

National Institutes of Health

# news & features

S p r i n g 2 0 0 0



Prevention Research

National Institutes of Health  
[news]  
features

*Editor*

Mary Sullivan

*Cover Art*

NIH Medical Arts and Photography  
Branch/Salvadore Bru

*Graphic Design*

The Watermark Design Office

NIH Office of Communications and  
Public Liaison

Building 31, Room 2B10

9000 Rockville Pike

Bethesda, MD 20892

(301) 496-1766

Thanks to Michael Coogan (National Eye  
Institute), Martina Vogel (NIH Office  
of Disease Prevention), Linda Brown  
(NIH Medical Arts and Photography Branch),  
and Esther McBride.

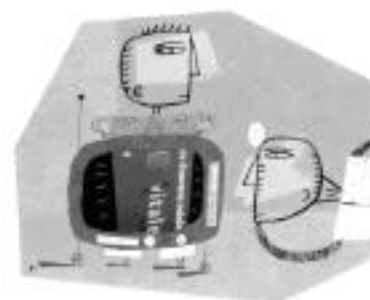
*NIH News & Features* is a government  
publication and holds no copyright privileges.  
Any material may be used without permission.

We would appreciate receiving clips when  
you use our stories or photos. Please fax clips  
and comments to the Editor at (301) 402-0395  
or send e-mail to: [ms41x@nih.gov](mailto:ms41x@nih.gov).

C O N T E N T S



- 2** Prevention Research at NIH: Bridging the Gap Between Medicine and Public Health
- 8** Communicators Focus on More Effective Health Messages
- 11** STAR Is Born: Testing Under Way of Two Drugs to Prevent Breast Cancer
- 14** Improving on Success: Making Vaccines Better
- 17** Cardiovascular Disease: When Can It Start? What Can Be Done to Prevent It? How Can Patients Cope With It?
- 23** A DASH of Prevention for Cardiovascular Disease
- 26** Preventing Stroke: Research Offers Hope
- 30** Why Do Children Use Drugs?
- 33** Preventing Underage Drinking
- 35** Preventing AIDS Among Underserved, High-Risk People
- 37** Combining Mass Media With School Program Prevents Teen Cigarette Smoking
- 39** Campaign Focuses on Oral Health and Cancer Care
- 42** Preventing Noise-Induced Hearing Loss



- 44** Saving Sight: Dilated Eye Exams Can Prevent Vision Loss in People With Diabetes
- 47** Preventing Diabetes: Looking for Ways to Stop Complications
- 51** Preventing Infant Homicide: Researchers Identify Risk Factors
- 53** Steroid-Induced Bone Loss: Studies in Mice May Lead to Prevention
- 54** Scientists Scrutinize Sun and Skin
- 57** Muscles: Use Them or Lose Them
- 59** Exercise: Feeling Fit for Life
- 65** Genetics and Public Health: The Human Genome Project and Disease Prevention
- 68** Your Environment Is Your Health: Tips on Staying Healthy

PREVENTION RESEARCH AT NIH:  
BRIDGING THE GAP

THE FOLLOWING IS AN  
INTERVIEW WITH  
DR. WILLIAM R. HARLAN,  
NIH ASSOCIATE DIRECTOR  
FOR DISEASE PREVENTION:

WHY WAS THE NIH OFFICE  
OF DISEASE PREVENTION  
ESTABLISHED AND HOW DOES  
IT RELATE TO THE RESEARCH  
PROGRAMS THE INSTITUTES  
ALREADY HAVE IN PLACE?

The NIH Office of Disease Prevention (ODP) was established in 1986 to promote and coordinate disease prevention research among the NIH institutes and centers and to advise the Director of NIH and senior staff on prevention research and related activities. Offices located in ODP coordinate research at NIH in the areas of dietary supplements, rare diseases, and the application of research findings to medical practice. ODP also works with other federal agencies as well as the private sector to stimulate and facilitate collaborative efforts.

As the primary link between the Office of the Director, NIH, and the 25 institutes and centers, ODP coordinates, collaborates, and manages information exchange across the diverse fields of biomedical science involved in prevention research at NIH. Through the NIH Prevention Research Coordinating Committee, which has representatives from each of the institutes and



Dr. William Harlan

# Between Medicine & Public Health

centers, ODP taps expertise across many disciplines to integrate NIH activities with other prevention organizations and to obtain technical review and comment on prevention issues affecting governmental policy and reports. For example, the ODP brought experts together to review progress on *Healthy People 2000* and to assist in developing health objectives for *Healthy People 2010*, the national prevention initiative to improve the health of all Americans. ODP also is coordinating the NIH role in developing the *Guide to Community Preventive Services*, which will recommend effective disease prevention programs that states and communities can use to move toward the goals of the *Healthy People Initiative*.

Another important part of ODP's mission is working with other agencies on community-based approaches to prevention. In recent years, ODP facilitated collaboration with the Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia, on the community prevention component of the NIH Women's Health Initiative (WHI). The WHI, one of the largest and most ambitious clinical studies ever conducted, is studying ways to prevent the most common causes of death

and disability among postmenopausal women. The prevention component is being funded by NIH and conducted by CDC's Prevention Research Centers Program.

Finally, ODP assists with policy formulation and program development on prevention research by providing NIH representatives on many federal interagency committees and workgroups. The expertise of these individuals provides a science-based research perspective in discussions and decisions on prevention and public health issues. Interagency collaboration also increases awareness of gaps in knowledge and helps in identifying new areas of research and collaboration.

## WHAT IS PREVENTION RESEARCH AT NIH?

Narrowly defined, prevention research includes studies of risk assessment and interventions to prevent disease and promote health.

Risk assessment means identifying factors that increase a person's risk for disease. These factors include individual genetic susceptibility to disease and exposure to environmental hazards. Risk factors are known for a number of common diseases, such as heart disease and some cancers, and provide the basis for research on specific interventions, such as lifestyle and behavioral choices. Risk assessment also involves developing better methods of detecting disease early before symptoms develop.

THE SCOPE OF PREVENTION RESEARCH FUNDED BY NIH RANGES FROM STUDIES ON GENETIC SUSCEPTIBILITY OR RISK FOR DISEASE, TO INTERVENTION STUDIES INVOLVING GROUPS OF PEOPLE WITH SPECIFIC CHARACTERISTICS.

Intervention research includes developing and evaluating biologic, environmental, behavioral and other methods, to prevent disease and promote health. Some interventions, such as diet and exercise programs for rehabilitating patients with heart disease, are used in treatment as well as in prevention. Research results from proven intervention studies often are translated into health messages to the public.

More broadly defined, prevention research includes studies that have a high likelihood of being applied to disease prevention, but are not directly related to risk assessment and intervention development. Examples might include studies aimed at understanding the fundamental causes of disease and the ensuing chain of events that lead to acute and chronic conditions. These research efforts often contribute to the development of future interventions. Further, many prevention studies include special groups, such as populations and families at risk for specific diseases. Information obtained from these observational studies has served as the foundation for large-scale clinical trials that have potential for improving public health.

Prevention research has been an integral part of the NIH research agenda for well over a decade. It now represents about 25 percent of the NIH research budget (see graphic for figures). About 85 percent of the prevention budget supports investigators in universities and medical centers outside NIH, reflecting the overall distribution of NIH research funds. This commitment represents an increasing interest in prevention and

an expansion of opportunities based in part on successful investigations.

The scope of prevention research funded by NIH ranges from studies on genetic susceptibility or risk for disease, to intervention studies involving groups of people with specific characteristics. Defining an individual's genetic risk for disease was once an imprecise procedure based on family history, but today's more exact measurements of irregularities in DNA provide better definitions of disease risk, and ultimately help uncover the biologic processes responsible for disease. Defining both the genetic contribution and the biologic alteration can improve our understanding of the effects of both genetics and the environment on the development of disease, and can ultimately sharpen the focus of disease prevention efforts.

WHAT ARE SOME OF THE CHALLENGES IN CONDUCTING PREVENTION RESEARCH?

Many behaviors and interventions affect more than a single disease or organ system, and studies often must balance the benefits to one condition and the increased risks for another condition. As a result, prevention research requires the involvement of investigators from many different scientific fields. At NIH that typically means involving several institutes and centers, something we refer to as "trans-NIH" studies.

There are many examples of institutes and centers joining expertise and resources to conduct prevention studies.

For example, the Women's Health Initiative (WHI) was developed by the Office of Disease Prevention with the involvement of staff from 14 institutes. At 40 clinical centers across the U.S., the WHI is studying ways to prevent the most common causes of death and disability among postmenopausal women—heart disease and stroke, cancer, and osteoporosis-related fractures. The study includes women at all levels of risk for these conditions, and assessments of both benefits and risks of the interventions are being conducted.

The WHI illustrates several issues that affect large-scale prevention studies. Observational studies and intervention studies can suggest risks and benefits by comparing the development of disease in individuals who receive the intervention versus those who do not. However, studies of larger and more representative populations, such as the WHI, are usually required to make valid public health inferences. Also, randomized studies (where participants are randomly assigned to receive either the intervention or a placebo) provide the most valid estimates of risks and benefits. The WHI includes both components. Large-scale prevention trials often take five years or more, require large sample sizes, and have relatively high costs. Several clinical sites are involved requiring collaborative participation by multiple investigators, and skilled NIH scientific staff are needed to provide central coordination and oversight.

The conduct of large clinical studies has resulted in important advances in prevention that have led to improved

public health. For example, prevention research has contributed to improved survival among people in the United States with coronary artery disease. Also, the decline in risk factors for this disease can be attributed, in part, to successful research. However, there are obstacles to conducting large studies, including rising costs, which make repetition of such studies unlikely and limit the overall number of studies that can be done. Further, limited resources make it all the more important to select appropriate study designs and to ensure that adequate follow-up is performed.

**THE NIH OFFICE OF BEHAVIORAL AND SOCIAL SCIENCES RESEARCH AND THE OFFICE OF DISEASE PREVENTION RECENTLY SPONSORED A CONFERENCE ON THE CONTRIBUTIONS OF THE BEHAVIORAL AND SOCIAL SCIENCES TO PREVENTION RESEARCH. WHAT IS THE SIGNIFICANCE OF BEHAVIORAL RESEARCH FOR IMPROVING HEALTH?**

The conference, “Preventive Intervention Research at the Crossroads: Contributions and Opportunities from the Behavioral and Social Sciences,” was a unique opportunity to showcase examples of NIH-funded research on prevention. This research ranges from studies aimed at preventing public health problems, such as HIV infection, alcohol abuse, child abuse, and smoking, to managing chronic illnesses, such as heart disease, asthma, and arthritis. Scientists exchanged

information on what works and what doesn’t work with regard to prevention and highlighted the challenges that exist in prevention research.

Healthy behaviors are essential for maintaining a high quality of life at every age. In addition, many of the major public health problems have a behavioral component. Scientific research is the foundation upon which recommendations for improving public health, including those for behavioral changes, are made. Research results relevant to specific diseases are translated into health messages and practices that ultimately save lives, reduce costs, and improve quality of life.

Preventive intervention programs like those presented at the conference are based on extensive research showing evidence of efficacy; however, they represent only the first step. There is a large gap between developing an effective prevention program and putting the program into actual practice. Establishing effective prevention programs in schools, neighborhoods, and larger communities is a major challenge. Research and demonstration programs form the basis for this effort by attempting to change both personal and community behavior using scientifically-proven techniques. These programs evaluate new and existing approaches to changing behavior and identify gaps in knowledge and problem areas for future investigation. The process allows for ongoing feedback that opens the way for continuing achievement of excellence in prevention research and relevance to the health goals of the nation.

## NIH Prevention Research

Participating ICs	FY 1999 Actual (Dollars in millions)
NCI	\$1,099.3
NHLBI	229.3
NIDCR	45.4
NIDDK	205.0
NINDS	82.7
NIAID	419.0
NICHD	293.5
NEI	135.7
NIEHS	311.6
NIA	298.1
NIAMS	69.1
NIDCD	24.8
NIMH	162.0
NIDA	80.6
NIAAA	82.1
NINR	11.0
NHGRI	107.7
NCRR	122.0
NCCAM	3.0
FIC	10.6
NLM	84.4
<b>NIH</b>	<b>3,876.9*</b>

NIH funding for prevention research among the institutes.

\*May not add due to rounding.



INFORMATION DISSEMINATION  
IS CRITICAL FOR APPLYING  
RESEARCH KNOWLEDGE  
ABOUT DISEASE PREVENTION  
AND HEALTH PROMOTION.

WHAT IS HEALTHY PEOPLE AND  
WHAT IS THE ROLE OF NIH?

**H**ealthy People is a national prevention program—coordinated by the U.S. Public Health Service—to improve the health of all Americans. It identifies the most significant, preventable threats to public health and enlists both public and private sectors resources to address these threats. *Healthy People* is based on scientific knowledge and is used for decision making and action. It can be used by many different people, groups, communities, and states concerned with a particular health problem or with the health concerns of a particular group. For the past several decades, national health goals have been set by the *Healthy People Initiative* for 1990, 2000, and now for 2010.

*Healthy People 2000* set three broad goals for the 1990s:

- Increase the span of healthy life for Americans.
- Reduce health disparities among Americans.
- Achieve access to preventive services for all Americans.

To help meet these goals, 300 specific objectives were set in 22 separate areas within three broad areas: health promotion, health protection, and prevention services. NIH is the lead agency for six *Healthy People 2000* priority areas: nutrition, environmental health, oral health, heart disease and stroke, cancer, and diabetes, and chronic disabling

conditions. During the 1990s, NIH staff conducted *Healthy People* reviews and supplied information to assess progress on the health objectives. They also coordinated and contributed to a mid-decade revision process by reviewing national health objectives and new information, developing new or revised objectives, and making recommendations regarding special populations.

Currently, the national health objectives for *Healthy People 2010* are being developed with broad community participation and collaboration. The objectives will address the additional goals of increasing quality of life (not only years of life) and eliminating health disparities among the U.S. population. Again, NIH has had a significant role with responsibilities in twelve major health areas.

WHY IS IT IMPORTANT TO  
DISSEMINATE THE RESULTS  
OF PREVENTION STUDIES  
TO THE PUBLIC AND TO  
HEALTH CARE PROVIDERS?

I nformation dissemination is critical for applying research knowledge about disease prevention and health promotion. Programs to provide current and useful information to the public and to health care providers are an increasingly important and expanding part of the NIH prevention research agenda. The NIH Web site (<http://www.nih.gov>) provides information to scientists and general audiences, including a section devoted to health and consumer information.

Prevention and health education often

are the key message in information provided by NIH to parents, teachers, community leaders, and other members of the general public. Many of the institutes have centralized distribution systems, such as clearinghouses and toll-free numbers, offering up-to-date scientific evidence and guidance on many prevention and health promotion topics. The *National High Blood Pressure Education Program* sponsored by the National Heart, Lung, and Blood Institute, the *Five-A-Day Program* from the National Cancer Institute, and *Eye Health* from the National Eye Institute are examples of programs that provide practical information based on scientific findings.

NIH produces material on prevention and health promotion for scientific and professional audiences as well as for the general public. An important facet of NIH dissemination of information on prevention is the interchange among scientists and the transfer of new findings to physicians in the community. The *NIH Consensus Development Conference Program*, which is in the Office of Disease Prevention, has conducted more than 100 conferences, many on topics related to prevention. Consensus Development Conferences are sponsored by several institutes and feature an informed, unbiased group of scientists, health providers, and the public who assess scientific evidence and develop a consensus on a controversial clinical issue. The consensus statements are published and are available on the NIH Web site (<http://consensus.nih.gov>). Over the years, these statements have



led to changes in prevention and disease management and have helped define future directions for research.

ODP also maintains a database of published, international, scientific literature on dietary supplements available free to the public through the Internet (<http://dietarysupplements.info.nih.gov>). The International Bibliographic Information on Dietary Supplements database (IBIDS), sponsored by ODP's Office of Dietary Supplements, helps scientists and the general public locate credible, scientific literature on dietary supplements.

Through the ODP's Office of Rare Diseases, a large database is available to the public and health care providers on the Internet (<http://rarediseases.info.nih.gov/ord>) that provides information about rare diseases (defined as conditions with fewer than 200,000 prevalent cases in the U.S.). The database describes research studies and provides access to informed health care and research projects. The information provides an opportunity for patients and their families to find care by knowledgeable health care professionals and for researchers to recruit patients for studies crucial to learning about the cause and treatment for over 4,000 conditions that are rare but important.

#### WHAT IS THE FUTURE OF PREVENTION RESEARCH?

Clearly, one of the biggest challenges we face today is to translate research findings into meaningful prevention practices at

the community and personal levels—to close the gap between “what we know” and “what we do.” For the future, one of the most important aspects of prevention research will be to develop ways to help federal officials, community leaders, and health care providers apply research results and to achieve the goals and objectives of *Healthy People*, and ultimately improve the health of the nation.

Another important focus is to eliminate the disparities in health status that exist in this country. We know, for instance, that minorities bear a disproportionate burden of both acute and chronic diseases, and that there are differences in health according to gender and income as well. *Healthy People 2010* has as an overarching theme the elimination of health disparities, so that all Americans can benefit from the advances that have resulted from NIH research efforts.

Finally, as we address the challenges of the next century, NIH continues to build a foundation of strong and scientifically-sound research to support interventions that will promote health and prevent disease. Our mission is clear—to improve health through research—and our commitment to supporting the highest-quality efforts in prevention research is enduring. The American public can be confident that the NIH will continue to lead the way in prevention research so that all Americans can look forward to a healthier future. •

---

*Mary Sullivan, public affairs specialist and Editor, NIH News & Features magazine, NIH Office of Communications and Public Liaison.*

# Communicators Focus on More Effective Health Messages

- SMOKERS ARE 10 TIMES MORE LIKELY THAN NONSMOKERS TO DEVELOP LUNG CANCER.
- BLACK MEN ARE MORE THAN TWICE AS LIKELY TO DEVELOP PROSTATE CANCER THAN WHITE MEN.
- INDIVIDUALS EXPOSED TO THE SUN, X-RAYS, OR ULTRAVIOLET LIGHT FOR LONG PERIODS OF TIME HAVE A GREATER RISK OF DEVELOPING SKIN CANCER.

Everyone reads and hears messages like these in newspapers, magazines, on television and radio, and in educational materials developed by credible sources of health information.

Whether or not people pay attention to and understand information about health risks—and in turn consider adopting behaviors that could decrease health risks, such as eating a healthy diet, often depends on how risk messages are presented.

What types of health risk information are more likely to capture people's attention? To help answer this question, NIH's National Cancer Institute (NCI) conducted research using focus groups with more than 100 people in three U.S. cities in December 1997. Participants discussed how they perceive, process, and interpret messages related to cancer risks, including specific terms, types of statistics, and graphics used to express cancer risk.

"We wanted to find out about the public's understanding of risk terms and concepts and explore people's perceptions of their own personal risk and related behaviors," says Ellen Eisner, Communi-

cations Research Manager at NCI's Health Promotion Branch. "We also asked participants to assess the credibility of the sources of information and specific messages containing risk information."

Many focus group participants said that they rarely pay attention to health risk information, and when they do, they often find reasons to discredit the information or believe it doesn't relate to them. They also said that short-term goals, like staying in shape, rather than long-term goals, like lowering risk of disease, motivate them to adopt or maintain healthy habits.

"If it's negative, you don't want to believe it so you ask a lot of questions," said a male participant. "Who did this study? Who are these scientists? Who's paying them?" One female participant said, "When you hear [that your risk is] 1 in 250, it's like you're not going to be that one."

## RISK INFORMATION SHOULD BE RELEVANT

Risk ratios needed to be at least 1 in 10 before some participants felt there was cause for concern. Presenting statistics using ratios introduced other problems as well. Ratios with large denominators, such as 1 in 1,000, were difficult for most participants to conceptualize. They had an easier time understanding risk ratios using small denominators, such as 1 in 10 or 1 in 50, because small groups of people were easy to picture in their mind—for example, they could imagine their coworkers, neighbors, or people in their religious congregations. Decimals (i.e. "risk increases by 1.6"), also confused many participants.





Percentages were found to be the most effective way to present statistics. For example, most people found it easier to understand that Americans' risk of developing the flu in a given year is 25 percent, rather than .25 or 1 in 4.

Specific words and terms also affected whether or not people paid attention to a message. For example, the word "risk" attracted people's attention more than "chance," because "risk" implies danger and a greater certainty that something bad can happen. Participants felt "chance" implied less certainty that something will happen and can apply to something good or bad happening.

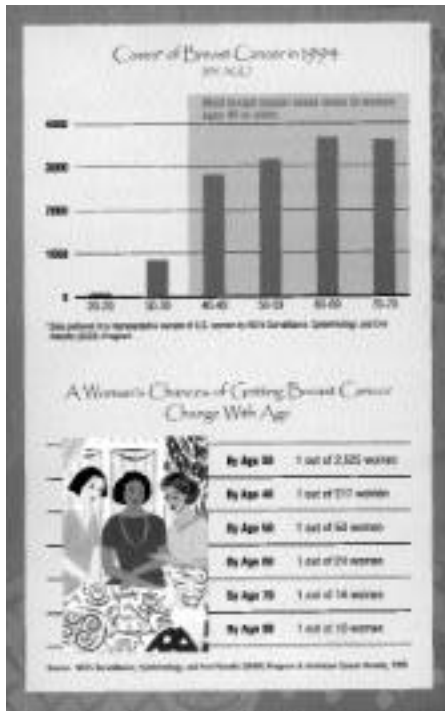
Terms like "fourfold" or "threefold" and "lifetime risk" also caused confusion. "How long do they consider a lifetime?" asked one female focus group participant.

#### NCI PROGRAMS USE RESEARCH RESULTS

These and many other insights provided by focus group participants have made NCI's Office of Cancer Communications more aware of audiences' needs and perspectives when designing health risk messages. The research results have been put to use in a variety of programs.

NCI's brochure, "The Facts About Breast Cancer and Mammograms," shows breast cancer incidence in graphics that were pre-tested with focus groups (see illustration on next page). The brochure also addresses readers directly to personalize the message. For example, instead of saying, "The risk of breast cancer increases with age," the authors wrote, "Your risk for breast cancer continues to increase over your lifetime."





Examples of graphics pre-tested with focus groups.

In addition, NCI is developing two tip sheets, one to help communicators create messages about cancer risk that are easier to understand and another to help consumers evaluate health risk information. These tip sheets will be included in the NCI's information packet, "Cancer Research: Because Lives Depend On It." The packet is part of a national program to educate people about cancer research, to present recent developments in cancer research, and to show how cancer research affects their lives.

The NCI plans to follow up its focus group research with a survey research project, which would involve more participants and produce results that could be generalized to a broader audience.

"Effective health communicators must do much more than provide accurate information," adds Eisner. "They also must make the message meaningful to their audience, using terms and statistics that most people can understand and relate to."

**For more information** about NCI's risk communication research and tip sheets for health communicators and the public, contact the NCI Health Promotion Branch at (301) 496-6667.

*Jennifer Smith, former health communications intern, National Cancer Institute.*

## Messages on Cervical Cancer Screening Aimed at Older and Minority Women

Women age 65 or older are less likely than younger women to get a Pap test, the primary screening tool for cervical cancer. Yet, older women account for nearly 25 percent of cervical cancer cases and 41 percent of deaths due to cervical cancer. This and other data from the Healthstyles Survey (1997), the National Health Interview Survey (1992), and the NCI Consensus Panel are the basis for NCI's campaign to encourage women age 65 and over to get Pap tests at least once every three years.

Compared to younger women, women age 65 and older:

- are less likely to get Pap tests—50 percent have not had a Pap test in the past three years. Also, 51 percent of women age 65 and older said they didn't intend to get one in the next year, and one-third said they were unsure.
- have a higher incidence of cervical cancer.
- have a higher death rate due to cervical cancer.

In addition, one-half of U.S. women diagnosed with cervical cancer have never had a Pap test, and another 10 percent have not had a Pap test in the past five years.

The Pap test, in which cervical cells collected during a pelvic examination are placed on a slide and examined under a microscope, is considered the most effective screening procedure for detecting abnormal cells in the cervix. Since the early 1970s when Pap testing became common medical practice, both numbers of cases and death rates for invasive cervical cancer have declined about 40 percent.

Studies reveal that older women may not receive Pap tests because they are unsure about how often to be tested, fear the test might be painful or embarrassing, underestimate their own personal risk, fear test results, have language and/or cultural barriers, or can't afford medical care.

The NCI is addressing these concerns by educating older women and their doctors about cervical cancer risks, the need for regular Pap tests, and follow-up of positive test results. A special effort is being made to reach minority women over 65, particularly African-American and Hispanic women, who have higher rates of cervical cancer—both numbers of cases and deaths—compared to white women in the same age group. NCI also is working with the Health Care Financing Administration to offer free or low-cost Pap tests to medically-underserved women. Medicare covers Pap tests once every three years for all Medicare beneficiaries.

**For more information** about Medicare coverage of cervical cancer screening evaluations, call the Medicare hotline at 1-800-638-6833.

Women and health care providers can obtain information about cervical cancer and Pap testing by calling NCI's Cancer Information Service (CIS) at 1-800-4-CANCER or visiting NCI's Web site at: <http://www.nci.nih.gov> (under information for public, patients, and the mass media).

Jennifer Bishop, former health communications intern, National Cancer Institute.

# STAR is born:

TESTING UNDERWAY  
OF TWO DRUGS TO  
PREVENT BREAST CANCER

Not long ago, a woman who worried about breast cancer had no proven way to cut her chance of developing the disease. Now, a drug has been proven to do exactly that, and women at high risk of breast cancer are currently taking part in a study to

test whether that drug, or another one, might do the job better.

The Study of Tamoxifen and Raloxifene, or STAR—funded by NIH’s National Cancer Institute (NCI)—is the largest-ever breast cancer prevention clinical trial (a research study conducted with volunteers), and is expected to include 22,000 women. At nearly 400 locations across the United States and Canada, women at increased risk of breast cancer can enroll to receive one of two drugs that could reduce their chance of developing breast cancer.

