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Testimony before the U.S.-China Economic and Security Review Commission

China's Evolving Healthcare Ecosystem: Challenges and Opportunities

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Thank you for the opportunity to provide testimony for this hearing. I was asked to testify as part of Panel I, which assesses China's domestic healthcare infrastructure, and the use of technology in China's healthcare system in light of COVID-19. I was asked specifically to focus my testimony on the following questions:

- What are the Chinese government's objectives for the development of its healthcare system? Assess the government's progress to achieving these objectives. What is the cost burden on the Chinese government?
- How has China's healthcare system developed in recent years to cope with an aging population?
- What is the extent of healthcare coverage (e.g., doctors per thousand people, hospital beds per thousand, etc.), and what is the quality of the coverage across different population segments? What is the cost burden on citizens?
- Describe the training pipeline for China's doctors, nurses, and health administrators.
- What are Beijing's ambitions for its domestic healthcare system, and how do they affect its interaction with the healthcare markets in the United States and other countries?
- The U.S.-China Commission is mandated to provide recommendations to Congress for legislative action; what recommendations do you have for congress regarding the development of China's healthcare system and its implications for the United States?

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China's national health reforms over the past two decades have brought the system closer to the modern, safe, reliable and accessible health system that is commensurate with China's dramatic economic growth, improvement in living standards, and high hopes for the next generation.[2]

China's national health reforms of 2009—continuing many reforms undertaken since SARS (2003)—consolidated a system of social health insurance covering the entire population for basic health services, contributing to a surge in healthcare utilization while reducing out-of-pocket costs to patients – which declined from 56% to 28% of total health expenditures between 2003 and 2017. An expanded basic public health service package, funded by per capita government budget allocations that include a higher central government subsidy for lower income provinces, provides basic population health services to all Chinese. Now the governance structure consolidates the purchaser role for social health insurance schemes under the National Healthcare Security Administration, with most other health sector functions under the National Health Commission. China's world-leading technological prowess in multiple fields spanning digital commerce to artificial intelligence—and accompanying innovative business models such as WeDoctor that have not yet been fully integrated into the health system—hold promise for supporting higher quality and more convenient healthcare for China's 1.4 billion.

However, many challenges remain, from dealing with COVID-19 and its aftermath, to other lingering challenges, from promoting healthy aging to the political economy of addressing patient-provider tensions, changing provider payment to promote "value" rather than volume, and deciding which new medical therapies qualify as "basic" for the basic medical insurance schemes. To make China's investments in universal health coverage and the accompanying rapid medical spending growth sustainable in the longer-run, policies need to help the most vulnerable avoid illness-induced poverty, increase health system efficiency, strengthen primary care, and reform provider payment systems, as Hai Fang and other colleagues and I argued recently (Fang et al. 2019).[3]

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[2] This section and much of the remainder of this testimony draw from my recent research, individuals works of which I have cited, as well as the text of my Stanford Asia Health Policy program working paper "Healing One-fifth of Humanity: Progress and Challenges for China's Health System," October 2019, available at https://aparc.fsi.stanford.edu/asiahealthpolicy/research/asia_health_policy_program_working_paper_series. A condensed and edited version of that research appears in Milken Institute Review: A Journal of Economic Policy, 4th Quarter 2019.

[3] For an overview of China's health system reforms, see the June 2019 special collection of articles in BMJ by Professor Qingyue Meng and colleagues of Peking University and their international collaborators.

- What are the Chinese government's objectives for the development of its healthcare system?

Broadly, China's government aims to develop its healthcare system to be comparable to the best among similar economies in the world and to meet the expectations of its citizens. At the beginning of the 21st century it set an ambitious goal for achieving universal health coverage after SARS, and has achieved that goal. The resulting system of basic medical insurance programs is gradually reducing disparities in coverage (e.g. between formal sector employees with relatively generous, compulsory coverage, and rural and informal sector workers or dependents, with subsidized voluntary coverage). I discuss these issues more in the healthcare financing section below.

Improved health arises from non-medical factors as much as from medical care, and many of those non-medical factors, and how they are prioritized in governance, can be considered part of the broader health system ecosystem in a society. Accordingly, discussion of China's health system objectives should include the specific goals for population health as well as healthcare goals over the coming decade, as set forth in October 2016 by President Xi Jinping in the "Healthy China 2030" blueprint (similar to the US "Healthy People" developed for decades, now common in many countries).[4] Healthy China 2030 includes over 20 chapters covering public health services, environment management, the Chinese medical industry, and food and drug safety. There are five specific goals to improve the level of health nationwide, control major risk factors, increase the capacity of the health services, enlarge the scale of the health industry broadly defined, and improve the health service delivery system. The blueprint sets forth "core principles"—health priority, reform and innovation, scientific development, and justice and equity—and outlines 13 core indicators to be reported this year and 2030.

China has achieved considerable progress in many of these arenas. As shown in Figure 1, life expectancy at birth compares favorably with other upper-middle income countries and even with some OECD countries (76.5 in China in 2018 according to OECD data, compared to 78.6 in US), while child vaccination rates surpass those of the US and many other wealthier countries (Figure 2). There remain several issues of concern, such as high male smoking rates (Figure 3), which contribute to the gap in

[4] See the "Outline of Healthy China 2030 Plan" (The State Council, 2016). The "Healthy People" plans in the United States "provide science-based, 10-year national objectives for improving the health of all Americans. For 3 decades, Healthy People has established benchmarks and monitored progress over time in order to: Encourage collaborations across communities and sectors; Empower individuals toward making informed health decisions; Measure the impact of prevention activities." (https://www.healthypeople.gov/2020/About-Healthy-People).

life expectancy between men and women (see Figure 1) and is the leading cause of premature mortality.

The Healthy China goals also seek to redress the health disparities within China, which remain wide despite laudable progress in lifting millions out of poverty. For example, as I emphasize in the introduction to *Healthy Aging in Asia* (Eggleston 2020), residents of the most developed provinces (megacities) enjoy first-world health outcomes, virtually a different country from that of their compatriots in the lowest-developed provinces, as illustrated by the 10-plus-year gap in life expectancy between the lowest and highest provinces -- equivalent to the gap in life expectancy between high-income and middle-income countries.

China's goals include building a stronger, more comprehensive and higher quality health insurance and health service delivery system. Having achieved universal health coverage through a network of basic social insurance schemes, China's health system now is moving on to harder steps that confront most health systems: implementing evidence-based policy to make new technologies available broadly; investing in and monitoring quality and responsiveness; providing greater financial protection and access for those most vulnerable, to ameliorate disparities in access and health outcomes; keeping up investment in pandemic preparedness even when other priorities come to the fore. Below sections of the testimony address the progress towards these goals and remaining challenges for China's health system.

- What is the extent of healthcare coverage (e.g., doctors per thousand people, hospital beds per thousand, etc.), and what is the quality of the coverage across different population segments?

China's healthcare infrastructure, or health service delivery system, includes its clinics and hospitals as well as the healthcare professionals that provide services within them. All these aspects of medical care in China have developed substantially since the turn of the 21st century, with policy goals to continue to improve both access and quality. This section provides an overview of that healthcare service delivery system, starting with arguably the most important aspect: the healthcare workforce, the human capital undergirding the health service delivery system.

As shown in Figure 4, skilled health professionals per 1000 population in China have increased substantially from 2.85 per thousand in 1980 to 7.04 per thousand in 2019, with noticeably accelerated growth after 2005 (correlated with the post-SARS health system investments). Within healthcare professions, the number of doctors per 1000 population increased from 1.2 in 2000 to 2 in 2017, comparable to the average for upper middle-income countries globally, and similar to Brazil (2.2), and far higher than India, South Africa, or Indonesia – each with less than one doctor per thousand, according to World Bank data. China's relatively low doctors or nurses per capita

relative to OECD countries (Figures 5 and 6) contrast with China's 4.3 hospital beds per 1000 residents, which exceeds that of the US (2.8) and falls about in the middle of the OECD country range (Figure 7). Figure 8 shows China's substantial increase in doctors per capita since 2000, with China shown in comparison with the average for upper middle-income countries and the average for high income countries, as well as specific comparison middle-income economies (India, Brazil, South Africa Indonesia, Vietnam) and OECD countries (Japan, South Korea, and the US). These figures all illustrate that China is catching up but behind the average for OECD countries and its neighbors Korea and Japan in terms of doctors per capita.

To be more specific and in depth, consider data on the skilled healthcare workforce from the World Health Organization (WHO) *Global Health Workforce Statistics*, focusing on China (compiled by Jinlin Liu and drawing from our joint paper on the association between healthcare professionals and health outcomes across countries, Liu and Eggleston 2020). The WHO *Global Health Workforce Statistics* data aggregates skilled health workers in three categories: medical doctors, nurses, and midwives. The data we present is the most recent year available between 2007 to 2017 in each country.

China's density of skilled health workers per 1000 population rose from 2.87 in 2002 (right before the SARS crisis) to 4.63 in 2015 (the latest available figure), a 60% increase in a dozen years. Among the 178 countries for which 2017 data is available, the density of skilled health workers in China is 3 times the average of low-income countries, and 1.5 times that of lower-middle income countries (using the World Bank's classification), but less than half (37%) of that of high-income countries, which enjoy about 11 skilled health workers per 1000 population.

Unsurprisingly, China's significant increase in skilled healthcare workforce over the past couple decades is correlated with its well-documented improvements in multiple population health outcomes, such as infant mortality rates. As the density of healthcare workforce increases, health outcomes have also improved, with a significant decrease in maternal mortality (see Figure 9) and in under-five mortality over time (Figure 10). Of course, this relationship is partly driven by the overall improvement in living standards in China over the past two decades, which has improved health outcomes from the non-medical determinants or health as well as the resources available for investment in training and employing a larger healthcare workforce to serve China's 1.4 billion.

Medical Education

As noted, China has made significant strides in increasing the skilled healthcare workforce serving both rural and urban areas, although vast disparities remain. The heterogeneity of China's health providers arises early in the pipeline, in terms of who receives college education and who goes on to which levels of medical education. The

vaunted barefoot doctors of Mao-era China had minimal training beyond middle school. In today's China, doctors usually receive at least four years of medical training in earning an MD as an undergraduate degree, and many have deeper and longer training. To increase the level of standardized medical education and train more high-level general practitioners to work in the rural areas and primary care institutions, China launched the "5+3" model of medical education in 2015, with a degree program and residency training. Starting this year, residency training in an accredited program is required for all new medical graduates looking for work in a clinical capacity.

Medical curricula have also evolved. Since the last decade, the Chinese government's aggressive push to expand the number of General Practitioners (GPs) has opened new paths for individuals with varying backgrounds to obtain certification (Lian et. al, 2019). While five years of a Bachelor of Science education plus three years of required residency (standardized nationwide in 2014-15, as noted above) are often required for GPs who wish to operate in both urban and rural areas, assistant GP candidates can obtain certification with significant flexibility, some of which require only a 2-year technical degree (Lian et. al, 2019; Lio et. al, 2018). According to a study conducted in Henan (Wang, Fu, Liu et al. 2018), most undergraduate medical students do not choose a general practitioner career, and factors such as gender, family income and hometown location influence choice of specialty significantly.

Despite the rapid growth of GPs in the past decade, China's medical education still suffers from inconsistency in quality and teaching resources across different geographical areas (Lio et. al, 2018). Some analysts argue that the lack of competency and skill-focused curricula, and the lack of training in outpatient and palliative care, contribute to low public trust in practitioners' competency and effectiveness (Xu et. al, 2010; Jiang et. al, 2016).

To mitigate these problems, China has incrementally undertaken several measures to standardize its curricula, such as releasing new standards for the internal medicine curricula in 2014, strengthening residency programs, and launching the National Clinical Skills Competition in 2010 (Lio et. al, 2018; Jiang et. al, 2016). Some argue that the simulation-based competition in particular not only created incentives for institutions to improve practical training and dedicate more resources, but also enhanced inter-school communication between medical institutions (Jiang et. al, 2016).

As noted, rural areas are especially likely to lack robust numbers of skilled healthcare professionals. Like many large countries, China has tried many policies to address the relative lack of doctors in rural areas. In 2010, China launched a program to recruit and retain doctors in rural areas called the "rural-oriented tuition-waived medical education program." While relatively new, some empirical evidence about the program suggests it holds promise but is unlikely at the current scale to close the

urban-rural skill gaps any time soon. Jinlin Liu (2020), in his systematic review, discusses the features of this national RTME program, which has been implemented in 22 provinces in central and western China (along with 8 provinces in eastern China which have implemented provincial RTME programs on their own). From 2010 to 2019, over 56 thousand rural-oriented tuition-waived medical students (RTMSs) have enrolled in the national 5-year program, so that the program provides a steady source for increasing the rural health workforce in China. The majority of students enrolled in the 5-year and 3-year programs do start by fulfilling their obligations for rural service under the terms of the program, but it appears "impossible to completely improve the shortage of health workforce in rural China only relying on this single program. More efforts need to be taken to enlarge the enrollment number of RTMSs, improve intrinsic motivation of RTMSs to work in rural areas, improve the retention of RTMSs after work contracts expire, attract more medical graduates to work and stay in rural areas, and develop and implement more rural health worker programs in China" (Liu 2020).

Having discussed the development of the PRC healthcare system infrastructure and healthcare workforce, I now turn to health system financing, including the investments made by the government, social health insurance coverage, and households' remaining financial burdens.

- Assess the government's progress to achieving these objectives. What is the cost burden on the Chinese government? What is the cost burden on citizens?

During the health reform era since the beginning of the 21st century, China has attained universal health coverage and put in place a series of policies to enhance access to effective medical care while decreasing households' out-of-pocket spending burden.[5]

China's health spending has grown considerably as its economy has experienced unprecedentedly rapid growth and investments funded the expansion of healthcare documented in the previous sections. Nevertheless, China's health spending per capita is much smaller than that in the US or even most other OECD countries (Figure 11). Total health expenditures represent 5-6% of GDP (depending on how one aggregates spending), amounting to an expenditure per person about average for upper middle-income countries but well below that for high-income countries (Figure 12b). Over the past two decades, the government share of spending has expanded considerably, by 2017 representing slightly over 9% of overall government expenditures (Figure 13). These investments, into and alongside subsidized social health insurance programs, improved risk pooling and brought down the financial burden on patients and their families. Out-of-pocket spending ("tax on the sick") declined from about 60% in 2000 to about 36% in 2017 (Figure 14). This government spending—both directly on

[5] This summary draws from Eggleston 2019 and the sources cited therein.

healthcare infrastructure and subsidizing social health insurance for the rural and urban non-employee populations—substantially reduces the burden on families, although many lower-income groups still face the risk of catastrophic health spending from hospitalizations or other very large expenses.

Utilization has greatly increased for healthcare services, especially hospital outpatient department visits and inpatient admissions. The relative decline in utilization at the village or community level has been an unintended consequence, although relatively straightforward to predict: with less of an out-of-pocket burden, patients self-refer to more trusted providers at higher levels, and swell the ranks of those crowding into secondary and tertiary hospitals. However, because the insurance coverage of the rural insurance program, the New Cooperative Medical Scheme (NCMS), is less generous than for urban residents and especially relative to insurance for urban employees, the risk of catastrophic medical spending and illness-induced poverty remains higher for rural than urban residents.

Recent mergers of insurance risk pools—such as raising NCMS benefit levels to those of the urban resident basic medical insurance—and implementation of catastrophic supplementary insurance within local social health insurance systems are encouraging trends for closing gaps in risk protection. As of the end of 2018, 316.7 million were enrolled in Urban Employees' Basic Medical Insurance, 897.4 million in Urban-Rural Residents' Basic Medical Insurance, and 130.4 million in "remaining NCMS," according to the National Medical Security Administration. Per capita spending per enrollee ranged from 3,316.7 RMB per urban employee to only 700.3 RMB per person in urban-rural residents' insurance and 627.6 RMB per NCMS enrollee.[6] Thus, urban formal sector employees enjoyed health insurance benefits worth more than 5 times those of rural residents. Closing this gap while continuing to cover new life-saving therapies for all will confront China's medical system with financing challenges for years to come. Ongoing integration of urban residents' insurance with remaining NCMS has led to coverage under the "Urban-Rural Residents' Basic Medical Insurance" for the vast majority of Chinese. However, the level of risk pooling remains local to a given county or municipality, and the level of risk protection they entail still varies widely across localities.

Study of NCMS and other health programs provide suggestive but not definitive evidence that they may have contributed to closing the mortality gap between rural and urban China, although the true impact is difficult to untangle from all the other changes affecting survival trends in China; see Zhou, Liu, Bundorf et al. 2017.

Expanding and equalizing catastrophic insurance coverage will be ever more important as medical care technology continues to advance. Breakthrough therapies draw upon increasing biomedical knowledge and "precision medicine" or

[6] This summary draws from Eggleston 2019 and the sources cited therein.

"personalized therapy" using genetic and other information, especially for cancers but also other major killers. These therapies can be extremely expensive. Providing equitable access to these new treatments poses a challenge for health system financing not only in China, but around the world. Financing experts recommend China explore policies utilized in other middle- and high-income economies, such as expanding the taxation base to assets for health insurance contributions as done in the health systems of South Korea and Taiwan.

In addition to expanding insurance coverage, China has put in place multiple policies to address health inequalities. Perhaps most salient was equalization of essential population health services as part of the 2009 national health reforms. As noted, addressing disparities has also been highlighted at the 2016 first national health meeting, in the Healthy China 2030 goals, and in other leadership statements. Such high-level attention is an important first step to continuing progress in reducing disparities. In China's system of governance, attention from leadership matters greatly for translating policy rhetoric into effective implementation. Qingyue Meng and colleagues recommend that local officials' performance evaluations be based in part on local health indicators, among other suggestions (Meng et al. 2019).

Health expenditures have increased rapidly as China has developed its system of universal health coverage. Double-digit health spending growth surpassed the rate of economic growth, and as a result, health spending absorbs an increasingly larger share of the total economy. Most recent policies seek to make sure additional spending on health and elderly care is efficient and effective, while also attempting to address the nonmedical determinants of health and promoting healthy aging.[7] More will need to be done. The health system needs to be reengineered to emphasize prevention, provide coordinated health care for people with multiple chronic diseases, assure equitable access to rapidly changing medical technologies, and ensure long-term care for frail elderly, all without unsustainable increases in opportunity costs for China's future generations.

