



Comparison between India, USA and China on the Basis of Rigidity of Public Health Measures with Case Count and Mortality Rate during COVID-19

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Authors' contributions

This work was carried out in collaboration among all authors. Authors RN and NG designed the study. Authors YH and RN performed the statistical analysis. Authors HR and MK drafted the initial manuscript and the literature searches. All authors critically evaluated and provided the feedback. All authors read and approved the final manuscript.

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ABSTRACT

The COVID-19 Pandemic has been governed by various policies across the world, with corresponding public health measures varying in rigidity. Does this influence the course of the illness within each nation? This research presents an analysis of policy approaches adopted by the United States, China, and India, to describe the rigidity of public health measures and effects on case numbers and mortality rates. We show that in India, high rigidity is correlated with lower mortality. Rigidity in policy is also influenced by available resources in the country; for a resource-poor country like India, strict lockdown measures are vital to prevent overwhelming the healthcare systems and its resources. However, for a nation like the United States, a greater availability of resources may result in less stringent measures, putting greater emphasis on the workforce that

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prevents total lockdown. Similarly, we observe that citizen trust also influences public health policies. Chinese citizens had greater trust in their government and followed the less strict measures, and were successful in decreasing the case number and mortality rates.

Keywords: Covid-19; global health policy; pediatrics; public health.

1. INTRODUCTION

The ongoing COVID-19 pandemic has impacted most countries across the globe, disrupting daily norms, causing economic loss [1], and suffering emotional devastation [2]. Different countries have tried to manage this pandemic through different policy approaches [3]. Furthermore, the degree of political leadership in implementing these policies has played a significant role in the apparent success or failure of these varied approaches during this pandemic [4]. Public health measures have varied from partial, staggered, and complete lockdowns [5], influenced by intuitive health policy and highly data specific analytical thinking [6]. Comparative data analyses regarding policy approaches, are slowly emerging from different countries; the knowledge from their implementation will potentially provide useful insights for future pandemics.

This research paper presents an analysis of policy approaches adopted by three different countries – the United States, China and India, to describe the differences in public health measures adopted by these countries to contain the COVID-19 pandemic. Analyzing the rigorous implementation of these measures and evaluating any potential association with mortality rates can be indicative of how they are handling this situation.

2. METHODS

Data on different public health measures deployed in these countries were obtained along with case and mortality rates reported in China, India and The United States was obtained from ICPSR [7]. The data tracks 12 public health measures and 7 economic measures taken by 229 governments, along with the number of cases and deaths reported on the given day by the European Centre for Disease Prevention and Control.

For the present analysis, Public Health Rigidity Index data, are computed as the average of ten coded public health measures: Bans on mass gatherings, bans on sporting and recreational events, restaurant and bar closures, domestic

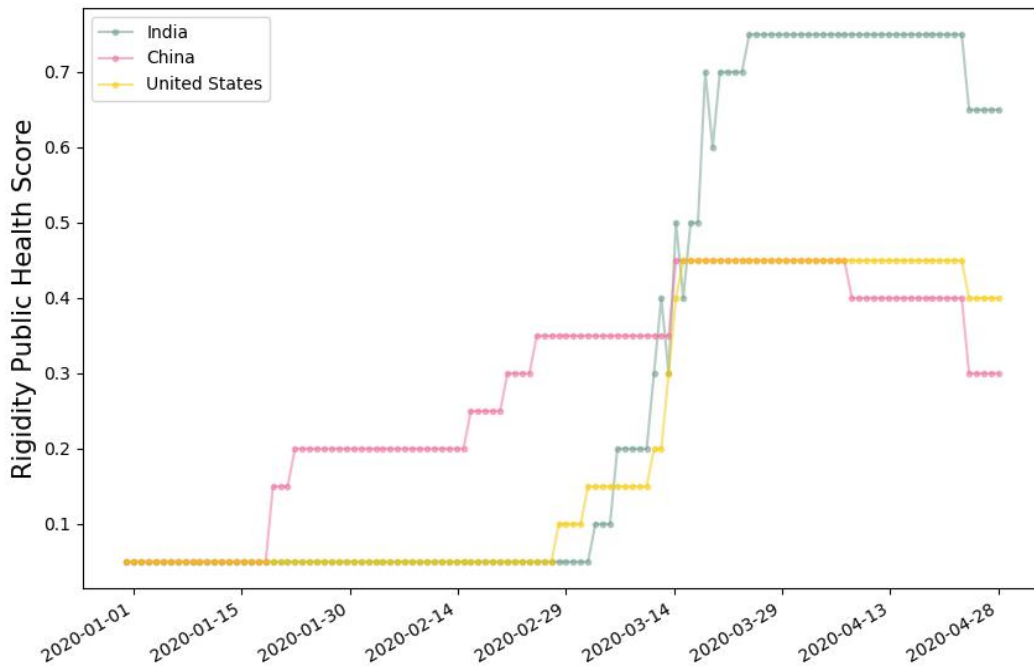
lockdowns, travel restrictions, declarations of states of emergency, public testing, enhanced surveillance, school closures and the postponement of elections [7].

