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## Confronting COVID-19 Myths: Morbidity and Mortality

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# Confronting COVID-19 Myths: Morbidity and Mortality

Pavel Jelnov\*

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## Abstract

COVID-19 mystery feeds the belief that the reported morbidity rates are not related to the true ones and that large parts of the population are already infected, the virus is not very dangerous, and the lockdown is unnecessary. Yet one observes two very strong correlations that disprove this belief. The cross-country correlation between log of tests and log of reported cases (per capita) is 0.87 and the correlation between log of reported cases and log of reported deaths (per capita) is 0.89. Using these correlations, I suggest that the infection rate in no country is higher than 10%. Furthermore, I suggest that the mortality from COVID-19 is at least 0.4%.

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# Introduction

COVID-19 pandemic is an unprecedented in the modern history ongoing event that feeds disbelief in the usefulness of the reported morbidity rates. The reported data is suspected to be biased by country-specific testing policy, fraud, and mysterious properties of the virus. Yet the unknown true levels of contagiousness and mortality have crucial implications on the effectiveness of lockdown and social distance policy. Thus, the big question is whether the number of deaths from COVID-19 is relatively modest because the virus is not very contagious or because it is not very dangerous. Those who claim that COVID-19 is very contagious but not very dangerous suggest that large parts of the population have been already infected, but have not developed symptoms and were not tested. Therefore, they overlook the reported data and doubt the effectiveness of the lockdown.

I show that the cross-country data that links COVID-19 tests to morbidity and morbidity to mortality is far from being erratic. By contrast, it is well structured around strong cross-country patterns. In the simple analysis below, I explain why the virus is probably not spread among more than a few percents of the population, but leads to relatively high mortality.

## Morbidity

I observe two very strong cross-country correlations. First, the correlation between log of tests and log of reported cases (per capita) is 0.87. This correlation is shown in Figure 1. Moreover, the regression slope between the two variables is 0.98 and statistically indistinguishable from one. Therefore, one can assume for simplicity (and in order to link the empirical model to some forthcoming theory) that in the model



$$\log(cases_i) = \beta_0 + \beta_1 \cdot \log(tests_i) + \varepsilon_i, \quad (1)$$

where cases and tests are given in per-capita terms, and  $\varepsilon_i$  is a country-specific error term,  $\beta_1 = 1$ . Then the estimated  $\beta_0$  is simply the mean  $\log(\frac{cases}{tests})$  across countries. It is equal -2.81 (estimated on April 12, 2020).

I estimate the maximal share of infected population by extrapolation to full testing. Because the slope is positive, the highest possible infection rate is associated with the highest possible testing (not a single word about causality). By coincidence, also the true number of cases can be revealed once everyone is tested. Thus, to estimate the maximal infection rate, one can set  $tests = 1$ , and the predicted maximal infection rate is  $Exp(-2.81) = 0.06$ . The 95% confidence interval is [0.03,0.1]. Thus, I estimate the cross-country maximal infection rate as 6% and not higher than 10%.

