelling
  - CNS and liver toxicity
  - Hepatotoxin
  - Hemolytic agent
  - Severe burns
  - Carcinogenesis:
    - ACGIH: A3
    - NIOSH
    - IARC: 2B

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Monomethyl hydrazine

- Colorless, fuming liquid with an ammonia-like odor
- Uses:
  - rocket fuel
  - solvents
  - chemical intermediate
- Odor threshold: 1 to 3 ppm
- PEL: 0.2 ppm (skin); TLV: 0.01 ppm [skin]; REL: 0.04 ppm (2 hrs)
- IDLH: 20 ppm

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Monomethyl hydrazine (Con'td)

- Primary route(s) of entry: Inhalation, skin
- Primary health effects:
  - Irritation of eyes, nose and respiratory tract
  - Methemoglobinemia
  - Chronic inhalation causes rare tumors of respiratory tract
  - Convulsions
  - Carcinogenesis
    - ACGIH: A3
    - NIOSH

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Selected Isocyanates

- Methylene Bisphenyl Isocyanate (MDI)
- Hexamethylene Diisocyanate (HDI)
- Toluene-2,4 Diisocyanate (TDI)
- Napthalene Diisocyanate (NDI)

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Uses of Isocyanates

- Polyurethane foams and plastics:
  - thermal insulation
  - in rubbers, adhesives, paints and textile finishes
  - molds
  - surface coatings
  - shoe innersoles
  - upholstery padding

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Exposure Limits of Isocyanates

TDI	0.02 ppm (ceiling)	0.02 (STEL)	LFL
MDI	0.02 ppm (ceiling)	0.005 ppm	0.005 ppm 0.02 ppm (10 min. ceiling)
HDI	None	0.005 ppm	0.005 ppm 0.02 ppm (10 min. ceiling)
NDI	None	None	0.005 ppm 0.02 ppm (10 min. ceiling)

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Health Effects of Isocyanates

- Primary routes of entry: inhalation and skin/eye contact
- Allergic sensitization of the respiratory tract and skin
- Irritation of eyes, mucous membranes and skin
- Possible corneal damage and skin blisters (HDI)
- Chest pain (MDI & NDI), loss of consciousness (TDI), wheezing (HDI) and abdominal pain, diarrhea and irritation of the mouth and stomach (TDI)
- CNS effects such as memory loss (TDI)
- Carcinogenesis: IARC 3 (MDI, NDI); IARC 2B, ACGIH A4 and NIOSH carcinogen (TDI)

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Components of Epoxy Resin Systems (ERS)

- Uncured resins: e.g., diglycidyl ethers of bisphenol A
- Curing agents: e.g., diethylenetriamine, triethylenetetramine, phthalic anhydride, trimellitic anhydride, polyamides
- Reactive diluents: e.g., phenyl glycidyl ether, allyl glycidyl ether, n-butyl glycidyl ether

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Components of ERS (Con'td)

- Non-reactive diluents: e.g., acetone, methylene chloride, toluene, MEK, MIBK
- Fillers: e.g., silica, calcium carbonate, talc

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Uses of ERS

- Principle use as protective coatings
- Also used in structural applications
  - laminating and reinforcing plastics
  - surface coatings
  - molding compounds
  - bonding agents
  - adhesives

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OELs of Selected ERS Components

Epichlorohydrin	5 ppm (skin)	0.5 ppm(skin)	LFL
Diethylenetriamine	None	1 ppm (skin)	1 ppm (skin)
4,4[1] methylene dianiline	0.03 ppm(skin)	0.1ppm(skin)	LFL
Phthalic anhydride	12 mg/m3	1 ppm	6 mg/m3
Trimellitic anydride	None	0.04 mg/m3	0.005 ppm
Phenyl glycidyl ether	10 ppm	0.1 ppm (skin)	1 ppm
Allyl glycidyl ether	10 ppm (ceiling)	5 ppm 10 ppm (STEL)	5.ppm (skin) 10ppm(STEL)

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OELs of Selected ERS Components (Con'td)

n-butyl glycidyl ether	50 ppm	25 ppm	5.6 ppm (15 min.)
Acetone	1000 ppm	500 ppm 750 ppm (STEL)	250 ppm
Methylene chloride	25 ppm 125 ppm (STEL)	50 ppm	LFL
Toluene	200 ppm 300 ppm (ceiling) 500 ppm (10 min.)	50 ppm	100 ppm 150 ppm (STEL)
Silica	(10 mg/m3)/ (%SiO2 +2)	0.05 mg/m3	0.05 mg/m3
Calcium carbonate	15 mg/m3 (total) 5 mg/m3 (resp.)	10 mg/m3	10 mg/m3 (total) 5 mg/m3 (resp.)

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Health Effects of ERS

- Uncured resins: skin irritant and/or sensitizer; minimal inhalation hazard; toxicity decreases with increase in MW
- Curing agents: respiratory and skin irritation and sensitization; eye irritation; blurred vision
- Reactive diluents: irritation of eyes, skin and respiratory system; skin sensitizer; CNS depression and possible reproductive effects.

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Health Effects of ERS (Con'td)

- Nonreactive diluents: toxicity dependent on individual solvent(s) used; eye and skin irritation; CNS effects; liver and kidney damage; defatting properties may render skin more vulnerable to irritating/sensitizing effects of other ERS components.
- Fillers: pneumoconiosis, and eye and skin irritation

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Summary

- Addressed selected chemical hazards associated with NASA operations
- Qualitative exposure assessment can be used to identify and rank hazards and set monitoring priorities
- Monitoring of workers is best way to quantitate worker exposure
- Overexposures must be quickly addressed by implementation of effective controls

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How to Contact NIOSH

- Homepage: http://www.cdc.gov/niosh/homepage.html
  - Resources
  - Research and Services
  - News
  - General Information
- NIOSH Hotline: 1-800-35-NIOSH
  - Address queries concerning specific OS&H issues
  - NIOSH publications available upon request
- My email: jmb4@cdc.gov

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Electrical Hazards in the Workplace

and

Lightning

Virgil Casini
NIOSH, Division of Safety Research
Morgantown, West Virginia

National Institute for Occupational Safety and Health

Electrical Hazards

Fifth leading cause of death in the workplace and accounts for 7% of all occupational fatalities

Serious, widespread occupational hazard to which practically all members of the workforce are exposed

Electrocutions occur to workers in all occupations and industries

Although workers know that the biggest danger is electrocution many don't understand electrical hazards

Definition

Electricity -- The flow of an atom's electrons or negatively charged outer particles through a conductor

Four Primary Electrical terms

Voltage (volts) - the fundamental force or pressure that causes electricity to flow through a conductor

Resistance (Ohms) - anything that impedes the flow of electricity through a conductor. The resistance of the human body is 100,000 Ohms

Current (Amps) - the flow of electrons from a source through a conductor

Ground - a conducting connection between an electrical circuit or equipment and the earth, or some conducting body that takes the place of the earth

Types of Electrical Current

Alternating current - flows back and forth (cycles) through a conductor. In the United States, the normal rate is 60 cycles a minute or 60 Hertz (Hz)

Direct Current - flows in one direction only

Ohm's Law

Used to link current, voltage, and resistance mathematically

Current = Voltage/Resistance
Amps = Volts/Ohms

Flow of Electricity
increases when voltage increases
increases when resistance decreases

Points to Remember

- Voltage causes current
- Your body resists the flow of current
- Current causes the damage when an electrical injury occurs

Four types of Electrical Injury

- Electrocution (fatal)
- Electric shock
- Burns
- Falls

Occurrences of Electrical Injuries

- Direct or indirect contact with electrical energy
- Electrical arcs (flow of electrons through a gas)
- Flash burns
- Flame burns

Severity of Electrical Injury

- Magnitude of electrical current
- Current's pathway through the body
- Duration of current flow through the body

Causes of Death by Electrical Energy

- Respiratory arrest
- Cardiac Arrest
- Burns
- Falls

Estimated Effects of 60 Hz AC Currents

1mA	Barely Perceptible
16mA	Maximum current a man can grasp and "let go"
20mA	Paralysis of respiratory muscles
100mA	Ventricular fibrillation threshold
2 Amps	Cardiac standstill and internal organ damage
20 Amps	Common fuse or breaker opens circuit

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Types of Voltage

Low Voltage <600 volts

- **common utilization voltages**
- **produce currents in the milliampere range**
- **1,000 mA= 1 Amp**

Example 1:

A worker contacts a 120 volt energy source under dry conditions. Under dry conditions, the resistance of the human body is 100,000 Ohms.

Current = Volts/Ohms
= 120/100,000
= 1 mA

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Estimated Effects of 60 Hz AC Currents

1mA	Barely Perceptible
16mA	Maximum current a man can grasp and "let go"
20mA	Paralysis of respiratory muscles
100mA	Ventricular fibrillation threshold
2 Amps	Cardiac standstill and internal organ damage
20 Amps	Common fuse or breaker opens circuit

Example 2:

Under wet conditions the same worker contacts a 120 volt energy source. Under wet conditions, the resistance of the human body may be as low as 1,000 Ohms.

Current = Volts/Ohms
= 120/1,000
= 120 mA

Estimated Effects of 60 Hz AC Currents

1mA	Barely Perceptible
16mA	Maximum current a man can grasp and "let go"
20mA	Paralysis of respiratory muscles
100mA	Ventricular fibrillation threshold
2 Amps	Cardiac standstill and internal organ damage
20 Amps	Common fuse or breaker opens circuit

High Voltage

High Voltage >600 volts

- **ruptures human skin**
- **produces currents in the ampere range**
- **greatly reduces the body's resistance**
- **causes greater damage to internal organs**

For example, if a worker contacts 1,000 volts

Current = Volts/Ohms = 1,000/500 = 2 Amps

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Estimated Effects of 60 Hz AC Currents

1mA	Barely Perceptible
16mA	Maximum current a man can grasp and "let go"
20mA	Paralysis of respiratory muscles
100mA	Ventricular fibrillation threshold
2 Amps	Cardiac standstill and internal organ damage
20 Amps	Common fuse or breaker opens circuit

Electrical Regulations

Occupational Safety and Health Administration

General Industry Subpart S
29CFR1910.302 through 29CFR1910.399

Requirements apply to all electrical installations and utilization equipment regardless of when designed or installed.

Construction Industry Subpart K
29CFR 1926.402 through 29CFR1926.408

Installation safety requirements for electrical equipment and installations used to provide electrical power and light at the jobsite.

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Electrical Regulations

National Electrical Code (NEC)

Practical safeguarding of persons and property from hazards arising from the use of electricity

Serves as the basis for electrical building codes across the United States

Electrical Regulations

National Electrical Safety Code (NESC)

Contains rules necessary for the practical safeguarding of persons during the installation, operation, or maintenance of electric supply and communication lines and associated equipment

Unlike the NEC, the NESC contains safe work rules in addition to installation requirements

Data Sources

The NIOSH National Traumatic Occupational Fatalities (NTOF) Surveillance System 1980-1994: 411 occupational electrocutions per year

A death-certificate based data system of work-related fatalities dating back to 1980.

- **16 years or older**
- **Positive response to "injury at work" item**
- **External cause of death (ICD-9)**
- **E800-E999**
- **E925**

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The NIOSH Fatality Assessment and Control Evaluation (FACE) Project

A research program for the identification, investigation, and prevention of fatal occupational injuries through surveillance, on-site investigation, and prevention activities

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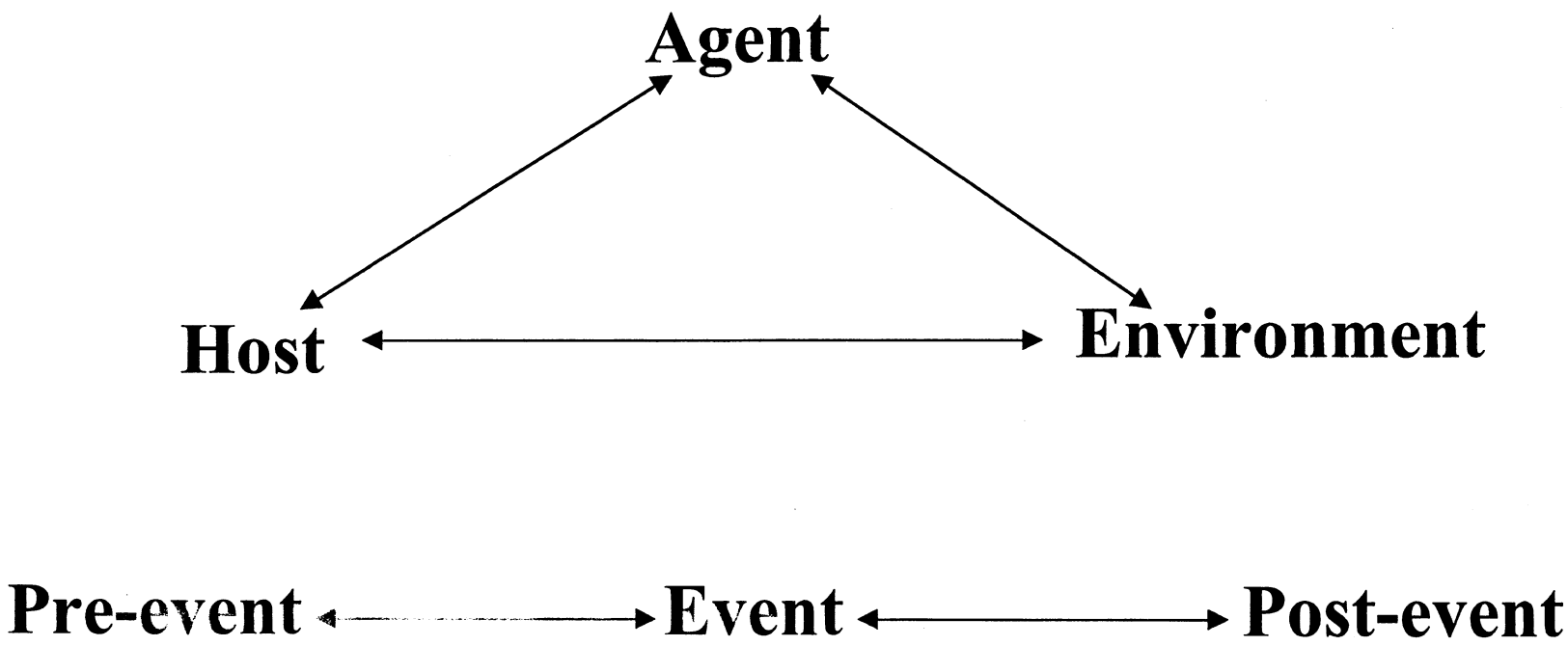
Fatality Assessment and Control Evaluation (FACE) Project



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Fatality Assessment and Control Evaluation (FACE Project)

November 1982 - December 1994

- Investigated 224 electrocution incidents
- 244 occupational fatalities
- Victims - 243 males, 1 female
- YPLL = 7,903 (33 years per victim)
- 64% victims under 35 years of age

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Five Case Scenarios

Direct worker contact with energized powerline (28%)

Direct worker contact with energized equipment (21%)

Boomed vehicle contact with an energized powerline (18%)

Improperly installed or damaged equipment (17%)

Conductive equipment contact with an energized powerline (16%)

NIOSH Electrical Publications

NIOSH Electrocution Monograph

NIOSH Alerts:

Contact with Electrical Energy
Backfeed Electrical Energy
Crane/Powerline
Damaged Receptacles and Connectors
Control of Hazardous Energy
Tree Trimming
Aluminum Ladder/Scaffold
Fast Food Restaurants

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The NIOSH Homepage

http://www.cdc.gov/niosh/

1-800-35-NIOSH
1-800-356-4674

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Lightning Strikes

Between 1959 and 1994

- 3,239 Fatalities
- 9,818 Non-fatal injuries
- 80-90 Fatalities per year in U.S.
- 98% of strikes occur over land

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Causes of injury

- Direct strike
- Currents flowing through the ground
- Sideflash from a nearby object struck by lightning (tree, flagpole, metal building)

Magnitude of Strike

- Current reaches a peak in 5 microseconds
- Current is gone in 100 microseconds
- Current has a median value of 30,000 Amps
- A ground resistance of 10 Ohms will have a voltage to ground of 300,000 volts

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Probability of a Lightning Strike

Related to the square of a person's height

Person tends to attract lightning that would have struck the ground in a circular area centered on that person

Radius equal to the person's height

Lightning would have struck that location whether or not the person was there

Probability of a Lightning Strike

Person standing next to a taller object such as a tree, flagpole, or building without lightning protection has an increased likelihood of being injured

Probability of the taller object being struck is greater that a person standing alone at the same location

A tree five times as tall as a person will increase the person's probability of being struck by a factor of 25

Hazardous Locations

Under or near trees (sideflash or ground current)

Near tall conductive objects such as flagpoles

Near small buildings or shelters without lightning protection

Lightning Protection System

Air terminals - lightning rods placed on the structure to intercept the lightning strike

Lightning conductors and down conductors - carry the intercepted lightning current from the air terminals to the grounding electrode

Grounding electrode - connects the lightning protection system to the earth

Bonding system - makes appropriate bonding connections with the power, telephone, and plumbing grounds

Lightning Myths

Lightning never strikes the same place twice

Someone struck by lightning is electrically charged

Rubber tires protect motorists from lightning

No rain means no lightning threat

Lightning Facts

More that 20 million lightning strikes hit the U.S. each year

A single bolt can reach 50,000 degrees Fahrenheit, five times hotter than the sun

Cloud to ground lightning poses the most danger to people but accounts for only 20 percent of all strikes

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Health Surveillance/Maintenance in the Workplace

Session 10 – Patient Safety in Health Care
August 9, 1999

Dr. Wing Chan introduced the tenth session in this fifth series of continuing education programs sponsored by NASA's Occupational Health Program, Office of Health Affairs (OHA), in cooperation with the Uniformed Services University of the Health Sciences (USUHS). Worldwide, this session is available on the Internet. Dr. Chan introduced the speaker: Dr. Charles R. Denham, President and CEO of Health Care Concepts, Inc., and Chief Operating Officer of Premier Innovation Institute (PII).

Dr. Denham focused his talk on hospital adverse event rates and discussed the challenges and potential problem solutions. PII represents about one-third of the hospitals in the U.S. One of the most interesting aspects of adverse events in health care is that the consumer is becoming increasingly aware of the challenges (e.g., recent articles in the *Wall Street Journal* and *USA Today*). A recent Harvard study published in the *Journal of the American Medical Association* indicated that at least 180,000 people die each year from medical errors. Twenty-one deaths occur per hour around the clock; at least three times as many people die from preventable adverse events as from breast cancer. First, we must understand the challenges—the safety culture; process reengineering; human factors; and safety innovation. Safety culture must be the bedrock of any solutions in the safety area. One of the questions is: Why does this occur, why haven't we done anything about it, and why are we just beginning to be aware of the problem? There are filters in the care process that have evolved to protect us from adverse events—administrative filters, nursing filters, anesthesia filters, and surgeon filters. There are holes or "gaps" in each filter; when the "gaps" line up, we have an adverse event. When we look at culture, there is "blunt" end (organizations, policies, procedures, regulations) and a "sharp end" (the practitioner). The practitioner is at the sharp end of what occurs; the monitoring processes are at the sharp end. This predisposes practitioners to be at greater risk. The "second story" (or the blunt end) never gets a lot of attention, although a chain reaction of events may occur that lead to an adverse event. When we look at the issue of safety culture and process reengineering, we must also look at human factors. Human factors have yet to be touched when we look at safety innovations that are developed.

Over the past 30 years, the earlier studies showed that the adverse effect rate was 3-6% of admissions to hospitals. In 1995, the Australians published an adverse event rate of 16% and will ultimately result in papers being published this fall. The adverse event was cross-examined by a U.S. group and the findings were very interesting. It appears that the adverse event rate in the U.S. is likely to be about three times what we think it is. The adverse events described up until the Australian data was released were about 4-5% of admissions. There is a very broad spread of adverse events across various specialties, although somewhat higher in surgical subspecialties. Negligence and serious disability have correlates. About half of the adverse events involving negligence do not end up in a claim for malpractice. Outside of the hospitals

(physician's office, home, ambulatory care unit, nursing home, etc.), there is also a very broad spread of adverse events, including those with negligence. What is seen is a pattern of relatively low incidence of reported adverse events spread over a great number of caregivers who were involved in a host of complex care processes. We need to have better reporting systems. A world-wide classification for adverse events is being developed. The criteria being used is that the incident must cause injury or suffering; must lengthen hospitalization, cause a new hospitalization, or cause death or disability; must be affected by medical management; and must be preventable. We must be able to measure the severity of the disease when entering the system, because the adverse event will be directly related to the baseline. Clinicians are trained in an environment of mentorship and share collective experience on adverse events. Clinicians are limited by the exposure of these mentors. The explanation for the lack of awareness is that there is a low enough incidence to be unaware, and high impact events are looked at as being isolated events and not part of a pattern. The study this fall will look at the circumstances and the contributing factors that lead to the challenges that lead to the problems that lead to the crises. The real challenge in examining the collective data is to broaden the reach of the opportunity of preventability and identify what the circumstances and contributing factors were that led to the problems that led to the crises. Are they preventable? What can we do to have an impact on such problems?

