Protective Modular Glass System for Healthcare Worker Protection

White Paper

R&D New Product Design Team

Last Publish Date: May 13, 2020

Purpose

The information contained in this report pertains to a new engineering control and personal protective equipment (PPE) product, which could rapidly be deployed, to mitigate front-line healthcare worker exposure to pathogens, including SARS-CoV-2 which causes the disease COVID-19. This whitepaper is designed to help healthcare decision makers, including clinicians, health system leaders and policymakers, to make informed decisions about options beyond conventional PPE that provide physical barriers and air filtration options to mitigate pathogen exposure. This product can provide alternatives in patient capacity planning for testing and increased patient throughput.

Background

Situational Analysis

- The pressure on the global healthcare workforce continues to intensify in this pandemic. This pressure takes 2 forms. (1) the potentially overwhelming burden of illnesses that stresses health system capacity, and (2) adverse effects on healthcare workers, including the risk of infection. (James G. Adams & Ron M. Walls, 2020)
- Evidence suggests that clinical workers are at much higher risk than the general population of being infected.
    - SARS-CoV first occurring in 2002: WHO documented healthcare workers made up a large proportion of cases; accounting for 37%–63% of suspected SARS cases in highly affected countries. (Park, et al., 2004)
    - MERS-CoV first occurring in 2012: healthcare workers constituted over one third of all secondary infections (Elkholy, et al., 2019)
    - SARS-CoV-2 first occurring in 2019:
        - February 26, the CDC reported that 222 of the 445 in the United States, or 50%, were healthcare personnel. (Rachel M. Burke, Claire M. Midgley, & al., 2020)
        - Within two weeks after the first Dutch case was detected, a substantial proportion of healthcare workers with fever or respiratory symptoms were infected with SARS-CoV-2, probably caused by acquisition of the virus in the community during the early phase of local spread. (Kluytmans, et al., 2020)
        - Italy reported 9.7% of COVID-19 cases were healthcare workers on April 1, 2020. (IT, 2020)
        - March 25, 2020 Spain health authorities reported the number of medical personnel infected was nearly 6,500 nationally representing 13.6% of the country's 47,600 total cases and about 1% of the health system's workforce. (PARRA & RISING, 2020)
        - April 17, 2020 CDC officials confirmed limited information is available about COVID-19 infections among U.S. health care personnel (HCP). Among 315,531 U.S. COVID-19 cases reported to CDC during February 12–April 9, data on HCP occupational status were available for 49,370 (16%), among whom 9,282 (19%) were identified as HCP (Figure). Data completeness for HCP status varied by reporting jurisdiction; among 12 states that included HCP status on >80% of all reported cases and reported at least one HCP patient, HCP accounted for 11% (1,689 of 15,194) of all reported cases. (Sherry L. Burrer, et al., April 2020)
- CEBM suggests viral load can influence the severity of COVID-19 disease. Healthcare workers can be exposed more often due to numerous infected-individual exposures. In the early stages of an outbreak, initial contacts might not be recognized, particularly contacts with those with mild symptoms, or when the use of protective measures is suboptimal. Reducing the frequency and intensity of exposure to SARs-CoV-2 might reduce the infectious dose and result in less severe cases. (Heneghan, Brassey, & Jefferson, 2020)
- Infection preventionists who completed a March survey are concerned about PPE. (APIC, 2020)

PPE Type	*Lack Enough*	*Almost Out*	*Completely Out*
Face Shields	49%	37%	13%
Masks	48%	31%	1%
Goggles	38%	28%	11%

- The CDC states an N95 FFR is a type of respirator which removes particles from the air that are breathed through it. These respirators filter out at least 95% of very small (0.3 micron) particles. N95 FFRs are capable of filtering out all types of particles, including bacteria and viruses. (CDC, March 14 2020)
- Transmission of respiratory viruses generally happens through large respiratory droplets, but some respiratory viruses can spread through fine particle aerosols, and indirect transmission via fomites can also play a role. (Cowling & Leung, February 13 2020)
- SARS-CoV-2, similar to SARS and MERS, is predominantly spread via respiratory tract with high infectivity. It is commonly recognized that droplet transmission is the main route. Spread by aerosol is suspected to be another important route of transmission but unestablished now. Epidemiological experts, as well as the WHO, consider more evidence is needed to confirm. (Han, Lin, Ni, & You, March 4 2020)
- SARS-CoV-2 remained viable in aerosols throughout the duration of our experiment (3 hours). (Doremalen, Bushmaker, & Morris, March 17 2020)
- 2019-nCoV also has enveloped virions that measure approx 50–200 nm in diameter with a single positive-sense RNA genome. 16 Club-shaped glycoprotein spikes in the envelope give the virus a crown-like or coronal appearance. (Chen, et al., Jan 29 2020)
- US physicians and nurses have a portion population at risk due to age; 31% of physicians and 26% of nurses are over the age of 55. (HRSA, 2018)

