

Pandemics Epidemiology: Societal Impacts and Strategic Response COVID-19-

How Geography Affects the Spread of Disease

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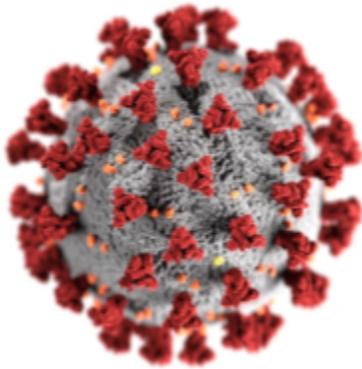
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## How Geography Affects the Spread of Disease

### Introduction

COVID-19 (also referred to as 2019-nCoV or 2019 novel coronavirus) is a global pandemic responsible for negatively impacting the lives of millions. As many different outbreaks of the coronavirus outbreak have occurred in the past, this individual species is one of the deadliest known to human-kind. Named after the surface resembling the sun's corona, all species of viruses under the family Coronaviridae are known for its single-stranded RNA containing 26-32 kilobases worth of genetic information. The infectious COVID-19 individual contains mutated RNA responsible for upper/lower respiratory tract infection (leading to symptoms such as dyspnea- shortness of breath), pyrexia (fever), and emesis (nausea and vomiting) (NIH). Some



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cases are even linked with symptoms affecting the nature of the heart (the correlation to this virus is still a mystery). Its genetic components continually struck confusion in ingenious ways, leading scientists to work day and night to conjure a possible solution to this medical crisis. There have been several coronavirus outbreaks in the past, which is why when it comes to this outbreak specifically the theories of origins are numerous. Many people believe that it was started by a bat as the COVID-19 has a similar makeup to that of a previously discovered bat coronavirus. To date (As of August 26th, 2020), there are 23,518,343 confirmed cases of COVID-19 (including 810,492 deaths) reported worldwide (WHO). Particular countries

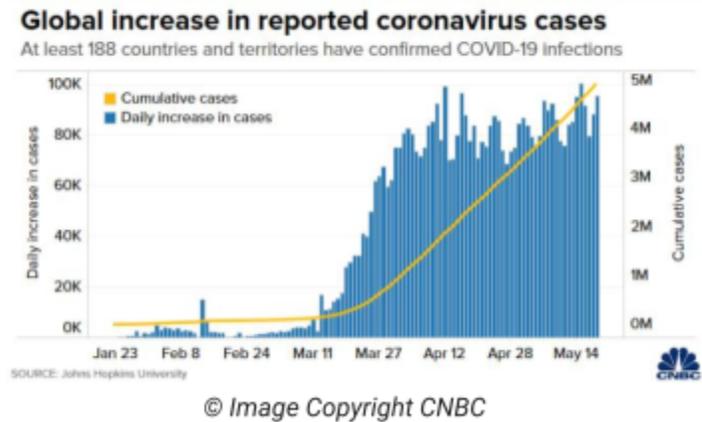
experience a large pattern of cases, especially Brazil- leading as the country with the second-largest number of affected COVID individuals.

The most common effects of COVID are coughs, shortness of breath, and fevers. The coronavirus is a respiratory disease meaning that more likely than not, your respiratory system will be what's being infected. This is the reason that you may feel coughs and shortness of breath if you have the virus. However recently COVID has shown to be related to the cardiovascular system as well. This has come as a striking development as past coronaviruses have been primarily respiratory, but with new patients being admitted to the hospital and showing signs of circulatory/cardiovascular damage more evidence is rising pointing towards the fact that it may also be a circulatory disease. Some of the newest and most unusual symptoms that are being researched are gastrointestinal symptoms. This is very intriguing because even though every system in our body is related, the relation between the gastrointestinal and respiratory is much less explicit as opposed to the respiratory and cardiovascular.

