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Workplace Personal Protective Equipment (PPE) and Supply Chain Issues for COVID-19

On February 29, 2020, Washington Governor Jay Inslee declared a state of emergency in response to the spread of the coronavirus (SARS-CoV-2) and first known death related to COVID-19 in the United States.[1] The Washington emergency declaration set off a cascade of similar restrictions, including stay-at-home orders, across the country as states began to battle the growing risks from coronavirus infection. As federal, state and local officials were coordinating COVID-19 risk mitigation responses, the CDC initially recommended only people showing COVID-19 symptoms, health care workers and first responders should wear masks.[2] However, in early April, the CDC changed course and recommended that everyone wear a face covering when out public due to the risk of asymptomatic spread.[3]

Although supplies for face coverings and other PPE were already dwindling by the time the CDC suggested that all people wear a covering in public, this shift in positioning solidified the growing strain on the PPE supply chain.[4] While supply chain issues have improved over the past few weeks, there are still many issues to consider when it comes to procuring and using PPE in the workplace. The purpose of this paper is to outline the current PPE and supply chain issues and discuss how workplaces can implement procedures and policies to help assess and fulfill their PPE needs.

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[1] https://www.governor.wa.gov/news-media/inslee-issues-covid-19-emergency-proclamation
[2] https://web.archive.org/web/20200331143006/https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html
[3] https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover.html
[4] https://www.nytimes.com/2020/03/19/health/coronavirus-masks-shortage.html

Availability of PPE

There are several reasons why the supply of face coverings and disposable gloves plummeted in the early stages of the coronavirus pandemic. One significant contributing factor was that nearly half of the world's masks were made in China prior to the coronavirus outbreak, which started months before it reached the United States. As part of its efforts to control the outbreak, China and other countries stopped exports of PPE (mainly surgical-style masks and N95 respirators) and effectively sold and distributed the PPE to its own citizens. Additionally, China received several donations of N95 masks from U.S. companies and others to help contain the spread within its borders.[5] In addition to mask exports being halted, the availability of source materials to create masks in other parts of the world was also heavily disrupted for similar reasons. For example, N95 masks typically use melt-blown plastic as a filter and nose clips which are mostly sourced from China.[6] As a result, global supply chain risk increased exponentially for many PPE manufacturers.

Material supply chains have also affected manufacturing of disposable rubber gloves. In Malaysia, the top producer of medical gloves had difficulty fulfilling packaging needs and was unable to procure enough shipping boxes to ship out the gloves they were still able to produce with half the workforce reporting to work.[7] Restrictions in production capacity like these spurred the FDA to ease guidelines on using expired gloves[8] and even reusing non-soiled gloves through washing and disinfecting procedures.[9] Additionally, NIOSH released extensive guidelines on reusing N95 masks that allowed organizations to preserve their PPE resources, particularly in health care settings.[10]

Coronavirus cases are still on the rise, overall, across the globe, but availability of critical PPE has increased compared to just a few months ago.[11] Companies like 3M and Honeywell increased domestic production of N95 masks in the U.S.,[12] and the CDC strongly encouraged U.S. citizens to wear cloth face coverings instead of medical or filtering masks in public,[13] which helped to decrease the lag in the supply chain. Additionally, the FDA released an Emergency Use Authorization allowing non-NIOSH approved respirators to be used with OSHA guidance as a last resort.[14] The federal government, through FEMA, also initiated "Project Air Bridge," which coordinated with health care distributors to arrange cargo flights from manufacturing sites back to the United States.[15] Although under criticism by some, "Project Air Bridge" did help lessen the transport time for PPE supply shipments.

Many NSC companies reported being able to source PPE materials from manufacturers in Central America and other places, especially before China started easing its export restrictions. Additionally, some NSC member companies resorted to 3D printing some of their own masks despite running into challenges with procuring the appropriate aforementioned filtering plastic.

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[5] https://www.nytimes.com/2020/03/13/business/masks-china-coronavirus.html
[6] https://www.bmj.com/content/369/bmj.m1910
[7] https://www.reuters.com/article/us-health-coronavirus-malaysia-packaging/virus-fight-at-risk-as-worlds-medical-glove-capital-struggles-with-lockdown-idUSKBN21C11W
[8] https://www.fda.gov/medical-devices/personal-protective-equipment-infection-control/medical-gloves-covid-19
[9] https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/gloves.html
[10] https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html
[11] https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200609-covid-19-sitrep-141.pdf?sfvrsn=72fa1b16_2
[12] https://www.massdevice.com/honeywell-3m-ramp-up-n95-face-masks-production/
[13] https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/about-face-coverings.html
[14] https://www.osha.gov/memos/2020-04-03/enforcement-guidance-respiratory-protection-and-n95-shortage-due-coronavirus
[15] https://www.fema.gov/news-release/2020/04/08/fema-covid-19-supply-chain-task-force-supply-chain-stabilization

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Despite these efforts, significant challenges remain regarding the availability of PPE for the near future. Businesses should consider:

- **Tracking PPE burn rates, expiration dates and usage metrics**. These steps will be critical for businesses as they learn to effectively and efficiently manage their PPE supply in preparation for potential future waves of the coronavirus pandemic.

