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# The Impact of Social Determinants of Health on Cancer Care: A Survey of Community Oncologists

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The Impact of Social Determinants of Health on Cancer Care: A Survey of Community Oncologists

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Abstract

Objective: Cancer survival rates have improved over the past few decades, yet socioeconomic disparities persist. Social determinants of health (SDOH) have consistently been shown to correlate with health outcomes. The objective of this study was to characterize oncologists’ perceptions of the impact of SDOH on their patients, and their opinions on how these effects could be remediated.

Design: Cross-sectional survey of physicians

Setting: Web-based survey completed prior to live meetings held between February and April 2020

Participants: Oncologists/hematologists from across the United States

Exposure: Clinical practice in a community-based or hospital-based setting

Main outcome and measure: Physician responses regarding how SDOH affected their patients, which factors represented the most significant barriers to optimal health outcomes, and how the impact of SDOH could be mitigated through assistance programs.

Results: Of the 165 physicians who completed the survey, 93% agreed that SDOH had a significant impact on their patients’ health outcomes. Financial security/lack of insurance and access to transportation were identified most often as the greatest barriers for their patients (83% and 58%, respectively). Eighty-one percent of physicians indicated that they had limited time to spend assisting patients with social needs, and 76% reported that assistance programs were not readily accessible. Government organizations, hospitals, non-profit organizations and commercial payers were selected by 50% or more of oncologists surveyed as who should be responsible for delivering assistance programs to patients with social needs; 42% indicated that pharmaceutical manufacturers should also be responsible.
Conclusion: Our survey found that most oncologists were aware of the impact of SDOH on their patients but were constrained in their time to assist patients with social needs. The physicians in our study identified a need for more accessible assistance programs, and greater involvement from all stakeholders in addressing SDOH to improve health outcomes.
Strengths and Limitations of This Study

- This study exploring the perspectives of oncologists from community practices across the United States on social determinants of health is the first of its kind.

- The participating physicians represented a large sample with broad geographic distribution, but the results may not be generalizable to all oncology practices within the United States.

- The survey relied on the physicians’ views of the impact of social determinants of health on their patients, however the physicians may not have had a complete picture of their patients’ circumstances, and views may be subjective.
Introduction

Social determinants of health (SDOH), defined by the World Health Organization as “the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life”, have garnered increased attention in recent years as evidence linking SDOH to health outcomes grows. Although there is no universally accepted consensus on the specific factors comprising SDOH, examples include economic stability (eg, poverty, food insufficiency or housing instability), education, social support, health insurance status, and access to transportation. Research indicates that clinical care accounts for less than 20% of health outcomes in the United States (US), with socioeconomic factors, health behaviors, and the physical environment contributing greater influence on outcomes. These findings provide further evidence that most of what impacts health occurs outside the walls of a clinic or hospital, and underscore the need for interventions targeting social and economic conditions to meaningfully improve health outcomes. Although healthcare expenditures in the US surpass those of other developed nations, healthcare outcomes do not reflect the increased investment.

Payers and health care systems have increasingly looked to addressing SDOH as a means to resolve this discrepancy and reduce healthcare costs. The impact of SDOH is particularly relevant to patients with cancer, as cancer is one of the costliest diseases to treat (second only to heart disease). Patients who reside in zip codes with lower socioeconomic status have lower rates of cancer screening, and are more often diagnosed with cancer at a later stage of disease. Further, patients with cancer living in areas of greater deprivation experience a higher incidence of rehospitalization and mortality. Financial hardship associated with cancer treatment is well-documented, and disproportionately affects patients with lower educational attainment, lower family income, and those who are uninsured.
Rising costs of cancer care and therapies, coupled with the prevalence of cancer (in 2020 there are an estimated 18.1 million cancer survivors in the US, and 1.8 million patients will be diagnosed with cancer this year), put a growing number of cancer patients at risk.\textsuperscript{13,14} As value-based care models shift more accountability to healthcare providers with respect to quality of care, cost containment, and improvements in outcomes, awareness of the impact of SDOH on patients has emerged as an essential element of care. For example, as a component of the Oncology Care Model (OCM)’s comprehensive, coordinated cancer care, each patient in participating practices must have a documented care plan that includes estimating out-of-pocket costs and addressing health-related social needs.\textsuperscript{15} The objective of this study was to gain insight into practicing oncologists’ views on SDOH and interventions to alleviate negative effects of SDOH. In this paper, we present the results of surveys completed by oncologists regarding their perceptions of the impact of SDOH on their patients, and their opinions on potential solutions to mitigate the SDOH burden.