COVID-19 and cost of care

During the period of containing the spread of SAR-CoV-2 and the pneumonia it causes, COVID-19, new policies were put in place to attempt to allay fears about payment for care, to assure that all patients sought and received treatment regardless of their potential out-of-pocket burden, and that providers would feel assured of revenue to cover their treatment costs. Whether the announced policies were successful, to what extent, will only be evident in the coming months or year, but in this section I lay out the basic aspects of the health coverage policies as announced in early 2020 and how they relate to what was just described in terms of health insurance coverage for different population segments in China.

[7] Eggleston chapter in Fingar and Oi, *Fateful Choices* 2020.

January 22nd, the National Healthcare Security Administration (*Guojia Yiliao Baozhang Ju*) and the Ministry of Finance announced two principles: patients should not worry about payment for COVID-19 care, and providers should not worry about covering their costs of providing care.[8] How exactly those promises would be met was not initially spelled out, and a full accounting will not be possible until at least a year from now probably, but authorities claim that this financing policy played an important role in control of COVID-19.

Basically, it comes down to a question of trust: did patients during the intense pandemic phase believe that the government would pick up the tab for their testing and treatment? We know early on there were reports of tragic cases: patients self-discharging for fear of inability to pay—a common phenomenon in China before universal coverage, and for those facing catastrophic health spending for services not covered or beyond the ceiling of spending allowed by the basic insurance program--then dying at home. Did patients and their families believe that they would not be asked later to settle the bill? Did healthcare providers believe that the government would allocate new funds to cover those treatments, not reduce already budgeted amounts or take these funds out of global budgets for the year, and so on? Extra government subsidies are supposed to cover both the care received before confirmed as COVID-19, as well as treatment received outside the home locality (e.g. by migrant workers in lockdown outside their hometown or home province). Ultimately there is supposed to be a national reconciliation of insurance claims, where each locality first covers treatment for everyone seeking treatment there, and then receives payment from other localities, net of what they owe. Announced estimates suggest about 170,000 RMB spent per confirmed case, two-thirds of which was covered by social insurance and the remainder by "support from MOF" – not clear if this *Bu Zhu* (assistance/support) means they completely cover the remainder, or if households are assisted based on some other measure of their ability to pay.

China also adjusted insurance coverage criteria during the pandemic – for example, ECMO (ventilator) treatment is expensive and frequently not covered by China's social insurance programs, but was covered by insurance for COVID-19 treatment. Moreover, policymakers took steps to try to address the care needs of other patients, such as allowing or encouraging longer-term prescriptions of anti-hypertensive and anti-diabetic medications, renewal of prescriptions and internet-based consultations that avoid physical contact. Only in the future will it be clear to what extent these steps mitigated the impact of delayed care.

[8] For news and policy announcements related to coverage of COVID-19 treatment spending, see for example the NHSA website (e.g. http://www.nhsa.gov.cn/art/2020/4/26/art_14_3054.html) or http://www.xinhuanet.com/politics/2020-03/29/c_1125784154.htm; http://www.gov.cn/xinwen/2020-04/12/content_5501508.htm.

One element of the COVID-19 response is relatively certain: the pandemic quite likely will give a significant and long-lasting boost to telemedicine and other tech-enabled, non-direct-contact forms of care in China, as has also been the case in much of the middle- and high-income world.

Regional and urban/rural disparities

In a country as populous, expansive, and diverse as China, it is not surprising that there are wide disparities in health and healthcare between different population sub-groups distinguished by wealth, education, urban-rural *hukou*, inland-coastal residence, and so on.[9] Health disparities can be assessed in multiple ways, and most tell consistent stories: China has achieved impressive improvements in health and longevity, including for the low-income residents in rural areas; however, significant gaps between the most- and least-privileged Chinese citizens persist, and in some cases are growing. Some of the best estimates of average life expectancy across different regions suggest gaps of 11·8 years for men and 12·8 years for women in 2013, and more recent Global Burden of Disease estimates for 2017 continue to underscore large regional differences.

Figures 15 and 16 illustrate China's significant regional disparities in skilled healthcare professionals per capita. Figure 17a shows urban areas, clearly much better endowed with doctors per capita than their brethren in rural areas (Figure 17b). Figure 18 shows the urban-rural gap in doctors per capita: rural areas were catching up 1980-2000, but the gap began widening again starting in 2005. Similar trends are evident for nurses per capita: although rural areas gradually enjoyed more nurses per capita, the pace of growth was faster for urban areas, increasing the urban-rural gap especially after 2005 (Figure 19).

Thus, despite progress, sizable healthcare disparities remain in China, contributing to and correlated with disparities in health. Health outcomes differ not only between urban and rural areas, but also and along other dimensions, such as between urban regions of higher or lower per capita income, or across individuals with more or fewer years of schooling. The burden of chronic disease is a case in point. For example, diabetes is associated with greater excess mortality in rural China, although prevalence is higher in urban areas (Bragg et al.) Lei et al. (2014) document strong educational gradients in self-assessed health, presence of any disability, and in survival expectations (respondents' self-report of possibility of surviving to age 75), using the China Health and Retirement Longitudinal Study (CHARLS) baseline survey, and controlling for per capita expenditures and other economic and location variables.

[9] This section of my testimony draws from Eggleston (2019).

Figure 20 shows the persistent urban advantage over rural areas in terms of hospital beds per 1000 population, 2010-2018, with rural areas in 2018 having fewer than urban areas enjoyed back in 2010. Figure 21 shows regional disparities in beds per capita, and Figure 22 contrasts urban and rural areas within each province. Of course, the nature of infrastructure investments, development of urban referral hospitals, and low density of population in rural areas suggests that perfect parity in beds per capita between urban and rural areas should not be expected. Rural residents of most large countries face more constraints on physical access to healthcare than their urban counterparts. Nevertheless, it is important to keep in mind that China continues to have very large regional and urban-rural differences in health system capacity, almost inevitably compounded by the differences in skills of their healthcare professionals as well (although the latter is less readily documented).

One attempt to measure quality, combined with effective access, is the Healthcare Access and Quality (HAQ) Index proposed by the Global Burden of Disease 2016 Healthcare Access and Quality Collaborators (2018). This index is based on measuring premature mortality from causes that should not occur if the individual had access to high-quality healthcare (GBD 2016 Healthcare Access and Quality Collaborators, Fullman et al. 2018). According to this index, China stands out for striking regional disparities. The 43-point regional disparity *within* China is the equivalent of the difference between Iceland (the highest in the world) and North Korea. China truly entails "multiple countries within one." By pulling up the lagging regions even other developed coastal areas leap ahead, China has been able to steadily improve nationally. China's rapid national improvement in access and quality as proxied by this HAQ Index is evident from the fact that even China's lowest region in 2016 was above the 1990 national median. Among 195 countries and territories, China shows the highest absolute change in the HAQ Index between 2000 and 2016; and China's HAQ index in 2016 was the highest among all countries with same or lower medical spending per capita.

China's primary health care system[10]

China has tried to strengthen primary care and develop a family doctor system, as described for example in Rize Jing and Hai Fang's chapter within *Healthy Aging in Asia* (2020). These represent the latest efforts to re-orient China's health service delivery system away from crowding at tertiary hospitals and establish reliable systems for community-based care. Jia, Du and Fan (2019) discuss the factors associated with residents' willingness to a contract with the family doctor, especially information; and Gao (2019) discusses how the family doctor contract service appear to have a significant effect on the community management of chronic hypertension

[10] This section draws from Eggleston 2019 and Eggleston, Donahue and Zeckhauser 2020 chapter on healthcare.

and chronic disease, and may be able to help patients better control blood pressure levels.

China's health policies have long supported prevention and primary care, yet during the last two decades many reforms had the unintended consequence of promoting hospital-based care rather than primary care. As Professor Meng Qingyue emphasized in his keynote address at a conference on the family doctor system (June 26th, 2018 at the Stanford Center at Peking University), increased demand for hospital-based services is an almost inevitable outcome of rising living standards and purchasing power of China's consumers, and their interest in high-quality medical services. Patients' suspicion of the quality of primary care is certainly not without foundation; as noted earlier, well-trained physicians are in short supply in many areas, especially for primary care. Despite efforts to train more general practitioners and enhance primary care, by 2017 only one in ten rural doctors at township health centers had at least five years of medical school (up from 5.6% in 2010; Meng et al. 2019). System reforms are needed to put in place the financing and incentives to attract, retain, and motivate qualified physicians, nurses, and other health providers at the primary care level. As highlighted in a recent World Bank report, patient-centered integrated care is one such approach.

Some areas such as Shanghai have implemented a decade or more of variations of the family doctor system and primary-care-based model, gradually gaining the trust and confidence of residents. Xiamen has developed a well-known team-based model that includes a health manager ("*jiankang guanli shi*") working with a general practitioner (GP) and any specialists the patients may need. Such team-based approaches may expand as the tasks more appropriate for physician assistants (including recordkeeping and basic population health service delivery, follow-up health education and care coordination) are taken over and leave the increasingly well-training primary care physicians with more time to focus on their comparative advantage in clinical management.

Offering a quick and convenient channel for upward referrals to the best urban specialists is one service that patients value. Referral back down to primary care after inpatient treatment has been less systematic, although new forms of provider integration linked to global budgets have given incentives for hospitals to partner with community health centers in follow-up care and rehabilitation. In fact, one of the metrics used by some integrated care systems is whether the number of downward transfers to primary care from hospitals is similar to or greater than the number of upward referrals for hospitalization. Whether improved dual-referrals systematically improve health outcomes while reducing expenditures and out-of-pocket burdens, however, remains unclear.

China's vibrant e-commerce and digital payment sectors have also been harnessed in preliminary ways to support population health and convenient medical care. In

addition to the aforementioned WeDoctor, many local health authorities are also experimenting with iphone apps to promote healthy lifestyles, self-management of chronic disease, or adherence to clinical recommendations. And many are thinking of ways to enrich the benefit package associated with signing up for the family doctor system, to attract patients into first-contact care at the primary care level. Such services include not only access to specialist referrals when needed but also easier prescription refills, home-based care for the disabled, and so on. Ultimately it will be important to assess whether such programs do achieve better convenience and lower cost without sacrificing quality of care.

Health data platforms and application of AI to healthcare offer many possibilities for deploying big data to support increasing "healthspan" in China (e.g. through appropriate analysis and decision support tools); but they also must navigate patient privacy and data security issues, assuring that they not exploited for commercial purposes without individuals' consent or official oversight. Here again progress had been rapid, but many issues remain to be addressed.

Unfortunately, there is not yet much rigorous evidence about the impact of improving primary care. Nevertheless, programs such as management of patients with hypertension and diabetes under the essential population health services package may provide a promising way forward. In a recent study with Yiwei Chen and Zhejiang colleagues, we analyze the impact of such a program that gives primary care physicians financial and reputational incentives to identify patients and enroll them in primary care management for their condition (Yiwei Chen et al. 2019). We assemble a unique dataset linking administrative and health data at the individual level for all registered residents of a county in Zhejiang province. The data include health insurance claims between 2011 and 2015 and primary care service records for over 70,000 rural Chinese diagnosed with hypertension or diabetes. Our study design utilizes variations in management intensity generated by administrative and geographic boundaries. Utilizing this plausibly exogenous variation, we find that patients residing in a village within a township with more intensive primary care management of chronic disease, compared to neighbors with less intensive management, had more primary care visits, fewer specialist visits, fewer hospital admissions, and lower inpatient spending. No such effects are evident in a placebo treatment year. Exploring the mechanism for reduced specialist and hospital utilization, we find that patients with more intensive primary care management exhibited better drug adherence as measured by medication-in-possession (e.g., the percentage of days in which the patient had a filled anti-hypertensive prescription in 2015).

These results suggest that physician incentives for improved primary care management led to better adherence to medications and primary care visits, and through that pathway reduced inpatient spending. A back-of-the-envelope estimate of welfare suggests that the resource savings from avoided inpatient admissions

substantially outweigh the public subsidy costs of the program, even if we ignore the value of any associated improvements in quality of life and survival.
Evidence from other programs would be valuable.

Incentives, organization, competition and market power

One tantalizing set of policy experiments in China involves health alliances or local integrated healthcare organizations based on formal mergers of local government-owned hospitals and primary care providers. Such integration initiatives may provide health benefits while slowing the rate of expenditure growth, although rigorous evaluation will be needed to see if that is the case. Such integrated care organizations usually unify the drug formulary for different levels of provider, so that patients do not have to go to tertiary hospitals to be prescribed specific medications or renew prescriptions (as had been an unfortunate consequence of the essential medication list policy as implemented in some areas). The next frontier may be in expanding coordination of health services with long-term care services for the elderly and disabled.

In these integrated care system experiments, one challenge will be to find the correct regulatory balance: strict, transparent oversight and regulation can be critical to uphold budget constraints and patient rights as well as to deter malfeasance; but on the other hand, flexibility and autonomy are needed for institutional innovation, and can be well justified as long as the organization is accountable for results. Sometimes the oversight and regulatory structures—such as the personnel employment system (*bianzhi*) or fragmented financing streams—stand in the way of innovations of considerable social value. Some well-intentioned policies lead to unfortunate distortions. For example, controlling spending by constraining per-visit expenditures and per-admission spending may seem intuitive and well designed, but it has unintended consequences: it gives incentive for providers to require more frequent, low-spending visits, with shorter drug prescriptions (and inability to substitute towards treatments that might promote longer-term treatment adherence and health). To avoid undue pressure to distort treatments for the more seriously ill, some places exclude chronic disease patients when reporting per-visit spending, removing the distorted incentives but leaving an incomplete picture of the resource use and effectiveness of cost control. Thus, simple metrics of per-visit or per-admission expenditures are no substitute for rigorous evaluations of whether reforms actually reduce the growth rate of overall medical expenditures.

Healthcare alliances appear promising in some respects, but it is not clear yet what their impact will be overall health outcomes and on disparities. Moving toward prepayment – such as adopting a global budget and/or capitation – does give incentive for prevention and investment in cost-effective settings for management, such as primary care. Yet there is need for balance and careful monitoring, because strong incentives to control medical expenditures also have important unintended effects,

including risk selection (turning away expensive-to-treat patients) and/or under-provision (stinting on care or withholding innovative treatments even when appropriate). The most vulnerable and disadvantaged could be most susceptible to these adverse impacts. Social tensions will also increase if only the rich can afford to "buy out" of under-provision by paying extra for better care. The hard-won trust in primary care could be soon undermined from the opposite direction: rather than (or in addition to) doubting the technical competence of community health centers or village clinics, patients may start to wonder if, in pursuit of lower spending, primary care providers will purposefully withhold referrals up to specialists (or accept a discharge back from a hospital to early). Therefore, reforms toward alternative payment systems and organization forms should be rigorously monitored and evaluated for impact on quality of care and access, especially for the most vulnerable patients.

Moreover, integration of all government-owned providers in a given district or county in effect creates a local monopoly. Although the role of competition in healthcare is controversial, relatively robust evidence suggest that patient choice (provider competition) in a well-regulated system can lead to improvements in quality (e.g. Bloom et al. 2015). Policymakers should be cautious in endorsing claims that local monopoly care organizations can better coordinate care and improve outcomes while controlling spending.

An integrated provider may excel by streamlining services, better coordinating care and investing in efficiency improvements – such as through centralizing procurement, logistics, human resources, and other operations—as well as promoting the appropriate site of care. However, new monitoring and evaluation systems will need to be put into place to make sure these local monopolies live up to social expectations. Those involved may call for mandatory within-network treatment, forced gatekeeping, and not making the local integrated care organization responsible if the empaneled patients seek care elsewhere. While it is true that many health systems have this feature, they also have substantial safeguards in place. There is a social value of allowing patients to "vote with their feet", even if that means providers cater to patient-observable dimensions of care and not technical quality of care. Evidence from the UK, for example, clearly links competition for patients to hospital management quality (Bloom et al. 2015). When integrated networks or primary care providers must compete to attract patients with the services they provide, this offers a counterbalance to under-provision, and gives policymakers a key feedback loop for monitoring whether providers are truly meeting people's needs. Moreover, private providers may be squeezed from the market, and without any regulatory structure on ownership and competition or anti-trust, the negative sides of this organizational structure may come to outweigh the benefits if not managed carefully. The success of integrated networks in China will depend on how well policymakers achieve this balance. Moreover, these policy initiatives may achieve few lasting results unless they are subject to rigorous evaluations.

Continuing tensions within the system also need to be addressed. For example, physician-patient conflicts have erupted into violence, and it remains unclear whether after COVID-19 these tensions will resume at similar, mitigated, or potentially even worse levels (especially if many young people are discouraged by the crisis from seeking careers in medicine). Consider, as one illustration, a recent study by Jinlin Liu about workplace violence against healthcare workers in tertiary public hospitals in west China (Liu 2020). Analyzing survey data from over 3000 healthcare workers in 2018-19 from six tertiary public hospitals in west China, he finds workplace violence against healthcare workers increased (from 23.3% to 45.0%) and was significantly associated with job burnout, higher likelihood of turnover, and with discouraging one's own children to go into medical care as a profession. The analysis suggests that patients' lack of trust in healthcare workers, poor communication between patients and healthcare workers, and inadequate laws regarding medical disputes were the top three factors, perceived by healthcare workers, that affected their relationship with patients.

Like in many other health systems, pharmaceutical pricing and distribution in China remain controversial and targets for punishing illegal activities such as price monopoly, price fraud, and unfair competition. China has undertaken significant policy reforms to remove the mark-up on pharmaceuticals that used to generate a large share of hospital and clinic revenues, and policy continues to try to squeeze out drug profit margins as a way to reduce spending growth. While part of the goal is laudable, it will not obviate the need for difficult trade-offs in promoting efficiency and innovation, systematically evaluating new technologies, and prioritizing public health and primary care to reduce disparities.

