Chronic Disease Control in Public Health Practice: Looking Back and Moving Forward

Ross C. Brownson, PhD^a Frank S. Bright, MS^b The origins of modern public health can be traced back to infectious disease epidemics of now uncommon diseases such as cholera, plague, and leprosy.\(^1\) As these diseases were controlled through a combination of improved sanitation and hygiene, the discovery of antibiotics, and vaccination programs, chronic diseases such as heart disease, cancer, and diabetes became increasingly prevalent over the 20th century. In 1900, the three leading causes of death were pneumonia and influenza; tuberculosis; and gastritis, enteritis, and colitis. These diseases accounted for nearly one-third of all deaths. Today, heart disease, cancer, and stroke are the three leading causes of death, accounting for almost two-thirds of all deaths. These and other chronic diseases are characterized by a complex interaction of risk factors, a non-contagious origin, a long latent period between risk factor exposure and clinical occurrence of disease, a long period of illness, and multiple risk factor etiology.\(^2\)

Among the 10 greatest public health achievements of the 20th century, five relate directly to the prevention of chronic diseases:³

- Control of work-related health problems, such as coal workers' pneumoconiosis (black lung) and silicosis;
- Decline in deaths from coronary heart disease and stroke;
- Development of and access to safer and healthier foods;
- Fluoridation of drinking water to prevent tooth decay;
- Recognition of tobacco use as a health hazard and subsequent public health anti-smoking campaigns.

Due to their ability to assess a public health problem, develop an appropriate program or policy, and assure that programs and policies are effectively delivered and implemented,⁴ state and local public health departments are in unique positions to control chronic diseases.^{5,6} But public health agencies face several challenges in developing and implementing chronic disease control programs. First, chronic diseases are often not seen as a crisis and the "pay-off" for prevention efforts occurs in future years. Second, the public often shows

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more concern about involuntary risks (e.g., potential exposure to a chemical waste site) than about voluntary risks (e.g., cigarette smoking), even though the voluntary risks account for the majority of the burden from chronic diseases. Third, many communities lack the chronic disease and risk factor data required to effectively set priorities and evaluate programs. This issue is beginning to be addressed, but remains a serious constraint at the county, city, and neighborhood level. And finally, sufficient resources have not been committed to chronic disease control efforts. Public health funding dedicated to state-specific chronic disease activities is disproportionately low in relation to the public health burden of chronic diseases. 8

This article outlines several historical advances in chronic disease prevention and control that illustrate key concepts useful to today's public health arena. Drawing on this history, we present several crucial lessons for success in public health practice in the future. In particular, we focus on initiatives that have been implemented through state and local health departments, which are key vehicles for delivery of effective public health programs and policies in the United States.⁶

HISTORICAL DEVELOPMENTS IN PUBLIC HEALTH

The development of chronic disease control programs has evolved in conjunction with several key historical events and achievements in public health. These benchmarks have paved the way for building capacity and infrastructure for the public health system, addressing modifiable risk factors, and controlling specific diseases such as cancer and diabetes. Table 1 highlights some of the public health milestones.

Table 1. Selected milestones in the historical development of chronic disease control efforts in the United States

Year	Event					
1911	Cancer reporting begins in New York State.					
1935	Connecticut establishes the first population-based cancer registry.					
1949	The Framingham Heart Study begins—among the first cohort studies.					
1950	Doll and Hill, Levin et al., Schreck et al., and Wynder and Graham publish the first case-control studies of cigarette smoking and lung cancer.					
1964	The U.S. Surgeon General's Advisory Committee on Smoking and Health publishes the first Surgeon General's Report on Smoking and Health; establishes criteria for evaluation of causality in epidemiologic studies.					
1971–1972	North Karelia Project and Stanford Three Community studies are launched—the first community-based cardiovascular disease prevention programs.					
1972	NHLBI launches the National High Blood Pressure Education Program.					
1984	CDC establishes the Behavioral Risk Factor Surveillance System, with 15 states participating in monthly data collection.					
1985	The First National Conference on Chronic Disease Prevention and Control is held.					
1986 1988	NCI launches its Technical Development in Health Agencies Program to enhance cancer control efforts. Release of the first Surgeon General's Report on Nutrition and Health.					
1988	California passes Proposition 99, establishing a 25 cent increase in the state tobacco tax, with funds dedicated to tobacco control.					
1989	CDC establishes the National Center for Chronic Disease Prevention and Health Promotion.					
1990	CDC establishes the National Breast and Cervical Cancer Early Detection Program.					
1994	CDC establishes the National Program of Cancer Registries to help states develop and improve registries.					
1996	Release of the first Surgeon General's Report on Physical Activity and Health.					
1996	DHHS begins development of the Guide to Community Preventive Services.					
1998	CDC begins funding state-based cardiovascular health grants.					

