Keynote Address: How Health Behavior Relates to Risk Factors

John W. Farquhar, MD

**Introduction**

Much has been discovered through cardiovascular disease research about health behavior and risk factors, and for the most part the causal links and their physiological mechanisms are quite well understood. I will give here only a brief review of the traditional linkages between health behavior and risk for cardiovascular disease. My main purpose will be to present a broadened view of behavior and risk factors by considering many elements of society that influence the health behavior of individuals within that society. A subtitle of the paper could be "How Society's Health Behavior Affects Risk for Cardiovascular Disease."

In covering these topics I will describe some recent favorable national changes in risk factors and I will then discuss behavior change theories and barriers to change, covering both individual and societal factors.

**Health Behavior and Cardiovascular Disease Risk Factors: The Traditional View**

Hypertension, various atherogenic blood lipid patterns, smoking, and sedentary lifestyle are most commonly listed as major cardiovascular disease risk factors, with male-pattern obesity, diabetes, and certain psycho-social attributes such as hostility, anger, and job strain as additional factors. Some of these risk factors (ie, smoking and sedentary lifestyle) are behaviors and risk factors in their own right, whereas hypertension, dyslipidemia, obesity, and diabetes have both behavioral and genetic antecedents.

Our traditional views of linkages between behavior and risk change as new discoveries are made. For example, we can cite the behavior of eating more fruits and vegetables as the cause of decreased atherogeneity of the low-density lipoprotein molecule induced by dietary antioxidants. So health behavior often stays in the loop as new research unfolds. As another example, one could predict that continued research in psychosocial factors, such as hostility, anger, and job strain, will lead to a more clear and sophisticated understanding of the relation between health behavior and cardiovascular disease risk. Furthermore, discoveries about insulin resistance and small dense LDL are also among many examples of a recent increase in knowledge of risk factors; in these examples we can continue to identify a behavior (physical inactivity) as a contributor to male pattern obesity and to both insulin resistance and increased levels of small dense LDL.

**Health Behavior and Cardiovascular Risk Factors: An Expanded View**

The less explored and, in my view, more important question is, what behaviors within society at large shape the behavior of individuals? Persuasion, modeling, and the presence of incentives or disincentives all influence behavior. These relations are depicted in Fig 1, which shows the main features of Bandura's social cognitive theory with its emphasis on self-efficacy.

Considering this theory and its supporting empirical foundations, one can readily comprehend that advertising, cost of cigarettes, and the presence or absence of the modeling or persuasive behavior of peers will strongly influence smoking behavior. In a study from our center on adolescent substance use in tenth-graders, it was found that use of any substance (cigarettes, chewing tobacco, clove cigarettes, PCP, LSD, cocaine, heroin) was strongly predicted by certain social environmental factors. The use of marijuana by friends (an example of modeling) was the strongest predictor for both boys and girls. Perceived safety of cigarette smoking was important to both boys and girls, and among girls perceived attitude of adults toward smoking also made a minor contribution. Certainly advertising, peer influence, and modeling by peers and adults contribute to these attitudes. This study and others emphasize the potential for preventing the adoption of various harmful behaviors, including substance abuse, through social-pressure resistance training methods that teach young people how to recognize and resist the influences of advertising and their peers. In another sense, it is noteworthy that factors such as school performance and parents' level of education were also reasonably strong predictors of substance abuse in the stepwise regression. This indicates that social environmental factors extend beyond peer pressure to include broad and multiple social forces that determine social norms. Thus, broader social changes that go beyond individual skills training may well be needed to solve many problems related to health behavior.

