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Innovation pathways to preserve: Rapid healthcare innovation and dissemination during the COVID-19 pandemic

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ABSTRACT

During the COVID-19 pandemic, healthcare systems rapidly responded to challenges in healthcare delivery with innovation. Innovations developed during the COVID-19 pandemic have filled needed gaps in medical care and many may be sustained long term. The unique conditions and processes that facilitated such rapid, successful, and collective innovation should be explored to support future change in healthcare. Decentralized decision making, crowdsourcing, and nontraditional information sharing may be valuable for ongoing innovation in healthcare delivery. Shared, collective purpose in solving challenges in healthcare appear critical to this work. Health care systems aiming to sustain rapid healthcare delivery innovation should consider these processes and focus on facilitating shared purpose to sustain ongoing innovation.

The COVID-19 pandemic radically disrupted several aspects of the healthcare system, requiring rapid redesign of medical services and care. This disruption resulted in “healthcare hacks” or intuitive innovations that were developed and implemented quickly by health systems, providers, and governments. These hacks manifest as solutions to problems inherent to our healthcare system, many of which were exposed or exacerbated during this crisis. Supply chain disruptions, exposure prevention, staffing shortages and imperfect disease information sparked novel approaches to personal protective equipment use, telemedicine, task shifting, and crowdsourcing, respectively.

As healthcare systems return to pre-pandemic operations, they should sustain these innovations - and crucially - the processes that facilitated such innovation. Namely, decentralized decision making, crowdsourcing, and nontraditional dissemination of information offer continued sources of innovation beyond the pandemic. This work highlights these innovation pathways, the prerequisite conditions that fostered them, and offers considerations for their sustainability.

1. Decentralized decision making

To facilitate and execute real time innovation during the COVID-19

pandemic, some healthcare organizations flattened standard hierarchies to support frontline workers’ ability to rapidly implement and test novel solutions. For example, in countries such as the United States which faced PPE shortages, staff developed aerosol boxes for intubation and extubation of patients with COVID-19.¹ At other institutions, leadership facilitated space to discuss novel challenges and encouraged staff to propose solutions which garnered buy-in and rapidly facilitated implementation. For example, the Massachusetts General/Brigham Center for COVID Innovation organized groups of staff, researchers, and community members to meet real time challenges in COVID-19 care and response.² These collaborative efforts led to the development of low cost decontamination systems allowing the reuse of N95 masks in response to PPE shortages.^{3,4} Decentralization permits those most proximal to the challenges to solve problems rapidly and intuitively without common barriers associated with change management and implementation. Decentralized decision making need not be formalized. At Princeton Medical Center, a wound care nurse identified COVID-19 patients’ risk for pressure ulcers and developed a strategy for proning COVID patients in the ICU, which was rapidly implemented and has prevented pressure ulcers.⁵

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2. Crowdsourcing

Crowdsourcing refers to a dispersed solution model in which ideas and solutions are generated and evaluated by a virtual community, which allowed for a global, rapid response to urgent COVID patient and provider needs.^{9,10} Technical professionals, medical providers and the lay community participated in crowdsourcing platforms and events such as Crowdfight COVID-19, MIT Healthcare Mini Hack Series, and COVID-19 Global Hackathon. Example innovations from these events include an e-alert system when pneumonia is detected on chest x-ray, remote monitoring devices, and predictive technologies distributed to patients receiving intensive care for COVID-19.^{11–13} Crowdfight COVID-19 matched members of the public with ongoing innovation projects in need of additional support from data analysis, to product design, and writing.¹¹ The MIT Healthcare Mini Hack Series and COVID-19 Global Hackathon hosted individuals across the globe during a period of days to collaborate and develop intuitive solutions which have now been adopted and implemented internationally.^{12,13} Crowdsourcing can also be implemented at local levels. For example, the Montreal General Hospital hosted the Code Life Ventilator Challenge to design a low cost ventilator; the winning design has, to date, produced over 10,000 such ventilators across the Canadian Health System.¹⁴

