National Safety Council

Case Study

SAFER

Personal Protective Equipment (PPE) Challenges during the COVID-19 Pandemic and Recommendations for Future Pandemic Preparedness

Introduction

The COVID-19 pandemic highlighted critical gaps in workplace safety, particularly in the availability and use of personal protective equipment (PPE). This case study aims to describe the challenges employers face in securing and managing PPE during the pandemic across different industries. Insights gained from this analysis can help organizations, especially those with essential workers, improve safety protocols and enhance their readiness for future crises.

This report focuses on the experiences of employers and workers from a range of sectors, including healthcare, manufacturing, retail and public services. These industries were particularly affected by PPE shortages and compliance issues, but lessons learned are applicable across all sectors.

Challenges Faced by Employers during COVID-19

The pandemic revealed several challenges related to PPE that employers across industries had to address. These challenges spanned supply chain disruptions, cost inflation, quality issues and difficulty ensuring proper use. Understanding these obstacles is crucial for preparing for future health crises and enhancing workplace safety protocols.

Ensuring Business Continuity

The best way for employers to ensure business continuity in a future pandemic is to have reserves of PPE on hand to protect critical workers--especially reusable respirators like elastomeric respirators. Because elastomeric respirators last for years in storage and can often be used for months before filters need to be replaced, they can be a lower-cost and more environmentally friendly option than disposable N95s. Stocking this PPE in advance of a pandemic is the best way to avoid shortages and price spikes that are likely to occur again.

- Victoria Slaughter
Director, PPE at Blueprint Biosecurity

Global Shortages

At the height of the pandemic, there was an unprecedented global demand for PPE causing severe shortages. Supply chains, already strained by factory closures and transport restrictions, struggled to keep pace. Export bans and national hoarding further exacerbated the issue leaving many employers, especially in smaller businesses and non-healthcare sectors, without adequate supplies. Essential industries like healthcare faced acute shortages of critical items such as N95 respirators, gloves and face shields which put both workers and patients at greater risk.[1]

Cost Inflation of PPE Supplies

As PPE became scarce, prices skyrocketed. Employers had to contend with a surge in the cost of basic protective items. For smaller companies, this posed a significant financial burden. Organizations already operating on tight budgets struggled to afford the necessary PPE which sometimes resulted in unsafe working conditions or interruptions to operations. In some cases, employers had to make tough decisions about rationing PPE to stretch limited supplies which further increased risks.

Substandard Quality and Counterfeit PPE Issues

The scramble to meet PPE demands led to a proliferation of counterfeit or substandard products. Employers faced challenges in sourcing reliable, certified PPE, especially as new and untested suppliers entered the market.[2] Many organizations lacked the expertise to verify product quality and, without proper regulatory oversight, counterfeit PPE made its way into the hands of workers, often offering insufficient protection.[3] This problem was particularly prevalent with imported items which did not always meet national safety standards.

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[1] https://www.sciencedirect.com/science/article/pii/S0091743520302875
[2] https://pmc.ncbi.nlm.nih.gov/articles/PMC7499936/
[3] https://www.ajicjournal.org/article/S0196-6553(20)30283-2/fulltext

Distribution and Allocation Imbalances

PPE distribution during the pandemic was often uneven with certain industries and regions receiving priority over others.[4] While healthcare workers were rightfully prioritized, other essential sectors such as retail, manufacturing, public service and education were left competing for limited supplies. Rural and under-resourced areas were especially affected. Employers in these regions faced delayed shipments or received lower-quality PPE, further compromising the safety of their workers.

Changing PPE Guidelines

Throughout the pandemic, health organization such as the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) frequently updated their guidance on PPE use in response to evolving scientific understanding. Some employers struggled to keep pace with these changes which created confusion about compliance. For instance, recommendations about mask or respirator types, filtration standards, and the need for additional protective equipment were updated multiple times. This shifting of guidelines made it difficult for employers to plan, train and procure the appropriate PPE in a timely manner.

Training and Usage Issues

Beyond the availability of PPE, employers faced challenges in ensuring that workers were trained on how to properly use it. For many industries, particularly those without a history of PPE reliance (such as retail or education), the pandemic represented the first time workers were required to wear protective equipment regularly. Without adequate training, there were widespread issues of misuse such as improper use of respirators, failure to replace disposable PPE, or not using PPE at all due to discomfort. This improper use diminished the effectiveness of the protective measures.

