

Innovation in a Time of Crisis

APRIL 6, 2020

Innovation and Crisis:

A pandemic or crisis often triggers efforts to find innovative solutions to the problem at hand. Three aspects of innovation that we have already seen in response to the COVID-19 pandemic are:

- **Public-private partnerships:** More government and nonprofit entities fund and encourage research
 - The Coalition for Epidemic Preparedness¹
 - The Biomedical Advanced Research and Development Authority (BARDA) collaboration with Janssen² and Sanofi³
 - America Makes⁴
 - Johns Hopkins University research funded by a partnership between Bloomberg Philanthropies and the state of Maryland⁵
- **Reconfiguration of private entities:** Private firms with relevant expertise reconfigure their innovative and productive efforts to tackle current needs
 - Car manufacturers innovate to build ventilators⁶
 - Beauty and cosmetic firms switch their production to sanitizers⁷
 - Pharmaceutical companies start clinical trials and move assets from their other anti-viral drugs⁸
 - Clothing companies repurpose factories to produce PPE⁹

¹ The Coalition for Epidemic Preparedness Innovation (CEPI). <https://cepi.net/covid-19/>

² U.S. Department of Health and Human Services (2020, February 18). *HHS, Janssen Collaborate to Develop Coronavirus Therapeutics*. <https://www.hhs.gov/about/news/2020/02/18/hhs-janssen-collaborate-to-develop-coronavirus-therapeutics.html>

³ Sanofi (2020, February 18). *Sanofi joins forces with U.S. Department of Health and Human Services to advance a novel coronavirus vaccine*. <http://www.news.sanofi.us/2020-02-18-Sanofi-joins-forces-with-U-S-Department-of-Health-and-Human-Services-to-advance-a-novel-coronavirus-vaccine>

⁴ Federal Drug Administration (2020, March 31). *FDA Efforts to Connect Manufacturers and Health Care Entities: The FDA, Department of Veterans Affairs, National Institutes of Health, and America Makes Form a COVID-19 response Public-Private Partnership*. <https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/fda-efforts-connect-manufacturers-and-health-care-entities-fda-department-veterans-affairs-national>

⁵ Johns Hopkins University (2020, March 27). *Bloomberg Philanthropies, state of Maryland fund Hopkins-led COVID-19 treatment research*. <https://hub.jhu.edu/2020/03/27/covid-19-sera-funding/>

⁶ General Motors (2020, March, 27). *Ventec Life Systems and GM Partner to Mass Produce Critical Care Ventilators in Response to COVID-19 Pandemic*. <https://media.gm.com/media/us/en/gm/news.detail.html/content/Pages/news/us/en/2020/mar/0327-coronavirus-update-6-kokomo.html>

⁷ LVMH (2020, March 15). *LVMH prepares to manufacture and distribute free hydroalcoholic gel in large quantities*. <https://www.lvmh.com/news-documents/press-releases/lvmh-se-mobilise-pour-fabriquer-et-distribuer-gratuitement-des-gels-hydroalcooliques-en-grande-quantite/>

⁸ U.S. Department of Health and Human Services (2020, March 30). *HHS Accelerates Clinical Trials, Prepares for manufacturing of COVID-19 Vaccines*. <https://www.hhs.gov/about/news/2020/03/30/hhs-accelerates-clinical-trials-prepares-manufacturing-covid-19-vaccines.html>

⁹ Brooks Brothers (2020, March 30). *Brooks Brothers responds to national call for enhanced supplies for medical professionals and others in need*. <https://www.brooksbrothers.com/masks-press-release/masks-press-release,default,pg.html>

- Free and open knowledge and information sharing:
 - Academic journals have opened their paywall for COVID-19 research¹⁰
 - Medtronic has made their product design public¹¹
 - 3D printing schemes are widely shared¹²

A pandemic or crisis often shifts demand and supply patterns in other sectors, which in turn prompts more innovation.

- 87% of marketers in North America predict an increase in consumer use of online services during the pandemic¹³
- 70% of U.K. marketers predict an increase in e-commerce usage¹⁴
- Telehealth capabilities are rapidly expanding and are expected to outlast the global pandemic¹⁵
- Zoom and Webex have experienced a record number of downloads¹⁶
- Universities have moved to online education¹⁷
- BroadwayHD is offering a one-week free trial in the face of closed Broadway theaters¹⁸ and London's West End is streaming free online videos¹⁹
- Repurposing hotel rooms for COVID-19 patients^{20,21}

A crisis often creates economic shocks that may lead to long-term innovations. After the immediate emergency is over, individuals who have lost their jobs may be more likely to found startups, rather than join an established firm.