## Mortality

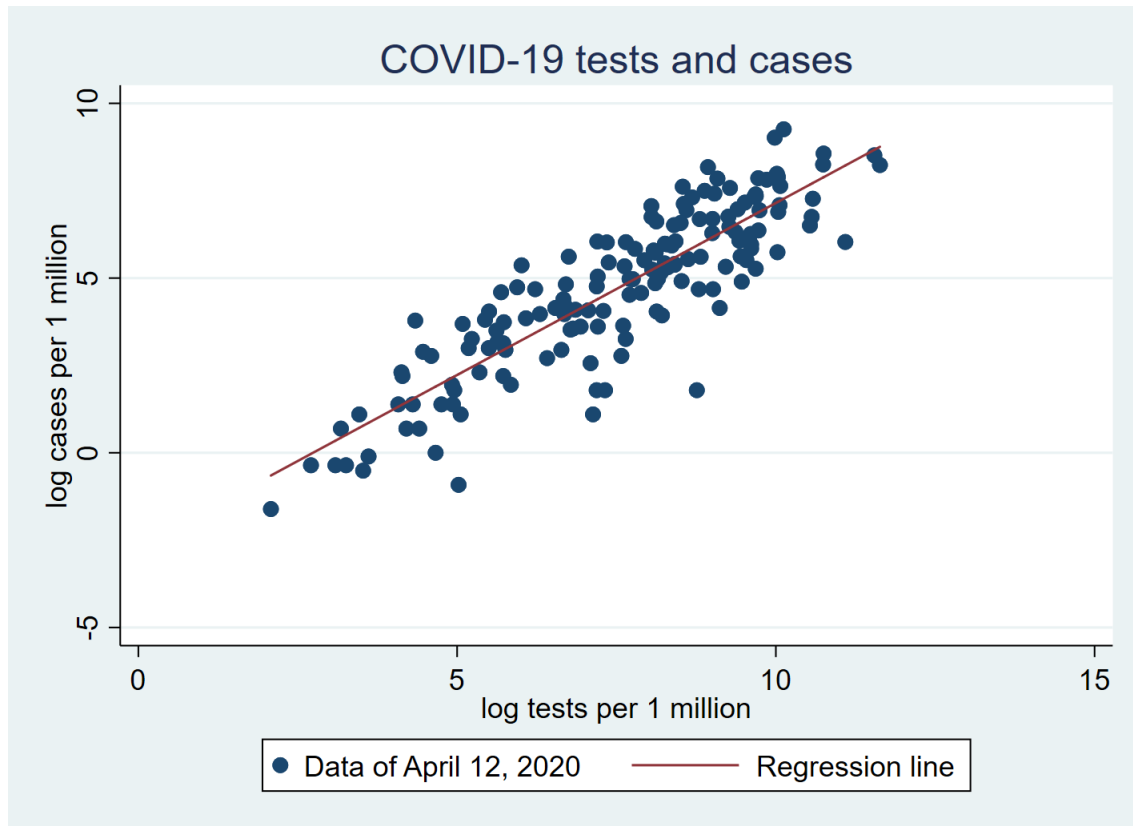
The second strong correlation is the correlation of 0.89 between log of reported cases and log of reported deaths (per capita). This correlation is illustrated in Figure 2. Once again, the cross-country data is (perhaps surprisingly) systematic. The regression line is

$$\log(deaths_i) = \alpha_0 + \alpha_1 \cdot \log(cases_i) + \nu_i, \quad (2)$$

where deaths and cases are per capita. The estimated slope  $\alpha_1 = 0.86$  (estimated on April, 12, 2020). Thus, the death rate is concave with respect to the number of treated cases. This concavity means that the share of lethal cases decreases in the number of treated cases.



Figure 1: COVID-19 tests and cases



Note: The Figure presents log of COVID-19 tests per one million of population vs log of reported cases per one million of population in 156 countries. Data was released from <https://www.worldometers.info/coronavirus/> on April 12.



In other words, the more COVID-19 cases a country treats, the lower the share of serious cases out of all treated is.

Most importantly, the almost-perfect correlation in Figure 2 shows that one can estimate the lower bound of mortality using extrapolation. The real mortality is  $\frac{\text{real number of deaths}}{\text{real number of cases}}$ . The maximal real infection rate is in the range calculated in the previous section. Because of concavity, the maximal number of treated cases is also associated with the lowest mortality (again, I do not suggest here any causality). Thus, the lower bound of mortality is, up to the confidence interval, the predicted mortality for the maximal infection rate.