**Methods**

Physicians in the Cardinal Health Oncology Provider Extended Network (a community of over 7000 medical oncologists or hematologists, practicing in a community-based or hospital-based setting in the US) were invited to participate in a series of live market research meetings held between February and April 2020. To be eligible, physicians must be actively practicing, must represent practices with a broad geographic distribution across the US, and could not have participated in another live meeting in the preceding 9 months. Participants received an honorarium for their participation. In a pre-meeting survey, the physicians were asked a series of multiple-choice (single select, modified Likert, and multi-select) questions regarding their
perceptions of the impact of SDOH on their patients, and their opinions on how the effects of
SDOH should be mitigated. Participants submitted their responses via a web-based survey.
Responses were summarized using descriptive statistics. This study was exempt from
institutional review board review.

Results
A total of 165 physicians were invited to participate and responded to the survey. The primary
medical specialty reported was medical oncology for 33% of respondents, hematology oncology
for 65%, and other for 2%. The physicians saw a median of 20 patients per day, and the median
number of years in practice for the respondents was 18. The regional location of their primary
practice was reported as the South for 44% of respondents, the Midwest for 21%, the West for
8%, and the Northeast for 27%. Of the 165 practices represented, 68 (41%) were participating in
the OCM value-based care model.
The majority of oncologists surveyed agreed that SDOH, including financial security, food
security, social isolation, housing security, addiction, access to transportation, and patient health
literacy, had a significant impact on their patients’ ability to achieve an optimal health outcome
(51% selected the response strongly agree; 42% agree; 7% neither agree nor disagree; 1%
disagree; 0% strongly disagree). As shown in Figure 1a, most of the participating oncologists
said at least half of their patients were negatively impacted by SDOH (4% chose the response all
or nearly all; 24% most; 40% about half; 32% few; 0% none).
The SDOH that were the most significant barriers for the patients of the oncologists surveyed are
presented in Figure 1b. Financial security/lack of health insurance was the response selected
most often (83%), followed by access to transportation (58%), health literacy (53%), social
isolation (43%), housing security (18%), addiction (12%) and food security (7%). Accordingly, the top 2 types of assistance oncologists indicated would have the greatest impact on helping their patients achieve better outcomes were assistance with the cost of medicine (79%) and assistance with transportation to clinic/physician office (57%).

When asked how often they and their staff talked to patients affected by SDOH about how these factors may be interfering with their care, 18% of oncologists surveyed selected “all the time”, while 51% selected “often”, 29% “occasionally”, 2% “rarely” and 0% “never” (Figure 2). The majority of oncologists indicated that they and their staff were constrained in the amount of time they could spend assisting patients with social needs, with 34% responding that they strongly agree, 47% agree, 14% neither agree nor disagree, 5% disagree, and 0% strongly disagree.

Most oncologists agreed that assistance programs to help patients with social needs were not readily accessible: 20% chose the response strongly agree, 56% agree, 16% neither agree nor disagree, 7% disagree, and 1% strongly disagree. When asked who should have responsibility for delivering assistance programs to patients, 50% or more of oncologists surveyed indicated that government organizations, hospitals/cancer centers, non-profit organizations and commercial payers/insurance companies all should be responsible; fewer than half (42%) indicated that responsibility should fall to pharmaceutical manufacturers (Figure 3a). Only 2% of surveyed oncologists believed that pharmaceutical companies should not be involved in the social needs of patients; most agreed that manufacturers can play a role in supporting the social needs of patients by offering more copay assistance programs, patient assistance programs/free drug programs, or patient education programs (Figure 3b).

To assess the impact of OCM participation, we explored potential differences in the perception of the contributions of SDOH upon patient outcomes among oncologists from OCM and non-
OCM practices. Only a few differences were noted to be statistically significant: oncologists from non-OCM practices identified food security as a barrier to optimal outcomes more often than those from OCM practices (59% vs. 43%, p= 0.04). Twice as many oncologists from OCM practices identified housing security as a barrier compared to non-OCM participants (25% vs. 12% p= 0.04). A greater proportion of OCM participants favored that hospitals and cancer centers should play a greater role in patient assistance programs (59% vs. 43% p<0.05).

