

Viewpoint

The Impact of COVID-19 on Cancer Screening: Challenges and Opportunities

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Abstract

Cancer is a leading cause of death in the United States and across the globe. Cancer screening is an effective preventive measure that can reduce cancer incidence and mortality. While cancer screening is integral to cancer control and prevention, due to the COVID-19 outbreak many screenings have either been canceled or postponed, leaving a vast number of patients without access to recommended health care services. This disruption to cancer screening services may have a significant impact on patients, health care practitioners, and health systems. In this paper, we aim to offer a comprehensive view of the impact of COVID-19 on cancer screening. We present the challenges COVID-19 has exerted on patients, health care practitioners, and health systems as well as potential opportunities that could help address these challenges.

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KEYWORDS

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Introduction

It is estimated that 606,520 Americans will die from cancer in 2020 [1], which is 4 times the number of recent projected deaths due to COVID-19 [2]. While cancer prevention and screening is integral to personal and population health, the cancer industry is experiencing seismic changes due to the COVID-19 outbreak [3,4]. Disruptions brought by COVID-19 have significantly interrupted almost all aspects of cancer control and prevention infrastructures, including canceled cancer screening services [3], deferred elective surgeries [5], dismantled therapeutic regimens [4], and furloughed health care practitioners [6].

One of the most severely impacted cancer control and prevention services is cancer screening. Cancer screening utilizes medical tests to identify precancerous lesions before cancer is formed or to detect cancer before it progresses into more advanced stages [7,8]. Screening is an effective prevention mechanism that could substantially reduce cancer incidence and mortality rates in patients [9-12]. While not curative, cancer screening has potential to decrease the burden of cancer [13]. Evidence shows that for women of all ages at average risk, screening is linked to an approximate 20% reduction in breast cancer mortality [14]. Data analysis further indicates that 3 times the deaths resulting from colorectal cancer would be avoided with

one third of current costs if colorectal cancer screening rates in people aged 50-70 years improved to 80% [15]. For the genetically predisposed individual, the benefit of prescribed cancer screening has an even greater impact [16,17].

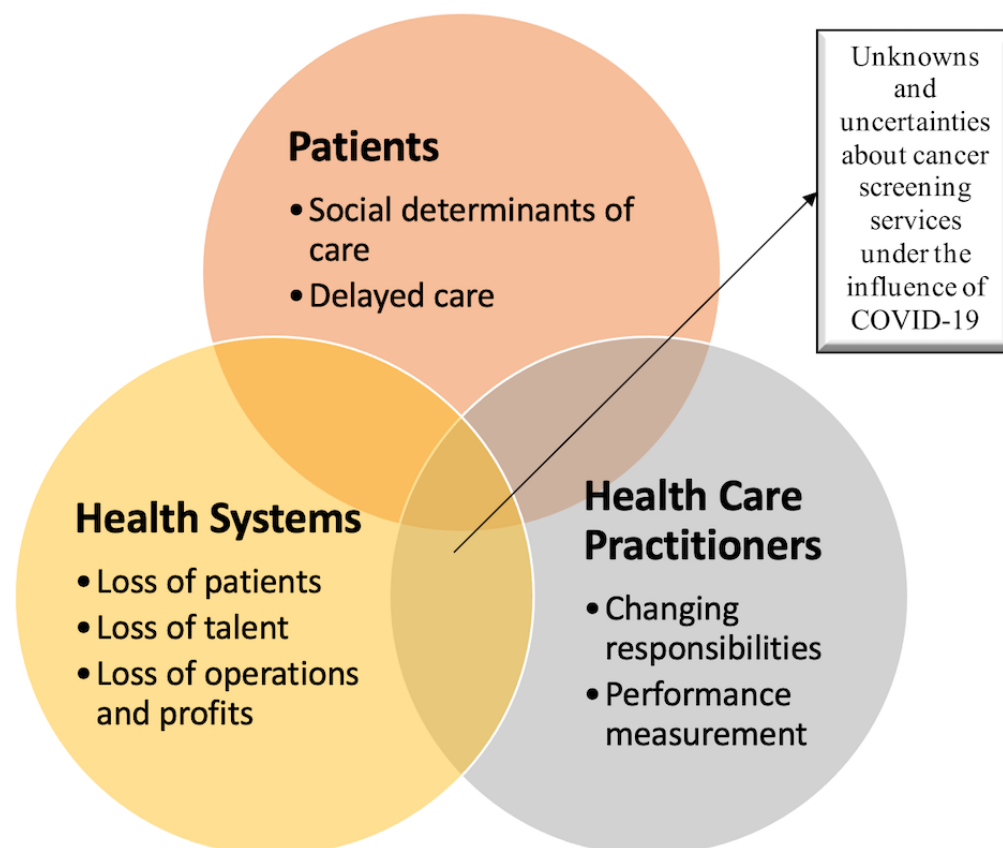
Cancer screening plays a critical role in early cancer detection, but COVID-19 has significantly hampered the cancer screening infrastructure [3]. To adjust the provision of health care resources, many cancer agencies have championed the idea of halting cancer screening services to patients [18-20]. After a US national emergency was declared on March 13, 2020, institutions such as the American Cancer Society have made the recommendation that people should pause their cancer screening plans during the COVID-19 outbreak until further notice [19]. This recommendation, along with other contextual factors (eg, social isolation measures), has caused drastic disruptions in cancer screening services. It is estimated that as a result of COVID-19, screenings for cancers of the breast, colon, and cervix have dropped by 94%, 86%, and 94% between January 20, 2020, and April 21, 2020, respectively [21]. Little is known about the impact the current pandemic will have on the cancer screening and prevention activities of patients, health

