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Noncommunicable Diseases: Three Decades Of Global Data Show A Mixture Of Increases And Decreases In Mortality Rates

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ABSTRACT **Noncommunicable diseases are the leading health concerns of the modern era, accounting for two-thirds of global deaths, half of all disability, and rapidly growing costs. To provide a contemporary overview of the burdens caused by noncommunicable diseases, we compiled mortality data reported by authorities in forty-nine countries for atherosclerotic cardiovascular diseases; diabetes; chronic respiratory diseases; and lung, colon, breast, cervical, liver, and stomach cancers. From 1980 to 2012, on average across all countries, mortality for cardiovascular disease, stomach cancer, and cervical cancer declined, while mortality for diabetes, liver cancer, and female chronic respiratory disease and lung cancer increased. In contrast to the relatively steep cardiovascular and cancer mortality declines observed in high-income countries, mortality for cardiovascular disease and chronic respiratory disease was flat in most low- and middle-income countries, which also experienced increasing breast and colon cancer mortality. These divergent mortality patterns likely reflect differences in timing and magnitude of risk exposures, health care, and policies to counteract the diseases. Improving both the coverage and the accuracy of mortality documentation in populous low- and middle-income countries is a priority, as is the need to rigorously evaluate societal-level interventions. Furthermore, given the complex, chronic, and progressive nature of noncommunicable diseases, policies and programs to prevent and control them need to be multifaceted and long-term, as returns on investment accrue with time.**

Over the past century, life expectancy has increased globally, primarily as a result of reductions in infectious diseases and maternal and child mortality.[1] During that time, however, largely because of population aging, noncommunicable diseases have emerged as dominant health problems.[2,3]

Noncommunicable diseases include a broad range of conditions such as cardiovascular diseases, chronic respiratory diseases, cancers, diabetes, and mental and neurological illnesses. This group of diseases accounts for 70 percent of global mortality[2] and a large proportion of years lived with disability.[3,4] Noncommunicable diseases are associated with catastrophic health expenditures, high opportunity costs, and lost productivity. As such, noncommunicable diseases are considered a severe threat to micro- and macroeconomic development globally.[5]

In this article we provide a comprehensive yet concise overview of noncommunicable diseases

globally. Since there are too many perspectives, interventions, and outcomes to catalogue in one article, our focus here is solely on country-level mortality patterns and comparisons between high-income countries and low- and middle-income countries. Our analysis is unique in its inclusion of the four leading causes of noncommunicable disease deaths—atherosclerotic cardiovascular diseases, diabetes, chronic respiratory diseases, and cancers.[6] Furthermore, we used mortality data directly reported by national authorities in forty-nine countries.

To complement the observations about cross-country variation in mortality, we also provide brief summaries from the literature regarding the influences of health system interventions and societal factors on mortality patterns over three decades. Lastly, we highlight important limitations and knowledge gaps regarding noncommunicable disease burdens, prevention, and control.

Study Data And Methods

MORTALITY We compiled mortality data for males and females ages 0–85 years for cardiovascular diseases, diabetes, chronic respiratory diseases, and cancers in countries with suitable data since 1980. Data came from the World Health Organization (WHO) Mortality Database,[7] which differs from modeled data used in the Global Burden of Disease Study. The WHO Mortality Database includes medically certified deaths coded using the *International Classification of Diseases* (ICD) system and transmitted directly to the WHO by national authorities from their vital statistics registration systems; the data reflect no adjustment. The proportion of population deaths covered by registration systems is also provided to the WHO.

We included data on only forty-nine countries deemed to have adequate national registration system coverage, as described previously.[8] We report age-standardized mortality rates stratified for males and females.

We defined *cardiovascular disease mortality* as deaths due to ischemic heart disease (ICD, Ninth Revision, Clinical Modification [ICD-9-CM] code 414.9) or cerebrovascular disease (ICD-9-CM code 437.9). Diabetes mortality was defined as deaths due to diabetes that were not related to cardiovascular diseases (ICD-9-CM code 250). Deaths due to chronic respiratory diseases were deaths related to asthma (ICD-9-CM code 493) or obstructive lung diseases (ICD-9-CM code 496).

For cancers, we limited our investigation. We included the following three common malignant neoplasms: cancers of the lung, trachea, or bronchus (ICD-9-CM code 162); of the breast (ICD-9-CM code 174); and of the lower gastrointestinal tract (colon, rectum, and anal canal; ICD-9-CM codes 153–54). We also included three infectious-origin cancers: malignancies of the cervix (ICD-9-CM code 180), liver and biliary system (ICD-9-CM code 155.0), and stomach (ICD-9-CM code 151.9).