Discussion

In this survey of 165 practicing oncologists in the US, 93% agreed that SDOH impacted their patients’ ability to achieve optimal health outcomes. Two thirds of the oncologists in our study estimated that half or more of their patients were impacted by SDOH, with financial security and access to transportation representing the most significant barriers. Nearly 70% of oncologists reported talking to their patients about how SDOH affected their care often or all the time, although most reported that they had limited time available to help patients with their social needs. Three quarters of oncologists surveyed thought that assistance programs were not readily accessible. Most of the respondents indicated that the responsibility for providing assistance to patients with social needs fell to government organizations, hospitals, non-profit organizations and commercial payers, although pharmaceutical companies could provide support through copay assistance, free drug programs or patient education. We did not find dramatic differences in the perceptions of oncologists from OCM and non-OCM practices.

Across the broader medical community, the recognition of the importance of identifying patients at risk for poor outcomes due to SDOH is reflected in the issuance of policy statements related to screening by professional societies such as the American Academy of Family Physicians, the American Academy of Pediatrics, and the American College of Obstetricians and
Similarly, the American Cancer Society has published a framework for addressing SDOH, which includes recommendations for screening, to further cancer health equity. In addition, the Centers for Medicare & Medicaid Services (CMS)'s Accountable Health Community model implements screening for health-related social needs among Medicare and Medicaid beneficiaries receiving healthcare at participating sites. However, despite these recommendations, how often screening for SDOH occurs in clinical practice has not been well described. A study of 739 hospitals and 2190 physician practices in the US found that only 24.4% of hospitals and 15.6% of physician practices screened patients for the 5 specific social needs outlined in the CMS Accountable Health Communities Model (food insecurity, housing instability, utility needs, transportation needs, and interpersonal violence). For those that didn’t screen for any of the 5, the most common barriers cited were lack of time and financial resources.

To alleviate the burden of screening, several strategies have been undertaken to better capture SDOH within electronic health records (EHRs). The American Medical Association in collaboration with UnitedHealthcare is working to create 23 new ICD-10 codes related to SDOH, including access to nutritious food, adequate and safe housing, available transportation, financial ability to pay for medications and utilities, and caregiver needs. The use of artificial intelligence (AI) also figures prominently into efforts to improve identification of SDOH for patients: natural language processing of the unstructured notes in EHRs has been shown to identify greater prevalence of tobacco use, alcohol abuse, drug abuse, depression, housing instability, fall risk, and poor social support than could be identified through administrative data. Health systems such as Mount Sinai have adopted AI solutions to pull data from unstructured notes to help identify patients at risk. Other health systems are using AI
technology that integrates clinical factors from the EHR with socioeconomic factors to flag patients at risk for readmission.\textsuperscript{25,26} Decision models incorporating clinical EHR data and community-level SDOH data have demonstrated the ability to predict the need for social service referrals.\textsuperscript{27} Applied machine learning using SDOH data alone has also been shown to accurately predict emergency department visits or hospital admissions.\textsuperscript{28} Finally, in a recent pilot study, an AI decision tool that incorporated SDOH helped patients with cancer receive timely palliative care, by identifying those who were at risk for short-term mortality.\textsuperscript{29}