¹⁰ Yasinski, E. (2020, February 13). Journals Open Access to Coronavirus Resources. The Scientist Magazine. <https://www.the-scientist.com/news-opinion/journals-open-access-to-coronavirus-resources--67105>

¹¹ Medtronic (2020, March 30). *Medtronic Shares Ventilation Design Specifications to Accelerate Efforts to Increase Global Ventilator Production*. <http://newsroom.medtronic.com/news-releases/news-release-details/medtronic-shares-ventilation-design-specifications-accelerate>

¹² 3DPrinting.com (2020, April 2). *3D Printing and COVID-19*. <https://3dprinting.com/3d-printing-use-cases/3d-printing-and-covid-19/>

¹³ Sentance, R. (2020, March 18). *Coronavirus: Major brands are delaying investment in digital transformation when they need to bring it forward*. Econsultancy. <https://econsultancy.com/coronavirus-major-brands-delaying-investment-digital-transformation-bring-forward/>

¹⁴ Sentance, R. (2020, March 18). *Coronavirus: Major brands are delaying investment in digital transformation when they need to bring it forward*. Econsultancy. <https://econsultancy.com/coronavirus-major-brands-delaying-investment-digital-transformation-bring-forward/>

¹⁵ Business Insider Intelligence. (2020, March 13). Here's what Business Insider Intelligence analysts think will be the biggest business impacts of the coronavirus pandemic. *Business Insider*. <https://www.businessinsider.com/business-insider-intelligence-biggest-business-impacts-of-coronavirus-2020-3>

¹⁶ Bary, E. (2020, April 1). Zoom, Microsoft Teams usage are rocketing during coronavirus pandemic, new data show. *MarketWatch*. <https://www.marketwatch.com/story/zoom-microsoft-cloud-usage-are-rocketing-during-coronavirus-pandemic-new-data-show-2020-03-30>

¹⁷ University of North Carolina Chapel Hill. *Coronavirus Updates*. <https://www.unc.edu/coronavirus/>

¹⁸ BroadwayHD. (n.d.). Retrieved April 2, 2020, from <https://www.broadwayhd.com/>

¹⁹ Wood, A., & Perks, D. (2020, April 1). Stage shows, musicals and opera you can watch online now for free. *WhatsOnStage*. https://www.whatsonstage.com/london-theatre/news/stage-shows-musicals-opera-free-stream-online_51198.html

²⁰ CMS.gov (2020, March 30). *Additional Backgrounds: Sweeping Regulatory Changes to Help U.S. Healthcare System Address COVID-19 Patient Surge*. <https://www.cms.gov/newsroom/fact-sheets/additional-backgroundsweeping-regulatory-changes-help-us-healthcare-system-address-covid-19-patient>

²¹ Gorner, J. (2020, March 31). City giving hotel space to first responders worried about bringing virus home. *Chicago Tribune*. <https://www.chicagotribune.com/coronavirus/ct-coronavirus-hotels-first-responders-20200331-cza5ocmztngyjix0337gscgvbe-story.html>

Evidence from the Great Recession indicates an entrepreneurial surge due to the positive influences of the slack labor market outweighing the negative aspects of the recession.²² Specifically, the literature found:

- The rate of entrepreneurship, measured as the monthly percentage of “adult, non-business-owner population who start a business,” and the unemployment rate follow the same cyclical pattern
- The business formation rate increased from 0.29% in 2006 to a 14-year high of 0.34% in 2009
- The largest increase of business formation occurred in the professional and business services sector and the construction sector

Community-based Giving:

- Large philanthropic foundations have pledged an increase in grant spending during the COVID-19 pandemic²³
- Giving Tuesday has been moved from the Tuesday after Thanksgiving to May 5 in order to support the increased need due to COVID-19²⁴
- There has been an increase in the development of funds to address COVID-19, such as the Bill and Melinda Gates Foundation’s Combating COVID-19 Fund, which focuses on treatment, vaccines and supporting vulnerable populations²⁵
- Facebook has seen an increase of over 300 local support groups, with a combined membership of more than 1 million people²⁶
- Platforms such as GoFundMe have experienced a surge in demand. COVID-19-related campaigns have increased by 60%²⁷

The Human Response:

Disaster response research has found:²⁸

- In general, a positive and generous response by people
- New strength and resiliency in communities

Anecdotally, these findings have been seen globally:

