Technology and Innovation in the Health Sector: Narrowing asymmetric information and increasing quality of human lives

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Introduction

Health is a fundamental human right.[i] A person's health is both a requirement and the goal of people's welfare. A healthy body and healthy mind are necessary to produce goods and services for adults and basic requirements for students to maximize things like high academic scores; they are key to enjoying life for the elderly or senior citizens. Since the prehistoric era, human beings have searched for maximum healthy conditions in line with their development. The old Greek motto of "Mens sana in corpore sano" still applies to modern life in the 21st century. Although medical sciences, technological sciences, and information technologies have reached great development, many diseases and the secret to long and healthy life are still a mystery. States and corporations across the globe continue to search for advanced technologies in diagnostics, treatment, and health information to ensure everyone on this planet gets the health care they need.

In 2015, world leaders signed the Sustainable Development Goals (SDGs) to ensure no one is left behind in the pursuit for global welfare. Among others, Goal 3.8 calls for Universal Health Coverage (UHC) in which everyone would have access to health care to achieve optimally healthy bodies and minds without financial hardship. The World Health Organization and the World Bank measure the progress towards UHC every five years. The key indicators measured in UHC achievement are the proportion of people in any country that are free from risk of catastrophic health spending and the proportion of people who become poor after accessing health care.

Human needs and the right to health care

In the context of the universal consensus that health is a fundamental human right, the United Nations Universal Declaration of Human Rights in 1948 includes the right to health and health care for everyone. Many countries, explicitly and implicitly, strive to provide comprehensive health services for all citizens. Differences in incomes, country developments, and political and other cultural conditions contribute to inequities in health financing, consuming health services, and health statuses across the world. Low- and middle-income countries (LMICs) in general have higher inequities across income groups.

The inequity in financing and consuming health services is rooted in the variations of health care needs by the people in each country. There are three main naturally occurring characteristics of health care needs.[ii] The first is the uncertainty of health care needs. One cannot accurately predict when, where, and how urgently one will need health care. The rational response to this uncertainty is to enable insurance mechanisms by broad or narrow definition. The broad definition of insurance is that an agency or country is responsible for the financial burden of health care services and provides relatively free access to all kinds of health care. The narrow definition of insurance is the transfer of financial risk from an individual to an insurer, including commercial bodies and social health insurance agencies. The implementation of this insurance mechanism to address the uncertain nature of health care needs varies by politics, democratization, income level, and historical development of the given country.

The second unique characteristic of health care is high information asymmetries. This characteristic creates market failure in health care, as the fair, fully competitive market mechanism requires

information symmetry.[iii] Consumers (e.g., patients) are currently generally *unable* to address their health care needs, access the required services or medical procedures, or cover the relevant prices or costs to fulfill the needs. In these diagnostic procedures, patients need consultants, such as medical doctors, to seek accurate information around their diseases and appropriate drugs or medical procedures to overcome the needs. Health care provision is the most complex service as almost all patients are unable to find adequate information to decide which and how many services they need to purchase.

In addition, the doctors are the ones who sell the required procedures or services. This double role facilitates moral hazard and fraud in health care and makes management of health care in public and private schemes difficult and costly. Even with the current information revolution, asymmetric information in health care is still rampant. Information technology, however, has narrowed the gap in information to a certain degree. Many characteristics of health care have been derived from this highly asymmetric information, such as patient ignorance, supply and induced demand, and moral hazard.

The third unique characteristic of health care needs are health care externalities, and COVID-19 has demonstrated how powerful externality is. By the end of 2020, the world had suffered an economic contraction of 3.4 percent GDP or a loss of about US$2 trillion in economic output due to COVID-19.[iv] In short duration, communicable diseases clearly demonstrate negative externalities that eventually require public sector interventions in regulation, financing, and provision of health care. Long-term, externalities, such as smoking cigarettes, creates a high burden of non-communicable diseases (NCDs) that especially burden public financing schemes. A lot of incidence and prevalence of NCDs are correlated with whether individuals consume healthy foods, practice healthy behavior, and keep healthy environments.