The physicians in our study viewed the responsibility for assisting patients with social needs as belonging to government organizations, non-profit organizations, pharmaceutical companies, hospitals and commercial payers. In the past decade, these entities have made important strides towards mitigating the impact of SDOH on clinical outcomes through policy changes, commitments for community programs, and initiatives to support individual patients, that go beyond screening. The Affordable Care Act, enacted in 2010, requires tax-exempt hospitals to conduct community health needs assessments every 3 years and to create an implementation strategy to improve health at the community level.\textsuperscript{30} Some states have also established waivers that allow Medicaid dollars to pay for interventions to support social needs of patients.\textsuperscript{31} Non-profits such as the Leukemia & Lymphoma Society provide co-pay assistance, travel assistance, education and community support to patients,\textsuperscript{32} and foundations such as the Robert Wood Johnson Foundation provide grants for programs to address food and housing insecurity, among other SDOH.\textsuperscript{33} Patient assistance programs provided by pharmaceutical companies,\textsuperscript{34} as well as patient support and adherence programs, co-pay and prior authorization support provided through hub services, are important resources for patients and providers. In addition, recent years have seen significant funding initiatives by hospitals, health systems and payers to address
SDOH. From 2017-2019, direct financial investments in programs addressing SDOH in the US are estimated at $2.5 billion, involving 57 health systems and 917 hospitals across the US. The majority of the funds were focused on housing initiatives, followed by employment, education, food security, social and community context, and transportation. Commercial payers such as Anthem, Kaiser Permanente, and United Healthcare have also invested millions into affordable housing solutions, and Humana introduced their Bold Goal strategy to address food insecurity, loneliness and social isolation, and transportation barriers, recognizing that the investment is likely to result in lower healthcare costs. There is evidence to support investment in social needs leading to better health outcomes: one study found that US states with a higher ratio of social to health spending (calculated as the sum of social service spending and public health spending divided by the sum of Medicare spending and Medicaid spending) had significantly better subsequent health outcomes across multiple health measures (including mortality rates for lung cancer).

At the level of the individual oncology practice, one strategy broadly employed to address the social needs of patients has been the addition of a navigator to the care team. Nurse, social worker or counselor navigators perform tasks such as making arrangements for patient services or peer support groups, referring patients to resources, and assisting patients with low health literacy. Providing patient navigation is another component of the OCM value-based care model, an important point to note as 41% of the physicians in our study represented practices participating in the OCM. By reducing barriers to care and bridging gaps for patients with cancer who have social needs, patient navigation has been shown to improve outcomes and increase patient satisfaction. In addition, the creation of a financial navigator role at some oncology practices, to help patients with copay assistance applications, free drug options, and other
resources to cover expenses during their care, has proven successful in reducing patient out-of-pocket costs.\textsuperscript{43}

Limitations of this study include its descriptive nature and its reliance on physicians’ estimates of the impact of SDOH on their patients and the amount of time spent by staff in assisting patients. We did not have access to any patient or practice data to support these estimates. Additionally, while the physicians in our study represented practices with broad geographic distribution across the US, we have no information on the communities where the practices are located or the representation of patients within the practices.

Conclusions

To our knowledge, this is the first peer-reviewed publication to date to assess oncologists’ perceptions of the impact of SDOH on their patients, and their thoughts about how SDOH could be addressed. We found that while awareness of SDOH was high (nearly all oncologists surveyed agreed that SDOH influences their patients’ health outcomes), most oncologists did not have the time or resources to assist their patients with social needs, and did not consider assistance programs to be readily accessible. Recognition of the negative consequences of SDOH burden is important, but physicians in our study lacked adequate means to resolve the issues. Borrowing from the concept of a cancer “groundshot”, the most effective solutions may be the simplest.\textsuperscript{44} For the most immediate impact on cancer morbidity and mortality, we believe that what is needed more urgently than expensive new technology or therapeutics that may only provide modest benefits to a small proportion of cancer patients, is to ensure that all cancer patients are equipped with the basic necessities of life: housing and food security, access to care, affordable treatment. While straightforward in concept, the challenge of addressing SDOH to promote health equity and improve health outcomes is a complex, long-term endeavor. The
incorporation of patient navigators into the care team for some oncology practices has shown that interventions targeting patients’ social needs can be effective. It remains to be seen if efforts underway to improve screening to identify patients at risk for poor outcomes due to SDOH burden, and increased investment by hospitals, health systems and payers in initiatives targeting SDOH, will translate into improved outcomes for cancer patients.
**Contributors:** AG and BAF designed the study. YJS analyzed the data. MEZ, AG and BAF interpreted the results. MEZ drafted the manuscript. All authors critically reviewed and approved the manuscript.

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**Patient consent for publication:** Not required.

**Ethics approval:** The data utilized in this study did not include any identifiers that met the standard for ethics board review.