STAR is taking place because of more than 25 years of research on a class of drugs called selective estrogen receptor modifiers—or SERMs. SERMs are drugs that act like the female hormone estrogen in some parts of the body and block the actions of estrogen in others. Estrogen plays many roles in a woman’s body, affecting her breasts, bones, uterus (womb), and blood, in both good and bad ways. For instance, estrogen helps keep bones strong and cholesterol levels low. But estrogen can also feed breast tumors, which is why SERMs, which can block estrogens, were first used as treatments for breast cancer.

## TAMOXIFEN FOUND EFFECTIVE IN PREVENTING BREAST CANCER

The first and most studied SERM is tamoxifen (Nolvadex). Tamoxifen has been used for more than 20 years to treat breast cancer patients because it blocks the action of estrogen in the breast. Studies showed that women with breast cancer who were treated with tamoxifen had a much smaller chance of getting breast cancer in the other breast. Based on this finding, in 1992 researchers launched the Breast Cancer Prevention Trial (BCPT)—the first large-scale breast cancer prevention study in North America.

In the BCPT, more than 13,000 women at high risk of breast cancer took either tamoxifen or a placebo (an inactive pill that looked like tamoxifen) to see if tamoxifen reduced their chance of developing breast cancer. A woman’s risk of developing breast cancer was determined by a computer calculation based on certain factors that affect the risk of breast cancer. These factors include age, family history of breast cancer, personal medical history, age at first menstrual period, and age at first live birth (see box). The National Surgical Adjuvant Breast and Bowel Project (NSABP), a Pittsburgh-based research network that had been studying tamoxifen as a treatment drug for 20 years, conducted the trial.

In April 1998, BCPT researchers released the initial results of the study: Women taking tamoxifen for an average of four years had about half as many breast cancers as women who did not take the drug.

Leslie Ford, M.D., an associate director in the National Cancer Insti-



Dr. Leslie Ford

tute’s Division of Cancer Prevention and the NCI person responsible for the BCPT, considers the study a real advance. “Women who are at an increased risk of breast cancer now have an option—to consider taking tamoxifen to reduce their chance of developing breast cancer.”

In addition to reducing breast cancer incidence by almost half, tamoxifen reduced the number of bone fractures of the hip, wrist, and spine—showing that tamoxifen mimics the good effects of estrogen on bone. But, as expected from years of studying the drug, tamoxifen also had some of the harmful effects of estrogen. Tamoxifen increased older women’s chances of three rare, but life-threatening health problems: endometrial cancer (cancer of the lining of the uterus), deep vein thrombosis (blood clots in large veins), and pulmonary embolisms (blood clots in the lung). Women younger than age 50 appeared to have no increased risk of these serious

# STAR



Dr. Lawrence Wickerham

adverse effects.

“Tamoxifen is not a perfect drug,” said Ford, “but we have proven that drugs can stop the clinical expression of breast cancer. Only through more research and more clinical trials will we find preventions that are even more effective, and have fewer side effects.”

Enter Raloxifene.

Raloxifene was produced by a drug company in the 1980s in an attempt to develop a tamoxifen-like drug to treat breast cancer. Drug companies often design new drugs by starting with one they know is useful and making a few changes. At least a dozen or so tamoxifen-like drugs have been developed, but few have become useful drugs. At first raloxifene looked like a failure, too.

“Compared to tamoxifen, raloxifene

was a disappointing breast cancer treatment drug,” explains Larry Wickerham, M.D., the NSABP physician in charge of prevention trials. So the drug company set it aside until further research proved that SERMs could help keep bones healthy and strong. Raloxifene was studied again and found to slow bone loss in women who had gone through menopause. It was recently approved by the U.S. Food and Drug Administration for that purpose and is sold by the brand name Evista.

#### RALOXIFENE'S EFFECTIVENESS IS UNDER INVESTIGATION

When routine safety studies were done with raloxifene, researchers found that women taking the drug had fewer breast cancers and fewer endometrial cancers than women who did not take the drug.

“Raloxifene seems to be as effective as or more effective than tamoxifen for preventing breast cancer, with fewer side effects,” said Dr. Wickerham, “but the only way to prove this theory is in a clinical trial where the two drugs are compared head to head.”

Thus, STAR was born.

Women participating in STAR must be age 35 or older and must be past menopause. They are randomly assigned to receive either tamoxifen or raloxifene daily for five years. They receive close follow-up examinations, including a mammogram, physical exam, and gynecologic exam, on a regular basis for at least seven years.

Similar to those in the BCPT, women participating in STAR have an assessment of their breast cancer risk and a physical exam to determine if they are eligible. They participate in an informational process known as informed

consent. A member of the STAR staff, often a nurse, talks to them at length about the study—including information about the drugs, the tests required, the possible side effects, and the possible benefits of participation. Volunteers in STAR continue to receive information about the study, the drugs, and breast cancer research as a whole, throughout the trial.

“Information is a powerful weapon,” says Wickerham. “Women who participate in STAR are well informed about tamoxifen and raloxifene, as well as about important advances in breast cancer research.”

Wickerham adds that there are other positive reasons to participate: “One of the most important is that skilled health professionals provide quality care and information.” He notes that women know they should see a doctor regularly and have mammograms, but by participating in a trial, “you have someone looking over your shoulder” to help you do something you know you should do anyway. •

WOMEN INTERESTED IN PARTICIPATING IN STAR CAN GET INFORMATION FROM NCI'S CANCER INFORMATION SERVICE AT 1-800-4-CANCER AND THE NCI WEB SITE FOR INFORMATION ON CLINICAL TRIALS AT: [HTTP://CANCERTRIALS.NCI.NIH.GOV](http://cancertrials.nci.nih.gov).



# STAR

## What puts a woman at risk for breast cancer?

*Kara Smigel-Crocker, senior writer,  
National Cancer Institute.*

**B**reast cancer is the most frequently-diagnosed cancer in American women after skin cancer. No one knows why some women develop breast cancer and others do not. The risk of breast cancer increases as women get older, and over the years researchers have identified certain characteristics, called “risk factors,” that influence a woman’s chance of getting the disease. Still, many women who develop breast cancer have no known risk factors other than growing older, and many women with known risk factors do not get breast cancer.

The factors that doctors in the Breast Cancer Prevention Trial used to estimate risk were:

- **Personal history of breast abnormalities.** Two breast tissue abnormalities—ductal carcinoma in situ (DCIS) and lobular carcinoma in situ (LCIS)—are associated with increased risk for developing an invasive breast cancer. These abnormalities can only be diagnosed when a laboratory looks at tissue from a lump or suspicious area found on a mammogram.
- **Age.** The risk of developing breast cancer increases with age. The majority of breast cancer cases occur in women older than age 50.
- **Age at menarche** (first menstrual period). Women who had their first menstrual period before age 12 have a slightly increased risk of breast cancer.
- **Age at first live birth.** Women who had their first full-term pregnancy after age 30 and women who have never borne a child have a greater risk of developing breast cancer.
- **Breast cancer among first-degree relatives** (sisters, mother, daughters). Women with one or more first-degree blood relatives who have had breast cancer have a higher risk of developing this disease.
- **Breast biopsies.** Women who have had breast biopsies have an increased risk of breast cancer, especially if the biopsy showed a change in breast tissue known as atypical hyperplasia. These women are at increased risk because of the condition that prompted the biopsies, NOT because of the biopsies themselves.
- **Race.** White women have a greater risk of developing breast cancer than African-American women (although African-American women diagnosed with breast cancer are more likely to die of the disease).

Other risk factors for breast cancer have been identified or proposed, but were not included in the assessment for two reasons: either the evidence that these factors contribute to breast cancer risk is not conclusive, or researchers cannot precisely determine how much they contribute to breast cancer risk. Such possible risk factors include: age at menopause, presence of dense breast tissue, use of birth control pills or hormone replacement therapy, a high-fat diet, alcohol use, exposure to radiation, and environmental pollutants.

Women can take an active part in the early detection of breast cancer by having regular clinical breast exams (breast exams performed by health professionals). NCI recommends that women in their 40s or older get screening mammograms on a regular basis, every one to two years. Many women also perform breast self-exams, although this is not a substitute for clinical breast exams or mammography.

# IMPROVING ON SUCCESS:

## Making Vaccines Better

VACCINES HAVE HELPED PREVENT ILLNESS AND DEATH FOR MORE THAN 200 YEARS. EDWARD JENNER'S 1796 DISCOVERY THAT PEOPLE COULD BE IMMUNIZED AGAINST SMALLPOX EVENTUALLY LED TO WORLDWIDE VACCINATION CAMPAIGNS THAT ELIMINATED THE DISEASE. BY THE EARLY PART OF THE 20TH CENTURY, VACCINES AGAINST RABIES, DIPHTHERIA, TYPHOID FEVER, AND PLAGUE HAD BEEN DEVELOPED. MANY CHILDHOOD DISEASES, SUCH AS MEASLES, MUMPS, AND CHICKENPOX, ONCE A NORMAL PART OF GROWING UP, CAN NOW BE PREVENTED WITH EVEN NEWER VACCINES.

Efforts to develop new and better vaccines must be continued to counter the increasing threat of emerging and reemerging infectious diseases and organisms that have become resistant to antibiotics. Scientists at NIH's National Institute of Allergy and Infectious Diseases (NIAID) and those at other institutions receiving funds from NIAID are exploring new ways to administer and develop new vaccines.

### ORAL, EDIBLE, AND NASAL SPRAY VACCINES TARGET THE MUCOSA

Research has shown that targeting vaccines to the mucosa—membranes that line the mouth, nose, and digestive and genital tracts—can effectively generate an immune response, because this approach mimics the route of entry taken by many disease-causing organisms. The oral polio vaccine, in use since the 1950s, is an early example of the success of this strategy. These non-injectable vaccines also decrease the risk of transmitting

infections such as hepatitis, a major problem of unsafe injection practices.

### EDIBLE VACCINES

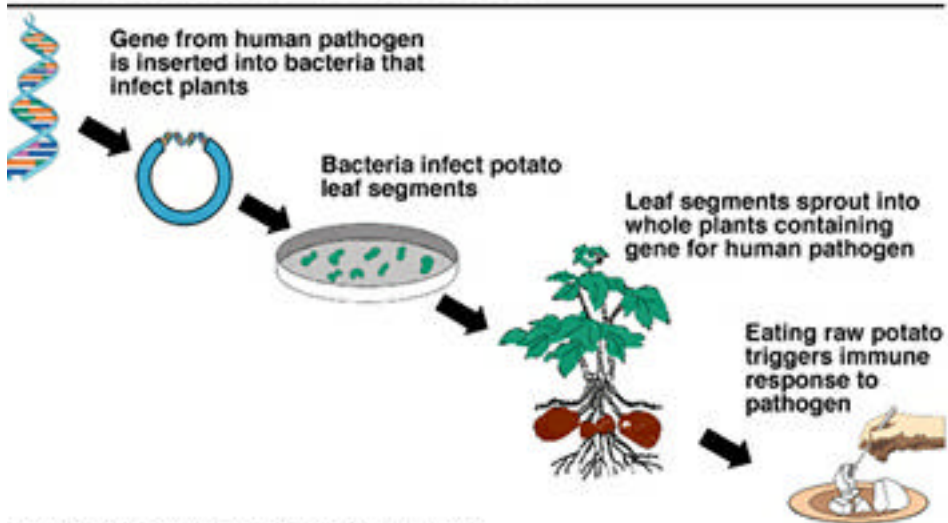
In the spring of 1998, collaborative researchers from the University of Maryland, Tulane University, and the Boyce Thompson Institute for Plant Research at Cornell University reported for the first time that an edible vaccine can safely trigger significant disease-fighting immune responses in people. Volunteers in the NIAID-funded study ate bite-sized pieces of raw potato that had been genetically engineered to produce part of the toxin secreted by the *Escherichia coli* bacterium, which causes diarrhea.

Encouraged by the results of this study, NIAID-funded scientists are using this technique to administer other antigens (proteins capable of eliciting an immune response). Edible vaccines against other intestinal disease-causing organisms also are being studied. Some of these include potatoes and bananas that could protect

# IMPROVING ON SUCCESS:

## Making Vaccines Better

### An Edible Vaccine



Source: Boyce Thompson Institute for Plant Research

against Norwalk virus, another common cause of diarrhea, and potatoes and tomatoes that could protect against hepatitis B.

“Edible vaccines offer exciting possibilities for significantly reducing the burden of diseases like hepatitis and diarrhea, particularly in the developing world where storing and administering vaccines are often major problems,” says Anthony S. Fauci, M.D., director of NIAID.

“The hope is that edible vaccines could be grown in the countries where they would actually be used,” said Regina Rabinovich, M.D., who oversees NIAID’s Vaccine and Treatment Evaluation Units.

#### NASAL SPRAY VACCINES

An experimental nasal spray vaccine recently proved to be highly effective at preventing both the flu and flu-related ear infections in young children. In a large study, funded in part by NIAID, the vaccine provided 93 percent protection against the flu and, unexpectedly, 98 percent protection against otitis media (ear infection), a common complication of the flu. Children experience the highest incidence of influenza disease, two to 10 times that seen in adults, and are a common source of its spread to adults as well as to other children in schools and daycare centers.

The vaccine is being developed under a cooperative research agreement between NIAID and the vaccine’s manufacturer, Aviron. Known as FluMist,<sup>™</sup> it is made from cold-adapted viruses, which are live but weakened influenza viruses altered to grow only at cooler temperatures, such as those found in the nose. “Cold-adapted viruses stimulate mucosal immunity in the nose but do not grow in the warmer environment of the lower respiratory tract,” explains Brian Murphy, M.D.

## VACCINES REMAIN AMONG THE MOST POWERFUL TOOLS FOR DISEASE PREVENTION.

“This allows the vaccine to mimic a natural infection and induce immunity without actually causing disease.” Dr. Murphy heads the Respiratory Viruses Section at NIAID’s Laboratory of Infectious Diseases, where much of the research to develop these cold-adapted viruses took place.

FluMist™ consists of proteins from master strains of cold-adapted influenza A and B viruses combined with surface proteins of influenza viruses that are currently circulating. Surface proteins are the parts of the virus that are recognized by the immune system. Each year, the surface proteins of the vaccine can be changed to match those of viruses expected to circulate during the upcoming flu season.

### DNA VACCINES: A NEW ERA IN VACCINE DEVELOPMENT

DNA vaccination, which involves injecting pure genetic material directly into the body, is one of the most exciting experimental techniques in vaccine development. In this approach, scientists inject people with genes (DNA) for one or more proteins from a disease-causing organism. The body’s own cells use the DNA to make “foreign” proteins. These foreign proteins stimulate an immune response, which can potentially result in lifelong protection. Since the vaccine only contains a fragment of the entire organism, it will not cause disease.

DNA vaccines are inexpensive, stable, easy to make, and don’t need refrigeration, qualities that make feasible their widespread use in developing countries. DNA vaccines for malaria, influenza, and HIV have been tested in humans. Early clinical trials have been encouraging, and have only touched the surface of this promising technology.

Donald L. Lodmell, Ph.D., Nancy Ray, Ph.D., and their colleagues at NIAID’s

Rocky Mountain Laboratories (RML) in Hamilton, Montana, recently developed a DNA vaccine against rabies that protected monkeys from the disease. It is the first DNA vaccine to produce complete protection in nonhuman primates against a virus that attacks the central nervous system (CNS).

In addition, antibodies elicited by the vaccine were effective against a global range of rabies viruses, suggesting that the DNA vaccine might be effective anywhere in the world.

The vaccine was made from DNA for the surface protein of the rabies virus. To test the vaccine’s effectiveness, Drs. Lodmell and Ray vaccinated eight monkeys with the DNA vaccine, two monkeys with a current rabies cell vaccine for humans, and two control monkeys with the DNA vector (carrier with no virus) alone. All animals received at least one booster shot at 190 days. The researchers found high levels of neutralizing antibodies against the rabies virus in all the animals except the two control monkeys. Neutralizing antibodies are the primary source of protection for humans and animals. When the monkeys were exposed to lethal doses of the rabies virus, only the two control monkeys developed the disease.

Experimental DNA vaccines typically provide long-lasting immunity, so a DNA vaccine against rabies could be used to protect people at high risk, such as veterinarians and people in developing countries. The only drawback of the DNA vaccine, says Dr. Lodmell, is that the antibody response cannot be detected until 30 days after vaccination. Hence, as currently designed, the vaccine would not prevent rabies after exposure to the disease. However, he believes researchers will be able to overcome this problem in the future.

### VACCINES OF THE FUTURE

In the future, vaccines may be used to treat or prevent allergies and autoimmune diseases, such as diabetes, multiple sclerosis, rheumatoid arthritis, and uveitis (eye inflammation). Other vaccines of the future may:

- be delivered through skin patches;
- be given during pregnancy to prevent mother-to-child transmission of certain diseases (e.g., Group B Streptococcus vaccine);
- add genetic information to breast milk genes in animals such as goats so that their breast milk will contain “vaccines”; and
- include subunit and DNA vaccines that enhance immune responses.

Vaccines remain among the most powerful tools for disease prevention. Advances in biotechnology have ushered in a new era in vaccine development that holds great promise for improving public health. NIAID will continue to lead research efforts in vaccine development. •

# CARDIOVASCULAR DISEASE:

When Can  
It Start?

What Can  
Be Done to  
Prevent It?

How Can  
Patients Cope  
With It?

THREE NURSE RESEARCHERS—FUNDED BY NIH’S NATIONAL INSTITUTE OF NURSING RESEARCH—PROVIDE PERSPECTIVES ABOUT THEIR PATIENTS, THEIR RESEARCH PROGRAMS, AND THEIR EXPECTATIONS FOR REDUCING THE RISKS OR COPING WITH THE DAMAGING EFFECTS OF CARDIOVASCULAR DISEASE.

## AVOIDING RISKS OF CARDIOVASCULAR DISEASE: AN EARLY START

“The important thing is to get them when they’re young,” says Joanne Harrell, Ph.D., R.N., F.A.A.N., speaking of the nation’s school children. As the principal investigator of a study



Dr. Joanne Harrell

of cardiovascular risk factors in young people, Dr. Harrell believes strongly that “rather than trying to treat heart disease after symptoms appear when we’re in our 40s, 50s or 60s, it’s much better to stop the disease at the outset. Research has already shown that the predisposition for heart disease can begin in childhood,” she adds. “We also know it is hard to change a pleasurable but unhealthy habit, particularly a

long-standing one, so the issue is how to prevent the habit from forming in the first place.”

To reduce the risks of cardiovascular disease (CVD), Dr. Harrell and her research team at the University of North Carolina, School of Nursing, have developed a successful school program to promote healthy habits. Called the Cardiovascular Health in Children program (CHIC), the study—begun in 1990—initially targeted 1,274 eight- and nine-year old elementary school children in 12 schools throughout the “stroke belt” state of North Carolina. Dr. Harrell’s goal was to find out how to promote healthy habits during childhood, and how to ensure that these habits continue throughout adulthood.

## SCHOOL PROGRAM LOWERED RISK FACTORS

Dr. Harrell found that in just eight weeks the children in the program experienced a significant drop in total cholesterol and amount of body fat. Additionally, although it is normal for systolic blood pressure to increase as children grow older, it increased at a much slower rate for children in the program than for those in the control group. The program group also improved in their physical fitness and their knowledge about nutrition and the dangers of smoking.

Dr. Harrell then turned her attention to answering another question. “I wanted to know if children who already have risk factors for CVD, such as obesity and high cholesterol, need special attention,” she explains. For this part of the study, she conducted a randomized controlled trial (a large study where participants are randomly assigned to different groups) of 422 children who already had risk factors



Elementary school children learn the importance of exercise in burning calories.

for cardiovascular disease. The children were from 18 rural and urban North Carolina schools.

Dr. Harrell divided the children with risk factors into three groups: those who received the special program from their teachers in a regular classroom along with the rest of the class; those who were placed in small groups apart from their classmates, where the program was taught by nurses; and controls (children not exposed to the program).

#### PROGRAM BASED IN THE CLASSROOM

“What is key in this second study,” Dr. Harrell points out, “is that the children with CVD risk factors in both classrooms and in small groups had striking reductions in cholesterol, blood pressure, and body fat, as well as increased health knowledge and physical activity, when compared to the control group. And the classroom approach did not affect the budget, was easy to implement, and reached more students.

This approach is clearly the direction to go, particularly in these times of limited resources.”

Dr. Harrell also explains that the classroom program avoids stigmatizing children who have risk factors, capitalizes on positive peer pressure, and includes children who are currently at low risk. Her findings were published in the August 3, 1998 issue of *PEDIATRICS*.

The CHIC program is based in part on the American Heart Association Schoolsite Program Kit. Children in the classroom version receive instruction from teachers twice a week for eight weeks. The course includes the importance of regular exercise and how to select heart-healthy foods. The children also participate in an aerobic physical education program taught three times a week by their regular physical education teachers. The children with risk factors who were placed in small groups of up to eight children were in a program

A group of 8th graders, who saw the 3rd and 4th graders having a great time with the physical exercise portion of the CHIC program, petitioned the school principal to change the 8th grade PE classes to CHIC, “because it looks like much more fun than what we’re doing.” Not only did the PE program in that school change, but a few years later, the CHIC study of 6th through 8th graders began in selected middle schools, to see if it was as effective for these youngsters. Shortly after the middle school program ended, one of the school health teachers who taught the CHIC program wrote that he had just had triple bypass surgery. He said that if it had not been for what he learned from teaching CHIC, he would have ignored his symptoms and would not have gone to the doctor. He was grateful for CHIC’s presence in his school.



An elementary school child is having her body fat measured.



tailored to their individual risk factors. All children received the same physical education program.

Dr. Harrell stresses that the children with risk factors do not have CVD symptoms; they are considered healthy. But they do have characteristics that can lead to heart disease later in life. She continues to follow these children to determine the effects of the CHIC model over time. She also has begun another aspect of the study which includes 1,200 rural, ethnically diverse 6th through 8th graders. “We need to determine the relative merits of elementary versus middle school programs to determine which age span is best to focus on,” says Dr. Harrell.

Dr. Harrell would like to see her classroom prevention program repeated in elementary schools across the nation. “I believe that mounting scientifically-verified health education programs presents an important challenge for our primary education system,” she states. “If we were able to produce our positive results in such a short time, imagine what a program given for longer periods, through many grades, could accomplish—the nation’s high incidence of cardiovascular disease could be significantly reduced in the future.”

## REDUCING HEALTH DISPARITIES: PREVENTING AND TREATING HIGH BLOOD PRESSURE IN A VULNERABLE POPULATION

“We must provide prevention programs and care to people in our society who need help in maintaining their health but are hard to reach,” says Martha Hill, Ph.D., R.N., F.A.A.N. “It is critical, and it is also the right thing to do.”

Dr. Hill, professor and director,

Center for Nursing Research, the Johns Hopkins University School of Nursing and immediate-past president, American Heart Association, practices what she preaches through research

to combat the current racial and ethnic disparities in good health and health care. She is studying treatment of hypertension (high blood pressure) and prevention of its complications in young urban, African-American men, who have the lowest rates of awareness, treatment, and control of this disease of any group in the United States. The 1995 death rate for African-American males of all ages from high blood pressure was 355 percent higher than for Caucasian males, and they developed the condition at an earlier age.

Dr. Hill is developing a model that uses an aggressive approach to reducing blood pressure in these men. Her research program may well be unique, and her advice on working with at-risk populations is sought by colleagues from around the world. High blood pressure is a major risk factor for cardiovascular diseases, such as coronary artery disease, angina (chest pain), heart failure, and stroke.

“It is hard to realize at first the degree of difficulty and complexity inherent in this type of research,” explains Dr. Hill. “A key issue we faced in our initial research phase was how to recruit and retain African-American young men, who are difficult to attract to health research projects. They are not often



Dr. Martha Hill

found in health care clinics where researchers are usually able to recruit study participants.”

Two factors made a difference in successful recruitment. First, Dr. Hill and her colleagues contacted the men whose charts from their trips to the emergency room, typically their source for primary care, indicated hypertension. Second, outreach was conducted in the community using ethnic community members to spread the word. Using this technique, the researchers recruited 204 young men for a 12-month study. Of note was that 91 percent of them remained with the project until its completion.

## INTENSE, MULTIDISCIPLINARY APPROACH USED

“We determined that we could attract and hold on to these young men in a research study, which meant we could turn our attention to finding out what works with this particular group,” Dr. Hill explained. “The results showed that to control the men’s hypertension, we had to conduct an intervention that was more intense than we had initially envisioned.”

After exploring several avenues, in 1996 Dr. Hill began a 12-week pilot project. What worked for the young men was interaction with a multidisciplinary team consisting of a nurse practitioner, a community health worker, and a physician, with the nurse practitioner providing free care and medication. At the conclusion of this short study, blood pressure was controlled in two-thirds of the men.

The interdisciplinary team approach is now being evaluated in an expanded two-year study involving 309 young, underserved African-American men—157 receive the special intervention and 102 serve as a comparison group.

All are given health education. In addition to services provided in the pilot project, the young men in the intervention group receive other services that include employment referrals, home visits, counseling, and transportation. This expanded approach became necessary when investigators found major, coexisting health problems in these patients that complicated prevention and treatment and needed to be addressed. For example, some of the men have heart and kidney disease.

After one year, preliminary results of the study showed that blood pressure control in the men increased to 44 percent. Visits to the emergency room, which they typically use for primary care, decreased from 145 to 35 visits.

The profiles of the men at the start of the study underscore the difficulties faced by the investigators. This makes the positive effect of the intervention, as reflected in the preliminary results, all the more impressive. About 72 percent of the young men were unemployed or disabled; 72 percent had an annual income of under \$10,000; 51 percent had no health insurance; 64 percent had spent time in prison; 62 percent had a history of alcohol abuse; 50 percent had a history of regular drug use; and 39 percent had not completed the 12th grade.