Another aspect of the broadened view of the relation between behavior and risk factors leads to the question, who in the population needs to change for patterns of disease to be affected? In our health care system the overuse of services and the high rate of cardiovascular events among individuals at high risk can both lead logically to a belief that the major yield will come from the so-called "high-risk" approach. Most recommendations from the Surgeon General and other bodies have included attention to lower-risk individuals or the entire population. This so-called "public health" approach recognizes that precursors of a high-risk status are found at earlier ages or lower risk levels and that primary prevention is needed as part of a comprehensive approach. However, in my view, the scientific
foundation for the public health approach has never been made more clearly than by Geoffrey Rose in a recent publication.7 His central finding is that mean levels of various attributes (alcohol consumption, blood pressure, body mass index) predicted the proportion of the population at “high risk” (the proportion defined as being alcoholic, hypertensive, or obese). Similar findings by Blackburn8 have been shown for blood cholesterol distributions in different countries. Rose7 therefore gives the public health approach greater legitimacy as larger numbers of attributes are shown to follow the “distribution rules” for blood cholesterol level. He points out that his conclusions about blood pressure were not possible until the Intersalt project6 gave us comparable survey methods in the 52 countries studied. These data allow us to ask whether a sufficient proportion of total effort in cardiovascular disease prevention and control is being devoted to the true public health approach. A radical view would be that all high-risk problems would be solved if we paid attention only to the low and middle parts of the distribution curve for any risk factor under study, as this shift of the curve to the left would drag in the tail of skewness, so to speak. Thus, the high-risk individuals would be relabeled as low- or medium-risk. I would label this as an experiment that will never be done because of ethical constraints as well as a lack of conviction by the experimenters. Nonetheless, it is clear that strong efforts to include a comprehensive total-population approach are absolutely essential for success in control of cardiovascular disease. In a later section I describe some of the obstacles to achieving adequate primary prevention by highlighting barriers to regulatory change, an essential component of the broadest approach.

National Changes in Health Behaviors, Risk Factors, and Cardiovascular Disease Outcomes

Much has happened at the national level to make us optimistic about the possibility of achieving widespread and important differences in health behavior. If conditions are right, these changes can be quite rapid. As an example, seat-belt use in the United States quadrupled (from 17% to 65%) from 1982 to 1987 (The Los Angeles Times. October 5, 1987). These changes occurred at a time of increase in both education and legislation. When the time is ripe, good things can happen, and health behaviors are not always stubbornly or hopelessly intransigent.

Nationwide change in cardiovascular disease mortality has been similarly dramatic but has occurred over a much longer time frame. Stroke mortality has declined slowly and steadily since 1940, and by 1989 had decreased by 73%. Coronary heart disease mortality has shown a different pattern, with a gradual rise from 1940 to 1963 and a steeper and continuing decline since then. The fall from 1963 to 1989 was an impressive 53%.10

The question of what proportion of these dramatic changes in cardiovascular disease are attributable to changes in diet, smoking, and exercise behavior is difficult to answer, but both stroke and coronary heart disease death rates began to decrease before widespread use of pharmacological agents occurred. It is of interest that the landmark Surgeon General’s Report on Smoking and Health of 1964 appeared shortly before the decline in coronary heart disease began. Of course the large decrease in smoking prevalence (an approximate 32% fall since 1970) is responsible for some of the decline in heart disease.10 Similarly, blood cholesterol levels of the US population have declined coincident with decreases in consumption of saturated fat and cholesterol from animal products.11 Blood pressure control has also improved markedly during the past two decades. Certainly use of pharmacological agents has played a major role in the changes in hypertension prevalence, but during this time food-grade salt sales have also declined by 36%.12 In the broadened view of health behavior, the increased use of pharmacological agents is still attributable to changes in behavior across many levels: (1) the patient’s adherence to medication, (2) changes by healthcare professionals in education, screening, prescribing, and monitoring, and (3) changes in education and screening by private and government health agencies.

The main lesson to be learned from the revolutionary changes in cardiovascular diseases outcomes is that health behaviors and risk factors can be changed. Given these victories, can we now turn our attention away from cardiovascular disease? By no means. We can take pride in the knowledge that the United States’ relative position in cardiovascular disease has fallen from first in the world in the 1950s to 15th for both men and women of 33 industrialized countries in 1990 (ranked from highest rate to lowest).10 However, in 1990 Canada ranked 28th and 27th for men and women respectively in this same group.10 Other comparisons show that there are large differences between different states and regions and for different ethnic and income groups in the United States. Comparison with Canada and differences within our own country point clearly to a continued need for aggressive action to improve the health-related behaviors of the many individuals and groups involved and particularly of certain subgroups of our population. The following section identifies barriers to widespread behavior change and how some of them might be overcome.

Barriers to Behavior Change

Barriers to health behavior change are many, and a few have been mentioned in this paper. A partial list, in no special order, includes (1) inertia and lag related to social norms, peer pressure, and the expected delays in adoption of innovations,1–13 (2) biological determinants, including addiction to nicotine, (3) lack of knowledge, incentive, or skills for change, (4) societal factors that lead to sedentary lifestyle or job strain and psychosocial stress, (5) economic barriers or inadequate training of
providers that disallow health promotion activities and deny access to clinical preventive sources, (6) economic factors that distort our public media, such as magazines that do not accept articles on the hazards of smoking, and (7) economic factors that influence politicians to delay regulatory changes that would otherwise facilitate beneficial health behavior change (such as increased excise taxes on tobacco). A longer list is possible, and of those mentioned only a few will be discussed in this statement.