This will greatly change the way that mitigation efforts are taken because treating a disease that affects the respiratory system is a lot different than treating a disease that affects the circulatory system since both systems function in very different ways and have varying treatments. Giving people treatments that may be effective against respiratory illness, may end up being detrimental if the illness has cardiovascular aspects to it. This greatly affects the mitigation process as it will now require more research and time to find a new type of treatment that will effectively handle both the respiratory and circulatory problems that patients face.

Brazil is known for its colorful tourist attractions, its most famous and celebrated carnival festival in the world, and its vast energy cultivation. However, this country is still recognized as

a developing, third-world country. With a relatively low GDP per capita, low living standards, and high birth and death rates, many of Brazil's citizens do not have proper health care accessibility (WHO). This issue in turn leaves many individuals vulnerable to disease and poverty; the spread of COVID-19 has only exaggerated the effects. Known as a populous country with 212,559,417 citizens, Brazil has a large population to easily cultivate the virus. Modern science proves how specific geographical factors of Brazil consistently influence the mitigation of COVID-19, and without proper regulation and direction regarding such landmarks, it will be particularly difficult to seize the virus's spread.



### Key Geographical Elements of Brazil

One key geographical element to take note of is the high temperatures present in Brazil. The high temperatures are significant because it fosters an environment for a lot of mosquitoes to reside in. Most areas in Brazil are heavily at risk for infection through mosquitoes. The infections that are most commonly caused include malaria, dengue, chikungunya, all of which are vector-borne illnesses. Brazil has had to deal with these illnesses long before COVID came around, meaning that once COVID started hitting Brazil, they did not have as many resources to fight COVID because they needed to allocate a portion of their resources for their already existing illnesses. It is important to remember that just because COVID is the “main” illness going around at this moment it does not mean that the population is immune to every other illness.

Another possible factor regarding the spread of COVID-19 in Brazil can be traced to the Amazon River- the largest river in the world. To this date, this river is used as a particular transport mechanism to travel across the nearby cities and landmarks. Many indigenous populations of Brazil continuously use this path to move across villages around the river for cultivation, supply production and formal distribution. Nearby mining reserves also serve a form of COVID-19 vector transmission. Gold mines, particularly in the largest reserves of the Brazilian states (located in Minas Gerais and Pará). With mining activity in more than 250 boroughs, and more than 300 mines in operation, the state has 40 of the 100 largest mines in Brazil. As sudden



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poverty struck the impoverished country, the gold mines became more populous as COVID-19 continued to take more lives. Dario Kopenawa, vice president of the Hutukara Yanomami Association, completed a research with the scientists at Universidade Federal de Minas Gerais and the São Paulo-based think tank Instituto Socioambiental. Their reports indicate that “40 percent of Yanomami living near the gold strikes are in danger of COVID-19 infection” and some “fear that a single infection could annihilate that indigenous community” (Kopenawa).

And the Amazon Rainforest, a geographical sanctuary to at least 40,000 plants, 427 mammals, 1,300 birds, 378 reptiles, 400 amphibians, and around 3,000 freshwater species, is also facing severe threats during such times. As more individuals try to cultivate the forests into farmland, large numbers of endangered species continue to go extinct. The migration of Brazilian citizens also increased the nation-wide spread of COVID-19. These events continue to pose a threat to the Brazilian citizens and the nation’s landmarks; however, government policies do not tend to these issues having their citizen’s best interests in mind.

### Politics in Brazil

The response of a nation to the COVID-19 pandemic plays a significant role in how quickly the virus spreads. Many countries have done an excellent job of containing the virus, while others increase the morbidity rate through their mismanagement. Brazil falls in the latter category, and that is mainly due to its President, Jair Bolsonaro.