Cutting-edge technology

At the India in Asia: Deeper Engagement Annual Conference, Dr. Soonman Kwon briefly and comprehensively presented recent innovations in digital health.[v] Little could be argued against what Dr. Kwon presented following huge developments in health medicine, pharmaceutics, diagnostics, and management accelerated by the cutting-edge computer and information technologies. Traditionally, the health sector has been slow to adopt mass production of new services, and often there are deviations in the correlation of the supply and demand in health sector. Global data unexpectedly demonstrate that a larger doctor population and hospital bed ratio correlate with greater health care per capita. One of the theories behind this correlation is that there is high information asymmetry which leads to supplier-induced demand. This phenomenon is often discussed but it is difficult to evidence in terms of moral hazard or fraudulence. The development of digital technology may narrow information asymmetry and lead to better effectiveness, efficiency, and equity of health care for all.[vi]

Diagnostics

The development of medical diagnostics has been continuous since the Human Genome Project successfully mapped out the human genome. New disciplines such as genetics and bioinformatics bring many more options to prevent or cure formerly unknown diseases. Early cancer detection that was previously thought impossible is now available via blood tests.[vii] Traditional physics- and electronics-based diagnostic procedures continue to evolve with the help of digital technology. Currently, the development of non-invasive diagnostic imaging is claimed to be able to detect signs of depression.[viii] Medical experts continue to pursue new and complex technologies to benefit human health as the

intermediate goal of human welfare for all; however, the tradeoff is that the costs of detecting previously unknown or undetected diseases are high, and many public sector health care providers in LMICs could not procure such cutting-edge technologies. This condition concerns world leaders in the fight for equity across countries of all income levels. For example, the use of mRNA technology in developing COVID-19 vaccines was a breakthrough in vaccine production; however, overall access to COVID-19 vaccination is inequitable among LMICs compared to high-income countries.[ix]

Treatment

The discovery of diseases and their causes continues to lengthen human lives. The World Health Organization revises disease codes every three years. The new International Classification of Diseases version 11 (ICD-11) comprises more than 100,000 index terms, including rare diseases, but how can a doctor understand everything?[x] For each disease code, there are various steps for diagnostics, medical procedures, electronic medical recording, and billing charges by hospitals. Not all those diseases are understood fully by current medical science, and the search for causal relationships for various cancers and drugs is in progress. Cancer prevention and treatment has become high-tech, and targeted drug therapy helps medication find and kill cancer cells while preserving normal cells. The average accumulated costs of the third year of breast cancer treatment using targeted therapy can reach US$769,573. This is more than ten times the US's per capita income in 2022. Certainly, without insurance people are going bankrupt to pay such medical bills.[xi]

Management

Coding diseases is complex but necessary to studies and disease management and requires disciplined medical records. Information technology is required to ensure proper hospital and health system management. Manual entry and work are no longer effective and efficient to sustain large hospitals. Supply chain management ensures that a hospital provides medical equipment, diagnostic reagents, specialists, and other management support. The economic principle of scale that leads to lower unit costs suits hospital services poorly. Networking hospitals to allow rare cases to be referred to proper or specialized facilities requires adequate funding for diseases like Guillain-Barre syndrome to be sent to hospitals with sufficient digital technology. Digital technology contributes to complex health care systems and achieves greater welfare for the population of several countries, yet many governments and health managers in LMICs struggle to provide basic health care for their citizens.

The most critical and important issue in health systems is ensuring everyone receives the care they need, regardless of income, social status, economic status, or religious or political affiliation. Digital technology can facilitate people living in remote areas to receive at least a consultation as the first contact or primary care, to then follow up with more advanced medical care as they need. Need, not demand, is the key indicator that a government should measure to ensure no one is left behind in the development of the health sector. Integrating all information into a single system—such as Satu Sehat, a single national health database being developed in Indonesia—is a challenge in LMICs but is a path to a prosperous community.

Challenges for universal health coverage

As mentioned earlier, SDG 3.8 aims for UHC by 2030, and all global leaders should strive to achieve this common goal for a healthy world. COVID-19 can be seen as an impetus to increase commitment to UHC.

The European Union warned that health care spending may fall in 2023 given high inflation and slower economic growth; thus, a difficult decision must be made. Evidence shows that digitalization provided new opportunities in the United States, Europe, and China though with stricter regulation. New business mechanisms to address volume and drug and medical supply prices are being developed in India and elsewhere.[xii] Yet, three primary gaps are anticipated to disrupt cohesion due to large gaps between national communities.