- **Having intimate knowledge of PPE vendor networks**. Businesses must be fully aware of the credibility and compliance standards of their PPE vendor network to be able to make appropriate decisions about contracts and agreements for procuring PPE.

- **Investing in technology to supplement supply shortages**. Some necessary PPE, like facemasks and respirators, can be manufactured using 3D printing methods that manufacturers can then use to apply for NIOSH certification

Availability of cleaning supplies and disinfectants

Supply chain shortages that created procurement issues with PPE also affected the availability of cleaning supplies and disinfectants. As early as March of 2020, cleaning products were difficult to find in retail stores.Many companies were having trouble finding suppliers to enable appropriate procurement of cleaning supplies needed to keep operations running in accordance with CDC and WHO guidance.[16] Sales of disinfectants increased over 200% from the prior year and even multipurpose cleaner sales increased over 100%.[17] The significant increase in demand led to supply shortages coupled with production shortages of key ingredients (e.g., different types of alcohol) from manufacturers in China and other countries. The coronavirus outbreak in China halted production and exporting of these raw materials to disinfectant manufacturers in the U.S. in particular.[18]

Because of the increased demand for cleaning products and the increasing number of recommendations from federal, state and local agencies to ramp up cleaning and disinfecting of workplaces, the EPA expedited their process for approval for new suppliers/manufacturers of key ingredients for disinfectants and cleaners.[19]

Specifically, the EPA implemented a new policy no longer requiring disinfectant manufacturers to obtain approval before switching suppliers for inert, or not chemically reactive, ingredients for their products.[20] The EPA also allowed List N disinfectant manufacturers to temporarily switch suppliers for certain active ingredients (e.g., ethanol) without prior approval from the EPA.[21] Finally, the EPA also temporarily allowed registered disinfectant manufacturers to add additional registered active ingredients to a formulation and setup new manufacturing establishments without prior EPA approval.[22] Taken together, these adjustments to the typical EPA approval process has allowed disinfectant manufacturing to work around some of the original supply issues.

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[16] https://www.cdc.gov/coronavirus/2019-ncov/community/reopen-guidance.html

[17] https://www.cnn.com/2020/04/29/politics/lysol-wipes-back-in-stores-when-disinfectant-sprays/index.html

[18] https://www.usatoday.com/story/money/2020/04/09/coronavirus-clorox-lysol-shortages-walmart-costco-publix-winco-lowes/2961818001/

[19] https://www.epa.gov/coronavirus/disinfectant-use-and-coronavirus-covid-19

[20] https://www.epa.gov/newsreleases/epa-continues-efforts-help-increase-availability-disinfectant-products-use-against

[21] https://www.epa.gov/newsreleases/epa-takes-action-assure-availability-disinfectant-products-use-against-novel

[22] https://www.epa.gov/newsreleases/epa-continues-efforts-increase-availability-disinfectant-products-use-against-novel

Many of the large manufacturers of disinfectants (e.g., Clorox) are predicted to be back on track in terms of supply by the middle to the end of summer.[23] Although many of these companies have re-strategized their supply chain issues, the increase in coronavirus cases throughout much of the U.S. might tip the supplier scales again, creating a second wave of supply shortages in early fall. Therefore, businesses should consider:

- **Identifying alternative suppliers for cleaning and disinfecting products**. Businesses should look to manufacturers with diverse sourcing of raw materials to account for potential disruptions in production.

- **Determining what surfaces should be cleaned versus disinfected**. Some seldom touched surfaces may only need to be cleaned with soap and water, whereas high-touch surfaces should also be disinfected.

- **Developing alternatives for commercially available disinfectants**. If commercial disinfectants are in short supply, some "home remedies" can be effective at disinfecting surfaces (e.g., 70% alcohol solutions or bleach water).

Triaging PPE appropriateness and need

One of the biggest challenges early on in the pandemic was that many citizens felt compelled to accumulate PPE (e.g., surgical masks and gloves) even without thorough knowledge of the need for such equipment. Federal officials urged the public to only purchase what they needed and to especially save respirators, gloves and gowns for essential workers at very high risk for contracting the virus (i.e., health care workers).[24] Although the CDC and others have recently urged Americans to wear face coverings in public, the focus on educating the public on the difference between face coverings and PPE has helped to keep respirators and PPE available for workers who really need it.[25]