NHLBI = National Heart, Lung, and Blood Institute

NCI = National Cancer Institute

CDC = Centers for Disease Control and Prevention

DHHS = Department of Health and Human Services

Building capacity and infrastructure

Epidemiology and public health surveillance. Epidemiology provides the basis for effective chronic disease control. It is a vehicle for determining the causes of chronic diseases; it allows practitioners to prioritize diseases and risk factors according to person, place, and time; and it provides tools for evaluation of programs and policies in community or clinical settings. Concepts in epidemiology have evolved greatly. Susser and Susser have described three eras of epidemiology over the past few centuries: (1) sanitary statistics; (2) infectious disease epidemiology; and (3) chronic disease epidemiology. On the past few centuries (1) sanitary statistics; (2) infectious disease epidemiology; and (3) chronic disease epidemiology.

The era of sanitary statistics occurred in the first half of the 19th century, when the prevailing theory of the cause of disease was "miasma" (i.e., poisoning by foul emanations from soil, air, and water). Methods during this era focused on assessing the clustering of morbidity and mortality and on preventive measures including drainage, sewage, and sanitation. In the era of infectious disease epidemiology (late 19th century through the first half of the 20th century), the germ theory prevailed, in which single agents were related one-to-one to specific diseases. The prevalent analytic approach in this era was laboratory isolation and culture of infectious agents (e.g., bacteria) from disease sites. The overriding preventive approach was to interrupt transmission of the infectious agent. Since World War II, the era of chronic disease epidemiology has prevailed. Preventive measures in this era have emphasized control of risk factors by modifying the environment or lifestyles (e.g., smoking, physical inactivity, etc.).11

In this most recent era, epidemiologic principles are the underpinnings of surveillance systems, which are essential for monitoring patterns and trends in chronic diseases. These systems are needed for three key reasons: (1) to identify groups of people who are at risk of chronic disease or who experience fewer benefits from interventions; (2) to measure the effect of program interventions; and (3) to identify newly emerging chronic diseases. Chronic disease surveillance systems are less well developed than those for infectious diseases.¹² The development and growth of surveillance systems such as the Behavioral Risk Factor Surveillance System (BRFSS) have been crucial building blocks for state chronic disease programs. 13,14 This now includes local BRFSS data in Selected Metropolitan/ Micropolitan Area Risk Trends (SMART), available at http://apps.nccd.cdc.gov/brfss-smart/. Yet as recently as a decade ago, 85% of senior program directors in state health departments reported that surveillance data were inadequate, reflecting in part the collection

and location of data sets outside the chronic disease unit or insufficient analytic capacity. An important related chronic disease function is the study of the departure of the observed pattern of disease incidence from the expected pattern (i.e., cluster investigations). Cluster investigations have developed in response to citizen concerns about potential cancer excesses. Protocols for cancer cluster investigations became prominent in the 1980s and early 1990s. 16,17

Setting priorities and measuring progress. Public health leaders began to formulate concrete public health objectives as a basis for action during the post–World War II era. This was a clear shift from earlier efforts, which placed emphasis on quantifiable objectives and explicit time limits. A 1978 paper published by the Institute of Medicine (IOM) sparked a movement in the United States to set objectives for public health. These initial actions by the IOM led to the 1979 Surgeon General's Report on Health Promotion and Disease Prevention, which set five national goals—one each for the principal life stages of infancy, childhood, adolescence and young adulthood, adulthood, and older adulthood. These goals were highly relevant to efforts in chronic disease control.

Most recently, the U.S. Public Health Service (PHS) established two overarching health goals for the year 2010: (1) increase quality and years of healthy life and (2) eliminate health disparities among Americans. To achieve these goals, PHS established a comprehensive set of 467 health objectives in 28 focus areas.²¹ To narrow priorities further, 10 leading health indicators were established. Three of these are commonly addressed by state and local chronic disease programs: physical activity, overweight and obesity, and tobacco use. The core of the year 2010 objectives is based on decades of epidemiologic research showing modifiable risk factors that could substantially influence the disease burden in the United States.

