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The Meaning and Value of Prevention Research

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PREVENTION IS AN ANCIENT CONCEPT THAT IS IMBEDDED IN CUSTOMS, culture, and religion distributed throughout history and geography. In virtually every society, beliefs about health and illness have given rise to behaviors and practices to protect health and prevent harm. Witness the wide array of amulets and protections against the “evil eye,” and dietary restrictions and rituals surrounding health maintenance. These behaviors range from individual (sprinkling salt in water before drinking it to “cool” the body after working in the fields) to societal (isolating people who are sick).¹ Ironically, in spite of this long tradition, contemporary medical education tends to focus on the individual and on the treatment of disease, and contains relatively little population-based health. While some individual prevention is taught, the concept of population-based strategies is seldom discussed. Clinical medicine, however, does teach continuity of care. The obstetrician in private practice will see the effects of his or her efforts to help a woman have a successful pregnancy. On the other hand, public health services and, particularly, public medicine, may have different institutions and payers for prenatal care and newborns in a neonatal ICU. An agency can save money by cutting back prenatal care and not have to deal with the consequences. Only by measuring and understanding the value and outcomes of prevention can the public health field inform policy makers of the economic and social consequences of failing to practice it.

Prevention is much more frequently discussed now than even a few years ago, but there is a wide range of perceptions and definitions surrounding it. Understandably, *prevention* is often defined in the self-interest of the person giving the definition, as well as from his or her perspective. For example, a recent television feature on “the prevention of injuries” turned out to showcase a rehabilitation surgeon whose treatment was touted as “preventing complications.” In another example, there has been extensive discussion on whether to include as prevention the most basic research leading to discoveries of new vaccines. Both examples are within the realm of prevention, but the meaning of prevention is quite different in the field of public health, and it is important for public health professionals to articulate and claim the public health perspective on preven-

tion. At the same time, we are hampered by the fact that market research by both CDC and Research!America shows that the American people don't relate to the word *prevention*, either. When public health prevention activities are described to them, they prefer the word *protection*. Thus, we are not only struggling to arrive at a common definition of prevention within the field of public health, we are also faced with communicating what we mean by that to a wider audience.

Prevention is the essence of public health. In the last century, great strides have been made to improve health: our life span has been extended from 45 years to 75 years, and the leading causes of death in 1900 are infrequent events today.² Improved health and increased longevity reflect advances in medicine (antibiotics and vaccines) and in public health (safe drinking water, fluoridated water, fortified foods, removal of lead from paint and gasoline, and workplace safety). In the latter half of the century, great progress in biomedical science and technology focused clinical medicine on the treatment of disease. Prevention as a medical strategy faded from the forefront as medical miracles reduced the life-threatening risk of infectious and contagious diseases. Today, the situation has changed again. With extended life spans, the quality of life and the number of healthy years is important. The leading causes of death and the leading indicators of health can be addressed in part through healthy behaviors.³ This heightens the significance of preventive measures and emphasizes the need for innovative new approaches for disease prevention and health promotion for individuals, communities and preventive systems.

In the broadest sense, much of medical science and all of public health can be labeled as "prevention." Prevention describes an approach to health that complements traditional medicine's emphasis on treatment by seeking to decrease risk factors for disease and to promote healthy behaviors. Prevention can focus on individual behavioral change, such as diet and exercise, on pharmaceuticals, such as vaccines, or be accomplished through policy and community actions, such as mandating the use of seatbelts or the removal of lead from gasoline. However, the research base to develop population-oriented prevention strategies that integrate behavioral and social science with biomedical science is sparse, as has been demonstrated through the recent efforts of the CDC Task Force which is developing the evidence based Guide for Community Public Health Practice (www.thecommunityguide.org).

Classic biomedical research at the National Institutes of Health (NIH) generates tools for prevention, such as

new vaccines, or the better understanding of disease mechanisms. Public health prevention research applies those discoveries at the population level. Prevention research in public health is population-based and is usually carried out through agencies such as the Centers for Disease Control and Prevention (CDC) or its community and academic partners. The translational function of public health prevention research allows us to realize the value of the nation's investment in health research. For example, no vaccine or treatment is effective if it is not used. Current coverage for some vaccines for common childhood illnesses is below 50% in some US communities; this is not sufficient to protect against epidemics. Measles vaccines have been available for 40 years, yet we are still experiencing epidemics and deaths from measles in cities like Chicago in the 1990s. Population-based prevention research translates scientific discoveries to populations and applies the medical tools we have. Increasingly, NIH and other agencies in addition to CDC are funding prevention research.

