Commentary

Disease Burden: Progresses Made, Current State, Future Challenges, and Opportunities

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DEMOGRAPHIC AND EPIDEMIOLOGICAL TRANSITIONS AND CURRENT STATE OF DISEASE BURDEN IN CHINA

Over the past three decades, the world has witnessed perhaps the most dramatic demographic and epidemiological transitions in China. During this period, the population of China has grown by a quarter of its size in 1990 to 1.41 billion in 2020 (*1*). Even though the fertility rate in China has experienced a sustained decline, mortality among the Chinese population has improved tremendously. Life expectancy at birth, a succinct summary index of overall mortality levels, has improved by 9.5 years to 77.6 years in 2019 (*2*). This is equivalent to an increase of a third of a year in life expectancy at birth for every calendar year in the past three decades, a feat rarely achieved by other countries at similar starting points.

Such impressive improvements in all-cause mortality coincided with a shift in both levels and compositions of causes of death during the same period. This rapid epidemiological transition manifested in a fast shift of disease burden from communicable diseases to non-communicable diseases (NCD), a continuation of health trends which started well before the 1990s. In 1990, about 12% of deaths in China came from infectious diseases. This proportion declined significantly to less than 3% in 2019. Meanwhile, the proportion of deaths due to NCDs increased by 17 percentage points to 90.1% in 2019 (*3*). With the continued improvement in economic conditions and general living conditions, it is safe to say almost all disease burden in China in the future lies in various diseases in the NCD category, a feature shared by all developed nations currently.

With this shift in disease burden to NCDs and improvements in health care and medical treatment, an average Chinese citizen spends more years with less-than-optimal health now compared to 1990. In 1990, the difference between life expectancy and healthy life expectancy (HALE) was 6.6 years. This gap has increased by about 40% over the past three decades to 9.1 years in 2019 (*2*). Such interconnections between improvements in population health and the challenges they present to both the public health and medical community requires rigorous research on the disease burden for precise and targeted health policy setting in China.

UNIQUE OPPORTUNITY IN BURDEN OF DISEASE RESEARCH

To know precisely where the disease burdens are coming from, health analyses must consider the combination of fatal and non-fatal outcomes of each disease and the risk factors responsible for each disease. Data on causes of death, prevalence and incidence of different diseases, and risk factor prevalence and exposures among the population should be used in combination with sophisticated statistical models, which can make sense of often sparse and biased data that may be inconsistent among different aspects of a single disease. All these factors are sorely needed to capture the full picture of health trends.

China is uniquely positioned to provide a wealth of data on population health to track precise distribution of disease burdens and its changes over time. In addition to diligently collected demographic data from the decennial censuses, intercensal surveys, and various sample surveys on fertility, the Chinese government has made tremendous achievements in setting up various disease surveillance systems, and civil and vital registration systems. Established in 1978 with only two pilot surveillance points in Beijing, the Disease Surveillance Points system (DSP), the bellwether of cause of death tracking system in China, has gradually increased to 145 points by 1990 with a covered population of 10 million. Further improvement in the last decade increased the number of DSP sites to 605, covering about one-quarter of the Chinese population (*4*). Being representative at the provincial level, cause

of death data from DSP is indeed the gold standard for mortality and burden of disease analysis in China. Another example of such richness in data is the National Maternal and Child Health Surveillance system, a perfect complement to the DSP system, which provides much more nuanced and accurate information on disease burden among children under age five.

Yet, to make sense of various data systems focusing on different aspects of the health of a population, a unified analytical framework is sorely needed to generate internally consistent estimates on incidence, prevalence, mortality, morbidity, and the associated risk factors of not just a few major diseases, but all diseases classified in the International Classifications of Diseases. This is particularly true for China, a country with over 1.4 billion population.

The Global Burden of Disease (GBD) analytical framework, developed for the World Health Organizations more than two decades ago, is the most comprehensive and continuously improved tool for the assessment of the burden of disease at the population level. Over the past decade, researchers from GBD's global collaborative network of over 7,000 members and the researchers from various research institutions in China and the China CDC have produced not only a systematic assessment of disease burdens and its associated risk factors at the country level, but also at the provincial level (*5*). The provincial level study is one of the first two in the world, the other being a state-level disease burden assessment for the United States.