#### HIGH BLOOD PRESSURE NOT HIGH ON LIST OF CONCERNS

“When we asked the men to list their chief concerns in life, high blood pressure was at the bottom of their list, so we knew highly-individualized care was going to be necessary,” says Dr. Hill. “We try to make it possible for positive health messages and practices to cut through the turbulence of these young men’s lives, while trying



Community outreach is key.

to help them deal with stressful events and poor health stemming from a variety of causes.”

Dr. Hill anticipates expanding the research program to provide even greater emphasis on interrelated health issues, such as substance abuse and kidney problems, and to follow the patients over time to determine the benefits of long-term blood pressure control. The cost effectiveness of the intervention compared with visits to the emergency room and other expenses also will be determined.

“Although one faces significant

One study participant—one of many challenging cases facing researchers—had alcohol and drug problems, smoked, was unemployed, and lost his home because of domestic disputes. The researchers addressed these issues and at one point helped him get a construction job helping to build the new School of Nursing on the Johns Hopkins University campus. Although he has had relapses, he has been doing well for over a year, and his hypertension is under control.

barriers when conducting health research involving high-risk, urban individuals,” Dr. Hill says, “the positive side is the potential for improving their long-term health, reducing health care costs, and fulfilling the ethical responsibilities of those of us who are in the business of providing health care.”

### **AFTER THE HOSPITAL: IMPROVING HEALTH AND QUALITY OF LIFE FOR PEOPLE WITH CARDIOVASCULAR DISEASE AND LOWERING COSTS**

“The challenge to the Medicare system in the 21st century will be its ability to respond to the needs of older people who live with multiple chronic illnesses, especially chronic cardiovascular disease (CVD),” predicts Mary Naylor, Ph.D., R.N., F.A.A.N. Her statement is based on considerable experience, starting with her staff position on the Senate Special Committee on Aging in the mid-80s. “From the time my interest in the health of our elderly population first began until now, more elderly people, primarily Medicare beneficiaries, are living longer with chronic CVD. And it is important to recognize that their numbers are expected to double over the next few decades.”

Dr. Naylor, a researcher at the University of Pennsylvania School of Nursing, is addressing a key concern about which there is little scientific knowledge: how to improve the quality of life in this high-risk, high-volume, group of older Americans living with chronic CVD. “The Medicare system was established over 30 years ago when acute illness was diagnosed and treated

during prolonged hospital stays,” explains Dr. Naylor. “Currently, hospital stays for beneficiaries are less than four days in some health plans, and there also have been recent cuts in



Dr. Mary Naylor

home care services. Acute episodes of CVD are not over once the patient leaves the hospital for home. Patients are still at considerable risk, and as the acute phase of the disease becomes chronic, they face both physical and emotional health problems.”

#### **TRANSITIONAL CARE MODEL USED**

Dr. Naylor uses a multidisciplinary team to test a model of transitional care from hospital to home, called comprehensive discharge planning. This involves determining and planning the patient’s care needs outside the hospital, and planning follow-up visits by a qualified nurse. The same nurse who prepares the patient for discharge also provides the home follow-up.

“This is in sharp contrast with current practice, which leaves most patients, once discharged, on their own to obtain necessary follow-up care,” says Dr. Naylor. “These nurse experts use their clinical judgment to determine the nature, intensity, and frequency of hospital and home visits for their patients. They are also available to patients and families by telephone seven days a week.” In other studies, with participants ranging from pregnant women with diabetes to women having hysterectomies, this transitional care

model has been highly successful.

Dr. Naylor is testing this model in older patients. From 1989 to 1997, she completed two randomized clinical studies, and a third is in progress. The first study tested the model in patients hospitalized with certain cardiac conditions. This involved hospital discharge planning and telephone contact with patients two weeks after discharge. The patients were followed for three months after discharge.

After six weeks, the data showed that the average cost of total health care services for medical patients was reduced by 62 percent; readmissions to the hospital were reduced by 61 percent; and the number of days spent in the hospital once readmitted were reduced by 70 percent. After the halfway point of the study, positive benefits began to decline, indicating the need for a second, more intensive study aimed at the most vulnerable older patients.

#### **INTERVENTIONS PROMISE BETTER HEALTH AT LOWER COST**

The second study included patients who were hospitalized for cardiac conditions that required medical or surgical treatment. They received home visits up to four weeks after discharge, and were followed for six months to see how they fared. Similar to the findings from the first study, the group receiving transitional care also experienced fewer readmissions; more time between discharge and readmission; and significantly reduced health care costs, compared to controls. For example, Medicare reimbursements for all health services were almost \$600,000 lower for the 177 Medicare beneficiaries that received transitional care. Dr. Naylor points out that “when one considers the number of older people hospitalized each year with

similar conditions, the potential patient benefits and savings to Medicare are tremendous.” Thus even for older people at high risk—with an average of five active physical and emotional problems—the model promises better health at less cost to the health care system.

One subgroup of patients, however, did not fare as well—those with heart failure, experienced only short-term benefits. Heart failure patients have the poorest outlook and the highest hospitalization rates of all adult patients. According to the Agency for Health Care Policy and Research, the annual inpatient expenditures for these patients are more than \$8 billion, and out-of-hospital costs of care are about \$3 billion. Their five-year mortality rate is 50 percent, and the period between initial diagnosis and the end of life represents a downward health spiral that includes a variety of disabling symptoms, including depression, and a loss of independence.

Dr. Naylor’s ongoing study, which began in 1996, applies the transitional care model more intensively to older people hospitalized with heart failure. For example, patients receive daily

visits from nurses while they are in the hospital and home visits within 24 hours following discharge. Patient and cost outcomes are being measured for one year after discharge from the hospital.

“It is difficult for patients and their caregivers to manage symptoms of heart failure, and patients often have trouble changing certain risky behaviors that contribute to poor general health,” explains Dr. Naylor. “These patients become profoundly ill. While the nature and severity of their symptoms and the complexity of treatment present a challenge, past studies indicate that between one-third and one-half of hospitalizations for heart failure are preventable.”

“I look forward to the day when scientific research can point the way to helping even the sickest patients and when their caregivers can manage their conditions outside the hospital and improve their quality of life. The opportunity to pursue this goal is an important privilege—and the outlook ahead is promising,” says Dr. Naylor. •

---

*Linda Cook, information officer, National Institute of Nursing Research.*

The case of a 73-year-old minister with severe heart failure is typical. Living in a 3rd floor walk-up apartment with his wife, who also suffered from multiple health problems, he had eight other chronic health problems, including coronary artery disease, atrial fibrillation, and arthritis. His ability to perform normal functions was moderately to severely impaired and he had been hospitalized four times within a six-month period prior to participating in the study. As a study participant, he received specialized services provided by a nurse, including education, counseling, and monitoring of his cardio-pulmonary status. The nurse also ensured proper medical follow-up care. As a result, the minister increased his ability to walk and perform activities of daily living without symptoms. He gained confidence in managing his own health and understood what symptoms to report and how to obtain timely and appropriate care. His readmission to the hospital was prevented for a 125-day period.

# Cardiovascular Disease

It was a Monday evening in the summer of 1996. Joann Jackson eagerly prepared what would be her last home-made meal for a long time. She grabbed some hot wings from the refrigerator, then spotted some crab cakes and a soda, and a bag of potato chips on the counter. Tonight she would enjoy her favorite foods. Tomorrow would be different. She was starting a special diet. It wouldn't help her to lose any weight. As a matter of fact, her weight would be monitored to make sure it didn't change. But she hoped the diet would help her heart.

Every minute the heart beats about 70 or 80 times. With every beat, blood is forced against the artery walls. This is called blood pressure. It is expressed as two numbers, such as 120/80 millimeters of mercury (mm Hg). The first number is the systolic pressure. It measures the force blood exerts on the arteries when the heart beats. The second is the diastolic pressure. It is the force of blood on the arteries between heart beats. Jackson's heart was working too hard.

Jackson discovered her high blood pressure by accident. "We had a blood

pressure screening at work, and I just decided to go over. I never had any problems with blood pressure before, but it was free, so why not?" Jackson says that after several measurements, she was surprised to learn that her blood pressure was high. "They were passing out brochures about the DASH study, and asked if I wanted to join. I'd try anything not to have to take medication on a daily basis," she says. "So I did it."

NIH's National Heart, Lung, and Blood Institute (NHLBI) sponsors Dietary Approaches to Stop Hypertension (DASH) along with NIH's National Center for Research Resources and the NIH Office of Research on Minority Health. The goal is to learn what effect dietary patterns have on blood pressure.

## HIGH BLOOD PRESSURE COMMON IN AFRICAN AMERICANS

About 50 million adult Americans have high blood pressure, which is defined as 140/90 mm Hg or higher. A third of them don't know they have it, and three-fourths of them aren't controlling it. High blood pressure is especially common among African Americans, who tend to develop it earlier in life and

more often than whites. Many Americans also develop high blood pressure as they get older. In fact, it affects half of people age 60 and older. High blood pressure can lead to cardiovascular (heart and blood vessel) diseases such as coronary heart disease, angina (chest pain), heart failure, and stroke.

Even slight elevations of blood pressure above the optimal level of less than 120/80 mm Hg are unhealthy, says Eva Obarzanek, Ph.D., NHLBI's project officer for the study. She says a significant portion of cardiovascular disease occurs in people whose blood pressure is above the optimal level.

Jackson was one of 459 participants in the study. About half were women and 60 percent were African American. Their blood pressures were 160/95 mm Hg or below when they started, and 133 of them had high blood pressure. The study was conducted at four sites: Brigham and Women's Hospital in Boston, Massachusetts; Duke University Medical Center in Durham, North Carolina; Johns Hopkins University in Baltimore, Maryland; and Pennington Biomedical Research Center at Louisiana State University in Baton

Study participants eating dinner at the Johns Hopkins University Pro Health Center.

Joann Jackson (second row, fifth from right) with study participants.

Joann Jackson (second from left) with center employees.





ABOUT 50 MILLION ADULT AMERICANS HAVE HIGH BLOOD PRESSURE, WHICH IS DEFINED AS 140/90 MM HG OR HIGHER.

Rouge, Louisiana. Kaiser Permanente Center for Health Research in Portland, Oregon was the coordinating center.

The DASH researchers compared three eating plans:

- a typical American diet, which is generally described as high in fat and low in fruits and vegetables;
- a typical diet, but with more fruits and vegetables; and
- a diet lower in saturated fat, total fat, and cholesterol, and rich in fruits, vegetables, and low-fat dairy foods.

All three plans used about 3,000 milligrams of sodium daily. That's about 20 percent below the average for adults in the United States. None of the plans was vegetarian or used specialty foods.

On her first day, Jackson walked two and a half blocks to the eating site at Johns Hopkins Pro-Health Center.

"I was sort of dreading it," she admits. "I wasn't sure what it would be like." Each participant chose one meal a day to eat with the study group; the other meals were packed in a cooler for later. "Eating with the group was very relaxing," says 46-year-old Gail Lloyd, who participated at the Duke Center in North Carolina with her husband. "I enjoyed going to the center every day. It gave me a chance to unwind and talk to the other participants. It was like therapy."

#### FOLLOWING THE DASH DIET

For the next 11 weeks, while Jackson and the Lloyds cooked regular meals for their families, they followed the DASH diet. They had 9 to 10 servings of fruits and vegetables a day, about twice the amount consumed by most American adults, along with nearly three servings a day of low-fat dairy products, about double the number Americans consume.



The DASH investigators. Top row (left to right): Thomas J. Moore, M.D., Principal Investigator, Brigham and Women's Hospital; William M. Vollmer, Ph.D., Brigham and Women's Hospital; Thomas M. Vogt, M.D., Principal Investigator, Kaiser Permanente Center for Health Research; Jeffrey A. Cutler, M.D., Prevention Scientific Research Group, NHLBI. Bottom row (left to right): George A. Bray, M.D., Principal Investigator, Pennington Biomedical Research Center; Laura P. Svetkey, M.D., Principal Investigator, Duke University Medical Center; Lawrence J. Appel, M.D., M.P.H., Principal Investigator, Johns Hopkins University Welch Center for Prevention, Epidemiology, and Clinical Research; Eva Obarzanek, Ph.D., M.P.H., R.D., Project Officer, NHLBI.

They say the nicest part was knowing they were eating healthy food, and the hardest part was knowing every day what they would have to eat. It would be easier to follow the DASH diet at home where you could switch the menu items around, says Jackson.

The study found that two of the plans reduced blood pressure: the diet with more fruits and vegetables and the diet with less total and saturated fat and cholesterol and plenty of fruits, vegetables, and low-fat dairy foods. The latter

one lowered blood pressure the most, by an average of 5.5 mm Hg for systolic and 3 mm Hg for diastolic. It worked even better for those with high blood pressure: the systolic dropped by 11 mm Hg and the diastolic by 5.5 mm Hg.

"We believe the DASH diet, if added to current lifestyle recommendations, could prevent hypertension and reduce or possibly eliminate the need for medication in those who already have the condition," says Obarzanek. She says current recommendations are to



maintain a healthy weight, to choose foods lower in salt and sodium, to drink alcohol in moderation (for those who drink), and be physically active. Obarzanek says if everyone in the country followed DASH and experienced the same reduction in blood pressure as did the study participants, it is estimated that the incidence of coronary heart disease would fall by 15 percent and stroke by 27 percent.

For study pioneers Jackson and Lloyd, this is no surprise. "My blood pressure was beautiful the whole time I was on the study," says Jackson. "It never went up, so I know diet has something to do with it." Lloyd, whose blood pressure was considered high normal, says the diet also changed her in other ways. "I used to fry foods, but since the study, I have had no fried foods at all, and I am very conscious of how I prepare things."

Lloyd says she knows hypertension is a leading cause of disease for African Americans, and hopes that her participation will help someone else. "I hope the word can get out so other people can try the diet, and I also hope they find a cure for high blood pressure," says Lloyd. •

**For more information** on eating the DASH way, contact the NHLBI Information Center at P.O. Box 30105, Bethesda, MD 20824-0105 or call (301) 592-8573. Fact sheets are free and bulk quantities are also available at a minimal cost. You may also visit the DASH Web site at <http://dash.bwh.harvard.edu>. For a recorded message on preventing and treating high blood pressure in Spanish or English, call 1-800-575-WELL.

---

*Sharon Ricks, technical writer/editor,  
National Heart, Lung, and Blood  
Institute.*

## Prevent Heart Disease with the Help of an Interactive Cholesterol Education Web Site

**A**nother way to prevent cardiovascular disease may be as near as your computer. "Live Healthier, Live Longer," is a new interactive web site that takes the guesswork out of lowering cholesterol for people with heart disease.

"Recent studies have proven that people with heart disease can prevent heart attacks and actually prolong their lives by lowering their blood cholesterol levels," says James Cleeman, M.D., coordinator of NHLBI's National Cholesterol Education Program. The purpose of the Web site is to provide accurate, personally-relevant information to help people with heart disease lower their LDL ("bad") cholesterol to the goal level of 100 mg/dL (milligrams per deciliter).

**To access the site, go to [www.nhlbi.nih.gov](http://www.nhlbi.nih.gov), look under "Highlights," and click on the interactive site. Visitors may:**

- Enter their LDL cholesterol level and learn what their doctor may prescribe to lower it.
- Get an estimate of their daily dietary allowances for saturated fat, total fat, cholesterol, calories, and sodium, based on their height, weight, age, gender, and level of physical activity.
- Select foods for a day of meals and see a report of the amount of saturated fat, total fat, cholesterol, calories, and sodium for each meal and for the day. This is compared with their daily dietary allowances.
- Find out how to read food labels in the grocery store.
- Learn how to recognize serving sizes.
- Get some heart-healthy recipes.
- Understand how drugs lower cholesterol.
- Take a cholesterol and heart IQ test.
- Discover how physical activity helps them stay healthy.

# Preventing Stroke:

## R E S E A R C H O F F E R S H O P E

On a hot day in July of 1994, Theodore Bly of Rockville, Maryland, was running errands. He left his car at a service shop near his home, and walked about a mile down the road to get lunch. On the walk back, he noticed that something was wrong.

“All of a sudden I felt unsteady,” he says. “I wasn’t really dizzy, but my stability was off. I was having trouble walking and I had no energy.”

Theodore Bly was having a stroke. More than 700,000 Americans have a stroke every year. It is the third leading cause of death in this country and the number one cause of adult disability. A stroke occurs when the blood supply to part of the brain is suddenly interrupted or when a vessel in the brain bursts. The resulting loss of oxygen kills brain cells.

Without knowing it, Mr. Bly was at high risk for a stroke. He was 72 years old, had suffered a heart attack in 1978, and had a history of hypertension (high blood pressure) and diabetes. He was also slightly overweight at the time of his stroke.

In addition to Mr. Bly’s risk factors—hypertension, heart disease, diabetes, age, and excess weight—others include atrial fibrillation (irregular heart rate), high cholesterol, smoking, and a prior history of stroke or transient ischemic attack (TIA), also known as a mini-stroke. Many of these health problems can make a person more susceptible to brain hemorrhage, blood clots, and/or atherosclerosis, the build

up of fatty material along the inner walls of the large arteries of the body.

Although aging can’t be controlled, medical conditions such as hypertension, diabetes, high cholesterol, and atrial fibrillation can be controlled with medications or other treatments.

People can also reduce stroke risk by quitting smoking, eating better, achieving and maintaining a healthy weight, and starting a physician-approved exercise program.

“The best way to prevent a stroke is an overall lifestyle change which includes, but is not limited to, treating risk factors,” says Thomas J. DeGraba, M.D., Head of the Clinical Stroke Research Unit at NIH’s National Institute of Neurological Disorders and Stroke (NINDS) in Bethesda, Maryland.

### RISK FACTORS FOR STROKE

Hypertension is the most important, treatable risk factor for stroke. People with hypertension have a risk for stroke that is four to six times higher than the risk for those without hypertension. One-third of the adult U.S. population, about 50 million people—including 40-70 percent of those over age 65—have high blood pressure. And 40 to 90 percent of stroke patients have high blood pressure before their stroke.

A person with hypertension can decrease his stroke risk with proper treatment for high blood pressure. Physicians have a variety of medications that can help lower blood pressure. Recent studies



Smoking is the most important modifiable risk factor for stroke. It almost doubles a person’s risk for ischemic stroke and more than triples a person’s risk for hemorrhagic stroke. Photo courtesy of the National Cancer Institute.

suggest that medication can reduce the risk of stroke by 38 percent and reduce the risk of death from stroke by 40 percent in people with hypertension.

In the 1970s and 1980s there was an upsurge in the identification and treatment of hypertension, which led to steady decreases in the incidence and death rates of heart disease and stroke in this country. However, the rates of stroke now have started to level off, because the number of people with hypertension is increasing, primarily due to the aging of the population.

The leveling off of the stroke incidence and mortality rates also may be due to an increase in stroke risk from other important risk factors, such as heart disease and diabetes. Evidence suggests that an increase in survival rates for patients with



heart disease, especially for those age 65 and older, has led to an increase in the number of people with heart disease who are at risk for stroke.

Also, rates for diabetes and obesity are increasing in this country, especially among the African-American population. Diabetes increases a person's risk for stroke by three times. Also, diabetes is often found with other risk factors. For example, the prevalence of hypertension is 40 percent higher in the diabetic population compared to the general population.

William Lensing, Chief Nurse at *Soldiers' Home*, a retirement center for U.S. veterans, in Washington, DC, was only 53 years old in 1994 when he had his stroke. He had no history of hypertension, diabetes, or smoking. But for six years Mr. Lensing had been living with atrial fibrillation. He knew that atrial fibrillation put him at high risk for a stroke and he was taking a low-dose aspirin every day in hopes of preventing one.

Atrial fibrillation is a type of heart disease characterized by irregular

Because brain damage progresses during the first few hours of a stroke, early and aggressive care is important. Dr. DeGraba is examining a patient using the NIH Stroke Scale, which was developed by scientists at NINDS to measure neurological deficits in stroke patients by having them perform certain mental and physical tasks.

Photo courtesy of NINDS.

beating of the left atrium or left upper chamber of the heart, and is the second most important risk factor for stroke after hypertension. In people with atrial fibrillation, the left atrium beats up to four times faster than the rest of the heart, leading to an irregular flow of blood and the occasional formation of blood clots that can leave the heart and travel to the brain, causing a stroke.

“I guess my heart kicked out a blood clot and it went to my brain,” he says of the incident.

Atrial fibrillation affects as many as 2.2 million Americans and about 15 percent of stroke patients have atrial fibrillation before they experience a stroke. The condition is more prevalent in the older age groups, meaning that the number of people with atrial fibrillation is increasing proportionately with the growth of the elderly population. In people over 80 years old, atrial fibrillation is the direct cause of one in four strokes.

“Considerable effort is being directed toward developing improved measures for preventing stroke,” says John M. Hallenbeck, M.D., Chief of the Stroke Branch at the NINDS. “The NINDS Division of Stroke and Trauma has sponsored a number of important stroke prevention trials.”

The NINDS-funded clinical trial, Stroke Prevention in Atrial Fibrillation (SPAF), started in 1987 and completed in April 1998, set out to determine the



Stroke is a medical emergency that requires rapid transport to a hospital and timely treatment upon arrival. Some hospitals have stroke emergency plans to rapidly diagnose and treat stroke patients. Photo courtesy of the Maryland Institute for Emergency Medical Services Systems (MIEMSS).

best treatment for preventing strokes in individuals with atrial fibrillation. It showed that a daily dose of aspirin was sufficient to prevent strokes in most atrial fibrillation patients. For those patients with additional risk factors, another drug, called Coumadin® or warfarin, provided better prevention than aspirin, though it led to a higher risk of bleeding.

#### EXPERIENCING SYMPTOMS BEFORE A STROKE

Samuel David Chambers, a retired Navy chaplain from Chevy Chase, Maryland, experienced transient stroke symptoms months before he had his stroke three years ago at the age of 74.

“I had indications before my stroke, such as tingling and numbness in my left hand,” says Chambers. “As I look back on it, those symptoms were indicative of a future stroke.”

When the physicians at the U.S. Naval

Hospital in Bethesda, Maryland, saw Mr. Chambers at the time of his stroke, they realized that he had a history of transient ischemic attacks or TIAs. A TIA is a short-lived stroke, sometimes called a mini-stroke, that starts just like a regular stroke, but then resolves leaving no noticeable symptoms or deficits. The average duration of a TIA is a few minutes, and most TIAs go away within an hour. If the symptoms persist for more than 24 hours, then the episode is labeled as an acute stroke and not a TIA. There is no way to tell in the beginning whether stroke symptoms indicate a TIA or an acute stroke, so all stroke symptoms should be taken seriously and prompt a 911 call.

A history of TIA or past stroke is the greatest predictor of a future acute stroke. Of the approximately 50,000 Americans who have a TIA each year, about one-third will have an acute stroke sometime in the future. About 25

percent of people who recover from their first stroke will have another stroke within five years. Recurrent stroke is a major contributor to stroke disability and death, with the risk of severe disability or death from stroke increasing with each stroke recurrence. The risk of a recurrent stroke is greatest right after a stroke, with the risk decreasing with time. About three percent of stroke patients will have another stroke within 30 days of their first stroke and one-third of recurrent strokes take place within two years of the first stroke.

#### RESEARCH OFFERS HOPE FOR SOME STROKE PATIENTS

There is hope for people at high risk for stroke. Some people at high risk may be able to prevent a stroke with proper identification and treatment of medical problems, such as high blood pressure, and maintenance of a healthy lifestyle. Stroke also may be prevented with medications, such as aspirin or warfarin, that prevent the formation of blood clots that can become lodged in an artery in the brain and cause a stroke. In some patients, surgery may be used to prevent a stroke by removing fatty deposits from the inside of one of the carotid arteries, which are located in the neck and are the main suppliers of blood to the brain.

There is hope for stroke patients on another front. In June of 1996 the Food and Drug Administration (FDA) approved the first drug for the treatment

of acute stroke, called recombinant tissue plasminogen activator, or t-PA. The FDA approval came after a revolutionary clinical trial, called the NINDS rt-PA Stroke Study, showed an overwhelming benefit for stroke patients who received the drug within three hours of their stroke versus those stroke patients who did not receive the drug. The treatment is used only for patients who have had a stroke caused by a blood clot (ischemic). It cannot be given to those who have had a hemorrhagic (bleeding) stroke, because of the risk of further bleeding.

T-PA is a thrombolytic, or a clot-busting drug, that must be administered to a stroke patient in a hospital *within three hours of the start of stroke symptoms*. The timing is very important. If t-PA is given to a stroke patient after three hours from the start of stroke symptoms, there is a significant chance that the patient might hemorrhage, leading to greater disability or even death. For this reason, it is imperative that the general public learn the signs and symptoms of stroke and know to call 911, *immediately!* . A stroke patient must get into the hospital within *one hour* from the start of stroke symptoms, because it takes time to assess the patient before he can receive the medication.

“The NINDS rt-PA Stroke Study has done more than any other clinical trial to give doctors who care for acute stroke patients a sense of hope,”

says Hallenbeck.

Mr. Bly, Mr. Lensing, and Mr. Chambers did not receive t-PA because they had their strokes before the approval of the drug. But, with the aid of rehabilitative therapy, all three are almost fully recovered from their strokes.

“I think I came through the stroke excellently, and praises to the doctors and nurses who took care of me,” says Chambers. “Because of them, I’m now able to take better care of myself and, hopefully, will prevent another stroke from happening.” •

**For more information** on stroke, call the National Institute of Neurological Disorders and Stroke at 301-496-5751 or visit their Web site at: <http://www.ninds.nih.gov>.