Proactive Fit Testing and Training

During a pandemic, the available PPE choices can be limited and fit testing--which ensures that a respirator is adequately protective--is difficult to perform. Getting your employees fit tested and trained in advance will help to roll out PPE use in a crisis.

- Victoria Slaughter
Director, PPE at Blueprint Biosecurity

Environmental and Waste Management Concerns

The surge in PPE usage during the pandemic led to significant environmental concerns, particularly around waste management. Single-use items such as disposable surgical face coverings, gloves and gowns contributed to a substantial increase in non-biodegradable waste. Employers were faced with the challenge of balancing worker safety with sustainability. In many cases, they lacked the infrastructure to handle the safe disposal or recycling of PPE, which contributed to pollution and overwhelmed local waste systems.

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[4] https://crsreports.congress.gov/product/pdf/R/R46628

Reusable PPE: A Smart Investment for Pandemic Preparedness

Maintaining a cache of reusable respirators in advance of a pandemic--at least one per critical worker--is a great way to avoid many of the challenges that employers faced during the last pandemic. They are more cost-effective over time, tend to fit more people on the first try than disposable N95s, and produce substantially less waste.

- Victoria Slaughter
Director, PPE at Blueprint Biosecurity

Industry-specific PPE Challenges

The impact of the pandemic of PPE needs and availability varied across industries. Different sectors experienced unique challenges influenced by the nature of their work, proximity of workers (and/or proximity to the public) and their ability to access PPE.

Healthcare

The healthcare industry bore the brunt of the PPE crisis. Hospitals and clinics were flooded with COVID-19 patients in addition to typical patients they had to then also shield from infection. Very few employers in the industry had a surplus of PPE in stock at the beginning of the pandemic due in part to cost-efficient budgeting models used by most healthcare companies.[5,6] This meant that by late March of 2020 nearly a third of hospitals in the US had almost no available surgical masks or respirators, and 25% were completely or nearly out of gowns.[7]

Healthcare workers required specialized equipment such as N95 respirators, gowns, face shields and gloves to protect themselves from direct exposure to the virus. The sudden surge in demand led to severe shortages forcing many healthcare facilities to ration PPE. Frontline workers often had to reuse single-use items heightening the risk of infection.[8]

As government prioritized healthcare facilities for PPE distribution, imbalances still emerged. Smaller hospitals and those in rural areas often struggled to compete with larger institutions for supplies. This imbalance forced

[5] https://www.sciencedirect.com/science/article/pii/S0091743520302875#bb0015
[6] https://www.sciencedirect.com/science/article/abs/pii/S0278425499000265?via%3Dihub
[7] https://www.bmj.com/content/369/bmj.m1367
[8] https://www.nationalnursesunited.org/press/new-survey-results

many healthcare workers to work without proper protection leading to a higher rate of illness and death among frontline staff.[9]

Beyond physical safety risks, the lack of PPE contributed to significant stress and burnout. Many healthcare workers faced anxiety and fear knowing they were at higher risk of infection without adequate protective equipment. This further compounded the mental health strain of working in an already high-pressure pandemic environment.

Manufacturing and Industrial Sectors

Manufacturing and industrial sectors were also heavily affected as these workplaces required close contact between workers and often lacked remote work options.

Manufacturing facilities faced difficulties securing enough PPE for their workers particularly in the early months of the pandemic. With workers operating in confined spaces, the lack of PPE made it challenging to maintain safe production lines. Some factories had to shut down temporarily due to outbreaks causing supply chain disruptions across the economy.

Employers had to reconfigure production lines to allow for social distancing while also mandating the use of respirators or surgical masks and gloves. However, PPE shortages meant that companies were often unable to meet these new safety standards leading to heightened risk of viral transmission in factories and warehouses. Small and medium-sized manufacturers faced significant financial strain as they tried to meet both production demands and the need for PPE. Increased costs of PPE and loss of productivity due to sick workers further impacted their bottom line pushing some to close either temporarily or permanently.

Retail and Service Industries

Retail and service industries which maintained a direct interface with the public had unique challenges while balancing customer service and worker safety.

Retail workers were among the most exposed interacting with hundreds of customers daily. However, many retailers struggled to enforce consistent PPE usage among both staff and customers. There were frequent incidents of customers refusing to wear face coverings which created confrontations and put workers at risk. Some workers also found respirators or face coverings uncomfortable for long shifts leading to improper or inconsistent use.

During the early months of the pandemic, many retailers found it difficult to procure PPE as priority was given to healthcare and essential services. This left workers exposed, especially in groceries and pharmacies, where foot traffic remained high throughout the pandemic.

