

Title: Did Better Health Systems Respond Better Early-on in COVID-19 Pandemic?: A Cross-country Ecological Association Analysis

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Conflicts of Interest: None

Background:

The role of resilient and high-quality healthcare systems in responding to COVID-19 has been advocated throughout the pandemic. The lack of universal health coverage (UHC) could have led to a poor pandemic response in certain countries and settings. We tested the hypothesis if the better status of health systems should be associated with better epidemiological outcomes early on in the COVID-19.

Methods:

We conducted a country-level ecological association analysis between confirmed case fatality ratios (c-CFRs) for COVID-19 and three indices reflecting the countries' health system status: healthcare access and quality (HAQ), UHC Service Coverage, and Sustainable Development Goal for Health. Data for COVID-19 confirmed cases and deaths was obtained from COVID-19 Data Repository by the Center for Systems Science and Engineering, Johns Hopkins University. Values for HAQ, UHC, and health-related SDG indices were acquired from Institute for Health Metrics and Evaluation (IHME) - Global Burden of Disease (GBD) 2016, World Health Organization - Global Health Observatory 2017, and World Health Statistics 2018: Monitoring health for the SDG, respectively. We included countries with at least 100 cases and one death as of 5<sup>th</sup> July 2020. We considered the percent cumulative c-CFRs at 30, 42, and 60 days from the day of the first confirmed case. Spearman's rank correlation was used to measure the associations between the exposure and response variables.

Findings:

We included 156 countries that fit the inclusion criteria. We found that HAQ (n=156), UHC service coverage (n=153, 3 missing data points), and health-related SDG (n=123, 33 missing data points) had significant (p<0.05) negative correlations of small-to-medium effect size with c-CFRs at 30 (correlations for HAQ: -0.31; UHC: -0.28;

SDG: -0.34) and 42 days (HAQ: -0.2; UHC: -0.16; SDG: -0.24). The correlations were non-significant and negligible for c-CFR at 60 days.

**Interpretation:**

The reduction in the correlation strength for all indices with case fatality from 30 days to 60 days depicts that these indices could be instrumental in a country's early response in the pandemic trajectory. These associations bolster the importance of high-quality health systems and services in the COVID-19 pandemic response.

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