---

*Marcia Vital, writer/editor, National Institute of Neurological Disorders and Stroke.*

# Why Do Children Use Drugs?

C O M M E N T A R Y

**A**t the top of virtually every parent's list of concerns is the fear that their children might become involved with drugs. And they are right to be concerned. Whether in cities, or in suburban or rural communities, whether in wealthy or in poor neighborhoods, drugs are now readily available to all young people. Even the seemingly nerdiest kids can speak with apparent fluency and familiarity about marijuana, cocaine, heroin, and such strange-sounding items as blunts, ecstasy, roofies, special k, and crystal meth.

Drugs are an equal-opportunity destroyer. Fifty percent of young people have used an illegal drug by the time they leave high school. What's a parent to do? How can a parent predict if a child is going to use drugs? What can be done to prevent drug use in children? How can parents help children once they've started using drugs?

The first step is to understand why children might be using drugs. Researchers have identified over 50 factors that might put a child at risk for drug use. These risk factors can be found at the individual, family, peer group, and broader community levels. They include things like having too much free time, weak family structures, peer-group social pressures, and the glorification of drug use by some in the popular media.

But those risk factors really only address overall probabilities of whether young people with certain characteristics might be more or less prone to using drugs. Knowing about these risk factors can help keep a parent alert, but no set of risk factors determines whether a par-

ticular child will use drugs, and many children who have many of those risk factors don't even try drugs. So parents really have to deal with the individual child's situation and state of mind.

## REASONS FOR CHILDHOOD DRUG USE

Research on the pathways to drug use and addiction suggests the immediate decision to use drugs is driven, basically, by one of two types of reasons. One group of young people seems to use drugs simply to feel good. They are seeking novelty or excitement, to have a good time. Included in this group are those who say they use drugs just because all their friends are doing it; they want to join in the common fun or be "cool."

These children are most likely to respond to prevention programs that educate about the harmful effects of drugs on their bodies. They also are more likely to be influenced by the powerful protective factor of having strong and loving parents interested and involved in all aspects of their lives. These children also seem to have the best chances of being successfully taught to seek alternative ways of having fun and to resist the temptation to seek novelty in drugs and in other harmful ways.

But a second, very different group of young people uses drugs for quite different and more intractable reasons. These are children who in some way or another are suffering and use drugs to try to make themselves feel better, or even normal. This group often includes people stuck in very difficult life situations—in poverty or in abusive families, for example. It also includes young people suffering from a variety of untreated mental disorders, such as clinical depression, manic depressive

illness, panic disorder, or schizophrenia.

It is estimated that as many as 10 million children and adolescents may suffer from emotional and psychiatric problems of such magnitude that their ability to function is compromised, and the majority of those individuals are at extremely high risk of becoming addicted to drugs.

These young people are not using drugs just to feel good. These children are actually trying to medicate themselves. They use drugs because they think drugs will make them feel better, or normal, in the same way that other people might use prescribed antidepressants or anti-anxiety medications. The problem, of course, is that using illicit drugs is not an effective treatment. Their use interferes with normal functioning and ultimately makes them feel worse, not better. Medical research has shown clearly that this kind of drug use only exacerbates underlying psychological problems.

## PREVENTION AND TREATMENT SHOULD ADDRESS UNDERLYING PROBLEMS

Both the prevention and treatment approaches for these "self-medicating" young people need to be quite different from the approaches used for novelty seekers or social users. If someone feels terrible today, it might not be effective to warn them that using drugs may alter their brains a month from now. Their problem is getting through today. Encouraging them to seek alternative sources of fun or nicer friends probably won't work either. They are trying to get through today's issues.

Even the otherwise powerful protective factor of loving, supportive family involvement in the child's life is not very effective in these cases. Those





young people who are trying to self-medicate must have help with their underlying problems. They need professional treatment.

Whatever the reasons, how do parents know if their children are using drugs and what do they do if they are? Telltale signs include recent mood and energy level changes, changes in eating habits, specific signs like redness around the eyes, and changes in social and educational performance. Parents need to listen carefully to what their children are telling them about their lives and how they feel. And they need to watch how they behave. It may seem natural for an adolescent to be a bit surly, but most adolescents are not actually sullen, withdrawn, apathetic, and lethargic. Parents should talk to their children about any of these symptoms. They need to know.

What if a child is using drugs? In a small percentage of cases, parents can work with their own children to get them to stop using drugs. This might be easiest when the young person is just using drugs occasionally to have a good time. And, of course, the earlier parents start talking to their children about drugs, the better the chances are they won't become involved with them. If a child reaches the age of 20 without

using alcohol, tobacco or marijuana, the probability is almost zero that he or she will ever develop a serious drug problem.

But if a parent suspects a child is really trying to self-medicate, or is using drugs regularly or is addicted, it is important to get professional help immediately. These are not problems the typical parent can handle alone. There are many professional social workers, nurses, drug counselors, psychologists, and psychiatrists trained to deal with both mental disorders and drug use problems. The child's school, family doctor, or community health center can help a parent get a referral. Parents should not assume that a child's drug use is just a passing phase or something every child must go through. It isn't. It may well be the beginning of a lifetime of problems that could be prevented with early intervention. •

**For further information**, please contact the National Clearinghouse For Alcohol and Drug Information (NCADI) at 1-800-729-6686 or the NIDA Web site at: <http://www.nida.nih.gov>.

---

*Alan I. Leshner, Ph.D., director,  
National Institute on Drug Abuse.*

IF A PARENT SUSPECTS  
A CHILD IS REALLY  
TRYING TO SELF-  
MEDICATE, OR IS USING  
DRUGS REGULARLY  
OR IS ADDICTED,  
IT IS IMPORTANT  
TO GET PROFESSIONAL  
HELP IMMEDIATELY.

# P R E V E N T I N G

# U N D E R A G E

# D R I N K I N G

**T**een alcohol consumption is a major public health problem. It significantly increases the risk for assault, accidental injury, suicide, academic and legal problems, and early unprotected sex among adolescents. In addition, alcohol is involved in 45 percent of traffic-related deaths among persons ages 15 to 24.

And the problem is widespread. According to recent nationwide surveys, approximately 50 percent of high-school seniors had consumed alcohol within the month before, and 43 percent of college students reported binge drinking (i.e., at least five drinks in succession for males and four drinks for females) in the two weeks before being surveyed.

Innovative programs are being developed to prevent alcohol consumption and its harmful consequences among underage youth. NIH's National Institute on Alcohol Abuse and Alcoholism (NIAAA) is sponsoring research to determine whether these programs reduce drinking behavior and affect community-wide attitudes toward underage drinking.

## INFLUENCING DRINKING BEHAVIOR

Research shows that a relatively brief, individualized counseling session can motivate some young people to modify their drinking habits.

From 1990 to 1994, a program at

the University of Washington, Seattle, evaluated this approach with a group of entering freshmen who were at especially high risk for developing alcohol-related problems. In the study, students were asked to monitor their alcohol consumption for two weeks prior to meeting individually with a counselor. Counselors compared the students' drinking patterns with those of their peers, and provided them with information to evaluate their beliefs about alcohol's effects on the body.

Each student was made aware of the potential consequences of his or her drinking behavior (poor grades, blackouts, motor vehicle crashes) and was given suggestions for moderating alcohol consumption. Suggestions were geared to the students' own lifestyles and problems. Students were encouraged to come to their own conclusions about their drinking and to set their goals accordingly.

Follow-up assessments over the subsequent two years revealed significantly lower levels of both drinking and alcohol-related problems among the students in the study compared with other high-risk students who had not undergone counseling. A five-year follow-up study is in progress.

## CHALLENGING BELIEFS

Drinking behavior is influenced not only by one's own experience with alcohol but also by prevailing social beliefs about the effects of alcohol on the body. Adolescents who are encouraged to confront and analyze these beliefs may

modify their drinking behavior. One study evaluated an approach that involved a combination of experimental sessions and group discussions. In the experimental sessions, a group of drinking-age college men were given a strongly flavored drink. Participants knew that some of the drinks contained an ounce of vodka, whereas others had no alcohol at all. Only the researchers knew which students had received alcohol.

The students then performed tasks that required problem solving and alertness, as well as social interaction. Afterwards, the students were asked to identify those, including themselves, whose performance and behavior suggested that they had consumed real alcohol. Their predictions turned out to be no more accurate than would be expected by chance alone. Between sessions, participants compared their reactions to alcohol with the impressions conveyed by the media, advertisements, and popular songs, as well as with the beliefs of their peers.

In group discussions, the students and researchers compared their observations with the results of the experimental sessions. The students reported reduced alcohol consumption six weeks later, despite the beginning of spring break, traditionally a time of increased drinking among students. A large-scale study is underway to confirm these results and to compare this approach with other strategies for reducing alcohol consumption among college students.

### PREVENTING DRINKING AND DRIVING

Many of the most effective prevention efforts focus on reducing drinking and driving. All states have a uniform minimum legal drinking age (MLDA) of 21. In 1983, states began to adopt “zero tolerance” laws, which make it illegal for persons under 21 to drive with *any* detectable amount of alcohol in their blood (i.e., 0.02 percent or lower). By 1991, 12 states had lowered their legal blood alcohol limits for young drivers; eight adopted zero tolerance laws, and four reduced their legal blood alcohol limits for young drivers to levels between 0.04 and 0.06 percent.

Between 1982 and 1996, alcohol-related traffic fatalities among persons ages 15-20 declined 57 percent. This decline reflects the combined effects of the uniform MLDA and the zero tolerance legislation, along with laws that permit police to confiscate a violator’s driver’s license at the time of arrest.

The effectiveness of drinking-and-driving legislation depends on voluntary compliance as well as on effective enforcement. In 1988, a comprehensive program, called “Saving Lives,” began in six Massachusetts communities to help reduce drinking and driving. The program also targeted other risky driving behaviors, such as speeding or failure to use seat belts.

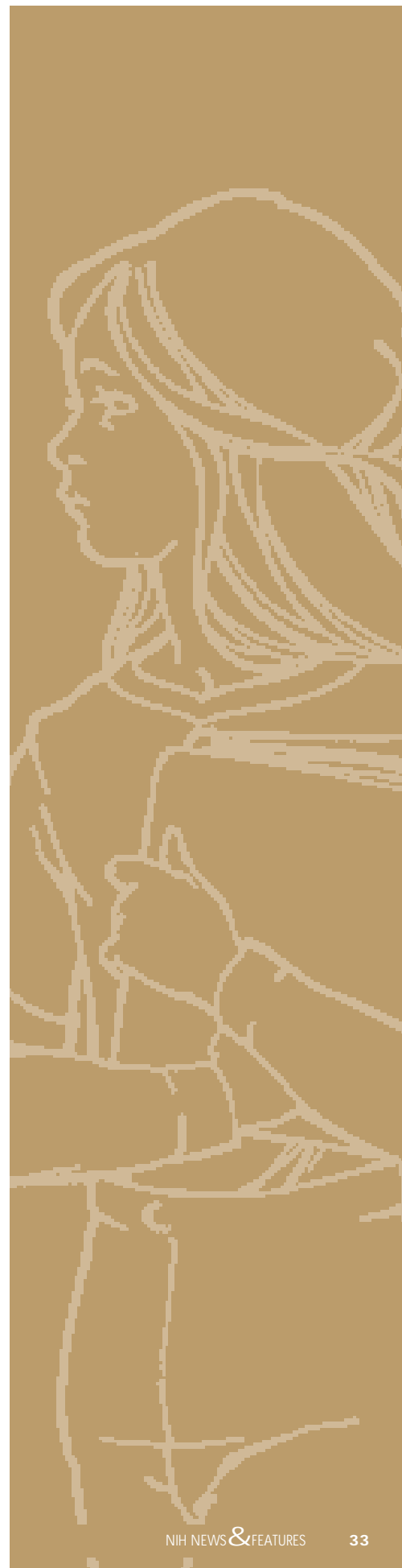
At each location, programs were initiated by a task force of private citizens, organizations, and city officials organized and coordinated by the executive office of

the local jurisdiction. Activities included high-school, peer-led education, college prevention programs, media campaigns, and police training. During its first five years, the Saving Lives program reduced alcohol-related traffic deaths by 42 percent relative to the rest of the state, with the greatest declines among college-age youth. Researchers are continuing to assess the long-term effects of the program.

### REDUCING ACCESS TO ALCOHOL

The effectiveness of programs to prevent underage drinking is influenced by the availability of alcohol. Restricting youth access to alcohol often requires changes in community attitudes and behavior. Adolescents rely mainly on adults and older peers to acquire alcoholic beverages, despite many state laws prohibiting nonparental adults from providing or selling alcohol to persons under 21.

Communities Mobilizing for Change on Alcohol (CMCA) was a two-year program designed to reduce youth access to alcohol. Begun in 1993 in seven communities in Minnesota and Wisconsin, its goals were to reduce illegal sales of alcoholic beverages to adolescents, and to modify the attitudes of parents, siblings, and older peers whose actions encourage underage drinking. Strategies included promoting new ordinances and improved enforcement practices; providing educational programs for both parents and youth; and establishing media and advertising campaigns. Surveys of the program’s



The effectiveness of programs

to prevent underage

drinking is influenced by

the availability of alcohol.

Restricting youth access

to alcohol often requires

changes in community

attitudes and behavior.

effects suggest that local merchants had increased their compliance with drinking-age laws. Eighteen to 20-year-olds reported that they were less likely to provide alcohol to younger persons, and were less likely themselves to try to buy or consume alcohol.

Project Northland, which ran from 1991–98 in several counties in northeastern Minnesota, encouraged adolescents not to use alcohol and attempted to reduce the availability of alcohol by influencing public policy and modifying community attitudes toward underage drinking.

The first phase of the project included three years of school-based curricula, parental education and involvement, and the formation of community task forces to spearhead policy changes. An important aspect of Project Northland was the involvement of student youth action groups. These students planned and promoted alcohol-free social and other activities for their peers.

The study's second phase focused primarily on changing community attitudes and policies relating to adolescent alcohol use. Multimedia campaigns and continued student involvement were emphasized. After the first three years (by 8th grade), rates of alcohol use were significantly lower among students participating in the program compared with students in nonparticipating communities. An evaluation of the program's effects through the 12th grade is under way.

#### FUTURE PROSPECTS

Lessons learned from prevention research are being applied to ongoing NIAAA-sponsored projects. For example, a trial

of mass media and community interventions to prevent youth drinking is being conducted in eight rural Vermont communities. These interventions are using approaches that have proven successful in anti-smoking campaigns, namely brief messages broadcast intensively on television and radio. These messages are altered each year for a slightly older audience, following the students from grades 4 and 5 to grades 7 and 8. In another project, researchers in Albany, New York, have developed an educational manual to help parents convey alcohol-related information to their children. The manual is currently being tested for effectiveness.

The Safe Border Project is aimed at adolescents who drive to bars in Tijuana, Mexico, where the minimum legal drinking age is 18. Begun in 1998, this project was developed to enhance drinking and driving law enforcement, detain alcohol-impaired drivers crossing the border, and provide transportation for impaired drivers. The program draws on the power of the media to modify community attitudes and beliefs about the risks of drinking and driving.

Programs to prevent underage drinking and its harmful consequences have saved many lives. Although no single approach works in all communities, scientists are beginning to understand the components of effective interventions that can be applied to future efforts. Research to improve existing strategies and develop and evaluate new ones will make future prevention efforts even more effective. •

---

*John Doria, contract writer, National Institute on Alcohol Abuse and Alcoholism.*

# Preventing AIDS

## Among Underserved, High-Risk People

High-risk sexual behaviors can be reduced by half and regular use of condoms can be doubled even among people considered hardest to reach, according to a recent study funded by NIH's National Institute of Mental Health (NIMH).

Begun in 1990, the NIMH Multisite HIV Prevention Trial enrolled 3,706 men and women in 37 inner-city, community-based clinics. The study was the largest randomized, controlled study of behavioral interventions to prevent HIV infection ever conducted in the United States.

Those who attended HIV prevention sessions to reduce high-risk sexual behaviors reported significant reductions in high-risk behaviors over a one-year period. In men, the incidence of gonorrhea—an indicator of unprotected sexual behavior—was reduced by half. Prevention sessions focused on motivation and skills to reduce high-risk sexual behavior.

“Reducing high-risk behaviors is still the best way to prevent new HIV infections,” said NIMH Director Steven E. Hyman, M.D. “NIMH has identified an effective strategy that could be adopted by public health and community organizations all across America. If these behavioral changes were maintained for even one year, there would be a profound, cost-effective, public health impact in the communities that adopted this program.”

#### MINORITIES DISPROPORTIONATELY AFFECTED

HIV infection and AIDS affect racial and ethnic minority populations disproportionately, especially African Americans, who represented 45 percent of new AIDS cases in 1997, but were only 13 percent of the U.S. population.

Several trends in the epidemic are especially disturbing:

- People are most often affected during young adulthood and mid-life.
- Infection appears to be occurring at increasingly younger ages.
- Heterosexual transmission is rising rapidly, especially among minority women.

The goal of the Multisite HIV Prevention Trial was to develop an intervention to prevent HIV infection based on the best available knowledge, and to test how well it worked for minority, heterosexual adults living in areas with high rates of HIV.

# Preventing AIDS Among Underserved, High-Risk People

NIMH funded studies at seven sites:

- Columbia University, New York City
- Rutgers University, New Brunswick, New Jersey
- The Johns Hopkins University, Baltimore, Maryland
- Emory University, Atlanta, Georgia
- The Medical College of Wisconsin, Milwaukee, Wisconsin
- UCLA, Los Angeles, California
- University of California, Irvine, California

Participants came from specific populations at risk of acquiring HIV and other sexually transmitted diseases (STDs): men and women age 20 and older seeking treatment in STD clinics, and women 18 or older attending health service organizations (HSOs), mostly primary care clinics in areas with high rates of HIV infection.

Eligibility criteria included:

1. Engaging in unprotected vaginal or anal sex in the last 90 days
2. Having at least one of the following over the last 90 days:
  - Sex with a new sexual partner
  - More than one sexual partner
  - An STD
  - Sex with a partner known to have had other sexual partners
  - Sex with an injection drug user
  - Sex with a person infected with HIV

Although 75 percent of the participants were over 25 years old, 45 percent of them had not completed high school, 70 percent were unemployed, and 60 percent were unmarried. Sixty-eight percent were African American and 20 percent were Hispanic. Most participants reported primarily heterosexual behavior, although 7 percent of the male participants reported having sex with men during the three months prior to the baseline interview. Participants were interviewed again at three, six, and twelve-month intervals.

## INTERVENTIONS FOCUS ON MOTIVATION, SKILLS

Because the intervention was based on a social cognitive model, many researchers and health-care providers were skeptical that it would be effective among people with limited education. Because many of the participants did not have a fixed address or a reliable phone number, scheduling appointments and follow-up visits was difficult and time-consuming. Despite these and other obstacles, such as poverty, violence, untreated drug abuse, and mental illness, researchers managed to achieve high participation rates.

The intervention consisted of seven, 90 to 120-minute sessions, conducted twice a week in groups of eight on average. The sessions focused on developing motivation and skills for changing risky behaviors. Facilitators tailored the intervention to correlate with specific experiences and behaviors of group members.

Participants in the control group attended a one-hour education session on AIDS that included a videotape and a question-and-answer period.

Persons in the intervention group attended an average of 5.2 of the seven sessions, and 63 percent attended six or all seven sessions.

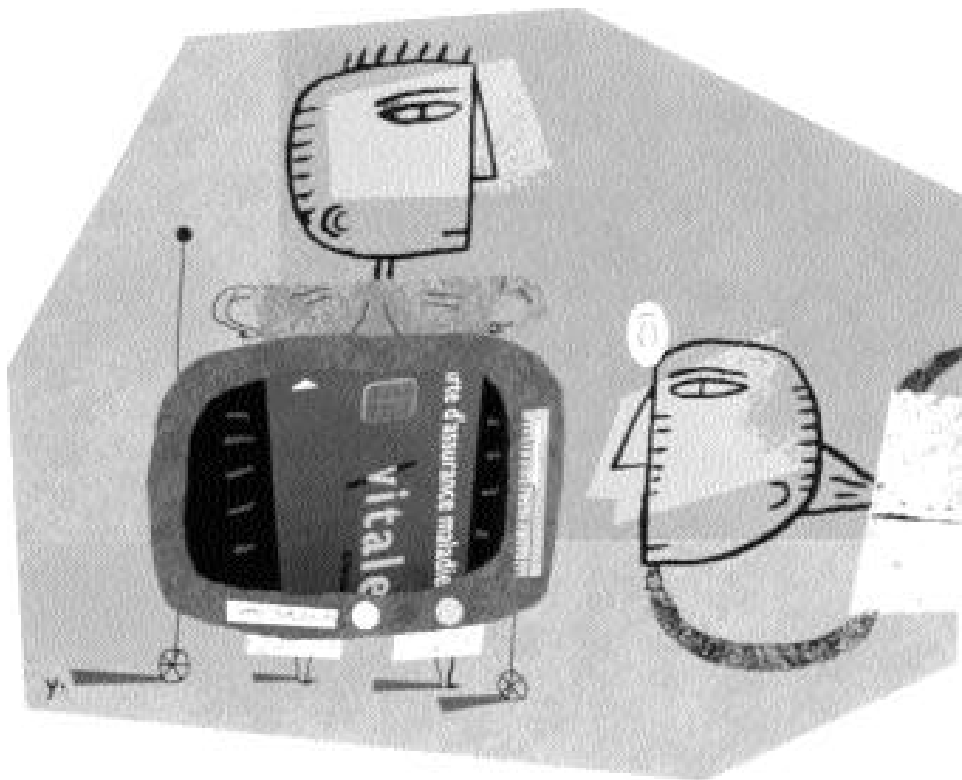
Reports of changes in risky behaviors were verified, and the more intervention sessions participants attended, the more likely they were to reduce these behaviors.

On average, the seven-session intervention cost only \$278 per person. Researchers noted that this is less than the cost for a one-month supply of only one of the drugs in the multi-drug treatment regimens of three or more drugs that are now considered the standard of care for HIV infection. •

---

*Rayford Kyle, public affairs specialist, National Institute of Mental Health.*





# Combining Mass Media with School Program Prevents Teen Cigarette Smoking

**T**eenagers are less likely to start smoking when they participate in an anti-smoking program that combines messages from the mass media with a traditional school-based program, according to NIH-funded researchers from the University of Vermont.

Cigarette smoking by children and teenagers in the United States is a major public health problem. Some studies report that the prevalence of cigarette smoking among young people has not declined for more than a decade. Most adult smokers started before they were 21 years old, and smoking habits in youth may determine cigarette consumption in adulthood. Young people are at high risk of becoming smokers if they have two or more family members or friends who smoke or have previously smoked themselves. Currently, an estimated 4.4 million teenagers, ages 12 to 17, are smokers.

School programs have been the traditional approach to preventing cigarette smoking in young teens and adolescents. “Results were generally disappointing and when they did produce an initial reduction in the onset of smoking, the benefits often faded with time,” explains Brian S. Flynn, Sc.D., director of the Office of Health Promotion Research at the University of Vermont’s College

of Medicine. “Researchers eventually realized that additional approaches were needed to compensate for the inherent limitations of the school programs, especially in reaching high-risk youngsters.”

In the early 1980s, the social influence model emerged as a valuable tool in developing approaches to change behavior. When applied to the prevention of cigarette smoking, four goals were identified as critical: develop a positive view of non-smoking; develop a negative view of smoking; increase the perception that most young people don’t smoke; and increase skills for refusing and avoiding cigarettes. To help prevent smoking, particularly among high-risk teens, the researchers evaluated a program that combined a school program based on the social influence model with a mass-media program based on the same objectives.

For this study, four U.S. cities with medium-sized populations were selected and categorized as two matched pairs. Lower income areas were targeted. Within each pair, one community was assigned to the school program only, and the other received the combined media-school program.

Approximately 5,500 students from schools in the selected areas participated in the study. The children were in grades 4-6 and grades 8-10. Each child received approximately 15 lessons given by classroom teachers. In addition, children in the mass-media communities were exposed to 17 radio and 36 television messages—30 and 60 second spots aired over local TV, cable, and radio stations. In a typical year, people in a city receiving the mass-media program were exposed to 540 TV and 350 radio anti-smoking messages.

At the end of the four-year study period, 15.7 percent of the students receiving only the school program were smokers; whereas 10 percent of the students in the combined program smoked. When the students, in grades 10-12, were followed up two years later, more significant results were noticed. Twenty-four percent of the students in the school program were reported smokers, but only 16.5 percent of the students in the media-school program were.

“These results indicate that there was a statistically significant reduction in smoking among the students in the media-school program, and that the effect was even more noticable two years after the study,” says Dr. Flynn. “From this study it appears that using

the mass media can be an effective way to reach young people.”

The effect was most striking among high-risk teenagers and females. Teenagers at high risk for cigarette smoking spend more of their time watching TV and listening to the radio than do lower-risk adolescents. Females may be more sensitive to the positive group norms portrayed in these messages. Also, says Dr. Flynn, higher-risk teens are faced with the decision to smoke at an earlier age than their lower-risk peers, and this period may have coincided with the intervention period.

Future research will focus on similar, but larger-scale, media-school programs involving a more diverse group of teenagers. The current study included mostly white teens, which is a “major limitation”, says Dr. Flynn. “Furthermore,” he adds, “mass-media intervention programs are intensive and require considerable resources. We need more research on developing effective messages that can be delivered in a cost-efficient manner, especially for young people at high risk of becoming smokers.”

In the meantime, Dr. Flynn concludes that “mass-media programs to prevent teen smoking should be part of a scientifically-sound, comprehensive tobacco-control program in every community.” •

**This research was funded** by NIH’s National Cancer Institute and National Heart, Lung, and Blood Institute.

For additional information on smoking, please visit the following Web sites:

- Smoke-Free Kids at: <http://www.smokefree.gov/>.
- National Cancer Institute at: <http://www.nci.nih.gov>.
- National Heart, Lung, and Blood Institute at: <http://www.nhlbi.nih.gov>.



