Leveraging Social Determinants of Health to Reduce Hospital Length of Stay: A Pilot QI Project for Solid Tumor Oncology Patients During the COVID-19 Pandemic

Sailaja Kamaraju, MD, MS; David Atkinson, MBA; Tamiah Wright, DNP, RN, APNP, AGCNS-BC; John Charlson, MD; Thomas Wetzel, MS; Grace Campbell, PhD, MSW, CRRN; Jennifer Cadman, RN; Joni Williams, MD, MPH; Leonard Egede, MD, MS; Janet Retseck, MD; Anjishnu Banerjee, PhD; Valarie Ehrlich, PA-C; Melinda Stolley, PhD; Steve Power, MBA

ABSTRACT

Introduction: The impact of the social determinants of health (SDOH) on hospitalized cancer patients and hospital length of stay is unknown. At our institution, a hospital-wide SDOH survey that examined patient-specific barriers to various domains of SDOH and facilitated hospital discharge was integrated into the electronic medical record. This study reports the effect of the SDOH survey on length of stay for oncology patients and the outpatient referrals generated to facilitate the discharge.

Methods: We examined length of stay index data on inpatient oncology patients and 2 comparator services (bone marrow transplant, internal medicine). We evaluated the length of stay using a 2-sample *t* test, and the rate of referrals per discharge using a 2-sample Poisson test.

Results: Compared to the baseline length of stay, after the launch of the SDOH survey, there was a significant (8.9%) decrease in the average length of stay for oncology patients (8.14 to 7.41 days, $P = 0.004$), the LOS decrease for the bone marrow transplant was a nonsignificant trend only ($P > 0.1$). Average referrals per discharge increased from baseline 1.063 per discharge to 1.159 after implementation ($P = 0.004$), and the mean values increased by 9%.

Conclusions: The SDOH survey tool assisted in a timely examination of patient-specific barriers to discharge, leveraged care coordination, and facilitated a safe hospital discharge. Such efforts increase the efficiency of health care service delivery in response to public health threats, such as the COVID-19 pandemic.

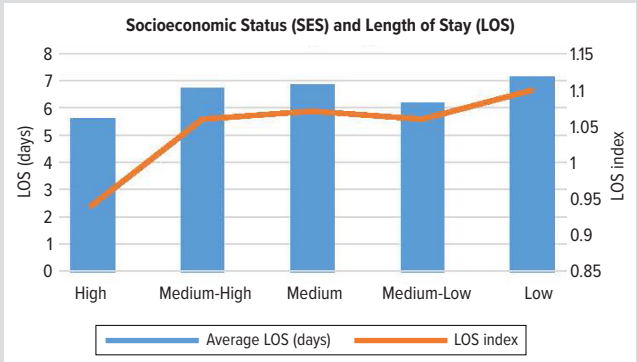
INTRODUCTION

Cancer treatment and the disease course can be complex and, for acute illness, hospitalizations are inevitable.[1] For hospitalized cancer patients, the length of stay (LOS) is dependent on the intricacies of tumor type, treatments, and preexisting comorbidities, as well as patients' barriers associated with socioeconomic determinants.[2-12] Given the economic burden of extended hospital LOS, health systems use multiple initiatives and multidisciplinary strategies for a safe discharge process.[10,13,14] For example, barriers related to various domains of social determinants of health (SDOH), such as sociodemographic factors (transportation needs, food, and housing insecurities), behavioral factors (tobacco, alcohol use, and physical activity), and others (social connections, intimate partner violence, and mental health issues), are prevalent among socioeconomically challenged populations.[8-10,15-17] Patients with housing insecurities related to a lack of a permanent place to live or unsafe home situations and migrating populations with transient living environments lead to difficulty establishing routine health care and long-term relationships with their medical providers.[18-20] Furthermore, patients with these barriers face impediments across the health care continuum: preventive care, cancer screening, advanced disease at presentation, and treatment delays leading to emergency department visits.[21,22] Additionally, the sociodemographic barriers also lead to a lack of routine checkups for diseases such as cancer, leading to unplanned/pro-

Author Affiliations: Author Affiliations: Medical College of Wisconsin, Milwaukee, Wisconsin (Kamaraju, Charlson, Williams, Egede, Retseck, Banerjee, Ehrlich, Stolley); Froedtert Hospital, Milwaukee, Wisconsin (Atkinson, Wright, Wetzel, Cadman); Duquesne University, Pittsburgh, Pennsylvania (Campbell); Duke Cancer Institute, Duke University Hospital, Durham, North Carolina (Power).

