

Berson Lecture

The Small World of Global Health

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Abstract

This article is based on the Solomon Berson lecture, delivered by Dr. Koplan in January 2000. In his remarks, Dr. Koplan discussed the current status of global health and projected trends in three categories: communicable diseases, risk factors for disease, and selected diseases and health conditions. Reflecting on differences in health issues in the 30 years since he left Mount Sinai, Dr. Koplan pointed out that the health problems of developed and developing nations are strikingly similar now — which also means they are amenable to similar interventions.

Key Words: Global health, developing nations, communicable diseases.

Introduction

IN THE 30 YEARS since I left Mount Sinai, there has been a true sea change in the homogenization of health issues around the world. In 1970, the health problems of the West and developed nations were chronic diseases. For less developed countries, the health problems were infectious diseases, coupled with a great concern about population growth.

In contrast, today, the spectrum of health issues is largely the same for most nations, and the relative contributions of chronic and infectious diseases will only become more alike over time. Increasingly, regardless of whether we live in an industrialized country or a developing one, the health problems we face are strikingly similar — and will only become more so if current trends continue.

In this article, which is based on a lecture I was honored to give at the Mount Sinai School of Medicine in January 2000, I would like to discuss our current global health status and projected trends in three categories:

1. communicable diseases
2. risk factors for disease
3. the diseases and health conditions themselves.

Transitions

A number of factors have contributed to the homogenization of organisms, exposures, risk factors, and vectors. These include:

- the increasing volume of travel, which has led to quantitative and qualitative differences in the number and types of people from different places moving around the globe, for short-term travel as well as more extensive and permanent migration
- a global marketplace that creates a demand for the free and constant movement of produce and other goods around the world.

Another way to think about this shift from the diseases of poverty (maternal and childhood illnesses and infectious diseases) to the diseases of affluence (such as ischemic heart disease, cancer, diabetes, and injuries) is in terms of epidemiologic, demographic, and behavioral transitions.

The epidemiologic transition occurs as countries become more industrialized and their populations become more affluent and educated. These technological and social changes

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influence the types of risk factors to which populations are exposed, typically shifting the major causes of death and disease from infectious diseases (gastroenteric and respiratory infections) to chronic, degenerative diseases.

It is worth noting that although many developing countries move steadily from a health profile dominated by infectious diseases to one dominated by chronic diseases, reverses are also possible. Parts of the former Soviet Union have experienced terrible setbacks as their public health infrastructures have crumbled and their populations have succumbed to a wide variety of preventable diseases.

Demographic transitions in countries or regions occur when fertility and birth rates decline at the same time that health improvements lead to increases in the number and proportion of elderly people. Migration patterns also affect the pace and scope of demographic transitions — not just among nations, but from rural to urban areas.

As both developed and developing countries have gained control over infectious diseases, the risk factors associated with the luxuries of non-subsistence living — tobacco, alcohol, increased dietary fat, inactivity, cars, and pollution — have loomed larger. These risk factors are the basis for the third type of transition: a behavioral transition. And unlike their microbial counterparts, these risk factors emanate largely from our own economic and cultural habits — habits that we are increasingly exporting to the rest of the world through marketing, entertainment, and economic clout.

These adverse side effects of economic progress and development counterbalance in disease burden the considerable progress we have made against infectious diseases. Most important, they are risk factors that we — as individuals, as communities, as governments — can influence to a far greater degree than we have demonstrated so far.

Communicable Diseases

Of course, no nation can ever completely transition away from infectious diseases, even if their relative burden decreases. At Mount Sinai's medical center, health care professionals daily confront hospital infections, antibiotic resistance, influenza, TB, HIV/AIDS, and so on. Infectious diseases have always been mobile and moved into new, susceptible populations. Among the many examples are the introduction of yellow fever from Africa into the Caribbean

and South America; the introduction of measles and smallpox into the Western hemisphere; and the worldwide circulation of influenza.

The ease and practically instantaneous speed of current transportation methods have helped microbes move freely around the globe, along with the rest of us. Jets not only transport many people quickly to every corner of the earth, but they increasingly move people to and from formerly remote places. Tourism is part of this picture, but so are the vast migrations that follow in the wake of wars, economic disruption, and the subsequent searches for safety and economic opportunity.