Jair Bolsonaro was elected President in 2018, representing the conservative party in Brazil. He has downplayed the pandemic and wishes for everyone to work as if it was not a problem. He continues to do this even after being diagnosed with COVID-19 himself. His beliefs on what should be done have caused him to clash with many different people. Nelson Teich, the Health Minister of Brazil, resigned less than a month after he was appointed after disagreeing with President Bolsonaro about what actions to take to deal with the pandemic. His resignation was only a few weeks after his predecessor was fired due to having a public dispute with Bolsonaro (CNBC, 2020). It is not just his chief of staff that he disagrees with, but also the various state governors. Many state governors have told their citizens to stay in lockdown and social distance. Still, the President has repeatedly asked his citizens to go to work to improve the economy (CNBC, 2020). This has caused the number of cases of COVID-19 to continue to rise as many people in Brazil have multiple jobs in different places because of the low salaries they have.



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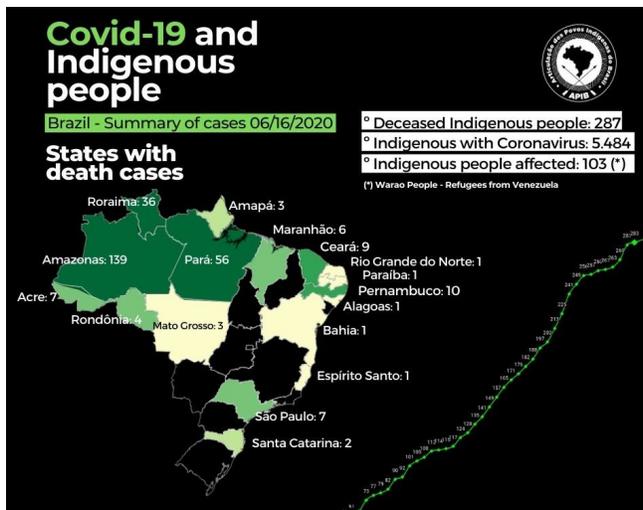
President Bolsonaro also strongly believes that Brazil should use the land in the Amazon for agriculture and to gain other resources. His strong desire for the utilization of the Amazon land has led to him supporting Brazilian advances on the ground that is legally designated to the Native tribes. Not only that but during his term, Brazil has decided to cut funding to departments that will help Natives (Lodoño, 2020). The loss of financing could have led to more Natives being infected as they have less money and resources to support themselves. Only a few

hospitals are available along the Amazon River, so boats are filled to the brim with patients who wish to receive a diagnosis or want treatment.

The president's actions regarding the Natives, coupled with Brazil's geography, have significantly increased the number of COVID-19 cases. If there was more funding available, there could be more health care facilities along the Amazon River, making it so that fewer people are riding the boats on the river at a time. The President also vetoed laws that would provide support for indigenous tribes during the pandemic. Not only that, but he also denied money for state governments that were willing to fund natives in their territory. His plan to deal with the Natives is to have no idea for them at all.

### The Indegenous Population in Brazil

While Brazil as a whole was heavily impacted by the pandemic, the indigenous population in particular took a devastating hit. A primary reason for the drastic consequences on the indigenous population is their geographical location: a significant number of tribes have been settled at the banks of the Amazon river, using the river as a life-sustaining resource as well as a means of transportation. The river is a critical aspect of sustaining life for 30 million people across a span of 8 countries (Turkewitz and Adreoni, 2020). While the river is an essential resource, it turns out it is also a superhighway for the spread of COVID-19. Six cities along the



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Amazon River have some of the highest infection and mortality rates in all of Brazil, even toppling Brazil’s national mortality rate: Manaus’ death rate is 2.4 times higher than the national death rate while Tefe’s is 3.6 times higher, both of which are cities bordering the Amazon River (Turkewitz and Adreoni, 2020). According to the Articulation of Indigenous Peoples of Brazil (APIB), the indigenous federation of Brazil, the death rate in indigenous communities was around 9.1%, almost double the national mortality rate of 5.2%.

The Amazon River also serves as a main attraction point of testing for COVID-19, as transportation via small wooden boats is being utilized for traveling to testing locations. However, due to limited supplies, boats are being overfilled, oftentimes to the point where more than 100 passengers are boarded onto a single boat for days on end, only increasing the chances for contagions such as the coronavirus to spread (Turkewitz and Adreoni, 2020). As indigenous people often heavily rely on the river to sustain life, this lifestyle has often been described as the “amphibious way of living” due to the excessive reliance on the river. While some indigenous people blame the river for the plague, others remain rooted in their beliefs that the river is their life source.