Corresponding Author: Sailaja Kamaraju, MD, MS, Medical College of Wisconsin, Cancer Center, 4th Fl Administrative Offices, 9200 W Wisconsin Ave, Milwaukee, WI 53226; email skamaraju@mcw.edu; ORCID ID 0000-0003-3031-9269

Figure 1. Baseline Needs Assessment Data of Hospital Length of Stay During the Needs Assessment: Pre-intervention Phase



longed hospitalizations and readmissions due to the complexity of the illness.[23-26]

In current practice, health systems have several strategies in place for hospitalized patients as needed, but care-delivery models integrating the SDOH evaluation into routine clinical practice are lacking. Integrating SDOH may help develop a standardized approach to care delivery for hospitalized patients and facilitate timely hospital discharge.

High rates of poverty are reported in several neighborhoods in Milwaukee, Wisconsin.[27] Beyer et al reported race-based housing discrimination, racial disparities, and inferior survival outcomes for colorectal, lung, and breast cancer patients among the underserved communities versus their White counterparts in southeastern Wisconsin.[28,29] Throughout the United States during the COVID-19 pandemic, unexpectedly higher hospitalization rates also were reported among Hispanic and Black individuals, and higher death rates were reported among American Indians.[30,31] At the same time, health systems factors, such as decreased workforce capacity, shortage of accepting facilities (eg, nursing homes), and patient-level barriers related to housing insecurities and transportation inadequacies, contributed to prolonged LOS.[32]

We conducted a quality improvement (QI) project under the auspices of the American Society of Clinical Oncology's (ASCO) Quality Training Program (QTP) to examine and address the LOS for inpatients admitted to oncology units. To help characterize the LOS and the associated socioeconomic determinants of oncology patients, we conducted a retrospective needs assessment at the Medical College of Wisconsin Cancer Center in Milwaukee, Wisconsin. First, we examined the hospital LOS for patients admitted to oncology units during the first through fourth quarters of 2018-2019. Our results demonstrated an inverse relationship between LOS and income compared to all other patient demographic factors. Based on our preliminary data, we initially planned to implement the QI initiative dedicated to cancer patients from the low socioeconomic status (SES) communities to address the LOS and the associated sociodemographic barriers during the ASCO-QTP.[33] However, during the pandemic, we observed an overwhelming volume of discharge planning required for most hospitalized patients, regardless of the presence or absence of cancer and the type of medical illness at admission. To facilitate discharge planning at our institution, a hospital-wide SDOH screen was integrated into the electronic medical record (EMR), which surveyed patients' SDOH across 11 domains within 24 hours of admission and identified the barriers that required care coordination for a timely discharge. For this project, we were interested in examining the impact of the SDOH survey among patients admitted to oncology units and the appropriate referrals generated to facilitate hospital discharge. We hypothesized that examining oncology patients' sociodemographic domain based on their SDOH survey at admission would enable the care team to address patient-specific barriers, ultimately reducing overall LOS.