**Data availability statement** Data are available upon reasonable request.

**Patient and Public Involvement:** It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research.
References

1. World Health Organization. About social determinants of health. Accessed November 12, 2020 at: https://www.who.int/social_determinants/sdh_definition/en/

2. United States Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Social Determinants of Health. Accessed November 12, 2020 at: https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health

3. Hood CM, Gennuso KP, Swain GR, Catlin BB. County Health Rankings: Relationships Between Determinant Factors and Health Outcomes. *Am J Prev Med.* 2016 Feb;50(2):129-35.

4. Organisation for Economic Co-operation and Development. OECD Health Statistics 2020. Accessed November 12, 2020 at: https://www.oecd.org/health/health-data.htm

5. Modern Healthcare. In Depth: Payers can't control costs without social determinants of health model. August 25, 2018. Accessed November 12, 2020 at: https://www.modernhealthcare.com/article/20180825/NEWS/180829956/in-depth-payers-can-t-control-costs-without-social-determinants-of-health-model

6. Modern Healthcare. In Depth: Hospitals tackling social determinants are setting the course for the industry. August 25, 2018. Accessed November 12, 2020 at: https://www.modernhealthcare.com/article/20180825/NEWS/180809949/in-depth-hospitals-tackling-social-determinants-are-setting-the-course-for-the-industry

7. Soni A. Top Five Most Costly Conditions among Adults Age 18 and Older, 2012: Estimates for the U.S. Civilian Noninstitutionalized Adult Population. Statistical Brief #471. April 2015.
8. Kurani SS, McCoy RG, Lampman MA, et al. Association of Neighborhood Measures of Social Determinants of Health With Breast, Cervical, and Colorectal Cancer Screening Rates in the US Midwest. *JAMA Netw Open.* 2020 Mar 2;3(3):e200618.

9. Roche LM, Niu X, Stroup AM, Henry KA. Disparities in Female Breast Cancer Stage at Diagnosis in New Jersey: A Spatial-Temporal Analysis. *J Public Health Manag Pract.* 2017 Sep/Oct;23(5):477-486.

10. Whitney RL, Bell JF, Tancredi DJ, Romano PS, Bold RJ, Joseph JG. Hospitalization Rates and Predictors of Rehospitalization Among Individuals With Advanced Cancer in the Year After Diagnosis. *J Clin Oncol.* 2017 Nov 1;35(31):3610-3617.

11. Gaubatz ME, Bukatko AR, Simpson MC, et al. Racial and socioeconomic disparities associated with 90-day mortality among patients with head and neck cancer in the United States. *Oral Oncol.* 2019 Feb;89:95-101.

12. Han X, Zhao J, Zheng Z, de Moor JS, Virgo KS, Yabroff KR. Medical Financial Hardship Intensity and Financial Sacrifice Associated with Cancer in the United States. *Cancer Epidemiol Biomarkers Prev.* 2020 Feb;29(2):308-317.

13. National Cancer Institute. Cancer Prevalence and Cost of Care Projections. Accessed November 12, 2020 at: [https://costprojections.cancer.gov/](https://costprojections.cancer.gov/)

14. National Cancer Institute. Surveillance, Epidemiology, and End Results (SEER) Program. Accessed November 12, 2020 at: [https://seer.cancer.gov/statfacts/html/common.html](https://seer.cancer.gov/statfacts/html/common.html)

15. Centers for Medicare & Medicaid Services. Oncology Care Model: Key Drivers and Change Package. June 2020. Accessed November 12, 2020 at: [https://innovation.cms.gov/files/x/ocm-keydrivers-changepkg.pdf](https://innovation.cms.gov/files/x/ocm-keydrivers-changepkg.pdf)
16. American Academy of Family Physicians Social determinants of health policy. Accessed November 12, 2020 at: https://www.aafp.org/about/policies/all/social-determinants.html

17. Council On Community Pediatrics. Poverty and child health in the United States. *Pediatrics* 2016 Apr;137(4):e20160339.

18. Committee on Health Care for Underserved Women. ACOG Committee Opinion No. 729: Importance of social determinants of health and cultural awareness in the delivery of reproductive health care. *Obstet Gynecol* 2018 Jan;131(1):e43-8.

19. Alcaraz KI, Wiedt TL, Daniels EC, Yabroff KR, Guerra CE, Wender RC. Understanding and addressing social determinants to advance cancer health equity in the United States: A blueprint for practice, research, and policy. *CA Cancer J Clin.* 2020 Jan;70(1):31-46.

