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India, Infectious Disease

India is a vast country, home to billions of people. The country is a beautiful place with rugged mountains, lush forests, and deep oceans. India's weather varies by location. It is also home to some of the most densely populated cities in the world, many of which are poor, dirty, and rampant with disease. With this much diversity of land, overpopulation creates many challenges for the government and the people of India.

India is trapped in a vicious cycle of poverty, which results in slums and poor rural communities. This leads to sanitation issues, which results in the spread of disease, leaving an overwhelmed healthcare system that cannot adequately support the health and well-being of all of its citizens. India is slowly collapsing under the weight of its population and the enormous socio-economic gap between urban and rural areas of the country which only exacerbates the problem. India's large population and underwhelming lack of government representation have led to large spreads of infectious diseases within the country, affecting millions of citizens.

Not only does India have a wide range of geographic areas but India's climate varies by region, ranging from deserts to tundra, and glaciers to forests. Since the country is so enormous, multiple climates must be managed and accounted for. The Himalayan mountains play a large factor in the country's climate. They block chilly winds coming down from northern countries, making the weather in India different from its neighbors. Typically, the country has a dry season and a monsoon season. Monsoons are wind patterns accompanied by rain that affect the country's ecosystem and crop yield. The citizens of India rely on monsoons to irrigate the land. It's typically the hottest from April to June before the monsoons roll in. Monsoon season even affects the economy of India, depending on the crop yield of that year. The great irony is that even though India has become a major food exporter; it still doesn't have enough food to properly feed its population.

According to the World Bank collection of development indicators, 60.45% of India's land is being used for agriculture. All this land needs to be irrigated. About two-thirds of the land in India is reliant on monsoons to irrigate. Agriculture is a huge part of India's economy and society. Fifty-eight percent of India's population rely on agriculture to support themselves (*IBEF*). They are the world's leading exporters of many essential foods. Foods such as rice, sugar, and beef make up a typical Indian diet along with being top exports.

Food and family play a large role in Indian culture. A major emphasis is placed on the value of connectivity within the household. Unlike western cultures, Indian families typically live together in one place. This includes multiple generations occupying the same dwelling including the grandparents, parents, and children, all living and eating together. This family stability and togetherness is valued over independence.

Families regularly gather to eat meals prepared by the wives. The meals are served in large quantities that everyone helps themselves to. Most meals are rice, flatbread, meat, and salad. Indians typically eat food with their fingers instead of with utensils. They also have many other customs such as greeting one another before meals, eating until stuffed, and burping to show you are full. This is a sign of prosperity, not poor manners. These practices differ significantly from those in Western cultures, which is not a bad thing, but some of these customs lead to many health issues and the spread of disease. For example, the unintended consequence of eating with one's fingers is the possibility to spread communicable diseases

such as COVID-19 which has hammered the country of India in 2020 and 2021 further burdening its fragile healthcare system.

In addition, many areas of India are very overcrowded. This leads to a wide variety of issues. There are not enough toilets nor the infrastructure of modern plumbing in India for every citizen to have one, especially in crowded areas like the urban slums. This leads to many people openly defecating in public. This waste has nowhere to go and thus piles up, leading to a rampant spread of infections and diseases across the communities.

While there is a country-wide, free healthcare program it is extremely inadequate. There is also a vast difference between the healthcare systems in urban areas versus rural areas. Many rural areas do not have enough doctors for the citizens or lack access to a hospital altogether. This often leads to rural areas being disproportionately impacted by diseases and infections. While India is striving for a reliable countrywide healthcare system, it is woefully short of achieving equity in rural areas.

India's population creates a tremendous strain on the under-funded system and many are forced to come out of their own pockets for private healthcare. The overwhelming majority only use public healthcare if they cannot afford private healthcare. Since healthcare is not widely available, infectious diseases like tuberculosis and malaria can spread rapidly. India is the number one center in the world for tuberculosis (World Health Organization). One study estimated that someone dies in India from tuberculosis every 1.5 seconds (Nial 1). Poor sanitation around the country (including hospitals) all contribute to the spread of these diseases.

India's government recognizes the problems that these diseases pose. "Prime Minister Narendra Modi announced in early 2018 his government's intention to rid India of tuberculosis by 2025" (Nial). India's Union Health Minister Dr. Harsh Vardhan stated that "by 2025, we wish to eliminate tuberculosis from India". This was a big headline and an even more ambitious undertaking. Government intervention and programs have seemed to improve in the last decade but a deep suspicion of corruption still exists.

Through India's passage of the National Food Security Act in 2013, India does appear to be improving its state of nutrition and thus its connection to the disease. However, it still has some of the highest rates of malnutrition and disease in the world mainly due to its sheer size. India cannot manage and fund this on its own. 1.3 billion people is an insurmountable figure for its government to effectively manage. The World must step in.

Food insecurity plays a major role in the health and well-being of India's population as well. Despite making strides in the area of food security and nutrition, India has one of the highest child undernutrition rates in the world (UN Report on Nutrition and Food Security). This has a profound impact on India's population including its ability to combat disease and have a functional society. It is all tied together including the connections between food insecurity and poor academic performance, diminished learning capacity, and reduced earnings. This cycle of poverty, food insecurity, disease, and unfulfilled human potential will continue to wreak havoc on India until the food issue is fully addressed.

Bill and Melinda Gates agree. Bill Gates has made the argument that food security and proper healthcare for every country is advantageous for the western world for three reasons:

1. The world would be a safer, more stable place
2. Food security and the food economy stimulate economic growth
3. It saves lives and creates a healthier world environment

Bill Gates view of promoting a stable world through food security and healthcare funding isn't alone. According to the White House; the U.S. has consistently supported India tallying up more than $2.8 billion in relief over the past 20 years including more than $1.4 billion for health care. HIV Infections, tuberculosis, and healthy pregnancies have all been a major part of the focus. This foreign aid has been critical to India as unfortunately, India's track record for achieving its nationwide goals has often failed.