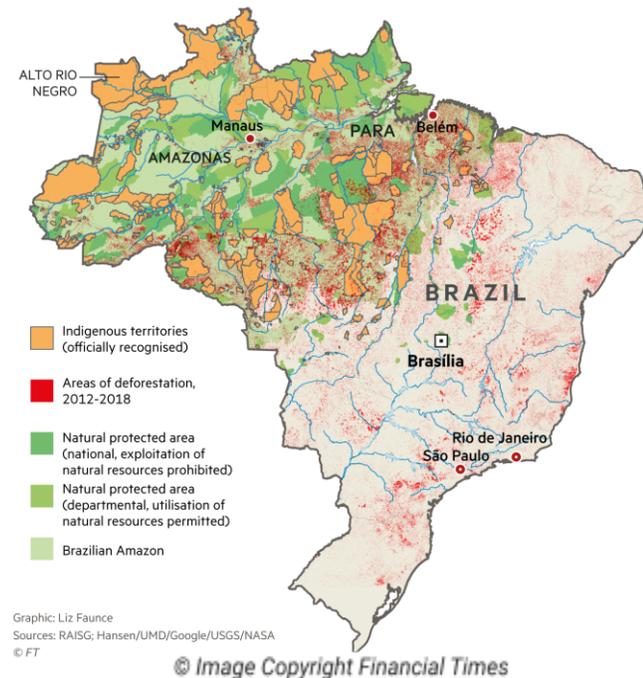
Due to the geographical isolation of the tribes from other populations, groups living near the Amazon are often uncontacted, thus increasing the risk of contracting diseases brought in by outsiders (Wallace, 2020). Not only is the risk of contraction higher due to this, but tracking the infection and mortality rate is much more difficult as SESAI agents are only allowed in certain

demarcated regions. Geographical isolation also has other drawbacks such as having to travel extensive distances for proper care. Many indigenous groups report that they are required to travel more than 1 full day to reach a clinic (“In Pictures”, 2020).

Additionally, indigenous communities’ hostile relationship with the government of Brazil has also played a significant role in heightening the death toll in indigenous communities. As indigenous communities have previously suffered from government efforts to exterminate their race, they remain wary of government motives behind certain mitigation efforts as well. An average of 1 tribe has disappeared from the Amazon during the first 8 decades of the 20th century due to epidemics, violence, and forced assimilation. Indigenous communities’ experiences with past pandemics with malaria, alcohol abuse, and STDs have ravaged their populations, dwindling their numbers, all of which they were exposed to by outsiders. In addition to pandemics, miners looking for gold from the soil near the river have contaminated the river with harmful chemicals such as mercury (Wallace, 2020). Much of these events have led to mistrust between the government and the indigenous population. Yet, similar efforts prove to remain intact through reports released which accuse the Brazilian government health-care workers of “flagrant negligence” as they had sanctioned four SESAI agents, workers of the federal indigenous health service, who have tested positive for the virus themselves into indigenous communities (Wallace, 2020). This leads to yet more mistrust of the government as indigenous leaders accuse the president of failing to defend their people from extermination by means of a plague on top of skyrocketing deforestation rates.

Many indigenous groups also hold strong cultural beliefs about such diseases, in this case, labeling it as an “ugly disease” (Turkewitz and Adreoni, 2020) which could only be the result of a God’s curse. To many indigenous families, contracting such a disease could mean potentially tarnishing the family’s reputation. However, as the virus continues to affect many members of indigenous groups, it threatens to unravel the core of their society. The elderly, who are at higher risk of contracting the virus, are also the people who are described by many as the “guardians of the culture” (Turkewitz and Adreoni, 2020). The elderly play an integral role in indigenous society as they are “living encyclopedias” (Turkewitz and Adreoni, 2020) who provide knowledge which is essential to the existence of their people, and as they possess the highest risk of contraction, it threatens a severe societal cascade.