Beyond airplanes, global shipping of foods and other products, while slower and less dramatic than jet travel, is a major transporter of disease vectors. Even in our own backyards, suburban encroachment of wild habitats puts more and more of us into the path of the deer ticks that cause Lyme disease, rabies carried by racoons, or even the dung-infested dust particles that carry Hantavirus from rodents to humans.

A case two years ago in Tennessee teaches us the same lesson as the West Nile encephalitis outbreak that first surfaced in New York: just because it has not been seen in this hemisphere, or in humans, does not mean we can rule it out.

In the Tennessee case, a channel-surfing nurse happened to watch a television show about vector-borne diseases, which featured footage of the reduviid or "kissing bug" — an insect that transmits *Trypanosoma cruzi*, the parasite that causes Chagas' disease in humans. After watching the TV show, the nurse went into another room to check on her 4-month-old baby, and there in the crib she saw the exact same bug she had seen on TV. Amazingly, she preserved it and sent it to a university lab for analysis, from which it was forwarded to us. The bug was indeed exactly what she thought it was. It carried the parasite *Trypanosoma cruzi*, and the baby had been infected.

We at Centers for Disease Control and Prevention (CDC) investigated this case and could find no other reduviid bugs in any of the houses near hers, nor could we find any other evidence of human infection. We had to conclude that this isolated event was probably the result of the bug hitchhiking, undetected, in a South or Central American migrant worker's belongings. Like Hantavirus and West Nile encephalitis, this was a transmission we had not seen before in the United States. And like those diseases

and vectors, we know that if we start looking, we will find more.

Each year, CDC investigates hundreds of outbreaks like these, 90% of which involve infectious agents. We know these are just the tip of the iceberg — the ones that are serious enough, or intriguing enough to someone, to get on our radar. We know that the mobility of people in the world and in this country is unprecedented in human history, with fewer financial and social constraints than ever before.

Both close to home (such as recent malaria cases traced to Long Island, Dengue fever in Texas) and far afield (such as nipavirus outbreaks among pigs in Malaysia; Ebola and Marburg in central Africa; new avian influenza strains in Hong Kong; and of course the looming threat of pandemic flu), we at CDC want to be vigilant about emerging infectious diseases. But, as the examples of Chagas, West Nile, influenza, and TB illustrate, we have a broad and varied range of threats to monitor - new vectors in unexpected places, old vectors appearing in new hosts, and everything from travelers to immigrants to fresh produce helping them along. And even more recently, we have had the horrific experience of investigating cases of anthrax, unleashed by one or more bioterrorists.

In the past 30 years, 30 new infectious agents have been identified around the world. Again, we know that the harder we look, the more we will find, and we will likely have dozens more in the years to come. Whether they emerge as a result of natural mutations or because of a manmade bioterrorist event like the recent anthrax cases, we take our preparation against these bugs very seriously.

From these examples, one should not conclude that developing countries exclusively pose the threat of communicable diseases, against which those of us in the West must guard ourselves. For example, in many countries (including China), HIV/AIDS is viewed as a Western import, spread by promiscuous and immoral travelers.

In fact, risk factors and diseases move along a two-way street. Just as travel brings us into closer contact with new microorganisms to which we would never have been exposed before, a number of forces — communication, entertainment, the growth of market economies — expose people in other parts of the world to many aspects of our lifestyle. Some of these are detrimental to health and serve as risk factors for serious diseases and health conditions.

Risk Factors: Global Convergence in Tobacco Use, High-Fat Diets, and Motor Vehicle Crashes

Today, chronic diseases account for less than half of the deaths in developing countries, but by 2020, if current trends continue, this proportion will increase to 7 out of 10 deaths (1). In 1990, chronic diseases superseded infectious and parasitic diseases as the cause of death in every region of the world except sub-Saharan Africa. Yet even in sub-Saharan Africa, chronic disease rates are ascending, and infectious and parasitic diseases are declining — a testament to successful immunization campaigns and other types of interventions. There is no question, though, that by the time data from the end of the 1990s are available, chronic diseases will have surpassed infectious diseases as the leading cause of death around the world. Globally, this means that both risk factors and causes of death are converging.

