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Social inequalities and the COVID-19 pandemic

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Abstract

Social inequality has been identified as an important determinant of the outcome of infectious diseases and the recent SARS-CoV-2 pandemic has vividly reminded us that there are no “equal opportunity infectors”. In a recent article, Chakrabarty et al. (2023) reported the finding of a cross-country comparison of COVID-19 cases and social deprivation, using up-to-date statistical modelling. These results add to the extensive evidence showing that vulnerable populations are consistently at higher risk of contracting the infection and to suffer from more severe symptoms, whatever the spatial scale used (from the country to the neighborhood). Spatial clustering of socially deprived groups, preexisting pathologies and hotspots of COVID-19 cases and deaths indicate that the SARS-CoV-2 should be seen as a syndemic, where both the infection dynamics and the outcome of the disease strongly depend on the three-way interaction between the virus, preexisting pathologies, and the socioeconomic environment.

During the last decades, the rate of emergence of infectious diseases from zoonotic reservoirs has steadily increased (Jones et al. 2008). The reasons explaining why there are more emergence events now than 50 years ago are manifold and include both better monitoring and diagnostic, and unprecedented human-driven environmental changes.

Outbreaks of zoonotic infectious diseases can be particularly devastating on human populations that have not been previously exposed to the pathogen, since the infectious agent can rapidly spread across populations of fully susceptible individuals. If the pathogen is transmitted via respiratory droplets and aerosol, the common belief states that it will homogeneously spread through the susceptible population due to its ease to transmit among hosts. In this sense, by transmitting irrespectively of specific attributes of individuals in a given population, airborne diseases were considered as equal opportunity infectors, “striking the rich and the poor” (Mein 2020; Zelner et al. 2022), in contrast with other infectious diseases that tend to cluster within specific communities due to their transmission route (e.g., HIV and other sexually transmitted diseases). In other words, while some pathogens were easily recognized as agents of diseases with a strong social component, others were considered as socially neutral (Bambra et al. 2020).

We know now that this simplistic view is wrong. Even for airborne diseases within fully susceptible populations (populations that lack previous exposure to the pathogen), pathogens do not spread homogenously among individuals and the associated morbidity and mortality are not randomly distributed. The emergence and spread of the SARS-CoV-2 has powerfully reminded us the importance of within-population heterogeneity as a driver of both the infection dynamics and the morbidity/mortality. Individuals within a population can of course differ due to intrinsic causes, such as biological age. However, other sources of variation are inherently associated to the structure and functioning of human societies, depicting, broadly speaking, socio-economic inequalities.

As mentioned above, it has been repeatedly suggested that airborne infectious diseases blindly strike irrespectively of the socioeconomic conditions, but a careful analysis of the major epidemics occurred during the 20th century clearly shows that social inequalities are important

determinants of differential susceptibility to the infection. For instance, there is extensive evidence showing that the Spanish flu did not similarly hit wealthy and poor countries (Murray et al. 2006; Bambra et al. 2020), and within countries, lower socioeconomic groups appeared to suffer from higher mortality rates (Grantz et al. 2016; Bambra et al. 2020). More recent flu pandemics revealed the same pattern. A systematic review on health disparities during the 2009 H1N1 flu pandemic showed that inequalities in social conditions increased the exposure and risk of infection for low socioeconomic status populations (Kondo et al. 2022).

Although the history of human infectious diseases should have warned us about the vulnerability of people with low socioeconomic status, the COVID-19 pandemic has once again revealed to what extent social liabilities determine the outcome of the infection.

In a recent article, Chakrabarty et al. (2023) conducted a cross-country analysis with the aim of investigating the link between relative deprivation and inequality and the daily spread of COVID-19 during the January 2020 – April 2021 period. Their modelling approach showed that two time-invariant parameters (the Gini coefficient of disposable income and the per capita GDP) were consistently associated with the number of new cases, after controlling for time-variant parameters (e.g., Google mobility statistics), with countries having the largest inequalities in post-tax income having the worst outcome in terms of new cases.