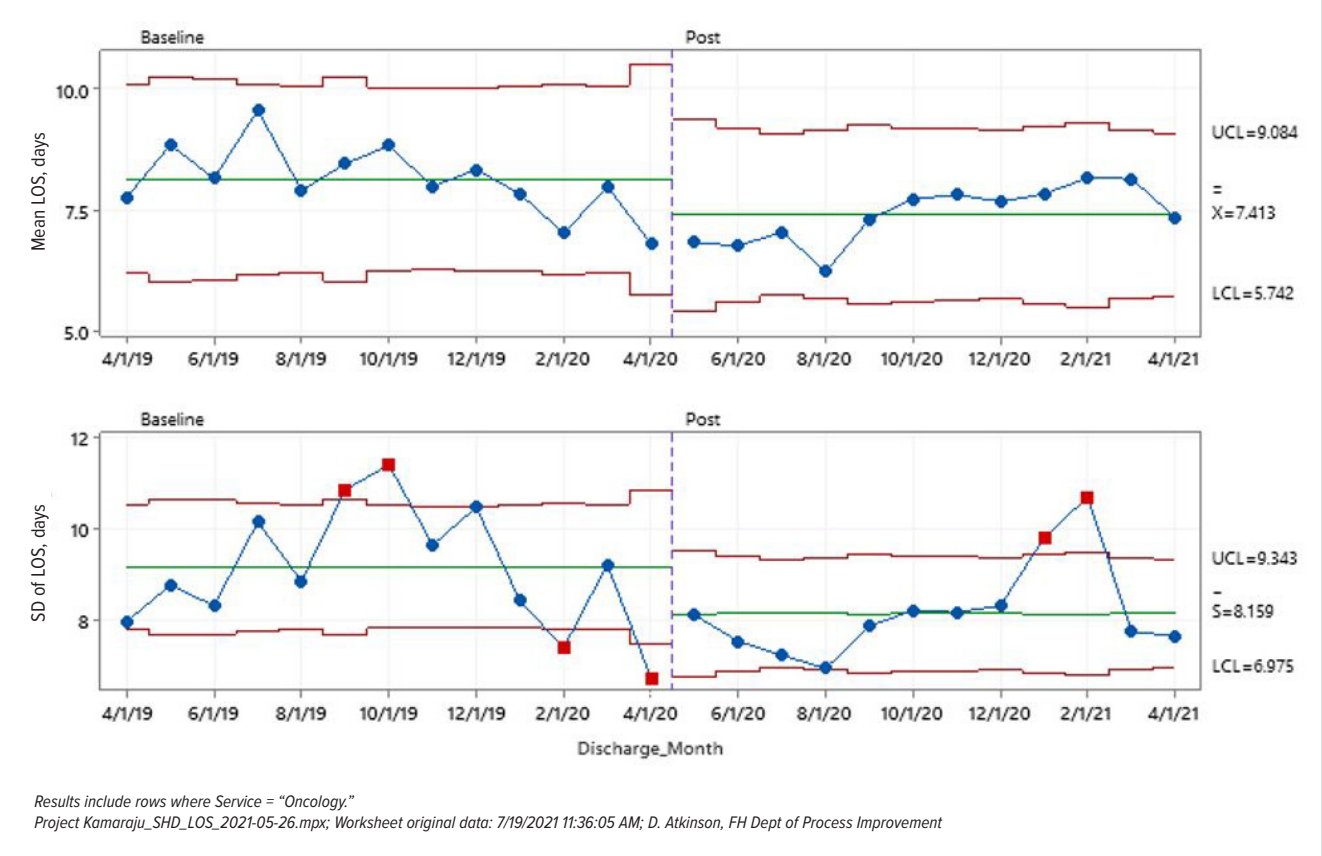
METHODS

Study Approach

In the planning phase of the QI initiative, we retrospectively analyzed the observed LOS using 1848 deidentified records of inpatient oncology patients from the first through the fourth quarters of 2018-2019. Eligibility criteria included age 18 and older and a solid tumor diagnosis at admission. Patients with a remote cancer diagnosis who were admitted to other hospital units and hospice were excluded. Our needs assessment determined SES by patient income and percent with bachelor's degrees, when available. Otherwise, SES was based on ZIP code and census tract data and categorized in groups as low, medium-low, medium, medium-high, and high income. Our patient cohort included residents of Milwaukee and outside Milwaukee County. Insurance payer types included Medicaid, Medicare, managed care, and others (self-pay/unknown). Using Vizient's 2019 academic medical centers risk model, we obtained the LOS data from the Vizient Clinical Data Base for each encounter.[34] We collaborated with inpatient and outpatient clinicians and developed a process map that examined patient flow, care plan, discharge planning, patient-specific barriers, and patient readiness for discharge. The study qualified as exempt from full institutional review board review.

During the subsequent phases of the QI initiative, we collaborated with inpatient teams during the hospital-wide implementation of a validated SDOH screening survey. The survey examined 11 specific domains of hospitalized patients, including sociodemographic factors (financial, food, housing insecurities, stress, transportation), behavioral factors (alcohol, tobacco use, physical activity), and other risks (intimate partner violence, social connections, depression)[16,17,35-38] (Appendix, Figures 1 and 2). The inpatient team's case managers provided formal training on the SDOH screening tool to hospital social workers, who then coordinated with patients to complete a 1-time SDOH survey within 24 hours of hospitalization and repeated once every 6 months (Appendix, Figures 1 and 2). Based on the survey results,

Figure 2. Flow Chart for Inpatient Hospital Length of Stay (LOS) for Oncology Demonstrating an Improvement After the Launch of Social Determinants of Health Screen (Plan-Do-Study-Act Do and Study Phase)



Results include rows where Service = "Oncology."
Project Kamaraju_SHD_LOS_2021-05-26.mpx; Worksheet original data: 7/19/2021 11:36:05 AM; D. Atkinson, FH Dept of Process Improvement

Abbreviations: UCL, upper confidence limit; LCL, lower confidence limit.
Significance level of 0.05.

the inpatient case manager team identified patient-specific social risks and barriers across all the SDOH domains and generated appropriate outpatient referrals in collaboration with the inpatient clinicians.

