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LETTER TO THE EDITOR

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# Why obesity, hypertension, diabetes, and ethnicities are common risk factors for COVID-19 and H1N1 influenza infections

To the Editor,

Obesity, hypertension, diabetes, and specific ethnicities (Black and Hispanic) have been reported to be common comorbidities and possible risk factors for the severity of both coronavirus disease 2019 (COVID-19) and H1N1 influenza infections.[1,2] Thus, it is important to understand why these four risk factors are common to both COVID-19 and H1N1 influenza infections, and whether a common mechanism exists.

Respiratory failure is the most important pathology that contributes to the severity of both COVID-19 and H1N1 influenza infections. Patients with obesity show a restrictive breathing pattern and reduced lung volumes. In severe cases, this obesity-hypoventilation syndrome can lead to respiratory failure. Additionally, obesity has been reported to be a risk factor for the development of acute respiratory distress syndrome (ARDS),[3] which is a serious clinical manifestation of both COVID-19 and H1N1 infections. Among patients admitted for ARDS, the $PaO_2$-to-$FiO_2$ ratio has been found to significantly increase in the prone position in patients with obesity compared with patients without obesity.[4] Critical care clinicians treating patients with COVID-19 have reported that patients with ARDS appear to respond well to invasive ventilation in the prone position, and hence, prone ventilation has been recommended by the international guidelines for the management of COVID-19.[5]

Although patients with obesity have a higher risk of developing ARDS, they appear to have lower mortality rates compared to patients without obesity.[6] Obesity is associated with lower mortality in patients with sepsis,[7] the most common cause of ARDS, and also with lower mortality in patients with community-acquired bacterial pneumonia.[8] These phenomena are examples of the "obesity paradox" and may reflect stronger immunity in patients with obesity [9] since bacterial infections are the most common causes of sepsis and community-acquired pneumonia. Heightened immune responses, however, could be harmful to patients with COVID-19 because of excessive cytokine production, known as the cytokine storm, which can contribute to ARDS or multiorgan dysfunction in some infected individuals. Therefore, the obesity paradox might not apply to COVID-19 infections.

Obesity is a risk factor for hypertension, but importantly, no published study has presented a convincing mechanism explaining how hypertension could contribute to the severity of COVID-19 and H1N1 infections. Most of the previous studies showing hypertension as a risk factor for the severity of COVID-19 and H1N1 infections were either not based on multiple logistic regression analyses or did not include obesity or body mass index (BMI) as an explanatory variable in their multiple logistic regression models. Additionally, it is important to mention that the accuracy of the patient height and weight measurements is unreliable in emergency and critical care admissions, where preadmission measurements are not taken. Therefore, there might be a statistical artifact resulting from the confounding influence of the association between hypertension and obesity.

Moreover, similar attention is needed when specifying patients with diabetes or of specific ethnicities (Black and Hispanic) as potentially more vulnerable to either infection, because obesity also correlates with diabetes, and is more prevalent in these ethnicities.[1] Similarly, attention is needed when dealing with COVID-19 death rates as a result of people belonging to different ethnicities and the obesity rates in each country. Notably, a retrospective cohort study has shown that obesity or high BMI are predictive risk factors for severe COVID-19 outcomes, independent of age, diabetes, and hypertension.[3]

Taking all the above-mentioned points into consideration, it can be concluded that associations between hypertension, diabetes, ethnicities, and severity of COVID-19 and H1N1 infections may be confounded by obesity to a considerable extent.

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## CONFLICT OF INTEREST

The author declare that there is no conflict of interest.

## AUTHOR CONTRIBUTIONS

DM contributed to the conception or design of the work; the acquisition, analysis, and interpretation of data; and the drafting and revision of the manuscript. DM approved the current version of the manuscript and agree to be accountable for all aspects of the work.

  

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## REFERENCES

1. Dietz W, Santos-Burgoa C. Obesity and its implications for COVID-19 mortality. *Obesity*. 2020;28:1005-1005.
2. Schoen K, Horvat N, Guerreiro NF, de Castro I, de Giassi KS. Spectrum of clinical and radiographic findings in patients with diagnosis of H1N1 and correlation with clinical severity. *BMC Infect Dis*. 2019; 19(1):964.
3. Simonnet A, Chetboun M, Poissy J, et al. High prevalence of obesity in severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) requiring invasive mechanical ventilation. *Obesity*. 2020;28: 1195-1199. https://doi.org/10.1002/oby.22831
4. De Jong A, Molinari N, Sebbane M, et al. Feasibility and effectiveness of prone position in morbidly obese patients with ARDS: a case-control clinical study. *Chest*. 2013;143:1554-1561.
5. Alhazzani W, Møller MH, Arabi YM, et al. Surviving sepsis campaign: guidelines on the management of critically ill adults with coronavirus disease 2019 (COVID-19). *Intensive Care Med*. 2020;46:854-887.
6. Zhi G, Xin W, Ying W, Guohong X, Shuying L. "Obesity Paradox" in acute respiratory distress syndrome: asystematic review and meta-analysis. *PLoS One*. 2016;11(9):e0163677.
7. Arabi YM, Dara SI, Tamim HM, et al. Clinical characteristics, sepsis interventions, and outcomes in the obese patients with septic shock: an international multicenter cohort study. *Crit Care*. 2013;17:R72.
8. Corrales-Medina VF, Valayam J, Serpa JA, Rueda AM, Musher DM. The obesity paradox in community-acquired bacterial pneumonia. *Int J Infect Dis*. 2011;15:e54-e57.
9. Ilavská S, Horváthová M, Szabová M, et al. Association between the human immune response and body mass index. *Human Immunol*. 2012; 73:480-485.