The database reports daily codes for these public health measures: each measure was coded 0, 0.5, or 1, depending on the strictness of these measures, or as a missing variable if the country is not covered. 0 represents no public health measure, 0.5 if the measures were localized or had partial coverage, and 1 if the measures were strictly and comprehensively enforced to ensure full coverage of lockdown.

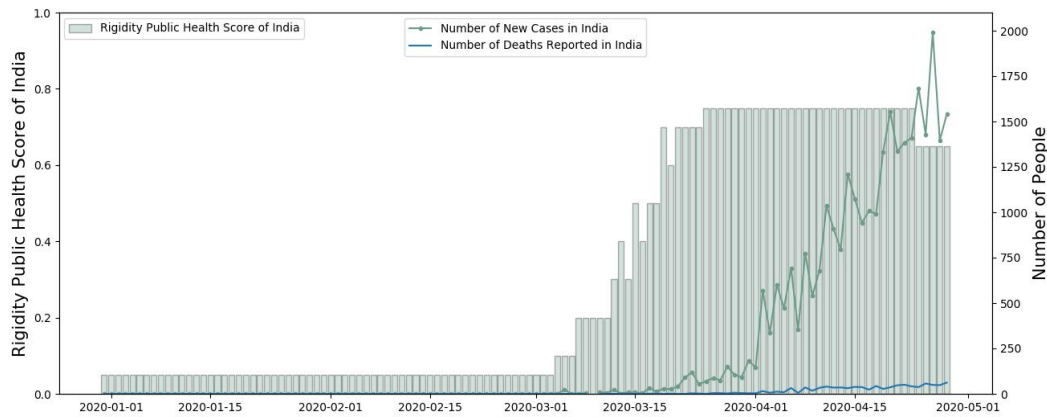
For the further analysis, three variables - rigidity public health index, cases and deaths - in China, India and the United States from 1st Jan 2020 to 28th Apr 2020 were queried from the whole database. In order to compare the rigidity of public health measures, we plotted the public health rigidity index of China, India and the United States in one single graph. Then, we plotted the rigidity public health index, the number of daily cases and deaths in each country respectively to see the relationship between rigidity public health index and the severity of COVID-19 in each country. Case fatality ratios were calculated as total number of deaths divided by total COVID-19 patients and is compared across the countries in the discussion.

3. RESULTS

The above chart observes the United States, China, and India, and ranks them based on the rigidity in their policy response to COVID-19. (0 = no measures or restrictions, .50 = localized or partial restrictions, and 1 = national or strict restrictions.) China was first to implement these measures, in January, while India and the United States adopted lockdown policies at the beginning of March. However, India more effectively enforced a lockdown, demonstrated by the data from mid-March to the end of April, as the numbers are closer to 1. The United States, is coded below 0.5, similar to China, demonstrating localized/partial restrictions that never reached a national lockdown. While these policies were enforced earlier in China, by March, the rigidity is very similar between the US and China.



Graph 1. Comparative Analysis of the Rigidity of Public Health Measures: India, USA, and China