When we examine the threats to health that we can prevent, many are rooted in chronic diseases and injuries. The global impact of several of these — particularly tobacco use, diet, and motor vehicle crashes — is compelling. More important, these are risk factors that we can actually do something about. The combination of individual behaviors and health promotion policies that influence these risk factors may seem mundane, compared to the more exotic infectious diseases. But their impact is real and growing.

Tobacco

Worldwide, tobacco accounted for 4 million deaths in 1998. By 2030, this figure will rise to 10 million — more than the total deaths from malaria, maternal and major childhood conditions, and TB, combined. Half of these deaths will occur in the 35–69 age group, with an average loss of 20–25 years of productive life. Seventy percent of these deaths will occur in the developing world (2).

Thanks to vigorous tobacco control efforts here and in other high-income countries, tobacco consumption has generally fallen in the developed world since its peak years of the mid-1960s, when 40% of Americans smoked (and 60% of American males, including our Surgeon General).

But smoking prevalence is increasing in developing countries, at a rate of 3.4% per year. In contrast to our current rate of 23%, smoking

prevalence among men in developing countries is approximately 48%. Of the 1.15 billion smokers in the world today, 82% live in low- and middle-income countries (3).

Consider this: the largest tobacco company in the world is not Philip Morris or RJ Reynolds, but the China National Tobacco Corporation, which produced nearly a quarter of the world's cigarettes in 1997 (4). In China, 70% of adult men smoke (5). Unlike their Western counterparts, many Chinese lack even basic information about the hazards of smoking. A 1996 survey of Chinese adults revealed that half of smokers — and half of nonsmokers as well — believed that there was little harm in smoking. Only 4% of the survey respondents could correctly identify a connection between smoking and heart disease (6).

What is behind these consistently high smoking rates? Profits. The world retail market in cigarettes is estimated to be worth \$300 billion. Tobacco companies are hugely profitable, and as consumption falls in high-income countries, the developing world has become an ideal market for expansion. Developing countries are tantalizing to tobacco companies because they offer a package of untapped markets combined with few or nonexistent restrictions on advertising.

There is one small exception to the flow of tobacco exports from the United States to developing countries, and that is the growing popularity of *bidis* — hand-rolled, flavored cigarettes from India — among teenagers here in the United States. A survey of Massachusetts teenagers in 1999 indicated that 40% had smoked bidis at least once, and 16% were current smokers (7). Most disturbingly, many of the teens believed that bidis are safer than cigarettes. Nothing could be further from the truth. Their cherry, chocolate, and mango flavoring masks the fact that they produce about three times the amount of carbon monoxide and nicotine and nearly five times the amount of tar as cigarettes — and bidi smokers inhale more often and more deeply because of the characteristics of the cigarette's leaf wrapper.

In any case, in the developing countries where tobacco consumption has not increased, there is the potential to avert the massive health care costs and tobacco-related morbidity and mortality that we know all too well here in the United States, and that faces China and many other countries if current consumption patterns persist.

Diet and Nutrition

In developing countries, the overwhelming dietary problem is often under-nutrition. But as nations and their residents become more prosperous, a paradoxical set of new hazards appears, brought on by higher consumption of meats, fats, processed foods, and total calories.

In China, one of the most rapidly industrializing nations in the world, fat intake has increased rapidly, especially among the higher-income populations that are concentrated in urban areas.

At its most extreme, over-consumption of foods can be seen in levels of obesity among adults and, sadly but with increasing frequency, among children.

In this country, we are experiencing an epidemic of obesity.

Diet and nutrition are areas where our health habits constitute a dangerous export to the rest of the world. For years, we have been intrigued (and made green with envy) by the “French paradox” — the seeming ability of the French to eat foods rich in artery-clogging saturated animal fat, yet avoid mid-life heart attacks. Several possible explanations for this phenomenon have been offered over the years, including the protective role of wine, moderate drinking, fiber consumption, and portion sizes — among others.