The findings of this ecological study add up to many others that have been published during the last couple of years. Overall, the existing literature reports a remarkable consistent pattern, whatever the geographical scale upon which the analysis has been conducted. For instance, another cross-country study compared COVID-19 related mortality across 84 countries and found that economically unequal societies (with large disparities in income among individuals) had the highest COVID-19 deaths (Elgar et al. 2020). Positive cross-country correlation between Gini coefficient for income and COVID-19 cases and deaths was also reported by Davies (2021).

Comparisons at the regional level (within a country) have provided similar results. In England, the most deprived areas suffered from the highest COVID-19 related mortality. In addition to this, a

regional pattern also emerged where the most deprived areas in the North of England had higher mortality than similarly deprived areas in the rest of the country (Munford et al. 2022).

At smaller geographical scales, Islam et al. (2021) conducted a comparison of COVID-19 fatalities during the early phase of the pandemic across 3141 US counties. They found that social vulnerability (that includes metrics related to socioeconomic status, household composition, ethnic minority, etc.) was associated with higher COVID-19 cases and fatalities. In particular, there was a two-fold difference in COVID-19 cases and deaths between counties with the most and least vulnerable populations.

A scoping review of the correlation between social inequalities and COVID-19 outcomes confirmed the consistency of the effect size across very different geographical scales (from the neighborhood to the region) (McGowan and Bambra 2022). Among the 95 papers included in the review, 91% reported higher rates of COVID-19 mortality in areas with high levels of social deprivation.

A full understanding of the social determinants of susceptibility to infection also requires taking into account how populations in different socioeconomic conditions behave during the different stages of the pandemic. This important point is particularly well illustrated by the analysis of cases and deaths in US counties over time (Clouston et al. 2021). Counties with higher socioeconomic status had an earlier onset of COVID-19 cases and higher initial incidence compared to counties with lower socioeconomic status. However, the trend inverted with time, and as soon as social distancing policies were implemented, lower socioeconomic status counties had the higher incidence and mortality. The earlier onset of cases in high socioeconomic status counties might be due to the higher connectivity of affluent areas where people travel more for both work and leisure and were more likely to import the virus. However, as warnings were raised on the sanitary risks of the SARS-CoV-2 and public health actions taken to mitigate these risks, socially vulnerable populations become more exposed.

In the light of these results, the reported positive correlation between GDP and number of cases and deaths during the first wave of the pandemic might seem paradoxical (Sorci et al. 2020; Chakrabarty et al. 2023). Indeed, rich countries were supposed to have the capacity, as well as the authority, to deal with the epidemic better than countries with weaker institutions. There are several explanations for this finding. First, Europe and North America were stroke by the virus earlier than southern countries, possibly due to their higher connectivity. Second, health-aggravating factors are not equally distributed among countries. For instance, median age varies tremendously between wealthier and poorer countries. Actually, a further analysis, which took into account a series of potential confounding effects, provided evidence supporting the idea that states with effective institutions faced the pandemic in a better way than countries with weaker institutions (Gisselquist and Vaccaro 2022).

Another important observation is that socioeconomic factors correlate with disease outcome even in supposedly less vulnerable populations. Vicetti Miguel et al. (2022) analyzed the outcome of COVID-19 pediatric infections in the USA and found that children of ethnic minorities were overrepresented among the hospitalized cases and deaths. Social vulnerability has also been associated with increased likelihood to suffer from multisystemic inflammatory syndrome in children (Javalkar et al. 2021). In another study, Gonzalez et al. (2022) assessed the socioeconomic predictors of severe complication in low-risk patients hospitalized with COVID-19. For this purpose, they used the records of 963 adult patients with COVID-19 from three New York hospitals, considered at low risk due to the absence of preexisting comorbidities. They found that among patients over 55 years, limited English proficiency and having a public insurance (compared to a commercial insurance) predicted life-threatening complications.