COUNTRIES AND REGIONS We used the classification systems of the United Nations Statistics Division[9] and the World Bank's country and lending groups[10] to group countries based on geography and high-income or low- and middle-income status, respectively (for more details, see the methods section of the online Appendix).[11] To provide concise exhibits of global patterns, we display data for ten countries that were considered representative of their regional partners in terms of mortality patterns and population characteristics: Japan (representing Asia-Pacific, high-income countries), Australia (English-speaking Asia-Pacific, high-income), Italy (Southern Europe, high-income), Finland (Northern Europe, high-income), the Czech Republic (Eastern Europe, high-income), Ukraine (Eastern Europe, low- and middle-income); Russia (Western Asia, high-income); the United States (North America, high-income), Mexico (Central America, low- and middle-income), and Chile (South America, high-income). A dotted line representing the average age-standardized mortality rate of all countries with available data for a given indicator is included in each exhibit as a benchmark. Exhibits including all forty-nine countries are available in the Appendix.[11]

We describe patterns and differences for all forty-nine countries and nine regions qualitatively, without formal statistical testing for trends or differences.

LIMITATIONS Our study had some limitations. First, the lack of reliable representative data for many countries—especially China, India, Indonesia, and sub-Saharan Africa—compromises our understanding of causes of death among almost half of the world's population.[8]

Second, some of the observed differences in mortality patterns across countries and over time could reflect differences in how diseases are certified and recorded in vital registration systems. For example, if more cancers are being detected over time, increases in cancer mortality might reflect this increase in detection and certification of cancer deaths instead of a true increase in mortality from cancer. Furthermore, data from vital registration systems do not include comorbidities, since each death is assigned a single primary cause. For example, people with diabetes who die from cardiovascular disease are counted as cardiovascular disease deaths, not

diabetes deaths. If the assignment of primary cause of death differs across countries and over time, this could partially explain some of the observed mortality trends, particularly for diseases with overlapping pathophysiologies such as diabetes and cardiovascular disease.

Third, although we looked at the four leading causes of noncommunicable disease deaths, our data do not represent the total burden of noncommunicable diseases. For example, mental and neurological illnesses were not included.

CAUTIONS IN INTERPRETATION A key consideration in interpreting mortality rates is that decreases in the rates could reflect improvements in treatment—that is, people with disease are treated and live longer—instead of true reductions in disease incidence. The collection of incidence data for noncommunicable diseases poses formidable logistical challenges because most of the diseases have long latency periods and require costly testing to confirm diagnoses.

Another consideration in interpreting mortality data is that decreases in mortality rates can occur despite increases in absolute numbers of people dying from disease. For example, in the Global Burden of Disease Study, despite a 39 percent decrease in age-specific cardiovascular disease death rates in the period 1990–2013, there was a corresponding 41 percent increase in the absolute number of cardiovascular disease deaths worldwide resulting from increases in population size.[12]

Study Results

Regional and country-level mortality patterns in the period 1980–2012 associated with each set of noncommunicable diseases are presented separately below.

GLOBAL CARDIOVASCULAR DISEASE MORTALITY

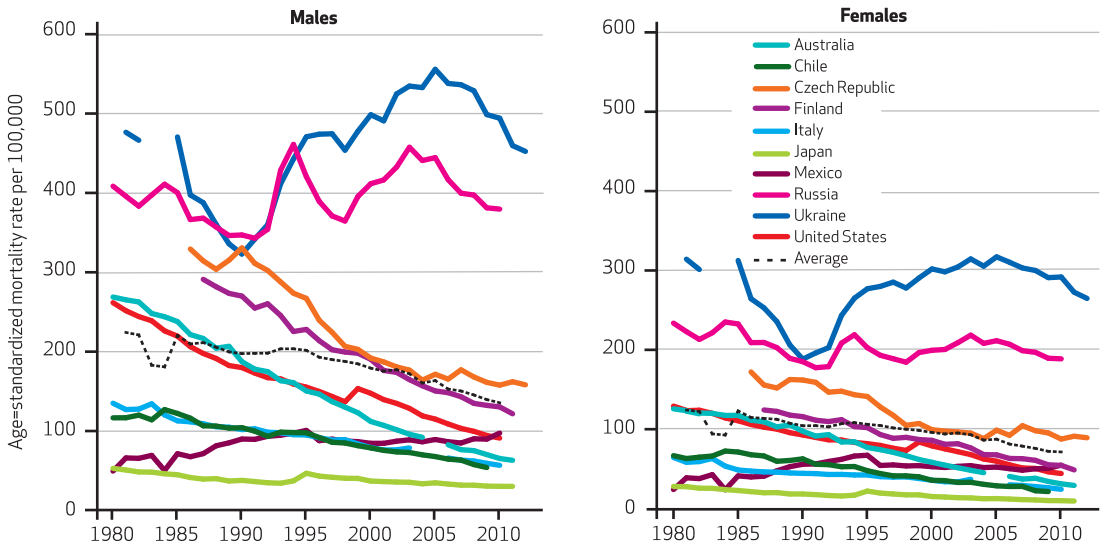
With few exceptions, heart disease mortality declined in almost every region of the world (Exhibit 1; for full results, see Appendix Figure B1)[11] and for men and women alike. Notably, heart disease mortality rates have always been higher—approximately double—among men than among women, and they remained so during the study period.

