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 Preparedness Innovation
  - The Biomedical Advanced Research and Development Authority (BARDA) collaboration with Janssen and Sanofi
  - America Makes
  - Johns Hopkins University research funded by a partnership between Bloomberg Philanthropies and the state of Maryland

- **Reconfiguration of private entities:** Private firms with relevant expertise reconfigure their innovative and productive efforts to tackle current needs
  - Car manufacturers innovate to build ventilators
  - Beauty and cosmetic firms switch their production to sanitizers
  - Pharmaceutical companies start clinical trials and move assets from their other anti-viral drugs
  - Clothing companies repurpose factories to produce PPE

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• Free and open knowledge and information sharing:
  • Academic journals have opened their paywall for COVID-19 research\(^{10}\)
  • Medtronic has made their product design public\(^{11}\)
  • 3D printing schemes are widely shared\(^{12}\)

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 pandemic\(^{13}\)
• 70% of U.K. marketers predict an increase in e-commerce usage\(^{14}\)
• Telehealth capabilities are rapidly expanding and are expected to outlast the global pandemic\(^{15}\)
• Zoom and Webex have experienced a record number of downloads\(^{16}\)
• Universities have moved to online education\(^{17}\)
• BroadwayHD is offering a one-week free trial in the face of closed Broadway theaters\(^{18}\) and London’s West End is streaming free online videos\(^{19}\)
• 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.

\(^{17}\) University of North Carolina Chapel Hill. Coronavirus Updates. https://www.unc.edu/coronavirus/
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.\textsuperscript{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 pandemic\textsuperscript{23}
- Giving Tuesday has been moved from the Tuesday after Thanksgiving to May 5 in order to support the increased need due to COVID-19\textsuperscript{24}
- 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 populations\textsuperscript{25}
- Facebook has seen an increase of over 300 local support groups, with a combined membership of more than 1 million people\textsuperscript{26}
- Platforms such as GoFundMe have experienced a surge in demand. COVID-19-related campaigns have increased by 60%\textsuperscript{27}

The Human Response:

Disaster response research has found:\textsuperscript{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\textsuperscript{29,30}


\textsuperscript{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


Innovation in a Time of Crisis

- Balcony concerts, workouts and singalongs
- Volunteers delivering food and medicine to the elderly and those most at risk
- Companies providing monetary and physical donations of medical supplies

COVID-19 and Mental Health:

Isolation:

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

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

- 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.

Isolation in retirement and nursing homes:

- The CDC recommends:
  - 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

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

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

- 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 2019\(^{53}\)**

![PPE Market Segmentation for 2019]

Source: Statista

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


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

\(^{50}\) 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 PPE\textsuperscript{54}

![Industry Segmentation of PPE](image)

Source: IBISWorld

Figure 3: Respiratory Protection Equipment Industry Segmentation\textsuperscript{55}

![Respiratory Protection Equipment Industry Segmentation](image)

Source: IBISWorld