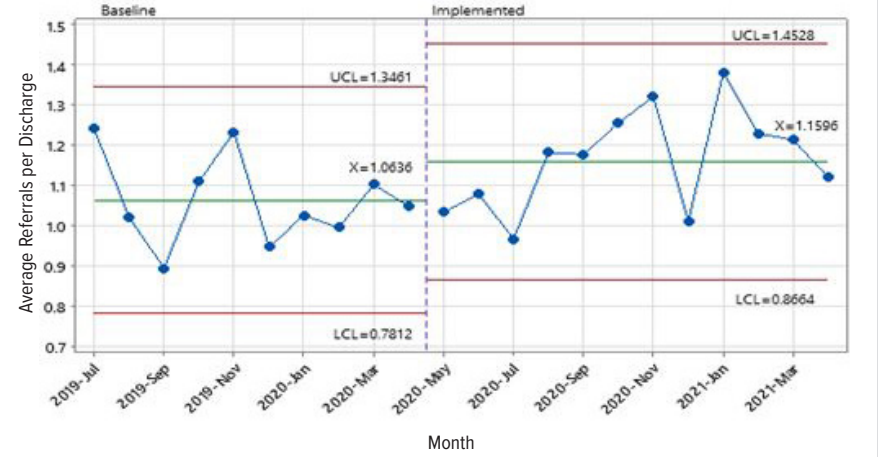
Patients who reported intimate partner violence were given informal and formal debriefing sessions with case managers/social workers and referred to counselors and behavioral health experts when appropriate.[39] For patients with food insecurities, referrals to the local shared food programs (IMPACT 211) were provided.[40] The IMPACT 211 program offers central access for people who need assistance during a crisis, community disaster, or for those regaining stability.[40] We partnered with the Milwaukee Health Care Partnership (MHCP) program for patients needing housing assistance. Established in 2007, this program is a public consortium dedicated to improving health care for low-income and underserved populations in Milwaukee County.[41] MHCP's initiatives serve clients with housing insecurities—either as fee for service or overnight shelter accommodations—and collaborate with Milwaukee Rescue Mission and Repairs of the Breach, a nonprofit organization that provides daytime refuge and resources for homeless adults.[41,42] Other partnerships with community advocates were used for rental assistance.[43] Additional referrals that facilitated a safe discharge included a home health nurse, home physical therapy, dietician, and medication management. Social workers and case managers who assisted during this project were employed and salaried by Froedtert Hospital, and no additional payments were made. Our prospective study cohort included patients 18 years and older with a solid tumor diagnosis hospitalized in oncology wards from May 1, 2020, through April 30, 2021.

We then compared the LOS and referrals data before the implementation of the SDOH survey (October 1, 2019 – April 29, 2020) to the period following implementation (May 1, 2020 – April 30, 2021). Finally, to further evaluate the differences in LOS across non-solid tumor comparators, we examined the LOS separately for bone marrow transplant and general internal medicine wards.

Study Outcomes

The primary and secondary outcomes included the difference in the mean observed hospital LOS and the number of referrals generated, respectively. Mean observed LOS was defined by subtract-

Figure 3. Average Number of Referrals for Inpatient Oncology Patients



Abbreviations: UCL, upper confidence limit; LCL, lower confidence limit.
The number of referrals per oncology discharge—baseline and postlaunch—was evaluated using a 2-sample Poisson test. Referrals increased from baseline by 0.0959977 (9.03%) with a 95% CI (0.0307458–0.161250) and *P* value = 0.004.

ing the date of admission from the date of discharge. The length of stay index (LOSi) is calculated by dividing the observed LOS by the expected LOS values obtained from the Vizient Clinical Data Base.[34]

Statistical Analysis

A monthly Xbar-S Statistical Process Control Chart was used to visualize the LOS for the oncology service during the baseline period and after launching the SDOH tool.