China's health service delivery system is overwhelmingly government-owned and managed. However, in recent decades authorities have not only allowed but even encouraged investment from non-state sources, both for medical care and for long-term care services. In many regions and segments of the medical services markets, private providers constitute a nontrivial albeit definitely still minority share of service. For more on mixed-ownership health service delivery and engagement of the private sector in China, compared to the US, see Eggleston, Donahue, and Zeckhauser (2020).

For example, the "Law of the People's Republic of China on the Promotion of Basic Medical and Health Care" to go into effect June 1, reiterates promotion of private sector engagement in health services, while strengthening regulation and prohibiting specific kinds of joint ventures.[11] The government has previously specifically encouraged private sector investment and public-private partnerships for elderly care (e.g. "PPP prioritizes supporting three major sectors in the field of elderly care

[11] "Joint ventures building up new hospital districts or branch hospital models (e.g. "Wei Zexi Event" in 2016, "Ningxia Military Region General Hospital Incident" in 2017) will be prohibited by the Law, and thus such cooperation will face repositioning and adjustment."

services" 2017), encouraging PPP in the construction of elderly care institutions, community care systems, and "integrated development of medical care and health." For an overview of these policies and examples of "collaborative governance, Chinese style" in long-term care, see the healthcare chapter in Eggleston, Donahue, and Zeckhauser (2020). Others also provide related cases and studies. For example, Zhang (2018) discusses a demonstration project in community elder care illustrating how PPP operation models are being tailored to local conditions.[12]

Public-private engagement in the health sector can be vital for addressing social needs, as perhaps well illustrated by the current pandemic. Development of a health service and research ecosystem can be key to an "all hands on deck" approach to developing a vaccine or innovating in social and economic policy to mitigate the costs of lockdown or physical distancing, without too deeply and permanently scarring our societies in other ways. Private connections also link the global scientific community and its cooperation. Within weeks of the first cluster of cases, Chinese researchers had released the genomic sequence of the virus. Such prompt data sharing enabled vaccine candidates. According to the Coalition for Epidemic Preparedness Innovations (CEPI), there are at least 8 promising vaccine candidates, with some in early clinical trials and some may be ready within a year. None of that would have been possible without international scientists' culture of data sharing, careful but prompt review of evidence, and collaboration among public and private sectors to get the job done.

Innovations may prove life-saving not only for re-opening global supply chains to support the healthcare response (PPE, ventilators, masks, pharmaceutical ingredients, food, etc), but also innovations that can enhance the ability of societies to leverage civil society and public-private partnerships for the broader social good, to help the poor and vulnerable, to assure that a vaccine once developed is widely and equitably available; and to restore treatment for other urgent health conditions, avoid "deaths of despair" (Case and Deaton) and a devastating mental health toll, or even starvation from the loss of livelihoods in low-resource settings. China's strengthened health system, compared to SARS or earlier public health crises, along with industry and research capacities, have enabled a more resilient response than would otherwise have been the case.

Turning more directly to the question about technology during the pandemic, let me offer a few brief observations.

[12] Yu and Lu (2015) discuss some case studies. Wang and Zhang (2019) find that Chinese respondents appear generally willing to pay reasonable fees for primary health care services or for improved therapies in private healthcare or PPPs.

Technology and COVID-19 control -- and beyond

China's government and private sector have utilized many technologies in response to the crisis, which, like elsewhere, may continue to play a much larger role in the healthcare system in the future. A prime illustration is telemedicine and "internet-plus" healthcare. For example, China's WeDoctor launched a platform for doctors to provide online consultations, psychological assistance and other services, making it possible for people to consult with a doctor at home during COVID-19.[13] Others have long observed development of technology-enabled home-care for the elderly (e.g., Cao et al 2016). Recently, Qi Xiaoxia, Director General, Bureau of International Cooperation, Cyberspace Administration of China, has argued that China's leveraging of multiple technologies in the efforts to curb COVID-19 portend broader use of these technologies in the future as well, with examples including the following:

- AI: Baidu Research open-sourced LinearFold (its linear-time AI algorithm), to epidemic prevention centers, gene testing institutions, and global scientific research institutions.
- Big data: Qihoo 360 released "Big Data Migration Map" this past February which users can access through mobile phones or computers to help understand and predict changes in the epidemic situation nationwide.
- Cloud computing: Alibaba Cloud made its AI computing power available to public research institutions around the world for free to accelerate the development of new pneumonia drugs and vaccines.
- Blockchain: Lianfei Technology launched the nation's first blockchain epidemic monitoring platform, which can track the progress of COVID-19 in all provinces in real time, and register the relevant epidemic data on the chain so that the data can be traced and cannot be tampered with.
- 5G: China Mobile opened 5G base stations at Huoshenshan and Leishenshan hospitals, providing real-time views of the construction. [14]

In the future, China as elsewhere (e.g. South Korea, Singapore) will probably continue to roll out and deepen technologies for contract tracing during the remainder of the COVID-19 pandemic, with differing levels of social debate about the trade-offs between civil liberties and intrusiveness on privacy, on the one hand, and benefits of real-time contact tracing and containment of epidemic spread, on the other. China has seen some objection to widespread technology deployment in everyday life – such as a lawsuit against requiring face scanning for park annual passes – but whether the

[13] People's Daily Online. "'Internet plus healthcare' platforms assist fight against COVID-19 at home and abroad." *People's Daily Online* (2020). http://en.people.cn/n3/2020/0408/c90000-9677073.html (accessed April 18, 2020).

[14] Qi, Xiaoxia, "How next-generation information technologies tackled COVID-19 in China," World Economic Forum, https://www.weforum.org/agenda/2020/04/how-next-generation-information-technologies-tackled-covid-19-in-china [accessed April 12, 2020].

current crisis will permanently shift that debate remains to be seen. Certainly, the integration of telemedicine and other technologies for healthcare and elderly care will continue to develop, with the potential of either increasing or ameliorating the current disparities within China's health system.

More broadly, the response to COVID-19 in China and its devastating impacts around the globe will leave an indelible mark on health policies for decades to come, not only in terms of technology adoption but also organizational innovation and hopefully, prioritization in resource allocation to safeguard and undergird the rest of the "China Dream" (or "American Dream" for that matter). Clearly this crisis is a test of governance – policymakers have stated as much. Unprecedented measures have been successfully implemented to contain the virus spread, and the PRC health system is much better prepared than during SARS. But China's society and economy are also not the same as at the turn of the century. Dismissal of officials clearly shows that not everyone believes no mistakes were made along the way. Sometimes health systems can only be as strong as their weakest link. Commitment to strengthening the weakest links in the future – that would be a fitting tribute to the victims of the COVID-19 outbreak, from Li Wenliang to the many less well-known others. Perhaps in the future renewed investment and innovation can diagnose and effectively treat health system weaknesses, just like scientific cooperation about the SARS-CoV-2 virus itself. Maybe China will champion renewed commitment to evidence-based, scientific study of health systems – leveraging new technologies to strengthen prevention; address the root causes the patients' ubiquitous lament, "getting healthcare is difficult and expensive" (*Kan bing nan, kan bing gui*) and the sometimes tense physician-patient relationship in China; and invest in cost-effective, high quality primary care and two-way referral systems that can promote healthy lives for every Chinese citizen, including the rural, poor and vulnerable.

- How has China's healthcare system developed in recent years to cope with an aging population?

Through the last four decades, China has benefitted from a demographic dividend caused by the large bulge in the working-age population. To achieve future economic growth, however, it will need to increase investments in health and education -- two sides of human capital — to promote innovation and boost productivity in the Chinese economy. Higher productivity will in turn be the means by which a smaller workforce can support China's large and growing cohort of retirees, for which the health system needs to adapt.

China's current population and demographic trends — including relatively rapid aging — reflect the success of earlier investments in infectious disease control, public health measures, and other contributors to mortality reduction, as I argue in the chapter I contributed to the volume *Fateful Decisions* (Fingar and Oi 2020). China's

total fertility rate declined from approximately 6 in 1950–55 to around 2 in 1990–95. It has been below replacement level for about a generation. The most rapid decline was in the 1970s, prior to adoption of the one-child policy. The dependency ratio declined by more than a third during the past three decades, primarily because of the reduction in youth dependency. Large cohorts in the working ages have contributed substantially to economic growth but are now moving toward retirement. China's population in the age category of fifteen through sixty-four has begun to decline and is projected to decrease to a little more than eight hundred million by the one hundredth anniversary of the People's Republic of China in 2049. Over the same period, the sixty-five and older population will likely reach about three hundred and fifty million. By 2050, China's "oldest old"—those eighty years and older—will represent the same share as the sixty and older population did in the 1960s and an absolute number greater than the current population of France. The proportion of China's population age sixty and older is projected to more than double over the next three decades, reaching 33 percent in 2050.[15]

The lingering effects of family planning policies, historic preferences for sons, and rapid economic development are also major considerations. Together, these factors have produced a shrinking working-age population, a growing number of older adults, a gender imbalance, and hurdles for inclusive urbanization.

Compared to Europe and North America, the demographic transition from high to low fertility and mortality has been more rapid in China, like much of East Asia. That means social institutions, such as retirement, living arrangements, and intergenerational support, have to adapt quickly.[16] For example, extending work-lives will be necessary but *feasible* only if the added years are healthy ones, and *equitable* only if the least advantaged also benefit from healthy aging. The blessings of longevity dim when clouded by pain, disability, and loss of dignity. An urgent question for China's future is to what extent policies will ameliorate disparities in health, healthcare use, and burden of medical spending.

Retirement also interacts with health insurance policies. Several studies present mixed evidence on the relationship between retirement and healthcare utilization. In Zhou, Eggleston, and Liu (2020), we explore the causal effect of retirement on outpatient and inpatient care utilization among urban workers in a megacity of China, using a fuzzy regression discontinuity design. Our results indicate that retirement significantly increases annual healthcare expenditures due to more intensive use of outpatient care at retirement, especially at the right tail of the distribution of outpatient visits. This increase in outpatient care use appears to stem from a decline in patient cost sharing and the reduced opportunity cost of time upon retirement, not from any sudden impact on health.

[15] Eggleston chapter in Fingar and Oi (2020)

[16] Eggleston 2020, *Healthy Aging in Asia*.

As I argue in Eggleston (2020), raising the retirement age will continue to be controversial – perhaps especially so with the pandemic-caused economic downturn and recovery, giving a ready excuse to avoid older workers (and/or women, seen as primary home care providers). But "nudging" Chinese to embrace longer work-lives for both men and women is urgent. The triumph of longevity threatens the fiscal integrity of pension systems and other social support programs disproportionately used by older adults. Policies are also needed in rural China to ease the transition of families strained by migration and work pressures, and to support the adult children who wish to fulfill roles of filial piety for parents left behind in rural areas or those already relocated to the city with them.

Chronic disease control and healthy aging[17]

While strengthening infectious disease control, China's primary burdens of morbidity and mortality arise from chronic diseases; thus, the focus of much effort to address health inequalities and raise overall population health continues to be enhancing control of chronic disease. China has implemented National Demonstration Areas for Comprehensive Prevention and Control of Non-Communicable Diseases, which include some promising ideas for enhancing collaboration across multiple agencies and sectors. Such intersectoral coordination can be critical to address the social determinants health, reduce risk factors, and integrate health education and promotion with effective screening and management of chronic disease. One important step forward for healthy aging would be a renewal of China's commitment to tobacco control, the leading preventable cause of premature mortality. For example, using an earmarked increase in tobacco taxation to invest in health promotion for rural and low-income China would be a win-win policy reform, compensating for the regressivity of such taxation, and perhaps help to close the longevity disparity between men and women as well.[18]

Moreover, primary care management of chronic disease is especially important for China's older population, meriting experiments with evidence-based methods for tracking progress. For example, in the *Healthy Aging in Asia* (2020) chapter entitled "Avoidable Admission Rates for Diabetes Patients and Associated Medical Spending in Rural China," Min Yu of the Zhejiang provincial CDC and co-authors note that diabetes poses a critical public health issue in many countries, especially for health systems ill-prepared to manage chronic disease within primary care. China's efforts to

[17] This section draws from Eggleston 2019 and Eggleston, Donahue and Zeckhauser 2020 chapter on healthcare.

[18] For more discussion on tobacco taxation and the political economy of this industry in China, see *Poisonous Pandas: Chinese Cigarette Manufacturing in Critical Historical Perspectives*, edited by Matthew Kohrman, Gan Quan, Liu Wennan, and Robert N. Proctor, Stanford University Press, Stanford, California, 2018.

strengthen population health and primary care management for diabetes, especially in rural area, deserve careful study and benchmarking to international experience to inform further progress. Improved prevention and control may not only improve health and quality of life for patients, but also potentially save resources by reducing avoidable hospital admissions. The authors propose age- and sex standardized medical expenditures on avoidable admissions as a useful metric.

Long-term care for the frail elderly

According to the "Thirteenth Five-Year Plan for the Development of Civil Affairs" (2016) and previous precedents, China seeks to develop a robust "multi-level old-age care service system" based on home care for most, supplemented by community-based support and medical care, and with institutional or residential facilities for the most frail individuals in need of regular support with activities of daily living (eating, bathing). Accordingly, policies such as the "Notice on the establishment of a subsidy system for the elderly at the national level" (2016) encouraged all localities to "introduce policies such as old-age allowance, old-age service subsidies, and nursing subsidies as soon as possible in accordance with local conditions, and do a good job in the assessment of the elderly, gradually improve the subsidy standards and coverage."

China's current policies seek to balance individual responsibility, community support, and taxpayer redistribution through safety-net coverage funded by central and local governments. Like many countries, China would benefit from improved coordination across multiple agencies and structure incentives to avoid or mitigate unintended consequences that undermine the goals of its health system. Recent governance reforms, such as the creation of the National Healthcare Security Administration, aim to address these challenges.[19]

Most recently, in light of COVID-19 and its severe threat to institutionalized elderly populations, China's authorities have tried to modify policies to support the vulnerable, though it is not clear how successful that has been or will be if there are second and third waves of infection before a vaccine is readily available. According to Xinhua April 28th, "China has urged efforts to resume services of elderly care institutions in an orderly manner while strengthening epidemic prevention and control, according to a recent circular jointly issued by five authorities, including the Ministry of Civil Affairs and the National Health Commission. Safeguarding the life safety and health of elderly people living in elderly care institutions and supporting the normal operation of elderly care institutions have also been stressed by the circular. The establishment of a national rating system for elderly care institutions was underlined, according to the circular. It also emphasized the importance of improving safety management and the nursing service of elderly care institutions."[20] The mention of the

[19] Eggleston 2020 in Fingar and Oi.

[20] http://en.people.cn/n3/2020/0428/c90000-9685027.html [accessed 28 April 2020].

'national rating system for elderly care institutions' warrants underscoring, because such a rating system – like Nursing Home Compare in the US,[21] the Japanese government dataset *Kaigokensaku*,[22] and others around the world – represent important efforts in China to standardize and improve the quality of long-term care services.

Similar policies and notices emphasize the "leading role of the government in supporting the development of home and community elderly care services, and … in implementing preferential policies such as access, finance, taxation, and land." The link to medical care is recognized in calls for hospitals to establish gerontology departments to improve the diagnosis and treatment of geriatric diseases.

Financing long-term care for China's aging population remains a critical issue, building upon ongoing pilots that draw funds from the medical insurance schemes and government allocations in different ways.[23] See for example the "Outline of the 13th Five-Year Plan for Human Resources and Social Security" (2017), which called for "explor[ing] the establishment of a long-term care insurance system, and carry[ing] out long-term care insurance pilots." This critical arena of financing for long-term care is inextricably linked to issues of pensions in China, an important area that largely falls outside the scope of my testimony. However, China's recent rural pensions merit mention for their impact on old-age support and potentially reducing disparities. Multiple studies have shown the positive impact of improved old-age security for China's rural elderly by assessing the impact of the rural pension scheme. The new rural pension scheme, although far less generous than urban schemes, enables beneficiaries to take care of own health and medical care and long-term care needs a little better, and to be less dependent on sons and other adult children, perhaps even contributing to reduced mortality.[24]

While the better-off urban population has several options for in-home and institutional care to supplement family informal care, those in rural areas and/or with few resources have fewer options. Moreover, wealth and educational disparities reinforce health disparities: those achieving greater educational attainment able to command higher wages, achieve higher lifetime wealth, enjoy more security in retirement while

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[21] https://www.medicare.gov/nursinghomecompare/search.html

[22] http://www.kaigokensaku.mhlw.go.jp/.

[23] This summary draws from Eggleston 2019 and the sources cited therein.

[24] See for example "The Power of Social Pensions" by Wei Huang, National University of Singapore, and Chuanchuan Zhang, Central University of Finance and Economics, presented at the NBER-SAIF conference on retirement security, Shanghai, PRC, June 30, 2018; Xi Chen, Karen Eggleston, and Ang Sun, 2017. "The Impact of Social Pensions on Intergenerational Relationships: Comparative Evidence from China," *The Journal of the Economics of Ageing*. http://dx.doi.org/10.1016/j.jeoa.2017.04.001; and Karen Eggleston**,** Ang Sun, and Zhaoguo Zhan, 2016. "The Impact of Rural Pensions in China on Labor Migration." *World Bank Economic Review* July 2016: DOI: 10.1093/WBER/LHW032.

still investing in their children. Healthy aging enables longer working lives and thus also helps to finance the health services that lead to healthy aging (just as longer working lives lead to more sustainable social security/pension financing as well). Zhang and Ji (2018) document significant differences across cohorts in financial planning, with many relying exclusively on family.

Housing and the built environment are also important for health across the lifespan and in promoting healthy aging. As China continues to urbanize rapidly, affordable housing and linking to accessible community health services and affordable long-term care services remain challenges.

China has developed quickly and population aging is more rapid than in many of the current high-income countries such as the US. One implication is that the current elderly grew up in much poorer circumstances than their children and grandchildren, and may face particular difficulties in remaining healthy into old age and providing for their own care. Future cohorts of elderly in China, similar to Japan, Korea, or Singapore, will benefit from better life circumstances and perhaps a "compression of morbidity" to be healthier as well as live longer. Many demographers have studied these patterns. For example, Zhang, Feldman and Du (2019) find significant cohort differences in change in activities of daily living (ADL) among the oldest-old. Different levels of poverty, childhood experiences and living environments affect ADL change trajectories and contribute to cohort differences.

