To Test or Not to Test: The Case of Covid-19 in India

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Abstract: There is apprehension that India is not testing enough, and therefore the number of COVID-19 affected cases and deaths is less in India. In this short note, we analyse what the outcome may look like if India was to test as is done in some developed countries. Although the numbers increase many folds, we argue eventually India may not see that many increases in the number of COVID-19 affected people. The number of COVID-19 related death will be much less. India has a much younger population in comparison to the developed world. The tropical weather, dietary habits, large vaccination program, and ability to supply affordable drugs are an added advantage.

Keywords: COVID-19, Testing, States in India, Population, Fatality Rate.

JEL Classification: I14, I15, I16.

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1 Introduction

In a bizarre move, on 28 April 2020, Chief Minister of West Bengal, Miss Mamata Banerjee has asked the people detected with COVID-19 to go for home quarantine (The New Indian Express, 2020). For the State of West Bengal located in the eastern part of India, it seems, do not have adequate health infrastructure to quarantine "lakhs and lakhs of people". This apprehension may be true for other parts of India as well. For India, given its fragile healthcare infrastructure, lockdown is seen as a preventive measure. With a community spread of COVID-19, India does not have enough doctors and hospital beds to provide treatment. India has 0.9 hospital beds and 0.7 doctors for every 1000 people, against the WHO mandate of 1.9 hospital beds and 1 doctor per 1000 population (World Bank, 2020). For any state in India, unable to implement lockdown measures properly, home quarantine becomes the second-best option. Off late, the great Indian migration of around of 100 million workers has made the lockdown measures less effective.

The lockdown is a way to implement state enforced social distancing. The virus spread through person-to-person contact, and the only way to limit its spread is to identify the people who got affected. With proper screening and lockdown of the affected person, the virus can be eradicated within 14 days.

The reason why South Korea is successful is because testing and isolation of the affected are done at a rapid speed. Latest figures from Our World in Data (as on 23 April 2020) suggest, South Korea tested 11.34 people for every 1000 people in comparison to Italy testing 26.72, UK testing 8.67, and the US testing 14.06 people for every 1000 population (Our World in Data, 2020). However, on 1st March, Italy tested 0.357, UK tested 0.17, and the US 0.007 tested people, in comparison to South Korea testing 1.88 for every 1000 people. This points out to the importance of testing and isolation in controlling the spread. Italy, UK, and the US have learnt in a hard way. The number of fresh cases has almost stopped emerging in case of South Korea, whereas for the other three countries thousands of fresh cases are emerging every day.

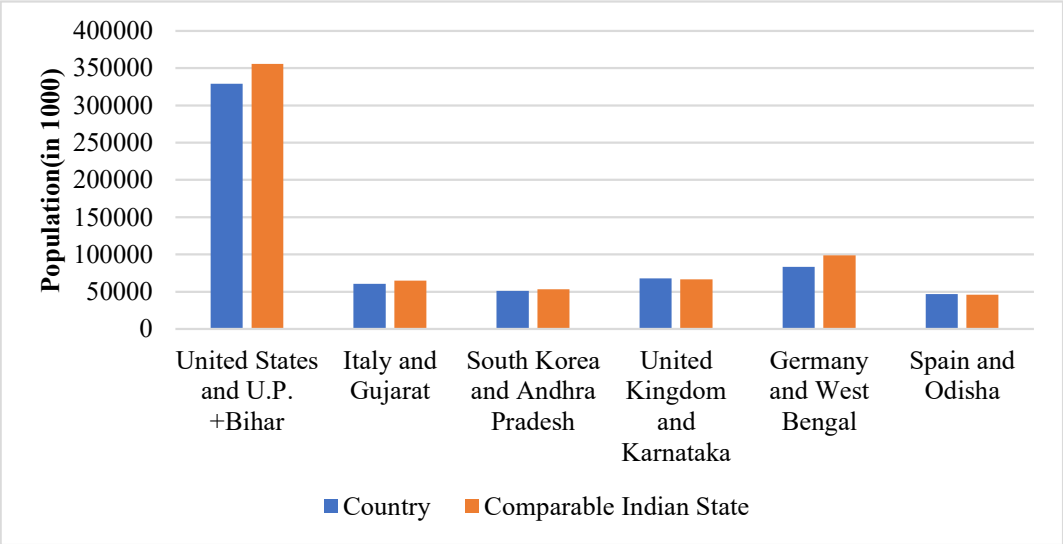
Apart from testing, independent role of bureaucracy and previous exposure to handle MERS outbreak during 2015 and SARS outbreak during 2003, also helped South Korea to contain the spread. For example, a 'new regulatory system' was introduced in South Korea where the bureaucrat fast-track approval for newly-developed testing kits without obtaining permission from the political head (Hille and White, 2020). Such an independent role of bureaucracy may not be possible for India, where the politicians are powerful and at times guided by religious interest groups.