Hypothesis testing using a 2-sample *t* test was performed to compare the mean LOS baseline and post-launch for each comparator service (bone marrow transplant and internal medicine) to identify statistically significant differences. Average referrals per discharge were plotted on a monthly run chart; a 2-sample Poisson test was then used to compare the baseline and post-launch rates. All statistical analysis was performed using Minitab 19.2020 software (Minitab, LLC).

RESULTS

We retrospectively examined 1848 oncology patient records as a needs assessment (Figure 1). The cohort was reflective of a tertiary academic center serving southeastern Wisconsin. The study sample was predominantly White (81.7%), with Black (13.1%), Hispanic (2.3%), and other races (2.8%) comprising the remainder of the sample. Twenty-three percent lived in rural areas. Health insurance types included Medicare (49.2%), Medicaid (6.9%), and commercial insurance (41%). Additionally, 2.9% were uninsured. Oncology patients from the low SES groups had an average LOS of 7.2 days compared to 5.6 days for the high SES group (Figure 1).

We then prospectively examined the effect of the SDOH survey launch on patients' LOS. Figure 2 describes the differences in the LOS before versus after the survey integration. Compared to the baseline LOS, after the launch of the SDOH survey, there was an 8.9% decrease in the inpatient average LOS for oncology patients (8.14 to 7.41 days, $P = 0.004$), with a nonsignificant trend for the comparator groups (6.6% for bone marrow transplant [15.27 days to 14.26, $P = 0.166$] and 7.5% for internal medicine [4.87 to 4.50 to days, $P = 0.131$]) (Figure 2).

After implementation of the SDOH initiative, the average number of referrals per discharge increased from a baseline of 1.063 to 1.159. The mean values increased by 9.0% ($P = 0.004$) (Figure 3). Appropriate discharge referrals included radiation, psychiatry, pharmacy for medication management, wound care, nutrition, physical therapy, and palliative care. Other referrals included home health nurse (19.6%) and durable medical equipment referrals for canes/walkers and other supplies (11%). Health insurance coverage of postdischarge billable referrals depended upon their insurance payer type, and patients were notified of this information in advance; additional resources were provided for those who were denied reimbursements. For patients with transportation barriers, cab vouchers and bus tickets were provided. Social workers provided specific transportation resources and pertinent information for Medicaid participants. Behavioral health concerns related to social networks or depression, smoking, alcohol use, and physical activity were addressed mostly by physicians caring for the patients. Patients who reported intimate partner violence on the SDOH survey and agreed to share their personal stories received a social/safety assessment and a confidential interview by our social workers/case managers. The assessment included safety at home and dependents' welfare. If appropriate and a patient expressed interest, the social workers provided additional resources to file a case with local law enforcement officials.

DISCUSSION

This prospective study shows a small but significant improvement in the LOS for oncology patients after integrating the SDOH survey at hospital admission. To our knowledge, this is the first study that prospectively evaluated the impact of the SDOH on routine inpatient care. At this time, the SDOH screening is integrated and documented permanently on inpatients' EMR, and we plan to expand this tool from hospital-wide to system-wide. The SDOH screen has been an essential first step for our case managers and social workers, enabling them to recognize patient-specific needs and subsequently coordinate local resources.

Although most health care systems collaborate with local community organizations to assist patients with high-risk sociodemographic challenges, referrals are only generated as needed before hospital discharge. However, during this project, the integration of the SDOH survey into the EMR at the time of admission streamlined the approach, assisting some of the most vulnerable patients who otherwise may have had additional delays in addressing barriers to discharge. For example, in Wisconsin, the number of domestic violence cases rose during the pandemic in 2020; based on the SDOH tool results, our social workers promptly generated interventions with appropriate referrals to local violence prevention programs.[37,39,44] Additional resources included collaboration with Sojourner, the largest provider of domestic violence prevention and intervention services in Wisconsin.[44] For patients with housing and food insecurities, partnerships with local organizations in Milwaukee County (MHCP, Community Advocates, Milwaukee Rescue Mission, and IMPACT 211) offered food vouchers, food pantry lists, and food share programs for mothers of young children through the Women, Infants, and Children (WIC) program.[40-43,45] Through state funding mechanisms, MHCP and the Community Advocates programs assisted with rental payments, which was highly helpful in preventing eviction. Even for patients without specific transportation or food/housing barriers, the SDOH survey triggered automated alerts on the EMR for other needs, such as family counseling while adjusting to the new cancer diagnosis and caregiver counseling.

