

The Impact of COVID-19 on Patients With Cancer

A National Study of Patient Experiences

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Objectives: The coronavirus disease 2019 (COVID-19) pandemic abruptly disrupted cancer care. The impact of these disruptions on patient experiences remain relatively understudied. The objective of this study was to assess patients' perspectives regarding the impact of COVID-19 on their experiences, including their cancer care, emotional and mental health, and social determinants of health, and to evaluate whether these outcomes differed by cancer stage.

Materials and Methods: We conducted a survey among adults with cancer across the United States from April 1, 2020 to August 26, 2020 using virtual snowball sampling strategy in collaboration with professional organizations, cancer care providers, and patient advocacy groups. We analyzed data using descriptive statistics, χ^2 and *t* tests.

Results: Three hundred twelve people with cancer participated and represented 38 states. The majority were non-Hispanic White (n=183; 58.7%) and female (n=177; 56.7%) with median age of 57 years. Ninety-one percent spoke English at home, 70.1% had health insurance, and 67% had access to home internet. Breast cancer was the most common diagnosis (n=67; 21.5%). Most had Stage 4 disease (n=80; 25.6%). Forty-six percent (n=145) experienced a change in their care due to COVID-19. Sixty percent (n=187) reported feeling very or extremely concerned that the pandemic would affect their cancer and disproportionately experienced among those with advanced cancer stages compared with earlier stages ($P < 0.001$). Fifty-two percent (n=162) reported impact of COVID-19 on 1 or more aspects of social determinants of health with disproportionate impact among those with advanced cancer stages compared with earlier stages.

Conclusions: COVID-19 impacted the care and well-being of patients with cancer and this impact was more pronounced among people with advanced cancer stages. Future work should consider tailored interventions to mitigate the impact of COVID-19 on patients with cancer.

Key Words: COVID-19, cancer care delays, social determinants of health, mental health

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As of April 1, 2021, coronavirus disease 2019 (COVID-19) has infected over 30 million people and resulted in over 550,000 deaths in the United States.¹ In the spring of 2020, after the first cases of COVID-19 were reported in the United States, many states issued stay-at-home restrictions to reduce infection risk across the country.² Consequently, many health systems delayed or canceled various aspects of cancer care to preserve health worker capacity and prevent patient exposure to COVID-19, given the increased risk of severe COVID-19-related illness and mortality among patients with cancer as compared with the general population.^{3–5} While the extent to which patients were, and continue to be, affected remains largely unknown, recent data show that in 2020, compared with 2019, outpatient cancer clinic visits decreased by 70%,⁶ cancer screening rates decreased by 60% to 80%,⁶ and enrollment in cancer clinical trials decreased by 60%.⁷

Furthermore, pandemic-related delays in cancer care, along with social isolation from stay-at-home restrictions, and higher COVID-19 mortality risk, may add new sources of stress and anxiety for many patients with cancer. Before the pandemic, patients with cancer commonly suffered from depression and anxiety,⁸ especially those with more advanced stages of disease.^{9,10} In 1 study during the pandemic, patients on active cancer treatment reported greater concern of COVID-19 infection risk and higher rates of family distress than patients who had completed treatment or without a cancer history.¹¹ Others report increased anxiety, depression, and hopelessness among survivors of cancer during the COVID-19 pandemic,¹² corroborating findings from a few studies in Asia.^{13,14} To our knowledge, few studies have evaluated whether these concerns may disproportionately impact those with advanced cancer stages.

The impact of COVID-19 and resulting social isolation and modifications in cancer care on patients' experiences is understudied in the United States. The goal of this study, therefore, was to conduct a national survey to assess patients' perspectives regarding the impact of COVID-19. Specifically, we sought to understand the impact on cancer care, emotional and mental health, and social determinants of health (SDOH) and to evaluate whether these outcomes differed by cancer stage.

