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Principles of disease prevention from discovery to application

Summary

This paper reviews the well-known evidence that many of our diseases today relate to lifestyle practices that have their beginning in childhood. While mechanistic understanding of a disease is of obvious value, the history of medicine has shown that preventive measures can be applied long before the pathogenesis of a disease is understood. The greatest obstacle to preventive medicine for the average person is the illusion of immortality and that each of us does not readily make a sacrifice of something pleasurable for a potential benefit in the future, and that for health professionals preventive medicine is not as economically rewarding as therapeutic practice. Hospitals, physicians, parents, and schools can all contribute to enhancing healthy lifestyle practices. We place here particular emphasis on early comprehensive school health education and strongly suggest that such educational efforts must be on par with the teaching of other subjects since good healthy habits strongly affect both children's physical and mental development and thus contribute to a more productive future society.

Chronic diseases are not an inevitable consequence of aging. Examining the history of human health and disease makes it apparent that nature does not intend for us to die of illness but rather from the genetically-controlled terminal processes of aging. The goal of nature and thereby the aim of medicine is, and always should be, "to help people to die young, as late in life as possible". All health professionals should make this goal a reality through the application of current scientific knowledge and principles bearing on preventive medicine. Achieving this goal is medically feasible, and certainly it is socially and economically imperative. Let us briefly examine the opportunities and obstacles in preventing diseases that have their essential cause associated largely with lifestyle.

Metabolic Overload – Its Key Role and Cost in Disease Causation

Scientists involved in the experimental and epidemiologic aspects of noncommunicable diseases, notably cardiovascular diseases and cancers, have long observed that these conditions are generally a consequence of specific, chronic metabolic overloads. While evolutionary adaptations over millions of years have equipped us with anatomic and physiologic defenses against micro exposures from the environment, we are not in the same position against macro insults, particularly those from agents of relatively recent vintage.

Most of these metabolic insults – tobacco and alcohol; excessive nutrition, particularly excessive dietary fat intake; sunlight exposure; and insufficient physical activity – relate to personal behavior as do unsafe sexual practices. These factors are responsible for such major causes of premature disease morbidity and mortality as atherosclerosis, many types of cancer, and acquired immunodeficiency syndrome.

While some infectious diseases are also a consequence of personal behavior, others are due to poor sanitary conditions, even though in most parts of the world the latter have been progressively corrected. Some infectious disorders have been virtually eliminated through immunization – a major medical accomplishment during this century. Such "passive prevention", strategies have had a major impact

on the incidence and mortality of many diseases, largely because they were mandatory and did not require an active behavioural change, or other active involvement by individuals.

Those concerned with the epidemiology of chronic diseases should reflect more on man's innate capacity, or the lack thereof, to defend himself against both external and internal exposures. Yet, in the early 1950s, it was perplexing that, even while the major scientific evidence was accumulating, our peers would not at once accept that exposure to the toxic chemicals in inhaled tobacco smoke was a likely cause of injury to lung tissue[1,2]. It took years of detailed epidemiologic and laboratory research to secure the proof that smoking was a key element in lung cancer, before it was accepted not only by scientists but also by most of the public and legislators. If we find such an obvious correlation difficult to comprehend, it can be seen why we have difficulty in conveying the value of the concept of nutritional metabolic overload. We consider our "normal, traditional" diet as standard and cannot readily recognize that our diet in terms of total calories, type of calories, and bolus eating overexposes us in a manner for which our systems is ill prepared. In the field of atherosclerosis, the recommendation to shift from a 40% fat diet to only 30% of calories from fat, is certainly based on limited experimental or epidemiologic evidence. Dean Ornish and Barry Lewis have clearly shown that a significant reduction in total fat and, importantly, a proper choice of the type of fat is crucial in our efforts to prevent the progression of atherosclerosis[3,4]. In a study on vegans (obligatory vegetarians), we have shown that, even though their total fat intake is around 30%, due to their very low consumption of saturated fats, their average cholesterol level is about 130 mg/dl – a level at which a population would have virtually no coronary artery disease[5]. Nutrition, then, as Ancel Keys has told us for many years, is an area that has not received the attention of the medical and biomedical world which it deserves[6]. Yet, traditional nutrition is responsible for the causation of major chronic disabling and killing diseases anywhere in the world. The clinical management of these diseases is often not very successful, and in any case, is very expensive. In the USA, the annual "medical", we should rather say diseases-care costs, are now over 800 billion dollars per year. Clearly, avoidance of diseases through prevention is not only best for the people, but has enormous economic impact.

