An Interim Solution to the Decreased Availability of Respirators Against COVID-19

To the Editor

We read the recent article titled, “Utility of Substandard Facemask Options for Health Care Workers during the COVID-19 Pandemic” by Abd-Elsayed and Karru1 with great interest. The authors do an excellent job capturing the issue of N95 respirator shortages due to a surge in Coronavirus Disease 2019 (COVID-19) cases and panic use by the public. However, the article emphasizes the importance of facial seal and fit in face masks but they do not provide a solution to this ongoing issue. We would like to shed light on a few more potential alternatives to the N95 that exhibit good facial seal and may be considered under dire circumstances.

Boston Children’s Hospital has conducted a pilot study on a do-it-yourself reusable respirator. The respirator is comprised of an anesthesia mask, inline ventilator filter, or high-efficiency particulate air (HEPA) filter and elastic straps (Figure A). It has minimal leakage around the mask’s edge (if appropriately sized), and breathability was shown to be similar to the N95 respirator but with N100 filtration efficiency (99.97% efficient in filtering viral and bacterial particles).2 This apparatus can be washed with soap and water or disinfectant when contaminated. The filter should be changed when visibly damaged or difficult to breathe through.2 Our first author applied the mask while simultaneously monitoring pulse oximetry and end-tidal CO₂ for 15 minutes. There was no decrease in oxygen saturation, and normal end-tidal CO₂ was observed. The mask was comfortable and easy to breathe through. Overall, the device was simple to construct and cost-effective.

Second, the authors mention that surgical masks are “suboptimal,” which is controversial and may not be true. A randomized control study showed that surgical masks offered comparable protection to N95s against viral respiratory infections in the clinical setting.3 Also, a case report from Singapore demonstrated 41 health care workers (HCWs) who came in contact with COVID-19 patients during aerosolizing procedures. The HCWs were subsequently tested negative for COVID-19. Eighty-five percent of the HCWs wore surgical masks and 15% wore N95s, showing that surgical masks combined with other recommended precautions were efficacious.4 However, we do agree that protection in these masks can be optimized with proper seal, as stated by the authors.1 To better conform a mask to the face, an organization called “Fix The Mask” designed a “surgical mask brace.” All that is needed are 3 rubber bands and a surgical mask. Rubber bands are looped together to create a chain. The mask is donned with the middle rubber band over the mask and the lateral rubber bands around the ears to create a better seal (Figure B).5 This is also a simple, cost-effective design and is now undergoing quantitative testing by the organization.

Alternatively, the authors of this letter used 2 tourniquets fashioned together instead of rubber bands to create a better seal (Figure C). Tourniquets are readily available in the hospital system. Tourniquets offer an advantage over rubber bands because they are wider, providing more surface area over the edges of the mask. After using this technique and performing a user seal
check, we noticed no evident air leakage around the mask margins during inhalation and exhalation. We would recommend that this be used with an American Society for Testing and Materials (ASTM) Level 3 surgical mask with eye protection and reserved for situations that do not involve aerosol-generating procedures.

In conclusion, there is no high-level evidence showing that either of these devices are safe at this time, and none are approved by the National Institute for Occupational Safety and Health (NIOSH) or the Food and Drug Administration (FDA). However, these strategies may be good alternatives during crisis capacity. Powered air-purifying respiratory hood systems, although expensive, can also be an alternative, especially when performing procedures with high aerosolization. Furthermore, it is important to remember that other personal protective equipment (PPE) must be used in addition to the respirator or facemask to protect against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), such as goggles, face shield, gown, and gloves. The user must also correctly don and doff the PPE and hand wash for at least 20 seconds to help prevent the spread of SARS-CoV-2. Solutions to the shortage of N95 respirators are crucial for protecting health care workers from contracting the virus and becoming a vector of transmission to others.

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