Dr. Denham addressed the challenges of the PII—to look at the adoption curve of any new innovation, and to accelerate the adoption of a protocol, procedure, product, or device. There are decidedly different groups of adopters. About 2-5% of the market are innovators, and they will adopt early; the early adopters are also part of the early market, and will adopt the innovation to differentiate themselves in their own delivery system; the mainstream market is looking at verifiable evidence before they adopt. The challenge is to close the chasm between the early adoptors and the early majority of the mainstream market. The goal is to unlock the market penetration lock for safety products as well as all innovations. Dr. Denham provided an overview of the breakthrough processing system that is used to assess new products and procedures for the Premier hospital network. The group purchasing organizations purchase huge volumes of products and develop large contracts that secure long-term opportunities for suppliers. There is a problem in that—how can innovators gain access to the market if there are long-term contracts for these institution? PII has a Web site for the Technology Breakthrough Processing System. The first phase of the effort is the submission request and reference package for the new innovation; the submitters supply a questionnaire driven approach to justify the validity of the innovation; then they undergo a clinical scientific briefing. Dr. Denham used the safety syringe as an example. No less than 20 states have passed legislation requiring the use of safety syringe products. It is critically important for the products to be examined for potential risk. The FDA has approved about 250 products. It is critical that as products are being developed, the factors such as safety culture, human factors, protocol development are considered. Premier examined the twelve best products and found that none of these products would address more than 15-20% of the clinical scenarios for which the products were designed. None of the manufacturers considered the safety culture or climate, and none could articulate in

any fundamental way the human factors issues that were at play when they designed their product.

Dr. Denham described some of the preliminary examination of the data and data mining of the adverse events. The opportunity to have a dramatic impact on care delivered today is outstanding. We do not have to undertake very complex examination of patterns of information to identify early warning opportunities. Such examples include anesthesia deaths. Other examples that are very impressive are endo-trachial fires. In the U.S., there are over 100 endo-trachial fires each year, and yet there are currently no protocols developed to help control or coordinate the process of the surgeon, the nurse, and the anesthesiologist. Dr. Denham cited several examples: slipped tubes; device mismatch; equipment mismatch; minimal training; absent protocols; alarm design, device maintenance; human factors; etc. In just the preliminary data analysis, there are patterns of low incidence/high impact events and there is an opportunity to address care process and the design of solutions.

Questions:

KSC: A lot of items are limited in the scope of patients they handle. Medications go into a hospital setting where other medications and equipment are being used that are not considered. Do you have in-house surveillance on these interactions to detect them?
Dr. Denham: Yes, you have addressed one of the number one causes of adverse events—confluence of separate processes that come into focus at the "sharp end". What is being done over the next year is redesigning an element of the classification and incident reporting system to identify contributing events, pre-existing conditions, and other complicating events.

KSC: Regarding negligence—is this negligence related to something that happened that put the hospital in negligence or was it failure on someone's part to do something?
Dr. Denham: The definition used by the U.S. team was somewhat different than that used by the Australian team; typically when the medical reviewers reviewed the data, something was identified as an extraordinary lapse of the care process and management, as differentiated from the mathematical likelihood of error.

HQ: Do you think human factors would play a large role in terms of having negligence problems? Are any institutions looking into this?
Dr. Denham: It is a very interesting area, and almost a gold-rush opportunity. In looking at negligence and human factors and the care process engineering opportunities, you almost cannot get involved without finding a great opportunity to impact care and suffering. As hospitals and clinicians become aware of the incidence of adverse events, and the corrective measures that they can take, there will be a much reduced negligence rate. The adverse events are high because of lack of awareness, rather than because of human factors.

HQ: Is some kind of Task Force looking into this issue?

Dr. Denham: Yes, there is a global patent safety task force advisory group. Participants are: FDA, the European counterpart to FDA, the Australian Safety Patient Foundation, Ford, General Motors, Daimler Chrysler, the WHO, the National Patient Safety Foundation at the AMA, Allegiance Health Care, Credit Swiss, Fuji, Seimans, Premier, and the Texas Medical Institute of Technology. This entire group has agreed to collaborate in this area. There will be an annual meeting of the collaborators next year on this issue.

Health Surveillance/Maintenance in the Workplace

Session 11– Nutrition/Nutritional Supplement:
An Alternative Approach for Workplace Health Maintenance
August 16, 1999

Dr. Wing Chan introduced the eleventh session in this fifth series of continuing education programs sponsored by NASA's Occupational Health Program, Office of Health Affairs (OHA), in cooperation with the Uniformed Services University of the Health Sciences (USUHS). Worldwide, this session is available on the Internet. Dr. Chan introduced the speakers: Ms. Catherine Angotti, a Registered Dietitian and Program Executive for Occupational Health, Office of Health Affairs, NASA Headquarters; and Dr. Scott Smith, Nutritionist and Research Scientist in the Life Sciences Research Laboratory, Johnson Space Center.

Ms. Angotti discussed the current consumer health trend towards complementary and alternative treatments. In this country and throughout the world, patients in unprecedented numbers are going outside conventional medicine for help. A recent American Osteopathic Association survey showed clear dissatisfaction with the U.S. healthcare system. About 30% of all modern drugs are derived from plants, but only about 5% of all herbal medicines are sold in pharmacies. There has been an increased use of alternative medicines between 1990 and 1997, and a large percentage of people are looking elsewhere than conventional medicine for treatment and help. The leading causes of death have changed in this century from infectious diseases to chronic diseases. In 1900, the three leading causes of death were pneumonia and influenza; tuberculosis; and gastritis, enteritis, and colitis. In the 1990s, the three leading causes of death are heart disease, malignant neoplasms (cancers), and cerebrovascular disease. We have made significant strides in heart disease; in the future, cancer death rates may exceed heart disease. Changes in dietary practices can do much to prevent premature death and the disability caused by heart disease, stroke, various cancers, and other chronic diseases. A strategic objective for chronic disease control is to change the public's perception from one of inevitability to preventability. A reduction in chronic disease burden is best achieved by altering high-risk behavioral factors such as poor nutrition and lack of physical activity. Examples of chronic disease that we are dealing with today, include heart disease, hypertension, and diabetes.

Ms. Angotti discussed prevention strategies and health maintenance. From the beginning of the practice of Dietetics until the 1970's, the principal prevention strategy was tertiary prevention, i.e., to reduce the complications/disability in a symptomatic population. Dietary practice was mainly in hospitals. In the 1980's, we moved into secondary prevention. The populations being addressed were asymptomatic, and the goal of the diet was to reduce the prevalence and the consequence of the disease. This strategy was often referred to as "disease control." In the 1990's, we are looking at primary prevention. This population base consists of those who are susceptible (e.g., have a family history, but do not yet have a particular chronic disease), and the goal of the diet is to reduce the incidence of the disease altogether. Disease risk factors must be

established for primary prevention to be feasible, e.g., recommendations to reduce the consumption of saturated fat and the promotion of physical activity.

The U.S. Public Health Service estimates that smoking, diet and physical activity patterns, and alcohol consumption are the actual causes of about 40% of all deaths. An early Surgeon General report concluded that improvements in health would be better served through health promotion than through increased medical services. Ms. Angotti discussed the therapeutic nutrition for tertiary prevention. Heart disease was typically treated with a low-calorie, low-fat, low-salt diet without particular regard to type of dietary fact (animal vs. dietary); diabetes was typically treated with a no-sugar, very low-carbohydrate diet with multiple feedings; hypertension was treated with a very-low sodium diet; ulcers were treated with a high protein, high fat, low carbohydrate approach with multiple feedings; and diverticulitis was treated with a very low residue diet. Focusing on narrow nutritional restrictions often did not achieve the desired results and made compliance for any length of time difficult. Heart disease treatment now differentiates types of fat, recommends increased soluble fiber, and encourages physical activity. Hypertension treatment now restricts sodium less, but restricts alcohol more. It also recommends increased potassium intake, weight loss, and exercise. Diabetes treatment now has less emphasis on pure sugar restriction in favor of concentrating on fiber content, weight loss, and exercise. Treatment for ulcers is less regimented, with more carbohydrate and less fat. Dietary treatment for diverticulitis has come full circle with recommendations for a high fiber diet.

Health beliefs are a key factor in why some people can be successful in preventive efforts and others cannot. Health beliefs most commonly correlated with positive health behaviors are based on a person's perception of their susceptibility to the disease in question, the severity of the disease, the benefits of the preventive actions or treatment, and barriers to taking the recommended actions. Work sites provide an opportunity to reach a captive adult audience with intervention and incentives for positive health behaviors, enhance health knowledge, facilitate screening and follow-up, and reduce the occupational hazards of the environment. The occupational health program at NASA is divided into two main categories: occupational medicine (preventive health exams, medical monitoring, etc.), and environmental health.

Reducing health risk factors through nutritional interventions and the use of primary prevention play a major role in the occupational medicine category of occupational health. When certain risk factors are present, nutrition follow-up includes recommending reduced saturated fat intake, increased soluble fiber intake, increased physical activity, and weight loss (if indicated). The life style recommendations for primary prevention in heart disease include: reduce the total fat intake to less than 30% of calories and reduce the saturated fat to less than 10% of calories; increase antioxidants; increase fish consumption; increase soluble fibers; increase Folic acid and B vitamins; and increase aerobic activity. When certain risk factors are present for diabetes, nutrition recommendations include reduced sugar intake, increased complex carbohydrate intake, physical activity, and weight loss if indicated. Life style recommendations for primary prevention of diabetes include: lose weight (if overweight); discourage concentrated sweets; restrict the total fat intake to 25-30% of calories; increase the consumption of complex

carbohydrates; increase aerobic activity; decrease alcohol intake; and avoid micronutrient supplementation. When risk factors are present for hypertension, nutrition recommendations include increase of potassium-rich foods, restriction of alcohol intake, increased physical activity, and weight loss (if indicated). Recommendations for primary prevention for high blood pressure include: weight loss (if overweight); limited alcohol; increased aerobic activity to 30-45 minutes most days; reduced sodium intake; adequate potassium intake; adequate intakes of calcium and magnesium for general health; smoking cessation; and reduced intake of dietary fat and cholesterol. When risk factors are present for cancers, nutrition recommendations may include reducing body fat, restricting alcohol and total fat consumption, and increasing fiber content. No known individual foods are carcinogens. Life style recommendations for primary prevention of cancer include: increase food sources of antioxidants; increase dietary fiber; reduce animal fat intake; decrease alcohol intake; lose weight (if overweight); and increase activity.

The FDA is charged with regulating both foods and pharmaceuticals. A product must be either a food or a drug; it cannot be both. Herbal medicines and nutrition supplements do not have to meet the same strict requirements as pharmaceuticals. Daily Reference Values (DRVs) appear on food labels as a set of dietary references that are based on a 2,000 kcal diet and are set for nutrients not addressed by the Recommended Dietary Allowances (RDA). DRVs are provided on food labels for fat, saturated fatty acids, cholesterol, total carbohydrate, fiber, sodium, potassium, and protein. Ms. Angotti discussed several current nutrition terms. *Phytomedicines* are herbs as medicinal plants (also called botanicals). They contain plant materials as their pharmacologically active component and are often complex mixtures of compounds that generally do not exert a strong or immediate action. Herbs are regulated as dietary supplements under the Dietary Supplement Health and Education Act of 1994. *Nutriceuticals* are foods, food-derived compounds, dietary supplements, or natural food additives that have demonstrated to offer health benefits. They include *functional foods, pharmafoods, and designer foods*. Functional foods have been around for decades. Milk with vitamin D, orange juice with calcium, cereals fortified with iron are some examples. Further studies are needed to evaluate the role/impact of these foods in an overall balanced diet. "Health diets" need to begin early in childhood and continue throughout life. Populations with a positive family history for certain chronic diseases should consume a "balanced/health diet." The worksite is an excellent opportunity for primary prevention through health education and wellness programs. One of the major things that can be done is an on-site cafeteria program that offers patrons a choice for reduced fat foods, fresh fruits and vegetables, options for a vegetarian diet, etc. NASA started a "Happy Heart" program in the late 1970s. At the NASA cafeteria sites, it reduced the number of saturated fat and high-sodium foods and increased the number of complex carbohydrates (through introduction of salad bars), and identified foods low in saturated fat and sodium.

There are certain nutrients that are used as medicine in primary prevention: calcium; carotenoids, e.g., beta carotene; folic acid; potassium and magnesium; selenium; vitamin C/ascorbic acid; and vitamin E. Some botanicals and herbs commonly used as medicines in primary prevention are bilberry, chamomile, Echinacea, feverfew, garlic, ginko biloba, ginseng, kava-kava, psyllium, and St. John's Wort. These botanical and herbs can have some harmful side effects. Health care

professional must become educated regarding the beneficial and harmful effects of alternative nutrition therapies, include supplement usage in initial drug history, and caution patients who use botanicals and nutritional supplements about the lack of quality and safety regulations. Medwatch has a toll free number for reporting adverse effects of herbs (1-800-332-1088). In addition, the Office of Alternative Medicine has a web site: altmed.od.nih.gov.oam. These are web sites for sound and reliable nutrition information:

- The American Dietetic Association—http://www.eatright.org;
- The International Food Information Council Foundation—http://ificinfo.health.org;
- Johns Hopkins Health Information—htttp://www.intelihealth.com/IH/ihtIH;
- Medline—http://www.nlm.nih.gov/databases/freemedl.html;
- Government Healthfinder—http://www.healthfinder.gov;
- and the Mayo Health Oasis (of the Mayo Clinic)—http://www.mayohealth.org.

Questions:

HQ: You mentioned the Dietary Supplement Health and Education Act of 1994 that has created a great deal of controversy. In your opinion, do you believe the FDA should be more involved in regulation of botanicals for safety and efficacy?
Ms. Angotti: Assuming that FDA is the appropriate regulatory agency, there should be more involvement, definitely for safety and efficacy, because of the large numbers of people who are using these products. Problems result from an individual's failure to disclose the use of dietary supplements when they visit with their private physicians. About 30% of the population are taking supplements or are using alternative treatments that could affect their health.

HQ: I have heard that grape seed extract is the component that is important in heart disease, rather than the wine itself. Is this so?
Ms. Angotti: I have some information on grape seed extract, and I will provide it to you separately. Please note that there are also some side effects listed.

ARC: A recent study at Berkeley on garlic showed that if anything, it raises cholesterol instead of lowering it, which is interesting.
Ms. Angotti: I am not aware of that particular study, but would like to see it. Several published sources I have researched indicate the positive effects of garlic. In terms of actual garlic intake, the equivalent would be half a clove a day.

HQ: The answer to whether nutrition supplement can be considered an alternative approach to health surveillance is increasingly positive at this time. Have any other federal agencies or industries implemented nutrition programs?
Ms. Angotti: Nutrition has been advancing for a long time as a source for alternative treatment. In terms of federal agencies that have wellness programs with nutrition as an element, I believe that probably NASA is in the forefront. DHHS had a very good program at one time, but I am not up to date on their current status. Funding cuts may have effected their program.

HQ: With respect to weight control, how do people wade through all of the noise in supplements in that area? Is there a distinction between food and natural supplements and chemotherapy drugs?
Ms. Angotti: It is almost impossible even for those in the field to wade through all of the information on supplements for weight control, fat-burners, etc. This task has been made more difficult in recent years due to the abundant availability of nutrition and dietary supplement information on the Internet. My recommendation is to not try to tackle it all, but rather focus on a change in eating patterns and increase in physical activity as the best approach to health maintenance. In terms of whether or not the different supplements for cancer and their toxicity are regulated any more than other "normal" supplements—they are not. They are allowed to make their claims and are not well regulated. However, if it is a prescription medicine, that is different—those are regulated as a pharmaceutical.

Dr. Smith discussed nutritional issues in space flight and how JSC is working towards long duration space flight and what nutritional issues have to do with it. There are several functions of nutrition in the space program. The first and most obvious is to meet the energy and nutrient requirements of the crewmembers. Nutrition also serves an important aspect of life in space—psychosocial aspects (the importance of mealtimes, palatable food, etc.). It also acts as a countermeasure to some of the negative aspects of space flight on the human body. There are a number of physiological changes that occur during space flight: loss of body mass, lean tissue, and bone tissue and mineral; decreased red blood cell mass; fluid shift; cardiovascular deconditioning; and radiation exposure. All of these have nutritional impact. There are a number of nutrients we are concerned about in the space program. We are often concerned about crewmembers not getting enough energy, fluid, calcium, protein, vitamin D, vitamin K, and antioxidants. We are concerned about crewmembers getting too much iron and sodium. Sodium is one of the ways food is preserved, and sodium in preserved food diets, such as those on the Shuttle, tends to be rather high. High sodium diets are known to increase urinary calcium and this is something we want to avoid.

When we look at the diet composition during space flight (culled from previous reports from Skylab, Shuttle, and Mir), preflight and in-flight data, we can see how much of the diet calories came from fat, carbohydrates, and protein. Preflight, the crew ate fairly well. During flight, there was an increase in carbohydrates and a corresponding decrease in fat. Dietary protein held relatively constant. The problem with dietary intake during space flight is not the composition of the diet, but how much the crew is eating. Skylab was the only program where crewmembers ate the amount of food that we had hoped that they would. On the other programs (Apollo, Shuttle, and Mir), crewmembers ate only about 70% of the desired intake. Dietary intake is a significant concern during space flight, and as a result of the early work in the Mir program, we developed a nutritional status assessment project designed to look at nutritional status of crewmembers before, during, and after space flight. A panel of seven extramural experts were brought in to help design a comprehensive nutritional assessment profile. The assessment was

designed such that crewmembers were studied at six months and one or two weeks before the flight. The six-months provided for a baseline. In-flight, we studied dietary assessment, limited biochemical assessment, and body mass. Post-flight, we did biochemical assessment and looked at body weight and composition. If any deficiencies were found, we worked with crewmembers through their post-flight rehabilitation program.

Dr. Smith showed the questionnaire used during flight, which covered both the U.S. food system and the Russian food system on Mir. Once a week, crewmembers would fill out the questionnaire and results were downlinked and analyzed. Feedback was provided to the flight surgeon with respect to six key nutrients, among them energy, fluid, protein, and calcium. Dietary questionnaires are often subject to scrutiny, and Dr. Gladys Block (formerly with the National Cancer Institute and now at the University of California at Berkeley) was brought in to assist with the development of the Food Frequency Questionnaire (FFQ) to make sure that it would provide the information needed. Ground-based validation studies were done on the questionnaire. The FFQ provided a reliable estimate of intake of key nutrients. The FFQ was implemented with two astronauts. These two crewmembers ate approximately 50% of what their dietary requirements were predicted to be. When we look at body mass data, these two crew lost an excessive amount of body weight (over 10%). There was a compartmental fluid shift during space flight, but there was little or no evidence of dehydration or diuresis. Fluid intake is critical for reducing renal stone risk; the two crewmembers never reached the required fluid intake (about 2 liters/day). Crewmembers, on average, exceed the required 2 liter/day. In four subjects from Mir flights, vitamin D levels decreased during space flight (about 30-40% below pre-flight levels). The data also showed that there was a decrease of vitamin D storage during flight, a decrease in the active form of vitamin D, and a decrease in calcium absorption (50% below pre-flight levels). For three crewmembers, there was a 50-75% increase in bone calcium resorption during space flight, which quickly returned to normal after space flight. One other index from the study is bone calcium balance. On average, among the three crewmembers, there was about 250 mg/day negative calcium balance. After the flight, bone calcium reaccretion was approximately 100 mg/day. With these losses and gains, recovery would take about two to three times the length of the mission. This data compares reasonably well with bed rest studies. Iron intake is excessive in crewmembers consuming 70% of requirements. The concern for increased iron intake is related to the fact that there is increased iron storage during space flight. There is a decrease in red blood cell mass and an increase in tissue iron availability as well as an increase in iron storage. The question is: what happens to iron absorption during space flight, and is it increased to the point where we need to restrict iron intake even further? Another area that we have recently begun to examine is markers of oxidative damage to DNA. Data shows that these markers are increased after extended-duration space flight. This relates to the iron story—with excess iron availability, iron is a potential oxidant.