Recommendations for congress regarding the development of China's healthcare system and its implications for the United States

It is in the interest of Americans and Chinese to have a strong, resilient healthcare system in China. Constructive policies in support of health system improvements in both countries could strengthen the global capacity to control future pandemics and avoid the devastating social and economic effects of future outbreaks on the scale of COVID-19. The US government should also encourage China and its scientists and firms to work collaboratively with multilateral efforts like CEPI to leverage technology to prevent and control future pandemics.

Carefully designed and thoroughly evaluated policies, including those leveraging artificial intelligence and e-health technologies for prevention and accessible medical care, can support the vulnerable and help to close the health gaps that inhibit full realization of China's potential. The US should re-emphasize scientific, evidence-based health policy and regulation, and encourage China to do so as well.

Other recommendations include

- Support and prioritize efforts to **strengthen primary care** and population health interventions with proven cost-effectiveness.
- Share experiences with regional, community-based efforts to address the **social determinants of health** and promote multi-sector policies for healthy aging.
- Support health education and programs specifically **for disadvantaged populations** such as migrant workers and their children, or rural poor and elderly.
- Do not forget **mental health** among chronic diseases and support Chinese scientists, clinicians, and policymakers in efforts to address stigma and support better mental health service access and outcomes.
- Support China's policy efforts to define and regulate the fledgling private sector in service delivery that is categorized as **not-for-profit**, and share experience about how to define and make accountable for **"community benefits" in exchange for profit exemption**.
- Encourage **public-private collaborative governance** arrangements to strengthen the health sector in China, noting that the profit motive should be aligned with social benefits to yield most productive outcomes, and that government-owned and managed providers and insurers are not immune to problems of inefficiency and market power. Work with local and central authorities to fill their demand and encouragement of private sector engagement in healthcare and elderly care, sharing experiences with monitoring and regulating quality – an area where both China and the US wish

to improve (and tragic cases of COVID-19 spread in nursing homes has underscored the need for greater oversight).

- **Technologies** such as AI in health and long-term care should be developed, while taking into account different political and legal contexts in each country for balancing privacy and civil liberties with technology-enabled conveniences of daily life.
- Encourage transparent peer review of research and **international collaboration** between Chinese and American scientists, medical educators, health systems researchers, and technology developers (e.g. for vaccines, low-cost and new medicines such as for Alzheimers or other dementias), while supporting transparent enforcement of intellectual property rights and appropriate human subjects research oversight, and so on.
- Support **Chinese students studying in the US, and encourage US students to study in China and learn Mandarin**, with exchange of talent under transparent and reciprocal policies, including for medical education, clinical training, and related fields such as epidemiology, health economics, biology, and human-centered AI for healthcare and long-term care.
- Promote China's efforts to strengthen **medical education** curricula and residency training programs, especially to scale up GPs and recruit/retain qualified personnel in rural areas, by perhaps offering scholarships for students that commit to working to address disparities.
- Support China's efforts to **upgrade healthcare administration** management, from previous assumption that medical doctors could become managers without extra training, towards what has already been achieved by the top-level MBA and health management attained in some of China's leading (and very large) urban tertiary hospitals.
- Share case studies of US community and health system experiments with **integrated care and fostering patient-centered care**; these may offer useful lessons as Chinese strives to develop "two-way referral" systems and integrated care. Americans should keep an open mind about learning from Chinese experience as well, especially regarding organizational/technological innovations for developing lower-cost approaches to healthcare and long-term care. The time for patronizing assumptions about one-way learning is long behind us.
- **Encourage randomized controlled trials of traditional Chinese medicine**, and other science-based evaluations of herbal remedies.
- Work in conjunction with OECD partners in a **multilateral approach to support China's healthcare ecosystem development**, looking for reciprocity and pushing for openness while accepting that health systems all must be tailored to domestic conditions to some extent.

- Support China's efforts to develop more robust **systems of malpractice regulation and accountability for quality care**, as well as address physician-patient tensions.
- As China now is implementing alternatives to fee-for-service provider payment, including **DRG** roll-out, US should offer its rich **experience with bundled payment**, managing selection, supporting transparency and accountability. These next five years present a window of opportunity to share business operation experience without advocating the dysfunction that has gripped parts of the US health system. If DRG roll-out in China further undercuts patient trust in physicians and quality, then it could exacerbate physician-patient tensions and undermine the substantial progress with increasing access to care and raising quality in China's health system.
- Share American experience with **risk adjustment** and other strategies to try to equitably pay providers and reward them for their "value added," accounting for the differences in case mix of patients served. China is developing this apparatus, leading to opportunities for mutually beneficial exchange of research, procedures, software, and community feedback.
- Monitor the **quality and transparency of the pharmaceutical supply chain** – do not single out China, but hold to same global standards of inspections etc. as other global suppliers in Europe, India, and elsewhere. Completely "decoupling" supply chains for health and medical products is unrealistic and would be to the detriment of the American people; rather, productive engagement to assure supply and quality, with contingency plans for future pandemics, would be prudent.

The US may promote mutual policy learning in several important areas, such as tobacco control and firearm safety. US authorities can proudly share their experience with recovering the large amount of funds that tobacco causes in terms of higher healthcare expenditures. While specific to the US economic and legal context, the Master Settlement Agreement (MSA)—in which major tobacco companies agreed to compensate most states for Medicaid expenses—could provide a useful basis for experts in both countries to simultaneously improve population health and meet China's government's growing need for expenditures to support improved access and quality of healthcare for all Chinese citizens. For example, Cutler et al. (2002) study the MSA economic implications using data from Massachusetts. They find that the financial compensation states received was substantial, yet "dwarfed by the value of the health impacts induced by the settlement…. The value of health benefits ($65 billion through 2025 in 1999 dollars) from increased longevity is an order of magnitude greater than any other impacts or payments." (Cutler et al. 2002, p.1). Thus, the scientific and legal case of the MSA in the US could provide a useful basis for helping tobacco control advocates within the government of China and in non-government organizations to achieve the mutually reinforcing benefits of (1) lower

medical spending on tobacco-caused harms and (2) longer, healthier lives as called for in “Healthy China 2030.”

In return, perhaps China and other countries could share their positive experience with firearm safety (aka gun control) as a public health priority for mitigating the harms from firearms in the United States, an international outlier (see Rivara et al. 2018). What can we learn from each other about how to reduce premature mortality from tobacco and guns? China, Japan and Singapore have been relatively successful at the latter, while male smoking remains high. Certainly, the political economy of tobacco control in China and of firearm safety in the US are similarly fraught, with conflicts of interest between the industry and its interest groups on the one hand, and population health and its advocates on the other. Those interests have spilled over into constraints on regulation and research that prevent health researchers and advocates from fully realizing the benefits of tobacco control and firearm safety for reducing premature mortality in both of these great nations. The governments should support each other in breaking through this impasse in the interest of better health of Chinese and Americans alike.

The US should also work collaboratively with their Chinese counterparts to address regional issues of population health importance. These would include, for example, addressing health problems in the DPRK (malnutrition, MDR tuberculosis), working with southeast Asian neighbors on health issues, and integrating public health priorities into China’s Belt and Road Initiative.

Moreover, the US should support Chinese authorities in their laudable efforts to address climate change domestically and in the region, helping to achieve the co-benefits of green growth and better health (e.g. smart cities with green space and excellent public transportation to reduce air pollution, promote exercise, and foster healthy aging). US companies active in developing technologies for sustainability and green growth should actively collaborate with Chinese companies in leveraging those developments for improved health, given the strong link between planetary health and human health.

In all our policies and interactions, we should remember that China is large and diverse, not just the urban metropolises of Beijing and Shanghai; many important decisions in health policies as in other policies are undertaken by local government agencies. The “Chinese people” are not synonymous with any given leader, just as the “American people” are not synonymous with any given leader. Avoid politicizing the COVID-19 pandemic and other health and humanitarian issues. In other geopolitical considerations in bilateral US-China relations, uphold US interests while encouraging the PRC to be active as a globally responsible stakeholder. Be careful not to state or imply that the US seeks to contain or undermine the Chinese people’s aspirations for longer, healthier, thriving lives, with dignity and respect.

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Eggleston USCC Testimony: Figures – China's health system in international comparison

Overview of health outcomes and health behaviors

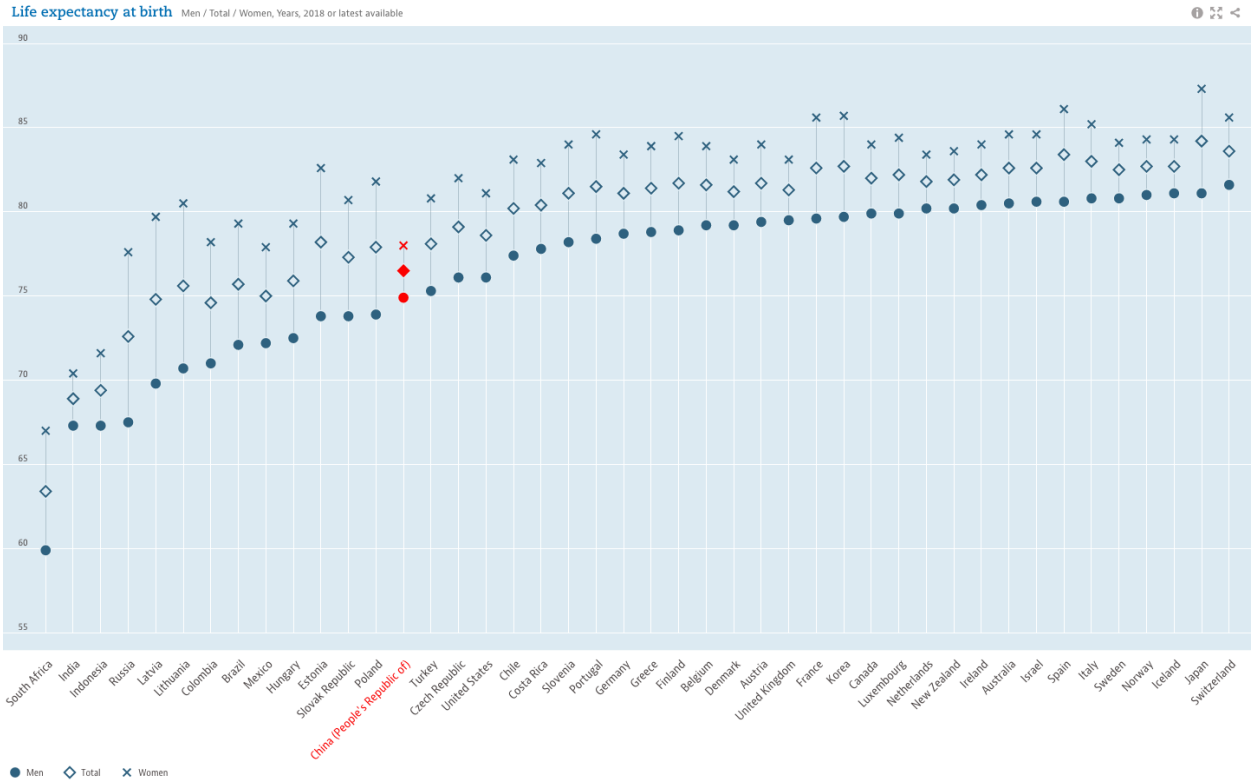

Figure 1. OECD (2020), Life expectancy at birth, 2018. doi: 10.1787/27e0fc9d-en (Accessed on 22 April 2020)

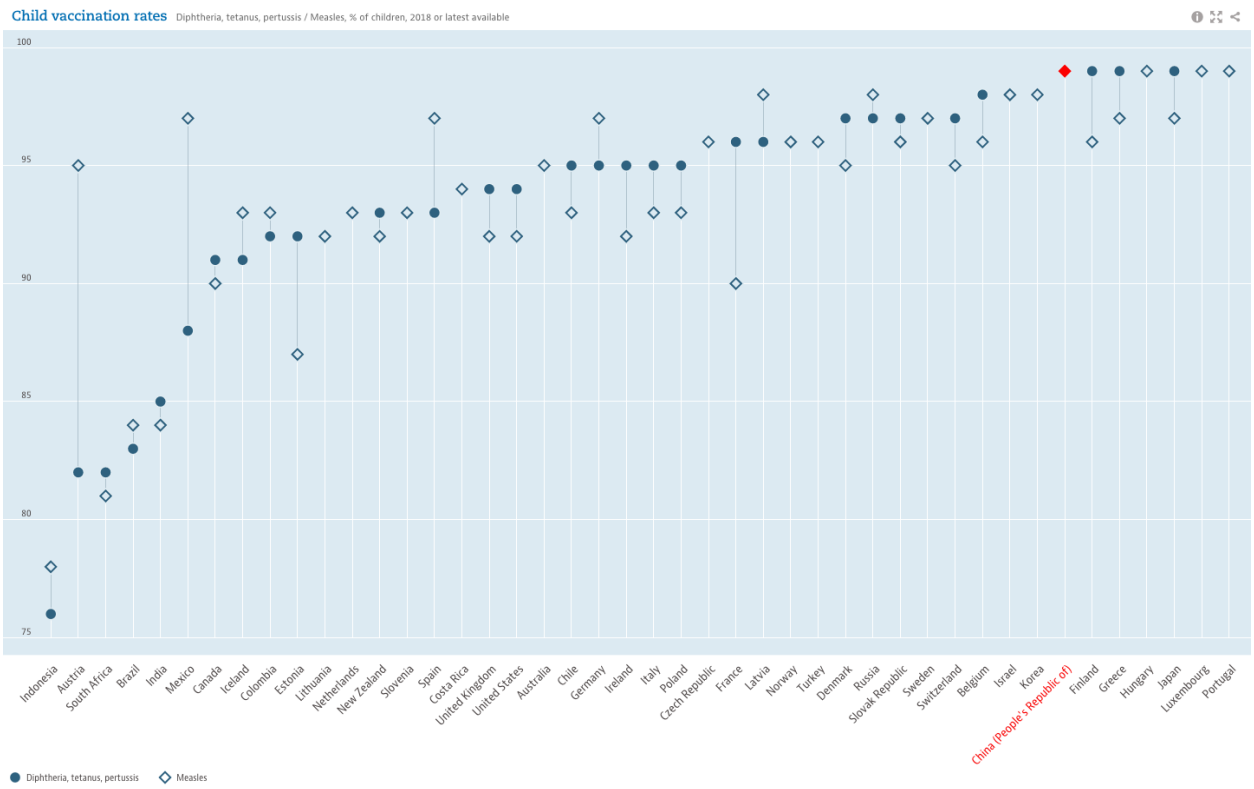

Figure 2. OECD (2020), Child vaccination rates, 2018. doi: 10.1787/b23c7d13-en (Accessed on 22 April 2020)

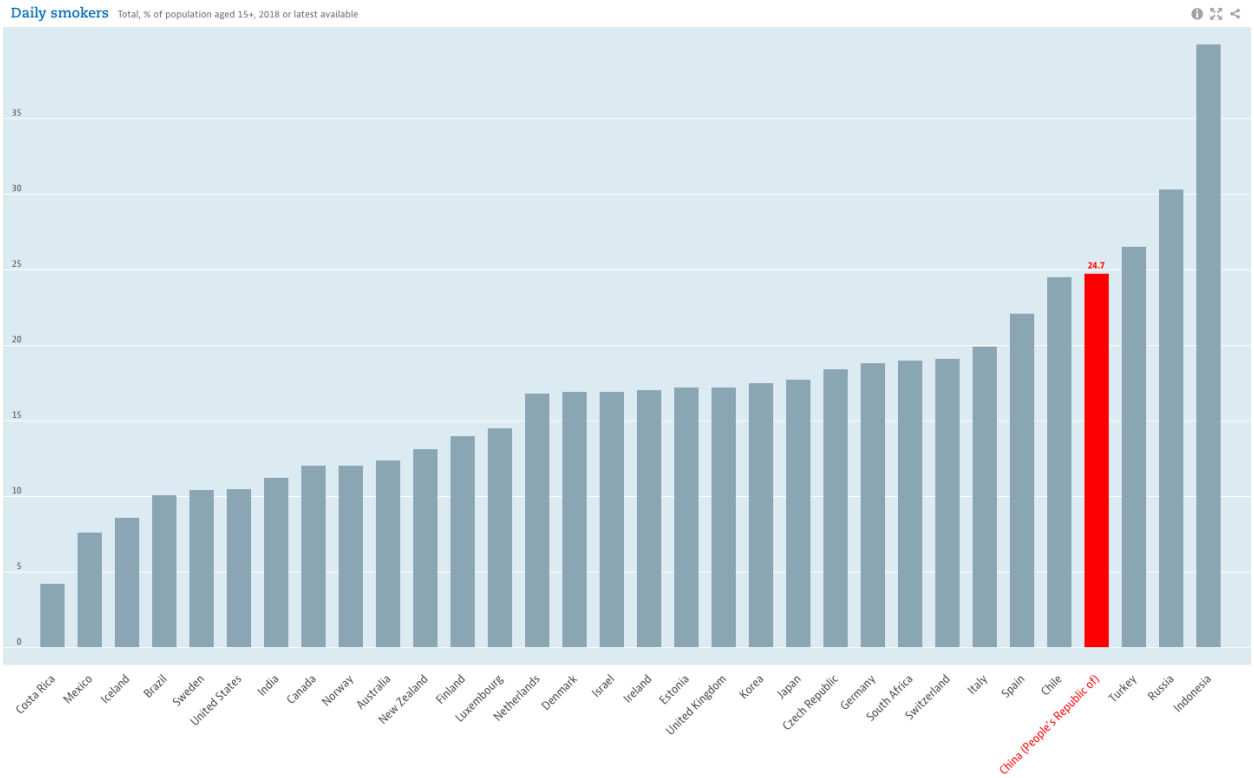

Figure 3. OECD (2020), Daily smokers, 2018. doi: 10.1787/1ff488c2-en (Accessed on 22 April 2020)

