COVID-19 Cases and Testing: A Cross-Country Analysis

Venkatanarayana Motkuri[1]

11 April 2020

Abstract

This policy brief is a cross-country analysis of the association between rate of testing and infection rate in population for COVID-19. A positive relationship indicates that countries with high rates of testing have high infection rates and vice versa. But, as the tests conducted are largely symptom-driven and not as a precautionary measure of screening, except in a few countries, it means that higher infection rates manifested through symptoms causing high rates of testing. This could increase the risk of spreading the infection through persons who are asymptomatic, but are possible carriers. This calls for screening and testing as a basic precautionary measure through contact tracing or in specific zones or through random sample to restrict the spread of the pandemic at the local or community level or pre-empt any widespread outbreak.

Introduction

The outbreak of novel coronavirus (known as COVID-19) in China in the last quarter of 2019 that gradually shifted its epicentre to Europe and North America (particularly, USA) in the first quarter of 2020. By the end of March 2020, more than 200 countries were experiencing the tremors of the pandemic. Many countries have been witnessing the exponential growth in infected cases. Globally, there are more than 1.6 million infected cases (as on 09/04/2020) and 95 thousand deaths. It means that there are 206 infected cases and 12.3 deaths per million population at the global level. There is huge variation across countries in terms of the number of infected cases and the rate of infection in the population. USA is having the largest number of cases (0.47 million) followed by four European countries (Spain, Italy, France and Germany) having more than hundred thousand cases each. Together these five countries have more than 62 per cent of the cases all over the world. Although, India has relatively fewer number of cases (above 6000 cases) compared to the high incidence countries across the globe, it has emerged as the sixth ranking among Asian countries, after China, Iran, Turkey, South Koreas and Israel.

Given the contagious nature of infection,[2] many countries have adopted physical/social distancing to contain its further spread. To ensure that people strictly comply with the same, some of the countries have imposed total or partial lockdowns. Screening through testing and then quarantining/isolating or hospitalising the infected cases are also considered as important aspects of containing the spread of this pandemic.

---

[1] Venkatanarayana Motkuri, PhD, is a Program Manager-HDRG, Centre for Good Governance (CGG), Hyderabad. He may be reached at: venkatanarayan@gmail.com. The author thanks Srijit Mishra and Bharat Bhushan for their comments and suggestions.

[2] Models of epidemiology, particularly SEIR (Susceptible, Exposed, Infection, Recovered), suggests that some among the infectious may be asymptomatic, but are carriers and they along with other symptomatic infectious carriers can get other susceptible population exposed.

In this backdrop, the current exercise is an attempt to analyse the number of tests for infection conducted across countries and the number of positive/infected cases they reported. Data are extracted on 07/04/2020 at 10:30 am (Indian time) from *worldometers* website (https://www.worldometers.info/coronavirus/). Even though more than 200 countries reported cases and deaths, only 140 have reported on the number of tests conducted. Hence, the current analysis is restricted to these countries.

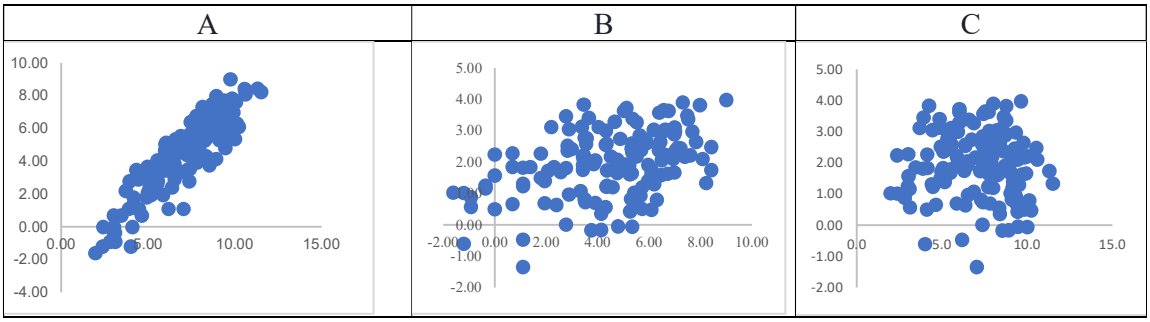
Analysis and Observations

The analysis will make use of country-specific data on the number of corona tests per million population or rate of testing ($\mathcal{T}$), the number of infected cases per million population or infection rate in population ($\mathcal{U}$), the number of infected cases per 100 tests or infection rate in tests ($\mathcal{V}$).[3] All these variable are transformed logarithmically to mend the extreme values of observations and to obtain a better fit in the linear pattern.