Whatever the explanation, the French seem to be losing their protection against the adverse effects of fat consumption. The consensus seems to be that French fat consumption has increased steadily over the last 20 years, and that heart disease rates — with their typical delayed manifestation — will catch up. But the increased fat consumption is not from richer sauces, fabulous pastries, and extra helpings of foie gras. Instead, the French have consumed more fat because their diets have become more Americanized (8).

The French now eat more meat and fast foods, snack more, eat fewer regular relaxed meals, exercise less, and drink less wine than they used to. But while they may be getting heavier, their obesity rates still lag far behind ours: 8 percent of French adults, versus 30 percent of American adults.

Motor Vehicles and Collisions

In developing countries, the escalating rates of motor-vehicle-related death and disability provide one of the best examples of the unin-

tended negative consequences of economic development, as motor vehicle deaths and injuries keep pace with increasing numbers of cars on the roads.

Those who have traveled in developing countries can readily understand why deaths and severe injuries are more commonplace. On poorly maintained roads with *laissez faire* enforcement of traffic laws, cars jostle with overcrowded buses, motorcycles, mopeds, rickshaws, bicycles, and pedestrians. In developing countries, half of all motor vehicle fatalities are among pedestrians and drivers of two-wheeled vehicles. Mortality rates per vehicle in Ethiopia and Nigeria are 50 times higher than in the United States and the United Kingdom (9).

This helps explain recent data from an internal Peace Corps analysis of deaths among Peace Corps volunteers. Although Peace Corps volunteers end up in some rather remote places, where one might expect them to be exposed to exotic infectious diseases, the leading cause of death by far is unintentional injuries, to which motor vehicle crashes are the largest contributor.

Injury prevention and control is an example of a health problem grown common in all parts of the world, with solutions and interventions that are largely applicable in all parts — from seat belts, air bags, child safety seats, better car and highway design, regulations and their enforcement, de-linking alcohol and driving, driver education, and many other interventions.

Similarly, models of risk factor reduction for chronic diseases such as coronary heart disease can be used worldwide. We in the United States have learned and applied a lot from the experience of our Finnish colleagues.

North Karelia, Finland, provides perhaps the best example of how a combination of individual health education and strong, across-the-board changes in policies achieved dramatic results.

Although our stereotype of Finns is of healthy, lean cross-country skiers subsisting on pickled herring and dark bread, in reality, at least in the early 1970s, they had very high rates of smoking and truly astounding patterns of animal fat consumption. These, in turn, had led to excessive heart disease mortality rates among the Finns, both men and women.

Over a 20-year period, the Finns implemented a “full-court press” on heart disease. In addition to physician education and media campaigns about cholesterol, blood pressure, and smoking, the dairy industry was persuaded to provide low-fat versions of milk and cheese. Between 1972 and 1992, heart disease deaths

among men declined 68%, and among women 55%. Perhaps most encouraging was the fact that these lifestyle changes seeped into Kuopio, the control region next to North Karelia, until both regions achieved similar reductions by the end of the second decade (10).

This tells us that when we persuade people that these changes can be made, and when policies support those changes, large-scale adoption of healthy behaviors can occur. So we know that a combination of individual health education and broad policies to promote health is critical — one without the other will not get us very far. And we know that it takes a long time — decades, in fact — to create these kinds of changes. Dramatic reductions in tobacco use in this country over the past 30 years are yet another example.

The same is true for motor vehicle injuries. In countries where motor-vehicle fatalities and injuries have declined — like ours — we have demonstrated that separating traffic of different modes and speeds, training drivers, enforcing seat belt and drunk driving laws are effective policies. Many of these interventions also were pioneered in other countries — yet another reminder that we have much to learn and adapt from the rest of the world when it comes to health and safety.

Changing Disease Patterns and Burdens

Tobacco use and dietary habits are risk factors for various chronic diseases and states of ill health, such as coronary heart disease, diabetes, and hypertension; while motor vehicles clearly take a toll not only in terms of injuries and fatalities, but also by reducing physical activity and increasing pollution.

I would like to discuss these trends more broadly by examining changing disease patterns and burdens around the world.