As we start to look to the future and developing food systems for future programs, there are a number of issues that need to be addressed: nutrient content; palatability; shelf-life; preparation; and storage. Nutritional supplementation is one of the most prevalent questions. The food system ought to provide all that the crewmembers need, and supplementation should not be

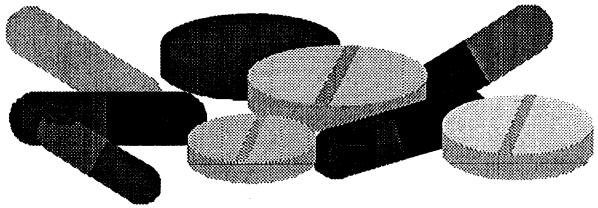
necessary except in severe cases. There may be potential impact on other dietary intake; specifically, we are often concerned that crewmembers do not eat enough in general. If they had a multi-vitamin supplement on board, there is concern that they would take the supplement and skip meals. The form of supplements is also at issue. Tablet forms are not as easily absorbed. One always needs to be concerned about nutrient interactions and bioavailability. If we are going to supplement, monitoring will be critical.

Energy and fluid intake are critical for maintaining health. This has been proven on the ground and in space flight. There is growing evidence that vitamin K may be even more important in bone health. There is a preliminary report on one study done on Mir which seems to indicate that vitamin K supplementation did improve some of the markers of bone metabolism. This needs to be studied further. We need to look closer at anti-oxidants as a potential means to counteract some of the radiation concerns during space flight. Many of these things have been looked at in ground-based studies and in flight. Adequate levels of nutrients will not be a panacea for all of the concerns; however, it is clear that if adequate levels are not provided, we will exacerbate the problem. Nutrition will continue to play an important role for crew health and in countermeasure development during extended-duration space flight. Space food systems need to be designed that will meet the nutritional requirements of the crewmembers, while providing variety and palatability to ensure consumption. Dr. Smith noted all of his collaborators on the material contained in his presentation.

Questions/comments:

Dr. Nicogossian: Nutrition is a very important issue for space flight as well as for occupational health. We have seen problems with nutrition because of adaptive and psychological issues. High protein/low fluid intake, along with high activity/exercise are common denominators for kidney stone development. Nutrition can be critical. If one provides a diet that is not conducive to adaptation, we know that there will be some problems. The issue of different cultures and ethic groups utilizing foodstuff is also very important.

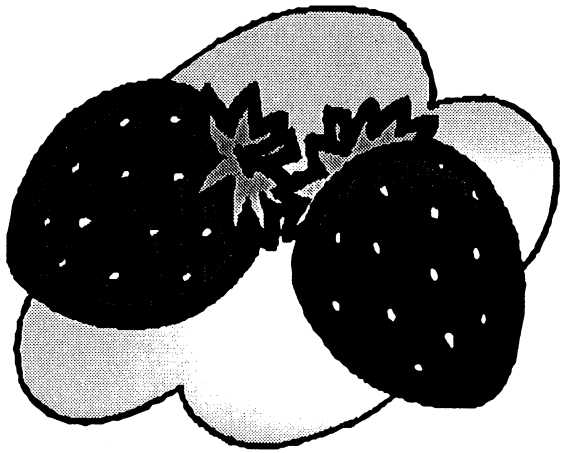
HQ: Didn't you find it difficult to get the astronauts to recall weeklong food intakes for the questionnaires?
Dr. Smith: We did have concerns about that. When we did the ground based studies (a 60-day and a 90-day), both fared very well. The crewmembers were motivated and trained on how to do this, and we have very high confidence. The crewmembers on the Mir program were also highly motivated and did not express a concern. The space program uses a fairly small number of food items; the menu cycle repeated itself every six days on Mir.



Nutrition/An Alternative Approach to Health Maintenance in the Workplace

Catherine M. Angotti, R.D., L.D.

Aug. 16,1999



Current Trend Towards Complementary and Alternative Treatments

"In this Country, & throughout the world, patients in unprecedented numbers are going outside conventional medicine for help"

Recent American Osteopathic Association survey showed clear dissatisfaction with U.S. healthcare system

30% of all modern drugs are derived from plants, but only 5% of all herbal medicines are sold in pharmacies

Increased use of Alternative Medicines Between 1990 and 1997

	1990	1997
Herbal Medicines	2.5*	12.1
Megavitamins	2.4	5.5
Folk Remedies	0.2	4.2
Homeopathy	0.7	3.4

* Percent of Respondents in 1998 JAMA survey

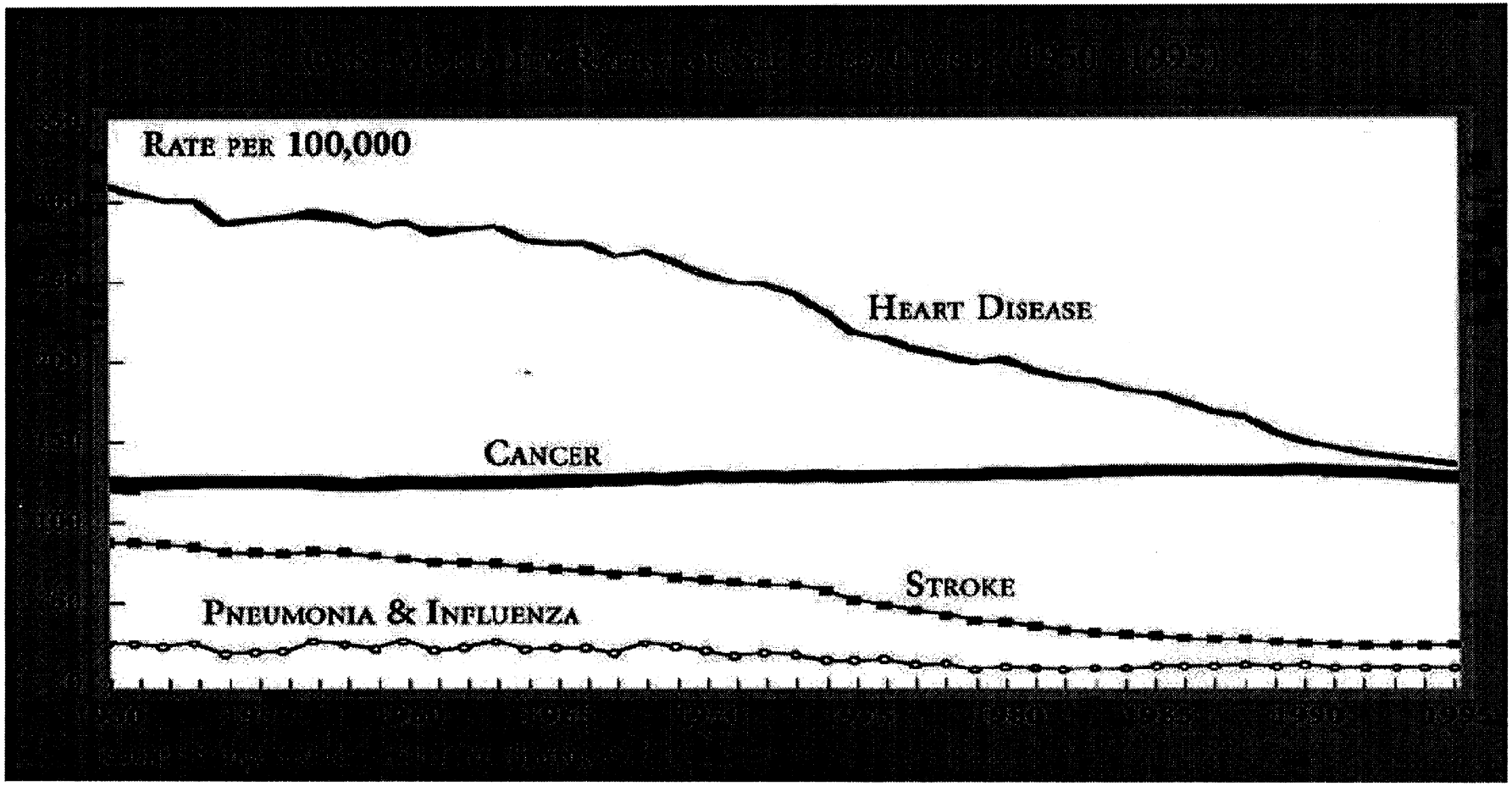
Leading Causes of Death

The leading causes of death have changed in this century from infectious diseases to chronic diseases.

In 1900, the 3 leading causes of death were pneumonia and influenza; tuberculosis; and gastritis, enteritis, and colitis

In the 1990s, the 3 leading causes of death are heart disease; malignant neoplasms; and cerebrovascular disease

Changes in U.S. Mortality Rates



Diet as Preventive Medicine

Changes in dietary practices can do much to prevent premature death and the disability caused by heart disease, stroke, various cancers, and other chronic diseases.

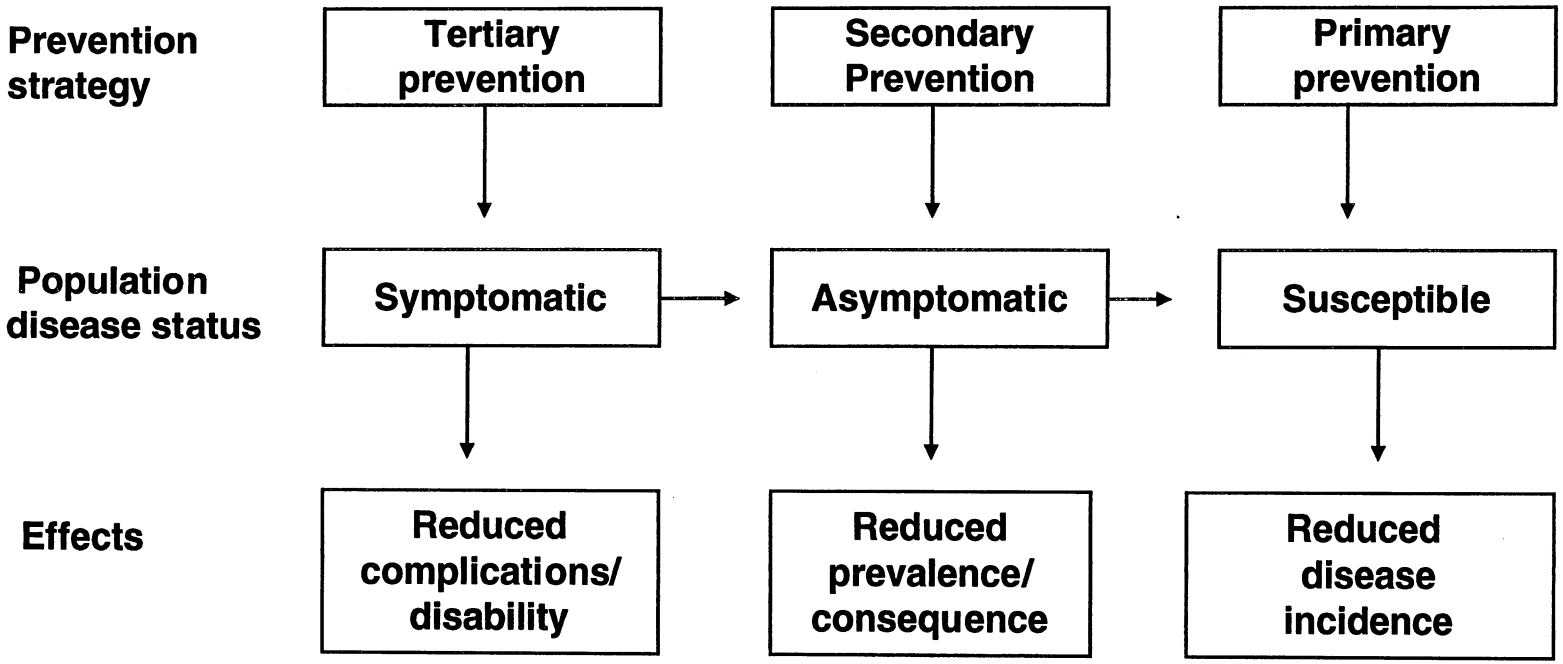
Nutrition labeling has shifted from reflecting deficiency disease RDAs to Dietary Reference Values for chronic disease prevention

Nutrition and Chronic Disease Control

A strategic objective for chronic disease control is to change the public's perception from inevitability to preventability

A reduction in chronic disease burden is best achieved by altering high risk behavioral factors such as poor nutrition and lack of physical activity.

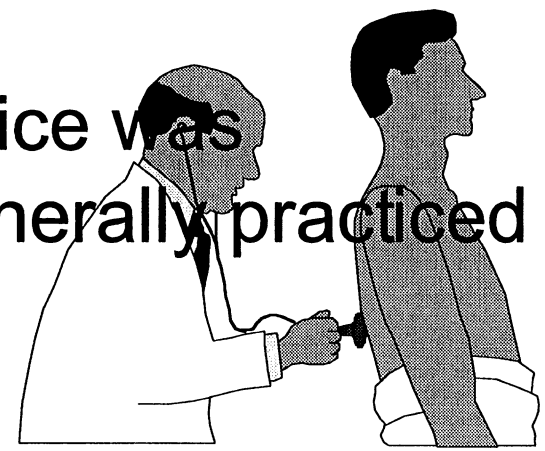
Prevention Strategies and Health Maintenance



Dietary Prevention Classifications

Tertiary dietary prevention was typically directed at preventing disability of the persons who already had symptomatic disease such as diabetes, hypertension, ulcers, etc.

Hence most early dietary practice was therapeutic in nature and generally practiced in a hospital setting



Dietary Prevention Classifications

Secondary dietary prevention is directed at people who are asymptomatic, but have developed the biological changes from the disease.

Often referred to as “disease control”, its goal is to detect the condition thru screening at an earlier, more treatable phase, e.g cholesterol and blood pressure screenings

Dietary Prevention Classifications

Primary dietary prevention is directed at a susceptible people before they develop a particular chronic disease.

Disease risk factors must be established for primary prevention to be feasible, e.g. recommendations to reduce the consumption of saturated fat and the promotion of physical activity.

Impact of Nutrition on Chronic Disease

The U.S. Public Health Service estimates that smoking, diet and physical activity patterns, and alcohol use are the actual causes of about 40% of all deaths.

An early Surgeon General *Healthy People* report concluded that improvements in health would be better served thru health promotion than thru increased medical services.

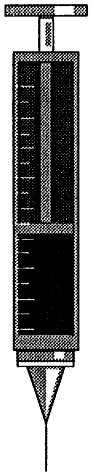
Therapeutic Nutrition/Tertiary Prevention

Heart Disease

- Typically treated with a low-calorie, low-fat, low-salt diet without necessary regard to type of dietary fat (animal vs. dietary)

Diabetes Mellitus

- Typically treated with a no-sugar, very low-carbohydrate diet with rigidly-fixed multiple feedings



Tertiary Prevention (continued)

Hypertension

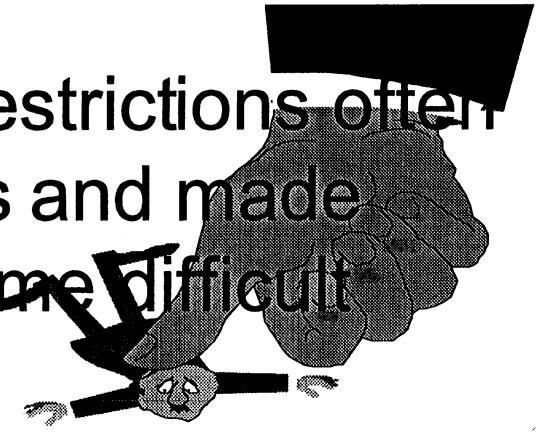
- Typically treated with very-low sodium diets (500 - 1000 mg.)

Gastrointestinal (Ulcers, Divirticulitis)

- Ulcers treated with a high-protein, high-fat, very low-carbohydrate approach with multiple feedings and divirticulitis treated with a very low residue diet

Shifting From Tertiary Dietary Prevention

Focusing on narrow nutritional restrictions often did not achieve desired results and made compliance for any length of time difficult



- Heart disease treatment now differentiates types of fat, recommends increased soluble fiber, and encourages physical activity
- Hypertension treatment now restricts sodium less, restricts alcohol more, recommends increased potassium intake, weight loss, and exercise

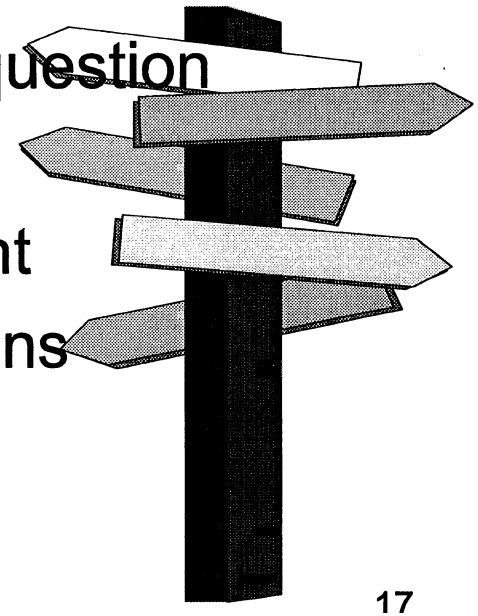
Shifting From Tertiary Dietary Prevention

- Dietary treatment for Diabetes treatment has less emphasis on pure sugar restriction in favor of concentrating on fiber content, weight loss and exercise
- Dietary treatment for ulcers is less regimented with more carbohydrate and less fat.
- Dietary treatment for divirticulitis, unless in the acute inflammatory phase, has come full circle with recommendations for a high fiber diet.

Correlation of Health Beliefs

Health beliefs most commonly correlated with positive health behaviors are based on a person's perception of:

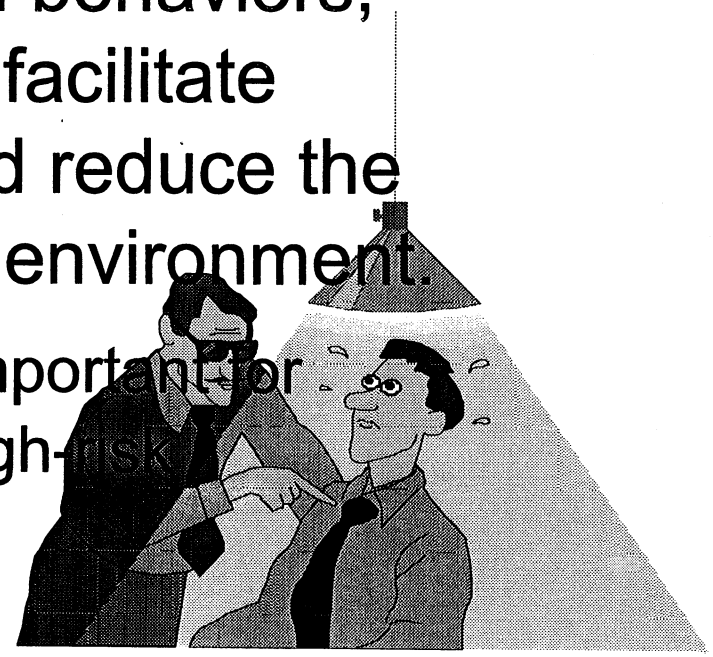
- Personal susceptibility to the disease in question
- Severity of the disease
- Benefits of preventive actions or treatment
- Barriers to taking the recommended actions



Secondary Nutrition Prevention

Work sites provide an opportunity to reach a captive adult audience with interventions, incentives for positive health behaviors, enhance health knowledge, facilitate screening and follow-up, and reduce the occupational hazards of the environment.

- Work sites are particularly important for delivering interventions to high-risk populations (e.g. CVD)



Nutrition As Secondary Prevention

Heart Disease

When certain risk factors are present (e.g. elevated cholesterol or decreased HDL-chol), nutrition follow-up includes recommending reduced saturated fat intake, increased soluble fiber intake, increased physical activity, and weight loss if indicated

Life Style Recommendations
Primary Prevention in Heart Disease

- Nutrition can change CHD incidence & severity
- Reduce total fat intake to < 30% of calories; reduce saturated fat to <10% of calories
- Increase antioxidants (esp. Vitamin E)
- Increase fish consumption
- Increase soluble fibers (fruits, grains & legumes)
- Increase Folic acid an B vitamins (fruits, vegetables, grains) if homocysteine levels elevated
- Increase aerobic activity

Nutrition As Secondary Prevention

Diabetes Mellitus

When certain risk factors are present (e.g. elevated blood glucose or obesity with a positive family history) nutrition recommendations include reduced sugar intake, increased complex carbohydrate intake, physical activity, and weight loss if indicated.