FUTURE DIRECTIONS FOR BURDEN OF DISEASE WORK IN CHINA

County Level Estimation For More Targeted Interventions

While provincial level assessments of burden of disease provide much needed information that national level metrics fail to present, for most provincial-level administrative divisions (PLADs) in China, a more granular assessment is necessary because of the population sizes of PLADs. The heterogeneity in geography, economics, and other socio-epidemiological situations among counties even within the same PLAD further demonstrate that provincial level assessment is not enough. Evaluation of disease burden at the county level is critical in providing the much-needed population health information for both the national and provincial governments to make targeted and efficient public health policies to make sure no one is left behind. Figure 1 below shows the age standardized death rate due to stroke at the county level in US in 2014. Our experience with burden of disease analysis at the county level in the United States shows the policy relevancy given the high level of heterogeneity among counties within the state and across the country (*6*).

China has been one of the most successful countries in achieving the Millennium Development Goals. To obtain similar or higher levels of success in the Sustainable Development Goal era, more nuanced and targeted interventions are needed to help counties that are lagging behind to achieve their full potential in improving population health. Burden of disease analysis at the county level is uniquely equipped to provide key information for decision makers at both the provincial and national levels. Researchers in China, particularly those at both the national and provincial CDCs, should take the challenge and further advance population health assessment in China at the county level.

Integrating Scenario Forecasting as a Policy Tool

Most burden of disease work focuses on making sensible and comprehensive population health estimates up to now using historic and empirical data. Such analysis is important as it provides the baseline of burden of disease of a population. Even equipped with such information, natural questions for policymakers are what interventions are available and what impact a certain intervention would exert on the future of population health and burden of disease. In this regard, scenario-based forecasting is critical in helping policymakers to make sense of the best intervention programs to achieve specific population health goals with the available budget and resources.

The GBD collaborative network has expanded upon the framework of Comparative Risk Analysis developed for the first Global Burden of Disease study at World Health Organization to make scenario specific forecasts of cause specific burden by assuming different level of changes in risk factors associated with various diseases (*7*). Figure 2 below shows the global distribution of country level mortality due to stroke in 2040 based on both mortality and risk factor assessments up to year 2016. This type of scenario-based forecast is a particularly useful tool for policymakers, effectively