3. Nontraditional dissemination

Due to the real time demands and evolution of knowledge, individuals across healthcare used social media to share their COVID-19 knowledge, problems and solutions quickly and efficiently. Social media such as Reddit, Twitter, and Facebook were used to share novel procedural strategies, infection control measures, and treatment considerations for COVID-19.^{17–22} On Twitter, healthcare teams shared strategies for intensive care layouts to optimize infection control; on Reddit, physicians discussed best practices for mitigating aerosolization during intubation and extubation.^{17,18}

Although journals prioritized and fast-tracked COVID-related publications, such processes still resulted in a delay. While lack of formal peer review may disseminate invalid data or conclusions, the formal peer review process is itself imperfect, and subject to its own biases. As an alternative, a “social media peer review” can vet information instantaneously, through a dispersed global network of peers that can share, like, comment and/or reply to novel or promising data.²³ To reduce misinformation and maintain trust among users, some social media outlets have required an organizational affiliation or National Provider Identifier to post medical information.²⁰ Although not all information can be appropriately shared through a pathway alternative to peer-reviewed publication, there may be more opportunity and interest in communicating through such methods.

4. Conditions

These novel innovation pathways arose under a unique set of conditions. A global crisis invigorated both clinician and citizen scientists. Health systems reduced non-critical care and deployed personnel to focus increasingly limited resources on a subset of patients with severe illness. As result, stakeholders within and external to health systems experienced a broad sense of shared purpose, which along with heightened focus, provided the setting for novel solutions.

5. Considerations

While such shared, urgent efforts may prove transient, relative only to the pandemic, these measures can be sustained across health systems via focused implementation targeting a particular disease or medical subspecialty. Engaging with patients to leverage their experience and that of associated stakeholders can also serve to sustain shared purpose and focus. This valuable pipeline for innovation could be modified to

facilitate rapid innovation and collaboration across the healthcare team, sustaining a decentralized approach from the front line. There are several innovation centers across the United States that have already taken on this approach, such as the NIH Center for Accelerated Innovations at Cleveland Clinic, the Levy Health Care Delivery Incubator at Dartmouth Hitchcock, and The Steele Institute for Health Innovation at Geisinger Health.^{6–8} On a smaller scale, health systems might consider a permanent process to connect frontline health care staff with hospital leadership to present care delivery challenges and suggested solutions on a quarterly meeting basis. Palanica and Fossat in 2020, highlighted that sustaining healthcare innovation from the COVID-19 pandemic requires a balance between rapid implementation and adequate time to review the safety and security of suggested measures.²⁴ To ensure innovation is effective, safe, and expediently implemented requires substantial resources. A major limitation in this process may be lack of resources including employees needed to review the safety and necessity of this work, to implement change, and to execute proposed innovation. If possible, institutions might develop a line item for these projects.

Crowdsourcing may be scaled up or down in order to address problems of varying scale. These collaborative platforms also lend themselves well to engagement with external stakeholders and direct patient involvement^{10,25} and has successfully fostered healthcare innovation before COVID.^{15,16} The unique ability of crowdsourcing to engage stakeholders, generate ideas and implement solutions should be considered by organizations seeking to further engage employees and continue rapid innovation. Institutions might consider hosting annual crowdsourcing events centered on a specific disease or care delivery process. Participants could include patients, community members, local researchers, engineers, and clinicians. Crowdsourcing presents an opportunity for robust idea generation, but it might be met with challenges in intellectual property and desire for developer oversight. Consideration should be made for how to address ownership and future involvement of developers in generated innovations.

Nontraditional dissemination of innovations during the pandemic has reinvigorated the debate regarding potential value of alternative information sharing in healthcare delivery. While the demand for such rapid information sharing may be most useful during an emergency, care must be taken to prevent inaccurate or, worse, misleading information. Individuals and institutions might also consider whether commonly used social media platforms are appropriate for information sharing, or if novel platforms should be developed to ensure accuracy, facilitate peer review, and moderate content.

As the world continues to learn from the COVID-19 pandemic, healthcare will continue to adapt. While the innovations themselves should be evaluated for long term efficacy, so too should the environment and processes that made them possible. Decentralized innovation, crowdsourcing, and nontraditional information sharing are valuable methods to healthcare redesign and change. Despite well founded limitations of these processes, they hold enormous potential to improve healthcare.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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