Life Style Recommendations
Primary Prevention in Diabetes Mellitus

- Estimated 14-16 million Americans have diabetes
- Lose weight if overweight
- Concentrated sweets discouraged (limited simple sugars allowable in the context of a mixed diet)
- Restrict total fat intake to 25-30% of calories
- Increase consumption of complex carbohydrates
- Increase aerobic activity
- Decrease alcohol intake
- Avoid micronutrient supplementation

Nutrition As Secondary Prevention

Hypertension

When risk factors are present (e.g. elevated blood pressure or obesity with a family history of stroke or hypertension)nutrition recommendations include increase of potassium-rich foods, restriction of [illegible] intake, increased physical activity, and weight loss if indicated

Life Style Recommendations
Primary Prevention in High Blood Pressure

- Lose weight if overweight
- Limit alcohol
- Increase aerobic activity to 30-45 min. most days
- Reduce sodium intake
- Maintain adequate potassium intake
- Maintain adequate intakes of calcium & magnesium for general health
- Stop smoking for overall cardiovascular health
- Reduce intake of dietary fat and cholesterol

Nutrition As Secondary Prevention

Cancers

When risk factors are present (e.g. a positive family history, elevated PSA, or positive mammography) nutrition recommendations may include reducing body fat, restricting alcohol and total fat consumption, and increasing fiber content.

Life Style Recommendations
Primary Prevention in Cancer

- No known individual foods are carcinogens
- Increase food sources of antioxidants (carotenoids, tocopherols, ascorbic acid)
- Increase dietary fiber (2:1 soluble to insoluble)
- Reduce animal fat intake
- Decrease alcohol intake
- Lose weight if overweight (increased cancer mortality with a BMI >30)
- Increase activity

Health Food/Supplement Regulation

- A product must be *either* a food or a drug. It cannot be both.
- FDA is charged with regulating both foods and pharmaceuticals
- Herbal medicines and nutrition supplements do not have to meet the same strict requirements (structure & function claims) as pharmaceuticals

Nutrition Terms

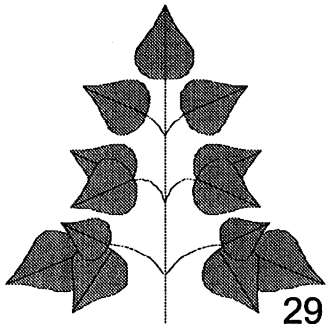
Daily Reference Value (DRV): Appear on food labels as a set of dietary references that are based on a 2,000 kcal diet, and are set for nutrients not addressed by the Recommended Dietary Allowances (RDA) which are set and updated by the National Academy of Sciences.

DRVs are provided on food labels for fat, saturated fatty acids, cholesterol, total carbohydrate, fiber, sodium, potassium, and protein

Nutrition Terms

Phytomedicines: herbs as medicinal plants, also called botanicals. They contain plant materials as their pharmacologically active component and are often complex mixtures of compounds that generally do not exert a strong or immediate action.

Herbs are regulated as dietary supplements under the Dietary Supplement Health and Education Act of 1994.



Nutrition Terms

Nutraceuticals: Foods, food-derived compounds, dietary supplements, or natural food additives that have demonstrated to offer health benefits.

- Functional food: **any modified food that may provide a health benefit beyond the traditional nutrients it contains**
- Pharmafood: **food or nutrient that claims medical or health benefits including disease prevention**
- Designer food: **Processed foods supplemented with ingredients rich in disease-preventing substances. May involve genetic engineering**

Nutrition Terms

Functional Foods

- Have been around for a long time,(e.g. milk w/ Vitamin D, orange juice w/ calcium, cereals fortified w/ iron)
- Touted for ability to reduce disease risk
- No legal definition or set labeling standards
- Need further studies to evaluate role/impact in overall balanced diet

Nutrition as Primary Prevention

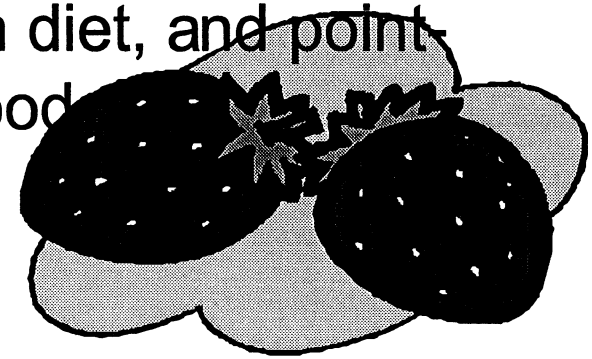
"Health Diets" need to begin early in childhood and continue throughout life

Populations with positive family histories for certain chronic diseases should consume a "balanced/health diet" with emphasis on diversity and the links between a high consumption of animal fats and a low consumption of complex carbohydrates to the risk for developing those diseases.

Primary Prevention at the Worksite

Excellent opportunity through health education and wellness programs (i.e. smoking cessation, physical fitness, stress management, and on-site cafeteria programs)

Successful cafeteria nutrition programs offer patrons a choice for: reduced fat foods, fresh fruits and vegetables, options for a vegetarian diet, and point-of-service identification of special food



Primary Prevention: Nutrients as Medicine

Calcium

Carotenoids, e.g. Beta Carotene

Folic Acid

Potassium and Magnesium

Selenium

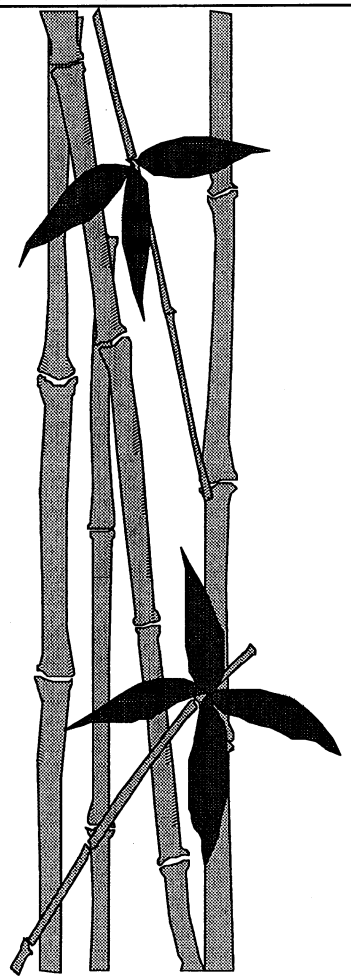
Vitamin C/Ascorbic Acid

Vitamin E

Primary Prevention: Botanicals and Herbs as Medicine

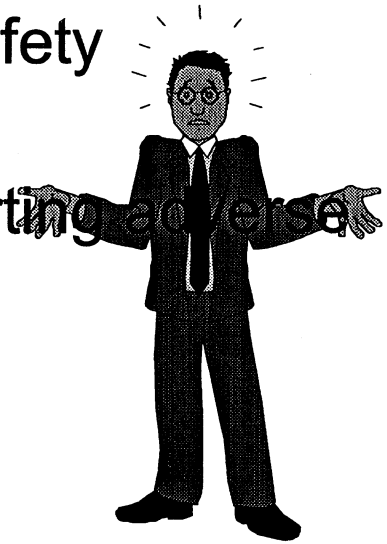
Bilberry
Chamomile
Echinacea
Feverfew
Garlic

Ginko bilboa
Ginseng
Kava-kava
Psyllium
St. John's Wort



Health Care Professionals' Responsibilities

- Become educated re: beneficial & harmful effects of alternative nutrition therapies (Poisindex or Medline)
- Include supplement usage in initial drug history
- Caution patients who use botanicals and nutritional supplements re: the lack of quality & safety regulations
- MEDWATCH: toll free number for reporting adverse effects of herbs (1-800-332-1088)
- OAM web site: altmed.od.nih.gov.oam



Sound Nutrition Information on the Internet

The American Dietetic Association

http://www.eatright.org

The International Food Information Council Foundation http://ificinfo.health.org

Johns Hopkins Health Information

Http://www.intelihealth.com/IH/ihtIH

Sound Nutrition Information on the Internet

Medline

Http://www.nlm.nih.gov/databases/freemedl.html

Government healthfinder

Http://www.healthfinder.gov

Mayo Health Oasis (of the Mayo Clinic)

Http://www.mayohealth.org

Back Up

Back-Up

American Osteopathic Association Survey

- Most Americans don't believe U.S. healthcare industry cares @ promoting the general well-being of the populace
- 4 out of 5 Americans don't have access to decent healthcare
- 7 out of 10 feel healthcare costs are a "rip-off" making vast sums of money for insurance companies and large hospital chains

People with chronic or incurable diseases often turn to C&A nutritional therapies for a "sense of control", the mental comfort from taking action, and the belief that conventional medicine has failed them.

Back-Up

Chronic Disease: defined as a disease that has a prolonged course, that does not resolve spontaneously, and for which a complete cure is rarely achieved.

Some examples of chronic diseases are heart disease, hypertension, and diabetes mellitus

Secondary Nutrition Prevention

The work site is an ideal setting to practice secondary prevention since the purpose of screening and follow-up service is to detect and treat disease at an early, curable, asymptomatic stage.

e.g. screening for hypertension,cholesterol, diabetes, and cancers (mammography, PAP, PSA, etc.)in a health maintenance physical exam

Back-Up

NASA's Cardiovascular Risk Reduction Program as a prime example of secondary dietary prevention

- High risk individuals for dyslipidemia
- Step II NCEP dietary protocols
- Recommendations for 15 hours of aerobic activity per month
- Dietary and exercise record-keeping
- Follow-up consultations for reinforcement
- Repeat lab work

Back-Up

NASA's Happy Heart Program began in late 1970's

Program proposed to reduce the number of saturated fat foods, reduce added sodium and high sodium foods, increase complex carbohydrates through addition of a salad bar at all sites, and identify foods low in cholesterol and saturated fat with the happy heart symbol

Back-Up

Calcium: Mineral, protects against osteoporosis. May inhibit cholesterol production, lowers LDL-cholesterol levels by increasing fatty acid excretion, and may lower blood pressure. May be useful in relieving moderate to severe PMS symptoms.

Sources: Dairy products, dark leafy greens, canned salmon w/bones

Beta Carotene: Powerful antioxidant. Reduces damage from free radicals. Demonstrated to be effective against certain types of cancers, heart diseases and stroke.

Sources:carrots, sweet potatoes, dark green vegetables

Back-Up

Folic Acid: Helps reduce certain birth defects, reduces the risk for heart disease, and may reduce breast cancer risk. RDAs recently significantly increased, but requirements still easily met because of 1998 enrichment initiative that adds folic acid to all grain-based foods

Sources: Naturally occurring in whole grains, fruits and vegetables

Potassium and Magnesium: Minerals. Based on recent large prospective studies, substantially reduce the risk of stroke.

Sources: grain foods, fruits and vegetables

Back-Up

Selenium: Essential trace element. Animal and human studies show promise as immunostimulant, antioxidant, and chemoprotective agent. 30 years of epidemiological studies show inverse relationship between serum selenium and overall cancer mortality rates

Sources: Brazil nuts, tuna, crab, soy beans, and whole grains

Vitamin C/Ascorbic Acid: Antioxidant. Requirements are increased w/ smoking. In some studies, shown to help prevent stroke, hypertension, heart attack, and cataracts. Best known for ability to reduce severity of cold symptoms thru daily dosing during winter months or as abortive therapy at first signs of cold

Sources: citrus fruits, strawberries, broccoli, potatoes

Back-Up

Vitamin E: Antioxidant. Protects body from cell damage that lead to cancer, heart disease, and cataracts. Combined with other antioxidants, offers protection against major chronic diseases e.g. atherosclerosis. May be mildly effective in slowing the rate of progression of Alzheimer's dementia

Sources: vegetable oils, wheat germ, seed, nuts, peanut-butter

Adverse Effects of Certain Dietary Elements

Alcohol: Increases risk of cancers of the mouth, esophagus, and liver. May increase risk of colon, rectal, and breast cancer by increasing cancer-causing free radicals

Salt: Excess sodium and salt-preserved foods increase risk of stomach cancer. May increase hypertension severity and risk for stroke in salt-sensitive individuals

Saturated Fats: Mostly animal origin. High intakes directly linked to CVD, elevated lipids, and certain types of cancer

Back-Up

Bilberry: Antioxidant. Used as a treatment for night blindness, micro-circulatory disorders and varicose veins. Effects of ingestion of large doses unknown. Self-medication for night-blindness may delay accurate diagnosis and long-lasting treatment.

Chamomile: Touted as an antispasmodic with sedative effect. May cause contact dermatitis and severe hypersensitivity in persons allergic to ragweed, asters, and crysanthemums.

Echinacea: Appears to shorten duration and frequency of the common cold. Immune stimulant and wound-healing enhancer. Contraindicated for persons w/ systemic diseases, e.g. TB, MS, and other auto immune diseases and HIV. Maybe detrimental for diabetics

Back-Up

Feverfew: Thought to help migraine headaches. Causes vasodilatation and reduces inflammation. Rebound symptoms may occur after discontinuation. Long-term safety not established. Contraindicated in pregnancy and for children, if chewed, can cause mouth ulceration, tongue inflammation, lip swelling, and loss of taste.

Garlic: Medicinal preparations have existed for thousands of years. Studies have shown effectiveness in significantly reducing CVD risk by effecting biosynthesis, transport, and uptake of cholesterol and lowering LDL cholesterol. May cause hypotensive circulatory reactions and/or prolonged bleeding and clotting time.

Back-Up

Ginko bilboa: Leaf extract. Thought to help dementia and may show promise for use with Alzheimer's. Possible side effects include headache, dizziness, heart palpitations, and dermatological reactions. Ginko seeds are toxic. Contact w/ fruit pulp causes allergic dermatitis.

Ginseng: Touted as performance enhancer and aphrodisiac by increasing resistance to physical., chemical, and biological stress and building up vitality. May cause nervousness. Contraindicated in diabetes due to hypoglycemic effect. Not recommended for pregnant and lactating women.

Back-Up

Kava-kava: Touted for general anxiety disorders. Mechanism unknown. In beverage form often causes numbness of the mouth. May adversely affect motor reflexes. Do not use more than 3 months w/out medical advice. Do not use w/ alcohol, barbiturates, and other psychoactive agents.

Psyllium: demonstrated to cause small, but significant reductions in serum cholesterol levels

St. John's Wort: Known as the herbal anti-depressant. Thought to inhibit seretonin re-uptake. Reported side effects rare. No known drug interactions, but contraindicated w/ other anti-depressants

NUTRITION ISSUES FOR SPACE TRAVELERS

S. M. Smith
Life Sciences Research Laboratories
NASA Johnson Space Center, Houston, TX

Functions of Nutrition in the Space Program

- Meet Energy / Nutrient Requirements
- Psychosocial Aspects
- Countermeasure

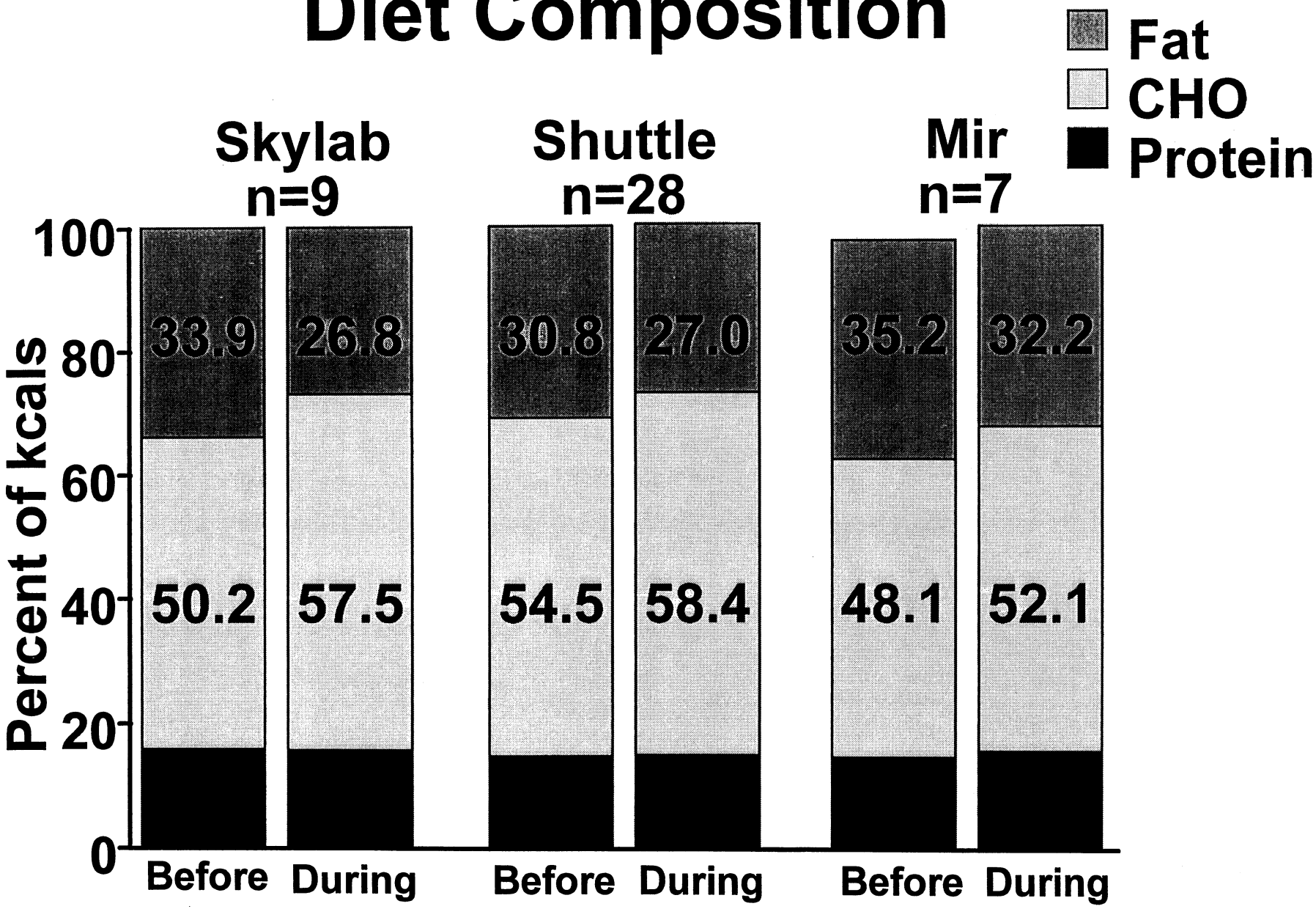
Physiological Impact of Space Flight

- Loss of: Body Mass
  Lean Tissue
  Bone Tissue / Mineral
- Decreased Red Blood Cell Mass
- Fluid Shift
- Cardiovascular Deconditioning
- Radiation Exposure

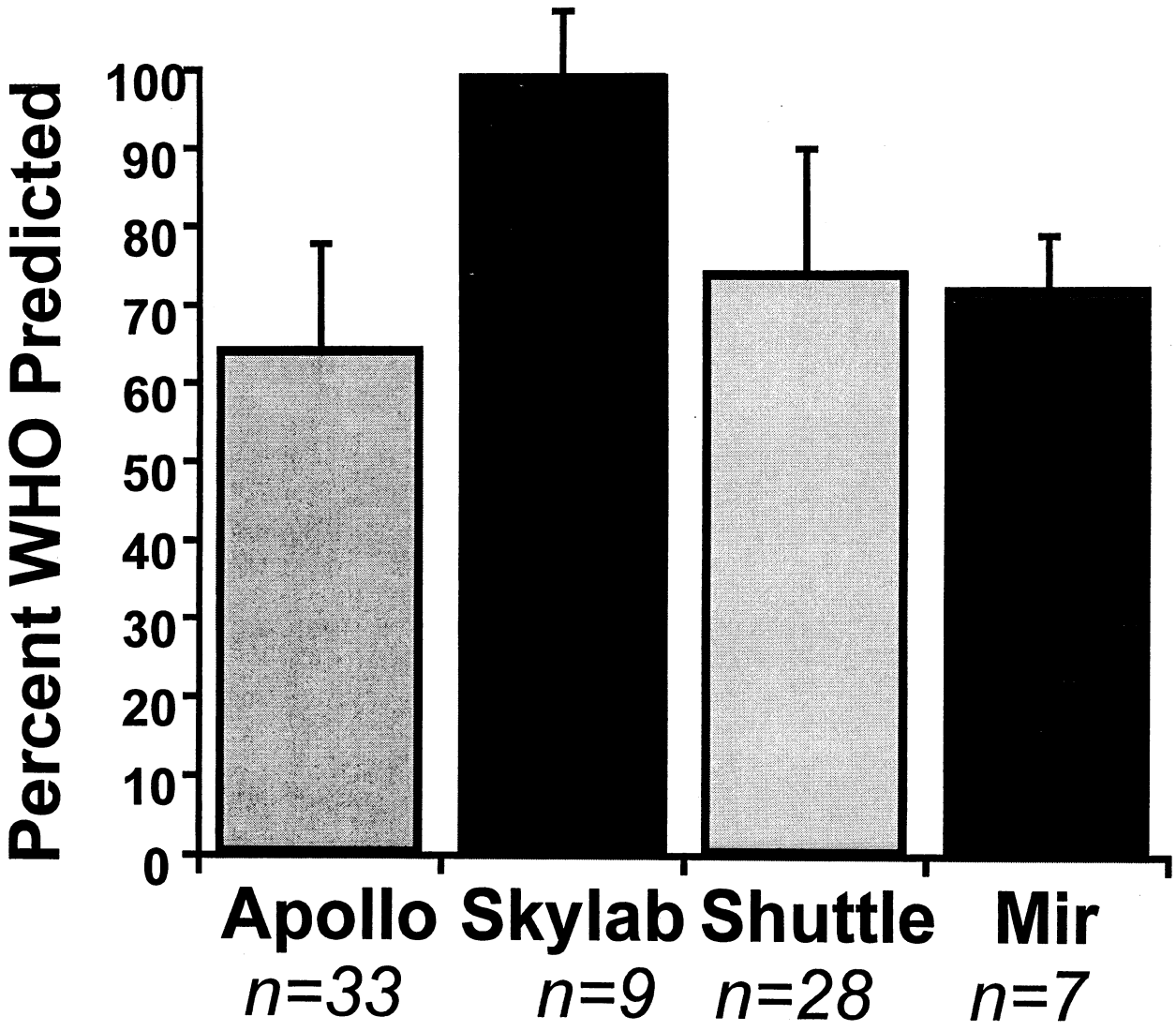
Nutrients of Concern

- Energy
- Fluid
- Calcium
- Protein
- Vitamin D
- Vitamin K
- Antioxidants
- Iron
- Sodium