For many diseases there are no "magic bullets," that is, treatments or vaccines that can be administered by clinical medicine. Instead, behavioral preventive strategies are effective, but involve getting people or communities to change behaviors and maintain those changes. One of the clearest examples is HIV/AIDS. For those who do not ever participate in known risk behaviors, the chance of contracting HIV is virtually nil. Cardiovascular disease and diabetes are other targets for behavioral change; obesity, lack of exercise, and poor diet may be modified by behavior to reduce risk of disease. The difficult part is that behavioral change must be repeated with each sexual encounter for HIV, and with each meal and exercise each day for cardiovascular disease and diabetes. The risk factors for these diseases are well known. The challenge is to develop and test interventions and systems that engage communities and effectively change behavior to decrease risk.

Much of health research can, in some way, be defined as prevention research. As attention toward prevention has increased, agencies and disciplines define their research as "prevention research." Multiple definitions and uses blur the clarity of the term. Perhaps the purpose of prevention research is more descriptive than a single definition. *The purpose of prevention research is to build the science-base to promote health and prevent disease, disability and injury.*⁴ In its widest definition, prevention research encompasses the full research spectrum that spans basic biomedical research, applied etiologic and determinant research, and field or community-based

research. Basic biomedical and applied public health research generates knowledge on the mechanisms and risk factors for disease; community-based research completes the research foundation. Community-based research carries research to the field and integrates social and behavioral sciences for the translation of science into effective preventive services and programs to benefit health. Prevention research is the bridge that links health research with practice.

While prevention includes the spectrum of health research, there are distinct differences in the objectives and the level of prevention that each targets. This illustrates the maturation of science from theory to practice and emphasizes the need to shepherd a research finding across the continuum. The Table below outlines the spectrum and shows the different objectives, targets for dissemination, and level of prevention involved in each.

As research moves from the laboratory to the field, the following characteristics are observed:

- behavioral and social sciences are used to apply biomedical science
- multidisciplinary and interdisciplinary teams replace single discipline investigators

- research moves from the laboratory to offices and computer labs to the field
- collaboration of science with communities and practitioners is essential

DEFINITIONS OF PREVENTION RESEARCH

The terms *prevention* and *prevention research* have as many definitions as the people using them. A search for prevention research in the scientific literature, and in NIH and CDC program and proposal announcements and conference and workshop proceedings, shows no consistent use of the term. In our opinion, the lack of a consistent definition for prevention research decreases the conceptual clarity of the term and impedes the development of a clear understanding of prevention research.

In the scientific literature, prevention is seldom listed as a key word, which makes searching for prevention research difficult. Key words usually include the specific disciplinary or categorical topic, that is, *smoking cessation* or *exercise programs*. While these are clearly prevention projects, authors and publishers do not appear to consider *prevention research* a descriptive term. More advanced types of searches that examine content of articles should provide a more comprehensive review of the

Table. Spectrum of current prevention research efforts in the United States

	Objective	Target for dissemination	Type of prevention
BASIC BIOMEDICAL RESEARCH	Theoretical and disease mechanisms	Research scientists	Basic science
APPLIED RESEARCH			
Clinical research	Treatment for disease	Researchers and clinicians	Tertiary prevention; secondary prevention
Public health etiologic research	Risk factors for disease	Research and health professionals	Primary prevention; secondary prevention
FIELD RESEARCH			
Clinical trials	Efficacy of treatments and drugs	Clinicians; people with specific disease	Tertiary prevention; secondary prevention
Community-based research	Efficacy of interventions and healthy behaviors	All health professionals; general public	Primary prevention; secondary prevention
Practice-based research	Efficacy of programs and health systems	Public health practitioners	Primary prevention; secondary prevention

scope and breadth of prevention research. But the point is that prevention research is not included as an identifying term for research. This makes tracking publications from funded prevention research programs difficult. We strongly recommend that authors and publishers begin including *prevention research* as an identifying term.

Another area in which the terms prevention and prevention research are used extensively is in NIH and CDC program descriptions. The terms are often used parochially to differentiate programs or types of funding within an agency. Program titles are used internally to differentiate various funding sources or to identify extramural programs from other activities. The definition also is used to differentiate applied research from basic research or to describe outreach programs rather than defining the focus of the research. Furthermore, no consistent definition is used even within the same program or division.

