Social determinants of health:

Reforming education and public health to improve health in the United States

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The determinants of health that are most focused on by physicians, and the general public, include diseases, genes, biology, and pathogens. While these are important, health and associated outcomes are determined by social factors that are often unrecognized and unappreciated.

Social determinants of health (SDH) include early life experiences; socioeconomic conditions (income and poverty); quality and level of education; access to employment, work/life balance, and work environment; social and physical infrastructure and living conditions; community and environmental factors; behaviors, social networks, and public safety. The World Health Organization's Commission on the Social Determinants of Health uses the definition "…the conditions in which people are born, grow, live, work and age," with complex interactions among lifestyle, socioeconomic, biological, environmental, and social factors that affect people's health and well-being. Physicians often learn about SDH through experiences caring for patients and families, and in clinical and community settings with diverse patient populations.

The cost of health care

The United States spends more than $3.4 trillion a year on health care. This is more than $10,000 per person, and more per person than any other country. The average life expectancy in the U.S. is 79.3 years, or 31st among developed countries. Most European and Asian countries, along with Greece, Slovenia, Cyprus, and Chile are all ahead of the U.S.[1] Infant mortality in the U.S. is 29th at 6.5 deaths per 1,000 live births, which is also behind most European and Asian countries.[2]

Most of the improvements in lifespan, quality of life, infant mortality, and other indicators of public health occurred prior to the discovery of the causative factors of diseases, and preceded the widespread use of vaccines, antibiotics, modern medical treatments, and other scientific discoveries. It has been estimated that only about five years of the almost 30 years of increase in life expectancy in the U.S. has been due to preventive and therapeutic medicine. Eighty percent of improvement in life expectancy and health outcomes has been attributed to improvements in SDH, including income, sanitation, nutrition, clean water, education, living conditions, and public health measures to prevent disease. As dramatic and consequential as medical care is for some patients, it is not the major determinant of overall levels of the population's health.

Influences on health

One of the most important contributors to poor health is poverty. Adult life expectancy increases with increasing income, and men and women in the highest income group can expect to live at least 6.5 years longer than poor men and women. Poverty leads to unhealthy behaviors, chronic stress, and few resources for improved health and access to preventive and primary health care.[3]

Education is also a significant determinant of health. Adult health status improves as educational attainment increases. Babies born to mothers who did not finish high school are nearly twice as likely to die before their

first birthday as babies born to college graduates. Adult life expectancy also increases with education. On average, 25-year-old college graduates can expect to live eight to nine years longer than those who have not completed high school.[4]

Higher levels of education prepare people with the skills to cope with day-to-day challenges, and enable them to participate more fully in work, employment, economic markets, social and family support systems, and local communities. The all-cause mortality, and coronary heart disease mortality, has been reported to be related to level of education. People who are more educated are less likely to smoke, drink to excess, be obese, or use illegal drugs. These associations remain after controlling for job characteristics, income, and family history and background.

In addition, location and associated enviornment within the U.S. can influence health and life expectancy. In New Orleans, a person born in one area can expect to live 25 years longer than one born just a few miles away, and this has been observed in other cities and towns throughout the U.S.

In 1854, before the germ theory and discovery of infectious disease pathogens that created epidemics, there was an epidemic of cholera in London. Dr. John Snow, a physician, often referred to as the father of epidemiology, evaluated patients with cholera manifestations and those ill with other non-cholera symptoms. He drew a map to illustrate the cluster of cholera cases around the Broad Street Water Pump where drinking water was provided by the waterworks company from sewage-polluted sections of the River Thames. He persuaded the local council to disable the pump by removing the handle, which ended the cholera outbreak.[5]

Snow utilized the evidence and his reasoning to perform an important and successful intervention for water borne cholera epidemics.

There is now evidence that social determinants influence disease development and ill health, but as Snow faced in the London cholera epidemic, we don't yet understand all the factors related to causation.

SDH and adverse health effects

Many social factors are associated with unhealthy behaviors that contribute to disease and ill-health. Evidence indicates that many social determinants are associated with "chronic stress" resulting in biologic and physiologic influences on the regulatory systems. These include perturbations in the hypothalamic-pituitary-adrenal axis; sympathetic autonomic nervous system; immune and inflammatory responses; metabolic systems; cardiovascular system; central and peripheral nervous system, and brain.