The lowest heart disease mortality rates over the entire study period were found in high-income Asia-Pacific countries such as Japan and Hong Kong and in Mediterranean countries such as Spain, Italy, Greece, and Portugal. In general, greater mortality declines were observed in high-income countries than in low- and middle-income countries. Heart disease mortality was flat in many Eastern European countries, particularly for women. It increased in Mexico and fluctuated in Russia and Ukraine.

For stroke mortality (Appendix Figures A1 and

EXHIBIT 1

Trends In Age-Standardized Mortality Rate Per 100,000 Population For Ischemic Heart Disease Among Males And Females In Ten Selected Representative Countries, 1980–2012



SOURCE Authors' analysis of data from the World Health Organization Mortality Database (Note 7 in text) as reported directly from national authorities for the period 1980–2012. **NOTES** Data are presented for countries representative of their geographic and economic regional neighboring countries, as explained in the text. Gaps in country mortality rate lines reflect lack of data for those points in time. The dotted line represents the average age-standardized mortality rate of all countries with available data for ischemic heart disease over the period.

B2)[11] the pattern was similar, except that high-income Asia-Pacific countries had the highest mortality rates, not the lowest as they did for heart disease. Still, in the study period, most countries experienced declining cerebrovascular mortality. Countries experiencing flat mortality or slight increases were largely from central parts of the Americas (Mexico) and eastern parts of Europe (Belarus, Kazakhstan, Kyrgyzstan, Lithuania, Poland, and Russia).

GLOBAL DIABETES MORTALITY Diabetes mortality rates (Appendix Figures A2 and B3)[11] were mostly either flat or increasing. The exception was Greece, where the mortality rate declined sharply in the 1980s. Flat rates were seen in the Americas, Western Europe, and the Mediterranean. Increases were observed in Mexico and, to a lesser degree, in Australia, New Zealand, Trinidad and Tobago, Venezuela, and some Eastern European and Western Asian countries.

Diabetes mortality rates throughout the study period were substantially lower than those for cardiovascular diseases and remarkably similar among men and women.

GLOBAL CHRONIC RESPIRATORY DISEASE MORTALITY Chronic respiratory disease mortality rates (Appendix Figure A3 and B4)[11] were also lower than those for cardiovascular diseases, but higher than for diabetes. Trends varied by sex. Divergent patterns for men and women—in which mortality rates declined or flattened for men but increased for women—were observed in many high-income countries, including Australia, New Zealand, Canada, the United States, the United Kingdom, and some Western European countries. In contrast, convergent patterns of declining mortality for both sexes were noted in Italy, Japan, some Eastern European countries, and some Latin American countries. In Russia and some Western Asian countries, chronic respiratory disease mortality increased among men and women until the mid-1990s and then declined.

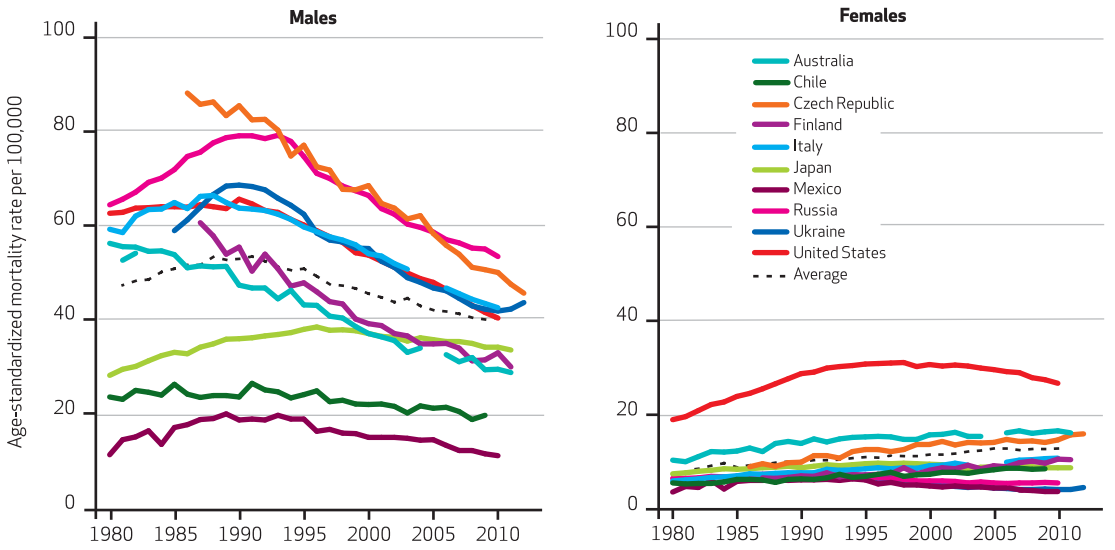
Whether divergent or convergent, chronic respiratory disease mortality rates among women were generally half the magnitude observed in men.

GLOBAL CANCER MORTALITY Cancer mortality patterns across regions were different by country income level and sex, depending on the organ involved.