A search for prevention research in program descriptions, requests for proposals, and workshop proceedings on the NIH website yielded a full range of programs from gene therapy to health education. For the most part, prevention efforts at NIH focus on individual health rather than populations. The National Institute of Environmental Health Sciences (NIEHS) has supported extensive efforts in community-based participatory research associated with environmental justice and the prevention of exposure to environmental contaminants. Research at the National Institute of Mental Health (NIMH) addresses primary, secondary, and tertiary prevention; it also includes phases of prevention research (pre-intervention, intervention, and services) and prevention and treatment research across disorders. The National Cancer Institute (NCI) has extensive research and outreach programs that study methods for increasing the effectiveness of outreach and the use of communication technologies to reduce the risk of cancer. The majority of NIH institutes have programs or activities identified as prevention. Other prevention programs target cardiovascular disease, substance abuse, and HIV, as well as a host of other diseases. Most of these programs do not use population-based science.

At CDC, all research has been characterized as prevention research. In public health, prevention research is population-based. The CDC extramural funded prevention research programs are primarily community-based. Many within CDC argue, correctly, that all prevention research is not necessarily community-based. Every center within CDC, however, has prevention research programs that are population-oriented. Specifically funded

extramural prevention research programs include the Prevention Research Centers (PRCs) and the Extramural Prevention Research Initiative, the Injury Control Centers, the Urban Research Centers, as well as prevention research within programs (such as cancer prevention and HIV prevention). Prevention research targets health promotion and disease prevention areas, such as chronic diseases, cardiovascular disease, cancer, nutrition and exercise, mental health, HIV, substance abuse, injury and violence, and childhood lead poisoning.

Within the research arena, the term prevention research has been used synonymously with other descriptive titles. Within public health, we need to articulate the distinctive aspects of our research. Prevention research may focus on individuals or populations; it may be conducted in laboratories, on computers, in agencies and universities, or in the community. Unfortunately, each of these types of research settings has been used as a definition at some point and these types of research have been used interchangeably with prevention research. Some of these terms include:

Population-based research focuses on groups or populations rather than individuals. Population-based research is a powerful tool to determine risk factors for disease that cannot be observed in individuals. Most public health research is population-based and the terms are sometimes used interchangeably.

Applied research has been used to differentiate public health prevention research from basic biomedical research. Public health research utilizes basic biomedical research findings to study diseases and their risk factors in populations.

Community-based research is often used interchangeably with prevention research. However, there are community-based activities that are not usually thought of as prevention research (for example, service delivery, treatment programs, and some clinical trials). It may also focus on individuals in a community rather than on populations.

Participatory research is a segment of community-based research in which community members participate in the development, conduct, and interpretation of results of a research project. A fundamental tenet is that the research is conducted *with* communities, not *on* communities. It is an interactive process for establishing research priorities and conducting research that involves communities as equal partners in all phases of research projects. Charac-

teristics include collaboration, interdisciplinary, cultural relevance, health disparities, and application of research findings directly to public health.

Practice-based research is a subset of community-based research that is focused on the practice community or organizations and agencies. It is defined as scholarship of discovery concerned with the development of new knowledge that solves the problems of public health and health care.⁵ It focuses on issues in public health practice and closely parallels community-based research. Characteristics include interdisciplinary, applied research, collaboration with practitioners, and links between research and practice.

Projects or programs in each of these types of research may also be classified as prevention research, but are not necessarily prevention research. Even with this wide array of terms and uses, certain characteristics emerge that describe *prevention research* in public health. These are:

- directed toward preventing disease and promoting health
- solution-oriented research
- multi-disciplinary
- population-based

THE PREVENTION RESEARCH CENTERS

Even in the early days of public health when few tools were available, the focus was on population-based prevention. From Africans building houses above the flight path of disease carrying mosquitos to John Snow disabling the contaminated pump during the London cholera epidemic, population based efforts have focused on behavioral and community interventions.

The CDC Prevention Research Centers program provides an important locus of current leadership in community based prevention efforts. By the mid-1980s, the disparity between the advances in knowledge created by health promotion and disease prevention research and the limited funding opportunities available to pursue these topics became increasingly evident. Public health leadership, including D. A. Henderson, William Bridges, and Robert Day, among others, with the active support of the Association of Schools of Public Health, responded to this disparity by urging Congress to create a dedicated program of support for investigators to pursue research and demonstration projects to improve public health.