Health service delivery system

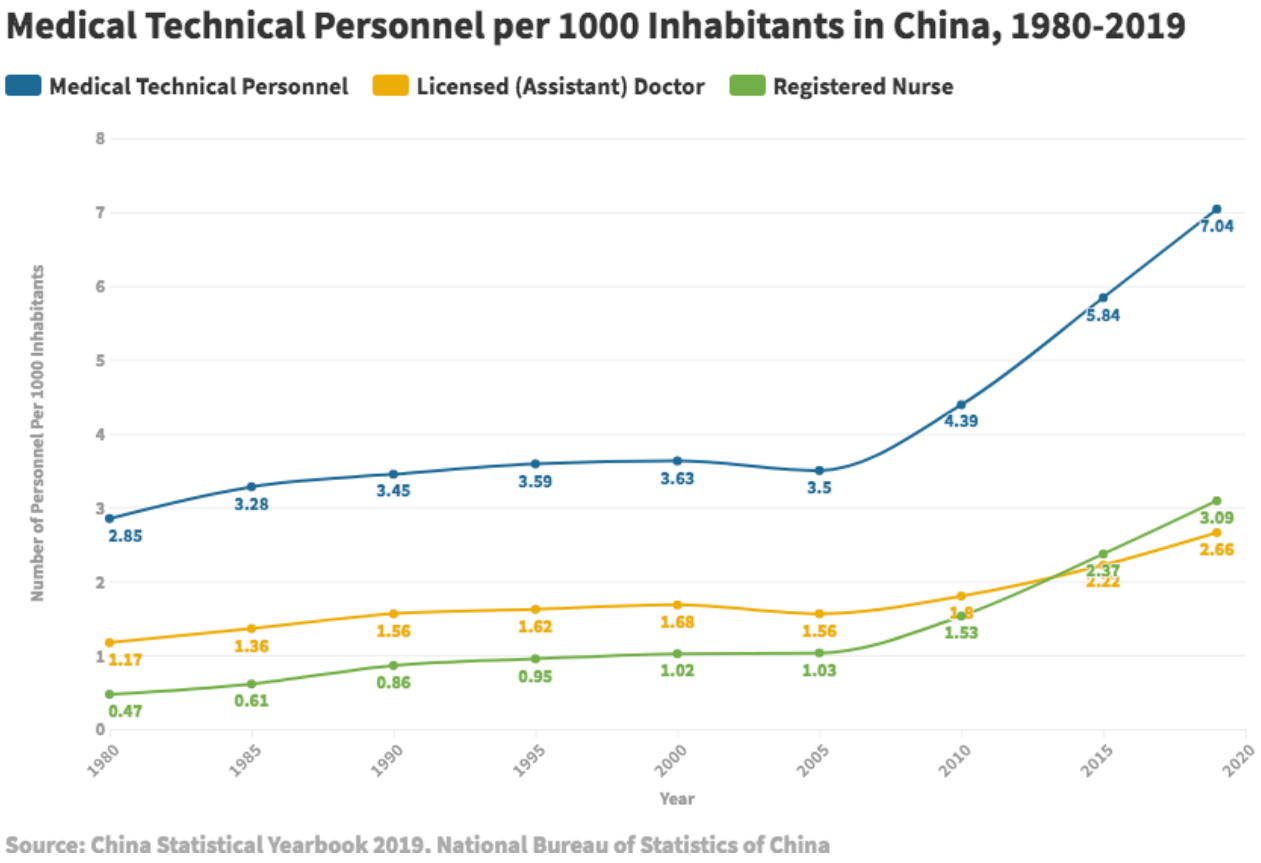

Figure 4. Skilled health professionals per 1000 population in China, 1980-2019. Prepared by the author using data from the "China Statistical Yearbook 2019," 22-3, National Bureau of Statistics of China, accessed April 22, 2020. http://www.stats.gov.cn/tjsj/ndsj/2019/indexeh.htm

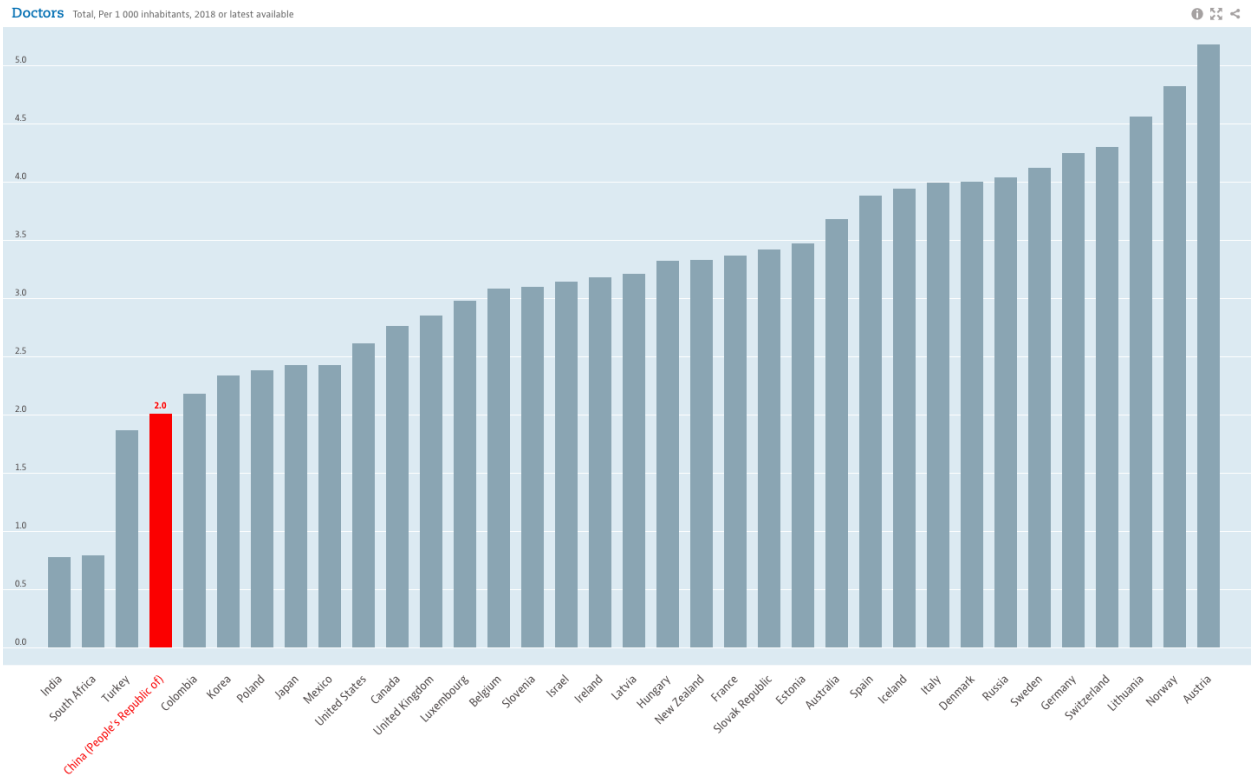

Figure 5. OECD, Doctors per 1000 residents, 2018. doi: 10.1787/4355e1ec-en (Accessed on 22 April 2020)

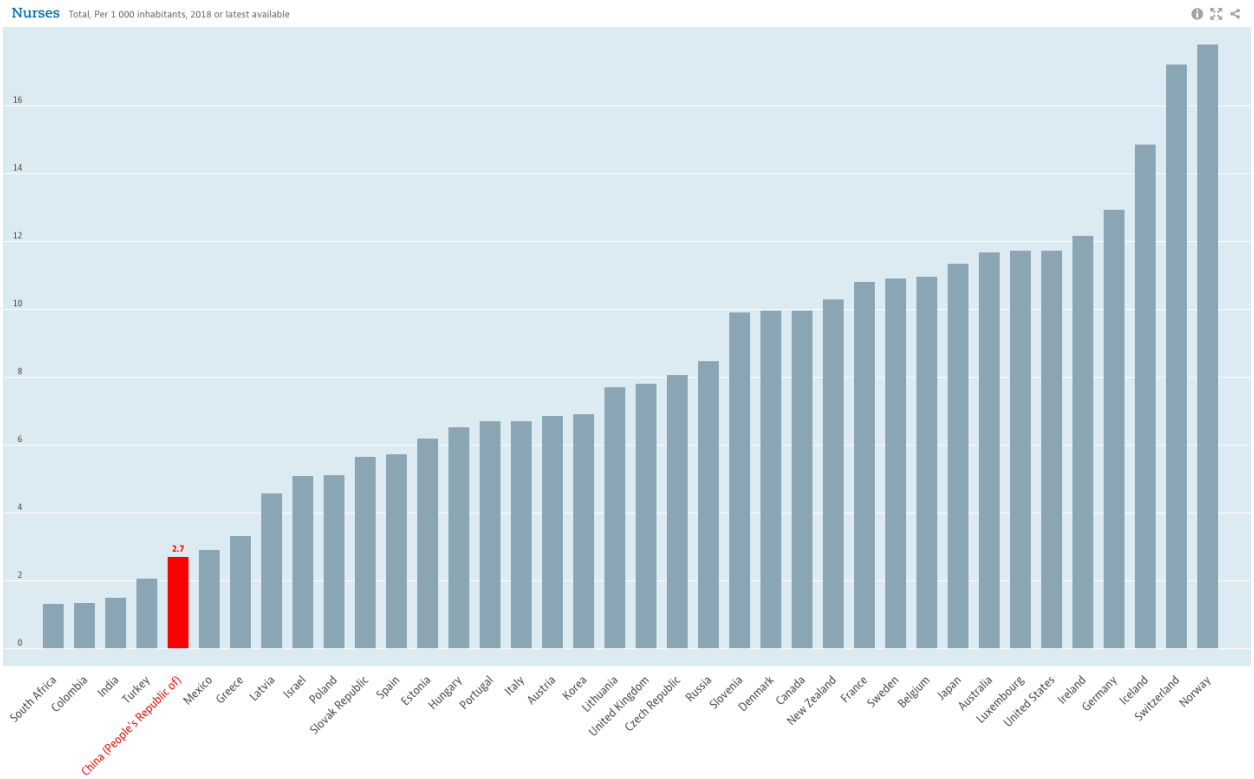

Figure 6. OECD, Nurses per 1000 residents, 2018. doi: 10.1787/283e64de-en (Accessed on 22 April 2020)

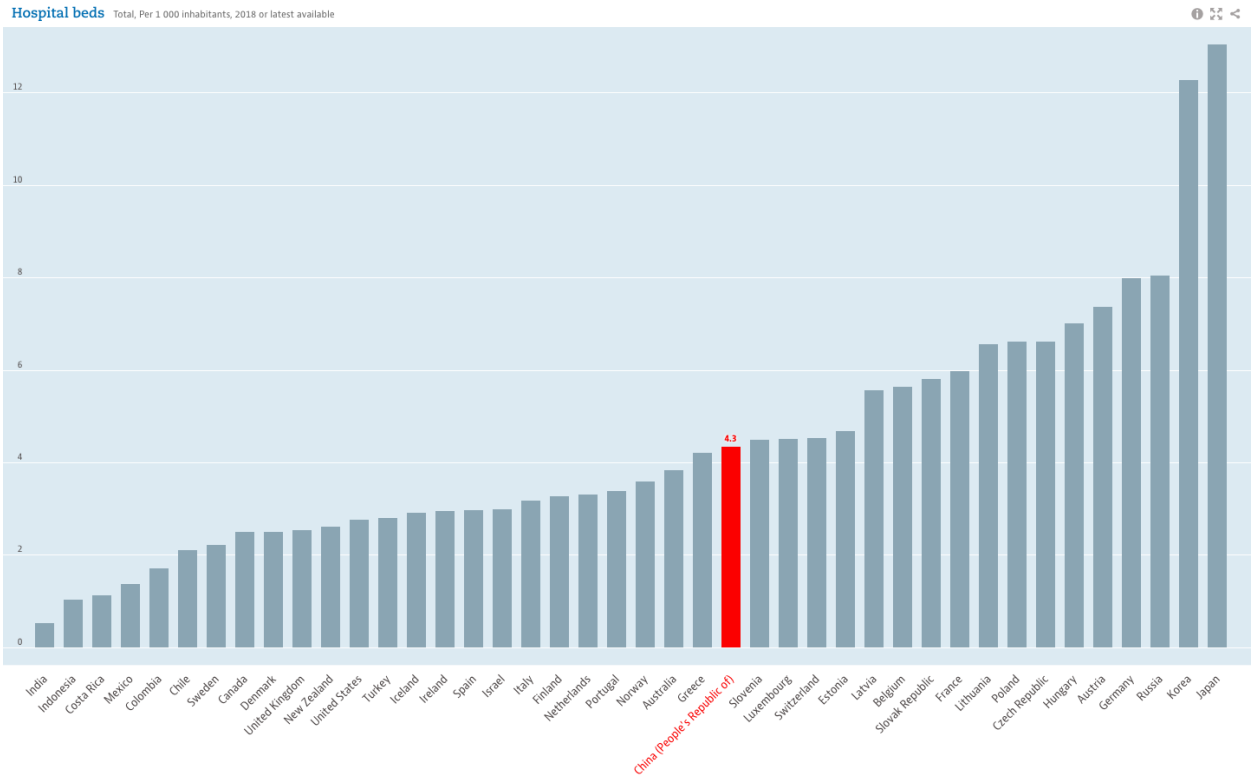

Figure 7. OECD, Hospital beds per 1000 residents, 2018. doi: 10.1787/0191328e-en (Accessed on 22 April 2020)

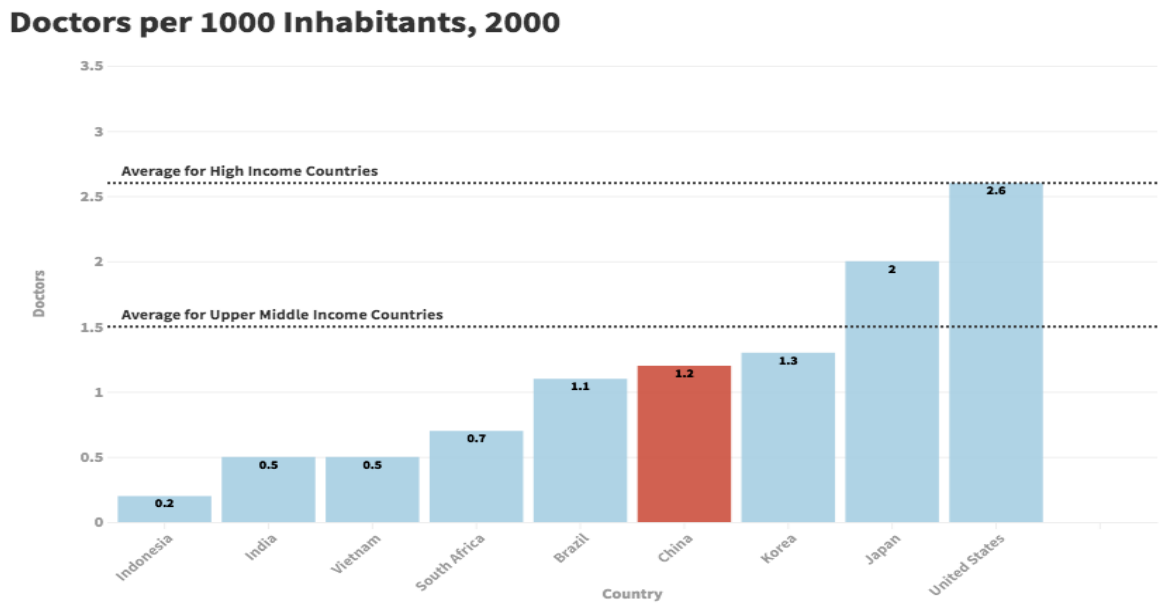

Figure 8a. Doctors per 1000 residents, 2000. Prepared by the author using data from the World Bank, World Development Indicators, accessed April 22, 2020.

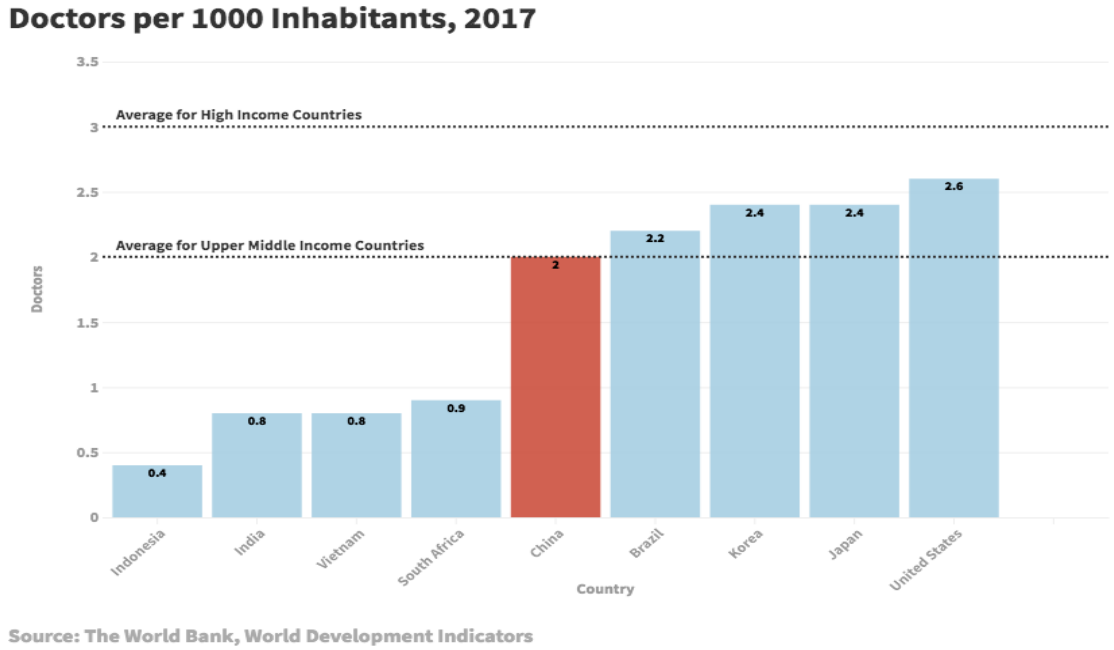

Figure 8b. Doctors per 1000 residents, 2017. Prepared by the author using data from the World Bank, World Development Indicators, accessed April 22, 2020.