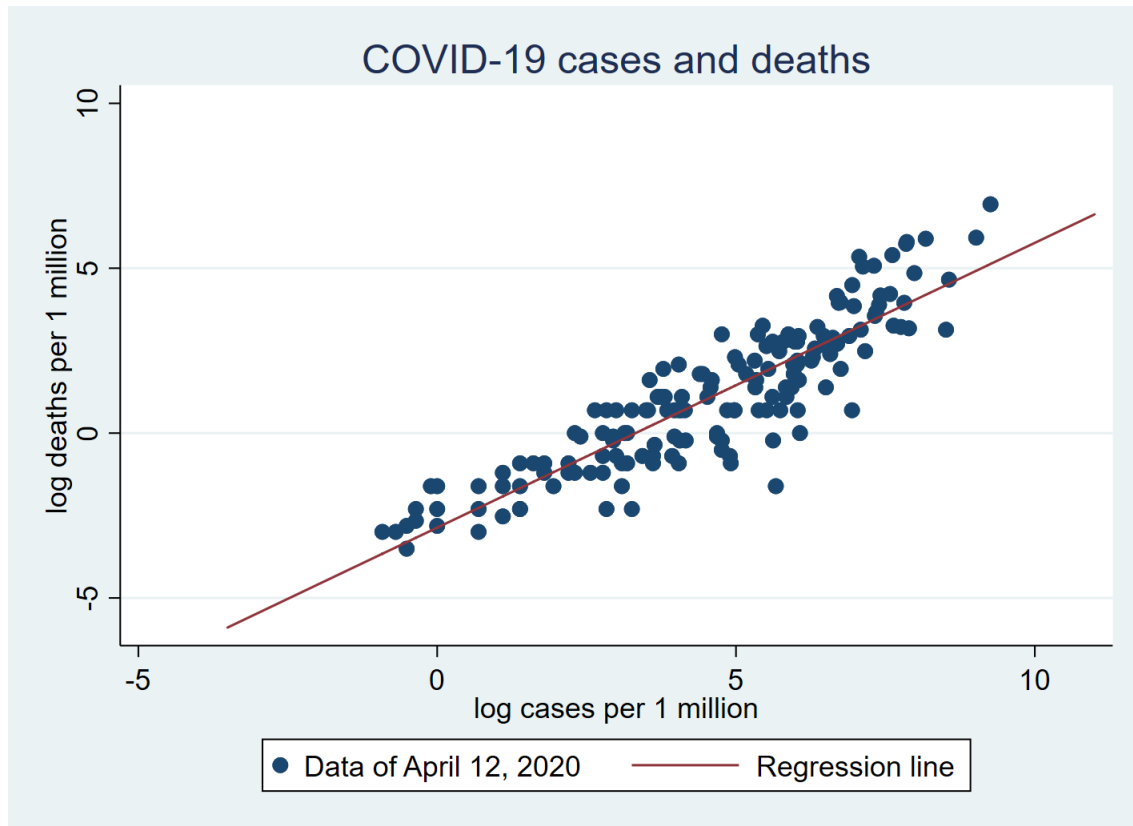
I estimate simultaneously Equations (1) and (2). The predicted mortality when the number of real cases is 6%, the maximal infection rate point estimate, is 1.1%. However, to obtain the lower bound estimate for mortality, we consider the upper bound of the 95% confidence interval for the maximal infection rate, which is 10%. The corresponding 95% confidence interval of mortality is [0.004, 0.012]. Thus, COVID-19 mortality is probably at least 0.4%. Moreover, the real mortality is somewhat higher than any estimate based on the current number of deaths, because unfortunately some of those currently infected but still alive will die in the future.

## Conclusions

The reputation of reported COVID-19 morbidity and mortality data is poor. Both are considered to be biased by country-specific testing and reporting policy and by the uncertain properties of the virus. Yet simple cross-country correlations show a systematic relationship between testing and reported morbidity and between reported morbidity and reported



Figure 2: COVID-19 tests and cases



Note: The Figure presents log of COVID-19 tests per one million of population vs log of reported cases per one million of population in 159 countries. Data was released from <https://www.worldometers.info/coronavirus/> on April 12.



mortality. The correlations are strong enough to be used for prediction. The extrapolation generates upper bounds of morbidity and lower bounds of mortality rates that show that the virus is not extremely contagious but is dangerous. These results advocate the strict lockdown policy.