care practitioners, and health systems. To bridge this gap, we aim to present the challenges COVID-19 has exerted on patients, health care practitioners, and health systems as well as potential opportunities that could help address these challenges.

Cancer Screening Challenges, Opportunities, and Solutions

Successful cancer screening is often carried out as a result of synergistic collaborations between patients, health care practitioners, and health systems [22-24]. Furthermore, as no evidence is available on the origin of the virus and no effective vaccine or curative medicine is available, both patients and health care practitioners also experience the shared unknowns and uncertainties regarding COVID-19. These uncertainties are also experienced by health systems, whose financial futures may be threatened. Therefore, to acknowledge the shared interests of patients, health care practitioners, and health systems in cancer screening, we organized evidence and insights around these key stakeholders to provide a connected and comprehensive understanding of the impact of COVID-19 on cancer screening (Figure 1).

Figure 1. Summary of challenges patients, health care professionals, and health systems face due to COVID-19.



Patients

Social determinants of health could be understood as the condition in which people are born, grow, live, work, and age [25]. In other words, as opposed to biological factors (eg, genetic traits), social determinants of health are a range of social,

economic, political, and environmental factors that contribute to individuals' health conditions and disparities, such as inequalities in cancer screening [26-28]. Results show that patients who have poor social determinants of health, such as lack of insurance, low income, and living in a deprived neighborhood, are often less likely to adopt cancer screening

[28-30]. Evidence from randomized clinical trials further indicates that, compared to patients with private insurance, patients with Medicaid or with no insurance received reduced benefits from the same intervention program [31]. These combined insights may help explain why screenings for cancers have dropped significantly since January 2020 (eg, breast cancer screening has dropped by 94%) [21]. The experience of dramatic events, such as the COVID-19 pandemic, losing health insurance, and lack of access to health care, and in some situations caring for ill family members, may exert added psychological pressure on patients and further impact the ability to receive services and increase their risk of medical conditions such as cancer [32,33].

Another social determinant of health, economic stability, has been greatly affected. Due to the impact of COVID-19, unemployment rates rose to a historical 20.6% in the United States, with more than 31 million workers filing unemployment claims between March 1, 2020, and May 2, 2020 [34]. It is estimated that 26.6 million workers and their dependents may lose their employer-based insurance [35]. This undoubtedly can have a detrimental effect on individuals' physical and psychological health, as health insurance status is often considered as a key social determinant of health that has substantial influence on individuals' ability to access health care services [36,37].