Addressing modifiable risk factors

Tobacco control. Smoking is the leading preventable cause of death and disability in the United States.²² During the early decades of the 20th century, lung cancer was rare; yet as cigarette smoking became increasingly popular, the incidence of lung cancer became epidemic. As the result of epidemiologic studies conducted in the 1940s and 1950s, the Advisory Committee to the U.S. Surgeon General concluded that cigarette smoking was a cause of lung and laryngeal cancer and the most important cause of chronic bronchitis.²³ Its 1964 report was seminal, and led to a series of events, including:

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- More research on the relation among disease, tobacco use, and secondhand smoke exposure to tobacco;
- Dissemination of this information to the public;
- Surveillance and evaluation of prevention and cessation programs;
- An increased understanding of the economic costs of tobacco; and
- Comprehensive campaigns to reduce smoking rates and eliminate exposure to secondhand smoke through counter-advertising, legislation restricting smoking in public places, and increased taxation of tobacco products.

As part of efforts to reduce smoking, California voters passed an earmarked tobacco excise tax in 1988 establishing the first comprehensive, statewide tobacco control program in the United States.²⁴ Through its planning and implementation, this effort has been one of the most intensive and aggressive public health interventions ever undertaken.²⁵ The resulting price increase and media campaign were effective in sharply accelerating the drop in both sales of cigarettes and in smoking (for the period from 1988 through 1993, double the rate expected based on the 1974 through 1987 trend). Approaches similar to that in California were followed in Massachusetts (1993), Arizona (1995), and Oregon (1997). In Florida (1998), proceeds from the state's lawsuit against the tobacco industry were used to establish a statewide program. A recent review concluded that when implemented as designed, these programs are effective in producing dramatic declines in cigarette consumption per capita and in reducing the overall prevalence of smoking in adults and youths.26

High blood pressure education and control. One of the first nationwide programs successful in chronic disease risk reduction was the National High Blood Pressure Education Program (NHBPEP), housed within the National Institutes of Health. It was established by the U.S. Congress in 1972, with the mission of promoting nationwide efforts to detect, treat, and control hypertension through education programs and referrals.²⁷ The program uses a consensus-building approach to identify issues and develop strategies to solve these via a broad-based partnership among federal agencies, national organizations, state health departments, and community-based programs. An important feature of this program is the continual shift from providing expert consultants and spokespeople from national sources to a predominant use of local experts as the program has matured.²⁸

Increased public awareness, treatment, and control of high blood pressure are probably the result of this program even though evaluation of its effects must be done without a "non-exposed" control group. For example, the percentage of hypertensives made aware of their condition by a physician rose from 51% between 1971 and 1972 to 73% between 1976 and 1980. Similarly, the percentage of hypertensives on medication increased from 36% in 1971–1972 to 56% in 1976–1980. A lesson from the NHBPEP is that while awareness can be increased substantially, achieving a high rate of control (e.g., hypertensives on medication) requires continual efforts.

Controlling specific diseases

Cancer. Federal support for cancer control activities in state health departments began in 1986, when the National Cancer Institute (NCI) initiated its Technical Development in Health Agencies Program.²⁹ This was followed by another NCI-sponsored initiative, the Databased Intervention Research (DBIR) Program, which had the goal of building the foundation for ongoing cancer control programs in state health departments.⁵ Evaluation of the DBIR showed that it had a major impact on how states use data in planning for cancer control.³⁰

The Breast and Cervical Cancer Mortality Prevention Act of 1990 established the largest public health application of breast cancer control technology.³¹ This initiative enables the Centers for Disease Control and Prevention (CDC) to sponsor comprehensive breast cancer screening programs through state public health departments. By 1995, all states and nine American Indian tribes had targeted mammography screening to low-income, minority, and medically underserved populations. Program components include screening and follow-up, public and professional education, mammography quality assurance, and surveillance. Evaluation of this program to date has shown initial evidence of a higher percentage of early stage breast cancers among those detected in the second or later round of screening.32

Based on the experience within state health departments, Meissner and colleagues summarized internal and external factors contributing to success in controlling cancer in the public health setting.²⁹ Internal factors include: (1) commitment of the organization's leadership to cancer control; (2) existence of appropriate data to monitor and evaluate programs; (3) appropriately trained staff; and (4) the ability to obtain funds for future activities. External factors include: (1) successful linkages and coalitions; (2) an established cancer control plan; (3) access to outside health experts;

(4) an informed state legislature; and (5) diffusion of initially successful programs to other sites.