*Mary Sullivan, editor, NIH News & Features magazine.*

# CAMPAIGN FOCUSES ON ORAL HEALTH AND CANCER CARE

Most people are aware of the common side effects of cancer treatment, such as nausea and hair loss. But many don't realize that one-third of people treated for cancer develop complications that affect the mouth. These problems can be serious and may interfere with cancer treatment and diminish the patient's quality of life. NIH's National Institute of Dental and Craniofacial Research (NIDCR) is sponsoring a campaign to increase awareness about how proper mouth care can prevent oral complications or help keep them in check.

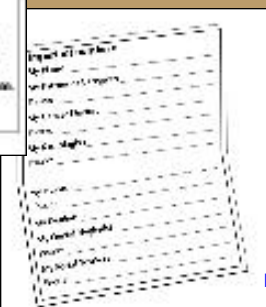
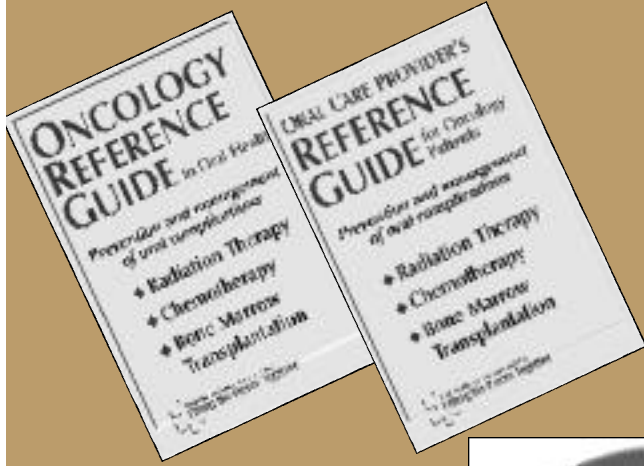
Of the 1.2 million Americans diagnosed with cancer each year, more than 400,000 will develop oral complications from their treatment. However, many health care providers and patients are not aware that these complications often can be prevented or minimized.

To address this problem, NIDCR recently launched a national awareness campaign about oral complications of cancer treatment. The message is that oral health care, when part of the cancer management plan, can prevent or reduce the occurrence and severity of oral complications and enhance both the cancer

patient's survival and quality of life.

The goals of the campaign are to inform dental and oncology (cancer) professionals about preventing and managing oral complications of cancer treatment; to encourage communication between oncology and oral health care providers; and to give patients the tools they need to be active participants in their cancer care.

"We are excited about the opportunity to make a significant difference, not only in oral health, but also in the overall health of patients undergoing treatment for cancer," noted NIDCR Director



Harold Slavkin, D.D.S. “Preventing and managing oral complications provide an excellent example of how dentistry and medicine can work together in partnership to benefit the patient.”

**ORAL COMPLICATIONS OF CANCER TREATMENT: SCOPE AND IMPACT**

Oral complications occur in almost all patients receiving radiation for head and neck cancers, in more than 75 percent of bone marrow recipients, and in nearly 40 percent of patients receiving chemotherapy for any type of cancer. These problems may be acute and short-term, or they may last a lifetime.

Common complications include sore, inflamed gums, mouth ulcers, bleeding, infection, and dry mouth that can become chronic. Other potentially long-term side effects that may occur include rampant tooth decay, jaw stiffness, failure of the mouth tissue to heal properly, permanent jaw bone damage, and in children, growth and developmental abnormalities of bone and teeth in children.

Oral complications can affect cancer treatment as well. These conditions can be so debilitating that patients may tolerate only lower, less effective doses of anticancer agents, postpone treatments, or stop treatment entirely. Oral side effects can also be the source of infections that can be life-threatening or that may interfere with cancer therapy.

Complications go beyond the obvious physical problems. “The pain caused by oral complications diminishes patients’ quality of life at a time when they are most vulnerable,” says Deborah McGuire, Ph.D., R.N., oncology nurse and associate professor of nursing at Emory University. “But what most people don’t know is that they can do a lot to prevent these problems, or if they do occur, keep them from becoming severe.”



#### PRACTICAL TIPS HELP PATIENTS TAKE CHARGE

The patient is a key player in maintaining oral health during cancer treatment. Campaign materials for patients explain the importance of seeing a dentist to ensure a healthy mouth *before* cancer treatment begins and how to care for the mouth during and after radiation or chemotherapy to help prevent complications. Written in an easy-to-read style, the materials provide practical self-care tips on problems such as keeping the mouth moist, brushing and flossing when the mouth is sore, and avoiding foods that could cause tissue injury or pain.

“Seeing a dentist and receiving any necessary oral health care before and during cancer therapy minimizes the threat of oral health problems during cancer treatment,” says Gerry Barker, a dental hygienist and coordinator of the oncology dental support clinic at the University of Missouri-Kansas City.

#### INFORMATION FOR THE ORAL HEALTH AND ONCOLOGY TEAMS

Campaign materials for oncologists and oral health professionals describe their different roles in preventing and minimizing oral complications. Information for dentists and dental hygienists includes the following:

- description of common oral complications during cancer therapy.
- identification of patients at low and high risk for complications.
- components of a thorough oral evaluation before cancer treatment begins.
- description of patient care during and after cancer treatment.
- tips for patient education.

Oncologists and oncology nurses receive information on oral complications and

their potential to interfere with optimal dosing of cancer drugs, treatment schedules, and patient participation. The materials stress the importance of a dental evaluation before cancer treatment begins, oral problems to look for during cancer therapy, and special considerations in coordinating dental treatment with the patient’s cancer treatment.

The professional materials also emphasize the critical importance of communication and cooperation between oncologists and dentists. “It’s all about communication,” said Dr. Slavkin. “Teamwork is the only way prevention and management efforts can be effective.”

For many patients at risk for oral complications, entering cancer treatment with a clean bill of oral health increases the likelihood that they will be able to complete their cancer regimen. No less important is that preventing and managing oral complications can significantly enhance patients’ quality of life.

Called *Oral Health, Cancer Care, and You: Fitting the Pieces Together*, the campaign is being conducted by NIDCR’s information service, the National Oral Health Information Clearinghouse (NOHIC). Campaign partners include NIH’s National Cancer Institute and National Institute of Nursing Research, Centers for Disease Control and Prevention, and the Friends of the National Institute of Dental and Craniofacial Research, a nonprofit organization for oral health research and education. •

**Information about the campaign** is available from the National Oral Health Information Clearinghouse; Attn: OCCT, 1 NOHIC Way, Bethesda, MD 20892-3500; toll-free phone: 1-877-216-1019. To view campaign publications or to order online, visit the National Oral Health Information Clearinghouse Web site at: <http://www.aerie.com/nohicweb/>.

---

*Patricia Sheridan, public affairs specialist,  
National Institute of Dental and  
Craniofacial Research.*



P R E V E N T I N G N O I S E - I N D U C E D

# HEARING LOSS

WE USUALLY TAKE OUR HEARING FOR GRANTED—UNTIL THERE IS A PROBLEM. EVERY DAY WE EXPERIENCE SOUND IN OUR ENVIRONMENT, SUCH AS NOISE FROM TELEVISION SETS, RADIOS, WASHING MACHINES, AUTOMOBILES, BUSES, AND TRUCKS. BUT WHEN WE ARE EXPOSED TO SOUNDS THAT ARE TOO LOUD OR LOUD SOUNDS OVER A LONG TIME, TEMPORARY OR PERMANENT HEARING LOSS CAN RESULT.

**M**ore than 20 million Americans are exposed to hazardous sound levels on a regular basis. People of all ages including children, adolescents, young adults and older people can develop noise-induced hearing loss (NIHL). Exposure occurs in the workplace, in recreational settings, and at home. There is an increasing public awareness of harmful noises in recreational activities, such as shooting targets or hunting, driving snowmobiles and go-carts, and using woodworking and other types of hobby equipment. Potential sources of harmful noises at home include vacuum cleaners, garbage disposals, lawn mowers, leaf blowers, gasoline engines, and power tools. Of the 28 million Americans who have some degree of hearing loss, about one-third have been affected, at least in part, by noise.

#### HOW NOISE RESULTS IN HEARING LOSS

Noise-induced hearing loss can be caused by a one-time exposure to loud sound or by repeated exposure to sounds at various loudness levels over an extended period of time. Loudness is measured in units called decibels. For example, normal conversation is approximately 60 decibels, the humming of a refrigerator is 40 decibels, and city traffic noise can be 80 decibels. Examples of sources of loud noises that may cause NIHL are motorcycles, firecrackers, and small arms fire, all emitting sounds from 120 to 140 decibels. Sounds of less than 75 decibels, even after long exposure, are unlikely to cause hearing loss.

Exposure to harmful sounds causes damage to the sensitive hair cells of the inner ear and to the nerves of hearing. These structures can be injured by noise in two different ways: from an intense brief impulse, such as an explosion, or

from continuous exposure to loud noise, such as that in a woodworking shop.

Exposure to impulse and continuous noise may cause only a temporary hearing loss, which largely disappears within 16 hours after exposure to loud noise.

The effect from loud impulse sound can be instantaneous and can result in an immediate hearing loss that may be permanent. The structures of the inner ear can be severely damaged. This kind of hearing loss may be accompanied by tinnitus, an experience of sound like ringing, buzzing or roaring in the ears or head, which may subside over time. Hearing loss and tinnitus may be experienced in one or both ears, and tinnitus may continue constantly or intermittently throughout a lifetime.

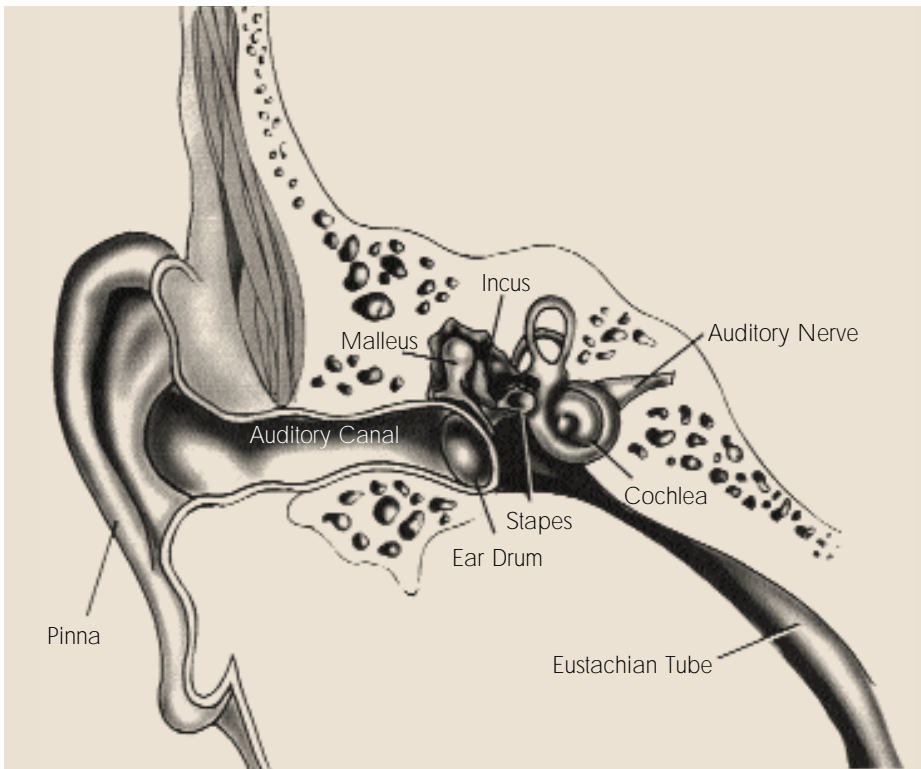
The damage that occurs slowly over years of continuous exposure to loud noise is accompanied by various changes in the structure of the hair cells. It also results in hearing loss and tinnitus.

The symptoms of NIHL that occur from continuous exposure increase gradually. Sounds may become distorted or muffled, and it may be difficult for a person to understand speech. An individual may not be aware of the gradual loss, but it can be detected with a hearing test.

#### HOW TO PREVENT NOISE-INDUCED HEARING LOSS

All types of NIHL can be prevented by the regular use of hearing protectors such as ear plugs. Everyone should understand the hazards of noise and how to practice good hearing health in everyday life:

- Know which noises can cause damage (those above 75 decibels).
- Wear ear plugs or other hearing protective devices when involved in a loud activity (special earplugs



Hearing is a series of events in which sound waves in the air produce electrical signals and cause nerve impulses to be sent to the brain where they are interpreted as sound. The ear has three main parts: the outer, middle, and inner ear. Sound waves enter through the outer ear and reach the middle ear where they cause the ear drum to vibrate. The vibrations are transmitted through three tiny bones in the middle ear, called the ossicles. These three bones are the malleus, incus, and stapes (also known as the hammer, anvil, and stirrup). The ear drum and ossicles amplify the vibrations and carry them to the inner ear. The stirrup transmits the amplified vibrations through the oval window and into the fluid that fills the inner ear. The vibrations move through fluid in the snail-shaped hearing part of the inner ear (cochlea) that contains the hair cells. The fluid in the cochlea moves the top portion of the hair cells, called the hair bundle, which initiates the changes that lead to the production of nerve impulses. These nerve impulses are carried to the brain where they are interpreted as sound. Different sounds move the population of hair cells in different ways, thus allowing the brain to distinguish among various sounds, such as different vowel and consonant sounds.

and other devices are available at hardware stores and sporting good stores).

- Be alert to hazardous noise in the environment.
- Protect children who are too young to protect themselves.
- Make family, friends, and colleagues aware of the hazards of noise.
- Have a medical examination by an otolaryngologist, a physician who specializes in diseases of the ears, nose, throat, head and neck; and a hearing test by an audiologist,

a health professional trained to identify and measure hearing loss and rehabilitate persons with hearing impairments.

#### RESEARCHERS FOCUS ON NOISE-INDUCED HEARING LOSS

Scientists focusing their research on the mechanisms causing NIHL hope their efforts will result in better prevention and treatment. For example, researchers funded by NIH's National Institute on Deafness and Other Communication Disorders (NIDCD)

have found evidence that suggests certain proteins form in the inner ear in response to external stress and heat, and moderate levels of sound. These proteins, known as heat shock proteins, may provide some protective effect against excessive levels of noise. The evidence suggests that the ear may be conditioned to withstand the effects of loud noise with little residual permanent effect on hearing. Therefore, the ability to form and retain heat shock proteins in the inner ear may be a factor in individual susceptibility to noise.

Other NIDCD-funded scientists are investigating potential drug therapies. For example, scientists have found reduced cochlear (inner ear) blood flow following exposure to noise. Further research has shown that a drug used to treat peripheral vascular disease (any abnormal condition in blood vessels outside the heart) maintains blood flow in the cochlea during exposure to noise. These findings may lead to the development of new treatments to reduce NIHL.

Continuing efforts will focus on research on noise-induced hearing loss as well as other diseases and disorders that damage hearing. Research funded by NIDCD will provide the tools to develop new, more effective methods to prevent, diagnose, treat, and eventually eliminate these diseases and disorders, and improve the health and quality of life for the millions of Americans who are challenged by the disorders of human communication. •

---

*Gail Blatt, information specialist,  
National Institute on Deafness and  
Other Communication Disorders.*

# Dilated Eye Exams Can Help Prevent Vision Loss in People With Diabetes

It's no secret that maintaining an overall preventive health care routine helps us live longer and more productive lives. But how many of us specifically include our eyes as part of our health routine?

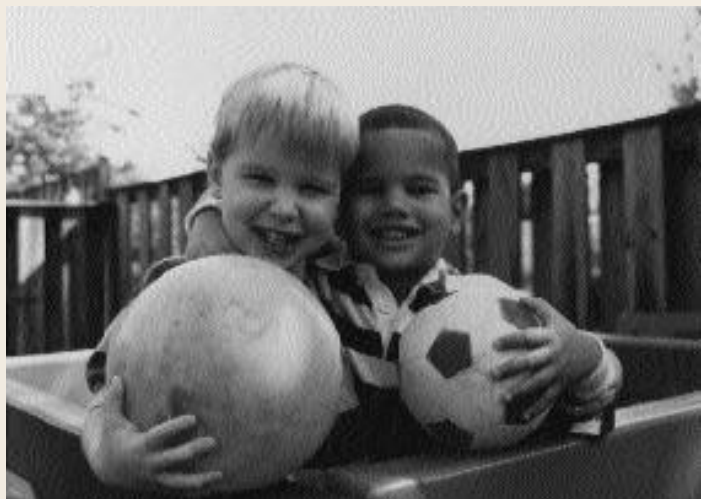
Like the rest of our bodies, our eyes need care and attention. Regular eye examinations through dilated pupils can diagnose early signs of eye disease and help prevent loss of vision. This is particularly true for people with diabetes, who have a high risk of developing eye disease. Dilated eye examinations at least once a year can help detect early signs of diabetic eye disease and, with timely treatment, help save vision. Diabetic eye disease includes cataract, glaucoma, and the most common form of diabetic eye disease, diabetic retinopathy.

Diabetic retinopathy occurs when diabetes damages the tiny blood vessels in the retina, the light-sensitive tissue that lines the back of the eye. At this point, most people do not notice any changes in their vision. However, the damaged blood vessels can leak fluid onto the macula, the part of the retina that lets us see detail. The fluid makes the macula swell, resulting in blurred vision. As the disease progresses, fragile, new blood vessels grow along the retina. Without timely treatment, these new blood vessels can bleed and cause severe vision loss.

Diabetic retinopathy blinds an estimated 25,000 people with diabetes each year, making it a leading cause of blindness among working-age Americans. Vision lost cannot be restored. But with early detection, routine monitoring, and laser surgery when needed, vision can be saved for about 90 percent of people who might otherwise become blind from the disease.

The longer a person has diabetes, the more likely it is that he or she will develop diabetic retinopathy. Virtually all people who have had type 1 diabetes for at least 15 years have some degree of diabetic retinopathy. Those who have had type 2 diabetes for 5-10 years have about a 40 percent risk, which increases to about 75 percent for those who have had the disease for more than 20 years. People with diabetes also are nearly twice as likely to get glaucoma or cataracts as people without diabetes.

"Prevention of needless vision loss is the key to controlling diabetic retinopathy," said Carl Kupfer, MD, director of NIH's National Eye Institute (NEI). "There often are no early warning signs with diabetic retinopathy and no pain. People may not know that the disease is slowly stealing their vision. Yet blindness and severe loss of vision from diabetic retinopathy is avoidable, if discovered in time. That is why dilated eye exams are recommended at least once a year for people with diabetes."



Normal vision



The same scene as it might be viewed by a person with glaucoma.

In a dilated eye exam, the eye care professional places medicated drops into the eye to enlarge the pupil. This enables the practitioner to better examine the back of the eye for early signs of the disease before noticeable vision loss occurs. If diabetic retinopathy is detected early, the patient's condition can be monitored and treated at the optimal time. Researchers funded by NEI have shown that effective treatment for diabetic retinopathy can prevent vision loss. (See accompanying sidebar).

"During their lifetimes, nearly half of all people with diabetes will develop some degree of diabetic retinopathy," Dr. Kupfer said. "People with diabetes are 25 times more likely to become blind than those without diabetes. But even though effective treatment for diabetic retinopathy is available, eye care professionals are seeing only half of the people at risk for this disease."

Dr. Kupfer emphasized the importance of getting regular dilated eye exams *before* any vision is lost. "I urge those with diabetes to seek annual dilated eye examinations even though they may not be experiencing problems with their vision," he said. •

---

*Michael Coogan, science writer, National Eye Institute.*

The same scene as it might be viewed by a person with diabetic retinopathy.



## Diabetes and Diabetic Eye Disease

In addition to diabetic retinopathy, people with diabetes may develop other sight-threatening eye problems as a complication of the disease. This group of ocular (eye) conditions is called diabetic eye disease and includes cataract and glaucoma.

A *cataract* can develop when protein in the eye's lens clumps together and blocks some light from passing through to the retina. This "blockage" blurs vision. Although the risk of cataract increases with age for everyone, people with diabetes have double the usual risk during middle age.

*Glaucoma* can occur when fluid pressure in the eye builds up and damages the optic nerve, which leads to the brain. People with diabetes are nearly twice as likely to develop glaucoma as other adults.

## The National Eye Health Education Program

As part of its mission to address the public health problem of diabetic eye disease, the National Eye Institute (NEI) has established the National Eye Health Education Program (NEHEP). The NEHEP is a partnership between the NEI and over 50 public and private organizations. The NEHEP plans and implements public and professional health education programs that encourage early detection and timely treatment of diabetic eye disease and glaucoma.

Because diabetic eye disease can occur at any age and in any ethnic group, the NEHEP targets its diabetic eye disease program to all people with diabetes. To help reach them, the NEHEP distributes a free brochure called, "Don't Lose Sight of Diabetic Eye Disease." This booklet educates people with diabetes about the ocular (eye) complications of the disease. A Spanish-language version, entitled *Ojo con su Vision*, or "Watch Out for Your Vision," is also available. To request copies, write to Diabetic Eye Disease, 2020 Vision Place, Bethesda, MD, 20892-3655.

## Diabetic Retinopathy Research

During the last 30 years, scientists have made great progress in managing and treating diabetic retinopathy.

In the Early Treatment Diabetic Retinopathy Study, researchers funded by the National Eye Institute (NEI) discovered that:

- Laser treatment is highly effective in preventing loss of vision from diabetic eye disease. Also called photocoagulation, laser surgery involves aiming a narrow, high-energy beam of light directly at leaking blood vessels near the macula. The laser seals the blood vessels to stop their sight-impairing leakage.
- Scatter laser treatment, which involves making hundreds of burns away from the center of the retina, causes abnormal blood vessels to shrink and reduces the risk of severe vision loss. This treatment is needed only when the diabetic retinopathy becomes fairly severe.
- Daily aspirin neither slowed the progression of diabetic retinopathy nor increased the risk of bleeding in the eye, but it did decrease the risk of complications from cardiovascular (heart and blood vessel) disease.

Results from another major NIH study, the Diabetes Control and Complications Trial, showed that people with diabetes who keep their blood sugar levels as normal as possible will slow the onset and progression of diabetic retinopathy and thus help maintain good, healthy vision. This trial—funded by NIH's National Institute of Diabetes and Digestive and Kidney Diseases—also showed that keeping low blood sugar levels as normal as possible helps reduce other complications from diabetes, such as kidney disease, stroke, and nerve damage.

NEI scientists also:

- developed the first animal research model for advanced (proliferative) retinopathy. This model allows researchers to more closely study the vascular changes associated with this disease. The model also encourages studies on new drugs to prevent and treat diabetic retinopathy.
- are studying whether growth factors influence the development of weak new blood vessels that grow in advanced stages of diabetic retinopathy.
- are closely watching the role of certain enzymes in the development of diabetic retinopathy and are studying ways to inhibit those enzymes.

Accurate data on the factors affecting the prevalence and progression of the disease are needed to support efforts to increase public awareness of the risks of diabetic retinopathy. For this reason, the NEI is supporting a long-term study of people with diabetic retinopathy.

"As science moves forward in its study of diabetic eye disease, it is likely that new treatments will result from laboratory and patient-oriented research," said Carl Kupfer, M.D., NEI director. "Improved treatment, coupled with heightened public awareness, should go far toward reducing diabetic eye disease as a national health problem.



Laura Shearer knows what it's like to live with diabetes daily. When her son, Michael, was diagnosed with type 1 diabetes two years ago, Laura had her two daughters screened for risk of the disease. Six-year-old Kayla was found to have more than a 50 percent risk of developing diabetes in the next five years. Her mother immediately enrolled Kayla in the Diabetes Prevention Trial Type 1 (DPT-1) to try to stave off the disease.

Type 1 diabetes is an autoimmune disease that develops

most often in children or young adults. The body's immune system attacks and destroys its own insulin-producing cells in the pancreas. People with type 1 diabetes must have daily insulin injections to survive.

Participants in DPT-1 with a greater than 50 percent chance of getting diabetes receive two injections of low doses of insulin each day. Once a year, they are admitted to a hospital for four days of insulin therapy. Patients at moderate risk take insulin pills or a dummy pill called a placebo.

Antonette Crugnale also knows too well the ravages of diabetes. She lost her younger brother and an aunt to complications of the disease. Her mother suffered from diabetes late in life, and Antonette's former husband has had leg amputations and laser surgery for diabetic eye disease.

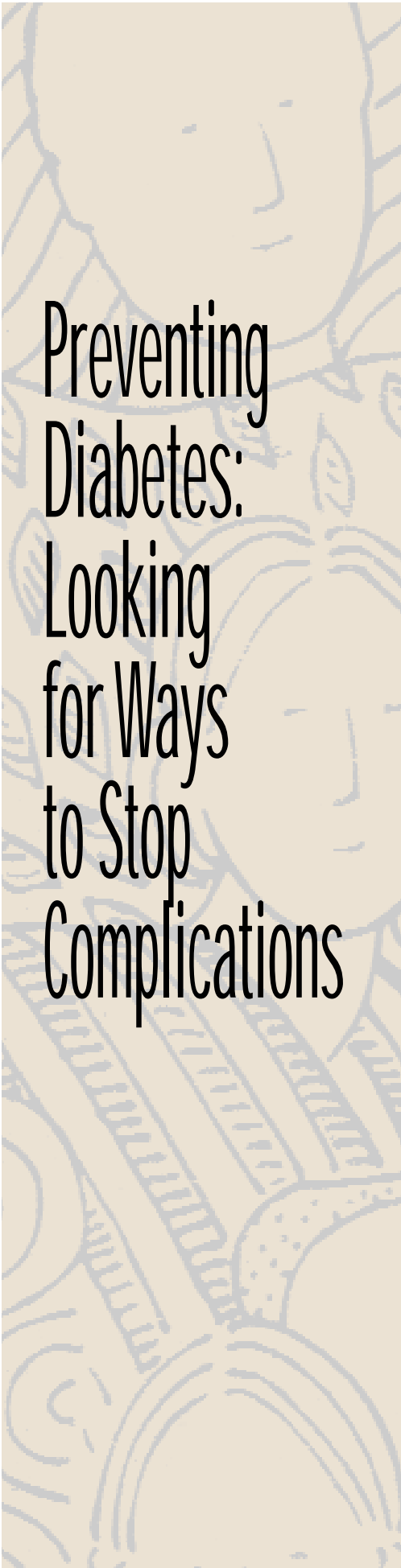
"Diabetes is rampant in my family. I know people who have had it and I really wanted to see if there's something I could do to prevent it," says Crugnale. As a volunteer in the Diabetes Prevention Program (DPP), Antonette is helping researchers determine whether type 2 diabetes can be prevented or

delayed by eating healthy foods, exercising, or taking a pill.

