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

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Abstract

Cancer is a leading cause of deaths in the U.S. 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 coronavirus outbreak many screenings have either been cancelled or postponed, leaving a vast number of patients without access to recommended healthcare services. This disruption to cancer screening services may have a significant impact on patients, healthcare practitioners, and health systems. In this article, we aim to offer a comprehensive view of the impact of COVID-19 on cancer screening. Specially, we present challenges COVID-19 exerted on patients, healthcare practitioners, and health systems as well as potential opportunities that could help address these challenges.

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

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Abstract

Cancer is a leading cause of deaths in the U.S. and across the globe. Cancer screening is an

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Keywords: cancer screening; COVID-19; coronavirus; telemedicine; social determinants of health; education and training; integrated marketing campaign; social media campaign; branding; co-branding

Introduction

It is estimated that 606,520 Americans will die from cancer in 2020 [1], 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 coronavirus outbreak [3, 4]. Disruptions brought by COVID-19 have significantly interrupted almost all aspects of cancer control and prevention infrastructures, including cancelled cancer screening services [3], deferred elective surgeries [5], dismantled therapeutic regimens [4], and furloughed healthcare 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]. Evidence shows that for women of all ages at average risk, screening is linked approximately 20% reduction in breast cancer mortality [13]. Data analysis further indicates that 3 times of the deaths from colorectal cancer would be avoided with one third of current costs if colorectal cancer screening rates in the 50-70 years old population improved to 80% [14]. For the genetically predisposed individual, the benefit of prescribed cancer screening has an even greater impact [15, 16].

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 healthcare resources, many cancer agencies have championed the idea of halting cancer screening services to patients [17-19]. After a U.S. 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 coronavirus outbreak until further notification [18]. This recommendation, along with other contextual factors (e.g., 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 94%, 86%, and 94% between January 20, 2020 and April 21, 2020, respectively [20]. While alarming statistics are available, little is known about the impact these statistics exerts on patients, healthcare practitioners, as well as health systems. To bridge this gap, we aim to present challenges COVID-19 exerted on patients, healthcare 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, healthcare practitioners, and health systems [21-23]. Furthermore, as no evidence is available on the origin of the virus and no effective vaccine or curative medicine is available, both patients and healthcare 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, healthcare practitioners, and health systems in cancer screening, we organized evidence and insights around these key stakeholders to provide a connected and comprehensive understanding on the impact of COVID-19 on cancer screening (see Figure 1).

Patients

Social determinants of health could be understood as the condition in which people are born, grow, live, work, and age [24]. In other words, as opposed to biological factors (e.g., 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 [25-27]. 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 [27-29]. Evidence from randomized clinical trials further indicates that, compared to patients with private insurance, patients with Medicaid or with no insurance received smaller benefits from the same intervention program [30]. These combined insights may help explain why screenings for cancers have dropped significantly since January, 2020 (e.g., breast cancer screening has dropped 94%) [20]. The experience of dramatic events, such as the coronavirus pandemic, losing health insurance, and lack of access to healthcare, 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 for medical conditions such as cancer [31, 32].

Another social determinant of health, economic stability, has been greatly affected. Due to the impact of COVID-19, the unemployment rates rose to a historical 20.6% in the U.S., with more than 31 million workers filing unemployment claims between March 1, 2020 and May 2, 2020 [33]. It is estimated that 26.6 million workers and their dependents may lose their employer-based insurance [34]. 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 healthcare services [35, 36]

Cancelling or postponing cancer screenings does not equate to avoiding a cancer diagnosis. On the contrary, the drastic decrease of cancer screenings in the U.S. 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, 37-40]. While patients might be in great need for help during this crisis, assistance from healthcare practitioners was also interrupted due to the coronavirus pandemic [41]. Furthermore, the accumulated need to screen those patients whose exams/procedures were postponed could directly impact *other* patients whose exams/procedures are now also due creating downstream cancer screening delays.