▶ **LUNG CANCER:** Lung cancer mortality rates among men generally declined or at least flattened across all countries (Exhibit 2; also see Appendix Figure B5).[11] For women, absolute lung cancer mortality rates were lower than for men but generally increased over time. These divergent patterns were most pronounced in Australia, the Czech Republic, Finland, Italy, Russia, the United States, and their respective

EXHIBIT 2

Trends In Age-Standardized Mortality Rate Per 100,000 Population For Lung Cancer Among Males And Females In Ten Selected Representative Countries, 1980–2012



SOURCE Authors' analysis of data from the World Health Organization Mortality Database (Note 7 in text) as reported directly from national authorities for the period 1980–2012. **NOTES** Data are presented for countries representative of their geographic and economic regional neighboring countries, as explained in the text. Gaps in country mortality rate lines reflect lack of data for those points in time. The dotted line represents the average age-standardized mortality rate of all countries with available data for lung cancer over the period.

regions. Although the divergent pattern was the same, the mortality slopes were milder in Chile, Japan, Mexico, Ukraine, and their regional neighbors.

▶ **COLON CANCER:** Colon cancer mortality rates were much more convergent for men and women within regions than was the case for lung cancer, but across-region differences were very evident (Exhibit 3; also see Appendix Figure B6).[11] Flat or declining mortality rates were observed in Australia, the Czech Republic, Finland, Italy, the United States, and their neighbors. Meanwhile, increases, whether slight or more pronounced, were observed in Japan, Chile, Mexico, Russia, Ukraine, and their neighboring countries. Thus, worldwide, there were general improvements in colon cancer mortality in high-income countries, but not in low- and middle-income countries.

▶ **BREAST CANCER:** Breast cancer mortality patterns were similar to those observed for colon cancer (Exhibit 4; also see Appendix Figure B7).[11] After reaching a peak in the early 1990s, breast cancer mortality rates generally decreased in Australia, Europe, and North America. Meanwhile, continued increases in breast cancer deaths were observed in regions represented by Japan, Mexico, Russia, and Ukraine, with flat levels in Chile.

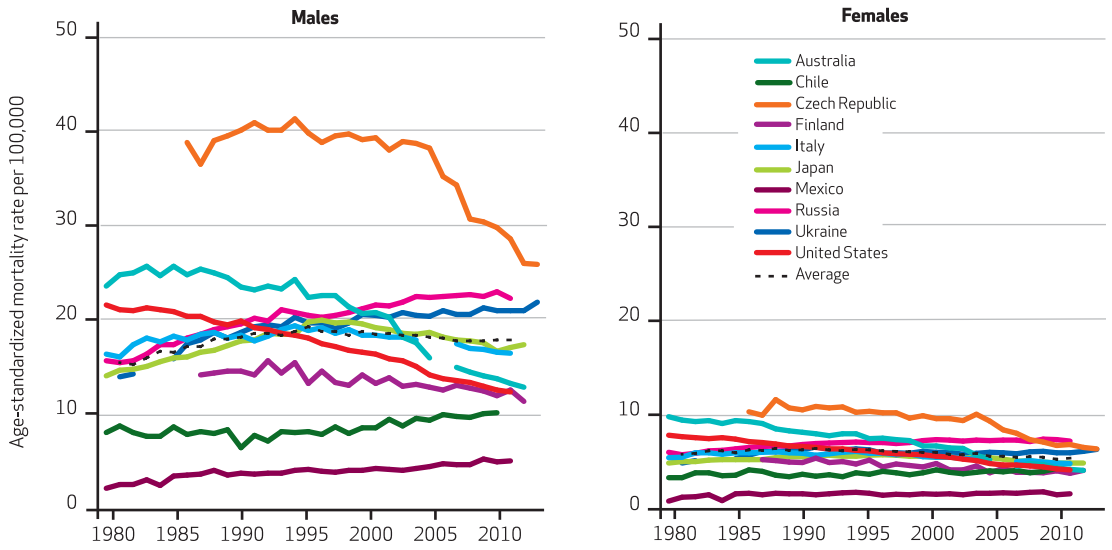
▶ **CERVICAL CANCER:** Among infectious-origin cancers, cervical cancer mortality rates decreased around the world (Exhibit 5; also see Appendix Figure B8).[11] The rates were already quite low in high-income regions such as the Asia Pacific, Western Europe, and North America and continued to decline in those regions. Latin American countries experienced substantial decreases in cervical cancer mortality, while Eastern European and Western Asian countries had less pronounced decreases.

▶ **LIVER CANCER:** Among both men and women, liver cancer mortality rates increased in the English-speaking high-income Asia Pacific, Latin America, and North America (Exhibit 6; also see Appendix Figure B9).[11] In Western Asian, Mediterranean, and Western European countries, there were more modest increases in liver cancer mortality among men and women. The only countries with substantial declines in liver cancer mortality were Japan after 1995 and Hong Kong, though rates started and remained noticeably higher there than in other regions.

▶ **STOMACH CANCER:** Stomach cancer mortality rates declined in all countries among both men and women (Exhibit 7; also see Appendix Figure B10).[11] The most pronounced mortality reductions were observed in Chile, Japan, Russia, and neighboring countries.