Type 2 diabetes, the most common form of the disease, occurs when the body cannot use insulin effectively. This results in high blood sugar levels that can damage the body over time. The DPP is the first nationwide study to test whether lowering blood sugar levels—through diet, exercise and medication—can prevent or delay the onset of type 2 diabetes in people who are at high risk.

About 16 million people in the United States have diabetes, a chronic metabolic disease that occurs when the body cannot produce or properly use insulin, a hormone that is needed to convert sugar, starches, and other food into energy. Consequently, high levels of blood sugar circulate in the body, wreaking havoc on the system over time. If left uncontrolled, diabetes gradually destroys major organs, such as the eyes, the kidneys, the nerves, and the heart. Diabetes is the leading cause of blindness, kidney disease, and lower limb amputations, and is also an important cause of heart attack and stroke. Diabetes costs the nation almost \$100 billion each year.

There is no cure for diabetes, but research has led to diagnostic tests to identify people at risk, and preliminary clinical studies show that both type 1 and type 2 diabetes may be delayed or prevented in these people. With the help of people like Kayla Shearer and Antonette Crugnale, NIH's National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) is testing methods of prevention through two nationwide clinical studies.



# Preventing Diabetes: Looking for Ways to Stop Complications

## Diabetes Prevention Trial— Type 1

Can type 1 diabetes, also known as insulin-dependent diabetes, be prevented or delayed in people at moderate and high risk? That's precisely the question that researchers and study volunteers at nine medical centers and over 350 clinics nationwide hope to answer in the Diabetes Prevention Trial-Type 1 (DPT-1).

Preliminary studies on animals and humans show that the onset of type 1 diabetes may be prevented or delayed in people by giving regular, small doses of insulin. A combination of genetic and environmental factors can trigger the body to mistakenly attack and destroy its insulin-producing beta cells in the pancreas. The cells are destroyed over a period of several years, and symptoms don't appear until most of the beta cells are damaged. Researchers theorize that giving insulin orally to those at risk may help protect the insulin-producing cells from being destroyed. This process is called "oral tolerization."

"In my view, there's been an explosion of new data on the immunological causes of diabetes," says Darrell Wilson, M.D., pediatric endocrinologist (hormone specialist) and principal investigator at the Stanford University Research Center. "This is the necessary beginning of a long-term project to prevent diabetes," Wilson adds.

The DPT-1 needs volunteers who have islet cell antibodies in their blood. These antibodies destroy the beta cells and are an immune system warning flag that signals a risk for type 1 diabetes. Laura Shearer vividly recalls the first day Kayla, who tested positive for islet cell antibodies, received her insulin injections. Kayla "was absolutely hysterical

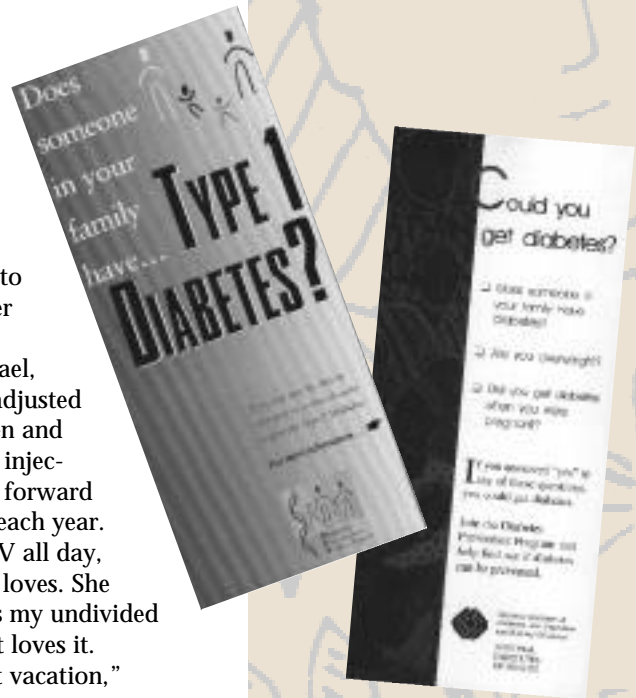
when the nurse tried to give her a shot." After that first day, Kayla, whose brother, Michael, has type 1 diabetes, adjusted quickly to her regimen and now gives herself the injections. She even looks forward to her hospital stays each year. "She gets to watch TV all day, which she absolutely loves. She gets presents. She has my undivided attention and she just loves it. She thinks it's a great vacation," says Shearer.

People most likely to have the antibodies are those age 45 or younger who have a sibling, child, or parent with type 1 diabetes; or in addition, people age 20 or younger who have a cousin, uncle, aunt, nephew, niece, grandparent, or half-sibling with type 1 diabetes are also at risk. Only three to four percent of those tested will actually have the antibodies, so the study will need to screen 80,000 to 100,000 people to eventually enroll 830 participants.

Michael Moss, another DPT-1 volunteer, is an active fifth-grader who plays baseball, basketball, and football. His dad, Hugh, has had diabetes since he was a child.

Because Michael has a moderate risk of developing diabetes in the next five years, he participates in the oral insulin part of the study. Individuals with a 25 to 50 percent chance of developing diabetes receive either an insulin capsule or take a dummy pill. Michael takes his pill once a day religiously before his morning shower.

He's missed his pill only once or twice. When Hugh was approached about enrolling Michael in the study, he didn't hesitate. "I was very encouraged when they approached me. They told me



what was involved; it wasn't risky as far as I was concerned. If they could learn something or prevent the onset of diabetes in my children, their children, children period — nobody wants to live with diabetes," says Hugh.

Michael has taken a very special interest in the DPT-1. He's learned a lot about diabetes through his experience with his dad and through the study. He asks a lot of questions and always wants to know what's going on. Asked about his participation in the DPT-1, Michael responds, "I feel pretty good about taking the pills. I feel like I'm helping the doctors and my dad and everyone else who has diabetes."

The DPT-1 is still enrolling volunteers for the study. Insulin treatments and medical observation are free. People who develop diabetes while participating in the study benefit from early detection and can begin immediate treatment, which may reduce their chances of developing serious complications later. Furthermore, volunteers are part of an important effort to determine whether type 1 diabetes can be prevented or delayed.

"My thought is that anything we can do to prevent diabetes from occurring, we'll do," says Laura Shearer. "Even with the shots, what Kayla does today is nothing compared to what her brother has to go through. If we can prevent it from going any further, there's no doubt in my mind we will."

The DPT-1 is a collaborative effort of NIH's National Institute of Diabetes and Digestive and Kidney Diseases, National Institute of Child Health and Human Development and National Center for Research Resources, the Juvenile Diabetes Foundation, and the American Diabetes Association. Additional support and supplies are provided

by Eli Lilly and Company, Becton-Dickinson & Co., Boehringer Mannheim Corporation, Bristol-Myers Squibb Company, Lifescan Inc., Bayer Inc., and Medisense Inc.

**To get a free blood test or for more information** about the DPT-1, call 1-800-HALT-DM1 (1-800-425-8361). You will receive an information packet, a directory of screening sites nationwide, and information on where to schedule a blood test close to your home.

People most likely to have the antibodies are those age 45 or younger who have a sibling, child, or parent with type 1 diabetes; or in addition, people age 20 or younger who have a cousin, uncle, aunt, nephew, niece, grandparent, or half-sibling with type 1 diabetes are also at risk.

## Diabetes Prevention Program—Type 2

The Diabetes Prevention Program (DPP) has recruited more than 3,000 people over the age of 25 who have impaired glucose tolerance, or blood sugar levels higher than normal but not high enough to be diagnosed with diabetes. These people are at extremely high risk for type 2 diabetes. People who are older, overweight, or underactive, and those who have a family history of diabetes, or who had gestational diabetes when they were pregnant are most likely to have impaired glucose tolerance.

In addition, African Americans, Hispanic Americans, Asian Americans, Pacific Islanders, and Native Americans are at high risk. To learn what works best for high-risk groups, the DPP has recruited 20 percent of people over age 60, and 45 percent from minority populations. This was no easy feat, but the DPP has been using grassroots community efforts to encourage people from diverse populations to participate in the study.

David Nathan, M.D., chair of the DPP and Director of the General Research Center and Clinic at Massachusetts General Hospital, explains that people with impaired glucose tolerance have a 35 to 45 percent chance of developing diabetes over four to five years. "It's pretty clear that they are at high risk of developing diabetes. Over a period of 10 years, 50 to 70 percent of them may get diabetes," says Dr. Nathan. Type 2 diabetes is largely an under-recognized disease and is often present for five to 10 years before it's diagnosed, damaging the body silently, before symptoms appear. According to Nathan, about 20 percent of people who are diagnosed with diabetes already



have some long-term damage to their eyes, heart, kidneys or nerves.

The DPP is being carried out at 27 medical centers across the country. Eligible participants are separated randomly into a group that receives intensive training to make healthy lifestyle changes; a group that takes a drug called metformin daily; and a control group that takes a dummy pill or placebo daily. Participants meet with their case managers regularly, answer questionnaires, and receive free physical exams.

Silver Spring, Maryland resident, David Hacker, has been in the intensive lifestyle group for over a year. He's lost 60 pounds and started an exercise routine. "There's always someone to make sure I don't stray off the program too much," says Hacker, who adds that he feels a lot better since joining the program. He sees his case manager often to review a daily journal of his activity and meals, and discuss his progress. "We talk about how things are going, areas where I'm having trouble and ways of dealing with it, and ideas for keeping my exercise minutes up or keeping my calories down."

Recruitment centers in Boston, Miami, Denver, San Antonio and other cities around the country are educating potential participants about the study, the risks of type 2 diabetes, and the available therapies. With this information, a volunteer can become a fully participating partner in the research.

Jean Jordan of Washington, D.C. wouldn't have it any other way. Jean takes a pill every day as part of the DPP, although she doesn't know whether she is taking the actual medicine or the dummy pill. Even though she says she's not the type of person to take medicines, she joined the study because her mother died from complications of diabetes and

## The Diabetes Prevention Program (DPP)

has recruited more than 3,000 people over the age of 25 who have impaired glucose tolerance, or blood sugar levels higher than normal but not high enough to be diagnosed with diabetes.

she's afraid of becoming diabetic herself. Jean believes that both the doctors and the participants are benefiting from the knowledge gained from the study. "If this were a program that said, 'Come in and let us give you some medicine and see if you will react to this medicine,' then perhaps I might have a misgiving or two. But in this case, it seems like there is an effort to prevent us from developing diabetes and that, to me, is a positive thing," says Jordan.

People join the DPP for a variety of reasons. Many do it because, like Antonette Crugnale and Jean Jordan, they've seen the devastating effects of diabetes on their loved ones and they want to avoid getting diabetes themselves. Others do it for purely altruistic reasons, to help pave the way to a greater understanding of diabetes and how to prevent it. Still others find that participating in the program is beneficial to them because it means receiving free medical exams.

"The benefits participants get in terms of the free care is sometimes almost incalculable," says Dr. Nathan. "They get a tremendous amount of health education. They get all kinds of dietary advice. They get careful follow-up. If they were to develop diabetes, they would find out as part of the program earlier than they ever would have otherwise. They are getting an enormous amount of testing they wouldn't otherwise have gotten and the testing specifically assesses their health status. It's information that's relevant to them," he adds. Or as Jean Jordan reasons, "How can you not do something that might prevent you from getting something as chronic as diabetes? If you can prevent something it's better than trying to treat it after you've gotten it."

The DPP is sponsored by NIH's National Institute of Diabetes and Digestive and Kidney Diseases and National Institute on Aging, the NIH Office of Research on Minority Health, the NIH Office of Research on Women's Health, the NIH Office of Behavioral and Social Sciences Research, the Centers for Disease Control and Prevention, the Indian Health Service, the American Diabetes Association, and corporations including Bristol-Myers Squibb Company and Lipha Pharmaceuticals, Inc. Additional support is provided by Nike, Merck & Co., Inc., Hoechst Marion Roussel, Merck-Medco, and LifeScan, Inc. •

**For more information** on the DPP, visit the DPP Web site at: [www.preventdiabetes.com](http://www.preventdiabetes.com).

---

*Mimi Lising, health communications specialist, National Institute of Diabetes and Digestive and Kidney Diseases.*

# PREVENTING INFANT

# HOMICIDE

**A**n infant is killed nearly every day in the United States. This tragic statistic is from an analysis of birth and death certificates by researchers at NIH's National Institute of Child Health and Human Development (NICHD) led by Mary Overpeck, DrPH, a researcher with NICHD's Division of Epidemiology, Statistics, and Prevention Research.

The researchers compared birth certificate data from 34,895,000 births in the United States from 1983 to 1991 to data from death certificates for infants who died during the first year of life. After analyzing the data, they determined that 2,776 infants died from homicide.

Many of these deaths are preventable, says Dr. Overpeck, because many of these infants are born to teen mothers who lack parenting skills and place their infants in unsafe or inappropriate environments.

"Very young teens aren't ready to be pregnant or become parents," Dr. Overpeck said. "Since these needless tragic deaths occur early in a child's life, the key to preventing them is to reach mothers early in their pregnancies, before the child is born."

Homicide is the leading cause of infant death due to injury, explained Dr. Overpeck. The NICHD analysis found that the likelihood of being killed was greatest for infants whose mothers were less than 15 years old, had fewer than 12 years of school, or did not have prenatal care. One-half of the infants were killed by four months of age.

## INTERVENTION PROGRAMS TEACH SKILLS AND OFFER SUPPORT

Studies suggest that having home nurses visit pregnant teens regularly could reduce the infant homicide rate. Earlier studies have shown that more than 80 percent of infant homicides are due to child abuse. The most successful programs focus on preventing child abuse by helping teen mothers develop behavioral skills and by offering them support, according to Dr. Overpeck.

"Most of these girls don't feel as if they're in control of their environment. The visiting health care professionals can help the girls pursue their goals—to finish school and take care of themselves and their babies."

The most successful intervention to prevent child abuse was conducted by Dr. David Olds in Elmira, NY. Dr. Olds and his colleagues studied low-income, primarily white, unmarried, pregnant teens. They found that visits by trained nurses during the girls' pregnancies and during the first two years of the infants' lives reduced the incidence of child abuse and neglect among first-born children. The girls in the study also had fewer subsequent children and were more likely to complete their education than were teen mothers who did not participate in the study.

"This finding is extremely important, because the risk of infant homicide is higher for second or later-born children of teen mothers," Dr. Overpeck said. "Follow-up studies of these girls and their children, 15 years later, also showed that both the mothers and their children were less likely to abuse drugs and alcohol."

## Researchers

## Identify

## Risk

## Factors



Dr. Mary Overpeck



# PREVENTING INFANT

# HOMICIDE

## YOUNGER MOTHERS WITH FEWER YEARS OF EDUCATION POSE ADDITIONAL RISK

Overall, second or later children born to mothers younger than 19 were 10 times more likely to be killed than the first child of older mothers. In addition, children born to mothers with less than 12 years of education were 8.4 times more likely to be killed than children born to mothers who had completed 16 years of education.

“It was difficult to separate the risk of death to infants born to mothers younger than 17 from the risk to infants born to mothers with less than 12 years of education,” Dr. Overpeck said. “Most mothers under 17 have not had the time to complete 12 years of education.”

However, when the researchers excluded girls younger than 17 from their analysis, the risk of homicide among children born to mothers who were old enough to complete 12 years of education, but had not done so, was still greater than for mothers who had completed additional years of school. In fact, children whose mothers were older than 17 but had not completed 12 years of school were 8 times more likely to be killed than infants born to mothers who had 16 years of education.

Moreover, the researchers found that 1 out of 4 homicides occurred by the second month of life, one-half occurred by the fourth month, and two-thirds by the sixth month.

Dr. Overpeck noted that she and her coworkers could not obtain a lot of information from death certificates about the circumstances surrounding the death. “Only 10 percent of the available certificates listed the relationship of the infant to the person identified with killing him or her,” she said. She noted

that some studies have reported that most infant homicides are carried out by either parents or stepparents, and a slight majority are carried out by males. Other studies also have found that most homicides of children older than two are carried out by someone unrelated to the child.

Still other studies, Dr. Overpeck added, have found that when a child is killed during the first week of life, the homicide was usually conducted by the mother. Similarly, 5 percent of infant homicides occurred during the first day of life; of these, 95 percent were not born in a hospital. “A possible explanation is that the mother committed the homicide to hide the pregnancy and birth,” Dr. Overpeck said.

In their analysis, the researchers theorized that infant homicides are probably underreported. For example, some homicides committed on the day of the child’s birth may be so well hidden that they simply go undetected. Other homicides may have been attributed to death due to accidental injury or some other cause. Other studies have shown that from 7 to 27 percent of deaths attributed to unintentional injuries actually may have been due to child abuse or neglect.

To get a more complete picture of infant homicides, Dr. Overpeck and her colleagues recommended that reviews of child deaths be conducted not just from death certificates and records of medical examiners, but also from abuse registries, crime reports, hospitals, and ambulatory care records.

“One review of the records from several agencies showed that the number of deaths from abuse and neglect for children up to four years of age were double the rate reported by medical examiners’ records,” Dr. Overpeck said. •

Studies suggest that having home nurses visit pregnant teens regularly could reduce the infant homicide rate.

---

*Robert Bock, writer/editor, National Institute of Child Health and Human Development.*

# STEROID-INDUCED STUDIES IN MICE MAY LEAD TO PREVENTION BONE LOSS:

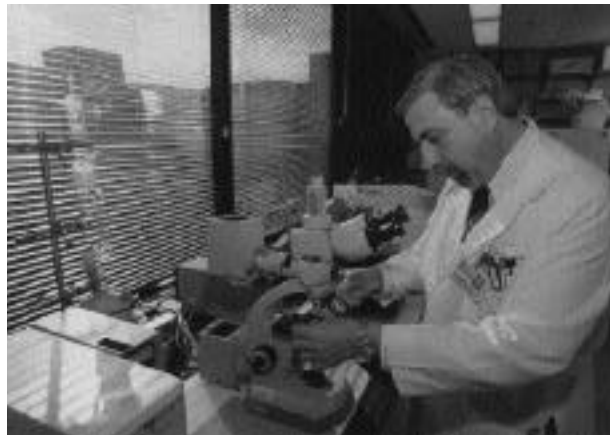
For thousands of transplant patients in the United States, glucocorticoids—a class of steroid medications that suppress the immune system—are a life-sustaining commodity: the drugs keep their bodies from rejecting newly-transplanted organs. Thousands more also use these drugs to deal with chronic diseases, such as rheumatoid arthritis, lupus, and asthma.

But despite their apparent success, glucocorticoids have a substantial shortcoming: long-term users often develop osteoporosis, a condition of serious bone weakening and loss that puts the body at risk for fractures and subsequent disability. Osteoporosis is a major threat for 28 million Americans. It causes 1.5 million fractures and an estimated \$13.8 billion in health care costs annually. Steroid-induced bone loss is only one cause of osteoporosis.

Scientists at NIH's National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) and other institutions around the country have long been interested in learning the mechanism behind glucocorticoid-induced bone loss, in the hope of discovering improved methods of treatment and prevention. Investigators have tried to study the effects of glucocorticoids on bone cells grown in the laboratory, but isolating these effects has proven difficult. In a living skeleton, bone is constantly being broken down and replaced, and osteoblasts (cells that build up bone cells) and osteoclasts (cells that break down bone cells) are continuously dying and being replaced by new cells from the bone marrow.

Researchers also have looked for an animal model to reproduce the glucocorticoid effects they see in human patients. Tests in rats and rabbits, however, have failed.

Recently, investigators at the University of Arkansas for Medical Sciences, with funding from NIAMS and NIH's National Institute on Aging, have successfully used a mouse model and cell culture techniques to shed new light on the destructive mechanism of glucocorticoids, and to point the way to preventive measures. The team of scientists, led by Stavros Manolagas, M.D., Ph.D., has shown that mice treated with prednisolone—a commonly used glucocorticoid—have bone loss similar to that seen in humans. The research team also found that:



Stavros Manolagas, M.D., Ph.D.

- Treated mice had reduced numbers of bone-forming osteoblasts.
- Cell cultures taken from the treated mice had a reduced rate of osteoblast formation.
- Treated mice had a greater number of dying bone cells than untreated mice.

The University of Arkansas group discovered that the dying bone cells included not only osteoblasts, which are present on bone surfaces, but osteocytes, which are imbedded in the bone itself and are thought to help stimulate new bone formation. This finding is also seen in humans with glucocorticoid-induced bone loss.

The Arkansas study shows that glucocorticoids may decrease the formation of new bone cells and increase the death of cells important to new bone cell development. But how could knowing these mechanisms help prevention efforts?

The process of programmed cell death, also called apoptosis, occurs at increased rates in bone cells during glucocorticoid treatment. The process is highly controlled and is usually triggered by a specific signal. If glucocorticoids act as a signal to bone cells to begin the dying process, and if the nature of that signal can be determined, it may be possible to design drugs to block the signal and spare many bone cells that might otherwise be lost.

For thousands of transplant patients, arthritis and asthma sufferers, and others at risk for steroid-induced bone loss, that's good news. •

---

*Ray Fleming, senior science writer, and William Sharrock, M.D., director, Bone Biology Program, National Institute of Arthritis and Musculoskeletal and Skin Diseases.*

# SCIENTISTS SCRUTINIZE Sun and Skin

The Greek hero Daedalus, according to ancient mythology, built wings for his son Icarus to escape a Labyrinthian prison. Escape he did, but despite his father's stern warnings, Icarus flew too close to the sun. The wings melted, and the boy plunged to his death in the sea below.

Today, the sun's rays continue to evoke warnings, especially from medical and public health professionals: wear appropriate sunscreen and protective clothing, limit exposure time, seek shade.

The reason? The sun's ultraviolet (UV) radiation, in the form of UVA (longer wavelength) and UVB (shorter wavelength) rays, has been implicated in skin aging and in skin cancers, particularly skin cancers such as basal-cell and squamous-cell carcinomas and melanoma. But scientists also have found that UV radiation is not all bad. It stimulates vitamin D production in the skin, and there is some controversial evidence of a possible connection to reduced risk of colon and rectal cancer and death from breast cancer.

The challenge for scientists supported by NIH's National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) is to understand both the positive and negative effects of UV radiation. What they learn may have major public health and prevention implications for people with skin conditions.

Several recent NIAMS-supported studies have focused on the interaction

## Be Sun-Safe!

- Use a sunscreen with a sun protection factor (SPF) of 15 or more that blocks both UVB and UVA radiation.
- Wear protective clothing: long sleeves, pants, and wide-brimmed hats.
- Limit your hours in the sun, especially during peak sunlight hours (between 10 a.m. and 3 p.m.) and during the summer, when the sun is stronger.
- Take advantage of "structured shade": trees, pavilions, and other outdoor structures that afford protection from the sun's rays.

of UV radiation, skin cancer, and vitamin D. These studies lend support to the dominant theory that UV radiation is the main identifiable and preventable cause of skin cancer, and also emphasize the importance of UV-induced vitamin D in cell growth and differentiation.

- To learn how UV radiation could start and promote skin cancers, NIAMS-funded researcher Alice Pentland, M.D., at the University of Rochester, NY, examined prostaglandins—cell components that contribute to tissue inflammation. Focusing on the protein COX-2, which helps generate prostaglandins, the study showed that 1) doses of UVB high enough to cause the skin to redden also increased levels of COX-2, and 2) skin areas with squamous cell cancer had higher levels

of COX-2 than normal, non-sun-exposed skin of the same patients. The increase in COX-2 caused by exposure to UVB could be a potential target for drug therapy in preventing skin tumors.

- NIAMS-funded researcher Robert Stern, M.D., and his colleagues at Harvard University looked at the incidence of squamous- and basal-cell carcinoma in patients with the skin disease psoriasis who had participated 20 years ago in a trial of PUVA therapy. PUVA is a treatment using UVA and a chemical, psoralen, that sensitizes skin to UV radiation. The scientists found that even in patients with minimal PUVA or UVB exposure over the past decade, initial exposure to high-dose PUVA in the trial continued to result in new squamous- and basal-cell cancers. According to the investigators, this finding shows that PUVA actually began the cancer process rather than simply stimulating a cancer that had already started. A similar study of melanoma incidence in the same population showed that PUVA can initiate this form of skin cancer.
- Vitamin D, which is synthesized in the skin as a result of UV exposure, promotes normal growth and differentiation of skin structures, which is somehow disrupted in skin cancers. With funds from NIAMS, Zhongjian Xie, M.D., Ph.D., and Daniel Bikle,

## Major Workshop Sharpens Focus on UV Radiation, Tanning

Much more research is needed on both the harmful and beneficial effects of UV light to improve the basis for prevention and public health actions. This conclusion was reached by participants at an NIH meeting, Research Workshop on the Risks and Benefits of Exposure to Ultraviolet Radiation and Tanning, in September 1998.

The workshop, cosponsored by NIAMS and five other federal agencies, involved basic and clinical researchers, the medical community, and representatives from government, industry and the public. Presentations and discussions covered five major topics: sources and measurement of UV radiation, UV effects on the skin, beneficial effects of UV, ways to produce and enhance the tanning process, and sunburn as an indicator of future biological events.

The other workshop sponsors were NIH's National Cancer Institute, National Institute of Environmental Health Sciences, and National Institute on Aging, the Centers for Disease Control and Prevention, and the Food and Drug Administration.