International trade policies affect health in ways that are not often fully appreciated. In 1992 the World Health Organization estimated that 10% of the current world population, or 550 million people, would die prematurely because of cigarette smoking. My own prediction is that this is an underestimate because of the accelerating adoption of cigarette smoking by residents of developing countries. Our center is currently involved in training Czech medical and public health scientists and educators in the community approach to cardiovascular disease prevention and control. During 1992 to 1993 it has become abundantly clear that Prague is virtually blanketed by an advertising blitz by American companies, with street cars, store windows, and outdoor cafe umbrellas promoting the now-desirable Western brands. In early 1992 Philip Morris outbid all rivals by a large margin to pay $413 million to purchase Tabak, the state-owned tobacco company, in what was then Czechoslovakia. A few quotes from The Wall Street Journal are testimony to the reason for the purchase: “Tobacco companies race for advantages in Eastern Europe while critics fume”; “So far Philip Morris seems to be ahead. It has established operations in eastern Germany, Hungary, Czechoslovakia and Russia and is negotiating for plants in Poland”; “Philip Morris’s biggest success so far has been in snatching Tabak, the Czechoslovak tobacco monopoly, from its rivals last April in one of the East’s most acrimonious privatizations. In so doing, it acquired popular Czech brands and about 56% of a market of 30 billion cigarettes per year” (The Wall Street Journal. December 28, 1992).

Worldwide promotion of cigarettes and other tobacco products such as smokeless tobacco is accelerating coincident with growing recognition of their health effects and of their economic penalties in healthcare costs, decreased productivity, and diversion of usable income by the end users. An important barrier to change is the use of tobacco companies’ enormous revenues to promote their products by forcing other countries, under threat of trade retaliation, to accept both these products and their advertising. The reason for the enormous revenues stems from the fact that the addictive power of nicotine itself allows charges to the consumer that exceed normal market cost. These extra revenues also provide funds that can be used for contributions to politicians at local, state, and federal levels who oppose legislation that would decrease tobacco use. A recent publication, “The Congressional Addiction to Tobacco: How the Tobacco Lobby Suffocates Federal Health Policy,” presents evidence for almost a dozen “victories” of the tobacco lobby on legislation regulating tobacco exports, excise taxes, labeling, tax deductions for tobacco advertising, prices charged to the military, and health education.14

A specific barrier is that the portion of the retail cost of cigarettes due to taxes has been kept lower in the United States than in any other country, thus denying tax revenue to governments and preventing the disincentive that would exist if tax increases raised the cost of cigarettes to a considerably higher level. Fig 2 shows that the tax burden on tobacco remained at about 48% of the total cost of cigarettes from 1955 to 1970 but has fallen steadily from then to about 25% by 1992. The failure to keep taxes in proportion has been attributed to the political influence of the tobacco lobby.14

Fig 3 shows how the United States compares to 18 other countries in taxes per pack of cigarettes.15 With the exception of Spain, all these countries have taxes from two to eight times as high as in the United States (where the average tax is 46¢ a pack), although there is considerable variation among states. The average tax in these 18 other countries is about US $2.00 per pack, a figure that I believe should be our short-term goal, with even higher taxes in the future.

If we raise taxes on cigarettes, will smoking behavior be influenced? California’s recent experience suggests that it will. Fig 4 shows a clear decline in the number of packs sold there immediately after taxes were raised by 25¢ per pack.16

Between 1989 and 1991 cigarette smoking declined by 17%, more than twice the United States average.17 A regression analysis showed that 5% to 7% of the decline during the first year of the tax was secondary to the tax alone.18

Based on this and considerable other data, price elasticity of demand for cigarettes is about −0.4 for adults19 and about −1.44 for adolescents.20 Thus even an increase as small as 10% in cigarette prices (less than the new California tax) would likely lead to a 4% decline in cigarette consumption for adults and a 14%
decline for adolescents. If a $2.00 per pack increase were to occur, teenage smoking rates could fall by the impressive degree of 46%.

Of course, other regulatory changes are needed to control smoking and would interact with and ultimately depend on continued vigorous education and cessation efforts. For example, despite the cost of cigarettes, prevention of adolescent smoking would predictably lose much of its impact if the majority of adults over age 30 were smokers, as was the case in the United States in the mid-1960s.