20. Centers for Medicare & Medicaid Services. Accountable Health Community model. Accessed November 12, 2020 at: https://innovation.cms.gov/innovation-models/ahcm

21. Fraze TK, Brewster AL, Lewis VA, Beidler LB, Murray GF, Colla CH. Prevalence of Screening for Food Insecurity, Housing Instability, Utility Needs, Transportation Needs, and Interpersonal Violence by US Physician Practices and Hospitals. *JAMA Netw Open.* 2019 Sep 4;2(9):e1911514.

22. American Medical Association press release. New ICD-10 codes will help physicians tackle social barriers to care. April 2, 2019. Accessed November 12, 2020 at: https://www.ama-assn.org/practice-management/digital/new.icd.10codes.will.help.physicians.tackle.social.barriers.to.care

23. Navathe AS, Zhong F, Lei VJ, et al. Hospital Readmission and Social Risk Factors Identified from Physician Notes. *Health Serv Res.* 2018 Apr;53(2):1110-1136.
24. Healthcare IT News. How Mount Sinai is using AI to unlock social determinant data in the EHR. June 17, 2019. Accessed November 12, 2020 at: https://www.healthcareitnews.com/news/how-mount-sinai-using-ai-unlock-social-determinant-data-ehr

25. Northwell Health press release. Northwell to use Jvion’s AI software to address patient readmissions. January 29, 2019. Accessed November 12, 2020 at: https://www.northwell.edu/news/northwell-to-use-jvion-s-ai-software-to-address-patient-readmissions

26. Novant Health press release. Novant Health launches program with prescriptive analytics leader Jvion. September 2, 2020. Accessed November 12, 2020 at: https://www.novanthealth.org/home/about-us/newsroom/press-releases/newsid33987/2419/novant-health-launches-program-with-prescriptive-analytics-leader-jvion-.aspx

27. Kasthurirathne SN, Vest JR, Menachemi N, Halverson PK, Grannis SJ. Assessing the capacity of social determinants of health data to augment predictive models identifying patients in need of wraparound social services. *J Am Med Inform Assoc*. 2018 Jan 1;25(1):47-53.

28. Chen S, Bergman D, Miller K, Kavanagh A, Frownfelter J, Showalter J. Using applied machine learning to predict healthcare utilization based on socioeconomic determinants of care. *Am J Manag Care*. 2020 Jan;26(1):26-31.

29. Gajra A, Zettler M, Kish J, et al. Impact of augmented intelligence (AI) on utilization of palliative care (PC) services in oncology. *J Clin Oncol* 2020: 38 no. 15_suppl., 12015.
30. Requirements for 501(c)(3) Hospitals Under the Affordable Care Act – Section 501(r).
   Accessed November 12, 2020 at: https://www.irs.gov/charities-non-profits/charitable-organizations/requirements-for-501c3-hospitals-under-the-affordable-care-act-section-501r

31. Alderwick H, Hood-Ronick CM, Gottlieb LM. Medicaid Investments To Address Social Needs In Oregon And California. Health Aff (Millwood). 2019 May;38(5):774-781.

32. Leukemia & Lymphoma Society. The Leukemia & Lymphoma Society website. Accessed November 12, 2020 at: www.lls.org

33. No authors listed. Funding To Improve Social Determinants Of Health. Health Aff (Millwood). 2019 Sep;38(9):1589-1590.

34. Yezefski T, Schwemm A, Lentz M, Hone K, Shankaran V. Patient assistance programs: a valuable, yet imperfect, way to ease the financial toxicity of cancer care. Semin Hematol. 2018 Oct;55(4):185-188.

35. Horwitz LI, Chang C, Arcilla HN, Knickman JR. Quantifying Health Systems' Investment In Social Determinants Of Health, By Sector, 2017-19. Health Aff (Millwood). 2020 Feb;39(2):192-198.