DALYs: Documenting the Burden of Disease

As noted earlier, chronic diseases and injuries have overtaken communicable diseases as the leading causes of death in much of the world, and this trend is likely to accelerate. But mortality is only one way to measure health trends. Disability-Adjusted Life Years, or DALYs, give us another portrait of the same trend.

DALYs combine measures of disease incidence, prevalence, severity, and mortality into a single measure. We have used this technique to

examine the 10 leading causes of DALYs in the United States.

DALYs have drawn some criticism recently on several fronts, questioning their usefulness for monitoring and comparing population health across countries and identifying priorities for interventions, research, and development (11). Although any measure as complex as DALYs offers room for improvement (as its original architects would be the first to agree), there is no question that DALYs have greatly informed debates about the health status of populations and how to improve them. As just one example, a major benefit of using DALYs rather than mortality alone is that it allows us to account for the burden caused by conditions that produce considerable disability — such as arthritis or depression — but that are not associated with high mortality rates.

The 10 leading causes of DALYs in the United States in 1996 are shown in the Table (12). One item not on the list — HIV — is something other than a chronic disease, a mental illness, or a type of injury. (And certainly an argument can be made that HIV shares many features with chronic diseases, irrespective of its infectious origins.)

DALYs are another way of looking at the epidemiologic transition described earlier. As both developed and developing countries have gained control over infectious diseases, the risk factors associated with the luxuries of non-subsistence living — tobacco, alcohol, increased dietary fat, inactivity, cars, and pollution — have loomed larger. Whether we use DALYs, mortality, or other measures, we are likely to see a convergence of risk factors and causes of death not only in the industrialized world, but between the developed and developing worlds as well.

Although comparisons between different countries and regions are instructive, we must also remember that nations are not necessarily homogenous in terms of health status. Just as the poorest countries have subgroups who enjoy better health and longevity than their fellow citizens, so too do richer countries harbor pockets of extreme poverty and disease. Unfortunately, we in the United States have this dubious distinction.

No discussion of health trends in the United States should overlook the fact that in terms of health status, we have the equivalent of a developing country within our borders. By calculating county-specific life expectancies at birth in the United States, by race, the DALY re-

TABLE
Estimated Leading Causes of Disability-Adjusted Life-Years (DALYs) in the United States in 1996
(in millions)

| | DALYs | | | Deaths | | |
|---|-------|------|-------|--------------------|--------------------|--------------------|
| | Total | men | women | Total | men | women |
| All Conditions | 34.2 | 18.3 | 15.9 | 2.31 | 1.16 | 1.15 |
| Ischemic heart disease | 3.15 | 1.97 | 1.18 | 0.54 | 0.29 | 0.25 |
| Unipolar major depression | 1.55 | 0.48 | 1.07 | (37) ^a | (12) ^b | (25) ^c |
| Cerebrovascular disease | 1.51 | 0.67 | 0.84 | 0.16 | 0.06 | 0.1 |
| Road traffic collisions | 1.39 | 0.93 | 0.46 | 0.04 | 0.03 | 0.01 |
| Lung, trachea, bronchus cancers | 1.36 | 0.81 | 0.55 | 0.17 | 0.10 | 0.07 |
| Alcohol abuse and dependence | 1.15 | 0.74 | 0.41 | 0.0066 | 0.0052 | 0.0014 |
| Chronic obstructive pulmonary disease | 1.06 | 0.55 | 0.51 | 0.10 | 0.05 | 0.05 |
| Diabetes mellitus | 0.96 | 0.46 | 0.50 | 0.06 | 0.03 | 0.03 |
| Osteoarthritis | 0.93 | 0.41 | 0.52 | (690) ^d | (182) ^e | (508) ^f |
| Dementia and other degenerative and hereditary central nervous system disorders | 0.89 | 0.38 | 0.51 | 0.04 | 0.01 | 0.03 |

a, b, c, d, e, f; the integer shown within the parenthesis is the number of deaths recorded.

Modified, with permission, from data of Michaud CM, Murray CJL, Bloom BR. Burden of disease — implications for future research. JAMA 2001; 285:535–539 (12).

searchers found a range in life expectancies that shows how unevenly distributed our health status progress really is.

