CORRESPONDENCE

Barrier Enclosure during Endotracheal Intubation

TO THE EDITOR: Clinicians with inadequate access to standard personal protective equipment (PPE) have been compelled to improvise protective barrier enclosures for use during endotracheal intubation. We describe one such barrier that is easily fabricated and may help protect clinicians during this procedure. The barrier studied was an "aerosol box,"[1] which consists of a transparent plastic cube designed to cover a patient's head and that incorporates two circular ports through which the clinician's hands are passed to perform the airway procedure. The dimensions of the box are provided in the Supplementary Appendix, available with the full text of this letter at NEJM.org.

In our simulation (see video), a laryngoscopist, attired in standard PPE, took position at the head of an airway mannequin. To approximate a forceful cough and generate a spread of droplets and aerosols, a small latex balloon containing 10 ml of fluorescent dye was placed in the hypopharynx of the mannequin. The balloon was inflated with compressed oxygen that was run through tubing inside the mannequin until the balloon burst; the explosion of the balloon represented a crude simulation of a cough. We repeated the experiment without and with the aerosol box, and after each simulation, we illuminated the scene with ultraviolet light to visualize the spreading of the dye.

With the use of PPE only, dye was found on the laryngoscopist's gown, gloves, face mask, eye shield, hair, neck, ears, and shoes (Fig. 1). Contamination of the floor occurred within approximately 1 m from the head of the bed and also on a monitor located more than 2 m away. When we repeated the experiment with the aerosol box, the simulated cough resulted in contamination of only the inner surface of the box and the laryngoscopist's gloves and gowned forearms. Examination of the laryngoscopist and the room with ultraviolet light showed no macroscopic contamination outside the box.

Our simulation method, although pragmatic, was not validated for the projectile direction, speed, or turbulence of a true cough, nor did it match the particle-size distribution. Droplets were overproduced as compared with aerosols. Our method of detection could not identify very small quantities of material that could be infectious. Nevertheless, we suggest that our ad hoc barrier enclosure provided a modicum of additional protection and could be considered to be an adjunct to standard PPE. A caveat: we found that the box restricted hand movement and would require training before use in the treatment of patients. Operators should be ready to abandon use of the box should airway management prove difficult.

Figure 1. Fluorescent Dye Expelled from a Simulated Patient Cough That Ended Up on the Laryngoscopist.

A video showing the simulation is available at NEJM.org

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1. Everington K. Taiwanese doctor invents device to protect US doctors against coronavirus. Taiwan News. March 23, 2020 (https://www.taiwannews.com.tw/en/news/3902435).

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