Diet Composition



In-flight Energy Intake



Nutritional Status Assessment

- Dietary intake assessment:
  - Food Frequency Questionnaire
- Body weight and body composition
- Biochemical assessment of nutritional status:
  - Protein status
  - Iron status
  - Antioxidant status
  - Vitamin and Mineral status
  - Blood Chemistry
- Renal stone risk profile
- Bone health: DEXA and Biochemical indices

Extramural Experts

Gladys Block, Ph.D.
Professor, Epidemiology and Public Health Nutrition
University of California-Berkeley

Stephen P. Coburn, Ph.D.
Director, Biochemistry Department
Fort Wayne State Developmental Center

Michael Holick, M.D., Ph.D.
Director, Vitamin D, Skin and Bone Research Laboratory
Boston University School of Medicine

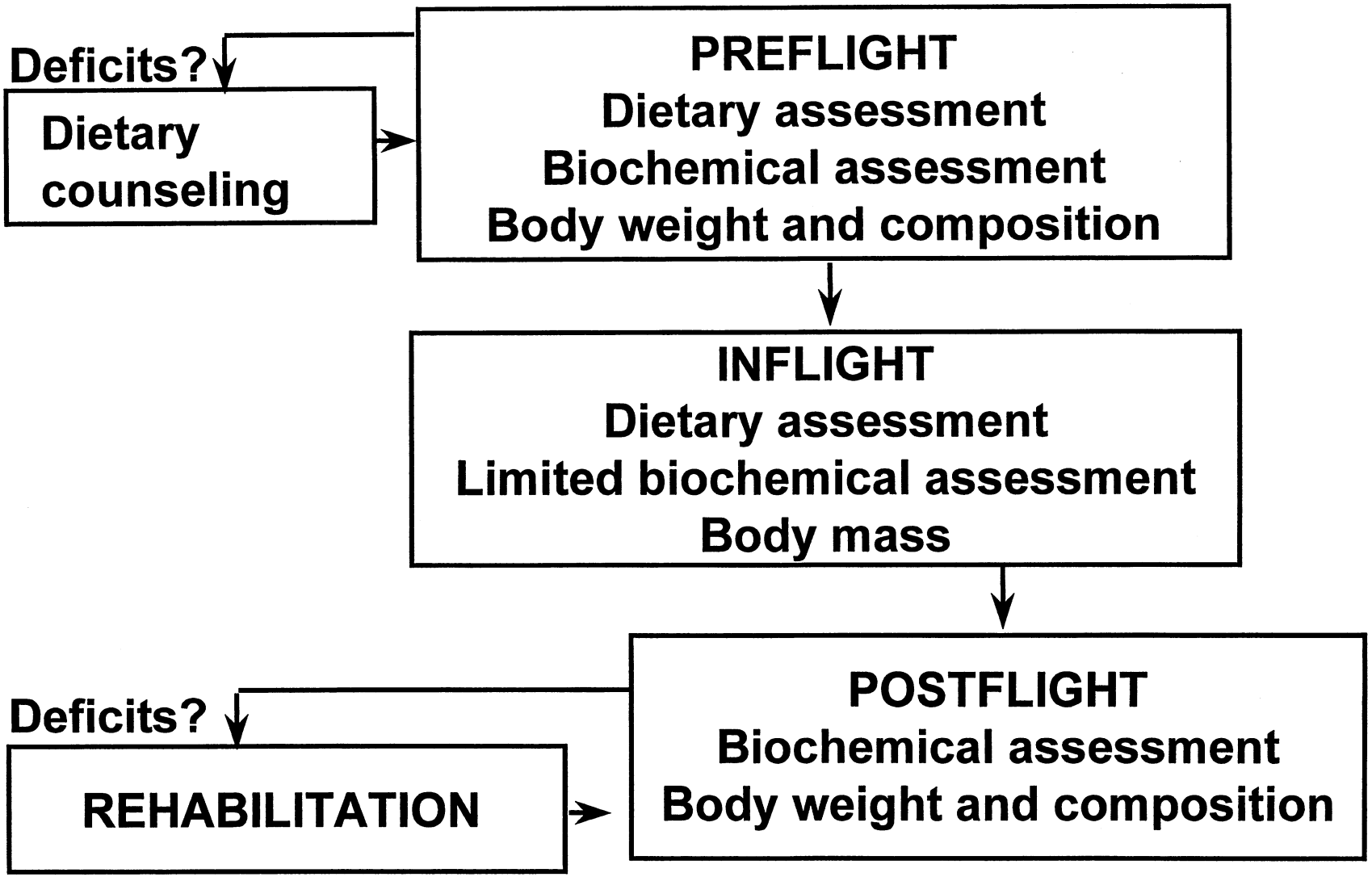
Carl Keen, Ph.D., Professor
Department of Nutrition
University of California-Davis

Donald McCormick, Ph.D.
Chair and Callaway Professor
Department of Biochemistry
Emory University School of Medicine

James Olson, Ph.D.
Professor, Department of Biochemistry & Biophysics
Iowa State University

Connie Weaver, Ph.D.
Professor and Head, Department of Foods and Nutrition
Purdue University

Overview


Deficits?
Dietary counseling
PREFLIGHT
Dietary assessment
Biochemical assessment
Body weight and composition
INFLIGHT
Dietary assessment
Limited biochemical assessment
Body mass
POSTFLIGHT
Biochemical assessment
Body weight and composition
Deficits?
REHABILITATION

Nutrition - Page 4 of 5

Cmdr		6/2/97 8:36:33 AM

For each food item listed, please indicate the number of packets you have consumed during the past we
Click the [Next] button to proceed to the next page. Click [Back] to return to the previous page.

Vegetables

Potatoes au Gratin, Broccoli au Gratin, Sweet Peas w/Milk Sauce.	
Mashed Potatoes or Mashed Potatoes/Onions.	
Beet Salad.	
Other Vegetables (Carrots, Corn, Green Beans, Stewed Cabbage, or Assorted Vegs).	

Soups

Chicken Consomme.	
L.S. Kharcho Mutton, L.S. Pureed Vegs, L.S. Peasant, or L.S. Borsch Soups.	
Meat & Veg. or Kharcho Mutton Soup.	
Other Soups (French Onion, Split Pea, Chicken&Rice, Pureed Veg., Pickled Cucumber w/ Meat, Peasant, or Sauerkraut Soup).	

Dairy

Fettuccine Alfredo or	
Cottage cheese w/Nuts.	
Yogurt or Cottage Cheese w/Cranberry or Other Fruit.	

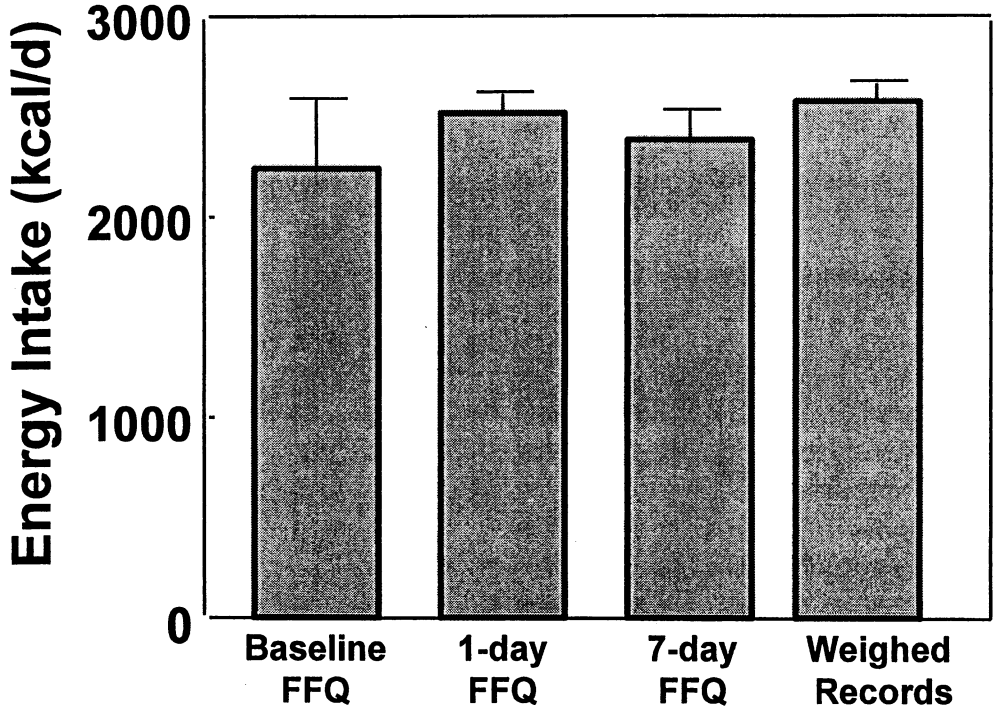
Fish

Shrimp Cocktail.	
Tuna or Salmon.	
Pike Perch Baltika.	
Bream w/Tomato Sauce, Pike Perch Polish Style, Spiced Pike Perch, or Jellied Pike Perch.	

Next

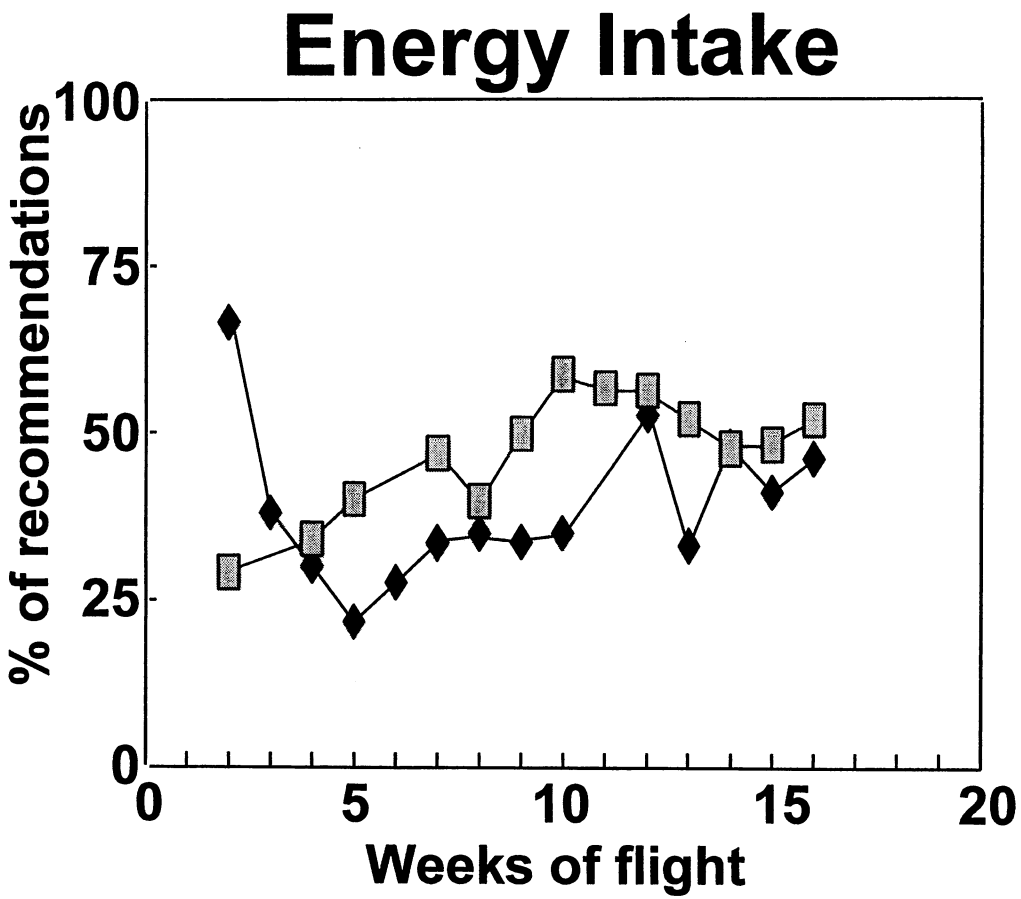
Ground-based Validation Studies

60-d Chamber Study



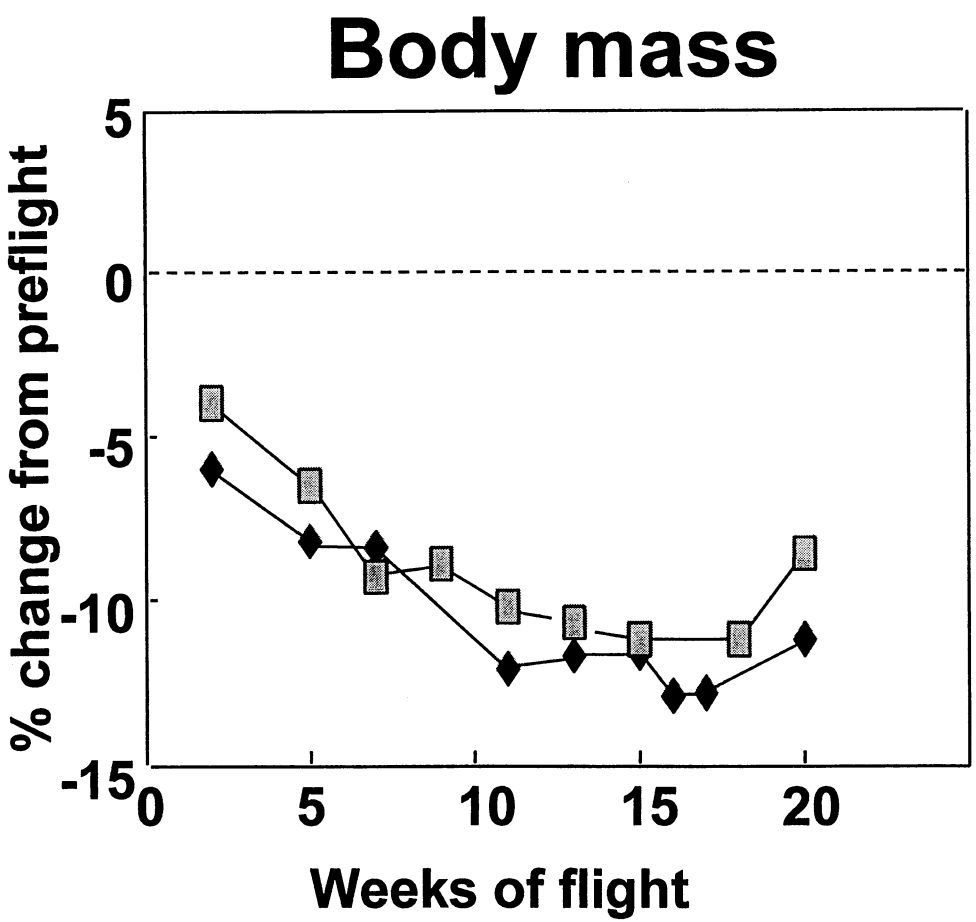
The FFQ provides a reliable estimate of intake of key nutrients

Intake Assessment



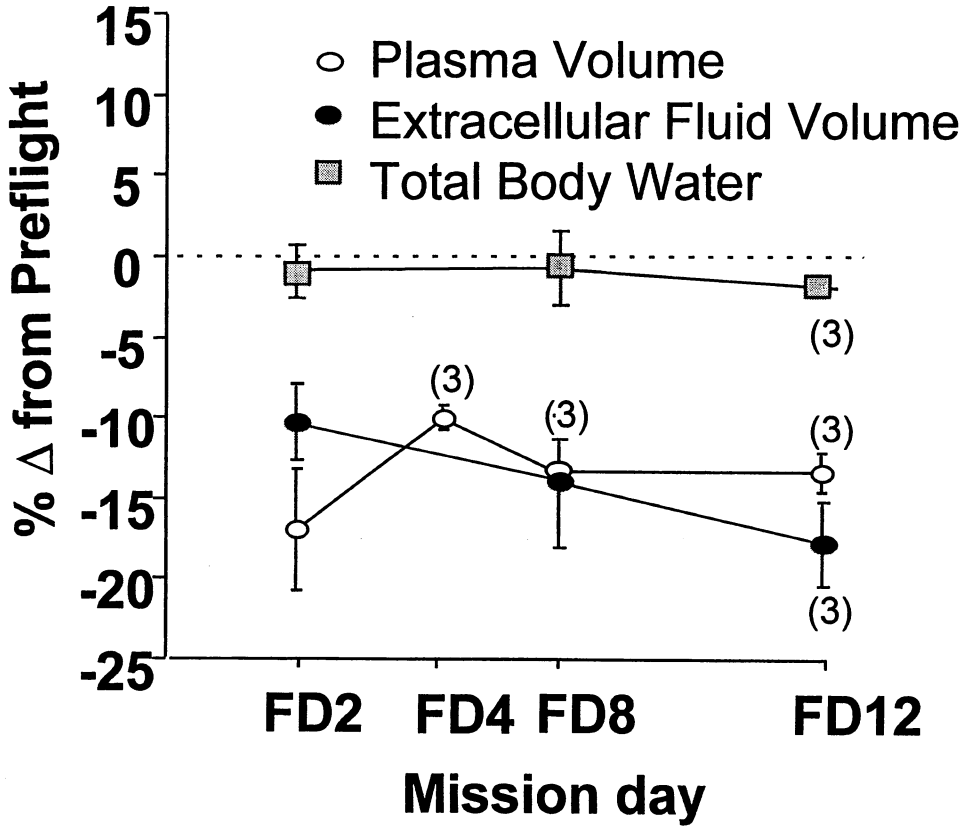
Food must be eaten for it to be nutritious