In Figure 1, the scatter plots with X-axis and Y-axis being logarithmic values of rate of testing and infection rate in population ($ln\,\mathcal{T}$ and $ln\,\mathcal{U}$) in panel A, infection rate in population and infection rate in tests ($ln\,\mathcal{U}$ and $ln\,\mathcal{V}$) in panel B, and rate of testing and infection rate in tests ($ln\,\mathcal{T}$ and $ln\,\mathcal{V}$) in panel C. Without implying any causal relationship, to find out the direction and significance of the relationships we regressed the variable in the X-axis on the variable in the Y-axis for all the three panels. The association between the logarithmic values in terms of correlation coefficient (or, r-square in a two-variable regression) are 0.80, 0.17, and 0.03, respectively. And, the slope coefficients (or, elasticities) are positive and significant at 1 per cent level, positive and significant, and negative but not significant, respectively.

Figure 1

Scatter Plot Showing Relationship between Logarithmic values of Rate of Testing, Infection Rate in Population, Infection Rate in Tests across Countries



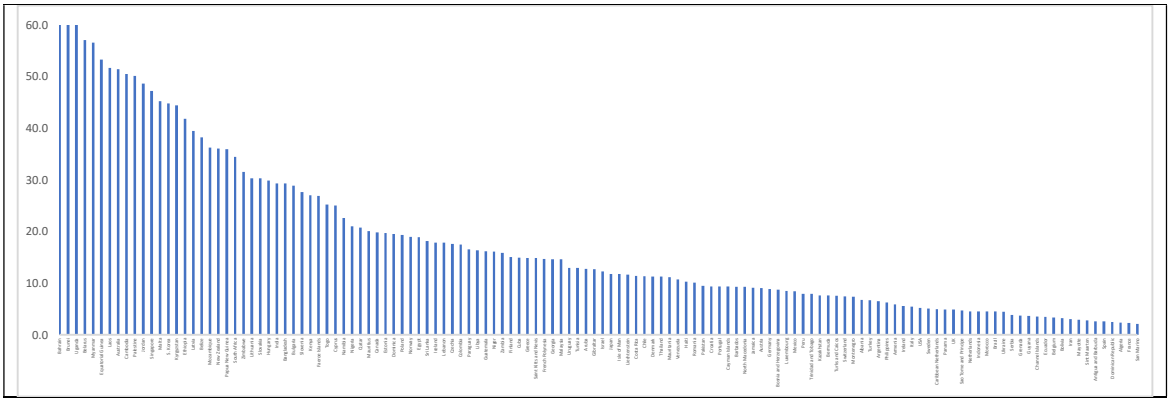
Note: *In panel A, X-axis is ln(rate of testing) and Y-axis is ln(infection rate in population). In panel B, X-axis is ln(infection rate in population) and Y-axis is ln(infection rate in tests). In panel C, X-axis is ln(rate of testing) and Y-axis is ln(infection rate in tests).*

Source*: Author's calculation based on https://www.worldometers.info/coronavirus/ accessed 8 April 2020.*

[3] Tests have been adjusted for repeats by subtracting twice the numbers recovered from the total number of tests. This has been done with the assumptions that a recovered person would have been tested at least thrice, once when the test was first positive and then there would have been at least two consecutive negatives before the person was declared recovered.

Further, a ratio of tests per infection or ratio of rate of testing to infection rate in population ($\mathcal{T}/\mathcal{U}$) across countries is indicated in Figure 2. It is the highest in Vietnam (348.9), which is followed by Nepal (184.0), Botswana (161), Russia (119.5) and New Caledonia (118.6). It is observed that seven among the top ten are Asian countries and some African countries are also showing better performance in this respect. The earlier severe acute respiratory syndrome (SARS) and Ebola epidemics experiences of some Asian and African countries, respectively, might have made these countries to have preventive and precautionary measures.