- Global city-wide cheers for healthcare workers^{29,30}

²² Fairlie, R. W. (2013). Entrepreneurship, Economic Conditions, and the Great Recession. *Journal of Economics & Management Strategy*, 22(2), 207–231. <https://doi.org/10.1111/jems.12017>

²³ Clolery, P. (2020, April 2). Foundation Leaders Starting To Step-Up On COVID-19. *The NonProfit Times*. https://www.thenonproffitimes.com/npt_articles/foundation-leaders-starting-to-step-up-on-covid-19/

²⁴ Hrywa, M. (2020, March 31). Coronavirus Targeted #GivingTuesday Now Set For May 5. *The NonProfit Times*. <https://www.thenonproffitimes.com/news/coronavirus-targeted-givingtuesdaynow-set-for-may-5/>

²⁵ Gates Philanthropy Partners. (n.d.). Gates Philanthropy Partners. Retrieved April 2, 2020, from <https://www.gatesfoundation.org/philanthropypartners/funds/covid-19>

²⁶ Harris, J. (2020, March 22). Facebook is still far too powerful. It’s also how millions are coping with this crisis. *The Guardian*. <https://www.theguardian.com/commentisfree/2020/mar/22/facebook-powerful-crisis-coronavirus-communities-online>

²⁷ Popper, N., & Lorenz, T. (2020, March 26). GoFundMe Confronts Coronavirus Demand. *The New York Times*. https://www.nytimes.com/2020/03/26/style/gofundme-coronavirus.html?utm_source=morning_brew

²⁸ Jacob, B., Mawson, A. R., Payton, M., & Guignard, J. C. (2008). Disaster Mythology and Fact: Hurricane Katrina and Social Attachment. *Public Health Reports*, 123(5), 555–566.

²⁹ Kacala, A. (2020, March 28). New Yorkers applaud health care workers and first responders. *Today*. <https://www.today.com/news/new-yorkers-applaud-health-care-workers-first-responders-t177033>

³⁰ See people around the world cheer for health care workers (n.d.). *CNN Video*. Retrieved April 2, 2020, from <https://www.cnn.com/videos/world/2020/03/25/people-cheering-solidarity-healthcare-workers-mh-orig.cnn>

- Balcony concerts, workouts and singalongs³¹
- Volunteers delivering food and medicine to the elderly and those most at risk³²
- Companies providing monetary and physical donations of medical supplies^{33,34}

COVID-19 and Mental Health:

Isolation:

AARP found that more than 8 million Americans aged 50 or older are negatively affected by isolation.³⁵

A 2020 report conducted by Cigna before the COVID-19 pandemic found that 61% of Americans are experiencing loneliness. The report found that:³⁶

- 79% of Generation Z feel lonely
- 71% of millennials feel lonely
- 50% of baby boomers feel lonely

Research indicates a link between loneliness and social isolation and negative health outcomes, such as a higher risk for high blood pressure, heart disease, obesity, a weakened immune system and cognitive decline.^{37,38}

Isolation in retirement and nursing homes:

- The CDC recommends:^{39,40}
 - Canceling all public or non-essential group activities and events
 - Limiting all non-essential visitors or volunteers
 - Establishing a “buddy” system of volunteers who can check in on residents

³¹ Balcony Workouts and Singalongs: Socializing in the Time of Coronavirus. (n.d.). *The Wall Street Journal*. Retrieved April 2, 2020, from <https://www.wsj.com/video/balcony-workouts-and-singalongs-socializing-in-the-time-of-coronavirus/48ABD17B-C49C-4261-97B1-6AE7028134FF.html>

³² United Nations (2020, March 17). *Acts of Kindness Spread Amid COVID-19 Outbreak as UN Acts to Counter Threat*. <https://www.un.org/en/coronavirus-disease-covid-19/acts-solidarity-spread-amid-covid-19-outbreak-un-continues-counter>

³³ Pichai, S. (2020, March 27). COVID-19: \$800+ million to support small businesses and crisis response. Google. <https://blog.google/inside-google/company-announcements/commitment-support-small-businesses-and-crisis-response-covid-19/>

³⁴ Anheuser-Busch (2020, March 25). *Anheuser-Busch Will Redirect Sports and Entertainment Investments to Support Those on the Front Lines of COVID-19*. <https://www.anheuser-busch.com/newsroom/2020/03/anheuser-busch-will-redirect-sports-entertainment-investments.html>

³⁵ AARP (n.d.) *What is isolation?* <https://connect2affect.org/about-isolation/>