Diabetes. Diabetes is an important health issue in the United States. The sixth leading cause of death, it accounts for nearly \$100 billion annually in direct and indirect costs. Early research on diabetes established its importance, complications, and methods of clinical management. More recently, diabetes has been viewed as a public health problem—one requiring a combination of clinical approaches and multi-level population-based interventions.^{33,34} This stems in part from the evolution of the science of diabetes control. Early diabetes interventions focused largely on health care delivery through patient-initiated visits. More recently, literature supports the use of more comprehensive disease management and case management.³⁵ It is also increasingly apparent that healthy eating and moderately intense physical activity are highly effective in reducing the incidence of type 2 diabetes.³⁶

The CDC established a diabetes division in 1977 and thus supports national and state-based programs to reduce the burden of diabetes in the United States. CDC's framework includes five major components: (1) defining the diabetes burden (public health surveillance); (2) developing state-based diabetes control programs; (3) conducting applied translational research; (4) implementing the National Diabetes Education Program; and (5) coordinating media strategies and providing public information. With fiscal year 2002 funding of \$62 million, CDC provides limited support to 34 states, eight territories, and the District of Columbia for core diabetes control programs and more substantial support to 16 states for comprehensive programs.

National and state-based diabetes control programs have shared several factors essential for success. These include consistent funding over time, a focus on the practical application of research findings, and involvement of key stakeholders in decision-making processes.

KEY AREAS FOR THE FUTURE

Based on past successes as well as the current and likely future needs of public health practice, we see six cross-cutting areas of focus that will enhance efforts in chronic disease control. These relate in part to four factors recently identified among state health departments as being key to effective chronic disease interventions: the data and science base to support the intervention, support from the community, support from decision makers, and meaningful collaborations.⁶

Focus on data and science-driven decision-making

It is documented that data-driven planning enhances the likelihood of successful chronic disease control programs.^{5,37,38} Researchers and practitioners increasingly recognize the vast amount of scientific evidence available for intervention planning and understand that its use can lead to more effective programs.³⁹ Two areas seem particularly important for the future.

First, guidelines are increasingly available to provide chronic disease program directors with information on effective interventions. Recently, an expert panel (i.e., the Task Force on Community Preventive Services) supported by CDC, began publishing The Guide to Community Preventive Services: Systematic Reviews and Evidence-Based Recommendations (i.e., the Community Guide). 40,41 The Community Guide summarizes what is known about the effectiveness and cost-effectiveness of population-based interventions designed to promote health, prevent disease, injury, disability, and premature death, and reduce exposure to environmental hazards. To date, evidence reviews and recommendations are available for the following chronic disease topics: reducing tobacco use, promoting physical activity, cancer, and diabetes. Full descriptions of the methods and results of each evidence review are found on the Community Guide website (http://www.the communityguide.org). Evidence-based reviews and best practices can be applied across a number of areas when developing chronic disease programs.⁴²

Second, practitioners need to have data at their fingertips. The proliferation of computer and information technologies provides exciting opportunities and challenges for chronic disease epidemiologists. Changes are occurring in three general areas: (1) increased use of the information "superhighway," enabling expanded transmission of information relevant to epidemiology; (2) increased analysis of secondary data; and (3) enhanced information systems in public health and health care. To break down "data silos," interactive websites (e.g., CDC's online public health information system at http://wonder.cdc.gov and the Missouri Information for Community Assessment system website at http://www.dhss.state.mo.us/MICA /nojava.html) provide timely, online data for analyses.

Shortening the time between discovery and translation

History teaches us that a long latency period exists between the scientific understanding of a viable chronic disease control method and its widespread application on a population basis (Table 2). Two examples illuminate this point. First, the Papanicolaou (Pap) test was perfected in 1943, but was not widely used until the early 1970s. Second, the Surgeon General first warned about the link between smoking and cancer in 1964, yet it was not until the early 1990s that population-based interventions to control tobacco use were imple-

Table 2	Time	lag between	discovery a	nd widespread	limplementation	of interventions in	the United States
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"Watershed" event	Year of discovery	Public health intervention	Year of implementation
Papanicolaou test perfected	1943	Screening programs for cervical cancer established in all state health departments	1995
U.S. Surgeon General's Advisory Committee concludes that smoking causes disease	1964	Statewide tobacco control programs established in all states	1993
Landmark clinical trial showing effectiveness of mammography	1982	Screening programs for breast cancer established in all state health departments	1995
U.S. Surgeon General's report on physical activity	1996	Statewide physical activity promotion programs established in all states	_

mented in every state. Shrinking this latency period must be a top priority for applied researchers, practitioners, and policy makers in the future.