Additionally, India does not have adequate number of testing kits. As on 23 April 2020, India has tested only 0.362 for every 1000 people in spite of having a much higher population than UK, South Korea, and the US (Our World in Data, 2020). In fact, the State of Kerala which has successfully dealt with controlling number of corona-related death has pointed out to the importance of aggressive testing and contact tracing.

There is a belief that India is under-reporting actual number of affected persons. As is the case with West Bengal, the suggestion for home quarantine is a way to signal that there may be a greater number of affected persons in the state than what the official figure suggests (Singh, 2020). A way to understand the fatality rate is to examine how many numbers of days it takes for total deaths to double. As on 25 April 2020, this number was 9 days for India - there were 410 COVID-19 confirmed deaths on 16 April, with the number doubling to 825 on 25 April 2020 (ICMR 2020). For New York, which was at the same stage of pandemic, this number was 2.5 days. The question everyone is asking how will be the statistics change if India is to do proper number of testing - as is done in the developed countries.

India is a hugely populous country. To undertake any meaningful comparison, ideally, we should compare Indian states with their counterparts in the developed world. For instance, population-wise, Odisha is similar to Spain, Karnataka is similar to the United Kingdom, Andhra Pradesh is similar to South Korea, Gujarat is similar to Italy, West Bengal is similar to Germany, and the Uttar Pradesh (U.P.) and Bihar are similar to the United States (See Figure 1).

Figure 1: Indian States and the Developed World



Source: Macrotrends (https://www.macrotrends.net)

2 What if India were to test more?

We do a counterfactual experiment to try and estimate the total number of cases detected and expected number of deaths, if these states in India were to do the testing similar to their counterpart developed countries. There are a few limitations of this analysis. First, the COVID-19 test figures may give some false positive, and may not necessarily means that the person is affected with the virus. Second, many people may not opt to go to hospital for testing at all, and the death toll may be much higher. For instance, Financial Times did a study covering 14 countries and found the death toll from COVID-19 may be almost 60% higher than reported in official count (Burn-Murdoch et al., 2020). India is not part of this sample. However, only 22% of the deaths in India are medically certified (Government of India, 2017). Lastly, we have not controlled for other factors such as level of income, congested living conditions, and availability of health infrastructure. Developed countries scores on account of a better living condition, high income, and better availability of health infrastructure. A majority of the Indian population, especially the urban poor, live in a congested environment with all the family members sharing a single room.

2.1 Data and Methodology

Data on test per thousand, tests per confirmed case, case fatality rate, for various countries are sourced from Our World in Data, a scientific online publication based out of the University of Oxford. India, specific data, which are also available at OWID are sourced from Indian Council of Medical Research, Government of India. For the calculation in an individual state, we consider the case fatality rate for India which is 3.2%. Case fatality rate measure the deaths among those diagnosed to have Covid-19,

by whatever clinical test criteria that is used to define that an individual is Covid-19 positive.[1] Test per confirmed case is defined as the ratio between tests per thousand populations over confirmed cases per thousand populations. To calculate expected death, for any particular state in India, say, Gujarat we proceed as follows. Gujarat has a population size similar to Italy. As on 25 April 2020, Italy was testing 26.72 people per thousand populations. Gujarat has a population of 64801 thousand, and if Gujarat were to test 26.72 people per thousand population as in done in Italy, then total number of COVID-19 affected people in Gujarat rise to $73999.9. \; Where, 73999.9 = \frac{64801 \times 26.72}{23.4}$. For India, test per confirmed case is 23.4. The expected fatality rate for Gujarat is 3.02, and with 73,999 as expected total number of COVID-19 affected persons in Gujarat, the expected COVID-19 related death rises to 3166 people.