³⁶ Cigna (2020). *Loneliness and the Workplace*. <https://www.cigna.com/static/www-cigna-com/docs/about-us/newsroom/studies-and-reports/combating-loneliness/cigna-2020-loneliness-factsheet.pdf>

³⁷ U.S. Department of Health and Human Services (2019, April 23). *Social isolation, loneliness in older people pose health risks*. <https://www.nia.nih.gov/news/social-isolation-loneliness-older-people-pose-health-risks>

³⁸ Singer, C. (2018). *Health Effects of Social Isolation and Loneliness*. *Journal of Aging Life Care*. <https://www.aginglifecarejournal.org/health-effects-of-social-isolation-and-loneliness/>

³⁹ Center for Disease Control and Prevention (n.d.). *Preventing the Spread of COVID-19 on retirement Communities and Independent Living facilities (Interim Guidance)*. <https://www.cdc.gov/coronavirus/2019-ncov/community/retirement/guidance-retirement-response.html>

⁴⁰ CMS.gov (2020, 3, 13). *Guidance for Infection Control and Prevention of Coronavirus Disease 2019 (COVID-19) in Nursing Homes*. <https://www.cms.gov/files/document/qso-20-14-nh-revised.pdf>

Mental Health:

A Pew Research Center survey found that 18% of U.S. adults had a physical reaction when thinking about COVID-19.⁴¹

Many organizations, including the World Health Organization (WHO), have issued guidelines for protecting mental health during the outbreak.⁴² These include:

- Maintaining social networks through virtual communication
- Engaging in a healthy lifestyle, including exercise, regular sleep, healthy foods and relaxing activities
- Limiting news consumption to seeking information at certain times of the day from a trusted source

It is important to acknowledge potential grief caused by radical life changes due to COVID-19 in order to manage anxiety and fear.⁴³

Overall Personal Protective Equipment (PPE) Market Landscape:

PPE encompasses respiratory protection, fall protection, ear protection, head protection, hand protection and protective clothing. As of 2019, hand protection was the largest PPE market segment, accounting for 24.22% of the market, while respiratory protection made up 13.1% of the market. See Figure 1 for more details regarding PPE market segmentation⁴⁴ and Figure 2 for industry segmentation.

The market share by revenue of PPE imports into the U.S. is:⁴⁵

- 25% from Ireland
- 15.5% from China
- 10.2% from Malaysia
- 8.7% from Mexico

Specifically within the U.S. market for respiratory protection equipment, healthcare accounted for only 2.7% of the market, while construction accounted for 12.8%.⁴⁶ See Figure 3 for more details regarding industry usage of respiratory protection equipment. The healthcare market share is expected to grow in response to increased demand due to COVID-19.

⁴¹ Keeter, S. (2020, March 30). People financially affected by coronavirus outbreak are experiencing more psychological distress than others. Pew Research Center. <https://www.pewresearch.org/fact-tank/2020/03/30/people-financially-affected-by-covid-19-outbreak-are-experiencing-more-psychological-distress-than-others/>

⁴² World Health Organization (2020, March 18). *Mental health and psychosocial considerations during the COVID-19 outbreak*. <https://www.who.int/docs/default-source/coronaviruse/mental-health-considerations.pdf>

⁴³ Berinato, S. (2020, March 23). That Discomfort You're Feeling Is Grief. Harvard Business Review. <https://hbr.org/2020/03/that-discomfort-youre-feeling-is-grief>

⁴⁴ Personal protective equipment market value by product category U.S. 2014-2026. (n.d.). Statista. Retrieved April 2, 2020, from <http://www.statista.com/statistics/895706/personal-protective-equipment-market-value-by-product-category-us/>

⁴⁵ Masters, N. (2019). Personal Protective Equipment Manufacturing. IBISWorld. <https://www.ibisworld.com/united-states/market-research-reports/personal-protective-equipment-manufacturing-industry/>. Although Ireland is a leading exporter of medical devices and medical technology and captures the largest market share based on revenue for U.S. imports, the majority of PPE imports come from low-wage countries.