In four contiguous counties in South Dakota, the life expectancy for American Indian males is 56.51 years, which is comparable to the life expectancy for men in countries like Bangladesh and the Sudan (13).

The good news is that some counties and subgroups have unusually high life expectancies. Asian females in Bergen County, New Jersey, for example, have life expectancies of 97.72 — very close to a century of life expectancy (14).

Cardiovascular Disease

Reductions in cardiovascular disease deaths represent one of the most dramatic public health accomplishments of the last century. Between 1972 and 1992, death rates from heart disease plunged by 51%, but coronary heart disease is still the leading cause of death in the United States (15). The decrease was driven by combinations of screening, education, cholesterol and blood pressure medications, dietary changes, and exercise regimens.

Because the risk factors for cardiovascular disease — smoking, diets high in saturated fats, and physical inactivity — are increasing in developing countries, we can expect these habits to lead to increased cardiovascular disease rates decades down the road.

India, for example, already accounts for 17% of global CVD deaths (16). Between 1985 and 2025, deaths attributed to circulatory system diseases in India are expected to increase by 103% in men and by 90% in women. During a recent trip to India, I met with a cardiologist who was seeing these trends first-hand in his own practice. He told me that he could easily do 50 angiograms a day and as many coronary artery bypass grafts, just on the patients referred to him. He believed that his patients' high-fat diets, low physical activity levels, and high smoking rate — especially among men — might be combined with some type of genetic susceptibility for heart problems.

The data bear him out — at least on the fat consumption trends. Affluent Indians — who are estimated to be 5% of the population — consume 40% of the fat consumed by the entire population, mainly in the form of ghee (clarified butter) and other edible oils. Of course, 5% of India's population is 40 million people at risk of serious health problems. As India accel-

erates its industrialization and development, my cardiologist friend's concern is further justified.

A Focus on Solutions

As diseases and risk factors converge around the world, we will have to recognize our interdependencies and look to each other for solutions. We know that a nipavirus outbreak in Malaysia has implications for hog farms in North Carolina. Effective tuberculosis control in India and Mexico affects TB rates in the United States, as does Dengue fever control in Mexico and the Caribbean. Foodstuffs contaminated with pathogens or pesticides can originate abroad and appear on your kitchen counter.

And just as microbes and trends from outside our borders affect us here at home, so do our actions and policies affect the rest of the world — and not always for the better, as I have noted. Our pressure on the tobacco industry here in the United States has immediate ramifications for the health systems and economies of developing countries. The impact of violent American television programming is felt all over the world.

By the same token, as I noted earlier, we do know what we have to do to reverse these trends. It is not a mystery; not a realm of scientific discovery yet to be revealed. We need to continue to learn from successes elsewhere, as we have from the Finns in North Karelia. The directly observed therapy to treat tuberculosis that we use in New York City today began in Chennai, India; the Australians have been leaders in developing skin cancer prevention programs for their sun-loving, fair-skinned population.

The types of solutions we must support here and abroad have much in common — just as the risk factors faced by Americans, Finns, Thais, and Indians and everyone else are increasingly similar.

Around the world, health promotion and health education, social marketing, creative applications of new technology, and strong regulatory and political action hold promise for reversing these trends and preventing unnecessary deaths and diminished quality of life.

We have had significant successes in promoting healthy behaviors. When I trained at Mount Sinai 30 years ago, attending rounds were smoke-filled events — which is certainly not the case today.

When Archibald MacLeish saw photos of the earth projected from the first trip to the moon, he was inspired to write (17):

To see the earth as we now see it,
 small and blue and beautiful in that eternal
 silence where it floats,
 is to see ourselves as riders on the earth
 together. . . .

We are indeed riders on the earth together. Distance no longer confers the protection it once did. Even in vastly different economic circumstances, the countries of the world seem to be pulled to a powerful magnetic north in which we are more alike, in causes of death and of DALYs, than we are different. This should serve to make us all healthier as we multiply our efforts as clinicians, researchers, and public health professionals toward these common goals.

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