Since the discovery of the structure of DNA by Watson and Crick, scientists have identified how the materials of life are made. Humans have about 20,000 different genes, all of which are transcribed into mRNA in various cells. The mRNA is translated into proteins in gene expression that can be regulated in different ways. DNA can be chemically modified and made more or less active for specific genes by the process of epigenetics. Transcription is regulated by chromosome access and a variety of regulatory proteins. Proteins are often chemically modified by things being added to them, such as phosphates, thiols, or sugars, thereby changing their activities. The proteins that result from regulated gene expression have enzymatic activities that are regulated, both up and down, by the things added to them, and by further regulatory components. The chemical foods of life—the nutrients—are synthesized by enzymes, or made available from foods using different enzymes; the microbiome plays a large role in these processes.

The entire flux, from genes to metabolites, is regulated precisely by extraordinary complexity, some of which we understand, most of which we don't. Evidence is accumulating that social determinants influence steps and processes in these complex pathways, including epigenetic processes, that regulate gene expression or suppression, and proteins in response to aging, environment, and other factors over time.

The constantly changing levels of proteins provides meaningful insight into a person's state of health, and wellness. Monitoring arrays of proteins over time, and response to social and other events, can potentially provide ongoing evaluation of changes in health, well-being, and quality of life, much like blood counts, chemistry panels, lipids, and blood pressure.

Omics, social media, and SDH

Understanding mechanisms of social determinants of disease may provide new interventions to prevent adverse health effects, or treat outcomes differently. The impact of the influence of SDH on health and illness has not been fully studied using modern technologies. Despite all the evidence, the world of health maintenance has been influenced only slightly, if at all by, "modern omics."

Nonetheless, corporate entities have decided to choose an omic and make it broadly and inexpensively available, hoping that the one chosen for development and introduction to health systems will be actionable and useful.

For instance, 23andMe chose genomics, SomaLogic chose proteomics, and Metabolon chose metabolomics. Each of these entities has made an expensive venture that their chosen omic will be useful.

Social media may be used to potentially improve health outcomes, motivate patients, educate professionals and patients, provide health information to individuals and communities, and increase awareness of news and advances. More than 75 percent of adults use social media, and it is prevalent across all ages and professions. Evidence is beginning to show that the use of social media in patient care can improve care and health outcomes, and increase patient satisfaction.

Social media is also used to improve patient access to health care information and educational resources. It can influence health behaviors and goals, and may be used to improve or enhance professional networking in education, patient care, patient monitoring, and public health programs.

Although potentially useful, social media also presents potential risks to patients and professionals due to poor-quality information, damage to professional image, and lack of privacy and professionalism. Eventually, social media will gravitate toward providing insights through omics to people so health and wellness has a chance of being democratized, especially as the cost for the measurements comes down. If used wisely and responsibly, social media offers the potential to promote individual and public health, professional education and development, and possibly even improve SDH.

Studying SDH, omics, and causation is a vital research agenda, but there is already sufficient evidence to work to mitigate the adverse effects of SDH. Waiting for more than 50 years, like with tobacco, is not an option.

Now that we have accumulated a huge amount of knowledge and evidence that SDH can adversely effect health, quality of life, survival, and well-being, we need to be documenting associations, exploring pathways, and mapping biologic and pathologic mechanisms. A high priority must be the development and implementation of interventions to improve health. We need to contemplate the questions:

- How can we give every child the best start in life?
- How can we help everyone to have the best health and life?
- How can we provide important educational opportunities for everyone?
- How can we strive for an adequate standard of living that supports health and sustainable communities?
- How can we prevent disease and disabilities, and provide medical and health care for all?

Time for change, and action

We should strongly support universal medical and health care for all, while recognizing the compelling need to develop interventions in SDH that are likely to improve the overall health of the nation. Physicians and other health professionals must take an active role in helping their patients become, and stay, healthy by recognizing their nonmedical needs, emphasizing their overall well-being, and connecting patients and families to local community supports. Care providers should assess whether patients have access to food and healthy meal choices, safe housing, educational opportunities, and jobs and training. They should recommend services in the community that can help address patient needs.