Many retail establishments encountered pushback from some customers against face covering requirements and other safety protocols. This could put workers in the difficult position of having to enforce safety rules while maintaining customer service. It has been found that these tensions added to the mental health burden on workers.

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[9] https://kffhealthnews.org/news/article/us-health-workers-deaths-covid-lost-on-the-frontline/

Public Service and Education

Public service and educational institutions faced significant PPE-related challenges particularly as sectors such as education transitioned back to in-person operations. Many public sector workers, such as police officers and postal workers, continued to work in-person throughout the pandemic. However, many agencies were slow to procure and distribute PPE leaving workers vulnerable. For example, police officers were often required to work in close proximity to the public without sufficient protective gear.

Schools faced challenges in adapting to the PPE needs of both staff and students. Teachers, custodial and support staff required PPE as schools reopened for in-person learning. Budget constraints in many school districts led to difficulties in ensuring that all staff had adequate protection. Furthermore, students, especially younger ones, found it challenging to comply with face covering rules making it difficult to maintain a safe environment.

Both public services and schools were forced to balance tight budgets with the need for PPE. Unlike private businesses, many public institutions were reliant on government funding which was not always distributed quickly enough to meet the needs of all workers. This led to gaps in PPE access particularly in underfunded or rural areas.

Recommendations for Future Pandemic Preparedness

Based on the challenges faced across industries during the COVID-19 pandemic and input from subject matter experts at Blueprint Biosecurity,[10] the following recommendations aim to strengthen future preparedness. These recommendations focus on ensuring PPE availability, effective distribution, quality control, training, design for better fit and comfort, and sustainability for effective pandemic response.

1. **Strengthening PPE supply chains:** To avoid future PPE shortages, governments and organizations should invest in building resilient, diversified supply chains that can withstand surges in demand.
    - Domestic and Local Manufacturing: Encouraging domestic production of essential PPE can reduce dependency on international supply chains. Governments can incentivize local manufacturers to produce PPE and create stockpiles for emergency use.
    - International Partnerships: Establishing agreements between countries for emergency PPE supplies can create a more reliable global supply network. Partnerships should ensure access to critical PPE for all essential sectors, especially during crisis periods.
    - Strategic Stockpiling: Stockpiling critical PPE can ensure that reserves are available during a pandemic. Stockpiles should be maintained at both national and regional levels with regular quality checks to avoid degradation over time.
2. **Establishing clear regulatory standards:** Uniform, clear regulatory standards are essential to prevent the distribution of counterfeit or substandard PPE and to simplify procurement during emergencies.

[10] For a comprehensive report of findings, see Blueprint Biosecurity's "Towards a Theory of Pandemic-Proof PPE"

- Uniform Certification and Quality Standards: Governments and international health organizations should adopt consistent PPE quality standards and certification processes to verify product efficacy. These standards should be globally recognized to ensure that all imported and domestically produced PPE meets safety requirements.
- Centralized Databases for Verified PPE: A centralized database of certified PPE suppliers can help employers verify product quality and avoid counterfeits. Such databases, managed by public health agencies, can guide organizations in procuring trusted PPE during future health emergencies.

3. **Financial assistance for small businesses:** Small and medium-sized businesses faced disproportionate financial challenges during COVID-19 struggling to afford PPE at inflated prices. Providing financial support can enable these businesses to protect employees without compromising their financial stability.
    - Government Subsidies or Grants for PPE: Governments should offer subsidies or grants to small businesses to support the purchase of PPE during emergencies. Funding could be provided based on business size and sector vulnerability.
    - Stabilizing PPE Prices During Crises: By establishing price controls or bulk-purchasing mechanisms during health emergencies, governments can prevent price inflation of PPE ensuring affordability for all businesses.
4. **Centralized PPE procurement and distribution:** A coordinated approach to PPE procurement and distribution can ensure access across regions and sectors.
    - Public-Private Partnerships for Efficient Distribution: Governments can collaborate with private organizations to create a streamlined distribution system allowing rapid PPE delivery to high-risk sectors. Priority access should be given to healthcare, essential services and high-contact industries.
    - Allocation Protocols: Distribution protocols should be designed to prevent shortages in rural or underserved areas. Allocation strategies can be based on industry risk level, geographical demand and reported PPE shortages.
5. **Continuous training on PPE usage:** Inconsistent and improper PPE use reduced its effectiveness during COVID-19. Ongoing training can help workers understand and comply with safety protocols.
    - Regular Training Programs for Workers: Employers should implement continuous, mandatory training on proper PPE usage. These programs can address common challenges such as respirator fit, replacement timing and hygiene, ensuring that employees feel comfortable and confident in using PPE.
    - User-Friendly PPE Guidelines for Employers: Health agencies should develop straightforward, up-to-date guidelines to assist employers in selecting the right PPE and instructing employees

on its proper use. Resources like video tutorials and visual posters can reinforce correct practices.