Why do socioeconomic inequalities correlate with health inequalities? During the COVID-19 pandemic, people with low socioeconomic status were both likely to be more exposed to the virus and to suffer from more severe symptoms. Increased exposure has multiple reasons. People occupying essential works during the pandemic could not benefit from the stay at home policy

implemented by many governments and therefore were more likely to contract the infection. Essential workers belonged, in many cases, to minorities with low socioeconomic status. Crowded multigenerational housing conditions also make people in low socioeconomic status to be more exposed to the infection.

There is also extensive evidence suggesting that people in vulnerable socioeconomic categories were more likely to suffer from severe symptoms and succumb to the infection. This finding is consistent with the idea of COVID-19 being a syndemic, where the interactions between the virus and preexisting pathologies, exacerbated by specific environmental conditions determine the outcome of the infection (Singer et al. 2017). Spatial analyses have shown that areas with high prevalence of certain pathologies (respiratory diseases, certain cancers, cardiovascular diseases, obesity) are also the areas where the mortality rate due to COVID-19 was particularly high (Mollalo et al. 2021, Arena et al. 2022). Unhealthy lifestyle is one of the drivers of chronic diseases that exacerbate the risk of severe COVID-19 symptoms and mortality. In the USA, there is a geographic overlap between metrics related to lifestyle behaviors (including physical inactivity, smoking and dietary habits), poverty and social inequalities, and COVID-19 cases and deaths (Arena et al. 2022; Arena et al. 2023). Socially deprived people are also those who suffer the more from preexisting comorbidities. Therefore the social determinants of health exacerbated the morbidity and mortality caused by SARS-CoV-2 due to the synergistic effects between the virus and other pathologies. Other socially mediated reasons also contribute to explain why mortality was exacerbated in minorities and economically deprived individuals, including access to health care.

A systematic review of the effect of racial/ethnic and socioeconomic disparities concluded that groups from low socioeconomic status were consistently more vulnerable to COVID-19, whatever the outcome considered (infection, hospitalization, death) (Khanijahani et al. 2021). The studies included in this systematic review identified several underlying factors possibly accounting for the increased vulnerability of low socioeconomic status populations (e.g., poor and overcrowded housing conditions, low household income). However, among the 52 articles included in the review, a

few studies reported opposite results (positive correlation between income and infection or death). This discrepancy might be due to different factors, including the epidemic stage at which the data have been collected.

Socioeconomic condition refers to a broad category and the actual causal link between social factors and disease involve a multiplicity of factors. With this respect, the extant literature is based on a diversity of metrics and indices, and we still lack a fine-graded mechanistical understanding of the causal relationship between social factors and disease outcome. The idea that socioeconomic status is not neutral during a pandemic is far from being novel, as 19th century physicians already recognized that infectious diseases hit more socially vulnerable classes (Coleman 1982). Despite this previous knowledge, the importance of the interaction between social factors and other pathologies as determinants of the outcome of SARS-CoV-2 infection has not been properly appraised. This is regrettable for several reasons. Considering the COVID-19 as a syndemic instead of a pandemic would have emphasized the importance of the social determinants and the preexisting morbidities afflicting more deprived populations, and bridge the gap between the biological and social determinants of disease (Kelly 2021). It should also be noted that the three-way interaction between infectious diseases, preexisting pathologies and the socioeconomic environment (that defines a syndemic) has been barely taken into account in epidemiological models (Zelner et al. 2022). More generally, predictive models have largely neglected the heterogeneity that exists among populations, depending on the social environment *sensu lato*. A better consideration of the importance of socioeconomic determinants of infection dynamics and disease output, during the early stage of the COVID-19 pandemic, might have improved the mortality burden by focusing on the most vulnerable populations. Holistic public health actions should therefore aim at reducing social disparities as a preventive, non-pharmaceutical, strategy to face the next pandemic.

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Conflict of interest

None to declare

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