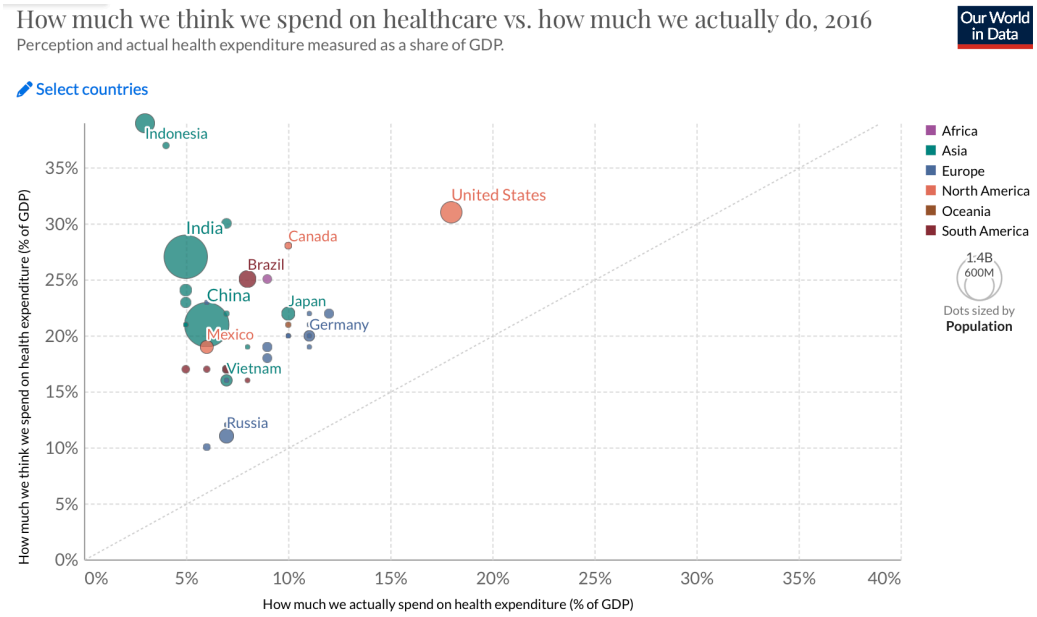
Information asymmetry

The large gap between producers, providers, and suppliers of health care for the population will continue to exist as more advanced technologies are adopted in LMICs. Less educated people with a possibly higher probability of having serious or rare diseases are unable to understand the opportunity for curing or controlling the diseases they are suffering. Though more sophisticated technology could provide better, easier, and faster access to overwhelmed health information systems, less educated people may not be able to benefit from information provided through technologies like cloud computing. Fabricated information, fake or ineffective drugs sold at high prices, and cross-country trade of "miracle drugs" or interventions could victimize those with little information.

Large gap in financing

As discussed above, innovative technology may produce spectacular medical products but they come at very high costs, particularly for rare, severe, or life-threatening diseases. Desperate patients may blindly purchase a costly drug or procedure offered with unproven effectiveness, especially in LMICs that experience a lack of public funding that inadequately covers comprehensive benefits. Even among subnational regions within a country, variations in equitable health financing schemes may create a wider gap in financing for essential health care. Evidence in some countries indicates huge gaps in health expenditures perceived by people and actually spent (Figure 1).[xiii]

Figure 1. Disparities in perceived and actual health spending as % GDP across select countries, 2016

