**Case-fatality rate of COVID-19 is declining since May 2020**

**Mohammad Nayeem Hasan1, Najmul Haider2, Richard A Kock2, Md. Jamal Uddin1**

1 Department of Statistics, Shahjalal University of Science and Technology, Sylhet 3114, Bangladesh.

2 The Royal Veterinary College, University of London, Hawkshead Lane, North Mymms, Hatfield, Hertfordshire

**Abstract:**

**Background**

The Case fatality rate (CFR) of any disease defined as the risk of death among infected cases indicates the severity of the infection. The objective of this study was to understand the variation of reported CFR (rCFR) of COVID-19 based on reported COVID-19 cases and deaths data globally over time and to identify variables that explain these differences in the rCFR of COVID-19 pandemic in different situations.

**Methods**

We collected daily COVID-19 cases and deaths data from the WHO’s daily situation reports from January 1 to August 31, 2020 (Epidemiological week 1-35). Further, we collected explanatory variables for each country including population density, gross domestic product (GDP), worldwide governance indicator (WGI), Global Health Security Index (GHSI), the prevalence of obesity, the percentage of people aged 65 and above. We performed an autoregressive integrated moving average (ARIMA) and automatic forecasting time-series model to predict 10-days CFR and compared with the rCFR data. We used beta regression models to investigate the association between the rCFR and potential predictors of each country and reported incidence rate ratios (IRRs) of each variable.

**Results**

The weekly global cumulative COVID-19 rCFR reached the peak at 7.23 during 17th Epidemiological week (April 22-28, 2020). We found a positive and increasing trend for global daily rCFR of COVID-19 until 17th Epidemiological week and then a strong declining trend up until 35th week at 3.4 (August 25-31, 2020) in ARIMA and automatic forecasting time-series model (Root Mean Square Error: 0. 22 and 0.44 respectively) (**Fig 1**). In both epidemiological periods (pre-and post-peak of rCFR), the percentage of people aged 65 and above (IRR: 1.07, 95% CI: 1.04-1.10 and 1.01 [1.01-1.02], respectively), the prevalence of obesity (IRR: 0.97 [0.95-0.99] and 1.01 [1.01-1.02], and COVID-19 tests per thousand population (0.98 [0.94-0.99] and 0.99 [0.98-0.99], respectively) were significantly associated with the COVID-19 rCFR.

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| Fig 1: Top: Observed and predicted daily worldwide daily cumulative reported Case-fatality rate (cCFR) using Auto-Regressive Integrated Moving Average (ARIMA) model. Bottom: Observed and predicted daily worldwide daily cumulative rCFR using Automatic Forcasting time-series model (Prophet). The black dots indicate observed data, blue line indicate the predictive CFR and shaded area indicate 95% confidence interval of predicted CFR. |
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**Conclusions**

Global cumulative rCFR of COVID-19 is decreasing since May 2020. However, the percentage of people aged 65 and above and related comorbidities (e.g. prevalence of obesity) of the country played a key role in the variation rCFR in different countries. Although number of tests/thousand population is negatively associated, our analyses indicate that the declining trend of global COVID-19 rCFR is not merely because of increased COVID-19 testing, as testing has poor predictive value. More studies are needed to understand the reason behind the decreased rCFR.

**Tweeter accounts:**

1) Mohammad Nayeem Hasan (@nayeem5847)

2) Najmul Haider (@HaiderNajmul)

3) Richard A Kock (@RichardKock6)

4) Md. Jamal Uddin ()