Protective Modular Glass System for Healthcare Worker Protection

Product Features

- Consists of a glass system designed to provide a transparent, easy-to-clean, physical barrier between healthcare workers and the public as they conduct patient screening and COVID-19 testing
- Utilizes the same tight joinery used on Oldcastle BuildingEnvelope® window and wall products to mitigate air flow
- Two available models: 3-sided or 4-sided fully enclosed
- Provided as a turnkey or unitized solution, incorporating storing and protecting of medical gear that would be exposed to patients
- Modular design can be configured individually or in multiple units, depending on logistics, exposure routes and healthcare needs
- Standard dimensions: 40" X 48" X 82" (enclosure); height ranges from 88" to 101" with pallet and filter
- Features:
    - Safety Glazing Certification Council (SGCC) certified glass
    - Non-porous and smooth surfaces that are durable and resilient
    - Durable integrated gloves designed for disposable glove overlay
    - No-draft speak-thru technology
    - Housed on a pallet or footings for easier maneuverability with a pallet jack
    - Anti-fatigue floor mat
    - Designed and manufactured in the U.S.A
- Model dependent features:
    - Filtration options are available:
        - High-Efficiency Particulate Air (HEPA) removing 99.97% of 0.3µm (micron)
        - Ultra-Low Particulate Air (ULPA) removing 99.99% of 0.12µm (micron)
    - LED lighting with warm and cool settings
    - Power-connected with built-in light switches and interior outlet
    - Privacy wings for added discretion and protection
    - External shelf for specimen collection supplies available
- Customization capabilities:
    - Hydrophobic coating available
    - Electric or battery operated 2-way communication speaker
    - Interior shelving
    - Options to control reflectivity/glare and various glass tints available
    - Multi-sided patient interaction (up to 3 sides)
    - Alternative glass fabrication (e.g. glove height outside standard dimensions)
- We are requesting an Emergency Use Authorization from the FDA in an effort to rapidly deploy the product.

Figure 1

About Us

Oldcastle BuildingEnvelope®, a CRH Company, is headquartered in Dallas, TX. Our business focus is on engineering, manufacturing, distributing and selling value-added glazing focused interior and exterior products. We are a global business that employs more than 6,500 people at over 90 locations across 5 countries. In the US, we have locations within 500 miles of all major metropolitan areas. This extensive network and national coverage enable faster shipping, delivery and most importantly, deployment.

United States Employment: >80% of total employee base; 70 locations

Works Cited

APIC. (2020). National survey shows dire shortages of PPE, hand sanitizer across the U.S. *The Association for Professionals in Infection Control and Epidemiology (APIC)*, 1.

CDC. (March 14 2020). What is an N95 filtering facepiece respirator (FFR)? *CDC https://www.cdc.gov/coronavirus/2019-ncov/hcp/respirator-use-faq.html*, 1.

Chen, N., Zhou, M., Dong, X., Qu, J., Gong, F., Han, Y., . . . Zhang, X. Z. (Jan 29 2020). Epidemiological and clinical characteristics of 99 cases of. *The Lancelet https://www.thelancet.com/action/showPdf?pii=S0140-6736%2820%2930211-7*, 6.

Cowling, B. J., & Leung, G. M. (February 13 2020). Epidemiological research priorities for public health control of the ongoing global novel coronavirus (2019-nCoV) outbreak. *Eurosurveillance.org*, 1.

Doremalen, D. v., Bushmaker, M., & Morris, M. (March 17 2020). Aerosol and Surface Stability of SARS-CoV-2. *The new england journal o f medicine*, 1.

Elkholy, A., Grant, R., Assiri, A., Elhakim, M., Malik, M., & Van Kerkhove, M. (2019). MERS-CoV infection among healthcare workers and risk factors for death: Retrospective analysis of all laboratory-confirmed cases reported to WHO from 2012 to 2 June 2018. *PubMed US National Library of Medicine National Institutes of Health*, 1.

Han, Q., Lin, Q., Ni, Z., & You, L. (March 4 2020). Uncertainties about the transmission routes of 2019 novel coronavirus. *Wiley Online Library*, 1.

Heneghan, C., Brassey, J., & Jefferson, T. (2020). SARS-CoV-2 viral load and the severity of COVID-19. *The Centre for Evidence-Based Medicine (CEBM) and Oxford University*, 1.

HRSA. (2018). The U.S. Health Workforce Chartbook. *US Department of Health and Human Services*, 12-18.

IT, C.-1. T. (2020). Integrated surveillance of COVID-19 in Italy. *Istituto Superiore di Sanità*, 1.

James G. Adams, M., & Ron M. Walls, M. (2020). Supporting the Health Care Workforce During the COVID-19 Global Epidemic. *JAMA Network*, 1.

Kluytmans, M., Buiting, A., Pas, S., Bentvelsen, R., Bijllaardt, W. v., Oudheusden, A. v., . . . Koopm, M. (2020). SARS-CoV-2 infection in 86 healthcare workers in two Dutch hospitals in March 2020. *MedRxIV*, 1.

Park, B. J., Peck, A. J., Kuehnert, M. J., Newbern, C., Smelser, C., Comer, J. A., . . . McDonald, a. L. (2004). Lack of SARS Transmission among Healthcare Workers, United States. *PMC US National Library of Medicine National Institutes of Health*, 1.

PARRA, A., & RISING, D. (2020, March 25). Spain's coronavirus death toll surpasses China as world struggles with containment. *Global News*, p. 1.

Rachel M. Burke, P., Claire M. Midgley, P., & al., e. (2020). Active Monitoring of Persons Exposed to Patients with Confirmed COVID-19 — United States, January–February 2020. *CDC*, 1.

Sherry L. Burrer, C., Marie A. de Perio, C., Michelle M. Hughes, C., David T. Kuhar, C., Sara E. Luckhaupt, C., Clinton J. McDaniel, C., . . . Maroya Walters, C. (April 2020). Characteristics of Health Care Personnel with COVID-19 — United States, February 12–April 9, 2020. *CDC*, 1.