In Wisconsin during the pandemic, widened disparities became more evident and created financial strain on health systems, highlighting the need for multidisciplinary interventions and care-delivery models that address patient-specific needs and barriers based on their SDOH.[34-36] Several health care systems encountered discharge delays due to a limited number of accepting facilities, such as nursing homes and rehabilitation facilities, and workforce shortages in outpatient settings (ie, home health services); at our institution, we also encountered other barriers related to high-risk sociodemographic factors.[20,37-39] And although our study planning started prior to the pandemic, we believe that capturing some of the SDOH needs is becoming even more relevant throughout the pandemic to provide patient-specific care delivery in a multidimensional approach.

While it is well known that LOS is complex and heavily dependent on acute illness and multilevel factors, leading to varied outcomes across different health systems and geographic locations,[12,30,31] a few studies explored SDOH on LOS and readmission rates. In a retrospective analysis of hospital LOS after trauma injury, Brasel et al found that prolonged LOS was associated with multiple factors: Medicaid use, discharge to nursing homes, rehabilitation facilities, and patients' sociodemographic factors.[46] A few investigators explored specific SDOH-related factors, such as SES and neighborhood household income in low-resource settings, and the impact on hospital readmission rates.[31,32] Zhang et al evaluated hospital 30-day readmission rates by incorporating SDOH information. Although the addition of the SDOH score failed to improve the readmission rates among all patients, Medicaid beneficiaries, patients 65 and older, and obese patients saw improvements in hospital readmission rates.[47] Investigators acknowledged that readmission rates depended on socioeconomic determinants in their retrospective studies, but these are not specific to oncology units or based on all the domains of an individual's SDOH.[12,31] Although readmission rates are not reported in this manuscript, based on our ongoing work, we conclude that SDOH-guided coordination also has potential implications for LOS, readmission, and optimal transition plans to outpatient medical follow-up appointments for cancer patients.[33-35]

Our study results are unique. Prospective evaluation of SDOH screening at the time of inpatient admission for oncology patients at a regional medical center in southeastern Wisconsin will lay a strong foundation for personalized and patient-specific care-delivery studies in the near future. While the SDOH survey may not be a tool to address all hospital outcomes, it is beneficial for accomplishing long-term, cost-effective strategies, such as transitioning to the outpatient setting. Additionally, as part of this QI initiative, our inpatient clinicians and case managers have been able to set up a protocol for home health and other skilled services in the outpatient setting during the pandemic, in keeping with COVID-19 guidelines and the facilities' policies. Finally, our social workers collaborated with multiple local organizations based on patients' sociodemographic needs as reported on the SDOH survey.

Most of our inpatient social workers and case managers received training to implement the SDOH tool, which is time-consuming (approximately 30 minutes per patient), suggesting the need for additional resources, including staffing and novel health care technologies. While we acknowledge the limitations of this being a single-institution study with a 1-year follow-up, the integration of the SDOH survey was timely in addressing health inequities during the pandemic. Further, a 1-time evaluation of the SDOH survey may have its limitations among populations with transient living situations, such as migrant workers or those with relocations due to changes in employment and or health care insurance coverage. The reasons for the overall increase in the outpatient referral patterns, including routine referrals (ie, radiation, medical, psychiatry), are unclear; however, we believe they are intended to encourage outpatient care during the pandemic and avoid extended LOS for patients ready for discharge and willing to follow up on an outpatient basis. Although beyond the scope of this study, we plan to evaluate the hospital readmission rates, emergency department use, health-related quality of life surveys, changes in the outpatient referral

patterns after the intervention, and feedback from patients and our case manager team. Ultimately, if successful in saving clinicians' time and cost-effectiveness, we anticipate the sustainability of the SDOH survey.

CONCLUSIONS

This study explored hospital LOS for oncology patients and the effect of integrating a SDOH survey on hospital discharge. Implementation of the SDOH survey at hospital admission demonstrated a small but significant improvement in LOS and generated appropriate referrals. Health care systems may benefit from developing SDOH-guided care-delivery models and, ultimately, improve patient care. Such efforts increase the efficiency of health care service delivery in response to public health threats, such as the COVID-19 pandemic.

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Appendix: Available at wmjonline.org.

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