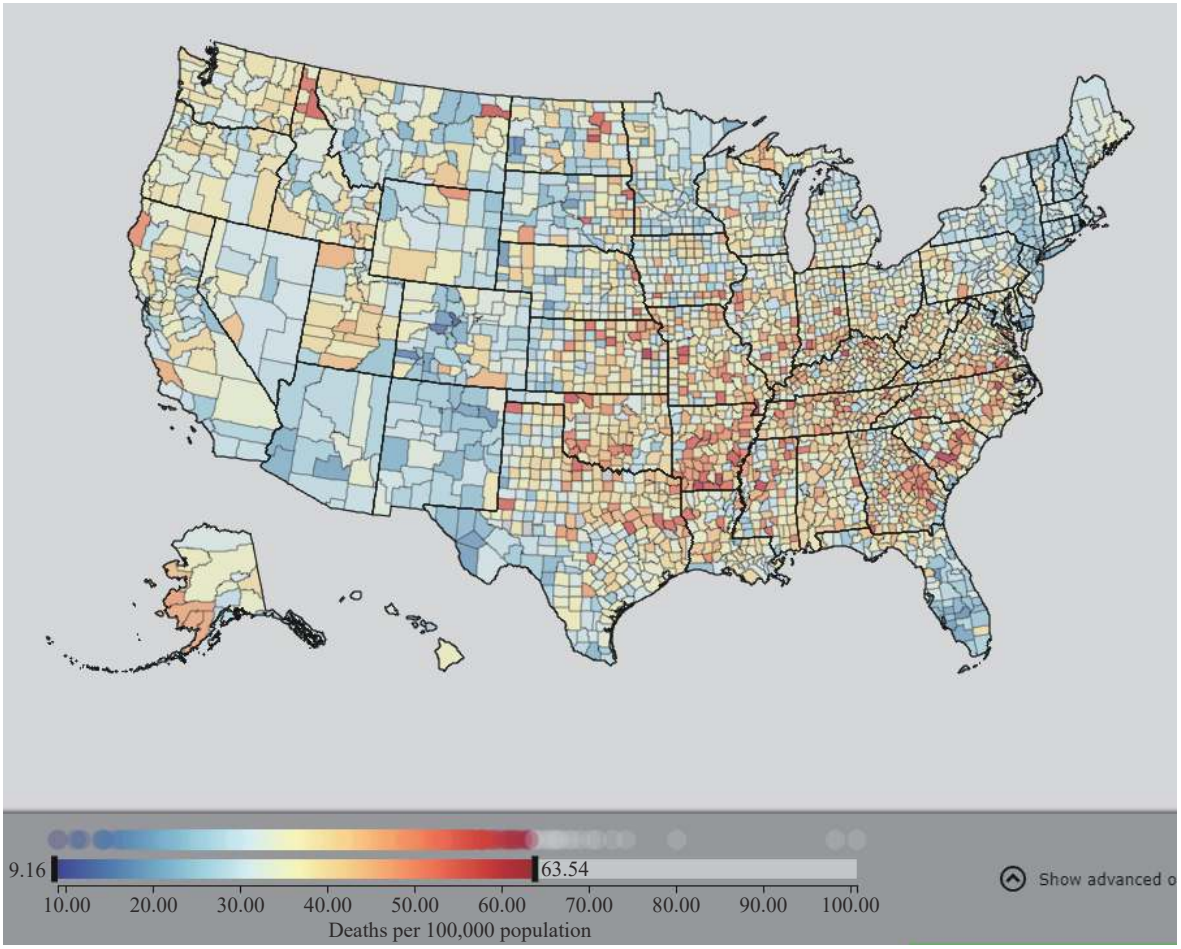

FIGURE 1. Age standardized death rate due to stroke at the county level in the United States in 2014.
Note: the figure is captured from the United States Health Map | IHME Viz Hub (healthdata.org).

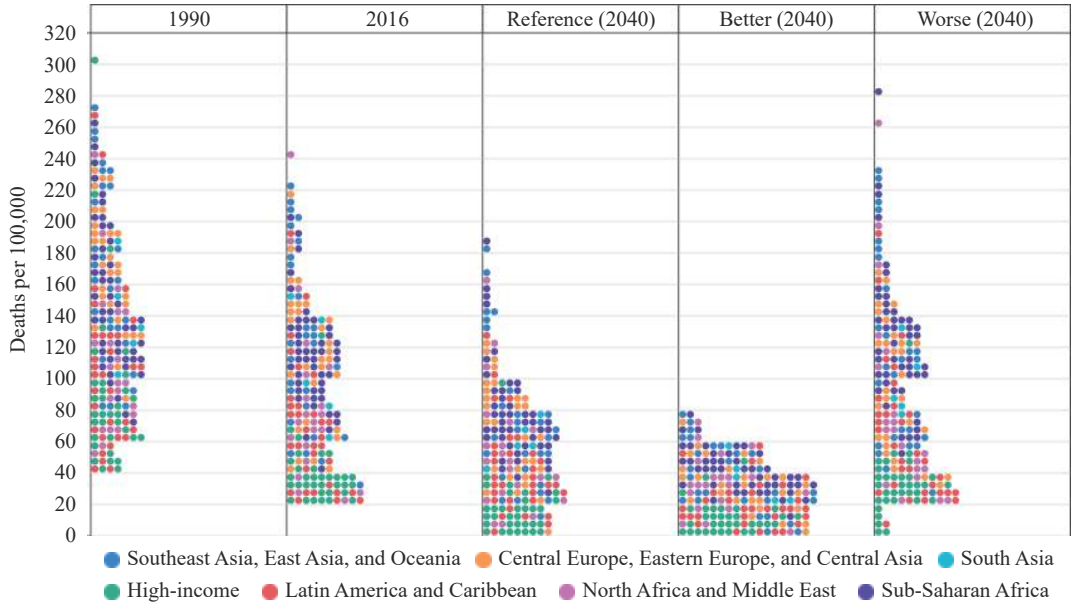

FIGURE 2. Global distribution of country level mortality due to stroke in 2040.
Note: Data is based on both mortality and risk factor assessments up to year 2016.
Resource: GBD Foresight | IHME Viz Hub (healthdata.org).

providing a menu of interventions with tangible changes in population health metrics such as number of deaths averted, improvement in life expectancy, and years of lives saved.

With rapid improvements in mortality and falling fertility rate, particularly since the Reform and Opening in 1978, China is experiencing rapid population aging which is likely to continue further into the future. The increasing burden of disease, particularly due to NCDs, while presenting a significant challenge to both national and subnational governments, also presents a historic opportunity for various industries to develop necessary technologies, tools, and medicines to improve quality of life, improving survival from diseases, and further improve life expectancy and HALE. To meet such a challenge, detailed and accurate assessments of burden of disease at county, provincial, and national levels should be considered a top priority for policymakers.

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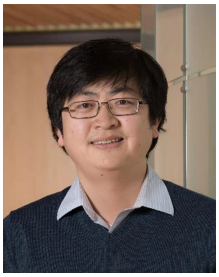

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