— Brazil’s indigenous people under threat from Covid-19



## Access to Information in Brazil

The role of the media and the spread of propaganda has also played a monumental role in the shaping of Brazil's COVID-19 pandemic response. For starters, both politics and the media have contributed to popular perceptions of the intensity of the coronavirus. Bolsonaro's claims of having roughly three million cases and one hundred fifteen thousand deaths have been speculated to be extremely inaccurate, thus underplaying the severity of the disease. A team of Brazilian researchers predicted that Brazil had twelve times its reported cases as of April 13, 2020, because of the alarmingly high death count compared to cases (Spring, 2020). This misinformation has led to the exposure of vulnerable individuals to the novel coronavirus. Additionally, Bolsonaro has spread further misinformation regarding the pandemic by endorsing President Trump's claims that hydroxychloroquine antimalarial drugs can treat the disease, even though medical research says otherwise (France-Presse, 2020). Even more, he has claimed that social distancing measures will severely hurt the economy. All of these incorrect statements have put the citizens of Brazil at great risk. If citizens are not concerned about the disease, they are less likely to social distance and take the pandemic seriously as a public health emergency.

Nonetheless, the media is pushing to focus on medical precautions and research to reach and alarm the public. Of Brazil's 209.5 million residents, approximately 65% have internet access - as many as 136,175,000 people can be positively impacted (Corrêa, 2020). Brazil has taken numerous measures in the past to make the internet more accessible; since the 21st century, the nation has motivated service providers to extend connectivity in rural locations. Wireless local area networks have also become more common. The press is dedicated to spreading scientific awareness for COVID-19, and many online users have taken to the media to openly criticize their leaders. The Brazilian Press Association even threatened to sue Bolsonaro for taking off his mask near reporters back in July (Pedroso, 2020).

However, Bolsonaro and other leaders have attempted to disguise their downplaying of the virus on social media as well. Bolsonaro recently posted a video of himself and various medical professionals in a ceremony dedicated to "the right to save lives." Despite his lack of preventative action toward the coronavirus, many users have taken to his Twitter and Youtube pages to express their satisfaction with his presidency and the handling of current issues. The most popular comment on his video, *Médicos e Presidente Bolsonaro em solenidade em prol do direito de salvar vidas*, is "God knows everything that happened. Bless the righteous. JB our greatest pride. Our greatest president." Others have claimed him to be "the Best President in the History of the Federative Republic of Brazil."

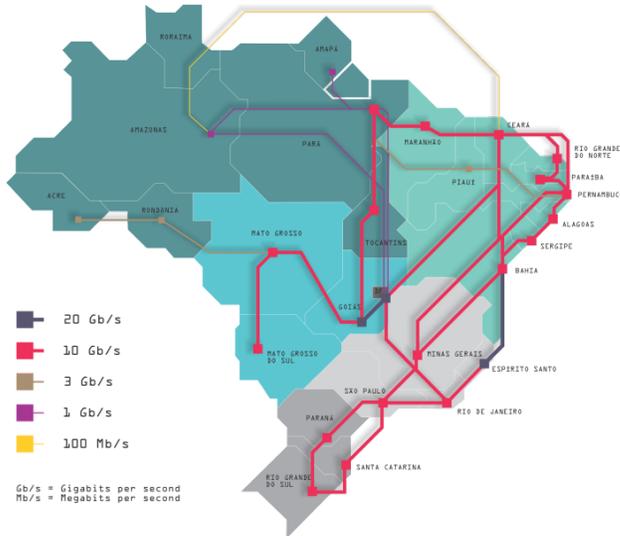
Furthermore, in response to Grupo Globo's claims stating that the Brazilian government failed to provide consolation to COVID-19 victims, Bolsonaro simply replied via Twitter, stating that the source was lying, "as always." Brazil's residents have a history of blaming Grupo for political and social incidents, even storming into its offices in 2013 protests (Corrêa, 2020).