The results are quite overwhelming. If the States of U.P. and Bihar were to do the same number of testing as is done in the US, then number of COVID-19 deaths increase from 23 to 2966. Similarly, for Gujarat, Andhra Pradesh, Karnataka, West Bengal, and Odisha the numbers increase from 103 to 3166.6, 27 to 780.5, 17 to 950, 15 to 3483.1, and 1 to 472.8. However, given that only 22% of the deaths are certified in India coupled with less than 3% mortality rate for majority states in India, we don't expect the total number of COVID-19 related death cross 30,000 marks in India for the fiscal 2020-2021.

Table 1. Counterfactual Experiment

Country	**Pop (in 1000)**	**Comparable State**	**Pop (in 1000)**	**Actual Deaths**	**Actual Cases**	**Expected Deaths**	**Expected Cases**
United States	329064.917	U.P. + Bihar	355635.5	23	1657	2966.7	213727.9
Italy	60,550	Gujarat	64801.9	103	2407	3166.6	74000.0
South Korea	51269.185	Andhra Pradesh	53390.8	27	895	780.5	25872.8
United Kingdom	67886.011	Karnataka	66834.2	17	443	950.0	24754.7
Germany	83517.045	West Bengal	98662.1	15	456	3483.1	105885.6
Spain	46736.776	Odisha	45861.0	1	83	472.8	39241.7

Note: Figures are based on the latest available figures, as of 23 April 2020.The figure for Spain is on 13 April, and that for Germany is on 19 April 2020.

[1] Death per million population is another measure that is used to measure impact of Covid-19. Death per million measures the extent to which the disease has caused deaths across whole population at a given point of time.

Table 2. Counterfactual Experiment

Country	Deaths per million	Cases	Cases per million	Tests per thousand	Tests per confirmed case	Fatality rate (in %)
United States	141.3403	842629	2545.7	14.061	5.5	5.6
Italy	414.8899	187327	3098.3	26.718	8.4	13.4
South Korea	4.681175	10702	208.7	11.338	54.6	2.2
United Kingdom	266.6234	133495	1966.5	8.666	4.4	13.6
Germany	60.79924	148046	1767.0	25.11	14.8	3.4
Spain	464.4872	208389	4457.1	20.02	5.6	10.4
India	0.493477	21393	15.5	0.362	23.4	3.2

Data Source: Statistics (https://www.statista.com/statistics/1103458/india-novel-coronavirus-covid-19-cases-by-state/); and Our World in Data (https://ourworldindata.org/coronavirus?country=ESP+TZA+DEU).

Tables 1 and 2, show COVID-19 confirmed cases and actual number of deaths as reported in these states as on 23 April 2020. *Expected cases* and *expected deaths* are the figures if these Indian states were to carry out testing at the rates that are similar to their counterpart in the developed world.