EXHIBIT 3

Trends In Age-Standardized Mortality Rate Per 100,000 Population For Colon Cancer Among Males And Females In Ten Selected Representative Countries, 1980–2012



SOURCE Authors' analysis of data from the World Health Organization Mortality Database (Note 7 in text) as reported directly from national authorities for the period 1980–2012. **NOTES** Data are presented for countries representative of their geographic and economic regional neighboring countries, as explained in the text. Gaps in country mortality rate lines reflect lack of data for those points in time. The dotted line represents the average age-standardized mortality rate of all countries with available data for colon cancer over the period.

Discussion

We noted important changes in noncommunicable disease mortality rates between 1980 and 2012. In high-income countries, mortality generally declined over time, except for deaths due to diabetes and to liver cancer for both sexes and to chronic respiratory diseases and lung cancer among women. In low- and middle-income countries, patterns were mixed: Cardiovascular disease deaths remained relatively constant, while diabetes, colon cancer, and breast cancer deaths increased over time. Also, although there were important reductions in cervical cancer mortality rates, the magnitude of the rates remained higher in low- and middle-income countries than in high-income countries over time. Lastly, worldwide, mortality rates for cardiovascular diseases; chronic respiratory diseases; and lung, colon, liver, and stomach cancer were consistently higher for men than for women.

Changes in mortality patterns have not occurred uniformly across regions and countries. Where noncommunicable disease mortality reductions have been observed—whether in high-income countries or in low-and middle-income countries—the patterns likely reflect the impacts of health system interventions and selected regulatory policies. These include tobacco taxation,[13] medications that lower lipid or blood pressure levels,[14,15] and individual behavioral interventions.[16,17] Where implemented effectively, these have contributed to decreases in noncommunicable disease mortality. In other cases, flat or increasing mortality rates reflect rapid societal transitions, the absence of interventions, or both.

It is beyond the scope of this article to provide a formal analysis that quantifies the contributions of different exposures and interventions to country-level mortality patterns for these noncommunicable diseases. Instead, below, we briefly review the literature and identified health system and societal factors that have contributed to the trends for each condition. Further below, we summarize knowledge and capacity gaps that impede progress.

HEALTH SYSTEM FACTORS Much has been written about declining cardiovascular disease mortality rates,[12,18–21] which may at least partially explain overall declines in all-cause mortality.[2] Studies from the United States[18] and Canada,[19] Finland,[21] Poland,[22] Turkey,[23] the United Kingdom,[20] and twenty-six high-income countries combined[24] have shown that reductions in cardiovascular disease risk factors together account for 40–70 percent of observed declines in cardiovascular disease mortality in these countries. Medical care—particularly, coronary revascularization via bypass surgery or angioplasty—

EXHIBIT 4

Trends In Age-Standardized Mortality Rate Per 100,000 Population For Breast Cancer Among Females In Ten Selected Representative Countries, 1980–2012