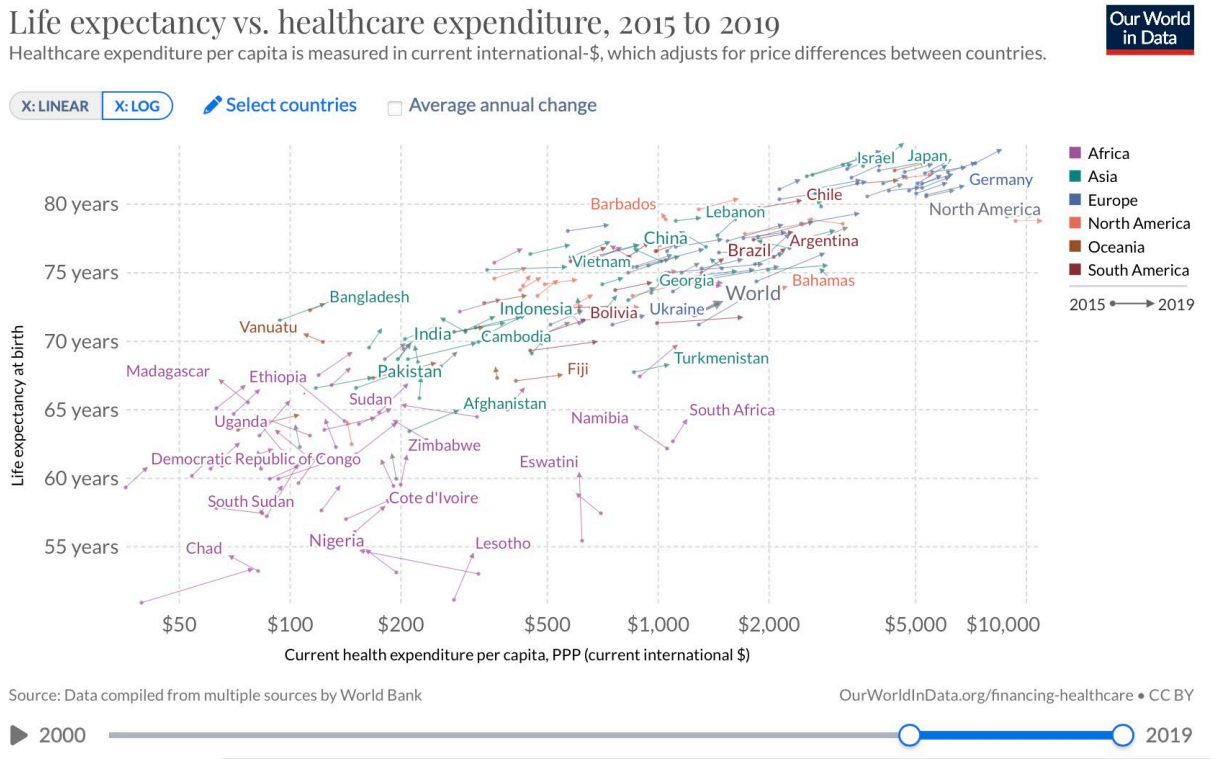


Source: Ortiz-Ospina, E. and M. Roser. 2017.

This misperception of health spending can be an indication that patients perceive their cost burden as much higher than actual expenditures. The actual health expenditures as a percentage of a country's GDP demonstrates a variation in perceived importance of health care in people's lives.

Figure 2 demonstrates that the gap in health financing across the selected countries in 2016 varied significantly due to affordability, use of innovative technologies, public financing mechanisms, and other behavioral impacts of people and health care professionals.[xiv]

Figure 2. Disparities in per capita health expenditures and health life expectancy across select countries, 2015-2019