MATERIALS AND METHODS

We developed a 74-item online survey using Qualtrics to assess the impact of COVID-19 on patients' experiences, cancer care, and SDOH. The survey was available in 5 spoken languages—English, Spanish, Vietnamese, Mandarin, and Hindi. We distributed the survey from April 1, 2020 to August 26, 2020 using a virtual snowball sampling strategy in collaboration with national cancer organizations and patient advocacy groups, including the American Cancer Society, the Komen Foundation, the American Society of Clinical Oncology, the

International Association for the Study of Lung Cancer, through social media (eg, Twitter, Facebook), and by e-mail to cancer center directors and clinicians across the United States. Patients were invited to participate in the full study if they were 18 years of age or older, diagnosed with cancer, and consented online to study procedures.

We calculated summary statistics (frequencies, percentages, and means) to describe the distribution of sociodemographic and clinical characteristics and survey responses among participants. We used χ^2 tests to evaluate differences in the proportions of care delayed by type of cancer care. We used Wilcoxon rank-sum (Mann-Whitney) tests and *t* tests to assess the differences between mean reported concerns by cancer stage.¹⁵ We defined early cancer stage as stages 0, 1, or 2 and advanced cancer stages as stages 3 or 4. All analyses were conducted using Stata 16 (Stata Corp, LLC). All study procedures were reviewed and approved by Stanford University Institutional Review Board.

RESULTS

Baseline Characteristics

A total of 523 participants responded to the survey. Of these, 211 were excluded for providing no survey responses or for responding that they had never been diagnosed with cancer. The final analytic cohort comprised 312 participants. The majority of participants identified as female, non-Hispanic, and White, with a median age of 57 years (Table 1). Survey participants represented 38 states, the District of Columbia and all 4 US Census regions. The overwhelming majority (91%) spoke English at home, did not live alone, were married and had a college or graduate degree. Thirty-nine percent reported they were currently working (full-time, part-time, self-employed). The majority had health insurance (70.1%); the highest proportion had private insurance (39.4%) and equal proportions of participants had public insurance (Medicaid/Medicare) (14.1%) or dual private/public insurance (14.1%). Survey participants commonly reported access to multiple forms of digital communication—68% reported access to a smartphone, 64% to a desktop/laptop computer, and 67% to home internet. Of the 60% who reported their income, 65% had annual household incomes of <\$100,000.

Clinical Characteristics

Breast cancer was the most common diagnosis. The highest proportion of participants reported stage 4 disease. Forty-six percent of participants were receiving active cancer treatment at the time of the survey with the highest proportion receiving chemotherapy and/or immunotherapy (39.9%), followed by combination or multimodal therapy (25.9%), oral or hormonal therapy (23.8%) and surgery or radiation (10.9%). Participants receiving active treatment with chemotherapy and/or immunotherapy were most frequently receiving treatment on 2-week (36.8%) or 3-week intervals (26.3%); 73.5% of participants receiving active treatment with oral or hormonal therapy were receiving treatment every day.

COVID-19 Impact on Cancer Care

Half of the participants avoided seeking health care (ie, routine clinic visits, urgent care, emergency department, hospitalization) due to fear of contracting COVID-19. Figure 1 presents the impact of COVID-19 on different aspects of cancer care among all participants. Forty-six percent (*n* = 145) experienced a change in their care due to COVID-19 that included treatment delays (33%), changes in care location (12%),

modifications or addition of new treatments (10%). Approximately 12% reported “other changes in care” that included restrictions on visitation policies and having to attend treatments alone. Among those who experienced a change in care, the majority (58.3%) reported that these changes were initiated by the physician or because of a hospital policy but some (13.9%) reported that they requested these care changes for fear of contracting COVID-19, and a few (6.2%) reported they did not know why these changes in their care were made. Compared with participants with earlier cancer stages, those with advanced stages more frequently reported modifications or additions of new treatments (22.7% [*n* = 15/66] vs. 2.5% [*n* = 1/40] *P* = 0.004) and change in care location (28.2% [*n* = 20/71] vs. 9.3% [*n* = 4/43] *P* = 0.016).

Cancer Care Delays

Figure 2 demonstrates the reported delays in different aspects of cancer care and the associated length of the delays. Approximately 19% (*n* = 58) experienced interruptions or delays in clinic visits, 16% (*n* = 50) in imaging, 11% (*n* = 35) in laboratory testing and 3% (*n* = 10) experienced cancellation of their surgery or biopsy. Six percent (*n* = 20) reported clinical trial interruptions, noting considerable delays and indefinite cancellation of planned clinical trial activities. Delays in multiple aspects of cancer care were common; 23.5% (*n* = 46) reported delays in 2 aspects of cancer care while 11.0% (*n* = 22) reported delays in 3 or more.