Healthcare Practitioners

One of the most impacted populations by COVID-19 is the healthcare practitioner community [42, 43]. Due to the coronavirus, healthcare 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 healthcare infrastructure, including disturbed clinical visits, cancelled or delayed medical surgery or procedures, and bridled therapeutic strategies [43, 44]. For healthcare 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 the coronavirus ceases to be a threat to the society at large. This unexpected need to adopt telemedicine may cause stress in healthcare practitioners, as some of them may be forced into adopting technology-based health solutions by COVID-19 without necessary knowledge or adequate training in place [45]. These changes in job duties and responsibilities may put extra pressure on healthcare practitioners, above and beyond the levels of stress experienced by general public in the face of COVID-19. For some healthcare practitioners, in addition to the unique work requirements and responsibilities they shoulder during COVID-19 pandemic, the fear of being exposed to the coronavirus at work may cause additional stress and anxiety [42]. 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, healthcare practitioners may lack the necessary data needed to identify those who need cancer screening [26, 46]. Though many healthcare practitioners have access to electronic health record systems, information stored in these systems is often too outdated and inaccurate to be utilized [46, 47]. 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 [20], healthcare professionals'

performance in value-based contracts are at risk [48]. A result could be decreased screening rates and the resulting poor performance in cancer screening metrics which in turn, can lead to decreased quality incentives [49, 50].

Reduced successful cancer care could be manifested in terms of decreased profits and diminished research funding [48], which in turn, may result in downstream cost-reduction and job loss. As a matter of fact, healthcare 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 healthcare practitioners lost their job since January, 2020 [51]. This grim job reality could exert additional pressure to the unknowns and uncertainties healthcare practitioners facing while trying to protect themselves and the patients from the coronavirus.

Health systems

In the context of cancer screening, the impact of COVID-19 on the health systems can be best illustrated in terms of loss: (1) loss of lives, (2) loss of talent, and (3) loss of revenues. Globally, it is estimated that 2,324,069 elective cancer surgeries (37.7% of all 1,735,483 elective surgical operations) were cancelled or postponed during the 12-week peek 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 healthcare practitioners post-COVID. Public perception of health care safety could impact utilization patterns of health care [52-54]. Since COVID-19 is seen as highly infectious and can be contracted from direct contact with others [55, 56], it is possible that current avoidance of health care may continue and patients may opt to not be screened for preventive care. This could have a detrimental

effect on patients' health, as many chronic medical condition such as cancer, high blood pressure, and diabetes are often asymptomatic until needing urgent attention [57-59]. Furthermore, drastic changes in patients' social determinants of health (e.g., health insurance status, geographic distance from healthcare center and associated transportation needs) may also contribute to the development of other non-cancer-related illnesses [60-63], resulting in competing interests in healthcare decisions that could further dampen patients' motivation to seek cancer screening services [64]. This, in turn, may also contribute to an increase of later-stage cancer diagnosis in patients.

Healthcare practitioners are losing their jobs, partially due to the dwindled demands of healthcare services caused by COVID-19. Overall, 1.4 million healthcare practitioners lost their jobs since January, 2020 [51]. Though the potential impact of COVID-19 on medical and nursing school enrollments is yet to be clear, it is safe to assume that this loss of talent in the healthcare industry may have a negative impact on healthcare practitioners' wellbeing and patient-provider relationships.

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 healthcare industry, it is easier to estimate the loss of profits in the healthcare industry caused by the coronavirus. According to the American Hospital Association, due to the impact of COVID-19, the estimated loss of U.S. hospitals and health systems between February, 2020 and June, 2020 would amount to $202.6 billion [48]. This loss of profit may also have an impact on patients and healthcare practitioners, considering that the 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.

Cancer Screening for At-Risk Patient Populations

We also need to pay attention to where the COVID-19 pandemic hit hardest and cancer screening rates are the lowest in our community [65-74]—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 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 (e.g., heightened risks for cancer) [73, 75-77], many thanks to COVID-19, they now face a triple impact with needing to pay extra attention and allocate already limited resources to protect themselves against the coronavirus while tackling unemployment or hazardous working conditions [78-80].

It is important to note that the impact of missing a cancer screening is not the same for every population [81, 82]. Evidence suggests that marginalized individuals like racial minorities are more likely to benefit from cancer screening [83]. Research also indicates that cancer screening is more cost-effective for high-risk races and ethnicities, such as Asians (($71,451 quality-adjusted life year or QALY) Hispanics ($76,070/ QALY), African Americans ($80,278/QALY), compared to non-Hispanic Whites ($122,428/QALY) [84]. 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 [66, 85-88]. 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 [89]. 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 being abused more frequently and deadly [66, 85, 87].

With so many people taking a stand and making their voice heard over injustice, if there is any lesson to be learned from the belated realization of police brutality in the U.S., it is that we, as a

society, need to pay attention to the disparities and inequalities that, we, as a united race called human being, are experiencing on a daily basis. 82 cents to a dollar [90] or violence against women [66, 89] are not just coldhearted terminologies or irrelevant phenomena we leave as inheritance to the future generations—these disparities are deteriorating our grandmothers, mothers, and daughters' health and making them less likely to screen for cancer [91, 92] and more at-risk for developing cancer [93-95]. It is questionable as how likely a domestically abused woman would take the initiative to screen for breast cancer amid COVID-19, even if she knows the lumps in her breasts have appeared or changed. The ramifications of COVID-19 are thus profound.