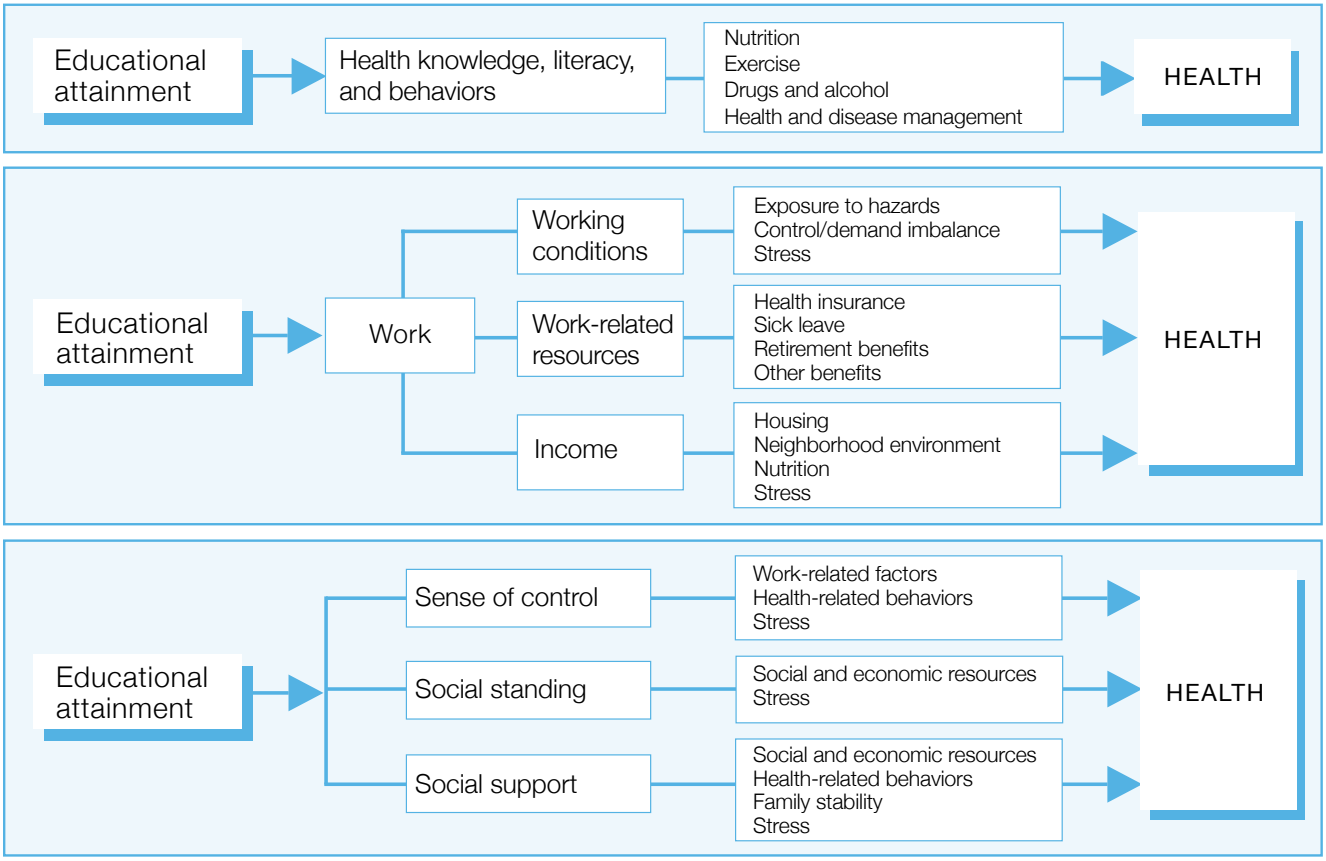
We should make interventions in SDH a national priority and integrate it into national, state, and city planning processes. SDH can no longer be viewed as peripheral environmental issues. They are the determinants of the health and well-being of our entire society.

We should develop, implement, and fund SDH research and investigation by initiating a major new longitudinal cohort study—similar to the Framingham Study—to investigate the SDH, and health outcomes, including mortality, illness, disease, and poor quality of life.

We should make education the most important intervention. Education means a longer and healthier life. We have an extensive educational system and corresponding supports that can be utilized for a national program in education and learning. We need societal incentives to influence staying in school and obtaining at least a high school education, if not completion of a college or technical school degree.

Some countries, like Peru, have a secondary school graduation requirement to obtain a driver's license. This results in an almost 100 percent high school completion rate. In the U.S., 27 states have "No Pass, No Drive" policies to counter truancy and dropout rates. With abysmal graduation rates in many states, these regulations tend to increase student retention and graduation. Given the importance of education to the health of people, this would seem to be a reasonable universal requirement to improve the population's health.

Interrelated pathways linking education to health



Source: Braveman P, et al. 2011. *Annu Rev Public Health*. 32:381 98. Used with permission.