3 Do we need to worry?

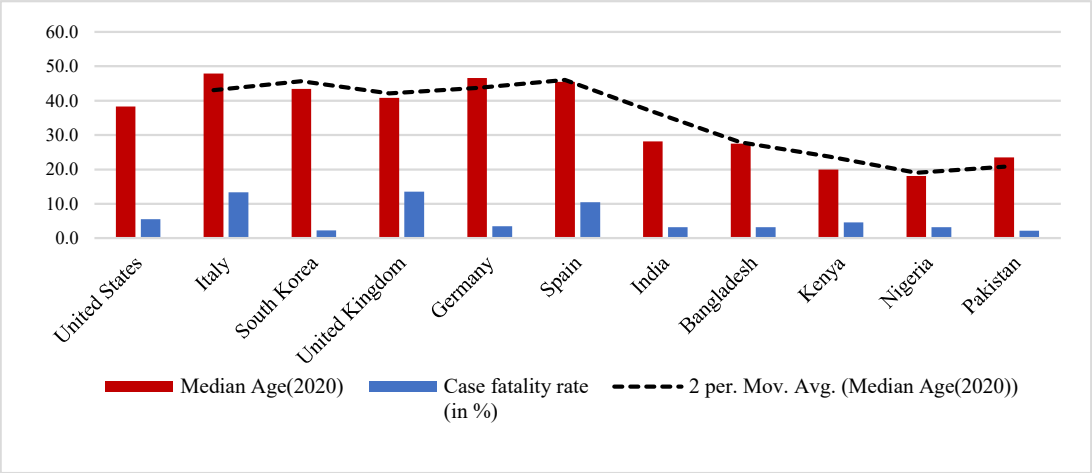
We believe that even if India were to do more testing, the total number of deaths will be far less than what the results show for the following reasons:

3.1 Age Profile

India has a much younger population in comparison the developed countries. With an increase in age the severity of the disease goes up. Elderly people are co-morbid and more likely to suffer from other types of diseases, such as diabetes mellitus, coronary artery disease, cancer, and upper respiratory tract infection (Valderas, 2009). For this group, chances of hospitalization and intensive care go up, leading to more deaths by the COVID-19 (Brurberg, and Fretheim, 2020). A report of 72314 cases that occurred in mainland China shows for the people aged between 70 and 79, the overall fatality rate increase from 2.3% to 8.0%. For the people above 80 years, the fatality rate was at 14.8%. Similarly, for Italy, for the people aged between 70 and 79, the fatality rate is 12.8%; whereas for the people above 80 years of age the fatality rate increases to 20.2% (Onder et al., 2020). In the US, according to a study undertaken by US Centers for Disease Control and Prevention, elderly people suffering from other diseases like heart disease and diabetes are 12 times more likely to die and six times more likely to be hospitalised because of COVID-19 in comparison to the younger healthy populations (Sharma, 2020).

As evident from Figure 2, India and countries such as Bangladesh, Kenya, Nigeria and Pakistan have a lower level of fatality rate in comparison to the developed countries – the US, Italy, South Korea, United Kingdom, Germany and Spain. India, Bangladesh, Kenya, Nigeria, and Pakistan have a younger population and also share similar economic profile (lower-middle income countries).[1] The trend is negatively slope, suggesting that an elderly population is more likely to have a higher fatality rate.

Figure 2. Median Age and Fatality Rate



Source: Out World in Data (https://ourworldindata.org/age-structure)

Note: A 2 point moving average tracks data as an average of last 2 periods to smooth out the data.

3.2 Tropical Climate

What is also particular about the sample of our lower-middle income group of countries is that they also share similar climatic condition. Most viruses exhibit seasonality, varying across geographic locations and across diseases (Martinez, 2018). The Covid-19 virus is sensitive to high temperature and humidity (Chin, et al., 2020). A study that analyzed the meteorological data for 166 countries revealed a negative relationship to both - temperature and relative humidity - on the daily number of new cases and new deaths resulting from COVID-19. A 3.08% (95% CI: 1.53%, 4.63%; CI stands for "Confidence Interval") reduction in daily new cases and a 1.19% (95% CI: 0.44%, 1.95%) reduction in daily deaths could be associated with a 1°C increase in temperature. Similarly, relative humidity increasing by 1% was associated with a 0.85% (95% CI: 0.51%, 1.19%) reduction in daily new cases and a 0.51% (95% CI: 0.34%, 0.67%) reduction in daily new deaths (Wu, et al., 2020). However, when temperature is below 3°C, the daily confirmed cases of COVID-19 increase by 4.861% (95% CI: 3.209, 6.513%) for every 1°C fall in temperature (Zhu and Xie, 2020). Cold and dry weather is favorable to virus survival and spreading. Also, the innate immune system's ability to function is hindered in cold and dry weather