More attention from healthcare practitioners are required to address these issues while improving screening rates for the highest at-risk populations. In other words, these health disparities minorities face are meaningful and life-or-death facts that healthcare practitioners need to 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 breasts [37, 96], FIT or other stool tests for colon [97, 98], and cost-effective technology-based solutions such as social media campaigns [99, 100], 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, as the coronavirus is more likely to be deadly for marginalized individuals with chronic conditions and cancer [101-105], it is important to make sure 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 [106-108]. Telemedicine, which literally means “healing at a distance” [109], could be understood as the delivery of health care services aiming to advance personal and population health [110]. Telemedicine allows timely, accessible, and cost-effective healthcare delivery to the patients, which renders itself a practical solution to COVID-19 induced constraints such as social-distancing and self-isolation [111-113]. Telemedicine tools such as virtual reality devices have been found useful in training healthcare practitioners [114]. As virtual reality can offer remote, yet realistic training experiences, it offers a valuable opportunity for training healthcare 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 also have great potential in facilitating cancer screening [108].

On a higher-technological scale, using a deep learning technique, researchers found that artificial intelligence (AI) can help identify faces of patients with cancer from those without [115]. This promising finding, not currently in use, suggests that AI-based telemedicine tools have the future potential to assist patients and healthcare 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 healthcare practitioners [107]. 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 healthcare (e.g., data science, AI) [116]. While it is imperative to update college curricula to reflect healthcare needs identified in practice [117, 118], 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 healthcare practitioners are up-to-date with telemedicine opportunities for the benefits of self

and patients [119, 120].

According to the Pew Research Center, approximately 96% of American own a cellphone of some kind [121]. Considering the prevalence of smart devices patients own, healthcare practitioners may face questions like “Which mobile applications (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, equates to 3.7 billion app downloads in total [122]. As mHealth continues to gather momentum, healthcare practitioners may also need to “prescribe” mobile apps to patients to protect them from ill-suited (e.g., apps addressing different sets of needs) or poorly-developed apps (e.g., apps filled with misinformation or lack of scientific underpinning) [123]. Technology-competence might be an integral part to effective patient-provider communication [112]. To embrace future technology-based healthcare challenges, healthcare practitioners may have to train their telemedicine muscles with regular education to be able to adequately answer patients’ telemedicine questions and concerns.

Leveraging Social Media to Boost Cancer Screening

In addition to boosting healthcare professionals’ core competence with regard to telemedicine [120], 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 [124, 125], they often yield desirable campaign outcomes [126-128].

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 [124, 125]. This advantage might be more pronounced in the era of COVID-19, as lockdowns and social distancing measures have limited people's ability to physically disseminate campaign messages, campaign mechanisms that can virtually distribute promotional information is desired. Evidence suggests that social media campaigns are effective in raising cancer screening awareness in the target audience [99, 100, 129]. Promising findings show that lung cancer screening social media campaigns using Google and Facebook to reach the at-risk population yielded above-industry-standard click-through rates [99]. These insights suggest that healthcare 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 healthcare systems is an opportunity for innovative solutions, especially in cancer prevention and screening. Without a working vaccine or functioning cure on the horizon, for better or worse, the coronavirus will likely continue shaping and reshaping our society for a long period of time [130-133]. Healthcare professionals need to remember that when human beings are not fighting the Black Death (1347), the Great Plague of London (1665), the Spanish Flu (1918), the SARS outbreak (2003), and the COVID-19 pandemic (2019), we are working for solutions to address communicable diseases like the H5N1 bird flu (1995), the Middle East respiratory syndrome (2012), the Ebola virus (2013), and the Zika epidemic (2015), as well as more deadly non-communicable health crises like type 2 diabetes, heart diseases, and cognitive impairments, to name just a few. Importantly, 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 wide-spread health problems, such as viral infectious similar to that we are experiencing in our current pandemic. We offer some solutions in Table 1. Complacency is not an option, and healthcare professionals must diligently work together with other stakeholders and across disciplines towards solutions to ensure patients, providers, and health systems have the tools and means necessary to screen for cancer *now*.

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Conflict of Interest

The authors have no conflict of interest.