Canceling or postponing cancer screenings may not equate to avoiding a cancer diagnosis but delayed cancer diagnoses could lead to increased mortality. On the contrary, the drastic decrease of cancer screenings in the United States and across the globe may have severe consequences, such as an unexpected rise in cancer incidence and later-stage cancer diagnosis, and in turn, more cancer deaths in patients [11,38-41]. While patients might be in great need for help during this crisis, assistance from health care practitioners was also interrupted due to the COVID-19 pandemic [42]. Furthermore, the accumulated need to screen those patients whose exams or procedures were postponed could directly impact *other* patients whose exams or procedures are now also due, creating downstream cancer screening delays.

Health Care Practitioners

One of the most impacted populations by COVID-19 is the health care practitioner community [43,44]. During the SARS (severe acute respiratory syndrome) outbreak, health care workers and hospital systems experienced measurable negative psychological impacts [45-48]. Due to the current outbreak, health care practitioners may have experienced a variety of multilevel stressors, such as (1) interruptions in routine job duties and responsibilities, (2) limited knowledge and data, and (3) worries about job security due to decreased patient volumes. COVID-19 has caused significant upheavals in the cancer health care infrastructure, including disturbed clinical visits, canceled or delayed medical surgery or procedures, and bridled therapeutic strategies [44,49]. For health care practitioners, these changes force them to tackle constant unexpected disruptions to routine job duties and responsibilities, such as the need to quickly learn and adopt telemedicine tools until COVID-19 ceases to be a threat to society. This unexpected need to adopt telemedicine may cause stress in health care practitioners, as

some of them may be forced into adopting technology-based health solutions without necessary knowledge or adequate training in place [50]. These changes in job duties and responsibilities may put extra pressure on health care practitioners, above and beyond the levels of stress experienced by the general public in the face of COVID-19. For some health care practitioners, in addition to the unique work requirements and responsibilities they shoulder during the COVID-19 pandemic, the fear of being exposed to SARS-CoV-2 at work may cause additional stress and anxiety [43]. This, in turn, may cause detrimental consequences on their psychological health and their performance in administering cancer care and treatment to patients.

Without key information from insurance payers, health care practitioners may lack the necessary data needed to identify those who need cancer screening [27,51]. Though many health care practitioners have access to electronic health record systems, information stored in these systems is often too outdated and inaccurate to be utilized [51,52]. This suggests that limited data may also hamper health practitioners' ability to help patients. Therefore, due to these issues coupled with COVID-19-related cancer screening cancellations and delays [21], health care professionals' performance in value-based contracts are at risk [53]. One consequence could be decreased screening rates and the resulting poor performance in cancer screening metrics, which in turn can lead to decreased quality incentives [54,55].

Reduced successful cancer care could be manifested in terms of decreased profits and diminished research funding [53], which may then result in downstream cost reduction and job loss. As a matter of fact, health care institutions, including hospitals and nonprofit organizations, such as the American Cancer Society, have been downsizing in the form of furloughs and layoffs [6]. According to the Labor Department, 1.4 million health care practitioners have lost their job since January 2020 [56]. This grim job reality could exert additional pressure to the unknowns and uncertainties health care practitioners are facing while trying to protect themselves and patients from COVID-19.

Health Systems

In the context of cancer screening, the impact of COVID-19 on health systems can be best illustrated in terms of loss: (1) loss of lives, (2) loss of talent, and (3) loss of operational activity and revenues. Globally, it is estimated that 2,324,069 elective cancer surgeries (37.7% of all 1,735,483 elective surgical operations) were canceled or postponed during the 12-week peak disruptions caused by COVID-19 [5]. These cancellations and delays could cause cancer disparities to become more pronounced. It is difficult to know how these discontinued services could further negatively impact the patient-provider relationship.