Teaching healthy living from the beginning

We should begin teaching about SDH in preschool, if not earlier. The science and teaching of parenting has made important advances, and is critically important during the early childhood development years. Parenting is essentially experiential learning while developing one's parent identity. Role models have traditionally been limited to one's own parent(s), but we can now develop curricula on learning to be a parent supported by coaches, physicians, and others in the local school system and community. This should start with parents during pregnancy and continue throughout childhood. It can be integrated into the ongoing well-child visits. Pediatricians, family physicians, child health professionals, and health care teams can incorporate ongoing parenting and pursuit of healthy living into well-child visits and health plans.

We should ensure an earlier educational start with pre-school for all. The curriculum would be appropriate for the child, but would have a core curriculum for early childhood develpment and healthy living. This would include learning to learn, socialization, health behaviors, physical activity, self-care, life-long learning skills, thinking skills, problem solving, reasoning, use and understanding of language, and social support.

Full-day kindergarten should develop a daily curriculum that would progress in the healthy living core curriculum component. K-12 would have a required healthy living core curriculum for each school year that supports and progresses with age and experience. The healthy living curriculum would emphasize and support efforts to improve education, and retain students through postgraduate education or training.

Illustration by Jim M'Guinness

We should update and revise our medical student, residency, and health professions curriculum, once again. Medical education continues to focus on the biomedical model with emphasis on biology, pathology, microbiology, and psychology. It is still largely focused on diseases and treatment. While this is certainly essential to development as a healer, becoming a healer and professional is more complex and occurs largely through experiential learning attained from those accomplished in caring for patients. Medical education must develop physicians who care for their patients, relieve suffering, and improve the health of communities. As Sir William Osler said, "The good physician treats the disease; the great physician treats the patient who has the disease."

He also said, "The practice of medicine is an art, not a trade; a calling, not a business; a calling in which your heart will be exercised equally with your head." Physicians need to think about health and medical care from a new, different perspective. We need to recognize that nonmedical factors play a significant role in our patients' health. We need to learn and understand more about the SDH that adversely affect communities, families, and patients.

During periodic patient visits we should continue to evaluate our patients' symptoms, physical findings, and test results to make appropriate medical decisions and provide counseling. But, we should also include preventive medicine assessments and interventions appropriate for the patient. We should broadly adopt a measure of health status and quality of life. The SF-36 Health Survey is available, and has been broadly evaluated. It is the primary

health outcomes measure in the Medical Outcomes Study, and was designed for use in clinical practice.

The SF-36 includes one multi-item scale that assesses eight health concepts (there is a short form):

1. Limitations in physical activities because of health problems;
2. Limitations in social activities because of physical or emotional problems;
3. Limitations in usual role activities because of physical health problems;
4. Bodily pain;
5. General mental health (psychological distress and well-being);
6. Limitations in usual role activities because of emotional problems;
7. Vitality (energy and fatigue); and
8. General health perceptions.

The use of this tool provides an ongoing regular standardized evaluation of a patient's health, and any changes. It could be correlated with changes in the SDH for the patient. This could be completed electronically before the patient arrives, and the score could be available to the physician and team.

Barriers in clinical and patient care

However, a major barrier to changing clinical practice and the care of patients still exists—the funding and payment system. The monthly productivity report, based on relative value units (RVUs), is produced for practitioners. Listening to patients, examining patients, evaluating who the patient is—family, work, income, stress, SDH—counseling patients, and comforting the patient and family earn few, if any, RVUs. Doing important research; teaching students, residents, colleagues, nurses, and other health professionals; and reading the medical evidence related to a patient earns zero RVUs. Doing a procedure, endoscopy, catheterization, surgery, CAT Scan, MRI, biopsy, removal of skin lesions, lab tests all earn many RVUs.

The RVUs have become the measure of physicians and their care of the patient, which describes a pernicious element in the care of patients that is a major impediment to providing great care.

In teaching institutions, faculty are often compensated only for their clinical productivity measured by RVUs, with no consideration of their teaching or scholarly work. Students and residents are taught and understand this system, which is a financial hidden curriculum that affects care of the patient, specialty choice, and the utilization of time with the patient and family. There is no time allotted for efforts to mitigate the adverse effects of SDH.

Promoting interventions

Physicians often have limited opportunity to change the social determinants for individual patients and their families, but we should strive to work in our communities as leaders to promote interventions that will have a positive influence. We can use our positions and expertise to advocate for change in areas outside of traditional medical care to promote research, and to identify social and other measures that promote good health. As physicians, we can make a difference by working to control the rising health care expenditures. As Harold L. May, MD, has stated, "all of the systems of society—health care, education, economic, political, justice—should work in harmony, as do the systems of our bodies."

We must influence how we reinvest our societal resources wisely, and in a way that complements and supplements what we are doing to improve patients' and society's health, well-being, and quality of life.

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