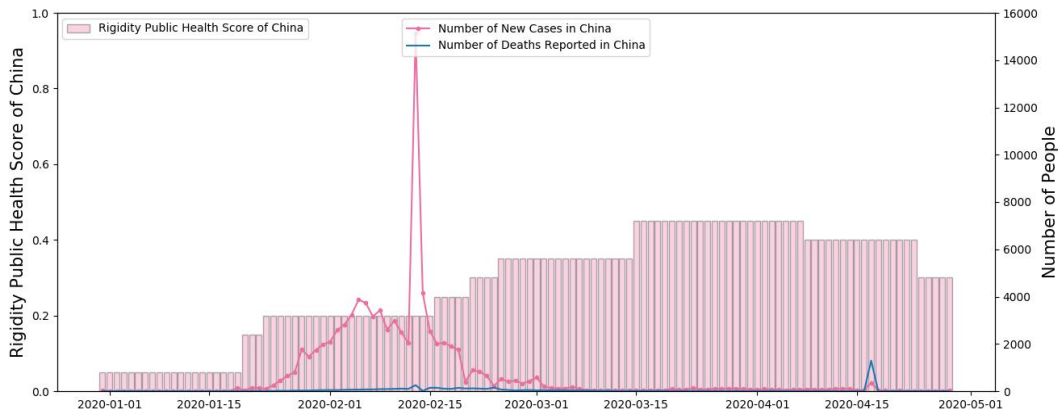


Graph 2. Rigidity of Public Health Measures, Cases, and Mortality in India

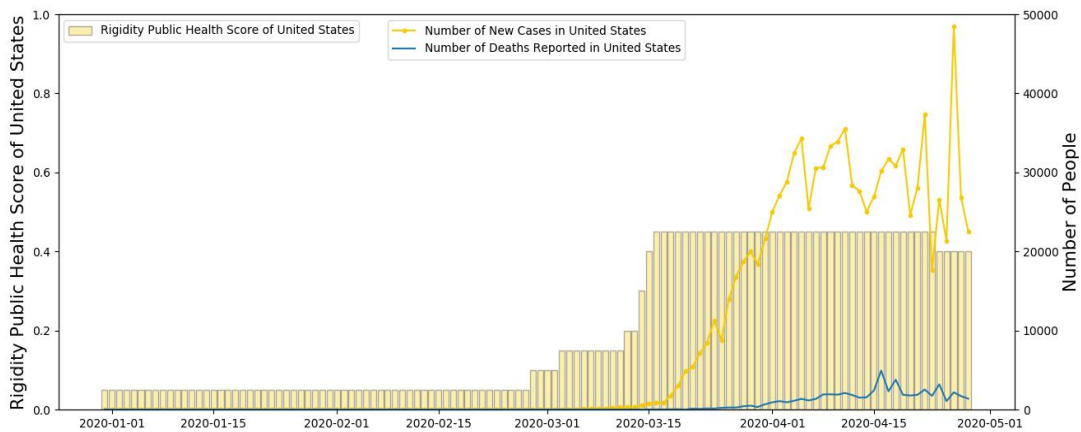
India's rapid increase in Rigidity score preceded the rise of COVID-19 cases, allowing for the healthcare system to prepare itself for the inevitably high number of patients in a highly populated country. In addition to national lockdown measures, India's rigidity is supplemented by its airport screening measures for passengers returning from China [8]. While the cases rose, India had a relatively low mortality rate, partially influenced by the high rigidity measures the government swiftly enforced. The rise in

case may be attributed to the limited initial testing [9].

Unlike India, where rigidity was increased rapidly, in China, rigidity was ratcheted up slowly, starting at the beginning of the year, with new cases spiking in February. Upon the prominent spike in new cases, rigidity was increased, but not to the extent that was observed in India. In fact, the maximum rigidity score is more similar to that of the United States, than in India. Mortality rates seem to be uncorrelated.



Graph 3. Rigidity of Public Health Measures, Cases, and Mortality in China



Graph 4. Rigidity of Public Health Measures, Cases, and Mortality in the United States

The United States began implementing lockdown measures around the same time as India but lacked the same fervor. The rigidity score peaked at 0.5, reflecting the country's state-specific approach to lockdown policies. The number of new cases per day is higher than that in the other two nations, reaching early 50,000 at the end of April, while it is less than 2,000 in China and India. The spike in fatalities result from the lag in reporting new cases by two to three weeks.

4. DISCUSSION

In February and March, China was the only nation that had implemented partial policy measures; India and The United States did not do so, as there were not as many cases. The success of China's partial closure may be attributed to the Chinese citizens' behavior, as they agreed to these measures imposed by their government and stayed home [10]. Hence, the

rigidity of the public health measure was only at 0.4; the government did not need to implement more forceful policies. However, in the United States, as many people did not agree with lockdowns, the rigidity of the public health measures was higher in some regions, compared to China. In India, however, the population agreed for complete lockdown due to their trust in the intuitive health policy decisions by the government [11,12]. Therefore, citizen attitude is important in formulating policies, especially in a pandemic [13]. In addition to political trust, citizen attitudes on belief in scientific institutions, is also an important factor to be further investigated [14].

The graphs represent the maximum rigidity of public health measures that was implemented in India. The Indian government has been appreciated for its complete lockdown, even by WHO [15]. Due to their poor resource availability,

a more rigid approach was necessary to prevent the virus to spread even more rapidly and further overwhelm the healthcare resources [16]. In comparison, the United States overestimated its economic power and technical knowledge of medicine and health which led to disparate policies and a subsequently higher mortality rate. Interestingly, China had also not been that rigid; this may be because they were the first country in the world to battle this illness, and did not realize the importance of lockdowns, other than the city of Wuhan, or how dangerous this virus was.

5. CONCLUSION

While the rigidity of public health measures greatly informs the course of this virus, this research clearly indicates that the mortality rate of COVID-19 may be related to other factors as well. For example, even as rigidity was somewhat similar in Chinese and American policies, the mortality rates differ. Behavior, social determinants, and local demographics have also played a significant role in the spread of the virus. However, the data in India illustrates that the rigidity of public health measure, taken together with positive citizen attitude towards the government's policies, are key to limiting damage caused by COVID-19.

6. LIMITATIONS

There are a few factors that are not controlled for in the scope of this analysis. It is still not known how much skewedness can be attributed to the lack of robust reporting of new cases and death by each country. Additionally, India has a much younger population than certain other countries, which may have an impact on their lower mortality rate.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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