⁴⁶ Curran, J. (2020). Respiratory Protection Equipment Manufacturing. MyIBISWorld. <https://my-ibisworld-com.libproxy.lib.unc.edu/us/en/industry-specialized/od4603/products-and-markets>

Based on the most recent publicly available data (from 2010) on the number of ventilators in the U.S., it is estimated that:^{47,48}

- U.S. hospitals have 62,000 full-featured mechanical ventilators
- U.S. hospitals have an additional 98,000 ventilators that are not full-featured but can provide basic functions
- The CDC Strategic National Stockpile (SNS) has about 12,700 ventilators for national deployment

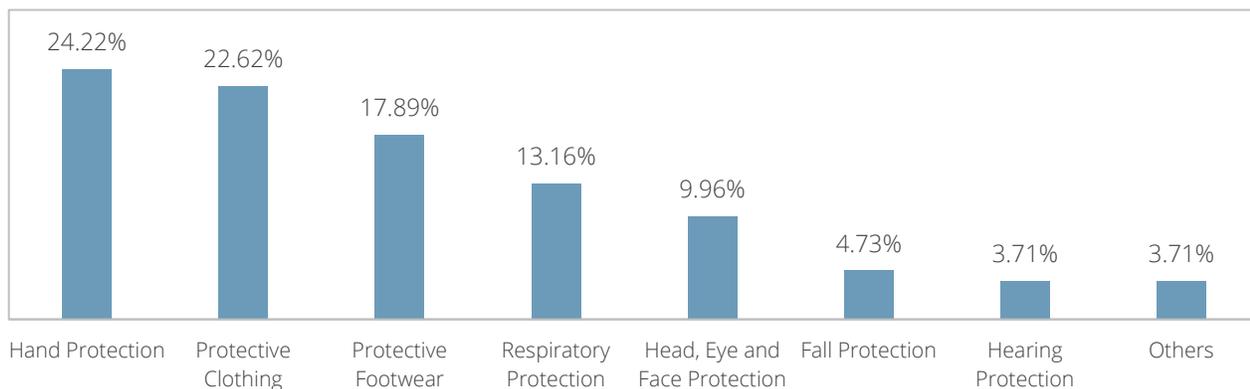
Effect of COVID-19 on PPE Supply:

Global demand has drastically outpaced global supply of PPE and supply chains are struggling to increase production in order to meet the growing demand.⁴⁹ Apart from rapidly increased demand, panic buying, hoarding and misuse have also contributed to the shortage.⁵⁰

The World Health Organization (WHO) has stated that global PPE manufacturing needs to increase by 40% in order to meet rising global demand.⁵¹ Specifically, WHO estimates that, on a global level, medical professionals will need the following amount of PPE per month:⁵²

- 89 million masks
- 76 million examination gloves
- 1.6 million goggles

Figure 1: PPE Market Segmentation for 2019⁵³



Source: Statista

⁴⁷ Center for Health Security (2020, April 1). *Ventilator Stockpiling and Availability in the US*.

<http://www.centerforhealthsecurity.org/resources/COVID-19/200214-VentilatorAvailability-factsheet.pdf>

⁴⁸ Rubinson, L., Vaughn, F., Nelson, S., Giordano, S., Kallstrom, T., Buckley, T., Burney, T., Hupert, N., Mutter, R., Handrigan, M., Yeskey, K., Lurie, N., & Branson, R. (2010). Mechanical Ventilators in US Acute Care Hospitals. *Disaster Medicine and Public Health Preparedness*, 4(3), 199–206. <https://doi.org/10.1001/dmp.2010.18>

⁴⁹ 3M (n.d.). *Novel Coronavirus and COVID-19 Outbreak - 3M Personal Protective Equipment (PPE) Considerations*

https://www.3m.com/3M/en_US/worker-health-safety-us/all-stories/full-story-detail/?storyid=8855304f-01cb-4af2-8937-83096cdb4113

⁵⁰ World Health Organization (2020, March 3). *Shortage of personal protective equipment endangering health workers worldwide*.

<https://www.who.int/news-room/detail/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide>