China's Skilled Healthcare Workforce (Doctors, Nurses, Midwives): Liu and Eggleston (2020)

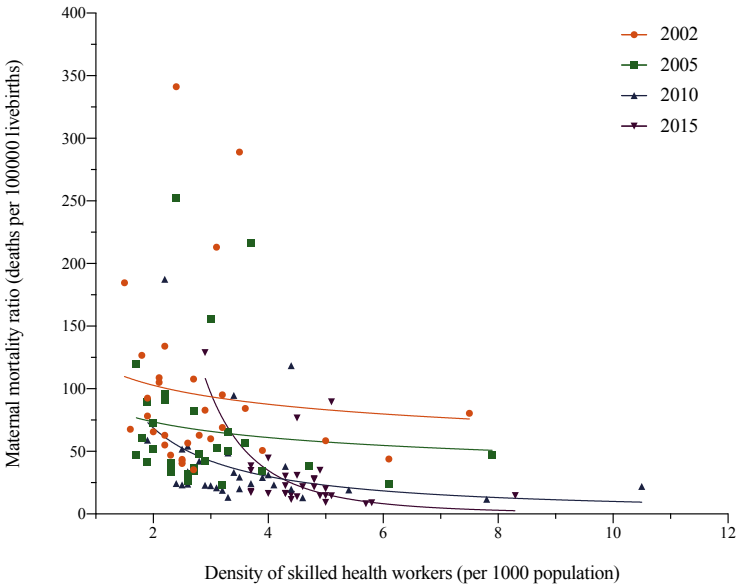

Figure 9a. Scatter plot of maternal mortality ratio and density of skilled health workers in China (2002, 2005, 2010, 2015) (log-log curve)
Sources: Liu and Eggleston (2020) analysis of data from China Health Statistical Yearbook (2003~2016) and the Global Burden of Disease estimates

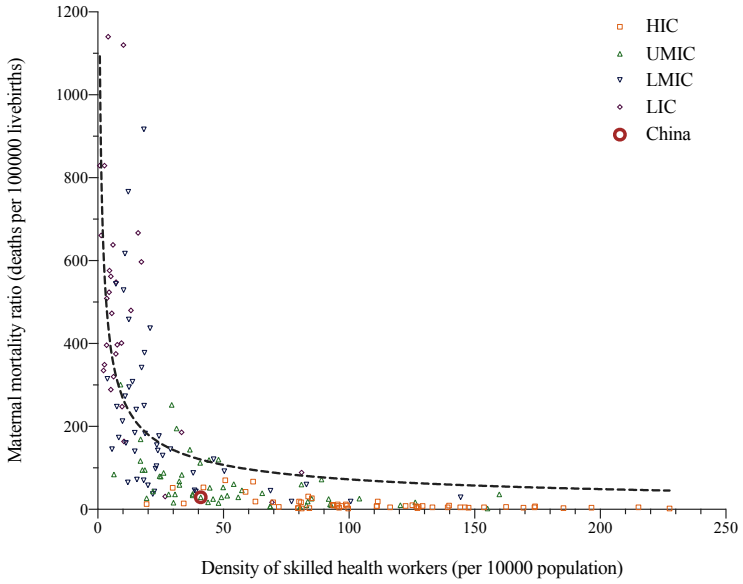

Figure 9b. Scatter plot of maternal mortality ratio and density of skilled health workers for 178 countries in 2017 (log-log curve)
Sources: Liu and Eggleston (2020) analysis of data from Global Health Workforce Statistics and World Health Organization

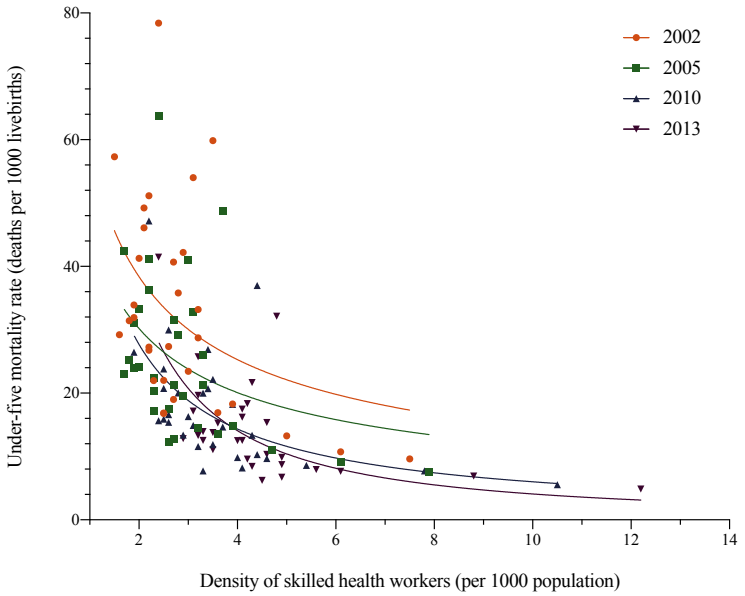

Figure 10a. Scatter plot of under-five mortality rate and density of skilled health workers in China (2002, 2005, 2010, 2013) (log-log curve)

Sources: Liu and Eggleston (2020) analysis of data from China Health Statistical Yearbook (2003~2016) and the Global Burden of Disease estimates

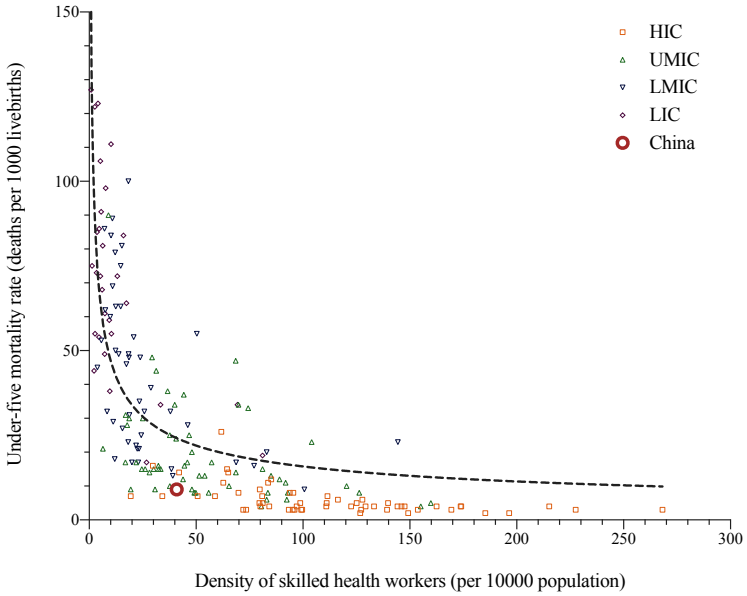

Figure 10b. Scatter plot of under-five mortality rate and density of skilled health workers for 189 countries in 2017 (log-log curve)

Sources: Liu and Eggleston (2020) analysis of data from Global Health Workforce Statistics and UN Inter-agency Group for Child Mortality Estimation

Health spending

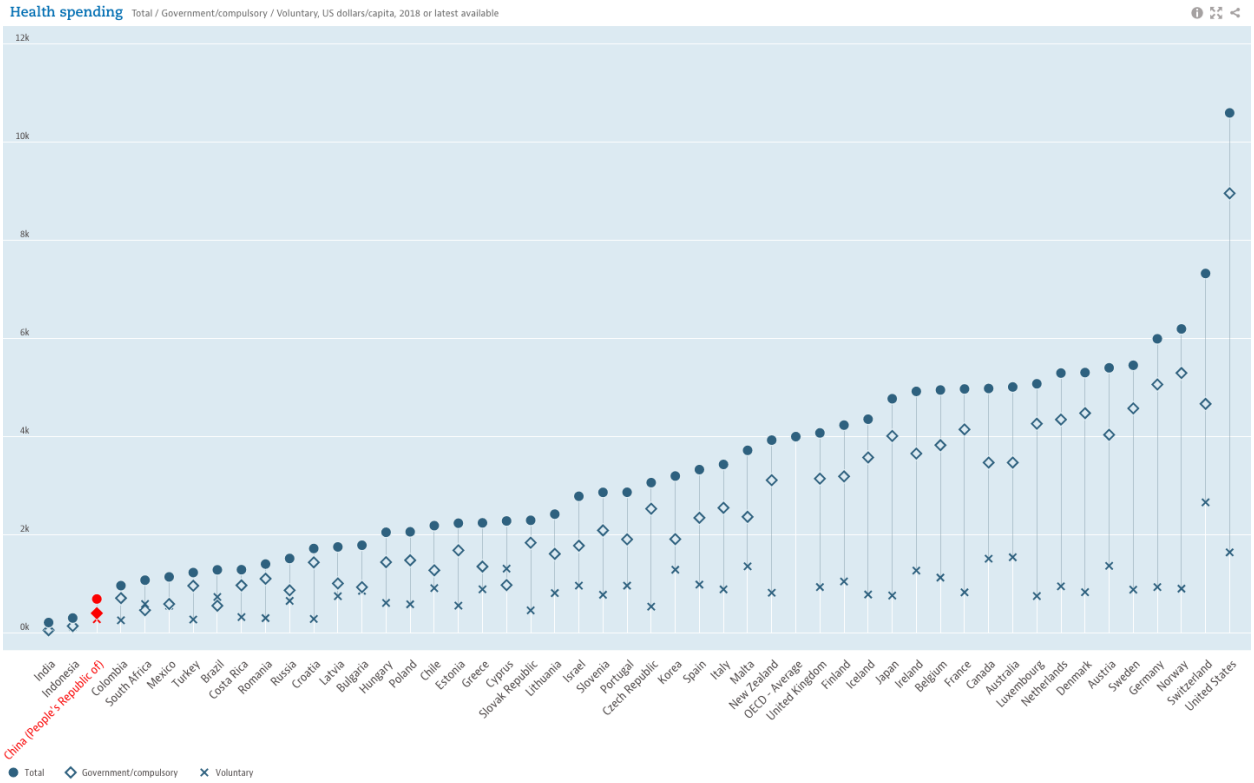

Figure 11. OECD (2020), Health spending, 2018. doi: 10.1787/8643de7e-en (Accessed on 22 April 2020)

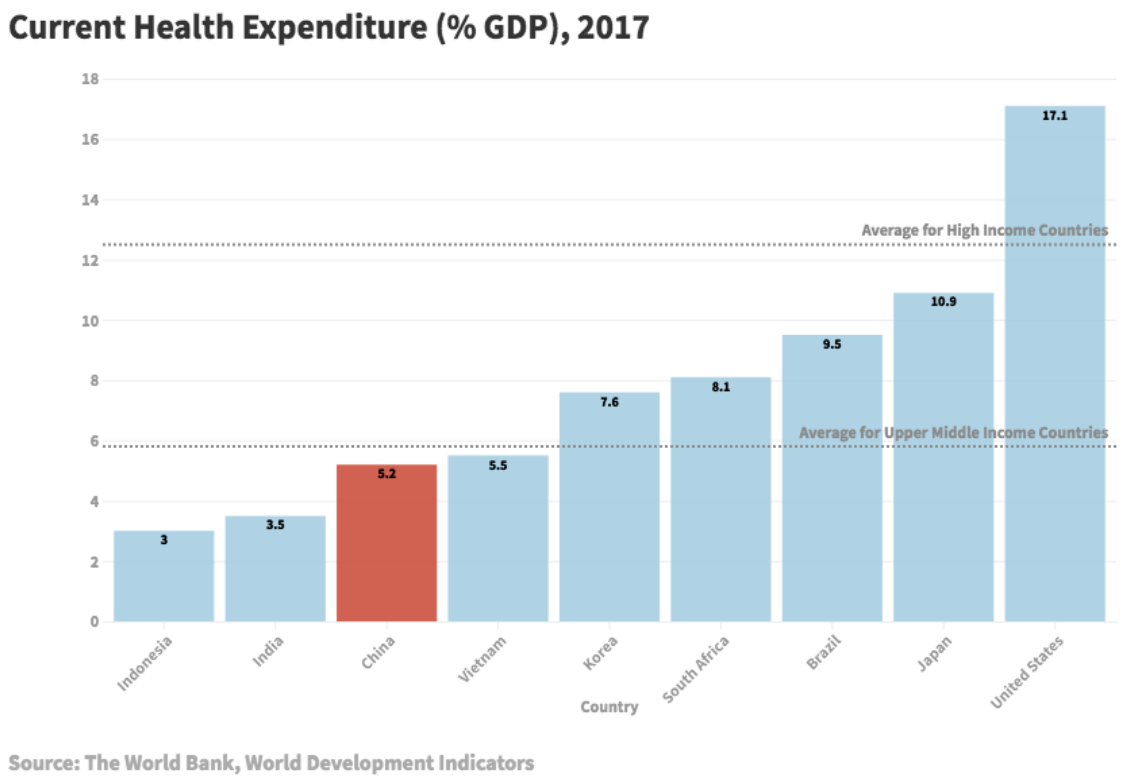

Figure 12a. Health spending, % of GDP, 2017. Prepared by the author using data from the World Bank, World Development Indicators, accessed April 22, 2020.

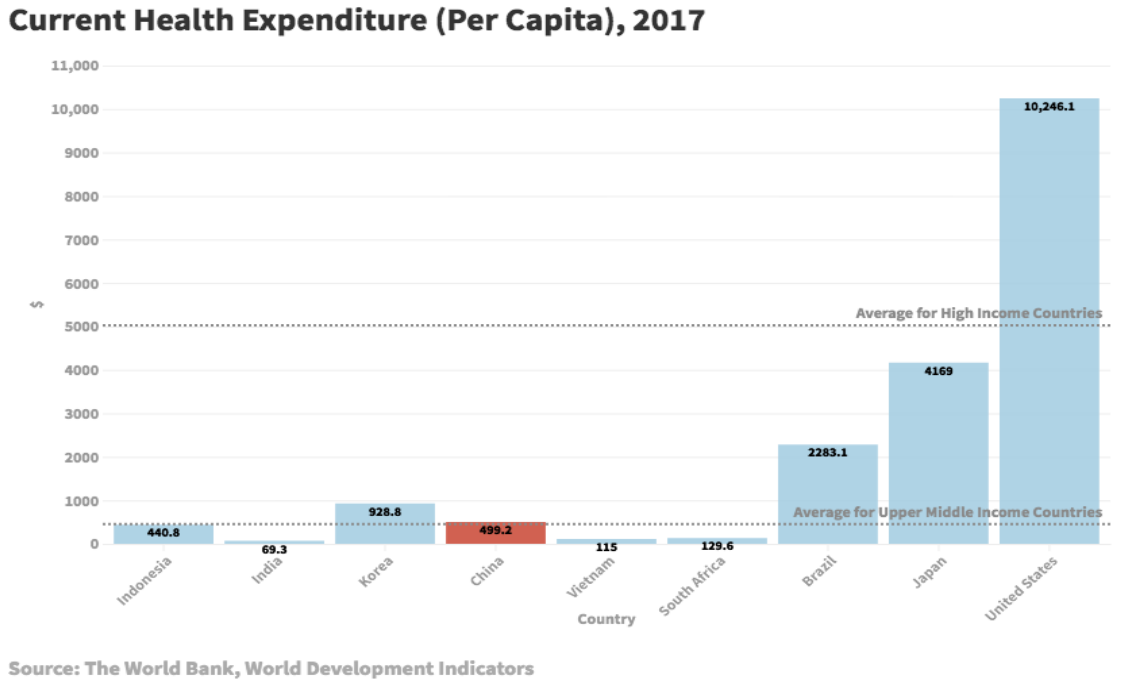

Figure 12b. Health spending per capita, 2017. Prepared by the author using data from the World Bank, World Development Indicators, accessed April 22, 2020.