The question needs to be raised what hope is there in improving the therapy for patients with atherosclerosis and its costly sequelae, in reducing the mortality of most cancers in adults, in decreasing the morbidity of emphysema and cirrhosis of the liver, to give just a few examples that point to the shortcomings of available therapy. The cost and effectiveness of coronary bypasses and of maintaining coronary care units need to be contrasted with the effectiveness of early dietary control of blood lipids and the cessation of smoking. The cost of chemotherapy in lung cancer, especially because of its limited rate of cure, needs also to be compared with the cost and success of efforts to reduce smoking. As we contemplate what we can do about the high cost and limited success of late onset of therapy, we need to consider the opportunities, effectiveness, and low cost of preventive strategies.

With the long-standing knowledge that cigarette smoking and saturated fat intake are the major-risk factors for myocardial infarction, and that these are preventable, it is hard to believe that in spite of some reduction in deaths, and in the face of considerable basic knowledge about lipids, heart attack continue to be a major medical, social, and economic burden to society.

Mechanistic Understanding

While complete understanding of the etiology and pathogenesis of a disease is likely to strengthen sound approaches to control, the history of medicine has shown that preventive measures can be taken long before the precise mechanism of a disease process has been fully delineated.

James Lind found the remedy for the prevention of scurvy in 1755, long before the discovery of ascorbic acid[7]; Edward Jenner, in 1798, could prevent smallpox decades before the viral cause of the disease was identified[8]; John Snow, in 1849, made the proper recommendation for preventing cholera, years before the cholera bacterium was identified[9]; and Ignaz Semmelweis, in 1847, was able to suggest effective measures to prevent childbed fever several decades before its causative streptococcus was discovered[10].

In this century, even before we knew anything about carcinogens and tumor-promoting substances in tobacco, we could predict that abstaining from tobacco use would have an enormous impact on reducing all tobacco-related diseases, from premature heart attacks to lung cancer and emphysema. Likewise it is clear that avoidance of alcohol abuse will significantly reduce alcohol-related disorders, from cirrhosis of the liver to motor vehicle-related accidents to cancer of the upper alimentary tract. Also, we can be certain that reducing the amount of salt and saturated fats in our diet will have a major impact on the leading cause of death in the Western World: cardiovascular disease[11].

Furthermore, along these lines, a lower consumption of fats, especially certain unsaturated fatty acis,

as customary in the Western World, would result in an appreciable reduction in the mortality from the nutritionally-linked cancers, including those in the breast, colon, pancreas, prostate, ovary and endometrium[12].

Obstacles to Prevention

Unfortunately, many of the diseases from which we suffer today require individuals to take an active role in their own health management. The good news, from a public health point of view, is that we have identified risk factors for disease. The bad news is that individuals have to act upon this knowledge and make the changes to minimize these risks. Most of us find modification of enjoyable habits difficult not only because we dislike making what we deem to be a personal sacrifice, but also because of an inherent, subconscious illusion of immortality, which is the key dilemma facing preventive medicine. In addition, for both academic and economic reasons, health professionals find it more attractive to be involved in therapy than to modify through direct interventions the behavior of individuals or of the public at large. Obstacles to disease prevention in behavioral medicine, thus, include innate human behavior, the benign disinterest on the part of most health professionals as well as that of the health insurance industry, and often the persuasive powers of commerce. It is of historic interest to note that already John Snow when recommending the cleaning up of the water supply said "Preventive measures against cholera are fortunately of a kind that would not interfere with commercial intercourse"[9].

Preventive Strategies

There are several approaches for us to engage successfully in the practice of to so-called "lifestyle medicine".

As a fundamental principle, good health throughout life must be based on health education of children, in which parents, schools, health professionals, media, and government must take an active part.

Health professionals in behavioural medicine need to be trained appropriately and must be academically and economically recognized so as to play effective roles in their practices, in hospitals, and in their community. Family physicians, pediatricians, and nurses may be particularly suited to lead this field, although preventive medicine should be practiced by all physicians and other health professionals.

Industry needs to be interested in making less harmful products, and if necessary, laws have to be enacted and enforced to reduce, if not eliminate, harmful or unhealthy products.

Parental health education must be made a prime goal. Young children mimic the behavior of their parents. As part of our Comprehensive School Health Education "Know Your Body" Program (KYB), we have developed an education guide whereby parents can read to their children about health-related issues at a time when the child is most susceptible to acquiring language, knowledge, and establishing behavioral patterns through a window of opportunity that is relatively limited[14,15].

Since most health behaviours have their beginnings early in life, we must instill in youths essential, good health behaviors. Since everyone must attend school, a mandatory comprehensive health education program from preschool to high school needs to be established. Our "Know Your Body" program serves such a purpose. The constituents of a comprehensive school health education program must be: annual health screening; a comprehensive health curriculum from pre-school through high school; extracurricular health-related activities; a yearly health test for attitude, knowledge, and behavior – all of which should be coordinated by a trained health educator. Such school-based activity represents one of our best hopes to reduce the incidence of lifestyle-related diseases including AIDS.