Participants reported duration of cancer-related care delays, on average, of greater than 4 weeks for clinic visits (71.4%), laboratory testing or blood work (79.3%), and imaging (80.0%). Among patients receiving chemotherapy and/or immunotherapy by intravenous or oral routes, 54.2% reported greater than 4-week delays in their treatment while 25% reported indefinite cancellation. While the number of participants scheduled for radiation, biopsy, or surgery was small, 100% reported delays of greater than 4 weeks or did not know how long their care was going to be delayed. There was no difference in length of clinic visit delays among participants with early cancer stage and advanced cancer stage (*P* = 0.59).

Experience With Telehealth

When cancer care was delayed or interrupted, 41% (*n* = 42) were informed that their appointment was rescheduled to a later date, 27% (*n* = 28) were informed that their appointment was canceled indefinitely, 23% (*n* = 24) received a telephone call by their physician, and 17% (*n* = 17) received a video visit with their physician. Of the participants who received a telephone call by their physician to replace their in-person appointment, participants reported a mean satisfaction score of 8 of 10 (with 0 being not satisfied at all and 10 being the most satisfied). Of the participants who received a video visit with their physician, participants reported a mean satisfaction score of 5 of 10 (with 0 being not satisfied at all and 10 being the most satisfied). When participants were asked what they would prefer if their care was delayed in the future, 28.2% (*n* = 88), preferred to switch to a video visit at the time of their original appointment instead of canceling it; 23.4% (*n* = 73) preferred to talk to their oncologist by phone at the time of the original appointment; 13.1% (*n* = 41) preferred to cancel their appointment until it was safe for an in-person appointment; 10.6% (*n* = 33) preferred to wait until their primary oncologist was available for an in-person appointment; 3.5% (*n* = 11) preferred to schedule an in-person appointment with another provided, and, 21.2% (*n* = 66) did not provide a response.

TABLE 1. Baseline Characteristics of the Study Participants (N = 312)

	N (%)
Sex	
Female	177 (56.7)
Male	51 (16.4)
Nonbinary	1 (0.3)
Other	1 (0.3)
Prefer not to answer	1 (0.3)
Missing	81 (26.0)
Age (y)	
25-39	21 (6.7)
40-59	106 (34.0)
60-79	90 (28.8)
80+	9 (2.9)
Missing	86 (27.6)
Race*	
White	183 (58.7)
Black or African American	11 (3.5)
Asian	14 (4.5)
Alaskan Native/American Indian	4 (1.3)
Native Hawaiian/Pacific Islander	1 (0.3)
Multiracial	5 (1.6)
Other	6 (1.9)
Prefer not to answer	5 (1.6)
Missing	83 (26.6)
Ethnicity*	
Hispanic/Latino(a)	24 (7.7)
Not Hispanic Latino(a)	205 (65.7)
Missing	83 (26.6)
Place of residence by United States region	
Northeast	30 (9.6)
Midwest	38 (12.2)
South	67 (21.5)
West	61 (19.5)
Missing	116 (37.2)
Other members in household	
Lives alone	33 (10.6)
1	85 (27.2)
2	48 (15.4)
3	35 (11.2)
4	21 (6.7)
5	7 (2.2)
6 or more	2 (0.7)
Missing	81 (26.0)
Marital status	
Married	158 (50.6)
Divorced	25 (8.0)
Widowed	6 (1.9)
Separated	4 (1.3)
Never married	22 (7.1)
In a relationship, unmarried	15 (4.8)
Missing	82 (26.3)
Highest education completed	
High school or less	35 (11.2)
Bachelor/associate	101 (32.4)
Master's/doctoral/other professional degree	98 (31.4)
Missing	78 (25.0)
Employment status	
Working (full-time, part-time, self-employed)	121 (38.8)
Retired	61 (19.5)
Disabled	37 (11.9)
Unemployed	15 (4.8)
Missing	78 (25.0)
Insurance status†	
Uninsured/cash	13 (4.2)
Insured	221 (70.1)
Private insurance only	123 (39.4)
Public insurance only (Medicaid/Medicare)	44 (14.1)
Other (tricare, other public insurance, none reported)	10 (3.2)

