Review of "Pandemic preparedness and COVID-19: an exploratory analysis, from Jan 1, 2020, to Sept 30, 2021"

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One-minute summary

- The authors completed an exploratory analysis to understand potential factors associated with variation of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection rates and infection-fatality ratios (IFRs) across 177 countries between January 1, 2020 and September 30, 2021.

- The analysis was completed in three stages. In stage one, the cumulative national infection rate and the IFR were estimated and standardized for demographic, biological, economic, and environmental variables. During stage two, cross-country associations were measured between each of the standardized cumulative national infection rates and IFRs from stage 1, and 28 health care, social and governance factors that policy makers can control (e.g., health-system capacity indicators, pandemic preparedness indices, political conditions). Stage three, the correlation between the social and governance factors associated with infection identified in stage 2 (i.e., interpersonal trust, government trust and government corruption) and the changes in mobility patterns and Coronavirus Disease 2019 (COVID-19) vaccinations were assessed.

- The authors found substantial cross-country variation in SARS-CoV-2 infection rates between January 1, 2020 and September 30, 2021. Variation due to known risk factors was predominantly due to seasonality (2.1% [95% uncertainty interval 1.7–2.7] of variation); altitude/population living below 100 metres (5.4% [4.0–7.9] of variation); and gross domestic product (GDP) per capita (4.2% [1.8–6.6] of variation). However, the majority of cross-country variation (60.6% [55.6–65.2]) in cumulative infection rates could not be explained by the factors accounted for in this analysis.

- The authors found that IFRs also varied across countries between January 1, 2020 and September 30, 2021. The variable attributable to the most cross-country variation for IFRs was the age profile of the country (46.7% [18.1–67.6] of variation) followed by national mean Body Mass Index (BMI) (1.1% [0.2–2.6] of variation) and GDP per capita (3.1% [0.3–8.6] of variation). 44.4% (29.2–61.7) of the cross-country variation in IFR could not be explained by the factors accounted for in the analysis.

- The authors noted there were no significant associations between standardized infection rates or standardized IFRs and pandemic preparedness indices (e.g., Joint External Evaluation (JEE), Global Health Security (GHS) Index and both their components) or health care capacity indicators (e.g., universal health coverage (UHC) effective coverage index and Healthcare Access and Quality (HAQ)).

- When authors assessed for associations with the governance variables (e.g., corruption, state fragility, government effectiveness), only reduced government corruption was identified as being associated with significantly fewer infections.

- Among social factors, there were statistically significant associations between standardized infection rates and interpersonal, and government, trust in the first ten months of the pandemic (pre-vaccines) (January to October 2020) as well as until September 30, 2021. Higher levels of trust were associated with fewer infections.

- The authors found that higher COVID-19 vaccination coverage (among middle and high income countries) was associated with more interpersonal trust ($p<0.0001$), government trust ($p=0.0060$), and less government corruption ($p<0.0001$). Increased reduction in population mobility was also observed amidst lower levels of government corruption ($p=0.0001$), which can be interpreted as the population complying with physical-distancing guidance and/or stay-at-home directives.

- Four main conclusions were made by the authors: 1) among the factors that explain variation in SARS-CoV-2 infections and IFR, there are factors that can be influenced by policy makers (i.e., encouraging healthy bodyweight, smoking cessation, trust in government) and factors that cannot (i.e., seasonality, altitude, age, and GDP), 2) indicators of health-care capacity and pandemic preparedness were not correlated with cross-country variation in SARS-CoV-2 infections or IFR, 3) greater trust in government and interpersonal trust, as well as less government corruption, had statistically significant associations with less infections across the study period, but not with global variation of IFR, 4) trust and corruption may impact COVID-19 outcomes through improved national vaccination rates and adherence to public health guidance.

Additional information

- Infection rates and IFRs were acquired for 177 countries and territories as well as 181 subnational locations from the Institute for Health Metrics and Evaluation modelling database between January 1, 2020 and September 30, 2021. Both were standardized using an indirect age standardization and multivariate linear models.

- For national infection rates, and IFR the authors considered demographic, biological, economic, and environmental variables at a national level.

- Consistent with an earlier Independent Oversight and Advisory Committee report, the authors of this study identified that health system and preparedness capacity are poor predictors of pandemic outcomes. They noted; however, that the JEE, GHS index and UHC effective coverage index (a health care capacity indicator) measures are tools for highlighting gaps in national capacity to better guide appropriate financial and political support, and not intended to predict pandemic outcomes.

- The authors quantify the contribution of the significant variables assuming they are causal. If all countries improved trust in government to the level of Denmark (75th percentile), then they estimate 12.9% fewer global infections would have occurred. If all countries improved interpersonal trust to the 75th percentile they estimate 40.3% fewer global infections would have occurred.

- **Limitations noted by the authors:**

  - The explanatory variables' came from several different sources, and an assessment of each should have been completed. The authors' attempted to propagate sources of uncertainty into the final results, however were unable to estimate the uncertainty of many of the explanatory variables.

  - Due to limited data, adjustments for differences in outcomes by sex was not performed and simple models based on design were used. A fuller model would have supported the use of interactions and non-linear effects.

  - The analyses focus mainly on national level data reflecting on factors that can be impacted by national policies. Country-specific response variables, like mask use, were not included in the primary analysis. Further research is needed for interpreting within-country variability.

  - Circumstances are constantly changing and can impact the outcomes presented in this analysis. This analysis does not discuss information about the causes of COVID-19 variation.

PHO reviewer's comments

- Questions remain with regards to the unexplained cross-country variation in SARS-CoV-2 infection rates and IFRs. While health-system capacity indicators and pandemic preparedness indices were accounted for in this analysis, they were poor predictors of pandemic outcomes. These metrics were not designed for cross-country comparisons or to predict pandemic outcomes but to direct investments for pandemic preparedness.

- This exploratory analysis found that there are factors that can and cannot be managed by policy makers. Age is the most important contributor to variation in IFR. Modifiable health risks (e.g., BMI, air pollution and smoking) are an example of factors that contributes to SARS-CoV-2 infections and IFR and could be managed by policy makers. Decision-makers should consider investing in national and international public health policies specific to these modifiable health risks (e.g., tobacco control policies, healthy eating and lifestyle) as it could positively impact future pandemic efforts.

- This study provides supporting evidence for decision makers to consider strategies to improve trust (government and interpersonal) as higher levels in trust for each were strongly associated with less infections. This can be done by sharing timely and accurate information about the pandemic. Previous studies have noted that having public health experts, as opposed to politicians, responsible for risk communication can improve public trust level.[1,2]

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