6. **Integrating PPE with broader workplace safety plans:** PPE should be part of a larger, integrated approach to workplace safety. Employers should develop comprehensive plans that address health and safety holistically.
    - Pandemic Preparedness Plans: Every organization should create a pandemic preparedness plan that includes guidelines on PPE, sanitation, social distancing and remote work arrangements. If regularly updated based on evolving health data, this plan can help companies respond quickly and adapt to emerging health threats.
    - PPE Alternatives and Hierarchy of Controls: In addition to PPE, employers should consider other safety measures such as engineering controls (e.g., ventilation) and administrative controls (e.g., staggering shifts). Using PPE as one part of a larger safety strategy reduces reliance on a single protective measure.
7. **Environmental sustainability in PPE use:** The environmental impact of disposable PPE was significant during COVID-19 leading to vast amounts of waste. Sustainable practices can mitigate these effects in future crises.
    - Promotion of Reusable PPE Options: Where possible, organizations should invest in reusable PPE options such as washable face coverings or gowns. Reusable items, when safe and appropriate, reduce waste and can be more cost-effective in the long term.
    - Development of PPE Recycling Programs: Government agencies and organizations can collaborate to establish PPE recycling and disposal programs. Specialized facilities for recycling PPE can help minimize environmental impact while ensuring safe waste management.
    - Encouraging Biodegradable PPE Materials: Promoting research and innovation in biodegradable PPE materials can support sustainability efforts. Biodegradable materials provide a practical solution for disposable items reducing the lasting environmental footprint of PPE waste.

These recommendations are designed to improve resilience and preparedness across industries addressing the challenges encountered during COVID-19 and helping organizations better protect their workers during future pandemics. By strengthening supply chains, implementing efficient distribution protocols, ensuring proper usage, and adopting sustainable practices, we can create a safer and more prepared workplace environment for any future health emergency.

Acknowledgements

We would like to thank Blueprint Biosecurity for their expertise and contributions to this case study.

Funding

This project was funded in whole by a cooperative agreement with the Centers for Disease Control and Prevention (CDC) grant number NU50CK000584. The CDC is an agency within the Department of Health and Human Services (HHS). The contents of this resource center do not necessarily represent the policy of the CDC or HHS and should not be considered an endorsement by the Federal Government.

Content

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References

Barniv, R., Danvers, K., & Healy, J. (2000). The impact of Medicare capital prospective payment regulation on hospital capital expenditures. Journal of Accounting and Public Policy, 19(1), 9–40. https://doi.org/10.1016/s0278-4254(99)00026-5

Cecire, M. H., et al. (2020). COVID-19 and domestic PPE production and distribution: Issues and policy options (CRS Report R46628). Congressional Research Service. https://crsreports.congress.gov

Cohen, J., & Van Der Meulen Rodgers, Y. (2020). Contributing factors to personal protective equipment shortages during the COVID-19 pandemic. Preventive Medicine, 141, 106263. https://doi.org/10.1016/j.ypmed.2020.106263

Kamerow, D. (2020). COVID-19: The crisis of personal protective equipment in the US. BMJ, 369, m1367. https://doi.org/10.1136/bmj.m1367

Lam, S. C., & et al. (2020). Global risk to the community and clinical setting: Flocking of fake masks and protective gears during the COVID-19 pandemic. American Journal of Infection Control, 48(8), 964–965. https://doi.org/10.1016/j.ajic.2020.05.017

National Nurses United. (2020). New survey of nurses provides frontline proof of widespread employer, government disregard for nurse and patient safety, mainly through lack of optimal PPE. https://www.nationalnursesunited.org/press/new-survey-results

Proffitt, E. (2020). The dangers of fake PPE. BDJ Team, 7(8), 20–21. https://doi.org/10.1038/s41407-020-0399-5

Spencer, J., & Jewett, C. (2021). 12 months of trauma: More than 3,600 US health workers died in Covid's first year. KFF Health News. https://kffhealthnews.org/news/article/us-health-workers-deaths-covid-lost-on-the-frontline/