Role of the Hospital

Each hospital needs to become a Disease Prevention Center both for its patients and for its community. It is necessary to have a critical mass of personnel of at least two experts, in epidemiology and health promotion who in collaboration with other clinical departments, local schools, worksites, churches, and media would provide a strong educational and clinical environment oriented towards prevention of avoidable diseases. Such efforts need to be remunerated by the health insurance system, be it private or governmental. These prevention-oriented activities should receive special attention by a society conscious of the economics of health care, since such programs if successful can readily reduce health care costs.

Victor Fuchs proved this year ago by comparing the health care costs of two states in the United States – Utah and Nevada[16]. The people in the state of Utah, with its high population of Mormons whose religious background stresses good health behavior, particularly in regard to smoking and drinking, had a much lower rate of chronic disease and health care costs than the people in Nevada.

The hospital epidemiologist should secure relevant information on all patients to enhance knowledge of etiologic factors for disease as well as factors that may influence survival. Each patient's record should

have suitable, detailed information that could serve both ends.

With such data, we would have much more information as to the extent to which, for example, dietary modification might affect the risk of cancer at major sites, such as breast, prostate, and colon.

Because of the growing evidence that nutrition plays a role in a variety of diseases, a professional nutritionist should assist the epidemiologist in obtaining data on the etiology and, on the basis of available knowledge, appropriate nutritional education should be provided to patients, their families, and the community at large. The nutritionist should work closely with the individual responsible for health promotion and education. Reliable information must be disseminated to the general population, to students in schools and employees at worksites, about all risk factors pertaining to preventable diseases, from smoking to alcohol abuse, from nutritional excesses to safe sex, from environmental to occupational exposures, and from prenatal to postnatal care. The hospital should have a smoking cessation clinic to help those that desire to give up smoking but have failed to do so by themselves.

Preventive medicine can best thrive in an informed, caring society. Many diseases of our day are a consequence of poverty, unemployment, lack of education, and break-up of the close-knit family. It is obviously difficult to instruct someone on good health behavior if that person sees no hope in tomorrow. Informative family interactions, pre- and postnatal care, housing, safe neighborhoods, quality preschool and school education are thus an integral part of any prevention strategy. The cost to society for such services will not nearly reach the levels of expenditures we ultimately pay for disease care as a result of our societal neglect. We can socially immunize ourselves – especially young people – against lifestyle disease, but not against a background of social deprivation. These issues have to be recognized and addressed by all who are concerned with lifestyle-related diseases. Action requires more than words. All segments of society need to be involved. As an adage states: "Tell me and I forget; show me and I remember; involve me and I understand" – we should, in fact we must, become a more interactive society to fulfil the basic premise of preventive medicine. In preventive as in therapeutic medicine, the dose makes for success. Thus, all the strategies presented here and in particular those of comprehensive parental and school health education are required for an optimal health status[17].

In the final analysis, society will judge whether we have affected the incidence and particularly the mortality of those diseases that rob us of healthy productive years of life. Only if we have effectively reduced preventable disease can we be satisfied. We may predict that, when the next chapter of the history of medicine is written, accomplishments in reducing exposure to established risk factors, mostly lifestyle related, will have had the greatest impact. This is not to deny that in the long run laboratory research may make it possible to provide us basic methods against molecular events that lead to neoplasms.

Proper lifestyle can lead to the day when all of use "die young, as late in life as possible". In this goal lies the true art of medicine – an art to which each health professional can and must contribute. At the threshold of the next century, the multidisciplinary activities in preventive medicine will hopefully be foremost among approaches to achieve optimal and lifelong health, for the benefit of all of society.

Zusammenfassung

Grundlagen der Prävention: Von der Entdeckung bis zur Anwendung

Diese Arbeit befasst sich mit der wohlbekannten Tatsache, dass manche der derzeitigen Krankheiten mit Lebensgewohnheiten in Verbindung stehen, die Ihren Ursprung in der Kindheit haben. Es ist unbestreitbar von grossem Wert, die Mechanismen einer Krankheitsentstehung zu verstehen. Die Geschichte der Medizin hat uns aber gezeigt, dass präventive Massnahmen angewendet werden können, lange bevor die Pathogenese bekannt ist. Die grössten Hindernisse in der Prävention sind, die Illusion der Unsterblichkeit, die Tatsache, dass die meisten unter uns nicht bereit sind, auf Annehmlichkeiten zu verzichten zugunsten eines potentiellen zukünftigen Gewinnes, und dass für die medizinischen Berufsleute die Prävention finanziell weniger attraktiv ist als die kurative Tätigkeit. Spitäler, Ärzte, Eltern und die Schule, sie alle können dazu beitragen, gesunde Lebensgewohnheiten aufzuwerten. Wir legen hier besonderes Gewicht auf eine frühe, umfassende Gesundheitserziehung in der Schule. Dieser soll ebensoviel Bedeutung zukommen wie anderen Lehraufträgen, denn eine gesunde Lebensweise fördert die körperliche und psychische Entwicklung des Kindes und trägt so zu einer zukünftigen produktiveren Gesellschaft bei.