Intake Assessment



Weight loss is a consistent finding in the US and Russian space programs

Fluid Volumes
SLS-1 and SLS-2



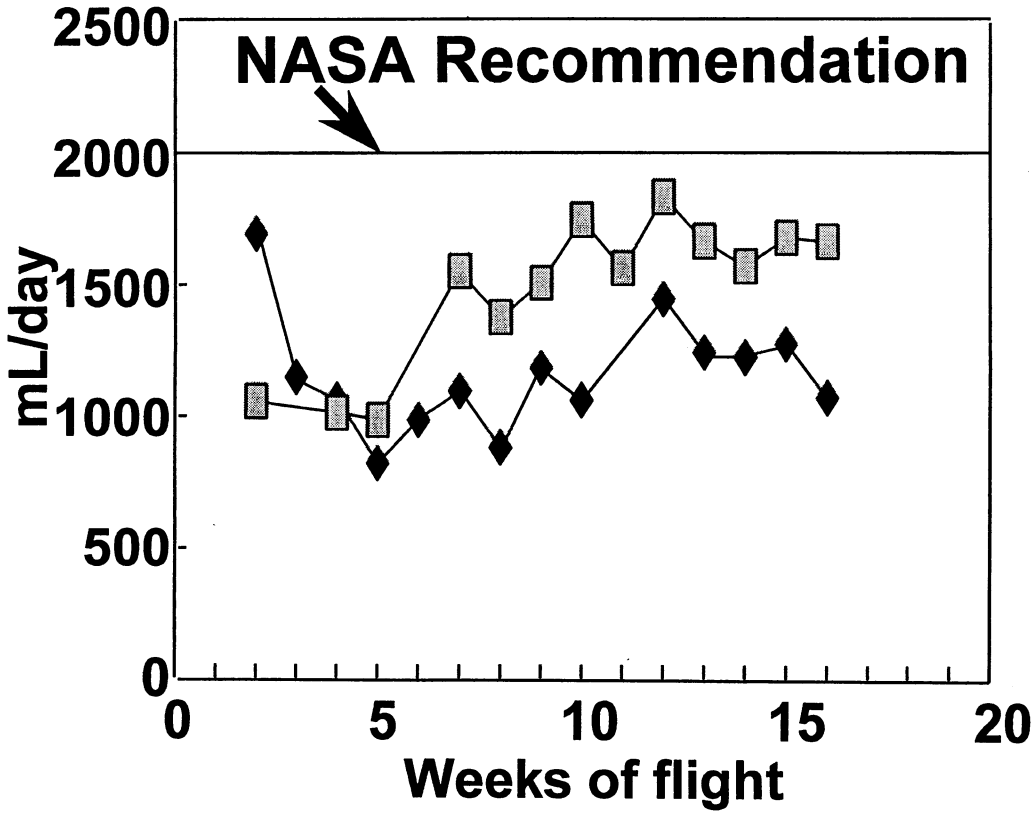
n=6 unless noted

Leach et al, 1996

There is a compartmental shift of fluid during weightlessness, but there is little/no evidence of dehydration or diuresis

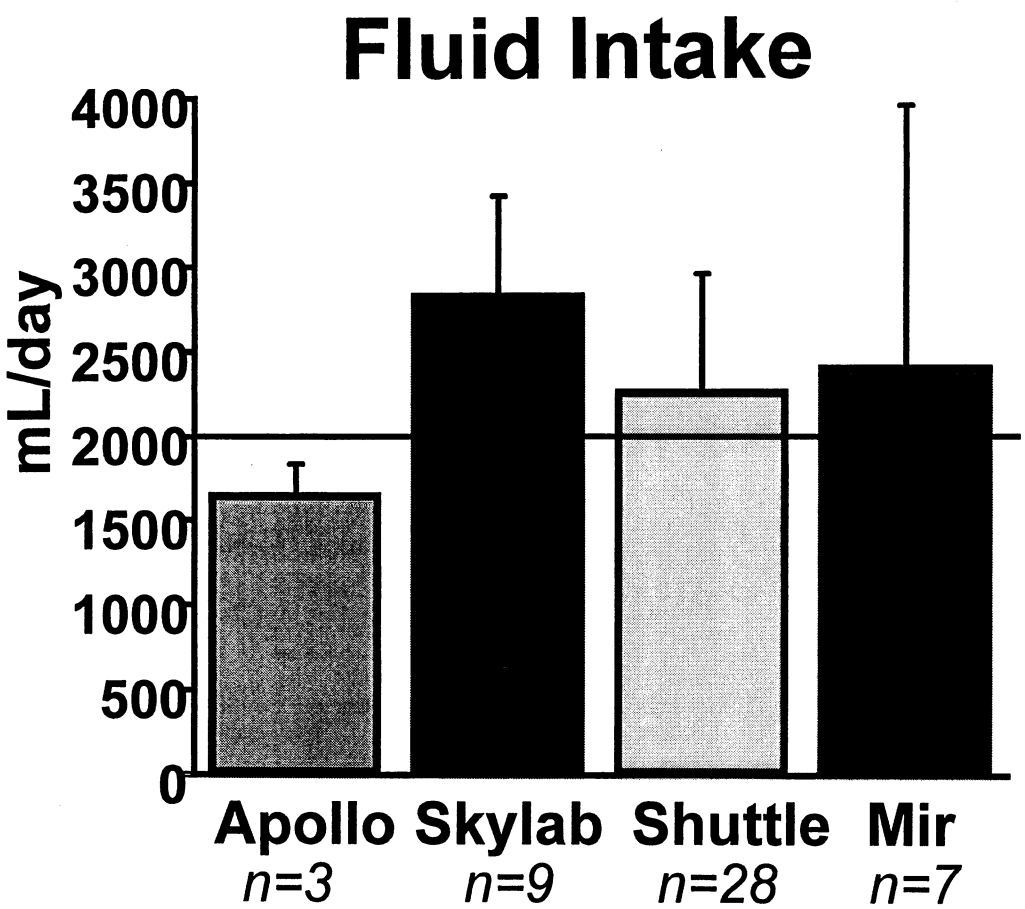
Intake Assessment

Fluid Intake



Fluid intake is critical to mitigate renal stone risk

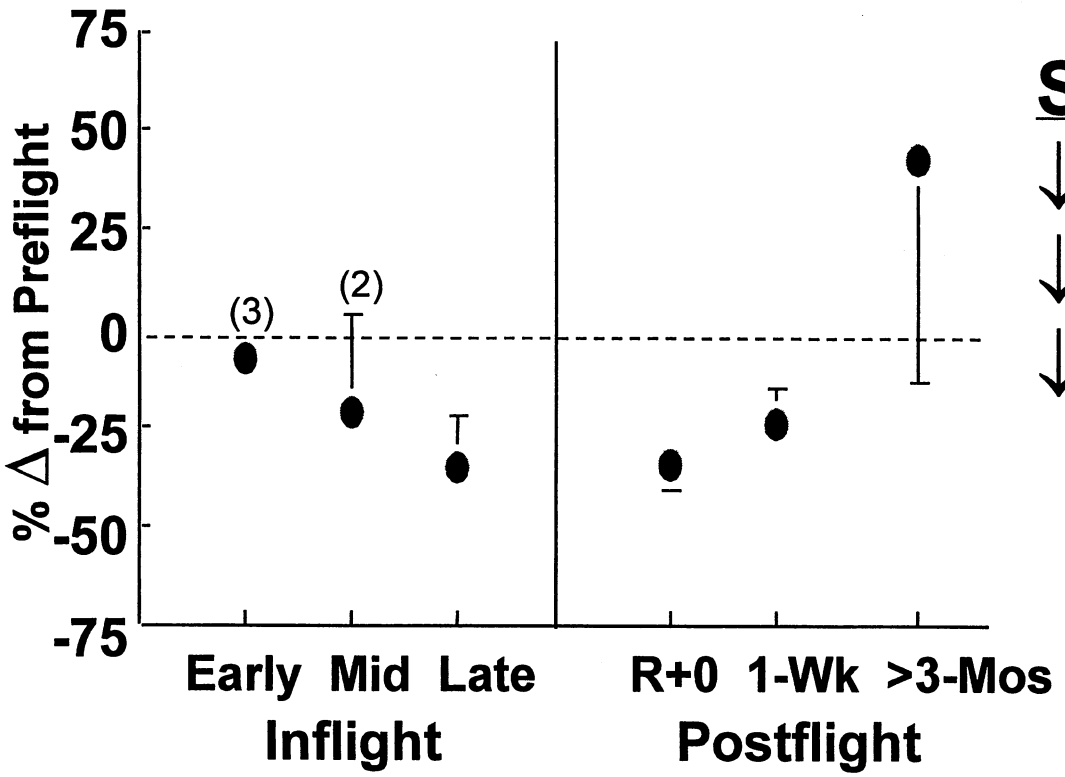
Intake Assessment



Fluid intake is critical to mitigate renal stone risk

Bone Health

25 (OH) Vitamin D



Space Flight:

↓ Vit. D stores

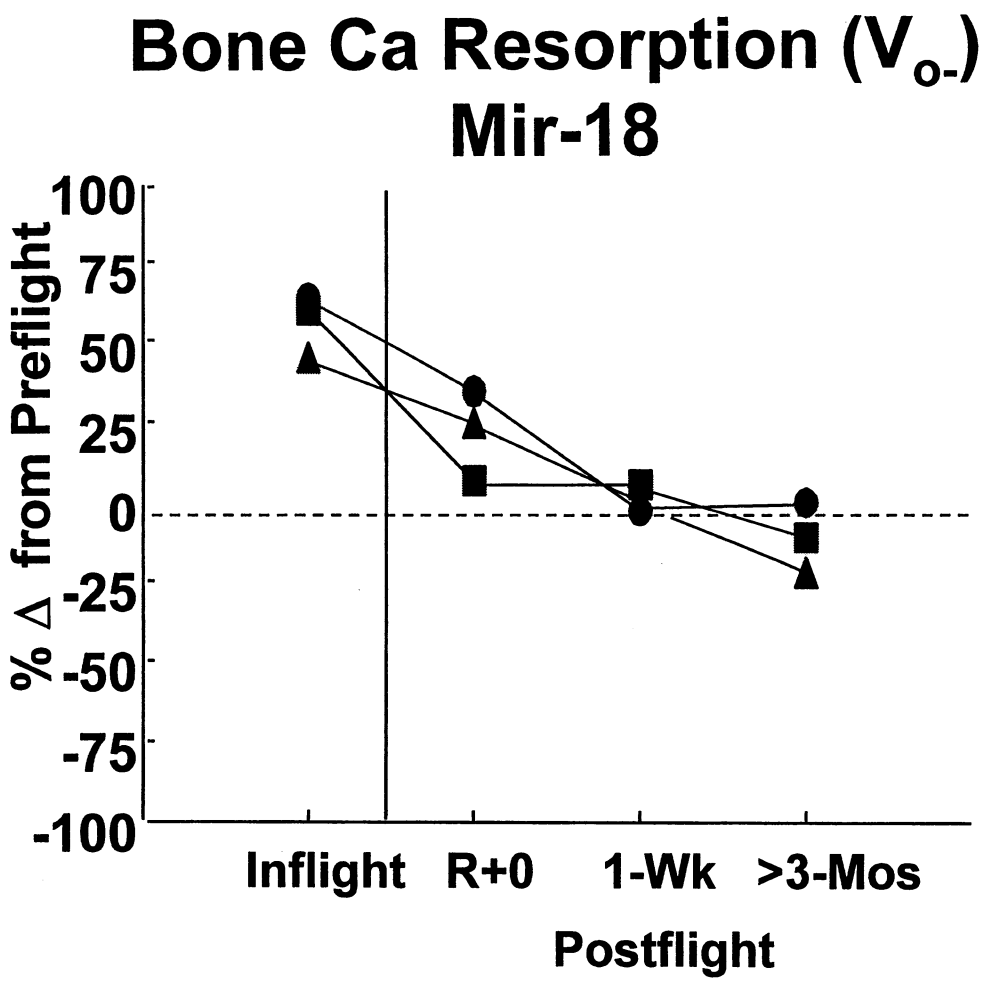
↓ Active Vit. D

↓ Ca Absorption (~50%)

n=4 unless noted

Smith et al., 1999

Bone Health



Smith et al., 1999

Space Flight:

↑ Urinary collagen xlinks

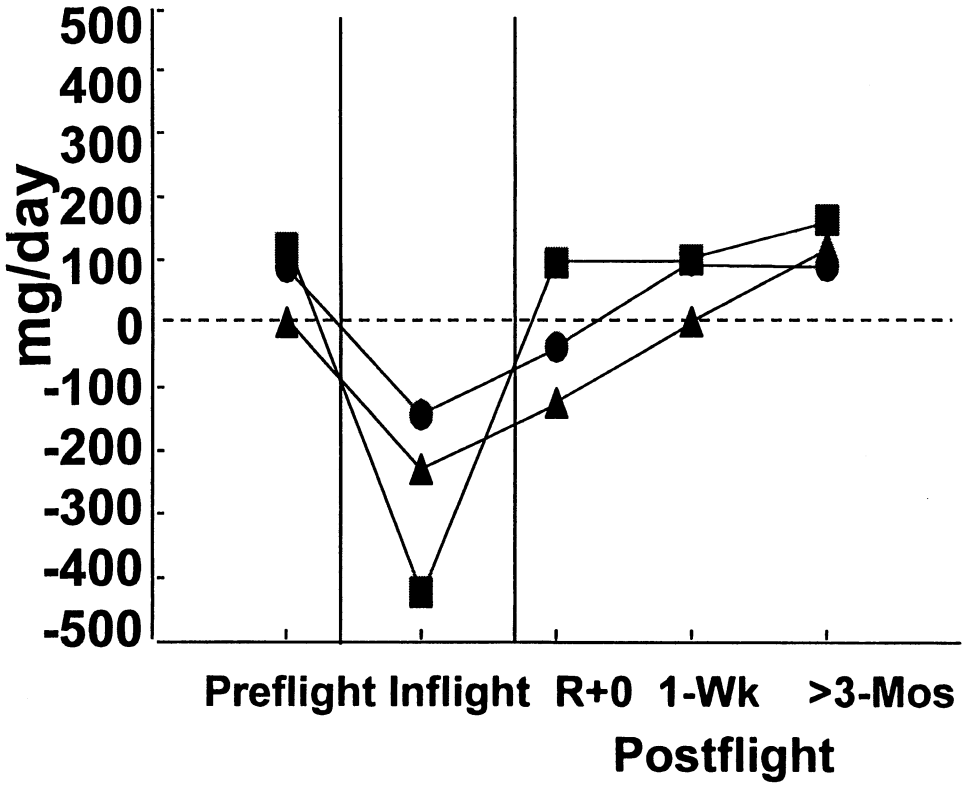
↑ Urinary Ca

↑ Urinary OHproline

Bone resorption is increased during flight

Bone Health

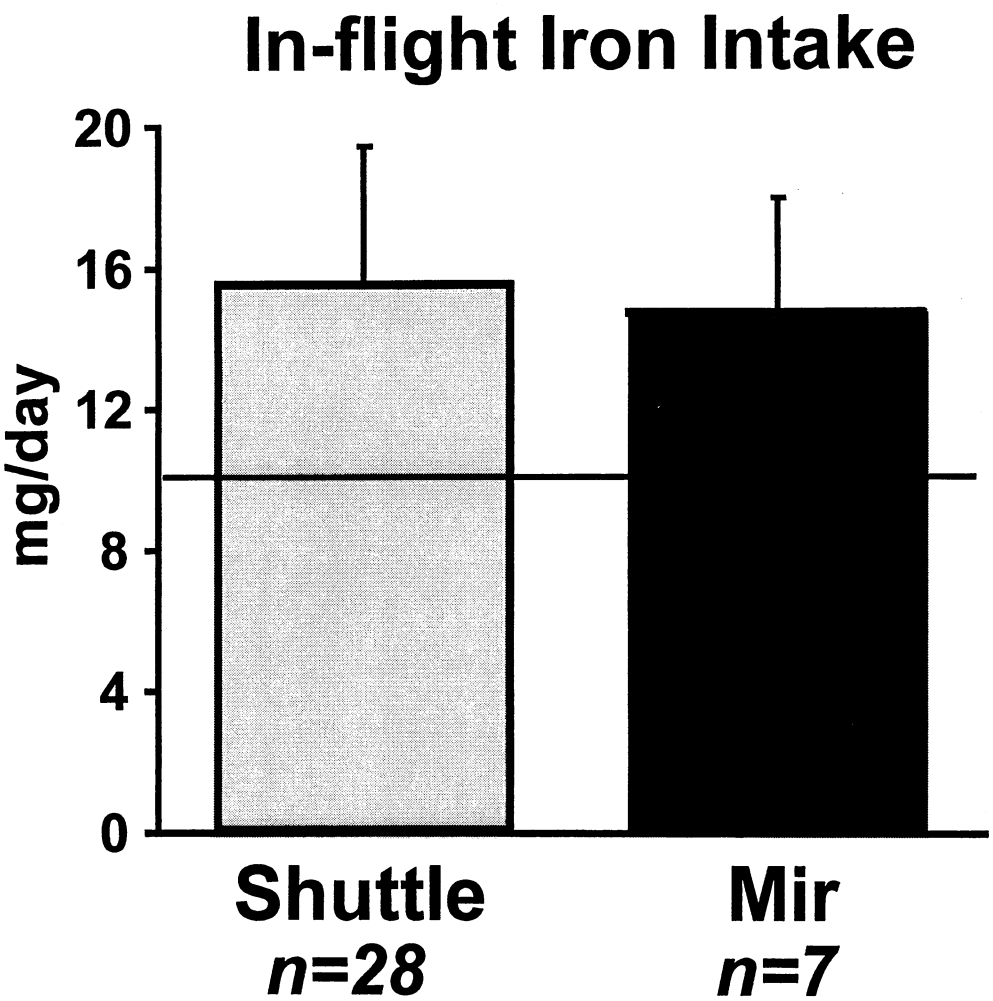
Bone Balance (V_{o+} - V_{o-})



Smith et al., 1999

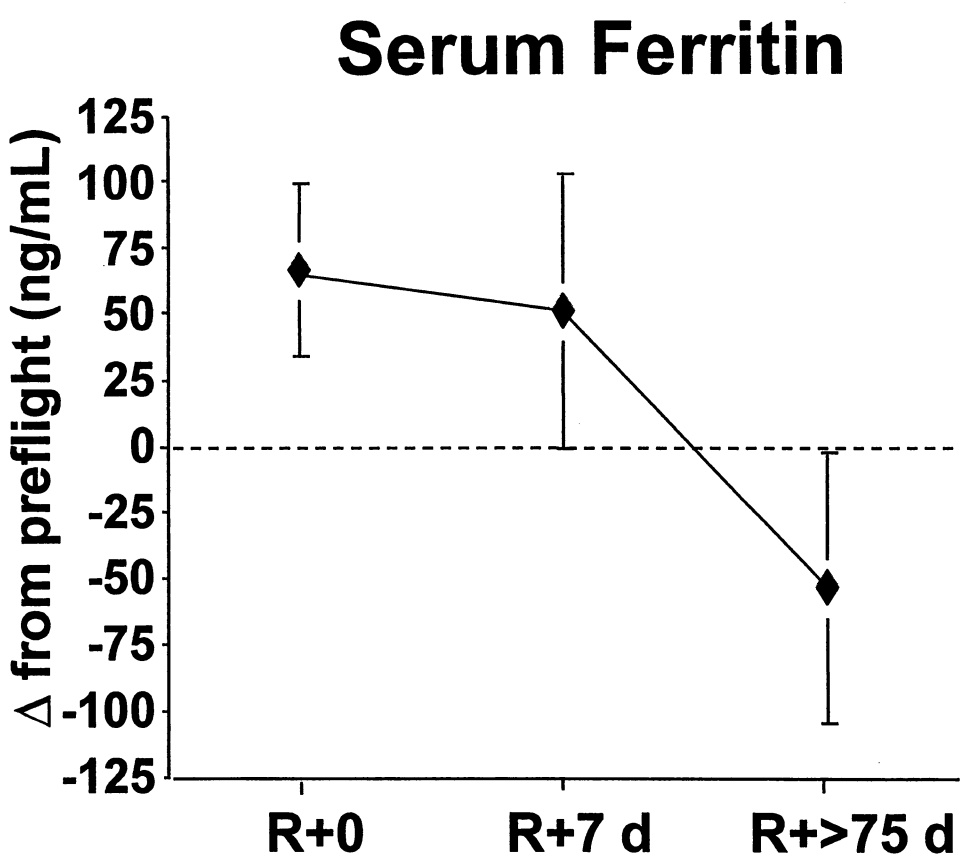
Bone Ca Loss ~ 250 mg/d
Bone Ca Gain ~ 100 mg/d
Recovery: 2-3 x mission

Hematology/Iron Storage



Iron intake is excessive in crewmembers consuming 70% of the caloric requirements

Hematology/Iron Storage



Space Flight:

↓ RBC mass

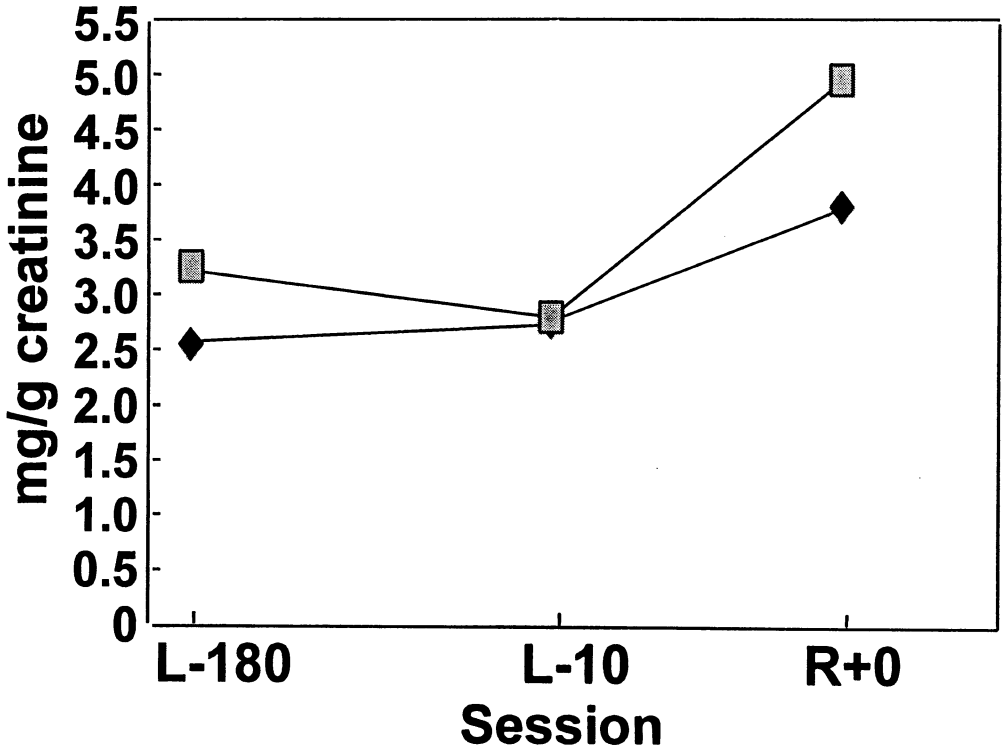
↑ Tissue iron availability

↑ Iron storage

Iron absorption - ??