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Though Grupo, the largest media network in Brazil, has not always been reliable, Bolsonaro has also exaggerated the extent of these lies. He recently tweeted, “For at least 10 years the Globo system has been chasing me and they have been unable to prove anything against me.” Unfortunately, similar to the United States of America, Brazil’s coronavirus pandemic has turned into a propaganda-based political issue rather than simply a public health issue, especially with the upcoming 2022 elections. This has caused contention among sources of information and prominent public figures.

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Keeping this in mind, however, it is vital to understand that access to information is not equitably dispersed across the geography of Brazil, especially in the Amazon rainforest. The cultural and geographical barrier—the Amazon basin—isolates the indigenous population of Brazil (Rushton, 2020). This means that the only contact most indigenous residents have with the outside world is through the Articulação dos Povos Indígenas do Brasil (APIB), an organization founded in 2005 to advocate for indigenous communities in Brazil (Rushton, 2020). A consequence of this lack of access to up-to-date information could be the differential mortality rate of COVID-19

in indigenous populations compared to the general

Brazilian population: almost twice, 9.1 percent, of Native people are dying after contracting the virus versus the 5.2 percent of the general population (Wallace, 2020).

**Conclusion**

Considering the diverse geographic setting of Brazil, the dispersion of vaccines for COVID-19 and future pandemic outbreaks will pose a unique challenge. However, this challenge can be overcome with the optimization of the Amazon river. Although the river runs through 9 different countries about 60% of it is contained in Brazil. A very simple way that the river can be used is by cargo ships. The vaccine can be packaged and then distributed in that way. Of course, since the river covers such a huge expanse of Brazil, there are a limitless number of ways to use the river for vaccine distribution. Additionally, to optimize herd immunity in the most vulnerable populations vaccine administration should begin in urban, populated, settings with school-aged children, high-risk individuals, and young adults (Alegana, et al., 2019).

In order to effectively stop the spread of the novel coronavirus, it is imperative that the Brazilian government urges its residents to engage in effective social distancing procedures, rather than gathering in large groups. Thus far, Bolsonaro has largely dismissed quarantine protocols and has joined large parties at local Brazilian beaches, held rallies without masks, and more. Because of this, he has not only put his own health in danger (and contracted COVID-19 multiple times), but he has also risked the lives of those who attend his events. To lower the

curve of infection, residents must practice self-isolation as much as possible and listen to public health figures (such as Mandetta), *not* necessarily corrupt political figures. While Bolsonaro has implied that self-isolation will hurt the economy, it will actually help Brazil rid itself of disease as fast as possible to return back to its original state.

As the pandemic threatens to unravel the very core of many indigenous societies, the government does little to prevent it. President Bolsonaro is highly influenced by President Trump, but he should realize how both America and Brazil have not handled the pandemic well. He should take the advice of medical professionals while making decisions regarding the pandemic. Taking into account the interests of the indigenous communities and being considerate of their lifestyle and culture may help bridge the gap that years of mistrust has created. In order to prevent misinformation from ravaging the country further, the public health department will have to utilize social media and broadcast programs to educate the public on accurate coronavirus prevention. Since the Amazon covers such an expansive area over Brazil, it should be taken into consideration as a mechanism to transport vaccines. Having 60% of the Amazon River located in Brazil is a huge gift to the country and should be taken advantage of. Different policies can also be made for Brazilians living in key geographical areas, such as protective miner outfits, sanitation measurements, and travel/work curfews. Considering the diverse geographic setting of Brazil, the dispersion of vaccines for COVID-19 and future pandemic outbreaks will pose a unique challenge. To optimize herd immunity in the most vulnerable populations vaccine administration should begin in urban, populated, settings with school-aged children, high-risk individuals, and young adults. These are just some of the many preventative measures that need to be implemented in Brazil and other countries to mitigate the threat of the novel coronavirus.

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