Leadership at all levels

Effective leadership is essential for successful chronic disease programs. In the United States, strong leadership must be present at the national, state, and local levels—both within and outside of government. Professional associations can also provide vital leadership. One example is the Association of State and Territorial Chronic Disease Program Directors (CDD).

CDD is one of several groups affiliated with the Association of State and Territorial Health Officers, composed of the chief public health executive of each state and territory. The CDD was first organized in 1988 to address the increasing impact of chronic diseases on the American population. Among the important activities regularly conducted by CDD are: (1) providing educational and training opportunities for members; (2) co-sponsoring an annual national chronic disease conference; (3) developing partnerships and collaboration with public health and scientific communities, health care providers, federal agencies, universities, and the private sector to pursue common goals; (4) advocating for the use of epidemiological approaches to planning chronic disease programs; and (5) developing legislative analyses, materials, policy statements, and other resources important to the work of members. A key future issue for CDD is the development of a highly qualified workforce for chronic disease control. Many of CDD's activities support the development of new staff and enhance the skills of existing personnel.

A particular challenge for public health leaders in chronic disease control is the need to take a "long view" of health. Such a vision is needed because many of the modern epidemics such as cancer and heart disease are manifested over years and decades. Also, working in many populations requires a substantial commitment of time and energy to build the necessary trust between public health practitioners and community members. It is a challenge for the future to focus on the long-term benefit of chronic disease programs when policy makers may put near-term emphasis on immediate threats such as bioterrorism and infectious disease outbreaks.

Supportive organizational and funding structures

One of the "diseases of disarray" described by Wiesner is "hardening of the categories"—that is, the large number of categorical grants and contracts undertaken by state and local public health agencies.⁴⁴ Often, these categorical programs are designed to serve high-risk populations and the same individual may be at risk for numerous chronic diseases. Categorical programs will always exist, and in many cases, are necessary because a policy maker may have an interest in a specific disease or population. But to the extent possible, funders should allow flexibility and encourage innovation with categorical dollars. To develop more flexibility in funding streams, there must be a larger constituency for prevention. The reality is that in virtually every legislative body, the passion for increased funding comes from disease-specific groups. In addition, health departments need to maintain an organizational culture that encourages cooperation and collaboration across programs.

Developing and maintaining coalitions and partnerships

Chronic disease programs can benefit from effective coalitions and partnerships. A coalition is defined as a group of community members and/or organizations that join together for a common purpose. 45,46 Some coalitions are focused on categorical issues, such as diabetes prevention or the reduction of tobacco use. Other coalitions form to address broader public health issues. An effective coalition has the power to influence chronic disease control policies and community-level actions far beyond the influence of any single member.

In order for these groups to be effective, it is essential that they begin by developing a common vision of what they want to accomplish and a common set of skills to engage in the change process together. In addition, it is important that the individuals involved in the coalition build relationships as individuals and as representatives of their respective community organizations. As with other types of community-based health promotion programs, in order to be effective, coalitions may need to focus on a variety of developmental issues (e.g., developing a common agenda and trust) at different stages of program implementation. More information is needed on how to build and maintain effective chronic disease programs within the limited budgets of many agencies.

Focus on environmental and policy factors affecting chronic diseases

Attention has increasingly been placed on how environmental and policy interventions can affect chronic disease. ^{47–49} Such interventions are aimed at changing physical and socio-political environments. ⁵⁰ Environmental and policy approaches may be especially indicated as a complement to more frequently used individual behavior and lifestyle modification strategies because they can benefit all people exposed to the environment rather than focusing on changing the behavior of one person at a time.

In nearly all cases, these interventions will require new skills and nontraditional partnerships with people and organizations not working directly in public health. For example, to address the major physical barriers to physical activity in U.S. cities, urban planners, transportation experts, and persons working in parks and recreation are essential in developing an environment and the political will that is physical activity-friendly.

CONCLUSION

Over the past half century, we have learned a great deal about the causes of chronic diseases and effective methods of public health intervention. In part due to these advances, Americans now enjoy the longest life expectancy in U.S. history—almost 77 years. This is an extraordinary gain of 30 years from a century ago. However, large health disparities remain for many segments of our population, and many known prevention technologies are not being applied. Rapid translation of scientific discoveries into public health action has the potential to greatly reduce the burden of chronic disease, thus enhancing quality of life for a large population. In an era of limited resources, achieving this goal will require a blend of the science of chronic disease control with the art of policy development.

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