According to Kernan Watts of Health Issues in India, "India was found to have the highest cases of malaria outside of Sub-Saharan Africa, which shares the brunt of the disease." India is also plagued with Human Immunodeficiency Virus (HIV), Kyasanur Forest Disease (KFD), Leprosy, Polio, and other diseases that have been completely eradicated or at least controlled in many modern countries.

The problem is that medicines, vaccines, and prevention are extremely scarce in urban slums and rural areas. This means that the diseases continue to spread rampantly throughout India until preventions are introduced and sustained in poor communities. While the government continues to roll out ambitious plans, lack of funding and overwhelmed healthcare systems are stalling any progress towards elimination. Solutions may seem daunting, but they are far from impossible, especially with the rise of technology throughout India. It is important to identify and locate where disease outbreaks happen and how they are transported. For example, mosquitoes are a major problem that needs to be controlled. Mosquitoes carry diseases from one person to the next and thrive in highly dense, unsanitary areas. Extermination methods for mosquitoes could make a big difference.

Another potential solution would be investment and reform of huge urban centers and rural areas. Beth Daley of the Olivier Telle Research Center stated that "developing more fair urban infrastructures, and most of all, developing inclusive cities is necessary. Investments are required." Global Solutions for Infectious Disease (GSID) has another strategy. Apps and software programs around the country allow individuals to monitor their health. If they feel sick or experience symptoms of a certain disease, they report it in the app. This would allow for fast and real-time tracking of disease spread and lead to better management. These apps can help with identification and fast activating containment. Apps like this were used in Africa to monitor the spread of Ebola.

Apple and Google are two prime examples of companies with a technology platform that have come together in a time of need to solve an issue. During the COVID-19 pandemic, contact tracing proved to be one of the most effective, but most difficult ways to track and stop the spread of the virus. It took lots of time and manpower to try and track down everyone who tested positive and in turn who they had been exposed to. Apple and Google collaborated to design an app that would help with this costly issue. According to Apple, the app is "designed to be a resource for individuals and does not replace instructions from healthcare providers or guidance from state and local health authorities".

To protect the privacy of all individuals, user information is not sent to apple, google, or the CDC. Users simply download the app and the app generates a random user profile that switches every few minutes, which according to Google, is to ensure that the app "can't be used to identify you or your location". Privacy is also protected by allowing users to opt-in or out at any time. Users can get on the app and complete a quick screening that asks questions about symptoms or exposure. If the user is suspected or confirmed to have been exposed to COVID-19, the app will then use a Bluetooth signal to alert any passing phones from the last 14 days that they have been near a person who may have been transmitting COVID. If someone is notified that they have been exposed, the app then transmits a list of recommendations from the user's local health agency with the next steps.

By implementing a similar app system in India, officials would be able to quickly track the spread of exposed individuals and keep communities safe. The app wouldn't keep any personal data. It would simply be used to keep people safe and stop further spread. By not keeping any personal data, companies

can further encourage people to opt in to keep communities safe and stop the spread. Making this technology optional and completely voluntary is the key as people tend to be suspicious of any government-mandated measures and particularly tracking through phones. A well throughout marketing and public relations plan would need to be developed and deployed.

Some experts have recommended a more hard-line approach to disease prevention and treatment. They may seem draconian to some but it's hard to argue with their effectiveness and the concept of the greater good. The United States cracked down on tuberculosis patients over the years during its initial, major outbreak. "The standard of care in the U.S. is a practice called Directly Observed Therapy. Public health workers watched patients with tuberculosis take every dose of their medication and support them through treatment. Over the last several decades, the number of cases of tuberculosis in the U.S. has dropped from 84,304 in 1953 to approximately 9,300 in 2016" (Bollinger). By taking such stringent measures and monitoring patients so closely, tuberculosis in the US is practically nonexistent.

Tighter measures like these could be enacted in Indian hospitals to ensure that individuals do not continue to spread tuberculosis or other diseases. Measures such as monitoring a patients' medicine or quarantining them for an appropriate length of time could go a long way to slowing the spread of the disease. This strategy could prove difficult in India because it lacks the infrastructure of hospitals and healthcare facilities to deliver the treatment.

The issues in India can be addressed, but it will take a multi-faceted strategy to achieve real progress. It all needs to start with government investment and action in urban slums and rural areas. Education about sanitation and disease spread should be widely available. Places need to be cleaned up, sanitized, and improved to help facilitate the removal of waste, garbage, and disease. This means building sustainable cities with cleaner environments.

The government and organizations like GSID will need to monitor all diseases throughout the country, but especially prevalent ones such as tuberculosis, HIV, and more recently COVID-19. This can be done by mobile tracking and new technologies in public healthcare systems to report numbers, track cases, and prevent spread. Once individuals or outbreaks are identified within the country, strict guidelines will need to be set in place to prevent further spread. Readily available medication and quarantines will help to stop people from spreading the disease across areas.

By making medications and vaccines readily available, tracking the spread and analyzing it in real-time, and by placing more care into the country's healthcare and sanitation, there is hope for India to slow the spread of these infectious diseases and eventually eradicate them, once and for all. There are solutions to India's problems, but they won't be easy to accomplish. They will take time, effort, and resources from the government and the public. Diseases cannot continue to spread at uncontrollable rates, infecting and killing millions. Action needs to be taken to get things under control. Real change needs to happen for the sake of over a billion citizens of India who represent nearly 20% of our entire world population.

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