The best way for employers to address the need for employee PPE is to conduct a thorough hazard assessment specifically for COVID-19 risks.[26] According to OSHA, workers who are in the lower exposure risk category (e.g., workers who do not have frequent contact with the public and other coworkers) do not need additional PPE to perform their jobs beyond what is ordinarily required of them. Workers in the medium exposure risk category (e.g., workers with frequent and close contact with coworkers or the public in a community where the coronavirus is spreading) may need to wear some combinations of a face mask and/or shield, gloves and/or gown depending on the work task and specific hazard assessment. However, respirators for workers in this category are also unlikely to be needed. Finally, workers in the high or very high exposure risk categories (e.g., workers interacting closely with known sources of COVID-19) will likely need several forms of PPE (e.g., respirator, gloves, gown, etc.) to perform their job duties safely.[27]

Still the majority of workers are going to be best served by wearing cloth face coverings (e.g., when recommended physical distancing cannot be achieved), maintaining recommended physical distancing and practicing good hygiene when in the workplace. Even if a thorough hazard assessment indicates some sort of PPE should be worn by the worker, employers should focus more of their COVID-19 risk mitigation efforts on engineering (e.g., installing clear plastic barriers for proper physical distancing) and administrative controls (e.g., flexible work policies and arrangements to limit workplace exposure) rather than rely on PPE as a first line of defense.

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[23] https://www.businessinsider.com/when-lysol-clorox-wipes-back-in-stock-available-by-summer-2020-4
[24] https://www.cnn.com/2020/02/29/health/coronavirus-mask-hysteria-us-trnd/index.html
[25] https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/coronavirus-face-masks-what-you-need-to-know
[26] https://www.osha.gov/shpguidelines/hazard-prevention.html
[27] https://www.osha.gov/Publications/OSHA3990.pdf

Counterfeit and illicit PPE

A consequence of interruptions in the PPE supply chain related to the coronavirus pandemic was the emergence of several PPE products, particularly face respirators, claiming to be NIOSH-authorized PPE. By April, several examples of counterfeit respirators were being marketed and sold as NIOSH-approved causing the CDC and NIOSH to issue guidance on how to identify counterfeit PPE.[28]

Several manufacturers of non-filtering face masks were simply altering the labels on the mask or gluing on NIOSH branded markings to attempt to fool consumers. The seemingly legitimate branding on some masks coupled with the stock availability and cheaper price led many consumers and some companies to believe they were purchasing NIOSH-approved respirators. As part of their education efforts, NIOSH published several examples, including pictures, of counterfeit masks of which they were made aware and posted key indicators of counterfeit masks that employers can monitor. Indicators of potential counterfeit masks include the following:

- Lack of markings on respirator
- No approval number
- No NIOSH brand markings
- Any misspellings of NIOSH or other words on mask
- Ear loops instead of headbands
- Claims to be approved for children

For a brief period of time KN95 masks, which are similar to N95 masks but held to Chinese standards rather than NIOSH, were allowed as suitable substitutions when N95 masks were not available. However, after NIOSH testing of some KN95 masks found them to be inadequate, the FDA purged several manufacturers in China from their authorized imported, non-NIOSH approved respirators list and has been slowly adding companies back to the approved list as companies conduct more rigorous testing.[30]

As cases of coronavirus are increasing again in the U.S., it is possible that demand for PPE from businesses who have returned employees to work and the public will lead to another wave of supply shortages. Therefore, it is more important for employers to be vigilant when procuring PPE inventory and to be sure to check with regulators like the FDA and NIOSH before purchasing stock from new suppliers or alternative manufacturers.

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[28] https://www.cdc.gov/niosh/npptl/usernotices/counterfeitResp.html

[30] https://www.fda.gov/medical-devices/coronavirus-disease-2019-covid-19-emergency-use-authorizations-medical-devices/personal-protective-equipment-euas#appendixa

Maintaining vigilance with limitations of PPE for COVID-19

Although issues with PPE and supply chains are important to consider, employers should remainfocused on prioritizing a hierarchy of controls approach to reducing risks from COVID-19.[31] PPE is not a perfect solution for preventing the spread of coronavirus in the workplace. Indeed, it should be treated as the last line of defense.

Employers would be better served by addressing COVID-19 risks through administrative and engineering controls, if possible. For example, the single greatest control measure for reducing the risk of COVID-19 would be to keep employees from coming into close contact with others, which could be achieved through remote work arrangements, shift staggering and/or other potential engineering controls set up in a facility (e.g., desk and work area spacing). Additionally, there is research potentially suggesting that the coronavirus can become aerosolized and transmitted among people sharing air within an enclosed space, which would suggest that more focus should be placed on proper ventilation controls and other engineering efforts to help combat spread.[32]

Finally, the best way to reduce complications related to adequate PPE supply is to reduce the need to use it in the first place. Employers should carefully examine and optimize the use of PPE in the workplace and determine through thorough hazard assessment which employees need PPE. However, once employers determine that PPE is needed, then careful consideration of supply chain management is crucial to avoid supply shortages or potential illegitimate products.

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[31] https://apps.who.int/iris/bitstream/handle/10665/331498/WHO-2019-nCoV-IPCPPE_use-2020.2-eng.pdf?sequence=1&isAllowed=y
[32] https://www.nytimes.com/2020/07/07/health/coronavirus-aerosols-who.html

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