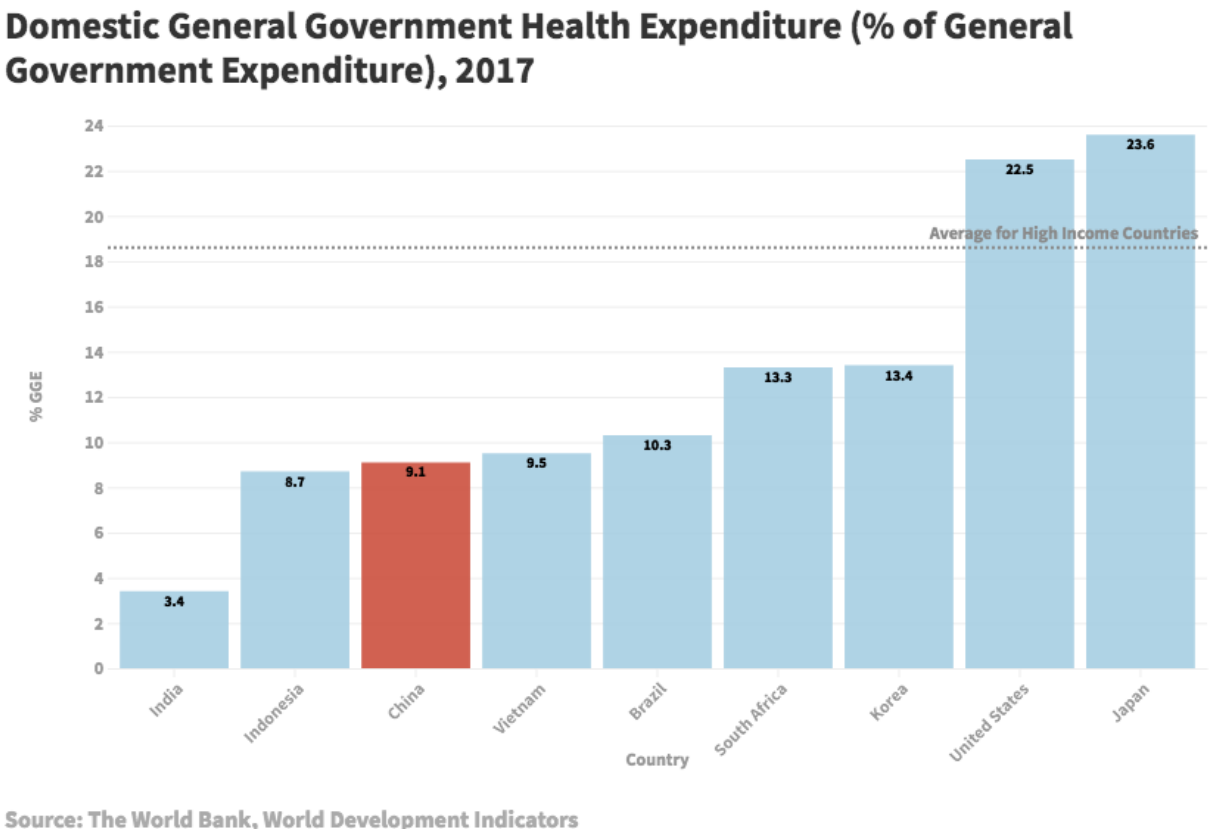

Figure 13. Prepared by the author using data from the World Bank, World Development Indicators, accessed April 22, 2020. https://datacatalog.worldbank.org/dataset/world-development-indicators

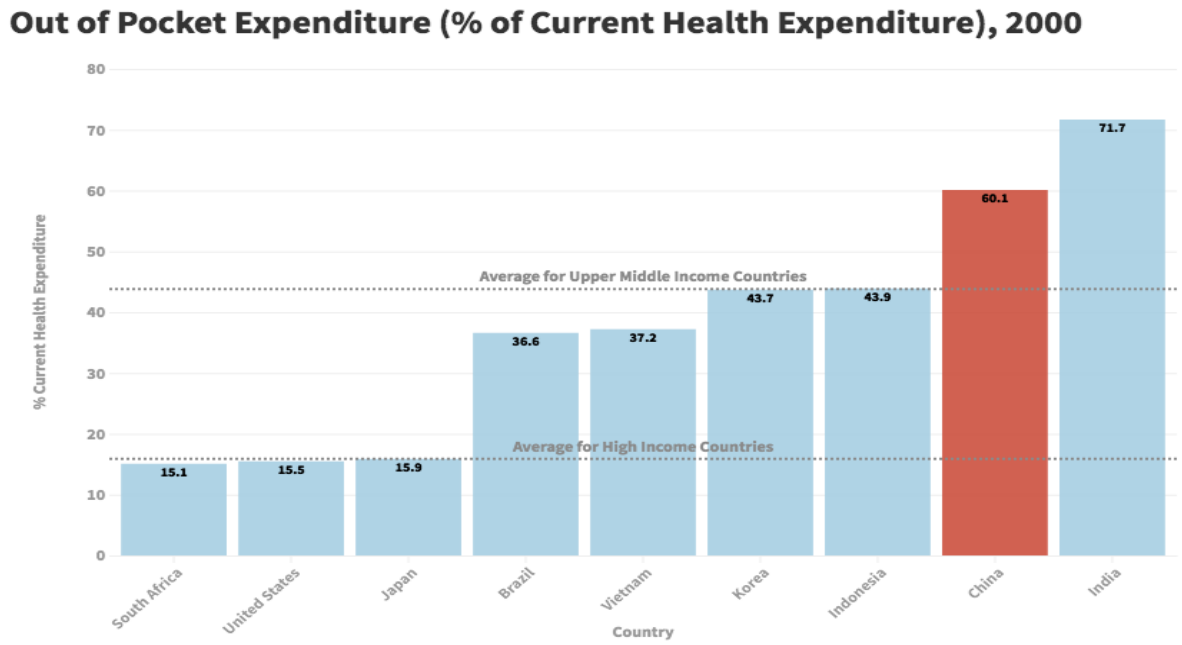

Figure 14a. Prepared by the author using data from the World Bank, World Development Indicators, accessed April 22, 2020. https://datacatalog.worldbank.org/dataset/world-development-indicators

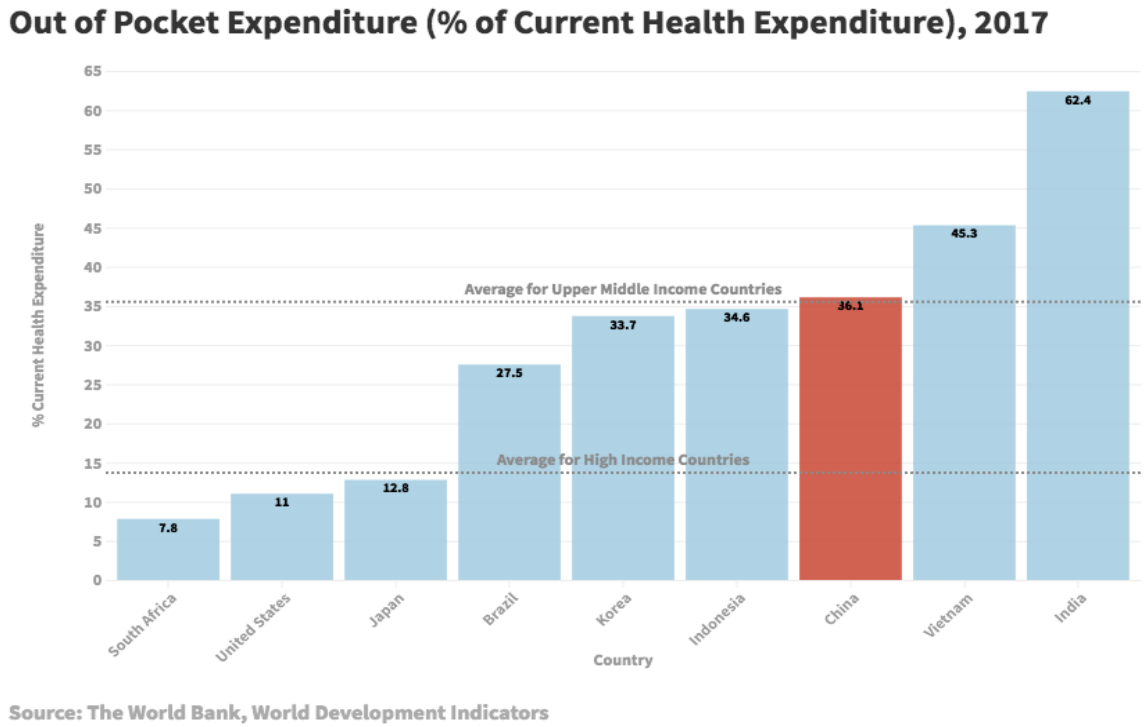

Figure 14b. Prepared by the author using data from the World Bank, World Development Indicators, accessed April 22, 2020. https://datacatalog.worldbank.org/dataset/world-development-indicators

Regional and Urban-Rural Disparities

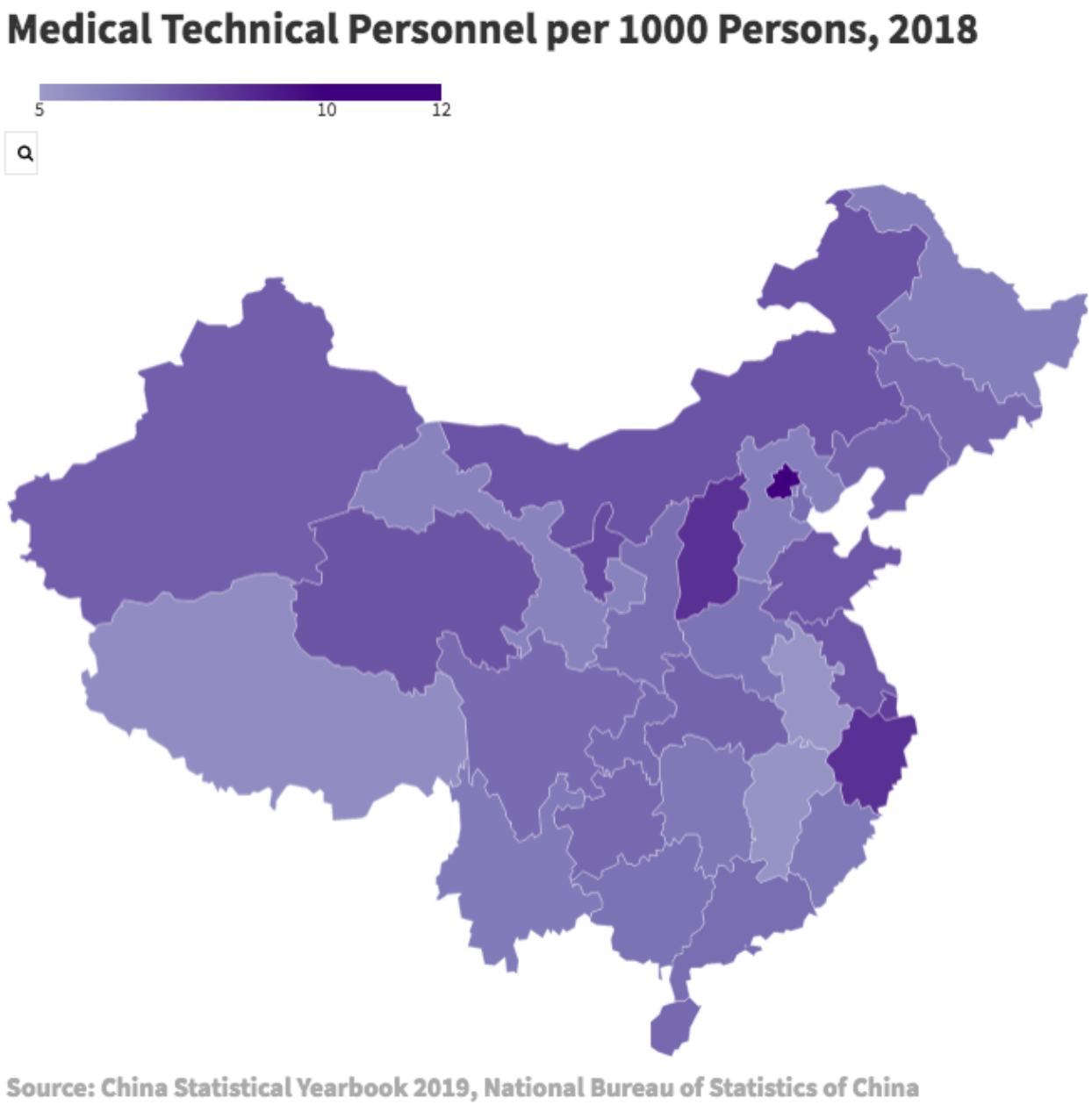

Figure 15. Prepared by the author using data from the National Bureau of Statistics of China, accessed April 22, 2020. http://data.stats.gov.cn/english/easyquery.htm?cn=E0103

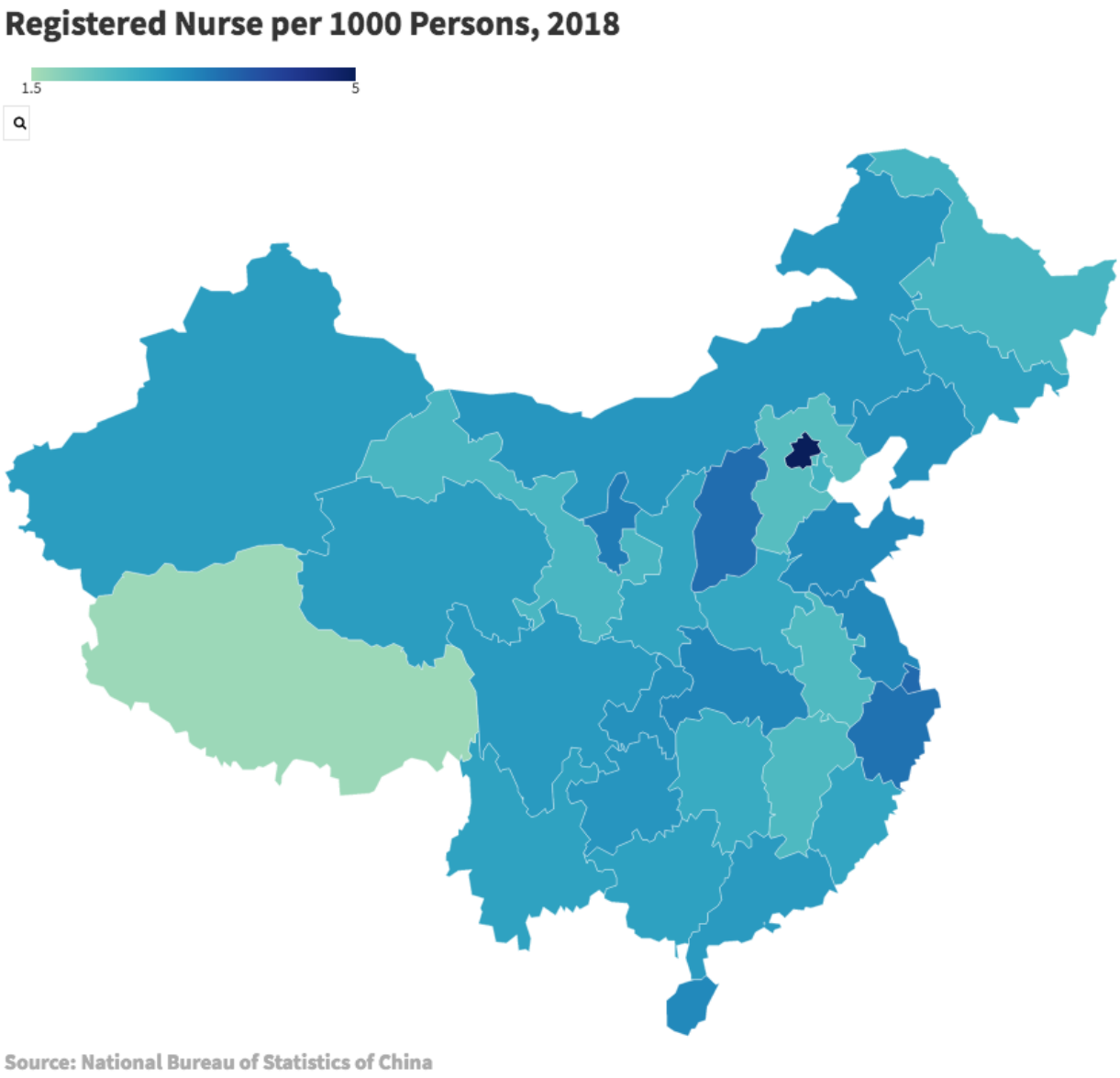

Figure 16. Prepared by the author using data from the "China Statistical Yearbook 2019," 22-3, National Bureau of Statistics of China, accessed April 22, 2020.

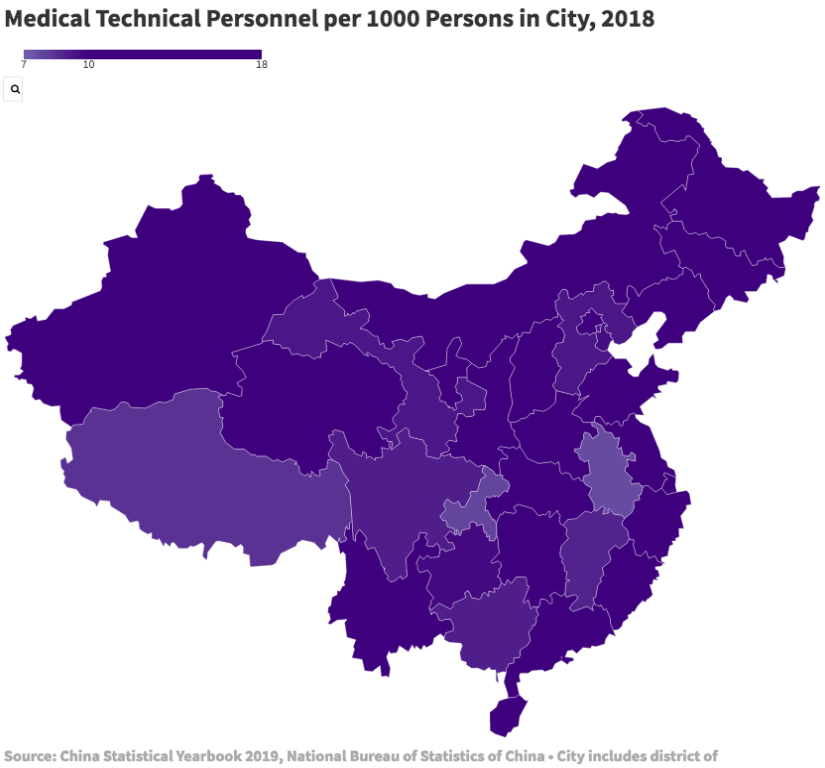

Figure 17a. Skilled healthcare workers per 1000 in urban areas, 2018. Prepared by the author using data from the "China Statistical Yearbook 2019," 22-3, National Bureau of Statistics of China.

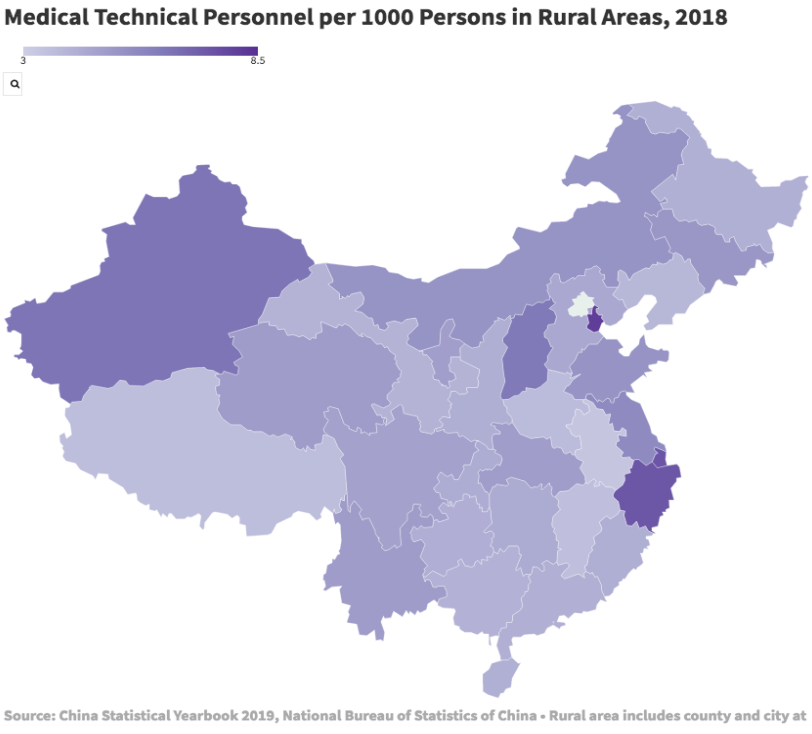

Figure 17b. Skilled healthcare workers per 1000 in rural areas, 2018. Prepared by the author using data from the "China Statistical Yearbook 2019," 22-3, National Bureau of Statistics of China.