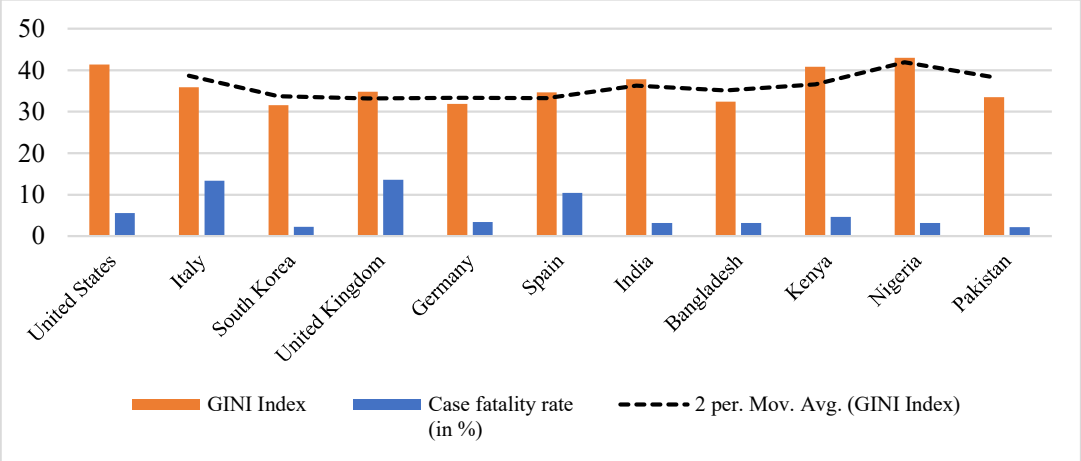
[1]World Bank classifies countries into three groups: low-income, middle-income and high-income. In 2018, the high-income countries are those with a per capita income more than US$ 12,376 per annum. Middle income countries are the ones with per-capita income between US$ 1,026 and US$ 12,376 per annum. Countries with per capita income less than US$ 1026 per annum are classified as low-income countries.

conditions (Sun et al., 2020). The reason why we may observe a higher mortality rate for the developed countries may be attributed to the temperate climatic condition characterized by cold and dry weather conditions.

3.3 Income Distribution

Income is one of the most significant determinants of health. Lower income affects life expectancy. The life expectancy of the poorest 5% of the income distribution did not increase between 2001 and 2014, whereas the gains were concentrated among the richer section of the population (Chetty et al., 2016). Poor health of lower-income individuals results directly from exposure to harmful environments, exposure to situations causing chronic stress, fewer opportunities for educational and occupational development, and a reduced ability to prevent and cope with disability and diseases (Kawachi and Subramanian, 2018). Income inequality affects health outcome, as the poor are not typically insured. The governments in low and middle-income countries also spend less on health care infrastructure, which means the poor people do not have access to *free* health care services. For example, per-capita expenditure on health in India is less than $75 per year in comparison to $9536 for the US, and $4396 for the United Kingdom. 80% of the out-of-pocket expenditure in India is on medicines (World Bank, 2020).

Figure 3. Income Distribution and Mortality Rate



Source: World Development Indicators, 2020 (https://datacatalog.worldbank.org/dataset/world-development-indicators) and

Out World in Data (https://ourworldindata.org/age-structure)

However, as noted in Figure 3, we do not find any clear trend between unequal income distribution and COVID-19 related death. We measure income inequality through Gini-coefficient – a higher value indicates the more unequal income distribution. Considering only the developed group of countries, we do find that countries such as South Korea is much more equal in comparison to the US,

United Kingdom, Italy, and Germany. South Korea also has a lower fatality rate. Unequal income distribution may be responsible but it is not the only factor.