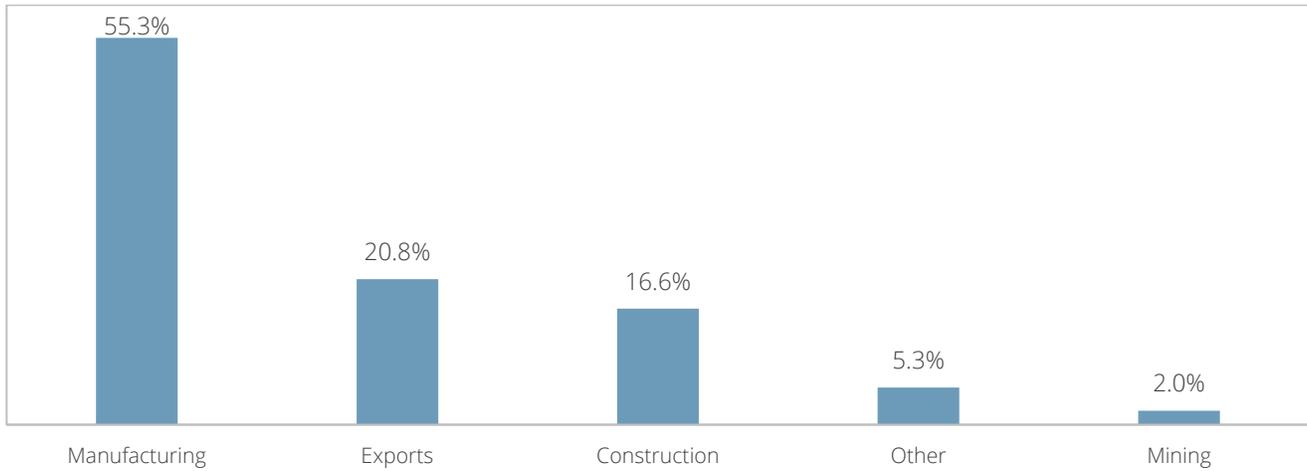
⁵¹ World Health Organization (2020, March 3). *Shortage of personal protective equipment endangering health workers worldwide*.

<https://www.who.int/news-room/detail/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide>

⁵² World Health Organization (2020, March 3). *Shortage of personal protective equipment endangering health workers worldwide*.

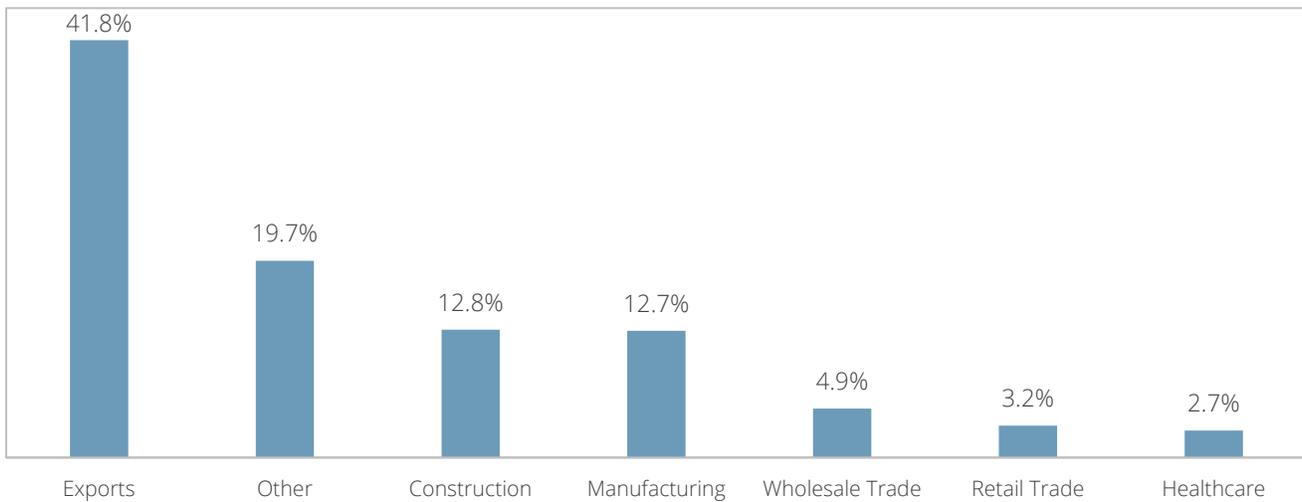
<https://www.who.int/news-room/detail/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide>

Figure 2: Industry Segmentation of PPE⁵⁴



Source: IBISWorld

Figure 3: Respiratory Protection Equipment Industry Segmentation⁵⁵



Source: IBISWorld

⁵³ Personal protective equipment market value by product category U.S. 2014-2026. (n.d.). Statista. Retrieved April 2, 2020, from <http://www.statista.com/statistics/895706/personal-protective-equipment-market-value-by-product-category-us/>

⁵⁴ Masters, N. (2019). Personal Protective Equipment Manufacturing. IBISWorld. <https://www.ibisworld.com/united-states/market-research-reports/personal-protective-equipment-manufacturing-industry/>

⁵⁵ Curran, J. (2020). Respiratory Protection Equipment Manufacturing. IBISWorld. <https://www.ibisworld.com/united-states/market-research-reports/respiratory-protection-equipment-manufacturing-industry/>