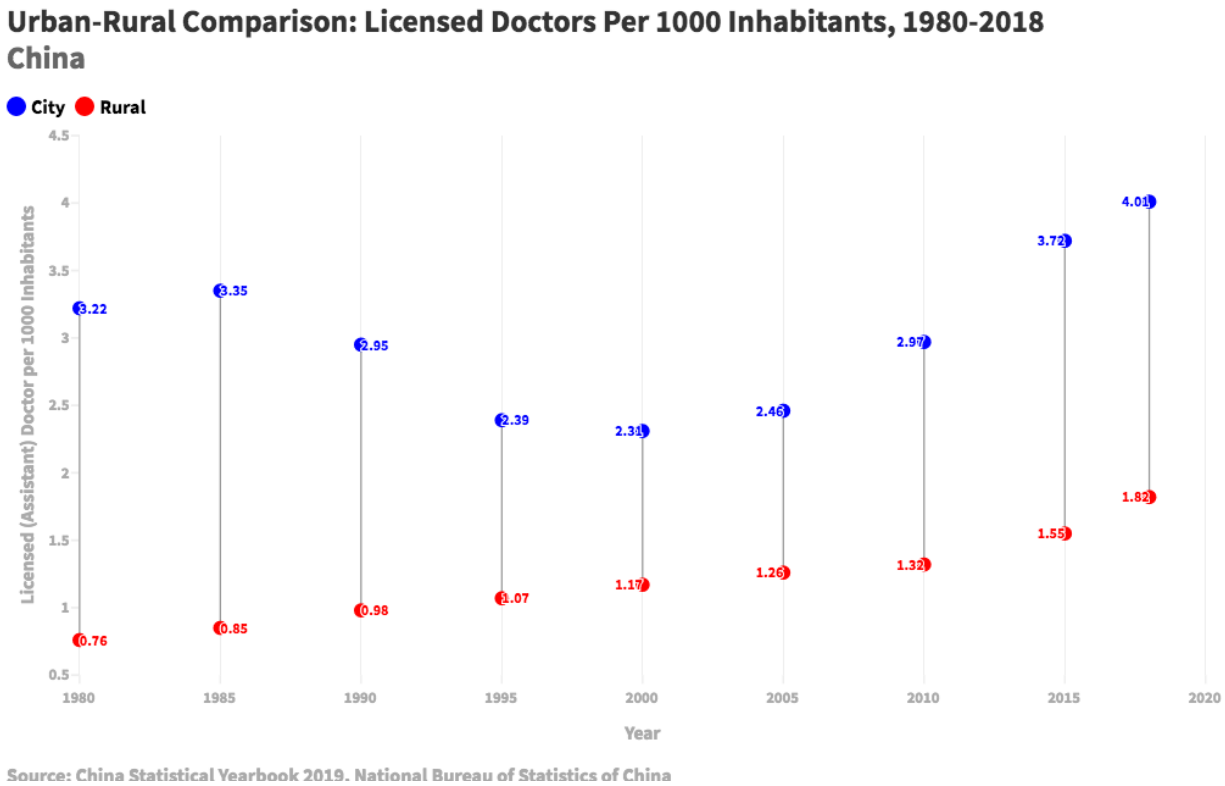

Figure 18. Doctors per 1000 population: Urban-rural comparison, 1980-2018. Prepared by the author using data from the "China Statistical Yearbook 2019," 22-3, National Bureau of Statistics of China, accessed April 22, 2020. http://www.stats.gov.cn/tjsj/ndsj/2019/indexeh.htm

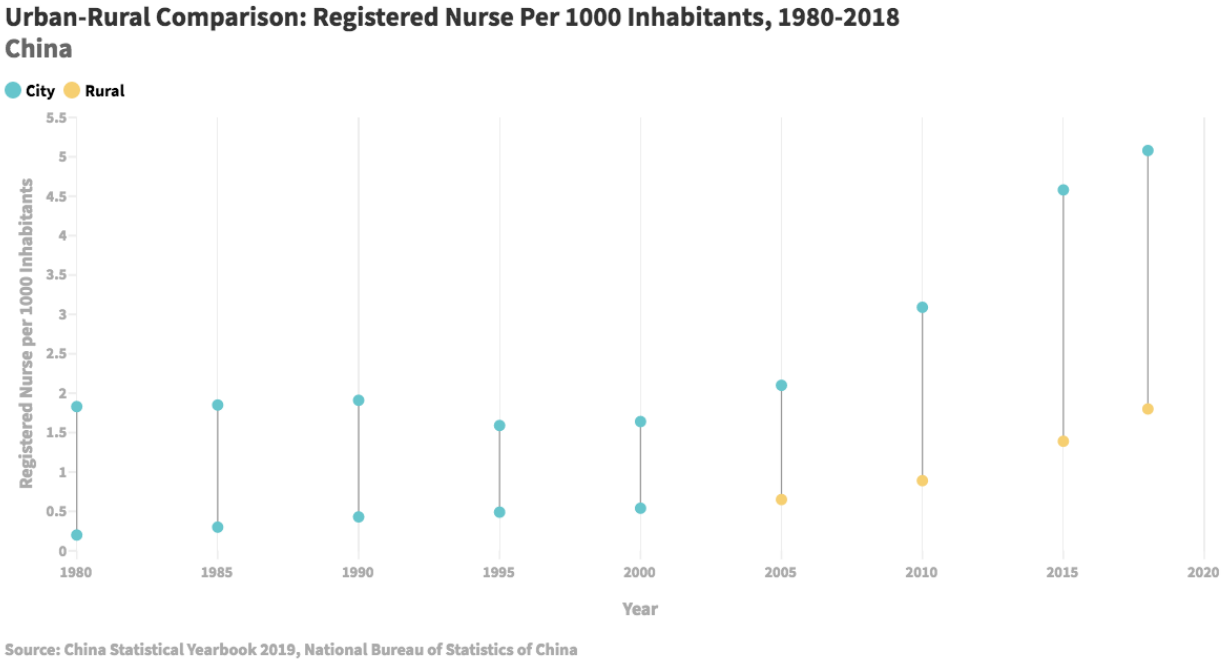

Figure 19. Nurses: Urban-rural comparison, 1980-2018. Prepared by the author using data from the "China Statistical Yearbook 2019," 22-3, National Bureau of Statistics of China, accessed April 22, 2020. http://www.stats.gov.cn/tjsj/ndsj/2019/indexeh.htm

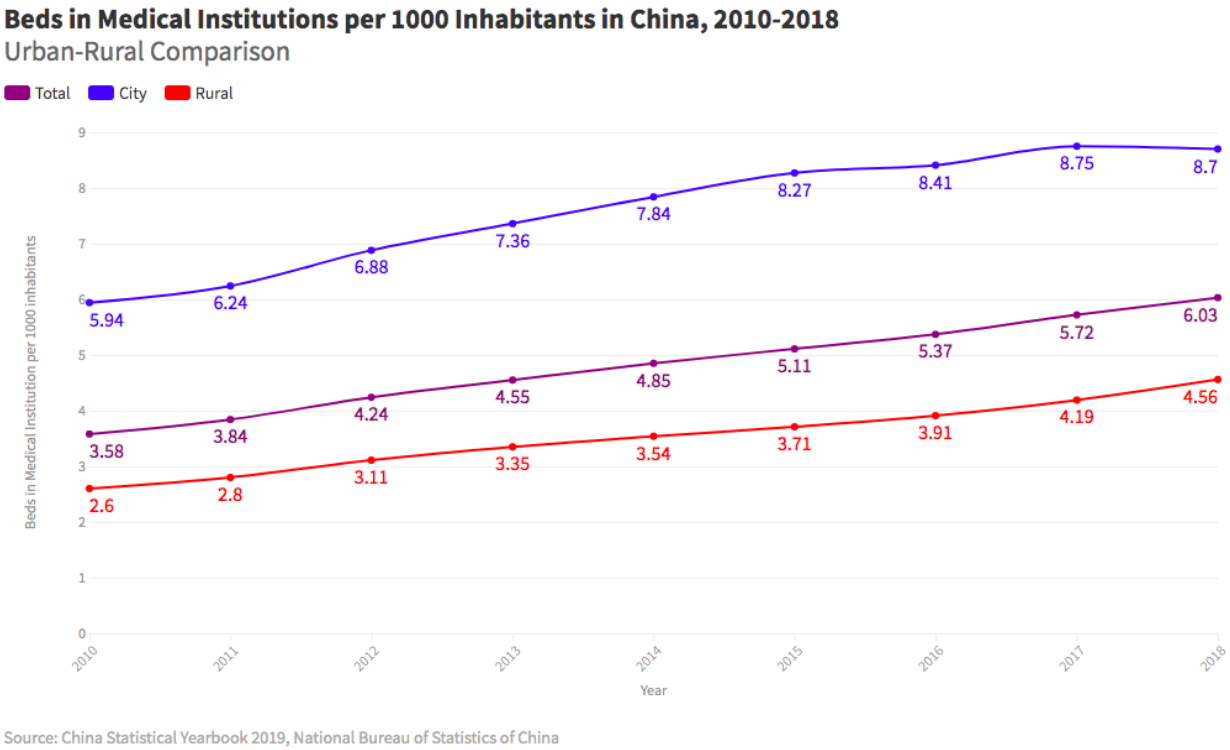

Figure 20. Urban-rural comparison of hospital beds per 1000 population, 2010-2018. Prepared by the author using data from the "China Statistical Yearbook 2019," 22-7, National Bureau of Statistics of China, accessed April 22, 2020. http://www.stats.gov.cn/tjsj/ndsj/2019/indexeh.htm

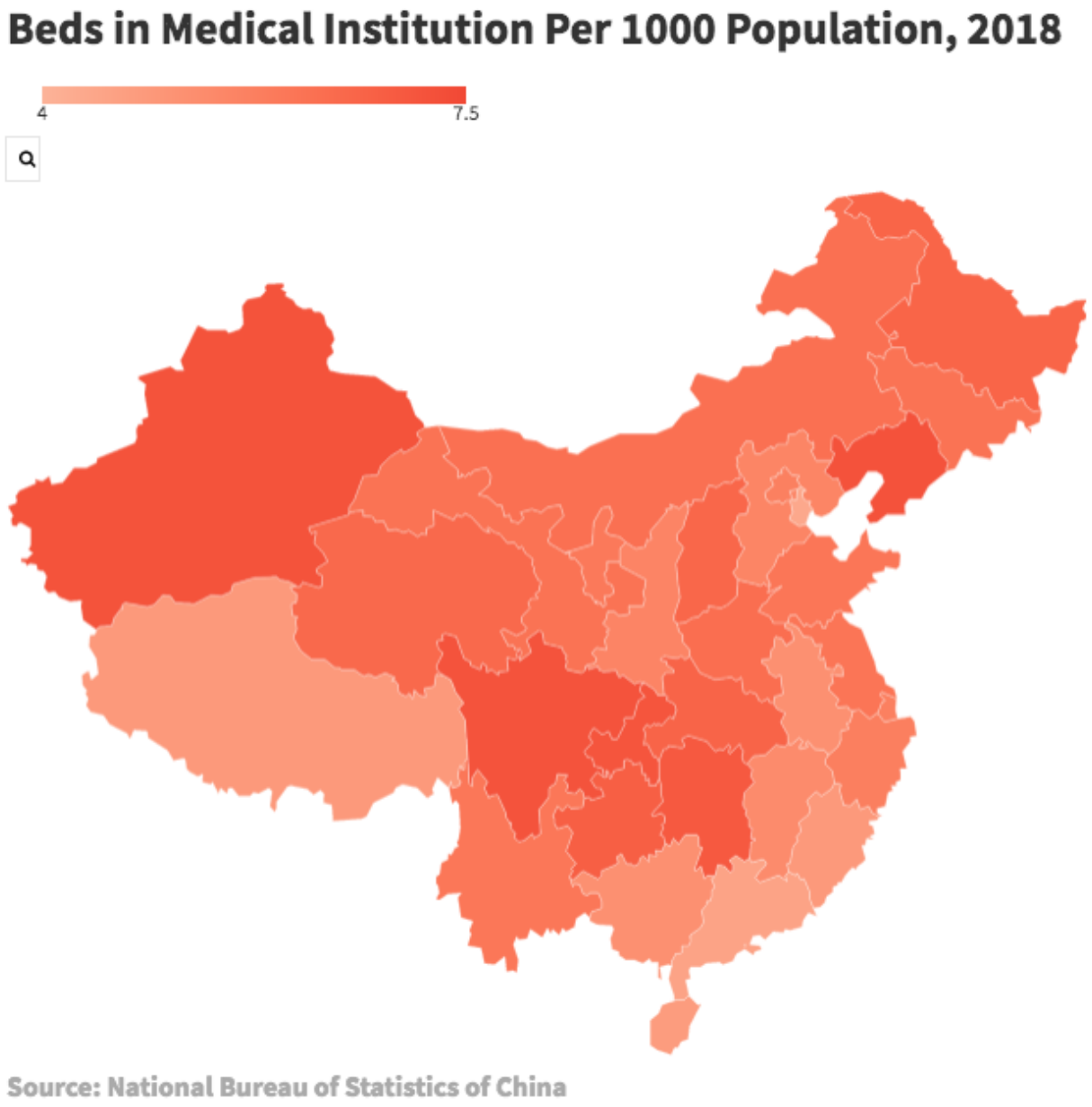

Figure 21. Prepared by the author using data from the "China Statistical Yearbook 2019," 22-7, National Bureau of Statistics of China, accessed April 22, 2020. http://www.stats.gov.cn/tjsj/ndsj/2019/indexeh.htm

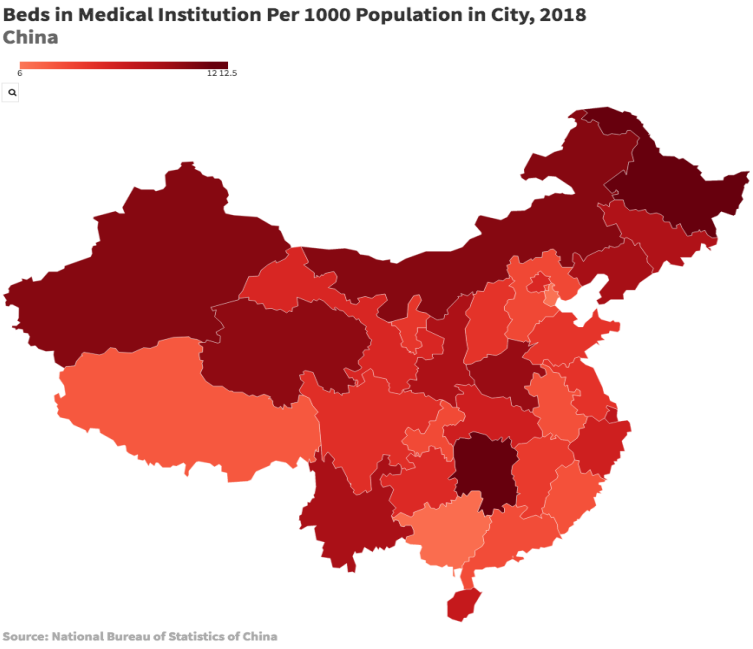

Figure 22a Prepared by the author using data from the "China Statistical Yearbook 2019," 22-7, National Bureau of Statistics of China, accessed April 22, 2020. http://www.stats.gov.cn/tjsj/ndsj/2019/indexeh.htm

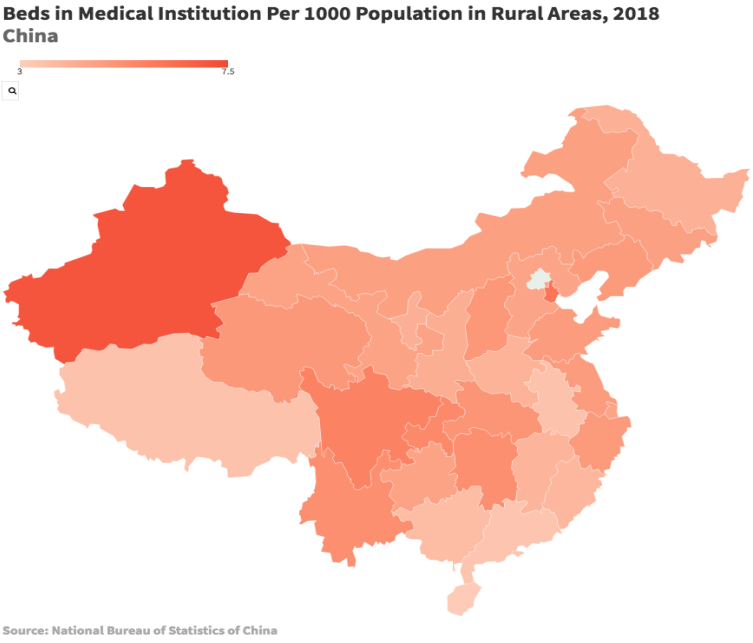

Figure 22b Prepared by the author using data from the "China Statistical Yearbook 2019," 22-7, National Bureau of Statistics of China, accessed April 22, 2020. http://www.stats.gov.cn/tjsj/ndsj/2019/indexeh.htm