It is also hard to predict how patients will respond to cancer screening messages from health care practitioners post COVID-19. Public perception of health care safety could impact utilization patterns of health care [57-59]. Since COVID-19 is seen as highly infectious and can be contracted from direct contact with others [60,61], it is possible that the current avoidance of health care may continue and patients without

symptoms may opt to not be screened for preventive care. This could have a detrimental effect on patients' health, as many chronic medical conditions such as cancer, high blood pressure, and diabetes are often asymptomatic until needing urgent attention [62-64]. Furthermore, drastic changes in patients' social determinants of health (eg, health insurance status, geographic distance from health care center and associated transportation needs, etc) may also contribute to the development of other non-cancer-related illnesses [65-68], resulting in competing interests in health care decisions that could further dampen patients' motivation to seek cancer screening services [69]. This, in turn, may also contribute to an increase of later-stage cancer diagnosis in patients. Early data from the United Kingdom predicts a substantial increase in the number of avoidable cancer-related deaths in England [70]. Other estimates predict COVID-19 will result in 10,000 excess deaths from breast and colorectal cancer [71].

Health care practitioners are losing their jobs, partially due to the dwindled demands for health care services caused by COVID-19. Overall, 1.4 million health care practitioners lost their jobs since January 2020 [56]. Though the potential impact of COVID-19 on medical and nursing school enrollments is yet to be ascertained, it is possible that COVID-19 may have a negative impact on health care practitioners' ability to provide high-quality education. Moreover, the impact of reduced patient contact and virtual learning on educational milestone attainment are yet to be determined.

While it is difficult to pinpoint the exact impact of disrupted cancer screening services on the loss of life or loss of talent in the health care industry, it is easier to describe the decreased activity and estimated loss of profits in the health care industry caused by COVID-19. According to the American Hospital Association, due to the impact of this coronavirus, the estimated loss of US hospitals and health systems between February 2020 and June 2020 would amount to \$202.6 billion [53]. This loss of profit may also have an impact on patients and health care practitioners, considering that loss of profits often translate into reduced investments in cancer research [6]. However, while these numbers present a dismal reality, opportunities and solutions that could address the challenges caused by COVID-19 on cancer screening are also available.

The impact of these health system issues on cancer screening measures are coming to light, especially as it relates to cancer screening. The World Health Organization warned of a worldwide decrease in health services for noncommunicable diseases [72]. These results include predicted increases in avoidable cancer deaths [70]. Many health care systems are finding fewer cancer diagnoses during the pandemic [73,74]. Fewer diagnoses can have financial impact on health care systems, especially when the United States spent roughly \$87.8 billion on cancer-related health care in 2014 [75].

Cancer Screening for At-Risk Patient Populations

We also need to pay attention to where the COVID-19 pandemic hit hardest and where cancer screening rates are the lowest in

our community [76-85]. Patients with low socioeconomic status (SES) or identify as minority, including racial and ethnic underserved minorities such as Hispanics and African Americans, and the LGBTQ (lesbian, gay, bisexual, transgender, and queer or questioning) sexual and gender minorities. It is important to recognize that there is a huge overlap between patients with low SES and those with minority status—rather than face the double impact of being poor and disenfranchised (eg, heightened risks for cancer) [84,86-88], as a result of COVID-19, they now face the additional impact of the need to pay extra attention and allocate already limited resources to protect themselves against the coronavirus while also tackling unemployment or hazardous working conditions [89-91].

It is important to note that the impact of missing a cancer screening is not the same for every population [92,93]. Evidence suggests that marginalized individuals such as racial minorities are more likely to benefit from cancer screening [94]. Research also indicates that cancer screening is more cost-effective for high-risk races and ethnicities, such as Asians (\$71,451 per quality-adjusted life year [QALY]), Hispanics (\$76,070/QALY), African Americans (\$80,278/QALY), compared to non-Hispanic White individuals (\$122,428/QALY) [95]. While these findings further support the importance of cancer screening, they also indicate that the likelihood of missing a diagnosis by delayed or missed screening will be amplified among these minority populations. In other words, screening is integral to these populations' protection against cancer.