Radiation/Oxidative Damage

Urine 8-OH-2'-deoxyguanosine



Markers of oxidative damage to DNA are increased after extended-duration space flight

Food System Issues

- Nutrient Content
- Palatability
- Shelf-Life
- Preparation
- Storage

Supplementation Issues

- Food System
- Impact on Dietary Intake
- Form
- Nutrient Interactions
- Bioavailability
- Monitoring

Nutrients of Concern

- Energy
- Fluid
- Calcium
- Protein
- Vitamin D
- Vitamin K
- Antioxidants
- Iron
- Sodium

Summary

- Nutrition will continue to play an important role for crew health and in countermeasure development during extended-duration space flight.

- Space food systems need to be designed that will meet the nutritional requirements of the crewmembers, while providing variety and palatability to ensure consumption.

Collaborations

NASA/Johnson Space Center

- Bone and Mineral Laboratory
- Clinical Laboratories
- Microbiology Laboratory
- Flight Crew Support Division
- Crew and Thermal Systems Division
- Planetary Sciences Division

NASA/Ames Research Center

- J.E. Greenleaf, Ph.D.
- S.B. Arnaud, Ph.D.
- A.R. Hargens, Ph.D.

International - Moscow

- I. Larina, M.D., Ph.D.(IBMP)
- B. Morukov, M.D., Ph.D.(IBMP)

*** = NSBRI**

EXTRAMURAL

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- M. Wastney, Ph.D. (Georgetown Univ)
- S.A. Abrams, M.D. (Baylor Coll Med)*
- C.P. Alfrey, M.D. (Baylor Coll Med)*
- G. Block, Ph.D. (UC- Berkeley)
- C. Gundberg, Ph.D. (Yale University)
- D.J. Baylink (Pettis VA Hospital/Loma Linda)
- D. Schoeller, Ph.D (University of Wisconsin)
- A. LeBlanc, M.D. (Baylor Coll of Med)
- S.P. Coburn, Ph.D. (Fort Wayne State Univ)
- A.A. Ferrando, Ph.D. (UT - Medical Branch)
- R.J. Gretebeck, Ph.D. (Purdue University)
- E. Lan, Ph.D. (UC- Los Angeles)
- M. Rose, Ph.D. (South Dakota State Univ)
- Z. Vickers, Ph.D. (University of Minnesota)
- B. Tobin, Ph.D. (Mercer Univ School of Med)

Health Surveillance/Maintenance in the Workplace

Session 12 – Emerging Trends and Policy
Workplace Health Surveillance/Maintenance in the 21st Century
August 31, 1999

Ms. Cathy Angotti introduced the thirteenth session in this fifth series of continuing education programs sponsored by NASA's Occupational Health Program, Office of Health Affairs (OHA), in cooperation with the Uniformed Services University of the Health Sciences (USUHS). Worldwide, this session is available on the Internet. Ms. Angotti introduced the speaker, Dr. Arnauld Nicogossian, Associate Administrator, Office of Life and Microgravity Sciences and Applications, NASA Headquarters.

Dr. Nicogossian reviewed health trends over the past 20 years and challenges for the next century. With respect to future trends, there are many forces at work: medical advances, changing administrative principles, professional opportunities, the cost of care, socio-economic gaps, public attitudes, and the general economy. These many parameters make it difficult to predict the trends in the 21st century. There have been many changes over latter part of this century: **cyber-health** (e-records, internet connections, etc.); **complementary medicine** (a decisive choice that people are making with respect to their health care, representing a $10 billion market); and **consumer attitudes and choices** (the entire perception of centralized health care has become a thing of the past). Global trends are informatics, evidence-based medicine, meta analysis/data bases, and standards of practice. There have been significant medical advances in **diagnostics** (PCR, Biosensor chips, expert systems, genetic ID), **imaging** (portability and precision), **surgery** (minimally or non- invasive, keyhole surgery, robotic) and **pharmaceuticals** (DNA vaccines, anti-sense DNA, anti-angiogenesis). In the not-too-distant future, the lines between the home and the hospital will blur. We have directed our practice to reflect evidence- and outcome-based medicine, which significantly impact our health care delivery approach. Other aspects of result-driven medicine are the electronic patient record, the "virtual patient," biocomputation, virtual drug trials, the portability of medical information, and portability in computing. Low cost is high quality—do it right the first time. One of the steps backward has been in the area of antibiotics. There is a decline in effectiveness and multi-drug resistance. In addition, there is the emergence of new infections and viruses. Strengthening of the Public Health is a must. There have been breakthroughs in technology to improve care and lower cost—in the areas of sensing, computing, remembering, and connecting.

Dr. Nicogossian revisited some epidemiological terms—precision, accuracy, internal validity, external validity, specificity and sensitivity, the likelihood ratio, prior odds, posterior odds, and posterior probability. He reviewed the definition of these statistical and epidemiological terms. As we combine databases that are somewhat similar, we are going to find that rapid computation and networks will give us much better insight into outcomes and predictions than we have today. There are a number of molecular biology tools which enable faster and more accurate diagnosis, e.g., prenatal disorders, infections, malignancies, and inherited diseases.

Dr. Nicogossian also discussed organizational principles, which are becoming more important today. There has been a lot of turmoil about HMOs. In the future, organizations will have to commit to a mission, and outcomes must be consistent with the missions. Any health organization must define and build on core values, which should not change with time. At the same time, they must continuously re-prioritize functions and streamline activities. The core value of all health organizations is to serve its customers and improve outcomes through preventive programs, evidence- and outcome-based care, and education. Public attitudes have changed as a result of many factors, including the internet, professional societies, news media and entertainment, contact with nurses, nutritionists, pharmacists, and health advisors, and self monitoring. Social forces are important. Greater instability can lead to increased famine and rise of communicable diseases. Natural disasters affect public health globally. We have seen populations displaced by wars. For the US, the aging population and maintaining the quality of life is an emerging issue. World population is expected to double once within the next generation. The health index gap between those who are well to do and those who are not will impact health care and the environment.

Other social forces affecting health care in the U.S. include the social structure, demographics, employment patterns, and the national deficit (a debate on where the economic surplus should be spent). In general, we find that people get more involved with a wide range of ecological issues through travel, leisure and even choice of dwelling location. Environmental injuries are becoming a part of our life. These include hypothermia, hyperthermia, smoke inhalation, marine envenomations (vertebrates, invertebrates, sponges, corals, sea urchins, etc.), lightning injuries (1000 fatalities per year, mostly work-related although recreational injuries are on the increase), and thermal, electrical and chemical burns. We must educate employees and their families on the dangers of these types of environmental injuries. Travel medicine is becoming more and more important as a result of environmental exposures, food poisoning, reemerging infections, and disynchronosis. Food borne gastroenteritis is becoming more common. This can be the result of contaminated water, milk, chicken, eggs, or fish. Antibiotics can cure most of these infections. Multiple chemical sensitivity, asthma, food engineering and allergies, and "la fin-du-siecle" perception (characterized by chronic fatigue, stress, and depression) can also be classified as "emerging diseases." Biothreats from anthrax, plague, tularemia, salmonella, smallpox, viruses or DNA fragments, brucellosis, and chemicals are becoming more of a global concern. Some of these can be treated, but some do present a perplexing problem with difficult choices.

Dr. Nicogossian briefly reviewed the major changes and drivers in health care over the last two centuries. There is a changing pattern in health care. Intervention has been focused mostly in the area of the healthy adult and pre-clinical phase. Most of the clinical care has been focused on the pre-clinical and disease phase. The trend will be for this gap to narrow, and prevention will span throughout life. Choices that one makes that affect long-term health—family, the workplace, the environment, education, lifestyle, longevity, and safety. For tomorrow, it will be a continuum; health care will need to address all of these choices. Leadership in health care must focus on the

future; the vision should reflect the core values. The vision should be really creative, and channel resources and efforts into fulfilling the goal.

Questions/comments:

HQ: With respect to global trends (informatics, evidence-based medicine, expanded databases, and the standards of practice), in your opinion, what will have the most impact?
A Informatics; bringing the databases together.

France: Dr. Nicogossian began to describe a very large health challenge in the field of public health for the future. I think that it is different in the workplace for a big organization. We must define priorities in the field of occupational medicine. What do you think about priorities in occupational medicine, particularly for occupational risk management?
A: You were asking that in your view, there is a potential difference between occupational problems in different workplaces. Smaller workplaces have different challenges than larger ones. What I was trying to communicate is that, in a generic fashion, lifestyle is a continuum and not just an isolated event in the life cycle. You cannot spend eight hours somewhere using one set of health principals and come home to another set of principals. The same way you treat the person as a whole as a patient, you must treat the environment and the workplace. In certain workplaces there will be different challenges than other workplaces. For example, at NASA, not all the problems apply to all the field Centers, but there is a core which applies to many field Centers. My message was that you have to treat home and workplace together, not as two separate issues.

KSC: It seems like there is a conflict between social pressure and results-driven medicine that impact upon the care that a physicians gives. The latest example may be magnets being used because there is iron in blood; some of the rationalization is that it brings increased blood to the area and it may work, but the evidence we have is different from what the social pressures are. In the past, the social pressure has been to go to the doctor and receive an antibiotic whether it is indicated or not. The effect of this social pressure has been increased lack of efficiency of the antibiotics. Do you think that this will be overcome by informatics, providing more information to the individual?
A: You are correct and it is a very good question. Part of that is education. It must not only be electronic; it must be printed and visual. If the Internet can provide that, fine; but it must be reinforced through responsible reporting (TV and newspapers). News media should be used correctly, and the workplace should also be the place where the education takes place. Education is the major component in removing biases. For example, if you go to the literature on injuries, the way people treat marine injuries reflects lack of education, e.g., warm water is the proper treatment for marine envenomation, but most people think what is needed is an ice pack.

HQ: It looks like it is a complex global issue. Does the World Health Organization have any task force set up to cope with planning and challenges in the 21st century?

A: Several reports have been published, one of them by the Institute of Medicine, I believe. There are a lot of publications dealing with public health issues. Leadership is important to get to the purpose—health care delivery without unnecessary services.

HQ: I enjoyed your talk, especially the slide on the changing pattern (the early application of principles to drive down the necessity for intervention) and tying medical informatics into this concept. I wanted to ask your personal opinion. Perhaps nowhere in medicine is the practical application of prevention more obvious that in the field of occupational medicine. Your spoke earlier about other organizations (HMOs, etc.) that ideally could apply preventive principles early (using advanced informatics techniques to educate their patient populations) and thereby reduce the need for intervention expenditure. As you have seen the pattern of medicine change over the past 15-20 years and you look ahead to the new millennium, how optimistic are you about the application of prevention; are we really going to be able to make a change in the way medicine is practiced, with preventive medicine techniques? Are we going to get an economic buy-in to those principles worldwide?
A: It is a good question. Globally, it would be a very big challenge. For the US, it has always been a difficult situation. Individual choice (deciding from whom one should get health care and how it should be administered) has been a major factor. The difficulty about answering your question is that in the US, we are probably going to move to a situation to remediate the lack of health insurance, and prevention will become more and more important. In order to have prevention in occupational health be more efficiently applied, you must have all the players on the same team (worker, physician, provider). Prevention really pays off. Once all of the medical care is put on an economic basis, the way you are going to make money is not to spend more money treating injuries and disabilities. As people start to demand different types of services, the providers will have to become competitive, and they will have to do it right the first time. The change is in this direction. Globally, it is very difficult to predict; the medical infrastructure in a lot of countries is not what it was earlier in this century. The infrastructure in the US and Canada has been stable for a couple of centuries. Europe has recovered, but other places of the world have not. This disparity must be breached. Disease does not recognize borders anymore. In the US, the move will be toward prevention because people understand that longevity and a healthy life is their right.

France: When you spoke about disease and environment, you did not describe musculoskeletal disorders. In the occupational workplace in France, musculosketetal disorders represent more than 50% of the compensation for occupational disease. What do you think about that?
A: You are correct. This is part of the education and proper planning for ergonomics. The reason I didn't describe it was because I was trying to pick up things that were on the unusual side, and I did not address back injuries, falls, etc. Ergonomics is the mainstay of those activities.

Ms. Angotti added that Dr. Nicogossian's optimism for prevention is one shared with occupational health. We clearly see that as our charge for health education. In terms of ergonomics and back injuries, in NASA (as in other federal agencies) slips, trips, and falls are the

number one causes of worker compensation charges, followed by lifting (which is related to back injuries)

Dr. Chan closed with some information about the next series and plans for continuing education. Series number six will be on emerging diseases, including both communicable and non-communicable diseases, in the October/November through March timeframe. Continued support would be very much appreciated. NASA and USUHS are in the process of searching for expertise in the US as well as outside the US for this series. The following topics will be covered: discussion on the concept of emergence; the emerging diseases in US and outside US; the application of remote sensing techniques for infectious disease detection; travel as related to emerging infectious diseases; the database on drug resistant microbials; and the Centers for Disease Control Strategic Plan. The Program will continue to use multi-cast broadcast, and will have video on demand system implemented by the next series. Anyone can go to the Web and view the broadcasts from their desktop at any time. Continued education credits will be offered to all non-federal as well as federal institutions. The agenda for the next series will be distributed as soon as it is ready.

FUTURE TRENDS & POLICIES OF WORKPLACE HEALTH SURVEILLANCE AND MAINTENANCE

NASA HQ CONTINUED MEDICAL EDUCATION SEMINAR SERIES

ARNAULD NICOGOSSIAN

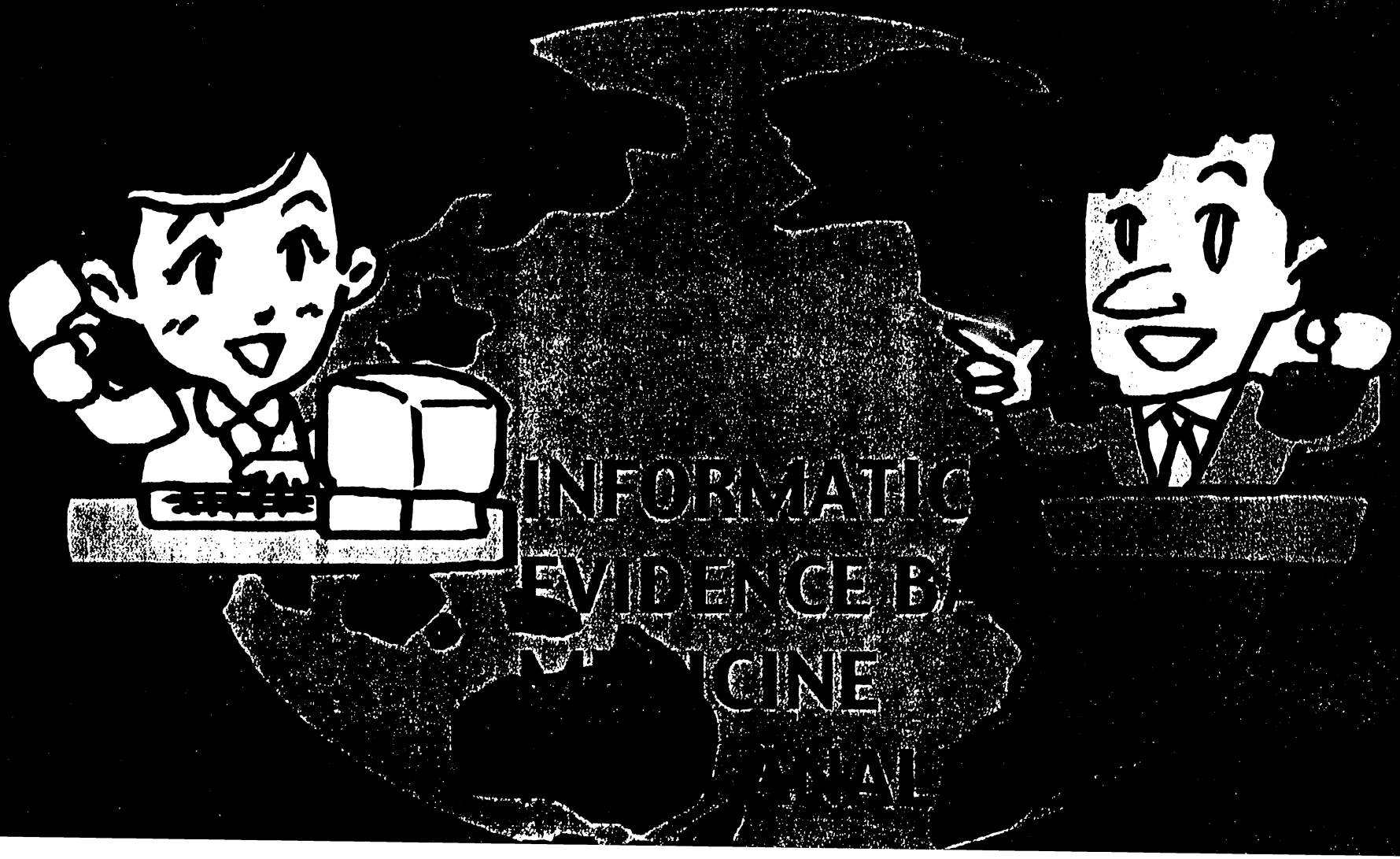
FORCES AT WORK

- MEDICAL ADVANCES
- ADMINISTRATIVE PRINCIPLES
- PROFESSIONAL OPPORTUNITIES
- COST OF CARE
- SOCIO-ECONOMIC GAPS
- PUBLIC ATTITUDES
- GENERAL ECONOMY

What has changed

- Cyber-health
  - E-records, internet connections,etc
- Complementary medicine
  - $10B market, reduced burden on health care institutions
- Consumer attitudes and choices
  - enhancing the experience
  - meeting the needs
  - segment products and markets

GLOBAL TRENDS



Medical Advances

- DIAGNOSTICS
  - PCR
  - BIOSENSOR chips
  - Expert systems(APACHE)
  - Genetic ID
- IMAGING
  - portability
  - precision
- SURGERY
  - minimally invasive
  - key-hole
  - robotic
  - non-invasive
- PHARMACEUTICAL
  - DNA vaccines
  - anti-sense DNA
  - anti-angiogenesis

Result Driven Medicine

- Evidence and outcome base medicine
- Electronic patient record
- Virtual patient
- (biocomputation)
- virtual drug trials
- Portability of medical information
- Portability in computing

