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## REPLY



We thank Drs Lagrew and Shields for their interest and inquiry. We apologize that not all the appropriate references were included in our manuscript. There are a number of different publications that have demonstrated aerosolization with cough, and many are summarized in a recent commentary by Brosseau.<sup>1</sup> We have listed some key references below, which identify aerosolization in cough.<sup>2–7</sup> In addition, it is important to consider that aerosolization in the setting of disease transmission is not equivalent across all diseases, but that does not mean it is nonexistent. For example, in tuberculosis (TB), the classic example of a disease with the risk of airborne transmission, the bacteria remain viable in the air for a long time. Increasing number of studies on animals and humans have reported on the role of close-range aerosol transmission by inhalation for influenza and coronaviruses.<sup>8–10</sup> Although airborne aerosolization risk of influenza and coronaviruses is not similar to that of TB, the risk of airborne spread remains, especially when considering prolonged close-range contact, as in the second stage of labor.

Our study also discusses the issue of limited resources and the actions the healthcare system must take in dealing with patients in the second stage of labor. Things to consider include ability to test patients for severe acute respiratory syndrome coronavirus 2. With recent advances, there is now rapid testing available that would allow for testing of all admissions to labor and delivery. This allows healthcare workers to reserve the use of limited personal protective equipment (PPE) for the confirmed cases of coronavirus disease 2019 (COVID-19). The test also reassures other laboring patients that they are COVID-19 negative. All forms of PPE are risk reducing but not risk eliminating. We present what best practices should be and recognize that best practices may not always be possible, especially in the real world where resources are limited. However, we strive to advocate, and to provide data to support, policies that will promote not only patient safety but also a safe work environment for healthcare providers.

The second stage of labor presents a unique clinical scenario of close contact (<6 feet), involving deep and heavy breathing of a patient. Despite both healthcare workers and patients wearing masks, there can be scenarios allowing the possibility of droplet and aerosol transmission, for example, close contact with a patient who has trouble keeping the mask on.<sup>3</sup> In the setting of a pandemic, it is important to consider that PPE and healthcare workers are limited resources. Knowing this, we continue to advocate for the consideration of the second stage of labor as a high-risk scenario for both droplet and aerosol transmission and advocate that the healthcare workers should be adequately protected.<sup>11–14</sup> ■

Rupsa C. Boelig, MD, MS  
Federica Bellussi, MD  
Vincenzo Berghella, MD

Division of Maternal-Fetal Medicine  
Department of Obstetrics and Gynecology  
Thomas Jefferson University  
Philadelphia, PA 19107  
[vincenzo.berghella@jefferson.edu](mailto:vincenzo.berghella@jefferson.edu)

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## REFERENCES

1. Brosseau L. Commentary: COVID-19 transmission messages should hinge on science. Center for Infectious Disease Research and Policy. 2020. Available at: <http://www.cidrap.umn.edu/news-perspective/2020/03/commentary-covid-19-transmission-messages-should-hinge-science>. Accessed April 9, 2020.
2. Yang S, Lee GW, Chen CM, Wu CC, Yu KP. The size and concentration of droplets generated by coughing in human subjects. *J Aerosol Med* 2007;20:484–94.
3. Milton DK, Fabian MP, Cowling BJ, Grantham ML, McDevitt JJ. Influenza virus aerosols in human exhaled breath: particle size, culturability, and effect of surgical masks. *PLoS Pathog* 2013;9:e1003205.
4. Lindsley WG, Pearce TA, Hudnall JB, et al. Quantity and size distribution of cough-generated aerosol particles produced by influenza patients during and after illness. *J Occup Environ Hyg* 2012;9:443–9.
5. Lindsley WG, Blachere FM, Thewlis RE, et al. Measurements of airborne influenza virus in aerosol particles from human coughs. *PLoS One* 2010;5:e15100.
6. Noti JD, Lindsley WG, Blachere FM, et al. Detection of infectious influenza virus in cough aerosols generated in a simulated patient examination room. *Clin Infect Dis* 2012;54:1569–77.
7. Blachere FM, Lindsley WG, Pearce TA, et al. Measurement of airborne influenza virus in a hospital emergency department. *Clin Infect Dis* 2009;48:438–40.
8. Tellier R, Li Y, Cowling BJ, Tang JW. Recognition of aerosol transmission of infectious agents: a commentary. *BMC Infect Dis* 2019;19:101.
9. Cowling BJ, Ip DK, Fang VJ, et al. Aerosol transmission is an important mode of influenza A virus spread. *Nat Commun* 2013;4:1935.
10. van Doremalen N, Bushmaker T, Morris D, et al. Aerosol and surface stability of HCoV-19 (SARS-CoV-2) compared to SARS-CoV-1. *medRxiv*. 2020. Available at: <https://www.medrxiv.org/content/10.1101/2020.03.09.20033217v2>. Accessed June 29, 2020.
11. Berghella V. Now! protection for obstetrical providers and patients. *Am J Obstet Gynecol MFM* 2020;2:100109.
12. Breslin N, Baptiste C, Miller R, et al. Coronavirus disease 2019 in pregnancy: early lessons. *Am J Obstet Gynecol MFM* 2020;2:100111.
13. Breslin N, Baptiste C, Gyamfi-Bannerman C, et al. COVID-19 infection among asymptomatic and symptomatic pregnant women: two weeks of confirmed presentations to an affiliated pair of New York City hospitals. *Am J Obstet Gynecol MFM* 2020;2:100118.
14. Boelig RC, Manuck T, Oliver EA, et al. Labor and delivery guidance for COVID-19. *Am J Obstet Gynecol MFM* 2020;2:100110.

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