COVID-19 has also helped expose many health disparities minorities face, especially structured and systematic health inequalities such as violence against women [77,96-99]. Prior to COVID-19, data from the World Health Organization already painted a horrifying picture where 1 in 3 women will become a victim of sexual or physical violence in a relationship at some point in their life [100]. A growing body of literature suggests that, as the pandemic and lockdown measures bring continuing financial blows and forced "close" time with their partners, women worldwide are experiencing more frequent and dangerous forms of abuse [77,96,98].

With so many people taking a stand and making their voice heard over injustice, as exemplified by the belated realization of police brutality in the United States, there is a societal need to pay attention to the disparities and inequalities that, we, as a population, are experiencing on a daily basis. "Pay inequity" [101] or "violence against women" [77,100] are more than inhumane terminologies or irrelevant phenomena to leave as inheritance for future generations—rather, these disparities are negatively impacting our grandmothers, mothers, and daughters' well-being and making them less likely to screen for cancer [102,103] and thus more at risk for missing early cancer detection [104-106]. It is questionable as to how likely a woman experiencing domestic violence will undertake the initiative to screen for breast cancer amid the pandemic, even if she is aware that lumps in her breasts have appeared or changed. The ramifications of COVID-19 are thus profound.

More attention from health care practitioners are required to address these issues while improving screening rates for the highest at-risk populations. In other words, these health

disparities that minorities face are meaningful and life-or-death facts that health care practitioners must acknowledge and address.

Some of the approaches to more universal access to cancer screening using traditional and organized outreach measures include local mammography vans for breast cancer [38,107], fecal immunochemical test (FIT) or other at-home stool tests for colon cancer detection [108,109], and cost-effective technology-based solutions such as social media campaigns [110,111], so that a broader population can be served and the widening cancer disparities can be alleviated. In the fight against inequalities, preventative measures such as cancer screening are more relevant to underserved populations than ever before. Since COVID-19 is more likely to be deadly for marginalized individuals with chronic conditions and cancer [112-116], it is important to ensure people can fight to overcome social determinants and injustices with maintaining a healthy and cancer-free body.

Opportunities and Solutions

Telemedicine Opportunities and Technology-Based Solutions

With the advances in science and technology, the application of telemedicine in cancer care and management is gaining momentum [117-119]. Telemedicine, which literally means “healing at a distance” [120], could be understood as the delivery of health care services aiming to advance personal and population health [121]. Telemedicine allows timely, accessible, and cost-effective health care delivery to the patients, which renders itself a practical solution to COVID-19-induced constraints such as social distancing and self-isolation [122-124]. Telemedicine tools such as virtual reality devices have been found to be useful for training health care practitioners [125]. As virtual reality can offer remote yet realistic training experiences, it facilitates training for health care professionals in a time when social isolation is the norm. Telemedicine has been shown to be effective in underserved geographically remote populations. Emerging technologies such as artificial intelligence (AI) also have great potential in facilitating cancer screening [119].

On a higher-technological scale, using a deep learning technique, researchers found that AI can help identify faces of patients with cancer from those without [126]. This promising finding, not currently in use, suggests that AI-based telemedicine tools have the future potential to assist patients and health care practitioners with cancer screening and improve screening accuracy.

While promising telemedicine opportunities are present, to successfully implement telemedicine in cancer care and primary care, education and training should be made available to both patients and health care practitioners [118]. Research conducted by Stanford University shows that 47% of physicians and 73% of medical students surveyed indicated that they are considering taking additional courses to better prepare for innovations in health care (eg, data science, AI) [127]. While it is imperative to update college curricula to reflect health care needs identified

in practice [128,129], it is important to note that telemedicine education and training should be considered as a long-term investment, rather than a short-term experiment. In other words, as technology advances, telemedicine education and training programs should also be updated regularly and frequently to ensure health care practitioners are up to date with telemedicine opportunities for the benefits of self and patients [130,131].