TABLE 1. (continued)

	N (%)
Covered by multiple insurance plans	44 (14.1)
Dual private and public insurance	23 (7.4)
Other dual coverage (private+other) (public+other)	21 (6.7)
Missing	78 (25.0)
Access to digital communication‡	
Smartphone	212 (68.0)
Desktop/laptop	201 (64.4)
Tablet	163 (52.3)
Internet access at home	210 (67.3)
Home telephone	97 (31.1)
Household income	
< 34,999	30 (9.6)
\$35,000-\$49,999	15 (4.8)
\$50,000-\$74,999	38 (12.2)
\$75,000-\$99,999	38 (12.2)
\$100,000-\$149,999	28 (9.0)
\$150,000 or more	37 (11.8)
Prefer not to answer	27 (8.7)
Missing	99 (31.7)
Anatomic site of cancer diagnosis	
Breast	67 (21.5)
Gastrointestinal	58 (18.5)
Genitourinary	19 (6.1)
Hematologic cancers	19 (6.1)
Thoracic	11 (3.5)
Gynecologic	11 (3.5)
Melanoma	9 (2.9)
Brain	4 (1.3)
Head and neck	3 (1.0)
Sarcoma	3 (1.0)
Other	26 (8.3)
Missing	82 (26.3)
Cancer stage at diagnosis	
0	13 (4.2)
1	38 (12.2)
2	41 (13.1)
3	44 (14.1)
4	80 (25.6)
I do not know	20 (6.4)
Missing	76 (24.4)
Treatment	
Receiving active treatment‡	143 (45.8)
Treatment everyday	31 (21.7)
Receiving treatment every 1 wk	18 (12.6)
Receiving treatment every 2 wk	29 (20.3)
Receiving treatment every 3 wk	23 (16.1)
Receiving treatment monthly or more frequently	13 (9.1)
Once	3 (2.1)
Unknown	26 (18.2)
Not receiving active treatment/missing	169 (54.2)

Displays the baseline demographic and clinical characteristics of 312 participants with a history of cancer that completed the survey from April 1, 2020 to August 26, 2020.

*Race and ethnic group were self-reported by patient.

†Multiple select.

‡Treatments included chemotherapy, immunotherapy, hormonal therapy, and radiation therapy.

COVID-19-related Impact on SDOH

Fifty-two percent of participants (n = 162) reported negative impacts of COVID-19 on 1 or more aspects of SDOH; 23% (n = 71) of whom reported negative impact on 2 or more aspects of SDOH. Among all 312 participants, 19.2% (n = 60) reported job loss or reduced wages or work hours, 20.2% (n = 63) reported difficulty accessing health care, 10.6%

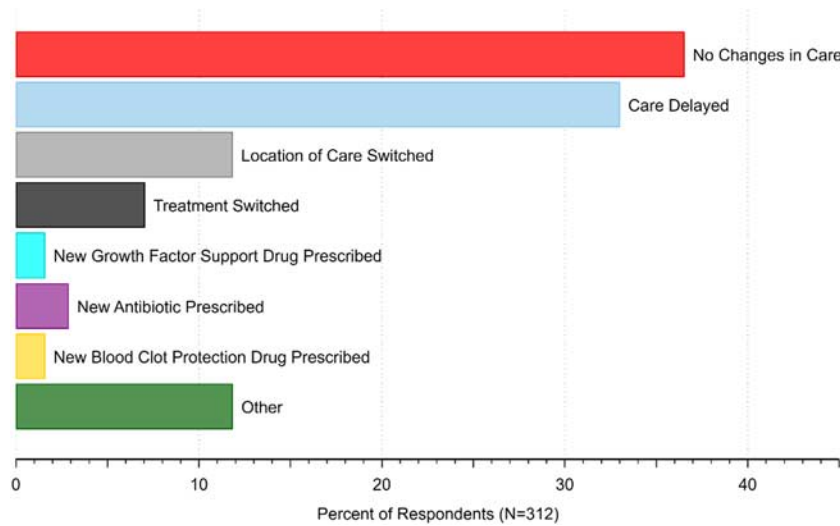


FIGURE 1. The impact of COVID-19 on cancer care, displays the impact of COVID-19 on different aspects of cancer care among a sample of 312 survey participants from April 1, 2020 to August 26, 2020. [full color online](#)

(n=33) reported difficulty obtaining essential medications, 16.7% (n=52) reported difficulty obtaining food, 5.8% (n=18) reported loss of transportation and 4.5% (n=14) reported difficulty obtaining childcare.