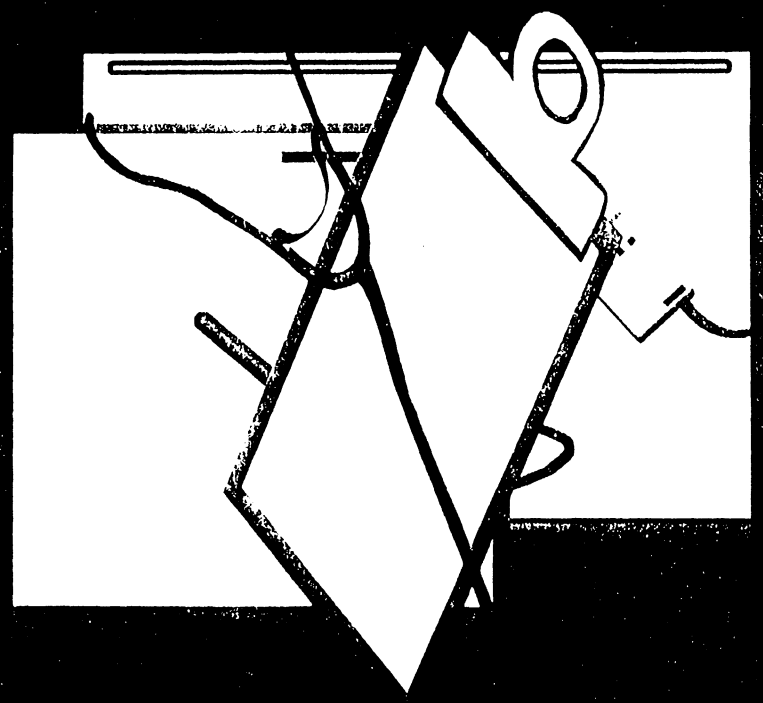
LOW COST IS HIGH QUALITY: DO IT RIGHT THE FIRST TIME

A STEP BACK - ANTIBIOTICS

- Decline in effectiveness
- Multi-drug Resistance
- Emergence of new infections and viruses
- Strengthening of the Public Health

TECHNOLOGY

- Sensing
- Computing
- Remembering
- Connecting
  - improve care
  - lower cost
  - home health
  - custom made care



EPIDEMIOLOGY REVISITED

- Precision
- Accuracy
- Internal validity
- External validity
- Specificity and Sensitivity
- Likelihood ratio
- Prior odds
- Posterior odds
- Posterior probability

MOLECULAR BIOLOGY TOOLS

- PRENATAL
  - cystic fibrosis
  - hemoglobinopathies
  - hemophilia's
  - familial hypercholesterolimia
  - neurodegenerative disorders
- INFECTIONS
  - tuberculosis
  - lyme disease
  - HIV
  - hepatitis C

MOLECULAR BIOLOGY TOOLS

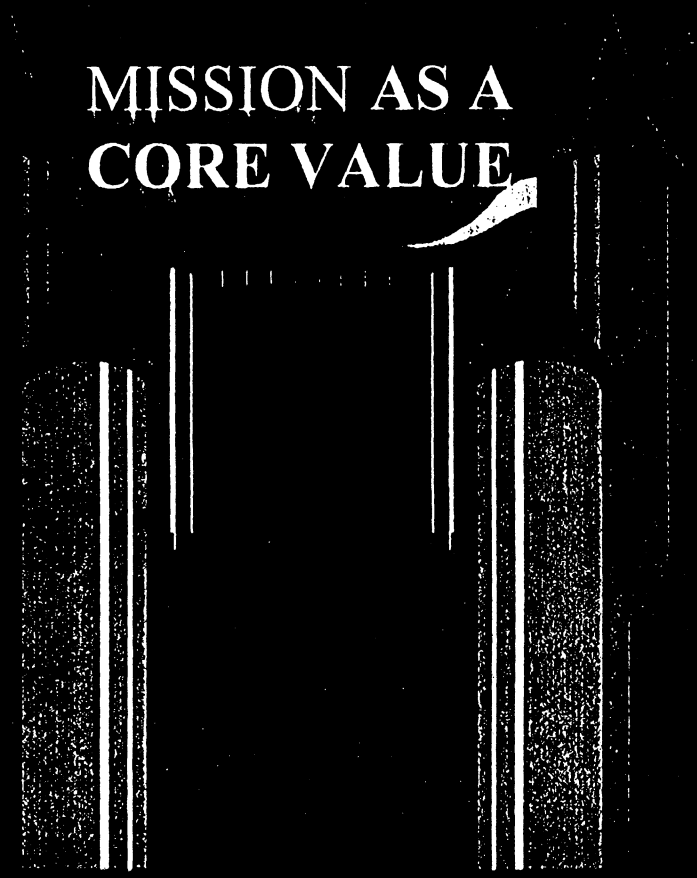
- Malignancies
  - breast cancer
  - colorectal cancer
- Inherited diseases
  - multiple malignancies
  - psychiatric and neurological disorders

ORGANIZATIONAL PRINCIPLES

- COMMITMENT TO THE MISSION
- MISSION GUIDES STRATEGIES
- STRATEGIC GOALS DEFINE OUTCOMES
- OUTCOMES CONSISTENT WITH MISSION

MAINTAINING FOCUS

- BUILD ON CORE VALUE
- CONTINUOUSLY RE-PRIORITIZE FUNCTIONS
- ALWAYS STREAMLINE ACTIVITIES



HEALTH CARE TRENDS

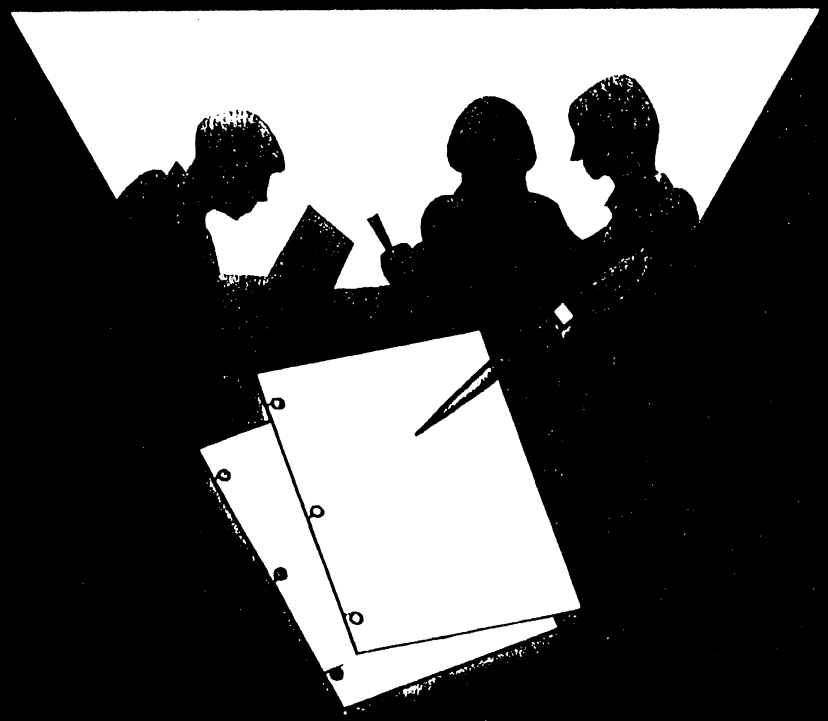
- THE CORE VALUE OF ALL HEALTH ORGANIZATIONS IS TO SERVE ITS CUSTOMERS AND IMPROVE OUTCOMES THROUGH:
  - PREVENTIVE PROGRAMS
  - EVIDENCE & OUTCOME BASED CARE
  - EDUCATION

Public attitudes

- Internet
- professional societies
- news media and entertainment
- contact with nurses, nutritionists, pharmacists, health advisers
- self monitoring

SOCIAL FORCES

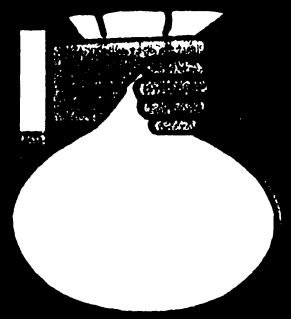
- Greater instability
- Increased famine
- Communicable diseases
- Natural disasters
- Globalization and displaced populations
- Aging US population



World population will double once within the next generation: 11B

SOCIAL FORCES

- Social structure
- Demographic
- Employment patterns
- National Deficit
  - education
  - health care
  - tax cuts
  - paying off the debt



ENVIRONMENTAL INJURIES

- CHEMICAL
- PHYSICAL
- WEATHER
- RODENTS
- MARINE LIFE
- REPTILES
- INSECTS
- PLANTS

ENVIRONMENTAL INJURIES

- Hypothermia
  - core temp< 35C
  - annual death 700-900(treated 0-50%)
  - predisposing factors(endocrine, met., cv.,etc.)
  - re-warming(passive internal, active external, active core)

HYPERTHERMIA

- Heat cramps
- Syncope
- Exhaustion(no signs of CNS)
- Heathstroke(mortality 40-70%)
- Aggravating factors >55y., >105F., CNS symptoms,thermal renal & liver injury, medications

Smoke Inhalation

- 7% of 150000 burn patients
- 3/4 of fire related deaths
- mortality approaches 20%
- Smoke contains degradation products of combustion source of materials is important
- Ventilation factors and decreased ambient oxygen

MARINE ENVENOMATIONS

- Vertebrates
  - scorpion fish: 80 out of 350 species,pacific & indian oceans- spines venom is heat labile. Rx warm water and standard wound care
  - stingray: tail barb venom is heath labile
  - sea snakes:sea of Philippines, Solomon Is., Americas.,most lethal to mammals(Austr. Anti-venin)

Marine Envenomations

- Invertebrates
  - jellyfish: world wide 10,000 stings, few deaths,venom is a hemolysin type, vinegar preferred , Irugandji type A & B syndrome(caused by Carukia Burnesi)
- Sponges, corals, sea urchins, sea cucumbers,cone shells(neurotoxin), bristleworms, sea Barther,s erruption

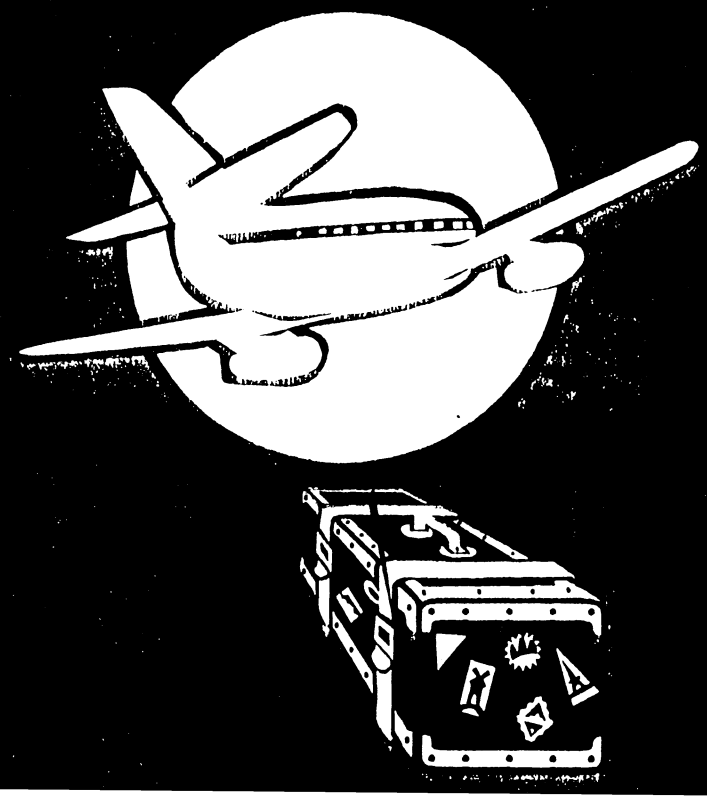
LIGHTNING INJURIES

- 2000 thunderstorms world wide at any moment
- lightning striking the earth more than 100 times/sec
- 1000 fatalities/y.
- mostly work related
- recreational injuries on the increase
- Rx different than electrical injury;treat as medical not surgical emergency

Thermal, Electrical & Chemical Burns

- 2Million burns annually;90-95% outpatients
- 100,000admited(severity, age, smoke inhalation, diseases) with 7% mortality
- Classification 1st, 2nd and 3rd related to exposure type (sun, chemical etc.)
- Electric 6.5% of all admissions
- Chemical :2.1 to 6.5% of admissions

TRAVEL MEDICINE



- ENVIRONMENTAL EXPOSURES
- FOOD POISONING
- REEMERGING INFECTIONS
- DISYNCHRONOSIS

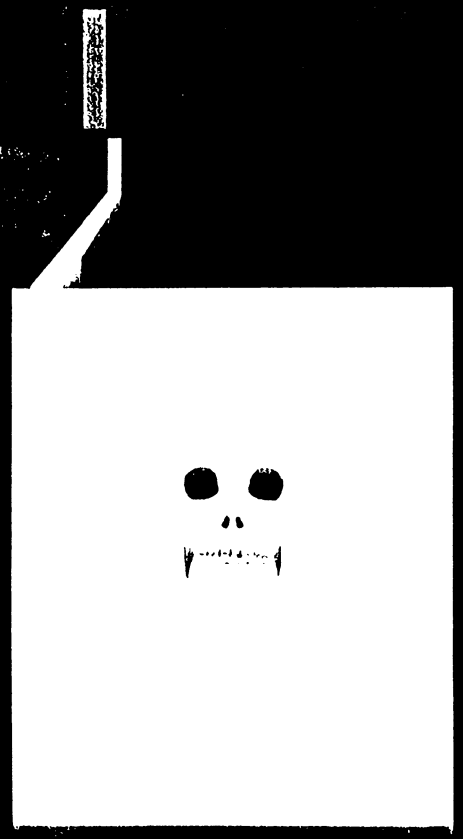
Food borne Gastroenteritis

- Water
  - Giardia,Cryptosporidium, Cyanobacterium,Norwalk virus
- Milk
  - Salmonella,Campilobacter, Yersinia
- Chicken
  - Salmonella, Campilobarium
- Eggs : Salmonella
- Fish
  - Vibrio,Norwalk,paralytic shellfish poisoning

Emerging Diseases

- Multiple Chemical Sensitivity
  - Reproducible symp.
  - Chronic exposures
  - multiple organs
  - multiple irritants
- Asthma and social status
- Food engineering & allergies
- "La fin-du-siecle"
- Chronic Fatigue & shift workers
- Stress
- Depression
  - violence
  - suicide

BIOTHREAT



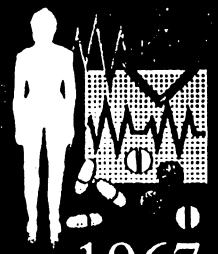
- ANTHRAX
- PLAGUE
- TULAREMIA
- SALMONELLA
- SMALLPOX
- VIRUSES OR DNA FRAGMENTS
- BRUCELLOSIS
- CHEMICALS

The Last Two Centuries

1796

1816

1945

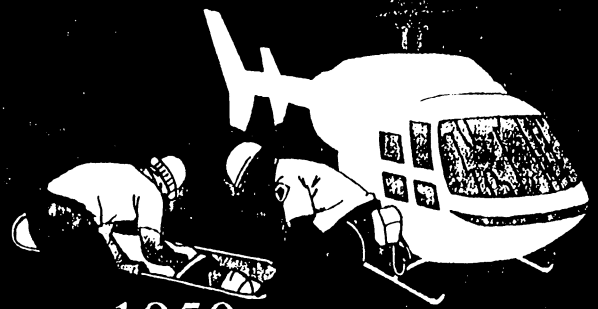


1967

1970

1845

1897

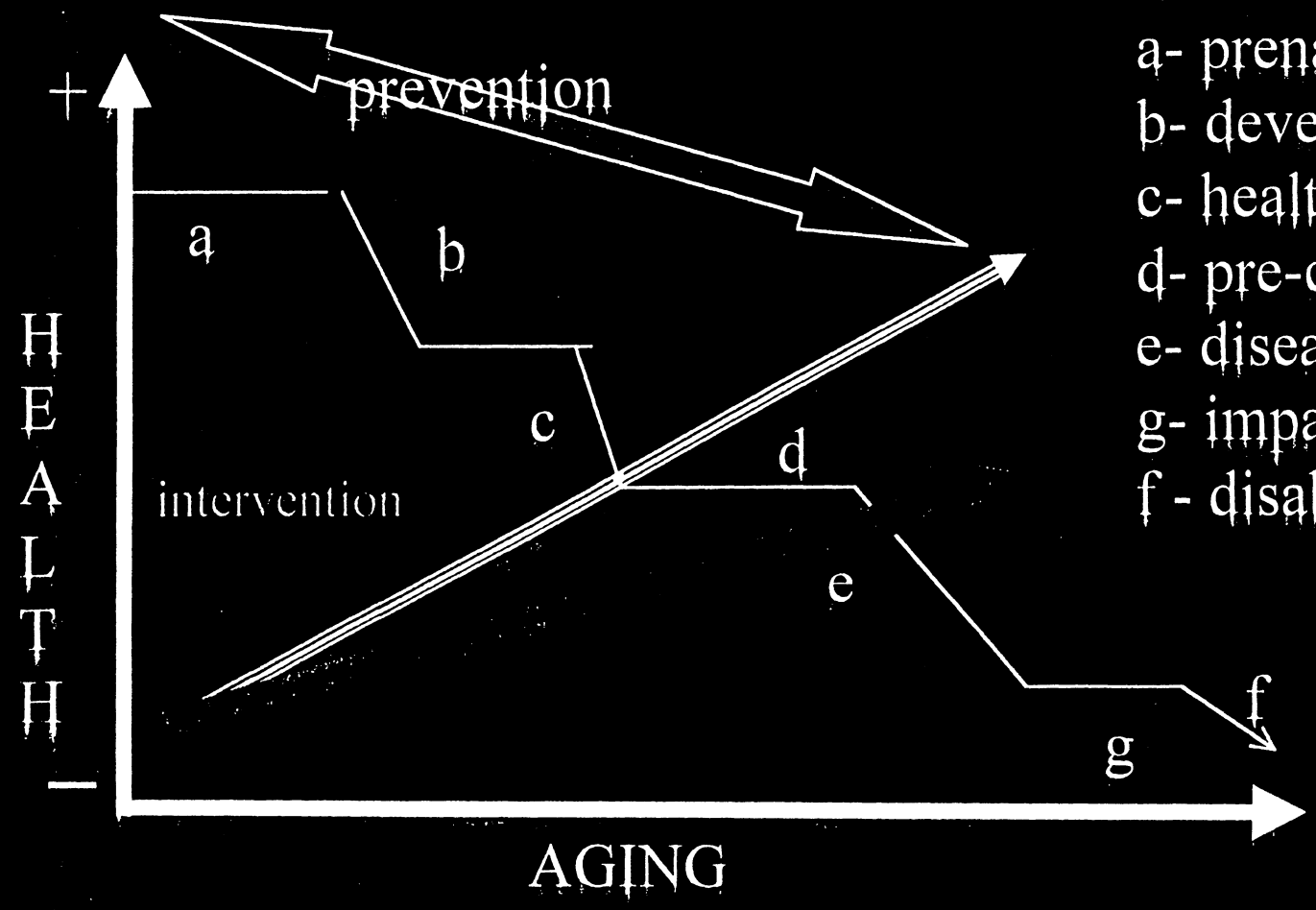


1950

1986

1990

THE CHANGING PATTERN

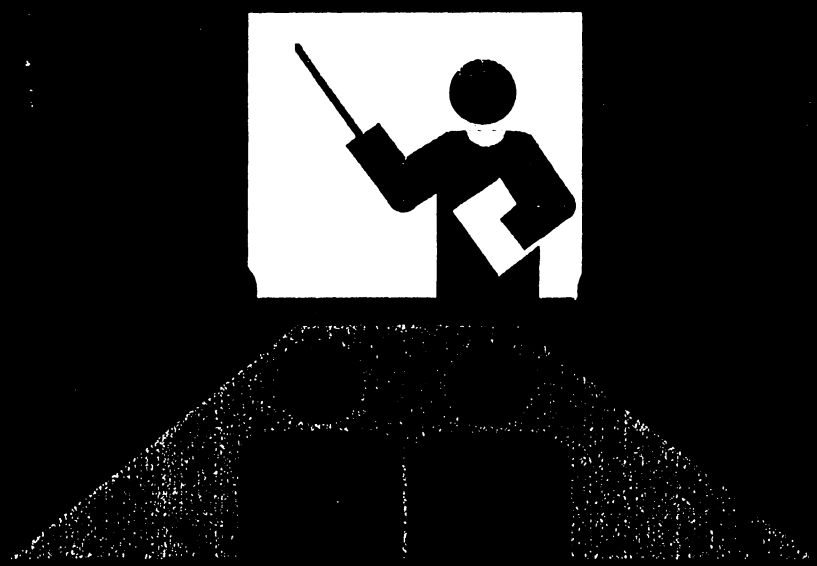


a- prenatal
b- development
c- healthy adult
d- pre-clinical
e- disease
g- impairment
f - disability

HEALTH & THE WORKPLACE

- CHOICES
  - family
  - workplace
  - environment
  - education
  - lifestyle
  - longevity
  - health
  - safety
- A CONTINUUM

LEADERSHIP IN HEALH CARE



- Focus on the **future**
- Founding the **vision** on the ***core values***
- Making the **vision** really creative
- Channel resources and efforts into the **vision**