Their efforts resulted in Public Law 98-551 that authorizes the Centers for Disease Control and Prevention to establish a program of university-based Centers for Research and Demonstration of Health Promotion and Disease Prevention.

The Prevention Research Centers program is a locus for the development of innovative strategies to improve the health of communities and their residents. The program has grown from 3 Centers in 1986, to 14 PRCs a decade later, to 24 PRCs in 2001. In 1998, Congress reauthorized the program through 2003. Each PRC was originally built around a thematic core. The PRCs now form a national network that builds upon the combined experience, expertise, and resources of academic institutions to reduce priority health risks and to promote healthy behaviors among Americans.⁶ The PRC's have succeeded in leveraging funding for prevention research. Researchers develop additional projects around the core themes and related topics, and seek funding from other sources, such as private foundations, and other federal agencies, such as NIH. Often, the original core funding is multiplied many fold, with consequent expansion and synergy among projects and results.

The PRCs have profited from the links to real-world settings and conditions. Similarly, the applied research conducted through PRCs has more relevance to the public health practice community and is more appreciated by it. The original vision of the PRCs contained the elements that have contributed to their success. Distinct characteristics are associated with public health prevention research conducted by the PRCs. They are:

- *Collaborative*: The PRC's develop strong, longstanding relationships with local communities, especially those with underserved and low-income populations with health disparities. Communities participate in the design, data collection and interpretation of results. These relationships create community-focused extensions of CDC where projects of high priority to CDC can be field tested quickly based on strong existing partnerships.
- *Community-based*: Research takes place in the field, that is, in the community or a practice setting. Community-based also reflects the collaborative nature of the research *with* the community.
- *Interdisciplinary and multidisciplinary*: Research involves teams drawn from biomedical sciences, epidemiology, behavioral and social sciences and other

disciplines that would not normally be involved, but are required for addressing community needs. This is leading to the evolution of innovative approaches and solutions to problems. The innovation that results from these synergies can be seen elsewhere in this publication.

- *Problem-solving and solution-oriented*: This is a subtle shift in the endpoint for research, from *knowing* to *doing*. PRC research targets the development of solutions for community and practice problems. Since the solutions are developed in concert with the community and practice, they are ready for implementation. This goal is in addition to the traditional research goal of contributing to the body of scientific knowledge.
- *Disseminative and translatable*: Prevention research includes the transfer of research results to practice for implementation. New methods to disseminate findings beyond scientific journals using channels that target practitioners are needed. Translation depends upon strong partnerships and collaboration among researchers and practitioners throughout the research process.

The multidisciplinary nature of the Prevention Research Centers is an important factor in their success. Faculty from many health sciences fields (public health, medicine, nursing, pharmacy, allied health, dentistry), from social and behavioral sciences (anthropology, psychology, economics, sociology, political science, urban planning) and other fields, such as engineering, work with community members and policy makers to identify problems, develop proposals for funding, and conduct and disseminate research. Another strength of the centers is in the interdisciplinary methodology utilized. The research

tools of the social and health sciences are viewed as a toolbox, with different instruments used in various combinations for each project. Qualitative methods provide baselines on the ranges and possibilities in population attitudes and behaviors, as well as the language, approaches, and survey instrument structure likely to capture the most accurate information. Observations of behavior also help design and validate survey approaches. Qualitative methods also provide means of involving communities in the design of projects and of research instruments. Quantitative methods range from structured surveys to complex intervention studies, and use theoretical and analytical tools from all the disciplines involved. The result is more accurate and meaningful data.

CONCLUSIONS

Research has shown that approximately one million preventable, premature deaths occur each year in the US.⁷ CDC analyses show that approximately 50% of preventable deaths are related to behavioral functions, 20% due to environmental causes, 20% due to genetic and biological factors, and 10% due to inadequate health care.³ Despite these studies showing that prevention is central to reducing premature death, expenditures for prevention constitute only 1–2% of our nation's health care budget. Similarly, an imbalance exists between funding for basic biomedical research and population-based prevention research.

Our nation is now preparing to inaugurate a “century of prevention” leading to longer, healthier lives through prevention. Increased attention to population-based prevention research will identify how to prevent disease and promote healthy ways we cannot even imagine today. Through new and innovative research, we can realize the vision of “Healthy People in a healthy world through prevention.”

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