Figure 3 displays the frequency of reported difficulties on various aspects of SDOH by cancer stage. There were no reports of difficulties in accessing transportation among participants with earlier cancer stages. Those with advanced cancer stages more frequently reported difficulties in accessing care (30% [n=37/124] vs. 17.4% [n=16/92] $P=0.04$) and medications (16.9% [n=21/124] vs. 7.6% [n=7/92], $P=0.04$) compared with participants with earlier cancer stages. There were no differences in the frequency of participant-reported reduced wages/work hours, job loss, or difficulties getting food or childcare between those with advanced and earlier cancer stages. Those with unknown cancer stage more frequently reported job loss, reduced job wages/work hours, difficulty accessing health care, and difficulty getting transportation compared with participants with known cancer stages (Fig. 3).

COVID-19-related Impact on Emotional and Mental Health

The majority of participants (n=169; 54.1%) reported feeling very concerned or extremely concerned about the COVID-19 pandemic overall. Furthermore, a larger proportion, 60% (n=187), reported feeling very concerned or extremely concerned that the pandemic would affect their cancer care; 100% of whom were overwhelmed by their concerns “often” or “always.” Almost half of participants receiving active cancer treatment (n=68; 47.5%) were very or extremely concerned their cancer treatments put them at a higher risk of contracting COVID-19.

Figure 4 displays the mean level of concern, on a scale of 0 to 10 with 0 representing no concern and 10 representing extreme concern, regarding the impact of COVID-19 on cancer outcomes and SDOH by cancer stage. Those with advanced cancer had higher mean levels of concern regarding their cancer worsening (3.9 vs. 6.0, $P<0.001$), their family getting the virus (7.8 vs. 7.0, $P=0.02$), and fears about personally getting the virus (7.2 vs. 6.0, $P<0.01$) than

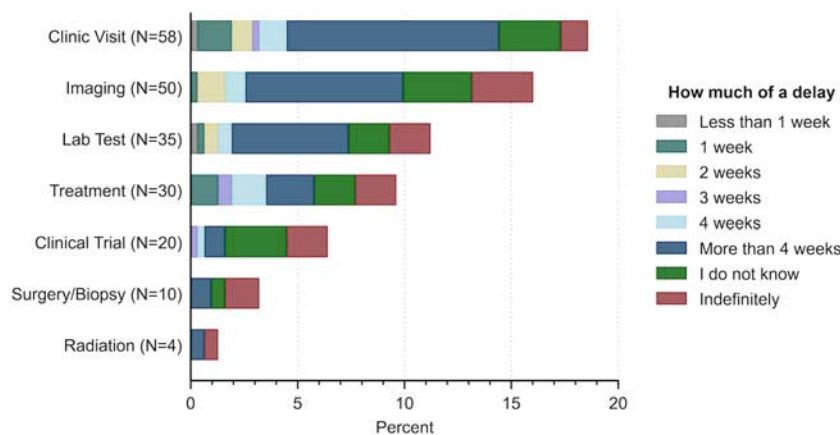


FIGURE 2. Reported delays in cancer care and the associated length of the delays, displays the reported delays in different aspects of cancer care and the associated length of the delays among a sample of 312 survey participants from April 1, 2020 to August 26, 2020. [full color online](#)

