Sterilization of PPE for reuse is critical to national health security and a resilient economy

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Problem

Our nation is facing alarming shortages of personal protective equipment (PPE), particularly face masks. The U.S. government's national stockpile currently contains only 1.2% of the estimated 3.5 billion masks needed in a single year during an outbreak.[1] Meanwhile we lack policies and protocols that support sterilizing PPE for reuse. We lack a localized supply chain for manufacturing PPE, leaving us dependent on an uncertain global supply chain. Viral epidemics are becoming more common due to climate change.[2] Mitigating critical shortages now and preventing them in the future will ensure that healthcare workers and patients are protected during emergency situations. It is a matter of national health security to develop a sustainable supply of PPE for times of crisis.

Opportunities

Sterilization and reuse of existing, disposable PPE

Healthcare workers across the country have already started reusing single-use PPE out of necessity.[3] The CDC's new guidance[4] which loosened regulations on existing PPE usage resulted in a burst of published research in decontaminating single-use face masks, including leaving PPE for 72-hr cycles;[5] sterilization

[1] https://www.nytimes.com/2020/03/09/health/coronavirus-n95-face-masks.html
[2] https://link.springer.com/chapter/10.1007/978-1-4419-1017-2_45
[3] https://www.livescience.com/sanitizing-medical-masks-for-reuse-coronavirus.html
[4] https://www.aappublications.org/news/2020/03/11/coronavirus031120
[5] https://jamanetwork.com/journals/jama/fullarticle/2764031

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through vaporized hydrogen peroxide,[6,7,8] nano-filtration that can be washed in water,[9] or UV germicidal irradiation;[10] and machines that decontaminate 80,000 masks per day.[11]

Localizing supply chains & developing durable, reusable PPE

Currently the materials used to manufacture masks are sourced from all over the globe. These include thermoplastic elastomers for straps, steel for the staples, polypropylene for the filter, aluminum for the nose clips, polyurethane for the nose foam, polyester for the shell, and polyester for the coverweb.[12]

Creating a closed-loop economy around these materials means sourcing and manufacturing them locally and refurbishing them into new masks after use. This will increase the resiliency of the U.S. economy, creating localized jobs and protecting us from disruptions to the global supply chain due to the pandemic.[13] We limit environmental pollution and spur innovation to move away from finite resources to materials that are more reusable.

Sterilizing PPE in the U.S. creates additional domestic, permanent jobs and allows for direct oversight and universal regulation. Examples of local mask sterilization include elastomeric respirators which can be disinfected and reused.[14] Reusable isolation gowns can be laundered effectively and are widely available, especially in European settings.[15]

Recommendations

Rather than rely on an uncertain supply of PPE to arrive from China or become available from the current U.S. stockpile, sterilization and reuse of PPE is the solution to remediate the current shortage and prevent future shortages.

For the immediate term, we recommend that public health authorities and healthcare systems analyze the available research on reusing existing, single-use PPE through safe sterilization and develop shared, standard protocols.

For the longer term, we recommend the development of policies, protocols, funding sources, and a redesigned supply chain to enable durable PPE to be locally manufactured, sterilized, and reused.

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[6] https://www.medrxiv.org/content/10.1101/2020.03.24.20041087v1
[7] https://www.safety.duke.edu/sites/www.safety.duke.edu/files/N95%20Decontamination%20Procedure.pdf
[8] https://www.umass.edu/newsoffice/article/urgent-research-shows-face-masks-can-be
[9] https://www.hospimedica.com/critical-care/articles/294781387/reusable-face-mask-could-help-remedy-worldwide-shortage.html
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