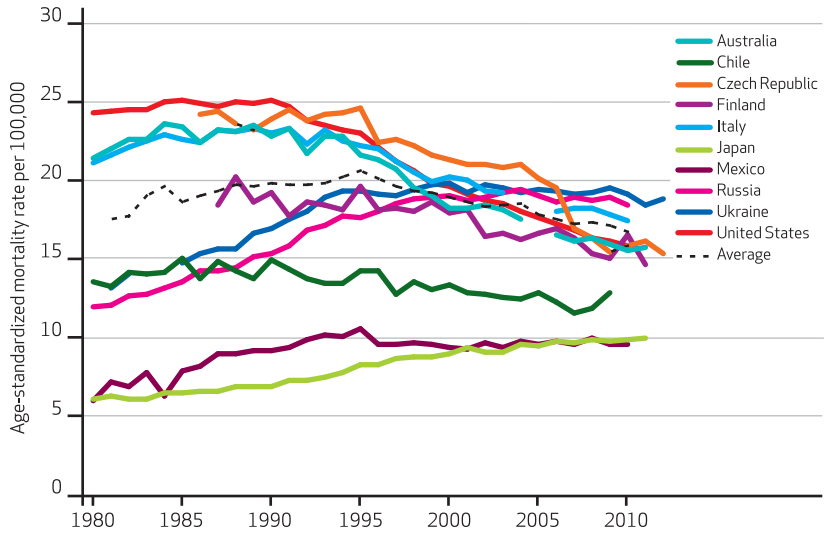


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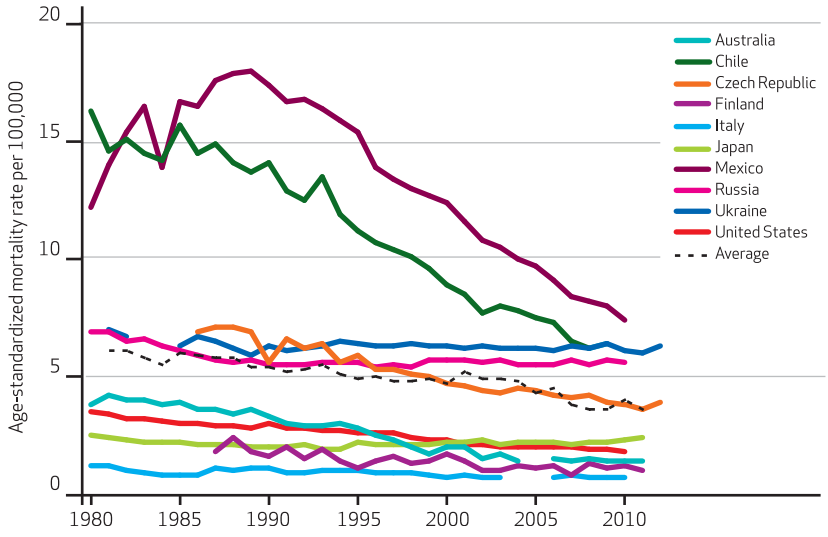
EXHIBIT 5

Trends In Age-Standardized Mortality Rate Per 100,000 Population For Cervical Cancer Among Females In Ten Selected Representative Countries, 1980–2012



SOURCE Authors' analysis of data from the World Health Organization Mortality Database (Note 7 in text) as reported directly from national authorities for the period 1980–2012. **NOTES** Data are presented for countries representative of their geographic and economic regional neighboring countries, as explained in the text. Gaps in country mortality rate lines reflect lack of data for those points in time. The dotted line represents the average age-standardized mortality rate of all countries with available data for cervical cancer over the period.

EXHIBIT 6

Trends In Age-Standardized Mortality Rate Per 100,000 Population For Liver Cancer Among Males And Females In Ten Selected Representative Countries, 1980–2012

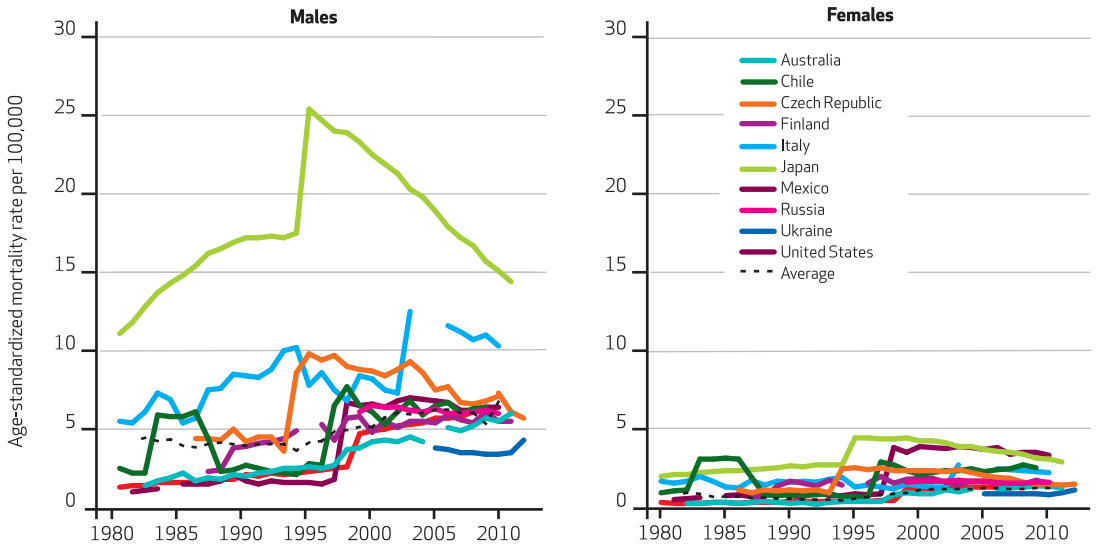


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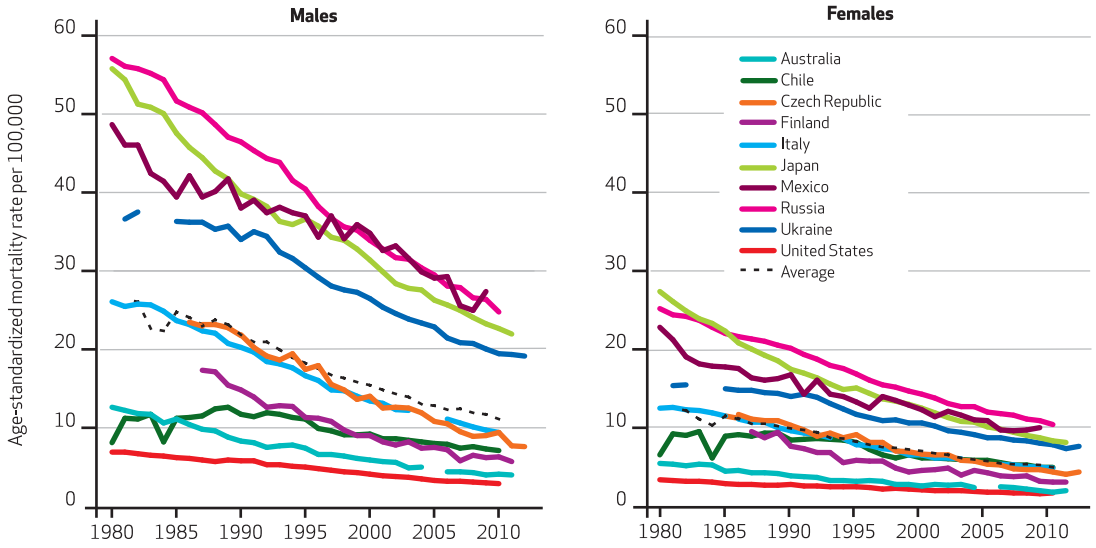
EXHIBIT 7