### A summary of the workshop's

discussions can be found on the NIAMS Web site at: <http://www.nih.gov/niams/reports/ulv.html>.

M.D., Ph.D., at the University of California at San Francisco found that cells from squamous-cell cancer failed to differentiate like normal skin cells in response to vitamin D. Their investigations suggest that these cancer cells lack a substance in their genetic machinery that allows vitamin D to do its developmental work.

Unlike the mythical Icarus, NIAMS intends to pursue the sun's rays from a safe distance. What it finds on its scientific journey should yield significant benefits to millions of people. •

---

*Ray Fleming, senior science writer, and Alan Moshell, M.D., chief, Skin Diseases Branch, National Institute of Arthritis and Musculoskeletal and Skin Diseases.*

# MUSCLES:

U S E

T H E M

O R

L O S E

T H E M

A P R O G R E S S I V E

C O N D I T I O N C A L L E D

S A R C O P E N I A —

L O S S O F M U S C L E

T I S S U E — S E E M S

T O B E A S T R O N G

C O N T R I B U T O R

T O P H Y S I C A L

D E T E R I O R A T I O N .

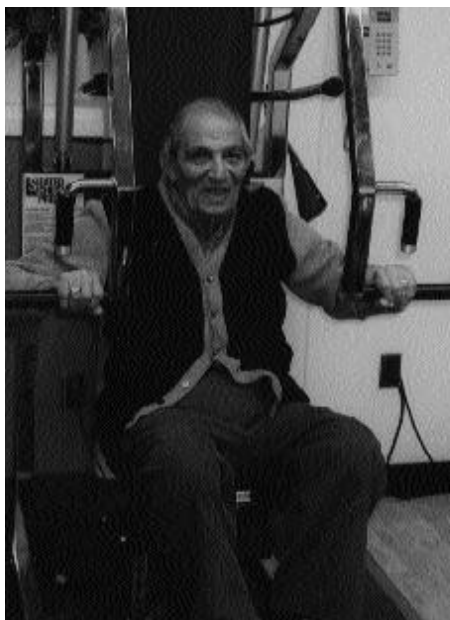
Instead of being the golden years, old age is all too often a slow decline into frailty and dependence. But researchers are continuously uncovering new aspects of the aging process, identifying what's normal and what can be done to ease the process. They're finding that muscles—or lack of them—play an important role in determining quality of life. Exercise, therefore, will not only prepare younger people for a healthy old age but also keep centenarians fit as well.

Physical and mental impairments among the elderly are major causes of institutionalization in nursing homes, costing this country billions of dollars each year. A progressive condition called sarcopenia—loss of muscle tissue—seems to be a strong contributor to physical deterioration. People have long been aware that body composition changes with age, most visibly as weight

shifts to the abdomen. Only recently has it become apparent that muscle loss begins as early as age 35 and is much greater than previously thought.

Sarcopenia, largely masked by increases in fat, leads to loss of strength, balance, mobility, and ultimately independence. Several studies of sarcopenia—assessing physical, nutritional, metabolic, psychological, and lifestyle factors—have been conducted at General Clinical Research Centers (GCRCs) funded by NIH's National Center for Research Resources. Among all the studies, exercise stands out as a simple, effective prescription that is appropriate for *everybody*.

In early studies of exercise in people older than 65, many investigators were apprehensive about recommending vigorous exercise for study participants. Consequently, the results were not encouraging. But in the late 1980s, William J. Evans, Ph.D., then director of Noll Physiological Research Center at Pennsylvania State University, University Park, and his colleagues experimented with high-intensity, resistance strength training directed at the large muscle groups important for everyday activities. The researchers had sedentary 60 to 72-year-old men exercise their shoulders, arms, spine, hips, and legs with free-weights as well as weight-stack machines. In 12 weeks the men's



To strengthen his chest muscles, a resident at the Jewish Rehabilitation Center for Aged, in Boston, works out at a seated chest press. (Photo Courtesy of the Jewish Rehabilitation Center.)





Dr. William J. Evans and his colleagues introduced weight training in nursing homes to help men and women improve their mobility.

strength doubled or, in some cases, tripled, and muscle size increased significantly. Later, when geriatrician Maria Fiatarone joined the research group, they took resistance training into nursing homes, with excellent results in men and women 72 to 98 years old.

Dr. Evans, currently director of the Nutrition, Metabolism, and Exercise Laboratory at the Donald W. Reynolds Department of Geriatrics, University of Arkansas, Little Rock, points out that if weight training can be done safely by nursing home patients who have multiple chronic diseases, such as hypertension, diabetes, osteoporosis, and heart disease, then exercise can be done safely by virtually everybody. He says, “The patients enjoy feeling their strength return.”

#### STRENGTH TRAINING HELPS PREVENT MUSCLE LOSS

Strength training also may be the safest way to lose weight and keep it off. People who try to lose weight without exercising lose muscle as well as fat, the investigators warn. This is one of the worst things that can happen to an older person with already depleted muscle mass. But not all types of exercise are equally effective. Although walking, biking, and swimming

are healthy activities, “the way one prevents or reverses loss of muscle is through resistance exercise, or strength training,” Dr. Evans emphasizes.

While Dr. Evans continues to apply his practical approach to treating weakened, aging muscles, other researchers try to grasp and understand the underlying details of the aging process. One of these researchers is Richard Baumgartner, Ph.D., at the University of New Mexico, Albuquerque. Dr. Baumgartner is associated with the New Mexico Aging Process Study, an ongoing, long-term investigation—began in 1979—of more than 300 men and women. He and his colleagues are collecting and analyzing a variety of sophisticated body composition measurements of their participants, whose ages range from 60 to 95.

“This work revolves around quantifying the changes so we can look at causes and consequences in a more objective way,” Dr. Baumgartner says. The hope is that greater knowledge will eventually lead to treatments of old-age deficiencies. Until recently, very few people lived past 75, so there isn’t much body composition data about the oldest old. “We’re trying to fill that gap,” Dr. Baumgartner says. His studies suggest that the changes in body composition seen in younger people continue in those in their 80s and older. Even healthy, active people lose 6 to 7 percent of their muscle mass over the 20-year interval from 65 to 85 years of age.

Because there have been no good methods to identify and quantify sarcopenia in population studies, its prevalence is unknown. Dr. Baumgartner is starting to



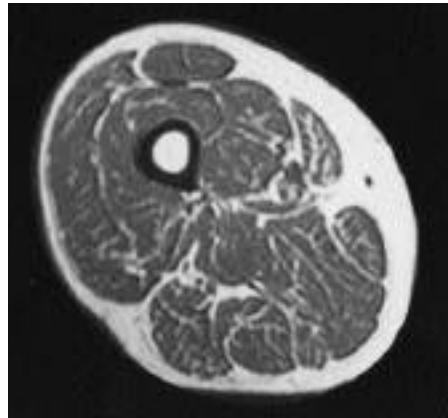
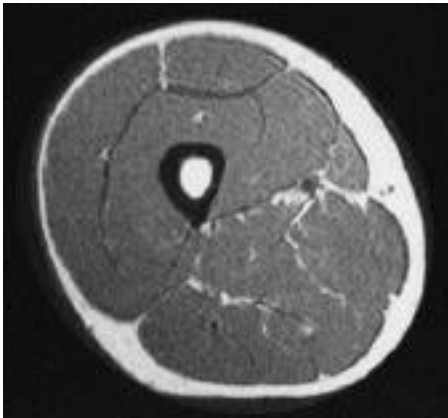
Dr. Marc Blackman is exploring the effects of growth hormone in older men and women. (Photo courtesy of Johns Hopkins University School of Medicine.)

fill that gap by developing an index that will help researchers identify people with sarcopenia as well as those at risk. One method compares an older person’s muscle mass to an average value derived from a reference group of healthy, active older people. If the muscle mass falls below a statistical cutoff value, the person is classified as having sarcopenia.

Serum albumin, the most abundant blood protein, may be another early warning sign of sarcopenia. The level of albumin in blood serum has long been recognized as a crude indicator of health that, like muscle mass, declines with age. In two recent independent population samples, Dr. Baumgartner’s team found that declines in these two protein stores—muscle and albumin—seem to occur in tandem.

#### HORMONAL STUDIES IN PROGRESS

The levels of several hormones in the body also decrease with age, most notably estrogen in women and testosterone in men. But a study published a few years ago raised the hope in some men over 60 that taking human growth hormone might reverse the aging process. “The changes in body



Magnetic resonance images of the thighs of a 25-year-old (left) and a 65-year-old man show that much of the older man's muscle tissue has been replaced by fat.

(Photo courtesy of Dr. Kevin Conley, University of Washington Medical Center.)

OLDER AMERICANS  
ARE GETTING  
THE MESSAGE AND  
ARE WILLING TO  
EXERCISE, BUT  
SOMETIMES THEY  
ARE CONFUSED  
ABOUT EXACTLY  
WHAT TO DO.

composition that were observed in men who received human growth hormone looked as though the clock had been turned back 20 to 30 years," says Marc R. Blackman, M.D., chief of the Division of Endocrinology and Metabolism at Johns Hopkins University School of Medicine, and program director of the GCRC at Johns Hopkins Bayview Medical Center in Baltimore, Maryland. Several large studies are under way to confirm and extend these findings.

Dr. Blackman, leading one of these research studies, is examining the effects of administering growth hormone alone or combined with sex hormones to eight treatment groups, four for each gender. The study is placebo-controlled, meaning that not every participant gets active hormones, and double-blinded, meaning that neither participants nor investigators know who is receiving active hormones or placebos. One group receives growth hormone and a placebo; another gets the appropriate sex hormone (testosterone for men, estrogen/progestin for women) and a placebo; a third group gets both growth hormone and sex hormone; and the fourth receives only placebos. Participants are tested at the beginning of the study to measure a variety of physical and psychobehavioral functions. After a

six-month period, the participants are tested again.

"We want to look at normal aging," Dr. Blackman says, "so we recruit healthy people over age 65. Because they're involved in a research study for six months, it takes special people willing to come to the medical center once a week even though they feel fine." Nearly 125 men and women have entered the study, now in its seventh year, and researchers are pleasantly surprised at the low drop-out rate.

So far, the researchers have found that people with naturally higher levels of growth hormone are the most physically active. Perhaps future data will suggest whether increased growth hormone levels stimulate physical activity, or physical activity causes the growth hormone level to increase.

Whether or not hormone treatments prove useful, Dr. Evans wants to spread the word about exercise. "I think it's a message of hope. We've been able to show that people into the tenth decade of life can respond marvelously to these low-cost, low-tech interventions," he says. Older Americans are getting the message and are willing to exercise, but sometimes they are confused about exactly what to do. "Our challenge is to try to put into the community the

kinds of programs that we know work in the laboratory," Dr. Evans says. "That's one of the things we're trying to do right now." •

**Studies funded by the** Clinical Research area of the NIH's National Center for Research Resources and the National Institute on Aging, the National Science Foundation, the U.S. Department of Agriculture, and the American Heart Association.

---

*Kathy Kaplan, information officer,  
National Center for Research Resources.*

# EXERCISE :

## Feeling Fit for Life

"It's made my life a lot better. I was slumped over. Now, I stand up straight, and I can look the world right in the eye. I don't intend to stop. I know what a difference it has made for me."

"It has just done me a world of good. My family is so thrilled and proud of me."

"I think once (people) experience how much better they feel, they'll want to keep on doing it. It has so many built-in benefits."

"I know seniors who are doing it .... and they look great."

What *are* all these people talking about that makes them feel so good? The surprising answer is exercise. These are quotes from older people who enjoy a regular program of exercise and physical activity.

### HEY, CAN'T YOU BE TOO OLD TO EXERCISE?

Well, probably not. Listen to Jeannette Chamberlin, 73, of Silver Spring, Maryland, "*At our age you have to exercise. I just feel that exercise enhances our state of living.*" Results from research funded by the National Institute on Aging (NIA) prove her point. For example, people who are 90 and who have become physically frail through inactivity have been able to double their strength through simple exercises. In fact, studies suggest that *not* exercising is risky behavior. Older adults who become inactive have a lot to lose. The good news is that you may be able to improve, maintain, or at least partly restore both health and ability. So, in all likelihood, exercise is one of the healthiest things you can do for yourself.

Okay, you ask yourself, "Where will I get the money to join a health club?" Or, "I have no place for all that special equipment." Or maybe even, "But I look terrible in gym clothes!" The fact is that just about every adult can do some kind of physical activity at little or no cost. You don't have to exercise in a

public place or use expensive equipment if you don't want to. The key is to increase your physical activity. As Georgia Burnette, 68, of Amherst, NY says, "*Everybody has to find their own way to exercise. They have to embrace it and make it work for them.*"

### SO, EXACTLY WHAT KINDS OF ACTIVITIES ARE YOU SUGGESTING?

There are four types of exercises that are important for older people:

**Endurance** exercises increase your breathing and heart rate. They improve the health of your heart, lungs, and circulatory system. And having more endurance may delay or prevent many diseases associated with aging.

**Strength** exercises build your muscles. They increase your metabolism which may help with obesity and diabetes, two major health problems for older people. Studies suggest strength exercises may help prevent osteoporosis.

**Balance** exercises help prevent falls, a common problem for older people. Falls are a major cause of broken hips and other injuries in older people. Some balance exercises can build your leg muscles.

**Flexibility** exercises are thought to keep your body limber by stretching your muscles and tissues. Physical therapists and other health professionals recommend certain stretching exercises to help their patients prevent or recover from injuries.



**Given what we now know about the health risks of not exercising, you should discuss with your doctor both the possible benefits of exercise as well as any concerns.**

Each of these types of activities makes an important contribution to your health. As Ron Ekovich, 61, Leesville, SC, notes, *“Exercise is like a savings account. The more you put in, the more you’re going to get out of it.”*

**SURE, BUT IS EXERCISING SAFE FOR ME?**

For the most part the answer is a resounding yes! Phyllis Wendahl, 85, Bothell, Washington, is enthusiastic. *“There’s always something within someone’s capabilities. There’s no reason older people need to be idle sitting in a rocking chair.”* For some older people, it’s a good idea to start by talking to the doctor. Given what we now know about the health risks of not exercising, you should discuss both the possible benefits of exercise as well as any concerns.

There are some precautions of course. A man over 40 or a woman over 50 should check with the doctor before starting *vigorous* physical activities. And, if you’re at high risk for any chronic condition—for example, if you have a family history of heart disease or diabetes, or if you smoke or are obese—you should also check with your doctor before increasing your physical activity. People with “abdominal aortic aneurysm” or “critical aortic stenosis” should not exercise unless their doctors say it’s okay.

**OKAY, OKAY. YOU’VE CONVINCED ME. NOW WHAT?**

There is a world of difference between knowing that exercise is a good thing to do and actually doing it. Arthur Canfield, 83, of Fairfax, VA is blunt. *“I hate the thought of exercise for exercise’s sake. I’ve never done that. It’s got to be fun... the rhythmic pattern of exercise is like music. You’re absolutely a free spirit. You forget about it as you’re doing it.”*



Stop. Look. Listen to your doctor’s advice about exercise if you have any of the following conditions:

- a new, undiagnosed symptom
- chest pain
- irregular, rapid, or fluttery heart beat
- severe shortness of breath
- significant, ongoing weight loss that hasn’t been diagnosed
- infections, such as pneumonia, accompanied by fever
- fever itself, which can cause dehydration and rapid heart beat
- acute deep-vein thrombosis (blood clot)
- a hernia that is causing symptoms
- foot or ankle sores that won’t heal
- joint swelling
- persistent pain or a disturbance in walking after you have fallen
- certain eye conditions, such as bleeding in the retina or detached retina
- hip repair or replacement

There are a lot of different physical activities that can improve your health and independence. Here are some suggestions for the four types of exercises.

#### IMPROVING YOUR ENDURANCE

Any activity that increases your heart rate and breathing over an extended period of time is an endurance exercise. You should build up your endurance gradually—starting out, if needed, with as little as five minutes at a time. It may take months to go from a long-standing sedentary lifestyle to doing some of these activities. You should aim at doing a total of 30 minutes of endurance exercises on most or all days of the week.



Examples of **moderate** endurance activities:

- swimming
- bicycling (including on a stationary bike)
- gardening
- walking briskly on a flat surface
- mopping/scrubbing the floor
- playing golf, without a cart
- playing tennis, doubles
- playing volleyball
- rowing
- dancing

Examples of **vigorous** endurance activities:

- climbing stairs or hills
- shoveling snow
- bicycling briskly up hills
- digging holes
- playing tennis, singles
- swimming laps
- cross-country or downhill skiing
- hiking
- jogging

#### IMPROVING YOUR STRENGTH

To do most strength exercises, you need to lift or push weights and gradually increase the amount of weight you use. Plan to do strength exercises for all your major muscle groups at least twice a week, being careful not to work on the same muscle group two days in a row.

Start by using a minimum weight and slowly build up. Try for eight to 15 repetitions in a row.

Take three seconds to lift or push the weight into place and another three seconds to lower it. Keep breathing while exercising—breathe out as you lift and breathe in as you relax.

Muscle soreness, lasting up to a few days, and slight fatigue are normal after muscle-building exercises, but if you are exhausted and feel sore joints and unpleasant muscle pulling, you are overdoing it.

#### THE FOLLOWING ARE EXAMPLES OF STRENGTH-BUILDING EXERCISES YOU CAN DO:

##### Arm Raise

Strengthens shoulder muscles. Sit in a chair, with your back straight. Your feet should be flat on the floor, spaced apart so that they are even with your shoulders. Hold hand weights straight down at your sides, with your palms facing inward. Take 3 seconds to lift your arms straight out, sideways, until they are parallel to the ground. Hold the position for 1 second. Take 3 seconds to lower your arms so that they are straight down by your sides again. Pause. Repeat 8 to 15 times. Rest; do another set of 8 to 15 repetitions.

Summary:

1. Sit in chair.
2. Feet flat on floor; keep feet even with shoulders.
3. Arms straight down at sides, palms inward.
4. Raise both arms to side, shoulder height.
5. Hold position.
6. Slowly lower arms to sides.



##### Knee Flexion

Strengthens muscles in back of thigh. Use ankle weights, if you are ready to. Stand straight, very close to a table or chair, holding it for balance. Take 3 seconds to bend your left knee so that your calf comes as far up toward the back of your thigh as possible. Don't move your upper leg at all; bend your knee only. Take 3 seconds to lower your left leg all the way back down. Repeat with right leg. Alternate legs until you have done 8 to 15 repetitions with each leg. Rest; then do another set of 8 to 15 alternating repetitions.

Summary:

1. Stand straight; hold onto table for balance.
2. Slowly bend knee as far as possible.
3. Hold position.
4. Slowly lower foot all the way back down.
5. Repeat with other leg.



##### Side Leg Raise

Strengthens muscles at sides of hips and thighs. Use ankle weights, if you are ready to. Stand up straight, directly behind a table or chair, feet slightly apart. Hold onto the chair to help keep your balance. Take 3 seconds to lift your right leg 6 to 12 inches out to the side. Keep your back and both legs straight. Don't point your toes outward; keep them facing forward. Hold the position for 1 second. Take 3 seconds to lower your leg back to the starting position. Repeat with left leg. Alternate legs, until you have repeated the exercise 8 to 15 times with each leg. Rest; do another set of 8 to 15 alternating repetitions.

Summary:

1. Stand straight, directly behind chair, feet slightly apart.
2. Hold chair for balance.
3. Slowly lift one leg to side, 6-12 inches.
4. Hold position.
5. Slowly lower leg.
6. Repeat with other leg.
7. Back and both knees are straight throughout exercise.





## IMPROVING YOUR BALANCE

Balance exercises can help you stay independent by helping you avoid the disability that may result from falling. There is a lot of overlap between strength and balance exercises; often one exercise serves both purposes. For example, the Knee Flexion and Side Leg Raise shown earlier will improve your balance while they improve your strength.

With only a slight change to the exercise, strength exercises can improve your balance. For example, if you go from holding onto the chair with two hands, to holding with one hand, to using only one finger as illustrated, then you are working to improve your balance. If you feel very steady, you can try doing the exercise with no hands and then with your eyes closed. But have someone stand close by to make sure you are steady. Don't do more than your regularly scheduled strength exercise sessions even when adding these changes for balance.

## THE FOLLOWING ARE SAMPLES OF BALANCE EXERCISES YOU CAN DO:



### Plantar Flexion

Strengthens ankle and calf muscles. Stand straight, feet flat on floor, holding onto the edge of a table or chair for balance. Take three seconds to stand as high up on tiptoe as you can; hold for one second, then take three seconds to lower yourself back down. For balance, add the following modifications. Hold table with one hand, then no fingertip, then no hands; then do exercise with eyes closed, if steady.

#### Summary:

1. Stand straight, holding onto a table or chair for balance.
2. Slowly stand on tiptoe, as high as possible.
3. Hold position.
4. Slowly lower heels all the way back down.
5. Repeat 8 to 15 times.
6. Rest a minute, then do another 8 to 15 repetitions.
7. Add modifications as you progress.

### Hip Flexion

Do hip flexion as part of your regularly scheduled strength exercises, and add these modifications as you progress: Hold table with one hand, then one fingertip, then no hands; then do exercise with eyes closed, if steady.

#### Summary:

1. Stand straight; holding onto a table or chair for balance.
2. Slowly bend one knee toward chest, without bending waist or hips.
3. Hold position.
4. Slowly lower leg all the way down.
5. Repeat with other leg.
6. Add modifications as you progress.

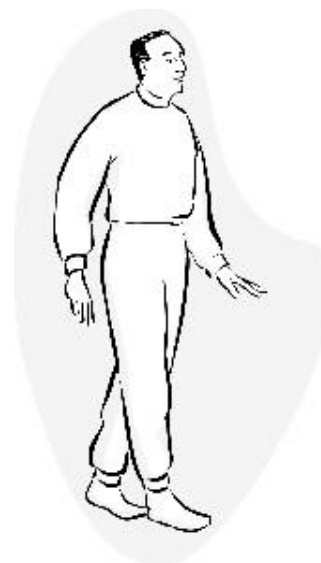


### "Anytime, Anywhere" Balance Exercises

These types of exercises also improve your balance. You can do them almost anytime, anywhere, and as often as you like, as long as you have something sturdy nearby to hold onto if you become unsteady.

#### Examples:

- Walk heel-to-toe. Position your heel just in front of the toes of the opposite foot each time you take a step. Your heel and toes should touch or almost touch. (See illustration.)
- Stand on one foot (while waiting in line at the grocery store or at the bus stop, for example). Alternate feet.
- Stand up and sit down without using your hands.



## IMPROVING YOUR FLEXIBILITY

Stretching exercises are thought to give you more flexibility and freedom of movement. Alone, they will not improve your endurance or strength.

Always warm-up before stretching—in fact, it's best to stretch after you do your regularly scheduled exercise. Stretching your muscles before they are warmed up may result in an injury.

Slowly stretch into the desired position and hold the stretch for 10 to 30 seconds. Relax, then repeat, trying to stretch farther. Mild discomfort is normal but you should never feel pain, especially joint pain, when you stretch. Don't "bounce" into the stretch—slow, steady movement is best.

## THE FOLLOWING ARE EXAMPLES OF STRETCHING EXERCISES YOU CAN DO:

### Hamstrings

Stretches muscles in back of thigh. Sit sideways on a bench or other hard surface (such as two chairs placed side by side) without leaning back against anything and with your back and shoulders straight. Your left leg should be resting on the bench, toes pointing up. Your right leg should be resting over the side of the bench, with your right foot flat on the floor. If your left knee is bent, stretch to get it to lie flat on the bench. If you feel a stretch at this point, hold the position for 10 to 30 seconds. If your left leg is flat on the bench and you don't feel a stretch, lean forward slowly from the hips (not the waist) until you do, keeping your back and shoulders straight the entire time (note: omit this part if you have had a hip replacement - don't lean forward, unless your surgeon or physical therapist approves). Stop and hold this position for 10 to 30 seconds. Reverse the position so that you stretch your right leg in the same way. Repeat 3 to 5 times on each side.



#### Summary:

1. Sit sideways on bench.
2. Keep one leg stretched out on bench, straight.
3. Keep other leg off of bench, with foot flat on floor.
4. Straighten back.
5. Lean forward from hips (not waist) until you feel stretching in leg on bench, keeping back and shoulders straight. Omit this step if you have had a hip replacement, unless surgeon/therapist approves.
6. Hold position.
7. Repeat with other leg.

### Wrist Stretch

Press your hands together, elbows down. Raise your elbows as nearly parallel to the floor as possible, while keeping your hands together. Hold for 10 to 30 seconds. Repeat 3 to 5 times.

#### Summary:

1. Place hands together, in praying position.
2. Slowly raise elbows so arms are parallel to floor, keeping hands flat against each other.
3. Hold position for 10 to 30 seconds.
4. Repeat 3 to 5 times.



## Floor Exercises

Knowing the right way to get into a lying position on the floor and the right way to get up is important. If you've had a hip replacement, check with your surgeon before using this method. If you have osteoporosis, check with your doctor.

To get into a lying position:

- Stand next to a sturdy chair
  - Put your hands on the seat of the chair
  - Lower yourself on one knee
  - Bring the other knee down
  - Put your left hand on the floor and lean on it as you bring your left hip to the floor
  - Your weight is on your left hip
  - Straighten your legs
  - Lie on your left side
  - Roll onto your back
- \* Note: You don't have to use your left side. You can use your right side if you prefer.

To get up from a lying position:

- Roll onto your left side
  - Place your right hand on the floor about at the level of your ribs
  - Push your shoulders off the floor
  - Your weight is on your left hip
  - Roll forward, onto your knees, leaning on your hands for support
  - Lean your hands on the seat of the sturdy chair you used when lying down
  - Lift one knee so that one leg is bent, foot flat on the floor
  - Lean your hands on the seat of the chair for support
  - Rise
- \* Note: You don't have to use your left side. You can use your right side if you prefer.