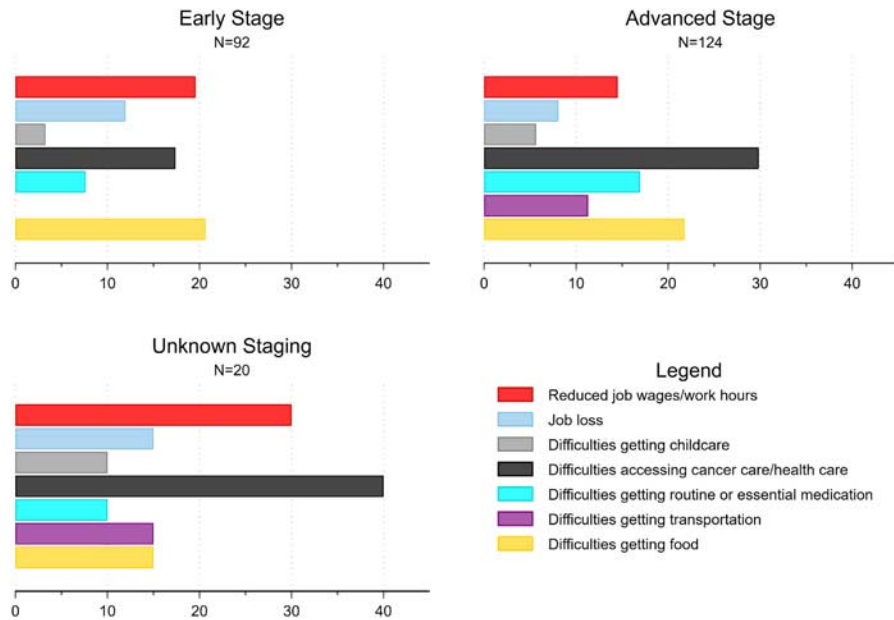


FIGURE 3. Frequency of reported difficulties on various aspects of social determinants of health (SDOH) by cancer stage, displays the frequency of reported difficulties on various aspects of SDOH by cancer stage in percentages (%) among 236 survey participants who reported their cancer stage and negative impacts on SDOH from April 1, 2020 to August 26, 2020. Early stage is defined as stages 1 or 2 and late stage is defined as stages 3 and 4. [full color online](#)

participants with earlier cancer stages. There were no differences in mean concern levels about getting food (3.8 vs. 3.7, $P=0.8$), not being able to work (4.7 vs. 3.9, $P=0.2$), losing housing (1.9 vs. 2.3, $P=0.5$), lack of childcare (1.8 vs. 2.3,

$P=0.4$), being able to pay for childcare (3.7 vs. 4.8, $P=0.1$), financial concerns (5.6 vs. 5.4, $P=0.8$), or that other health conditions would worsen (4.6 vs. 5.4, $P=0.2$) between those with advanced and earlier cancer stages.