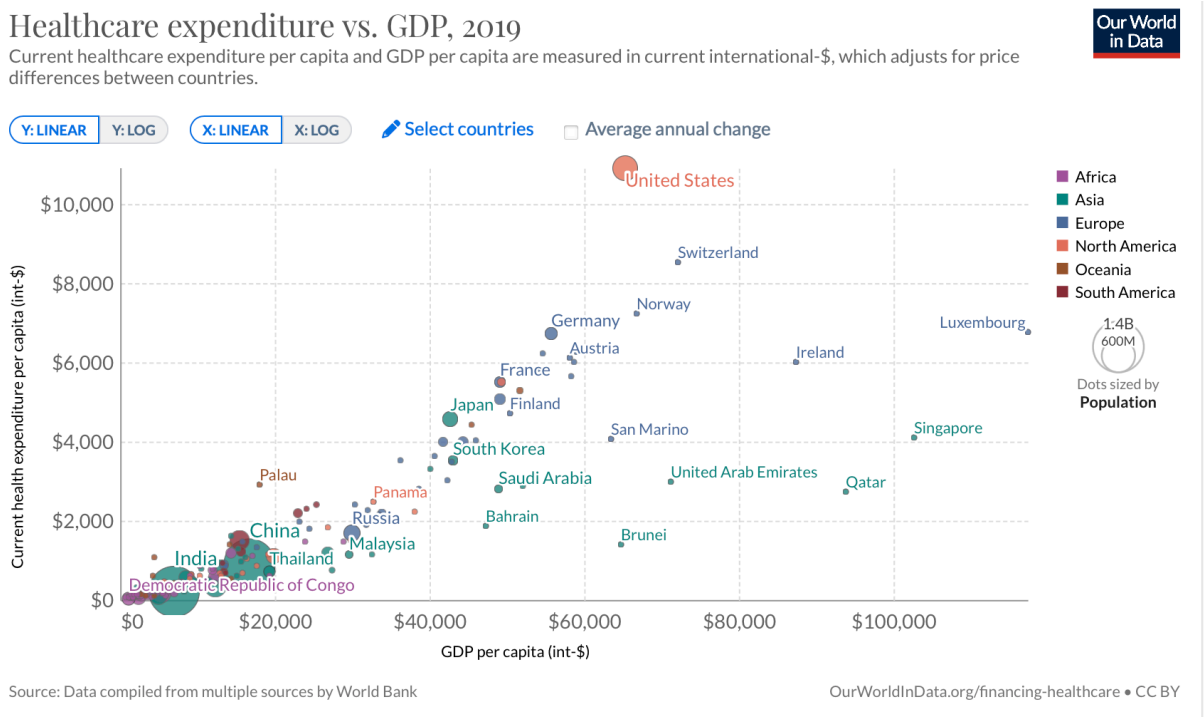


Source: Ortiz-Ospina, E. and M. Roser. 2017.

The outcomes of health spending can be measured, among other factors, by healthy life expectancies showing diminishing marginal benefits. Above Int$2,000 per capita per year in health spending, the marginal impact of health spending on life expectancy was close to zero. Figure 2 demonstrates how gaps in health spending resulted in varied life expectancies across the studied countries.[xv] Further analysis using artificial intelligence could provide valuable lessons from some countries to other countries to accelerate equitable and just health care across LIMCs.

In the last several decades, gaps in health financing across all income levels continue to grow. Most LMICs struggle to increase health spending per capita to achieve greater welfare and higher life expectancy, but, until recently, countries with a per capita GDP of under Int$2,000 hardly spent more than Int$2,000 per capita per year. In contrast, the US, which is criticized as the country with the least efficient health system, continues to spend more than Int$10,000 per capita per year. This cross-country comparison of various health technologies, data, and spending is becoming more available in real time and allowing LMICs to take lessons from more advanced countries (Figure 3).

Figure 3. Disparities in per capita health expenditures and per capita GDP in Int$ across select countries, 2019



Source: Ortiz-Ospina, E. and M. Roser. 2017.

Large gap in access

Everywhere in the world, access to essential modern health care is generally unequal for people with different incomes, education, place of residence, and cultural differences. For various reasons, some people intentionally choose not to access modern medicine. Some cannot afford modern health care in countries where public health insurance or national health service is not provided by the government. Others may have the legal right to essential health care, but they have financial difficulty in accessing health care providers because they live far away from the nearest provider and no transport allowance is provided by the government. The concept of UHC works to ensure that everyone on Earth receives health care they need based on medical knowledge and without financial hardship in consuming such services. Developed countries generally already have a system in place that minimizes catastrophic health spending. The recent WHO and World Bank joint monitoring of financial protection estimated that in 2017, between 1.4 to 1.9 billion people in the world were identified as making health expenditures that impoverished them.[xvi] With such financial burden, about a quarter of the global population—most in LMICs—are suffering from the double burden of poverty and lack of access to essential health care that may put more burden on low-income people.

The role of the public sector

As there is an overall market failure in health care, all LMIC governments should not overestimate the growing market of health care, drugs, and medical supplies. As pointed out by Dr. Kwon, the government must take an active role in protecting the people's right to health care. Innovation in medical and pharmaceutical technology should be properly managed to ensure access for everyone to essential health care. Lessons from COVID-19 during which global leaders worked together with proper

coordination by WHO proved that all countries benefitted from concerted and coordinated efforts. Now, as COVID-19 becomes endemic, countries, especially LMICs, may either return to business as usual or be trapped in market mechanisms to meet health care needs for all. The public investment in the health sector, both financing side and delivery side, should be strengthened. More advanced countries should assist with the capacity of human resources and production of essential drugs, medical supplies, and other health consumables.

Mixed financing as an innovation for UHC

Although, in general, market mechanisms fail to achieve the goals of a health system, which are effectiveness, equity, efficiency, and sustainability, this does not mean that trading health products is prohibited. Thousands of diseases require tens of thousands of supplies and services which have never been fully fulfilled by public financing mechanisms. In addition, some higher income groups in any country have the right to choose their preferences with or without supplemental insurance. They may opt out of their right to public financing and pay out-of-pocket or purchase private supplemental health insurance. For some low-cost drugs or supplies, they may purchase out-of-pocket without any financial harm to their household. Other private channels such as inner- and cross-country charities or corporate social responsibility funds could be properly harmonized.

Ultimately, all of us should be committed to equitable access to essential health care, regardless of how advanced the technology is and how high the costs for individual care are. Digital technology must be properly used to narrow the gaps created by information asymmetry and the gaps in health care financing and access to quality health care.

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