Trends In Age-Standardized Mortality Rate Per 100,000 Population For Stomach Cancer Among Males And Females In Ten Selected Representative Countries, 1980–2012



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Socioeconomic development has had positive and negative influences on noncommunicable disease mortality.

accounts for the remaining reductions in cardiovascular disease mortality in high-income settings.[18–20] This is corroborated by the fact that globally, both mean blood pressure and cholesterol levels have plateaued or declined over the past three decades.[25,26]

There is no clear explanation for these population-level physiological improvements. It is possible that greater availability and use of medications that lower lipid and blood pressure levels,[25,26] dietary changes,[27] or both have played a role. It is also not clear whether flat or increasing cardiovascular disease mortality rates in some low- and middle-income countries such as Mexico reflect increasing exposure to tobacco, alcohol, and other cardiovascular disease risk factors;[28,29] continued gaps in treatment and implementation or enforcement of tobacco control policies; or a lag in intervention benefits.[28,30,31]

Cardiovascular disease is a leading cause of death among people with diabetes, particularly in high-income countries.[32] However, it remains unclear whether reductions in cardiovascular disease mortality have benefited people with diabetes as much as they have benefited those without diabetes. Studies in the United States have found that cardiovascular disease mortality has decreased among people with diabetes.[33,34] This might explain increases in mortality not related to cardiovascular disease that have been observed globally among people with diabetes.

Another explanation for increases in diabetes mortality could be an increase over time in reporting diabetes as the primary cause of death, as seen in another recent study in the United States.[35] Yet another explanation is that the global prevalence of diabetes and absolute numbers of people with the condition have increased dramatically,[36] a trend that is likely related to continued increases in obesity. No country in the world has managed to decrease the prevalence of obesity.[37] In fact, it is remarkable that cardiovascular disease mortality declined globally despite increasing obesity. Although cardiovascular disease is not as strongly associated with obesity as it is with other metabolic factors, obesity reductions likely would have produced even greater cardiovascular mortality reductions.[38]

For breast cancer, many high- and middle-income countries have annual campaigns to raise awareness of the deadly and emotional consequences of breast cancer. This has likely led to increased self-examination; screening, including genetic screening; and treatment, and to better survival.[39] Sophisticated treatments targeting estrogen receptors for receptor-positive cases have also been shown to prolong survival,[40,41] but these treatments remain prohibitively expensive and so far have had limited reach for all but the wealthiest population groups.

Although cervical cancer mortality has declined worldwide, disparities remain. Low- and middle-income countries still experience higher mortality rates than high-income countries, perhaps because of limited awareness of cervical cancer, limited access to screening and health care, or both. While adequate data were not available from African countries for this article (the only African country with available data was Mauritius, which may not be representative of the region as a whole), Global Burden of Disease Study data show that rates of cervical cancer incidence and mortality in Africa are far higher those in other regions.[42] National awareness of cervical cancer and human papillomavirus vaccination campaigns,[43,44] along with increased access to screening and care, are needed to address this disparity.

Liver cancer mortality appears to have increased slowly worldwide. Despite increased hepatitis B vaccination provision at birth—which has reached 81 percent globally, according to the WHO[45]—the observed mortality increases from 1980 to 2012 might reflect adults who were not vaccinated in early life, the emergence of hepatitis C infections,[46] increases in alcohol use,[47] or better documentation of liver cancer deaths. Screening of blood products and interventions to reduce intravenous drug use may offer long-term benefits in lowering viral transmission.

With regard to stomach cancers, the combination of improved living conditions; reduced consumption of preserved meats; reduced smoking; and, more recently, the identification and treatment of *Helicobacter pylori* infection[48] has contributed to marked global mortality reductions.[49–51]

SOCIETAL FACTORS Socioeconomic development has had positive and negative influences on noncommunicable disease mortality. On the one hand, better hygiene and refrigeration have lowered exposure to infections and facilitated

year-round access to fruit and vegetables. On the other hand, economic development also increases exposure to harmful risk factors such as tobacco, environmental pollutants, and unhealthy food.[28] Evaluating whether and how societal factors or policies to address these exposures affect mortality is challenging, not least because of the lengthy follow-up required, and there are also issues of ecological fallacy and confounding. As a result, causation may never be conclusively demonstrated.

In the context of societal interventions to improve health, the necessary ingredients to make informed decisions include data regarding disease burdens, data regarding intervention effectiveness, resources, and the human and infrastructural capacity to act.[52] These ingredients do not all carry the same weight, but collectively they provide a framework in which effectiveness data from experimental studies, computational models, or quasi-experimental evaluations of large-scale policies or programs can be put to use. Ultimately, however, the data and study designs required to prompt action, as well as the ideologies influencing decisions, are specific to countries and to policy makers within countries.