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

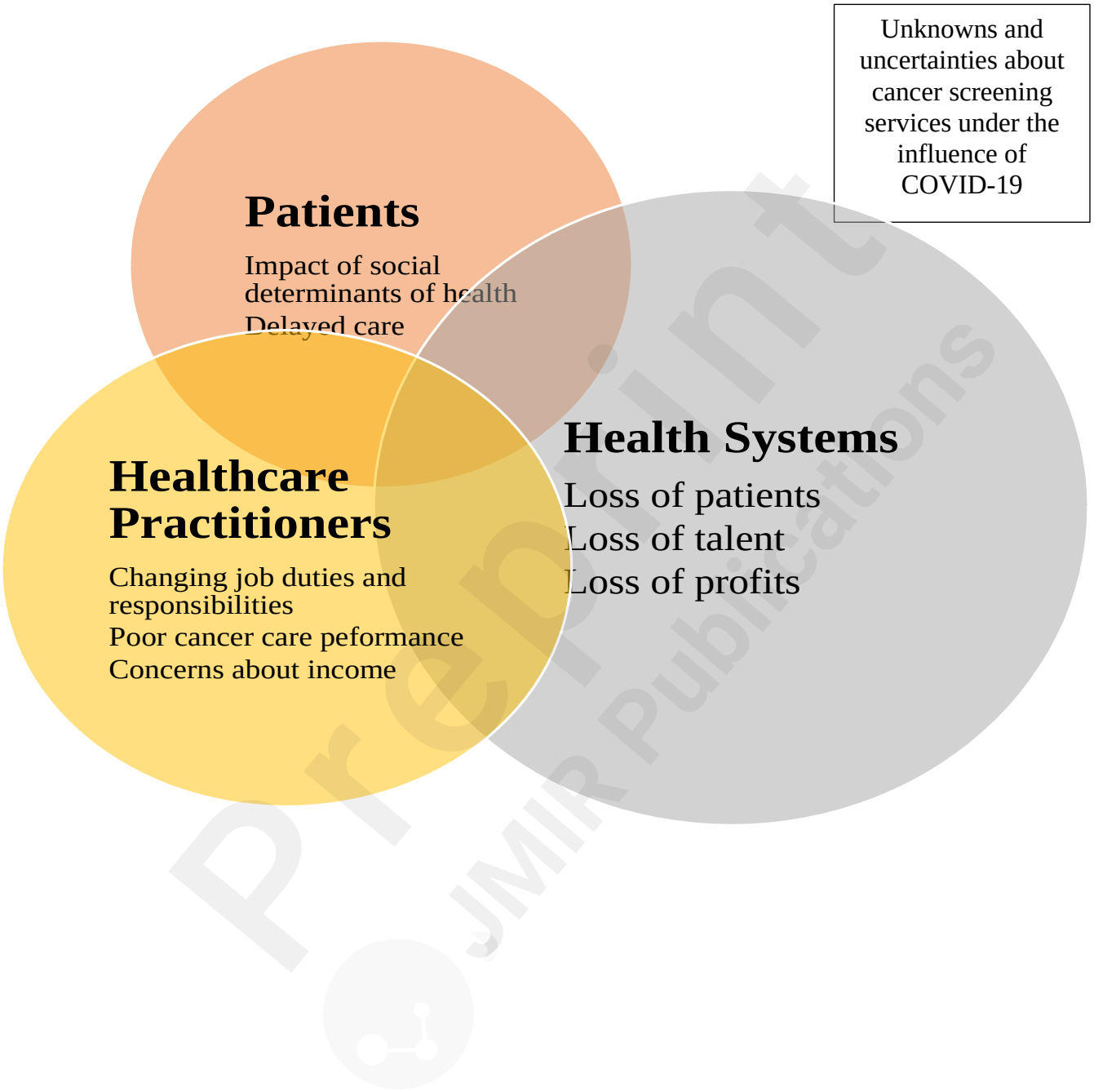

Table 1.

	Post-COVID-19 Screening Enhancement Recommendations						
Breast	Mobile	Proactive	Social	Media	Initial	Masking	Social

Cancer Screening	Mammography Unit	Outreach to Patients Due for Screening	Communication to Patients about Risks of Cancer and Safety of Screening Procedures	Assessment and Results Follow-Up via Telemedicine Appointment	Precautions (patient, clinician, and staff)	Distancing Precautions When Possible
Cervical Cancer Screening	Pap Smears +/- co-testing per guidelines					
Colon Cancer Screening	Enhanced workflows for FIT or Cologuard with appropriate patients					