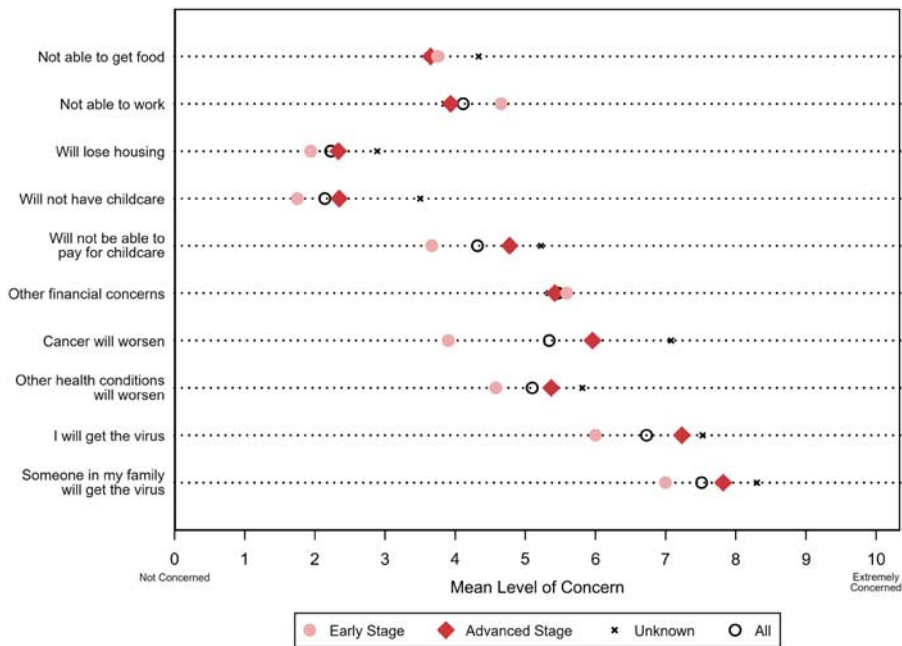


FIGURE 4. Level of concern regarding the impact of COVID-19 on cancer outcomes and social determinants of health by cancer stage, displays the mean level of concern regarding the impact of COVID-19 on cancer outcomes and social determinants of health by cancer stage among 312 survey respondents from April 1, 2020 to August 26, 2020. Early stage is defined as stages 1 or 2 and late stage is defined as stages 3 and 4. Level of concern is measured on a scale of 0 to 10 with 0 representing no concern and 10 representing extreme concern. [full color online](#)

Trusted Sources and Ways to Mitigate COVID-19-related Impact on Patient's Emotional and Mental Health

Approximately 60% of participants reported trusting their doctors as a reputable source for COVID-19-related information. However, the majority of participants ($n = 170$; 54.5%) did not discuss any of their COVID-19-related concerns with their cancer doctors and this varied by cancer stage, with less discussions among participants with earlier cancer stages compared with those with advanced cancer stages ($n = 83/124$; 66.9% vs. $n = 73/92$; 79.3%, $P = 0.04$). Specifically, 38.2% ($n = 65$) of participants who did not discuss their concerns, reported they did not want to bother their doctor; 28.8% ($n = 49$) did not think about discussing their concerns with their doctors.

Nearly half of all of the participants ($n = 135$; 43%) felt they were well-informed about COVID-19; however, 40.7% ($n = 127$) requested tailored information from their doctors regarding their risk of COVID-19 and prevention strategies to help mitigate their concerns regarding the pandemic. The government and news (paper or TV) were considered less trustworthy; 37% ($n = 116$) of participants reported that they trusted the government and 33% ($n = 103$) trusted the news for COVID-19-related information.

DISCUSSION

The COVID-19 pandemic abruptly disrupted access to health care services for many patients with cancer. This study is one of the first to comprehensively assess patient experiences with COVID-19, their specific concerns regarding pandemic-related changes in their cancer care, their emotional and mental health, and on various aspects of SDOH, nationally. In this study, patients experienced greater than 4-week delays in various aspects of cancer care and severe negative impact on various aspects of SDOH, specifically job loss and health care access. Patients also experienced negative impact on their emotional and mental health, noting extreme concerns about infection risk and that modifications in cancer care could severely worsen cancer outcomes and further negatively impact aspects of SDOH.

Consistent with previously reported clinic-based data,¹⁶ our patient-reported results demonstrate substantial delays and cancellations of various aspects of cancer care due to COVID-19. These disruptions mostly affected cancer clinic visits and cancer treatments, consistent with a prior 62-study systematic review that reported clinic visit interruptions for 25% to 60% of patients early in the pandemic.¹⁶ In a previous study of patients with breast cancer in April 2020, a higher proportion of patients (79%) reported delays than our results.¹⁷ This discrepancy may be due to the fact that we collected data on all cancer diagnoses through August 2020 when many clinics had reopened, and telemedicine was more widely available.¹⁸ Interestingly, in this study, participants reported a higher mean satisfaction score (8 of 10) with telephone calls from their physicians to replace their in-person appointment as compared with a video visit (5 of 10); however, a higher proportion of patients preferred to switch to a video visit (28.2%) than a telephone appointment (23.4%) if their care was delayed in the future. Although the reason for this discrepancy is not clear from the results, this finding could be due to technology issues that may have arisen during the video visits. More data is needed to assess this possible concern and to evaluate longitudinal satisfaction with these modalities of cancer care delivery.

Our current findings of universal patient-reported cancer care delays of greater than 4 weeks, regardless of cancer stage,

are longer than those previously reported.¹⁹ Although it remains unknown what impact COVID-19-related delays in cancer care may have on patient outcomes, prior work has demonstrated that delays greater than 4 weeks in receiving adjuvant systemic therapy for colorectal cancer and radiotherapy for head and neck cancer are associated with a 13% and 9% higher risk of cancer-related death, respectively.²⁰ Furthermore, our current patient-reported findings of indefinite postponement of clinical trial enrollment and other interruptions in clinical trial activities are not surprising: prior studies report a 60% decrease in clinical trial initiation during the early pandemic period as compared with prepandemic rates⁷ and a 50% to 80% reduction in clinical trial accrual.¹⁶ While modifications in study protocols and increased use of telemedicine have been implemented to mitigate the impact on clinical trials,²¹ the resulting patient outcomes are yet to be explored.