According to the Pew Research Center, approximately 96% of Americans own a cellphone of some kind [132]. Considering the prevalence of smart devices patients own, health care practitioners may face questions like “Which mobile apps can help me better take care of my health?” from patients more frequently in the future. There is also a boom in the medical app market. It was estimated that there were approximately 325,000 health apps available to patients in 2017, equating to 3.7 billion app downloads in total [133]. As mobile health (mHealth) continues to gather momentum, health care practitioners may also need to “prescribe” mobile apps to patients to protect them from ill-suited (eg, apps addressing different sets of needs) or poorly developed apps (eg, apps filled with misinformation or lack of scientific underpinning) [134]. Technology competence might be an integral part to effective patient-provider communication [123]. To embrace future technology-based health care challenges, health care practitioners may have to train their telemedicine muscles with regular education to be able to adequately answer patients’ questions and concerns about telemedicine.

Leveraging Social Media to Boost Cancer Screening

In addition to boosting health care professionals’ core competence with regard to telemedicine [131], health systems should also consider adopting integrated marketing campaigns, such as social media campaigns, to increase screening awareness and adoption rates in patients. Social media campaigns could be understood as the use of social media platforms to deliver persuasive communication strategies to the target audience in order to change their attitudes and behavior to improve health. One key advantage of social media campaigns is that as persuasive strategies adopted in these campaigns are evidence-based and tailored to the target audience [135,136], they often yield desirable campaign outcomes [137-139].

Social media campaigns may be extremely useful for promoting cancer screening services to at-risk populations. Compared to integrated marketing campaigns distributed via traditional media platforms, social media campaigns can be distributed remotely with limited costs and therefore have the added advantages of cost-effectiveness and scalability [135,136]. This advantage might be more pronounced in the era of COVID-19; since lockdowns and social distancing measures have limited people’s ability to physically disseminate campaign messages, campaign mechanisms that can virtually distribute promotional information are desired. Evidence suggests that social media campaigns are effective in raising cancer screening awareness in the target audience [110,111,140]. Promising findings show that social media campaigns on lung cancer screening using Google and Facebook to reach at-risk populations yielded click-through rates above the industry standard [110]. These insights suggest that health care professionals can consider using social media

campaigns to reach at-risk populations, such as minorities with pronounced needs to be screened for cancer, to further address the widening cancer disparities exacerbated by COVID-19.

Conclusion

The systemic disruption and tragedy that COVID-19 has brought to patients, practitioners, and health care systems is an opportunity for innovative solutions, especially in cancer prevention and screening [141-143]. Cancer prevention and screening professionals need to innovate in this current environment to continue to decrease the burden of cancer in communities. We need agile short-term plans tailored to the current COVID-19 infection control strategies as well as long-term plans that account for the capricious, costly, and deadly nature of cancer and its intersection with other widespread health problems, such as viral infections similar to the current pandemic. We offer some post-COVID-19 screening enhancement recommendations below:

- Breast cancer screening
 - Mobile mammography unit

- Cervical cancer screening
 - Pap smears +/- cotesting per guidelines
- Colon cancer screening
 - Enhanced workflows for FIT or Cologuard with appropriate patients
- General solutions:
 - Proactive outreach to patients due for screening
 - Social media communication to patients about risks of cancer and safety of screening procedures
 - Initial assessment and results follow-up via telemedicine appointment
 - Masking precautions (patient, clinician, and staff)
 - Social distancing precautions when possible

Complacency is not an option, and health care professionals must diligently work together with other stakeholders and across disciplines toward solutions to ensure patients, providers, and health systems have the tools and means necessary to screen for cancer *now*.

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Conflicts of Interest

RM is a consultant for Novartis, Sierra Oncology, and LaJolla Pharmaceutical and provides research support to Celgene, Incyte, AbbVie Inc, Samus Therapeutics, Genetech, Promedior, and CTI biopharma.

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Abbreviations

AI: artificial intelligence

FIT: fecal immunochemical test

LGBTQ: lesbian, gay, bisexual, transgender, and queer or questioning

mHealth: mobile health

QALY: quality-adjusted life year
SARS: severe acute respiratory syndrome
SES: socioeconomic status

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