36. Anthem Blue Cross press release. Anthem Blue Cross Takes Action Amid Pandemic to Address California Housing Crisis. August 3, 2020. Accessed November 12, 2020 at: https://www.bcbs.com/press-releases/anthem-blue-cross-takes-action-amid-pandemic-address-california-housing-crisis

37. Kaiser Permanente press release. Announcing $200M impact investment to address housing crisis. May 18, 2018. Accessed November 12, 2020 at:
38. United Healthcare press release. UnitedHealthcare’s Investments in Affordable Housing to Help People Achieve Better Health Surpass $400 Million. March 26, 2019. Accessed November 12, 2020 at: https://www.unitedhealthgroup.com/newsroom/2019/2019-03-26-uhc-affordable-housing-path-metro-villas.html

39. Humana. 2020 Bold Goal Progress Report. Accessed November 12, 2020 at: https://populationhealth.humana.com/2020-bold-goal-progress-report/

40. Bradley EH, Canavan M, Rogan E, et al. Variation In Health Outcomes: The Role Of Spending On Social Services, Public Health, And Health Care, 2000-09. Health Aff (Millwood). 2016 May 1;35(5):760-8.

41. Wells KJ, Valverde P, Ustjanauskas AE, Calhoun EA, Risendal BC. What are patient navigators doing, for whom, and where? A national survey evaluating the types of services provided by patient navigators. Patient Educ Couns. 2018 Feb;101(2):285-294.

42. Kline RM, Rocque GB, Rohan EA, et al. Patient Navigation in Cancer: The Business Case to Support Clinical Needs. J Oncol Pract. 2019 Nov;15(11):585-590.

43. Monak M, Bell K, Whitt A. Development of a financial navigation program to ease the burden of financial toxicity. J Clin Oncol 2019:37(15, Suppl):6565-6565.

44. Gyawali B, Sullivan R, Booth CM. Cancer groundshot: going global before going to the moon. Lancet Oncol. 2018 Mar;19(3):288-290.
Figures

**Figure 1a.** Responses to the question: In your opinion, what portion of your patients are negatively impacted by social determinants?

**Figure 1b.** Responses to the question: Which social determinants are the most significant barriers for your patients? (Please select your top 3.)

*Includes lack of health insurance.*
**Figure 2.** Responses to the question: Among patients affected by social determinants, how often do you or your staff talk to them about how these factors may be interfering with their care?

![Bar chart showing responses]

- All the time: 0%
- Often: 20%
- Occasionally: 40%
- Rarely: 60%
- Never: 100%
**Figure 3a.** Responses to the question: Who should have responsibility for delivering assistance programs to patients? (Please select all that apply.)

- Government organizations
- Non-profit organizations
- Commercial payers/insurance companies
- Hospitals/cancer centers
- Pharmaceutical manufacturers
- None of the above

**Figure 3b.** Responses to the statement: I believe pharmaceutical manufacturers can play a role in supporting the social needs of patients by offering more: (Please select all that apply.)

- Copay assistance programs
- Patient assistance programs/Free drug programs
- Patient education programs
- Adherence programs
- Assistance with transportation to healthcare appointments
- Help connecting to mental health and other social programs
- Addiction assistance
- Pharma companies should not be involved in the social needs of patients
The Impact of Social Determinants of Health on Cancer Care: A Survey of Community Oncologists

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The Impact of Social Determinants of Health on Cancer Care: A Survey of Community Oncologists

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Abstract

Objective: Cancer survival rates have improved over the past few decades, yet socioeconomic disparities persist. Social determinants of health (SDOH) have consistently been shown to correlate with health outcomes. The objective of this study was to characterize oncologists’ perceptions of the impact of SDOH on their patients, and their opinions on how these effects could be remediated.

Design: Cross-sectional survey of physicians

Setting: Web-based survey completed prior to live meetings held between February and April 2020

Participants: Oncologists/hematologists from across the United States

Exposure: Clinical practice in a community-based or hospital-based setting

Main outcome and measure: Physician responses regarding how SDOH affected their patients, which factors represented the most significant barriers to optimal health outcomes, and how the impact of SDOH could be mitigated through assistance programs.