### THE FOLLOWING ARE EXAMPLES OF STRETCHING EXERCISES YOU DO ON THE FLOOR:

#### Single Hip Rotation

Stretches muscles of pelvis and inner thigh. Lie on your back and bend your knees. Let your right knee slowly lower to the right, keeping your left leg and your pelvis in place. Hold the position for 10 to 30 seconds. Bring your right knee slowly back to place. Repeat the exercise with your left leg. Repeat 3 to 5 times on each side. Keep your shoulders on the floor throughout the exercise.

Summary:

1. Lie on floor.
2. Bend knees.
3. Let one knee slowly lower to side.
4. Hold position.
5. Bring knee back up.
6. Keep shoulders on floor throughout exercise.
7. Repeat with other knee.



#### Shoulder Rotation

Stretches shoulder muscles. Lie on the floor with a pillow under your head, legs straight. If your back bothers you, place a rolled towel under your knees. Stretch your arms straight out to the side, on the floor. Your upper arms will remain on the floor throughout this exercise. Bend at the elbow so that your hands are pointing toward the ceiling. Let your arms slowly roll backwards from the elbow. Stop when you feel a stretch or slight discomfort, and stop immediately if you feel a pinching sensation or a sharp pain. Slowly raise your arms, still bent at the elbow, to point toward the ceiling again. Then let your arms slowly roll forward, remaining bent at the elbow, to point toward your hips. Stop when you feel a stretch or slight discomfort. Alternate pointing above your head, then toward the ceiling, then toward your hips in this manner. Begin and end with the pointing-above-the-head position. Hold each position 10 to 30 seconds. Keep your shoulders flat on the floor throughout. Repeat 3 to 5 times.

Summary:

1. Lie flat on floor, pillow under head.
2. Stretch arms out to side.
3. Bend elbows to crook lower arms downward, at right angle.
4. Hold position.
5. Bend elbows to crook lower arms upward, at right angle.
6. Hold position.
7. Keep shoulders flat on floor throughout.



### THIS IS GREAT! CAN I GET MORE INFORMATION ABOUT EXERCISE?

The National Institute on Aging has a booklet and video about exercise for older people.

**For more information**, call toll-free 1-800-222-2225.

There are many organizations with information about exercising no matter what your age.

American Academy of Orthopaedic Surgeons  
6300 North River Road  
Rosemont, IL 60018-4262  
Phone: 1-800-824-BONES  
Web site: <http://www.aaos.org>

American College of Sports Medicine  
401 Michigan Street  
Indianapolis, IN 46202-3233  
Phone: 317-637-9200  
Web site: <http://www.acsm.org>

American Geriatrics Society  
350 5th Avenue, Suite 801  
NYC, NY 10118  
Phone: 1-800-247-4779  
Web site: [www.americangeriatrics.org](http://www.americangeriatrics.org) •

**Freddi Karp, head of publications,  
National Institute on Aging.**



# Genetics and Public Health: The Human Genome Project and Disease Prevention

The history of biology was forever changed a decade ago by the bold decision to map in detail the complete set of genetic instructions for human beings. The idea captured the public's imagination, perhaps not so much like America's targeted health wars on cancer or AIDS, but rather like the great expeditions—those of Lewis and Clark, Sir Edmund Hillary, and Neil Armstrong. Scientists knew that mapping the human genetic terrain would lead them to previously unimaginable insights, and from there to the common good. That good would include a new understanding of genetic contributions to human disease and lead to better ways to minimize and prevent disease.

The endeavor was both awesome and chancy. The instruction book—the human genome—was vastly larger than any genome tackled so far, and in 1990, the tools were not yet powerful enough

to perform the task. But a publicly funded initiative that focused on the molecular essence of humankind was too intriguing and too promising to forego. Since the 1970s, nearly all biomedical research approaches increasingly led to the gene. Genes contain the basic information about how a human body carries out its duties from conception until death. In between, of course, our bodies struggle to survive in a challenging environment. Our fate in this struggle depends largely, but not entirely, on our genetic makeup.

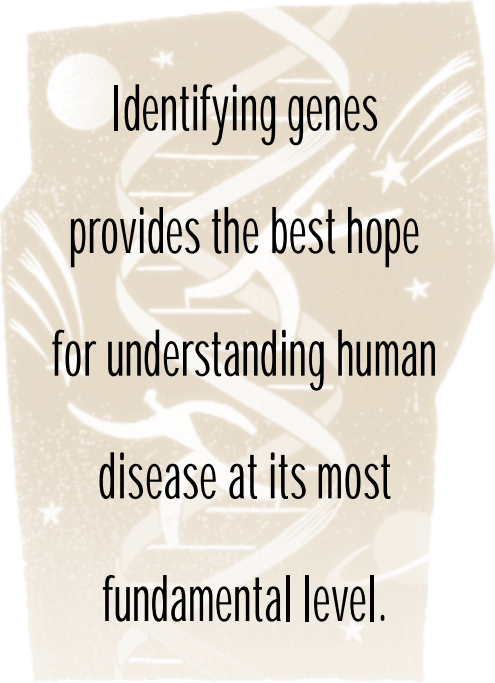
Not surprisingly, disease researchers wanted to find their leading gene suspects as soon as possible and at the least expense. This was no small order. The estimated 80,000 human genes made up of DNA (deoxyribonucleic acid) are scattered throughout the genome like stars in the galaxy. The search for the genetic sequence made up of “billions and billions” of uncharted DNA units

has frustrated researchers. If gene hunters were to fully explore the human genome, they needed more powerful tools and more ambitious strategies.

In 1988, the U.S. Congress appropriated funds to the Department of Energy (DOE) and the National Institutes of Health (NIH) to begin planning the Human Genome Project (HGP). Planners set a 15-year time frame, estimated to cost \$3 billion, and laid out formal goals to get the job done. In October 1990, the Human Genome Project officially began. According to early plans, the human race would witness its own blueprint in fine detail in 2005.

In March 1999, though, improvements in technology, success in achieving early goals, emerging research opportunities, and accelerating demand for the human DNA sequence prompted project leaders in the United States and abroad to promise the blueprint—the complete DNA sequence of the human





Identifying genes  
provides the best hope  
for understanding human  
disease at its most  
fundamental level.

genome—two years ahead of schedule, in 2003. The human genome is being sequenced by NIH, DOE, and scientists funded by the Wellcome Trust at the Sanger Centre in Cambridge, England, and other international partners.

#### HOW GENE DISCOVERY AIDS IN UNDERSTANDING HUMAN GENETIC ILLNESS

Identifying genes provides the best hope for understanding human disease at its most fundamental level. Learning how genes control cellular functions may provide the basis for preventing or treating disease. For example, finding the genes associated with Parkinson's disease (PD) has revealed new information about the disease. In one study, gene hunters mapped a suspect gene to a region of chromosome 4. Although the region contained approximately 100 genes, one was already known to encode the protein  $\alpha$ -synuclein. Earlier research had shown that  $\alpha$ -synuclein builds up in brain cells of people with Alzheimer's disease, and people with PD have similar deposits.

In just a few months, the researchers showed that an alteration in the  $\alpha$ -synuclein gene caused Parkinson's disease in the study families. Further research has shown that an alteration in a gene responsible for a protein critical to the breakdown of  $\alpha$ -synuclein and other proteins also results in Parkinson's disease. Understanding the genetic control of the disposal processes of brain proteins may provide new targets for interventions in a many disorders characterized by the accumulation of brain protein deposits, including Alzheimer's disease and Huntington's disease.

Even before a gene's role in disease is fully understood, diagnostic applications can be useful in minimizing or preventing the development of disease. Tests for DNA

alterations associated with disease may help diagnose a genetic disease, predict the development of disease later in life, or identify healthy carriers of diseases.

Genetic tests can be performed at any stage of life, with increasingly less invasive procedures. Whereas genetic testing was once sought almost exclusively by couples with a family history of early-onset disease for the purpose of family planning, information about genetic status is increasingly sought by individuals who wish to learn their predisposition to later-onset illness.

Increasingly, measures to reduce or prevent illness may be taken when a genetic predisposition is known. Success in reducing disease through treatment has been achieved for people with hemochromatosis (a common genetic disorder of iron metabolism), phenylketonuria (an inherited disease that increases the risk of developing mental retardation), and familial hypercholesterolemia, (an excess of cholesterol that runs in families), among others. Early detection and lifestyle changes may reduce the risk of certain disorders associated with genetic alterations, such as some cancers. As therapies develop from knowledge about the genetic basis of disease, many illnesses, now difficult to treat, may become treatable.

The recent discovery of an altered gene (HFE) that leads to hereditary hemochromatosis (HH), is an interesting example of the potential use of genetic information to prevent an adult-onset disease. HH affects about 1 in 300 people of northern European descent and is easily treatable if diagnosed early. Its major symptoms—liver cirrhosis, heart failure, diabetes, arthritis, and other organ damage—don't occur until mid-life and are easily misdiagnosed. Untreated, the disease causes early death, but by



having a small amount of blood drawn regularly to remove excess iron, people with HH can live a normal life span.

At first glance, hereditary hemochromatosis seems like an ideal target for public health approaches to hereditary disease prevention: the disorder is common, the number of disease-linked alterations in the gene are few, and a simple treatment can minimize or eliminate the effects of the disease. But there are a number of complexities that have worked against rapid introduction of a genetic test. People who carry the HFE gene may have no detectable illness or they may suffer severe organ damage from iron overload. At the moment, finding the genetic alteration does not predict the course of the disease. Before testing for the HFE gene in large numbers of people, further research is needed to explain the variations the disease can take in carriers and to relate these genetic findings more closely to health.

#### STUDYING THE COMMON, "COMPLEX" DISORDERS

The rather straightforward genetic rules that govern inheritance of disease have been worked out for many rare disorders resulting from an alteration in a single gene. But teasing out the genetic components of the so-called "complex" disorders—diabetes, heart disease, most common cancers, autoimmune disorders, and psychiatric disorders, which result from the interplay of environment, lifestyle, and the small effects of many genes—remains a formidable task.

Current techniques are well suited to discovering genes with strong influences. But it is more difficult to find genes with more subtle effects, and they account for a larger percentage of illnesses. The Human Genome Project is working on new ways to identify

genes that contribute in subtle ways to common, "complex" disorders.

#### GENETIC KNOWLEDGE AND PERSONALIZED MEDICINE

Identifying human genetic variations will eventually allow clinicians to subclassify diseases and adapt therapies to the individual. Large differences in the effectiveness of medicines may exist from one individual to the next. Toxic reactions can also occur and are likely in many instances to be a consequence of a person's genes.

The new field of pharmacogenomics, which uses information about genetic variation to predict responses to drug therapies, has already shown great promise. For example, researchers discovered that Alzheimer's patients with the gene subtype ApoE4 are less likely to benefit from the drug tacrine. This finding may result in new therapies specifically for ApoE4 carriers.

In another example, the formation of blood clots in the brain or legs is a rare but serious side effect of taking birth control pills. One study has shown a dramatically-increased risk for blood clots in the brain among women taking oral contraceptives who also carry the blood-clotting variant factor, V-Leiden. If V-Leiden is detected, a woman may decide to select other forms of birth control to minimize her risk of blood clots.

Pharmacogenomics also may improve breast cancer treatment. Recent studies have shown that tamoxifen reduces the incidence of breast cancer by 45 percent among women at high risk for the disease. Because it is known that women who respond to tamoxifen have a certain genetic makeup, studies are now under way to determine whether women respond to this drug based on the presence of a specific genetic alteration.

Genetic approaches to disease prevention and treatment will include many more drugs based on genetic information. Since the Food and Drug Administration's approval of recombinant human insulin in 1982, over 50 additional gene-based drugs have come available. These include drugs to treat cancer, heart attack, stroke, and diabetes, as well as many vaccines.

Since the Human Genome Project's beginning, the increasing detail and quality of genetic information has reduced the time it takes to find a disease-associated gene from years, to months, to weeks. As genome technologies move from the laboratory to the health care setting, new methods will make it possible to read the instructions contained in an individual's DNA. Such knowledge may be used to predict future disease and alert patients and their health care providers to begin better prevention strategies. •

---

*Adapted from: Fink, L. and Collins, FS, "The Human Genome Project: Evolving Status and Emerging Opportunities for Disease Prevention," in Genetics and Public Health: Translating Advances in Human Genetics into Disease Prevention and Health Promotion. Chapter 3, Oxford University Press (in press).*

# Your Environment Is Your Health:

T I P S O N S T A Y I N G H E A L T H Y

## 20 Easy Steps

## to Personal

## Environmental

## Health Now

At NIH's National Institute of Environmental Health Sciences (NIEHS) we don't think it's too much of an exaggeration to say "Your environment is your health." So to improve your health, see that your environment is a healthy one.

Of course, your genes play an important role, too, but you can't choose your parents. You can, on the other hand, do a lot about your personal environment—your surroundings, your exposures, your diet, and your health habits—to extend your life and to improve your fitness and appearance.

For example, the cleanup of one part of our environment—the purification of city water supplies—has been the most significant reason that the average life span has very nearly *doubled* over the past century or so. Millions live longer and better because of clean water and because our country and industries have reduced or eliminated exposures to lead and many other substances.

In addition to the environment we share, each of us has his or her own personal environment. Here are a few things that you and your family can do—health-wise—about yours:



### READ THE LABEL ON HOUSE AND GARDEN CHEMICALS:

Before you point that spray can, get your spectacles out and see if the directions or warnings have changed. In fact, before you even buy a house or garden chemical, compare labels to be sure you're buying the safest product for your intended use. (You may also decide a bug-less, weed-less lawn isn't all that important.) Note whether a product is for inside or outside use, and what protections—rubber gloves, respirators, and such—are needed. Read the labels for dry-cleaning solutions and other household chemicals, too. If a label says, "Open windows and ventilate," there's a reason. Likewise, read drug labels for warnings, and food labels for ingredients that don't agree with you, as well as to avoid extra calories and fat.

Recently, labels have been added to some art and craft supplies regarding ingredients posing a cancer risk. Charcoal has a new warning label. Prescription and nonprescription drugs get new warning labels when a new risk shows up during use. Food labels were reformed in 1993 to be more informative about fats and calories. A reprint, "Food Label Close-Up," tells how to make best use of the new food label format. To receive a copy, call your nearest Food and Drug Administration office listed in the U.S. section of your telephone book.

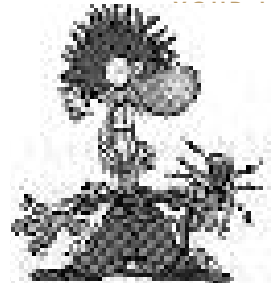


### PUT DRAIN OPENINGS, DRUGS, AND VITAMINS OUT OF KIDS' REACH:

Containing vitamins, ascription and nonprescription drugs, such as aspirin and minophen, can kill kids if they're candy. Lock them up or put them out of reach. Same with paints, detergents, drain cleaners, and other yard and home chemicals.

Look in your telephone book for your local Poison Control Center and ask for information and "Mr. Yuk" stickers to place on your telephone for use in a poisoning emergency. Or you can get the location of your nearest center at: [http://www.poison.org/find\\_your\\_local\\_poison\\_center.htm](http://www.poison.org/find_your_local_poison_center.htm) on the Internet.

### KNOW THE HAZARDS OF YOUR JOB:



Identify the risks wherever you work. They may include physical risks, such as falling off a ladder or lifting heavy packages, or chemical risks from petroleum products and solvents. In other occupations, computer use and other repetitive tasks pose risks of carpal tunnel syndrome. Identify the risks of your work and take the necessary precautions—whether it's using a particular respirator, gloves, goggles, or having a particular posture.

**SEE IF YOUR  
"COLD" MIGHT  
BE AN ALLERGY:**

You may be allergic to dust mites, your cat, the pollen from trees, or cockroaches. A-a-a-choo! And when plastic mattress and pillows, hiring an exterminator, dust-holders, curtains and rugs in your room may help.

Or, if it's trees and pollen that get to you, air conditioning and air filters may provide relief.

People also are allergic (which generally means they react to substances that don't bother most people) to mold and various chemicals. Asthma is often provoked by reactions to such substances.

**For a copy of** the fact sheet, "Asthma & Its Environmental Triggers," call NIEHS at (919) 541-3345.

**To receive a copy of** "Something in the Air: Airborne Allergens," (publication #98-495), from NIH's National Institute of Allergy and Infectious Diseases, call 301/496-5717.

**REMEMBER THAT LAKES AND  
STREAMS AREN'T ALWAYS PURE:**

A crystal-clear stream or lake may be a nice place to wade or swim but may harbor bacteria that can make your stomach sick. When walking in the wild, take along your own drinking water or disinfection kit.

To avoid waterborne diseases in less-developed countries, you usually need to avoid tap water (even



ice cubes) and stick to bottled water, and eat only cooked foods and fruit you peel, such as bananas and oranges.

**WATCH FOR LEAD,  
A CONTINUING THREAT:**

A lot has been done to reduce our contact with mind- and body-damaging lead in our environment. Lead-added paints and gasolines are a bad memory. (Lead content in paint was greatly reduced in the 1950s and later, in 1978, was eliminated.) But there remain many deteriorating, pre-1950 buildings with flaking lead paint that contaminates the ground and ends up on children's hands and toys as dust. Even low doses of lead can affect a child's development—causing problems with learning, remembering, and concentrating. Keep toddlers away from lead by cleaning up the flakes and dust regularly, and either carefully remove the source or wall it in.

Occasional high-level lead poisonings still occur from craft-style, lead-glazed pottery cups and dishes. Questionable products are best used for display, rather than food.

If there's a chance of lead exposure, a simple blood test can show how much lead a child is absorbing—before lead poisoning causes significant learning and behavior problems. More than one-fifth of African-American children living in housing built before 1946 have elevated blood lead levels.

**For more information**, talk to your doctor or call 1-800-LEAD-FYI. A short booklet called "Lead and Your Health" can be obtained by calling NIEHS at 919/541-3345 or send your request to [booklet@niehs.nih.gov](mailto:booklet@niehs.nih.gov) via e-mail.

**TEST FOR RADON:**

You can't smell radon gas in your home, but you can test for it. A naturally occurring gas that seeps out of rocks and soils, it comes from uranium buried in the earth and is itself radioactive.

There is evidence of an elevated lung cancer risk among miners exposed to radon, especially miners who smoke. Radon also seeps into homes and collects in varying amounts. To assess the possible danger, the Institute of Medicine convened a panel of experts to review the data. They said the lung cancer risk from radon in homes is small compared to that from tobacco products. Of about 160,000 annual lung cancer deaths, radon-related deaths were estimated to probably total 15,400 to 21,800, mostly because of synergism between smoking and radon. Fewer than 3,000 deaths were estimated to be radon-related among nonsmokers.

The picture is not perfectly clear. However, the Harvard Center for Risk Analysis argues that the weight of evidence is that radon in homes may pose a greater risk to more people—mostly smokers—than die of accidental falls, poisonings, home fires and burns, or accidental discharges of firearms. The test is inexpensive, and simple ventilation often can turn high radon levels into low ones.

**For more information**, call 1-800-SOS-RADON.





**PUT A CARBON MONOXIDE ALARM IN YOUR HOME:**

Carbon monoxide from space heaters and other home heating sources can be deadly. You need one or more smoke alarms, frequently checked of course, but they won't alert you to CO. For that, you need a carbon monoxide alarm.

**GROW PLANTS:**

House plants are cheery, and there's some evidence they clean pollutants from the air.

**DON'T GET BADLY OVERHEATED:**

Exercise is a way to keep fit, but when you run or exercise in hot weather, try to do it in the cooler hours. Keep water handy and drink plenty of it. Keep some available for your dogs and cats, too. Heat is a serious threat: nearly 1,700 people lost their lives from heat-related illnesses in the big heat wave of 1980.

For more details, visit: <http://www.cdc.gov/nceh/programs/emergency/prevent/heat/heat.htm> on the Internet.

**WASH YOUR HANDS:**

Whether you've been sneezing, handling chicken or other raw poultry or meat, have been to the toilet or changed a diaper, or are preparing to deliver a baby or perform brain surgery, washing your hands and environs (such as your cutting board in the kitchen) is a most important way you can prevent the spread of germs and infection. In many of these situations, it is *the* most important preventive measure you can take. It's as simple as that.



You may not be doing surgery, but more than 6.5 million cases of "tummy flu" or worse occur each year—often because hands and food implements aren't washed often enough, especially after handling poultry.

To start youngsters out with good hand-washing habits, your closest FDA office (listed in the U.S. pages of the telephone book) can provide the "Food Safety Coloring Book," or you can download it at: <http://www.foodsafety.gov/~dms/cbook.html> on the Internet.

**KNOW ABOUT OZONE:**

Ozone is a highly-reactive form of oxygen—three atoms of oxygen linked together instead of two—that occurs when there is a lot of vehicle exhaust and factory emissions. It accumulates when the air is stagnant. Ozone can irritate and damage sensitive tissues in the lungs, nose and throat, and can make breathing harder, especially if you exercise outdoors during its peaks. Mind the ozone and other air quality alerts in newspaper, TV, and radio weathercasts. Jog in parks away from auto traffic, when possible. Limit the time you spend outdoors when ozone levels are high, especially if you have asthma, bronchitis, or emphysema. Since evaporating gasoline adds to the ozone problem, don't overfill when you service your car or mower.



For more information on ozone, go to: <http://www.publicaffairs.noaa.gov/grounders/ozo1.html> on the Internet.

**WATCH PESTICIDE DRIFT:**

If you spray your roses upwind of your tomatoes, you are likely to dose your family with unapproved pesticides. Some pesticides are for non-food use only and have not been proved safe for foods.

**EAT A GOOD DIET:**

Not just an apple but *five or more* servings of fruits and vegetables a day may help keep the doctor, cancer, and other disorders away.

For a booklet on the value of "five a day" or for other information on cancer and diet, call 1-800-4-CANCER.



**TURN DOWN THE VOLUME:**

While occasional loud noises may just reduce your hearing temporarily, continuous exposures or very loud noises can cause permanent damage. If you can't remove the noise, wear protective gear or ear plugs.

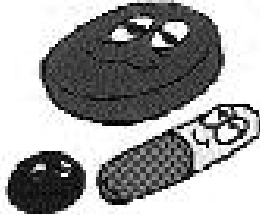
Loud motorcycles, firecrackers and small arms fire, close enough, can damage hearing, immediately or over time. That is, hearing may decline and/or there may be ringing, buzzing, or roaring in the ears or head.

For additional information, call NIH's National Institute on Deafness and Other Communication Disorders Clearinghouse, 1-800-241-1044, or send your request to [nidcd@aerie.com](mailto:nidcd@aerie.com) via e-mail.



**TAKE A VITAMIN**

The federal government recommends that all females of childbearing age take 400 micrograms (0.4 milligrams) of folic acid, one of the B vitamins, daily, to reduce the chances of having a child with a neural tube defect, his or her spine exposed or brain missing. You can get that amount in a multi-vitamin pill. The vitamin is needed regularly, *before* as well as during pregnancy, and it's hard to get the amount needed from an ordinary diet.



**Get more information at:**  
<http://www.modimes.org> on the Internet.

**YOU CAN'T AVOID ALL ACCIDENTS, BUT YOU CAN MINIMIZE THE RESULTS:**

Some good safety habits can save your life and health. Race drivers know that wearing seat and shoulder belts can reduce their risk by 45-50 percent. Other injury-preventing habits that athletes and other folks take: wearing bike helmets, athletic cups, and other protective athletic gear; looking ahead of time for the fire exits in a theater or hotel; checking your smoke detectors at home to make sure they beep; locking hunting rifles and other firearms away from kids and others who might misuse them; and avoiding unlit and dangerous areas. Carry a first aid or snake bite kit, when in the wild. Find a partner or two for climbing, swimming, or other exploits — someone to get you out of a tight spot or go for help.

**RESPECT SEX:**

More than 13 million Americans—two-thirds of them under 25—have sexually transmitted diseases, including HIV infections. For some young people this will mean early death, infertility, or cervical cancer. Young people can only be 100 percent safe if they avoid sex—and wait until they're prepared to have a lasting relationship with another uninfected person. But sexually-active teens and young adults can gain considerable protection by correctly and consistently using a latex condom. That's the advice of federal health agencies.

Incidentally, study after study shows that preparing children with good sex education, doesn't promote earlier sex, and several studies suggest it delays the onset of sex.

**For additional information,** call the National STD Hotline at 1-800-227-8922, or the National AIDS Hotline at 1-800-342-AIDS (in Spanish, 1-800-342-SIDA); or go to: [http://www.cdc.gov/nchstp/hiv\\_aids/pubs/facts/condoms.htm](http://www.cdc.gov/nchstp/hiv_aids/pubs/facts/condoms.htm) on the Internet.



**DON'T PUFF OR CHEW:**

With tobacco use, people die young and, often, slowly. Some young people worry more about the smell, about their teeth getting dark and about getting wrinkles—which are also reasons not to smoke, but relatively trivial. Smoking kills more people than AIDS, alcohol, drug abuse, car crashes, murders, suicides, and fires *combined*.

**For help in quitting,** call 1-800-4-CANCER, or the Office on Smoking and Health at 1-404-488-5705.

**WATCH THE SUN:**

It's not just sunburn you need to worry about or even ordinary skin cancer, which can be surgically removed without difficulty, and it's not just wrinkles. It's melanomas (malignant moles that sometimes spread and can kill) and cataracts that dim vision. Hats and other covers and ultraviolet-blocking sunglasses all can help. •

**For more information** on what melanomas look like (so you can get them removed), call 1-800-4-CANCER.

Protecting yourself from hazards in your environment (and protecting your environment from abuse)—these are all important preventive health measures. For *your* good health.

A **children's version**, using rhymes of popular names, can be viewed at: <http://www.niehs.nih.gov/kids/mabel.htm>.

---

*Bill Grigg, director of communications, National Institute of Environmental Health Sciences.*