3.4 Dietary habit, associated living condition, and health policy

Ministry of AYUSH, Government of India has issued guidelines for using Indian system of ayurvedic (traditional) medicines with antipyretic properties to be used as a general immunity booster (Government of India, 2020). Ayurveda is a plant-based science. There is a believe that the phytocompounds present in herbs such as andrographis paniculata, vetiveria zizanioides, cymbopogon jwarancusa, ginger, cyperus rotundus, etc. can stop the virus from replicating and protect the body from COVID-19 (Tejonmayam, 2020). The suggested guidelines for developing immunity, as issued by the Ministry of AYUSH, are based on the idea of practicing yoga and eating healthy diet.

Likewise, a cleaner air quality may help to reduce the chance of getting affected by the COVID-19. The research done in the US and in Italy suggests people living in polluted areas are more likely to die from COVID-19 than those living under cleaner environment. High death rates in the northern industrial part of Italy (in Milan and Lombardy) are attributed to higher-level of pollution (The Guardian, 2020). In fact, in India, following a strict lockdown measures, air-quality has improved. For example, in the national capital region of Delhi, the air quality index has fallen from the high of 900 micrograms per cubic meter in 2019, to around 20 micrograms per cubic meter during April 2020 (Ellis-Petersen, 2020). Moreover, unlike in the developed countries where people are used to working in a close office environment (with centralized air conditioning), majority of the people in India work outside, or under condition which do not require centralized air conditioning. The virus is more likely to spread under close office environment, wherein, if one person gets affected is more likely to affect others. A new found cleaner air-quality in India and absence of indoor office environment may have helped to develop immunity to fight COVID-19.

Health policy in India encourages universal vaccination for poor income cohorts. Few studies have commented on the effect of BCG vaccine in reducing respiratory infections (Hegarty et al., 2020, and Curtis et al., 2020). Lower incidence of Covid-19 related death among South Asian countries and other African countries, in comparison to their counterparts in North American and European continents, can be partially attributed to BCG vaccination policy (Miller, et al., 2020). Countries with higher Covid-19 related death counts, such as USA, Canada, and Italy do not have universal BCG vaccination policy, whereas, United Kingdom, Spain, France, and Germany, earlier used to have a universal vaccination policy.

3.5 India's pharmaceutical industry

India is home to 3,000 pharmaceutical companies and 10,500 drugs factories. India is the world's third largest manufacturers of medicines (by volume) and has emerged as a major exporter of generic drugs in such areas as diabetes, anti-depressants, high blood pressure, epilepsy and even cancer, in part because the Indian government allows foreign multinationals to invest in India. Tie-ups between Indian domestic drug manufacturers and foreign multinationals – Piramal Healthcare with Abbott Laboratories, Ranbaxy Laboratories with Daiichi Sankyo, Dr. Reddy's Laboratories with GlaxoSmithKline, Shantha Biotechnics with Sanofi-Aventis, and Biocon with Bristol-Myers Squibb

– have allowed India to move up the value chain, with formulations and packaging moving in here. In fact, pharmaceuticals are an important component of Indian trade with the African and South American continent, with India supplying 85% of all anti-retroviral drugs used to treat HIV in Africa. Like in the case with HIV, India is also a major manufacturer of hydroxychloroquine, the drug that is used to prevent and treat malaria, lupus and rheumatoid arthritis, and now being used in India, Brazil, and the US as a preventive drug to fight against COVID-19.

4 Conclusion

There is apprehension that India is not testing enough, and therefore the number of COVID-19 affected cases and deaths are less in India. In this short note, we analyse what the outcome may look like if India were to test as is done in some developed countries. Although, the number increases many folds, we argue eventually India may not see that many increases in the number of COVID-19 affected people and related death. India has a much younger population in comparison to the developed world. Indians while growing up have an early exposure to vector borne diseases such as malaria, dengue and chikungunya, and may have developed state of resistance to COVID-19. The tropical weather characterized by hot and humid conditions, may provide additional benefit, as the viral affect get weakened because of higher temperature and humidity. However, these observations need to be validated with a larger-set of data. Also, Indian policymakers need to be cautious about the elderly co-morbid population. COVID-19 is likely to affect this group more, and therefore need more attention from the welfare state.

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