The 1988 study by Altman et al. on the effects of a low-cost campaign in California’s Santa Clara County points to the value of educating merchants about observing the law banning cigarette sales to minors. In this study cigarette sales were reduced by about two thirds, while vending machine sales were unaffected. This example shows the value not only of enforcing existing laws (in this case through education and persuasion rather than threats) but also the need for new regulations (banning all vending machines in sites open to the underage public).

The preceding section was one-sided in its focus on tobacco. It is therefore important to list a few other topics for which there are regulatory and environmental barriers to change: Nutrition. (1) Labeling laws, (2) provision of healthy food choices (coupled with education) for students and other recipients of institutional food, (3) the lack of connection between national agricultural policy and health policies, and (4) restaurant and retail food market policies. Physical activity. (1) Lack of consistent policies for promoting physical education and opportunities for aerobic exercise in schools, (2) the geographical and regulatory factors that affect the ready availability of sites for walking and other forms of physical activity that are safe, convenient, and free of charge, and (3) factors in city structure, employment, and transportation policy that lead to long commuting times that interfere with time for physical activity. Psychosocial health. (1) Worksite factors that lead to job strain, (2) lack of opportunities for job retraining after termination of employment, (3) lack of opportunities for education and treatment of substance abuse, (4) lack of affordable housing and medical care, (5) exposure to violence in television and movies, and (6) lack of community support for and regulatory measures that promote family stability.

Many of these barriers, and others, are addressed in the 64 recommendations for cardiovascular disease pre-

---

**FIG 3. Total taxes per 20 cigarettes in US dollars, July 1993.**

Adapted from Non-Smoker’s Rights Association (Canada), personal communication, 1993.

**FIG 4. Decrease in per capita cigarette use following the California tax increase of January 1989.**

vention contained in the recently released Victoria Declaration on Heart Health (produced by the Advisory Committee to the first International Heart Health conference, held in Victoria, Canada in May 1992). I chaired this committee and Dr. David MacLean of Dalhousie University cochaired it. We were aided by 19 others from different disciplines and many different countries. Three examples from the Victoria Declaration on Heart Health follow.

Recommendation 4 — Governments provide schools with support and resources they need to carry out effective health and heart health education programs and to provide facilities and opportunities for daily physical activity.

Recommendation 21 — Governments a) adopt legislation to end the advertising and promotion of tobacco products and encourage those in the tobacco industry to make the transition to other areas of economic activity; b) use taxation liberally as an instrument to decrease tobacco use; c) apply at least 10% of the taxes raised through the sale of tobacco products to health promotion including anti-tobacco education.

Recommendation 62 — The private sector, especially the agriculture, food and pharmaceutical industries, continually reexamine their corporate marketing and production strategies to ensure that they support public policies for the prevention and control of cardiovascular disease.

All of the Victoria Declaration recommendations address the need for comprehensive approaches that combine education, regulation, environmental change, and cooperation among science, government, and the private sectors to achieve its goals.

Conclusions

The evidence presented in this statement for changes that have already occurred in the United States in health behavior, risk factors, and cardiovascular disease is cause for optimism that continued decreases in cardiovascular risk can be achieved. However, great pessimism can be engendered by awareness of barriers intrinsic to social norms and commercial and political pressures. The view of health behavior presented here therefore invites a broadened set of actions by health care professionals that adds advocacy for political action to education aimed at the entire public, with emphasis on precursors to risk factors. If we accept the need to broaden our efforts in education, advocacy, and political change, we cannot do it without recognizing the role television plays in our lives. As Neil Postman has said in his recent provocative book, Amusing Ourselves to Death, television is our culture’s principal mode of knowing about itself. We all certainly accept television’s proficiency in letting us know what to buy, but we have yet to acknowledge its legitimate role or to harness its power in aiding us in our quest for health.

The ultimate optimism that our quest may be realized lies in this quote from the founder of social cognitive theory, Bandura, who said, “But it is because of their considerable plasticity and powers of cognition that humans have an unparalleled capacity to become many things.”

The Victoria Declaration’s “Call for Action” states, “Cardiovascular disease is largely preventable. We have the scientific knowledge to create a world in which most heart disease and stroke can be eliminated.” In the spirit of Bandura’s statement, one of the “many things” we could become is a world that has achieved what was seen as possible in that call for action.

References

Behavior change and compliance: keys to improving cardiovascular health. How health behavior relates to risk factors.

J W Farquhar

Circulation. 1993;88:1376-1380
doi: 10.1161/01.CIR.88.3.1376

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 1993 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/88/3/1376.citation

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org/subscriptions/