We present two examples to illustrate this. Tobacco use is not a controversial target for intervention. Even with only observational studies at hand, a critical threshold of awareness and political will has been reached to prompt the implementation and enforcement of tobacco control policies. For example, both Australia and Uruguay can boast of outstanding antitobacco efforts,[53,54] and both experienced remarkable reductions in mortality from lung cancer and chronic respiratory disease.

Obesity offers a different example. In this case, the risk factors that should be targeted for intervention are mired in controversy, which leads to inaction. The food system is considered a primary culprit and potential point of intervention. However, diets are complex and composed of both good and bad nutrients. Thus, there is no consensus about a malevolent nutrient to target. By extension, there are no robust data showing that regulating single food or beverage products might lower noncommunicable diseases and mortality. As a result, obesity prevalence continues to increase globally.

Where does this leave societal interventions to prevent or delay noncommunicable disease morbidity and mortality?

First, most existing data regarding societal interventions are from pre-post ecological studies and are not robust enough to support decisions to make changes to the built environment, food labeling, or regulation of the agricultural and beverage industries as sole approaches to shaping behavior. Instead, to date, societal interventions should be viewed as complementary to interventions aimed at helping individuals adopt and maintain healthy behaviors.

Commitments to noncommunicable disease prevention must survive changes in political leadership.

Second, there are cultural and logistical challenges to addressing noncommunicable disease risk behaviors. A detailed discussion of these is beyond the scope of this article. However, an example of these challenges is the positive cultural perceptions of white polished rice in India, which impede efforts to substitute the possibly more healthy brown rice.[55] Similarly, different cultural or community ideals of attractive body size in Africa (where smaller is not necessarily more attractive) complicate weight control efforts.[56]

Third, each setting has epidemiological nuances. In some countries, for example, noncommunicable diseases coexist with infectious, nutritional, and maternal-child illnesses. In these contexts, different epidemics compete for policy priority and limited resources. Some countries also have unique economic barriers to implementing public health policies, especially in cases where large industries apply political pressure. As an example, while tobacco use has grown in China, implementing and enforcing tobacco policies is complicated given the Chinese government's stake in the industry.[57]

In sum, in making informed decisions to improve population health through both societal and health system interventions, countries need to use the data at their disposal to determine which noncommunicable diseases are most burdensome, which need to be targeted with interventions, and which need not be addressed immediately. Countries should synthesize the best available data on the effectiveness of different interventions; identify local costs of implementing interventions; and strategically use qualitative data to refine their approaches in light of cultural, logistical, epidemiological, and economic factors.

KNOWLEDGE GAPS While the data presented here offer some good news, clearly much more

can be done to increase the number of healthy and productive life-years and to contain health care cost increases globally. First and foremost, improvements in accuracy of cause-of-death documentation by national authorities and increases in the proportion of the population covered by vital registries would provide a more complete global picture and aid large countries such as India and China in their planning.

Second, large gaps exist in what is known about interventions to address noncommunicable diseases. Efficacy of interventions in trials can be determined, but their implementation, effectiveness, and cost-effectiveness in real life are less clear. There are interventions that have been proven to improve survival among people with existing heart disease, but less is known about the prevention of risk factors such as obesity and diabetes. Support for most societal-level nutrition and physical activity policies especially is patchy at best.[58]

Importantly, as countries and localities implement policies and programs, those efforts should be accompanied by robust evaluations. Ensuring longitudinal, repeated assessments of exposures and outcomes among those exposed and adequate control groups would go a long way toward enhancing causal inferences from these evaluations.[59]

Third, little is known about the human, financial, and infrastructure capacities that are needed to address noncommunicable diseases, especially in low- and middle-income countries.[60]

Conclusion

Multiple factors are involved and interact in the development and progression of noncommunicable diseases—namely, genetic, lifestyle, economic, psychological, and social factors. Therefore, noncommunicable disease prevention and control require integrated, complementary, and comprehensive approaches. For example, weight-loss counseling would be ineffective without dietary guidelines. By extension, national dietary guidelines that are not supported by complementary agricultural policies could lead to diluted outcomes.

In addition, because noncommunicable diseases are progressive and chronic, investments in prevention and management must be viewed over the long term during which health and economic returns accrue.[61] Therefore, commitments to noncommunicable disease prevention must also survive changes in political leadership.

Lessons from other countries can help. But given all of the nuances mentioned above, additional funding and country-specific evidence might be even more important in stimulating action within a given country. Without this evidence, decision makers cannot assess the potential value of their investments and decide how to situate and structure interventions and systems (that is, the financing, organization, governance, and deployment of technology) to address noncommunicable diseases. The agenda is extensive and daunting, but the analysis presented here offers hope that coordinated efforts can lower mortality. ■

NOTES

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11 To access the Appendix, please click on the Appendix link in the box to the right of the article online.

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