Figure 2
Tests per Infection across Countries



***Note**: Ten countries where tests per infection is more than 65 are not shown, as it impacts the Y-axis scale for all others. These countries are: Vietnam (384.9), Nepal (184.0), Botswana (161.0), Russia (119.5), New Caledonia (118.6), United Arab Emirates (106.0)), Hong Kong (105.7), Taiwan (99.8), Azerbaijan (70.2) and Greenland (65.3).*

***Source**: Author's calculation based on https://www.worldometers.info/coronavirus/ accessed 8 April 2020.*

So, how does one understand this. There is positive relationship between rate of testing and infection rate in population. It indicates that countries with high rates of testing have high infection rates in population and vice versa. Here one must note that the tests conducted in most of the countries are largely symptom-driven and not as a precautionary measure of screening. It means that high infection rates in population manifested through symptoms causing high rates of testing. At the same time, some countries like Vietnam, South Korea, Russia and a few others seemed to have followed the proactive measure and not taken the reactive approach.

It is this dual approach across countries that may to some extent explain, on the one hand, why the relationship between infection rate in population and inflection rate in tests has a low association (r-square) but slope coefficient is positive and significant, and on the other hand, why the relationship between rate of testing and infection rate in tests has a slope coefficient that is negative but not significant.

A matter of concern is that COVID-19 can also spread through persons who are asymptomatic, but are possible carriers. Given its transmission mechanism through droplets contact, physical/social distancing along with droplet protection and hygiene like face masks would be a basic precautionary measure to contain the pandemic spread at the individual and community level.

High density of population and the economic compulsions of the people, especially the middle classes and the poor, may not allow them to strictly follow the precautionary measures. To ensure them, partial or total lockdown has been adopted in some countries. Lockdown has substantive economic costs, immediately and subsequently, at the aggregate macroeconomic level and also at the individual level, especially for those whose livelihood opportunities are at stake.

Some countries like South Korea and Singapore among others have adopted large scale testing/screening approach and have been relatively less restrictive in terms of economy-wide lockdown. All they are showing is an alternative that balances partial lockdown with expanding testing. This calls for screening and testing as a basic precautionary measure through contact tracing or in specific zones or through random sample to restrict the spread of the pandemic at the local or community level or pre-empt any widespread outbreak.

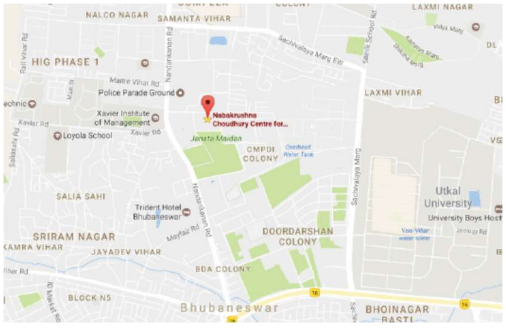
Conclusion

Across countries, there has been a positive association between rate of testing and infection rate in population. This is largely on account of symptom-driven reactionary approach that the pandemic has taken. At the same time there are some countries that have taken a precautionary approach that balances testing with relatively less restrictive lockdown. A leaf from the latter may help restrict spread at local or community level and pre-empt widespread outbreak.

* * *

This is the fifth NCDS policy brief in the COVID-19 series. The other four have been on analysis of cases across countries and provinces of China (PB12NCDS, 20 March 2020), on behavioural biases that could lead to panic like asking health care professionals to leave rented premises (PB13NCDS, 25 March 2020), on strengthening COVID hospitals and concerns of community transmission in Odisha (PB14NCDS, 28 March 2020), and on କୋଭିଡ -୧୯ ମହାମାରୀ ସମୟରେ ପୁଷ୍ଟିକର ଖାଦ୍ୟର ଉପଯୋଗିତା (PB15NCDS, 7 April 2020), which is an Odia translation of "Maintaining a healthy diet during COVID-19 pandemic" prepared by the Food and Agriculture Organization of the United Nations.

-0-X-0-



Nabakrushna Choudhury Centre for Development Studies (NCDS)
(an Indian Council of Social Science Research (ICSSR) institute
in collaboration with Government of Odisha)
Bhubaneswar-751013, Odisha, India

Phone: +91-674-2301094
Email: ncds_bbsr@dataone.in
Web: ncds.nic.in
Facebook: @ncdsbhubaneswar
Twitter: @ncds_bbsr
Google Maps: NCDS Bhubaneswar