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Letter to the Editor

# The Association between Out-of-Pocket Expenditure and COVID-19 Mortality Globally

## 1. INTRODUCTION

As the Coronavirus 2019 (COVID-19) pandemic evolves, its disproportionate impact on vulnerable and socially disadvantaged populations are becoming more pronounced [1,2]. These differences have been attributed to existing health disparities which have been traced back to economic inequality [3]. This is not an entirely new phenomenon as the influenza pandemic in 2009 disproportionately affected the poorest fifth of England's population [4] and death rates in some South American countries were up to 20 times higher than in Europe [5].

Pandemics are triggered by social inequalities and extreme poverty amongst specific groups and affluence among other groups amid greater global interconnectedness [6]. The links between socioeconomic indices (income, social class, occupational background, and educational achievement) and poorer health outcomes are magnified by COVID-19 [7]. Low socioeconomic status is associated with higher rates of comorbidities such as heart disease [8] and presence of comorbidities has been correlated with poorer clinical outcomes with COVID-19 [9].

We used the European Centre for Diseases Prevention and Control (ECDC) country summary data through April 30, 2020 ( $n = 194$  countries) [10]. We used the mortality number (log scale) for a

total of 179 countries, with a distribution of 29/179 (16.2%), 92/179 (51.4%) and 58/179 (32.4%) countries among low-, middle- and high-income countries respectively.

We matched different datasets, through three steps: (i) matching the mortality by country with Growth Domestic Product (GDP); (ii) combining data of the Gini index of net income inequality within countries [11]; and (iii) linking the data for each country health expenditure through out-of-pocket payments per capita in international dollars at purchasing power parity.

The median  $N$  COVID-19 cases Interquartile range (IQR) per income category was 109 (52; 482), 768 (136; 4794) ( $p < 0.01$ ) and 3754 (843; 15,834) ( $p < 0.01$ ) in the respective order from low- to high-middle-income. When it comes to reported median  $N$  death (IQR), it was 3 (0, 16), 16 (2,137) ( $p < 0.01$ ) and 89 (10, 580) ( $p < 0.01$ ) in the same respective order as mentioned earlier. The median incidence rate per 100,000 (IQR) was 0.02 (0.1; 0.7), 0.14 (0.04; 0.48) ( $p < 0.01$ ) and 1.25 (0.51; 2.23) ( $p < 0.01$ ) in the order of low- to high-income countries.

In the linear regression analysis, adjusted for the Gini index and GDP income category, we found a positive association between out-of-pocket expenditure and mortality ( $r = 4.6$ ,  $p = 0.04$ ) (Figure 1). With GDP income categories, the direction of the data



Figure 1 | Case fatality rate for patients infected with COVID-19 per country in relation to out-of-pocket expenditure.

was positive for middle- and high-income countries, although there was a statistically significant relationship between out-of-pocket expenditure and mortality only in middle-income countries ( $p = 0.01$ ). The median out-of-pocket expenditure was 37.7 (15.1; 50.6), 206.6 (99.9; 327.5) and 692.1 (470.3; 860.7) in low-, middle- and high-income countries.

The positive association of COVID-19 mortality with out-of-pocket expenditure underscores the challenges of COVID-19 mitigation in resource-limited countries. As with other infectious diseases (e.g. HIV, malaria, Tuberculosis), the COVID-19 is a disease of social inequalities as it exposes the growing gap between the rich and the rest more profoundly than any previous crisis. There is an urgent need for the international community to tackle these inequalities which pose an existential threat to millions of people. Country-specific measures which adopt inter-disciplinary approaches to address social, economic and health inequalities should be prioritized.

## CONFLICTS OF INTEREST

The authors declare they have no conflicts of interest.

## AUTHORS' CONTRIBUTION

ZEK and SY led the writing on this commentary and wrote the first draft. AO and UN supported manuscript revisions. All authors contributed to the outline, content and critical revision of the commentary.

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