

# Paradoxical Influence of Hygiene over COVID-19 Death Rate

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## ABSTRACT

In the recent times, COVID-19 pandemic had emerged as the most lethal of all infectious diseases and had affected globally, especially the developed nations. In such scenario, it is indispensable to understand the most compelling factor contributing towards higher mortality. Paradoxically, better sanitation leads to poor “immune training” and this Hygiene hypothesis postulates that exposure to pathogens early in life gives protection from allergic diseases later in life. Moreover, improvement in hygiene practices such as better sanitation, availability of safe drinking water, hand washing facilities etc. causes reduction in the impact of communicable diseases. On the contrary, such a reduction to the exposure to infectious agents might have a close relationship with higher prevalence of autoimmune disorders. Among all the contributory factors that lead to non-communicable diseases, autoimmunity is the most important one. Severe autoimmune reaction is one of the primary manifestations of COVID-19 occurring in the later phase of pathogenesis of the disease. There is a great paradoxical influence of poor hygiene and sanitation over reduction in COVID-19 death rate.

**Key words:** COVID-19 pandemic, immune training, Hygiene hypothesis.

## BACKGROUND

In the recent times, COVID-19 pandemic had emerged as the most lethal of all infectious diseases and had affected globally, especially the developed nations. In such scenario, it is indispensable to understand the most compelling factor contributing towards higher mortality.

In this modern world, the rapid increment in *Gross domestic product* (GDP) and improved Human Development Index (HDI) has led to improved sanitation and consequently reduction in the burden of communicable disease globally, especially among developed countries. [1] Appealingly, disease burden of non-communicable diseases now occupies areas of prime concern in the developed nations having higher HDI, whereas these are of lesser significance in the low and low-middle income nations. Thus, a distinct dichotomous association between HDI status of a nation, and the prevalence of specific diseases has emerged in the recent times. [2]

Near about 50% of the world’s total population lives in low and low middle income countries. [3] Accessibility to healthcare facilities, hygiene and sanitation is poorer in these countries and is often believed to be the key factor of higher

incidence of communicable diseases in these countries. Thus, it is not unexpected if infectious disease pandemics, such as that due to SARS-CoV-2, have calamitous consequences in the low and low-middle income countries. Yet on the contrary, the disease prevalence and the Case Fatality Ratio (CFR) during the COVID-19 pandemic shows a contrasting dichotomous trend in the low and low-middle income countries when compared to that of the high income countries. It is quite fascinating to explore the reasons behind the higher prevalence and deaths due to COVID-19 among richer nations.

There is a notable relationship between severity of COVID-19 outcome and several noncommunicable disorders such as diabetes mellitus, hypertension, cardiovascular diseases etc. [4-6] However, the burden of non-communicable disease of a country like India and its apparent relation to CFR due to COVID-19 is yet to be explored in detail. Since a large number of populations suffering from non-communicable disorders such as diabetes mellitus, hypertension, cardiovascular diseases etc disorders lives in the high HDI countries, hence these co-morbidities with diabetes, hypertension, cardiovascular disorders and respiratory disorders have now emerged as important key factors or determinants of CFR due to COVID-19 in these countries. Similarly, another important risk factor is age of 65 years and above [7], as the percentage of such people being significantly more in the higher HDI nations. [8] Thus, co-morbidities with non-communicable diseases and the fraction of people living above the age of 65, being predominant in the high-income countries, give enough plausible reasons for the perplexing observation of CFR dichotomy among nations worldwide.

Among all the contributory factors that lead to non-communicable diseases, autoimmunity is the most important one. Interestingly, a close relation between autoimmune disorders and HDI has already been proposed in the recent times. [9] Since,

severe autoimmune reaction is one of the primary manifestations of COVID-19 occurring in the later phase of pathogenesis of the disease [10], susceptibility to autoimmunity in COVID-19 infection is a possibility to be considered. One of the reasons of being a rising trend in prevalence of autoimmune disorders in the western countries has been proposed to be that related to the “hygiene hypothesis”. [11] Paradoxically, better sanitation leads to poor “immune training” and this hypothesis postulates that exposure to pathogens early in life gives protection from allergic diseases later in life. Moreover, improvement in hygiene practices such as better sanitation, availability of safe drinking water, hand washing facilities etc. causes reduction in the impact of communicable diseases. On the contrary, such a reduction to the exposure to infectious agents might have a close relationship with higher prevalence of autoimmune disorders. [12]

## DISCUSSION

About one-third of the Indian population lives under poor hygienic conditions with poor sanitation and low quality water. [13] This might seem ludicrous to someone, but this is a basic concept of Darwinian Natural Selection Theory, which proposes the idea of evolution of a species according to its surroundings and other biological factors, as most of the Indian population is living under these conditions for several decades. It has now been proved that changes in the surroundings may cause epigenetic changes that alter the gene properties or make dormant genes active, resulting in the potential to influence signal transduction or immune responsive circuits against the possible viral threats. [14] Corona virus enters gastrointestinal epithelial cells, and the faeces of COVID-19 patients are potentially infectious, which proves that unsanitary conditions may act as a catalyst in the transmission of the same. [15] Hence, owing to the environmental effect, Indian population has developed a relatively

stronger immunity under these unfavorable conditions over a longer period that is not in majority of the developed countries like USA, UK, Italy and Spain as these nations focus better on their healthcare sectors and hygienic surroundings.

## CONCLUSION

All in all, there is a great paradoxical influence of poor hygiene and sanitation over reduction in COVID-19 death rate.

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