We observed substantial emotional and mental health impact due to COVID-19 in this study. While the COVID-19 pandemic and consequential social isolation and economic recession have been associated with increased rates of depression and anxiety in the general population,^{22–24} fewer studies have examined the impact on patients with cancer, who have higher risk than the general population of emotional and mental health concerns.^{25,26} Our current findings are consistent with prior work from Asia that demonstrate fear and anxiety regarding COVID-19 infection^{13,14} and a study from the United States that demonstrate increased rates of anxiety, depression, and hopelessness among cancer survivors compared with patients without cancer.¹² Although most participants in this study reported trust in their doctors as a reputable source of information, many did not discuss their concerns with oncologists because they were concerned about burdening them.

Furthermore, in our study, participants with advanced cancer stages reported significantly higher levels of concern that modifications in their care would worsen their cancer when compared with those with earlier stages. These findings are consistent with prior work showing that patients with metastatic disease are more likely to report that COVID-19 negatively affected their cancer care when compared with those with nonmetastatic disease.¹¹ Our findings showing greater concern about COVID-19, including the risk of infection and the impact on cancer care among patients with more advanced cancer stages, may be due to greater rates of baseline anxiety^{9,10} and more frequent contact with the health care system due to frequency of immunosuppressive and other cancer-directed treatments among this population as compared with patients with earlier stages.

Our findings of substantial negative effects of COVID-19 on 1 or more aspects of SDOH are similar to other studies among the general population that show higher rates of patient-reported food insecurity, job loss, and earning reductions after state-mandated stay-at-home orders in the early period of the pandemic.^{27–29} These findings are particularly concerning given the association of SDOH, including lack of employment, transportation or health care access, food insecurity, and low income with worse cancer outcomes.^{30–32} Patients with more advanced stages, in our study, reported greater difficulties in accessing health care and medications. As dependency on caregivers is common among patients with more advanced stages of cancer,³³ these findings may reflect this dependency on caregivers who may have also been affected by stay-at-home orders.

This study has several limitations. First, we distributed the survey online, which was a strength in terms of national reach and speed of response time; however, online delivery may have

biased participant selection, as suggested by respondent demographics that skewed toward white, female, affluent, and educated populations with access to digital communication. Furthermore, while the survey was available in 5 common languages, it was only available in writing and therefore it is possible that participants with limited proficiency and literacy in any of these languages may have been unable to participate. These limitations may have affected the generalizability of our results to other populations with cancer, specifically populations with low socioeconomic status or racial/ethnic minorities whose experience may differ from our survey respondents. Further research is needed given the disproportionate negative and severe impact of COVID-19 on populations with low socioeconomic status and particular racial/ethnic groups, specifically Black populations and Hispanic populations.^{34–36} In addition, we were unable to calculate a response rate. One additional limitation in patient-reported data is misinterpretation of the patient response. For example, patients with in-person clinic appointments that may have been converted to virtual visits could have believed that these changes represented a delay in their care. While we attempted to mitigate this potential concern in patient-reported data by asking follow-up questions to validate their responses, such as exact next steps that occurred when appointments were canceled or delayed, we could not confirm the patient-reported data with electronic health record data regarding treatment and clinic visits delays. Finally, while we were able to obtain completed responses on the impact of COVID-19 in this study, including various aspects of SDOH, the small sample size and missing data on some variables limited statistical power for analyses by specific sociodemographic and clinical factors, which may account for some of the study findings.

The COVID-19 pandemic substantially disrupted the care and the well-being of patients with cancer. Patients with cancer report concerns, specifically regarding infection risk, treatment changes and the effect of these changes on cancer outcomes, and SDOH which are more pronounced among patients with more advanced stages of disease. Developing and implementing effective interventions to mitigate the impact of COVID-19 on patients with cancer are critical priorities for future research.

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