Résumé

Principes de prévention: De la découverte à l'application

Cet article reprend l'évidence bien connue que plusieurs de nos maladies actuelles sont liées à des habitudes de vie dont l'orgine remonte à l'enfance. Bien que la compréhension des mécanismes d'une maladie soit d'un intérêt manifeste, l'histoire de la médecine a montré que des mesures préventives peuvent être appliquées bien avant que la pathogenèse d'une affection soit explicitée. Les plus grands obstacles à la médecine préventive pour l'individu moyen sont l'illusion d'immortalité, le fait qu'aucun de nous ne sacrifie volontiers quelque chose d'agréable pour un bénéfice potentiel et futur et le fait que la médecine préventive ne soit pas aussi rémunératrice que la pratique thérapeutique pour les professionnels de la santé. Les hôpitaux, les médecins, les parents et l'école peuvent tous contribuer à promouvoir des habitudes de vie saines. Nous mettons ici l'accent sur une éducation à la santé précoce dans la scolarité et proposons vivement que de tels efforts éducationnels soient traités à égalité avec l'enseignement d'autres matières. En effet, des habitudes de vie saines influencent le développment tant physique que mental des enfants et contribuent ainsi à une société plus productive dans le futur.

References

1 *Wynder EL, Graham E.* Tobacco smoking as a possible etiologic factor in bronchiogenic carcinoma. J Am Med Assoc 1950; *143*: 329–336.

2 *Doll R, Hill AB.* Smoking and carcinoma of the lung. Preliminary report. Brit Med J 1950; *2*: 739–748.

3 *Ornish D, Brown SE, Schewitz LW, et al.* Can lifestyle changes reverse coronary heart disease? The Lifestyle Heart Trial. Lancet 1990; *336*:129–133.

4 *Watts GF, Lewis B, Brunt JN, et al.* Effects on coronary artery disease of lipid-lowering diet, or diet plus cholestryamine, in the St. Thomas-Atherosclerosis Study-(STARS). Lancet 1992; *339*:563–569.

5 *Resnicow K, Barone J, Engle A, et al.* Diet and lipids in vegan vegetarians: a model for risk reduction. J Am Diet Soc 1991; *91*:447–453.

6 *Keys A.* Seven countries: a multivariate analysis of death and coronary heart disease. Cambridge, MA: Harvard Univ. Press, 1980.

7 *Lind J.* A Treatise on the Survey. London: A. Millar, 1757.

8 *Jenner E.* An Inquiry Into the Causes and Effects of the Variolae Vaccinae, a Disease Discovered in Some of the Western Counties of England, Particularly Gloucestershire, and Known by the Name of The Cow Pox. London: Sampson Low, 1800.

9 *Snow J.* Pathology and mode of communication of cholera. London Med Gazette 1849; *9*:745–752.

10 *Semmelweis I.* Hoechst wichtige Erfahrungen über die Aetiologie der an Gebaranstalten epidemischen Puerperalfieber Z.K.K. Gesellsch. Aerzte Wien 1847; *4*: 242–244.

11 *Castelli WP.* Epidemiology of coronary heart disease: The Framingham study. Am J Med 1984; *76 (suppl 2A)*:4–12.

12 *Weisburger JH.* Causes of cancer and cancer prevention. Archiv für Geschwulstforschung 1990; *60*: 385–399.

13 *Wynder EL, ed.* Syposium: The Illusion of Immortality. Prev Med 1976; *5*:477–548.

14 *Resnicow K, Cross D, Wynder EL.* The role of comprehensive school-based interventions: the result of four "Know Your Body" studies. Annals NY Acad Sci 1991; *623*: 285–298.

15 *Wynder EL.* Primary prevention of cancer. The case for comprehensive school health education. Cancer 1991; *67*:1820–1823.

16 *Fuchs VR.*Who Shall Live? New York: Basic Books, Inc., Harper & Row Publ, 1974.

17 *Wynder EL.* The dose makes the therapy. [Editorial] J Natl Cancer Inst 1992; *84*:658–659.

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