Results: Of the 165 physicians who completed the survey, 93% agreed that SDOH had a significant impact on their patients’ health outcomes. Financial security/lack of insurance and access to transportation were identified most often as the greatest barriers for their patients (83% and 58%, respectively). Eighty-one percent of physicians indicated that they and their staff had limited time to spend assisting patients with social needs, and 76% reported that assistance programs were not readily accessible. Government organizations, hospitals, non-profit organizations and commercial payers were selected by 50% or more of oncologists surveyed as who should be responsible for delivering assistance programs to patients with social needs; 42% indicated that pharmaceutical manufacturers should also be responsible.
Conclusion: Our survey found that most oncologists were aware of the impact of SDOH on their patients but were constrained in their time to assist patients with social needs. The physicians in our study identified a need for more accessible assistance programs, and greater involvement from all stakeholders in addressing SDOH to improve health outcomes.
Strengths and Limitations of This Study

- This study exploring the perspectives of oncologists from community practices across the United States on social determinants of health is the first of its kind.

- The participating physicians represented a large sample with broad geographic distribution, but the results may not be generalizable to all oncology practices within the United States.

- The survey relied on the physicians’ views of the impact of social determinants of health on their patients, however the physicians may not have had a complete picture of their patients’ circumstances, and views may be subjective.
Introduction

Social determinants of health (SDOH), defined by the World Health Organization as “the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life”, have garnered increased attention in recent years as evidence linking SDOH to health outcomes grows.\(^1\) Although there is no universally accepted consensus on the specific factors comprising SDOH, examples include economic stability (eg, poverty, food insufficiency or housing instability), education, social support, health insurance status, and access to transportation.\(^2\) Research indicates that clinical care accounts for less than 20% of health outcomes in the United States (US), with socioeconomic factors, health behaviors, and the physical environment contributing greater influence on outcomes.\(^3\) These findings provide further evidence that most of what impacts health occurs outside the walls of a clinic or hospital, and underscore the need for interventions targeting social and economic conditions to meaningfully improve health outcomes. Although healthcare expenditures in the US surpass those of other developed nations, healthcare outcomes do not reflect the increased investment.\(^4\) Payers and health care systems have increasingly looked to addressing SDOH as a means to resolve this discrepancy and reduce healthcare costs.\(^5,6\)

The impact of SDOH is particularly relevant to patients with cancer, as cancer is one of the costliest diseases to treat (second only to heart disease).\(^7\) Patients who reside in zip codes with lower socioeconomic status have lower rates of cancer screening, and are more often diagnosed with cancer at a later stage of disease.\(^8,9\) Further, patients with cancer living in areas of greater deprivation experience a higher incidence of rehospitalization and mortality.\(^10,11\) Financial hardship associated with cancer treatment is well-documented, and disproportionately affects patients with lower educational attainment, lower family income, and those who are uninsured.\(^12\)
Rising costs of cancer care and therapies, coupled with the prevalence of cancer (in 2020 there are an estimated 18.1 million cancer survivors in the US, and 1.8 million patients will be diagnosed with cancer this year), put a growing number of cancer patients at risk.\textsuperscript{13,14} As value-based care models shift more accountability to healthcare providers with respect to quality of care, cost containment, and improvements in outcomes, awareness of the impact of SDOH on patients has emerged as an essential element of care. For example, as a component of the Oncology Care Model (OCM)’s comprehensive, coordinated cancer care, each patient in participating practices must have a documented care plan that includes estimating out-of-pocket costs and addressing health-related social needs.\textsuperscript{15} The objective of this study was to gain insight into practicing oncologists’ views on SDOH and interventions to alleviate negative effects of SDOH. In this paper, we present the results of surveys completed by oncologists regarding their perceptions of the impact of SDOH on their patients, and their opinions on potential solutions to mitigate the SDOH burden.

\textbf{Methods}

Physicians in the Cardinal Health Oncology Provider Extended Network (a community of over 7000 medical oncologists or hematologists, practicing in a community-based or hospital-based setting in the US) were invited to participate in a series of live market research meetings held between February and April 2020. Advanced practice providers and other healthcare professionals were not invited to take part in the meetings. To be eligible for an invitation, physicians must have been actively practicing, must have represented different practices with a broad geographic distribution across the US, and could not have participated in another live meeting in the preceding 9 months. All physicians who were invited and agreed to take part in
the live meeting completed a pre-meeting survey. Participants received an honorarium for their participation and were unaware that they would be asked about SDOH at the time they agreed to participate. In the survey, the physicians were asked a series of 10 multiple-choice (single select, modified Likert, and multi-select) questions regarding their perceptions of the impact of SDOH on their patients, and their opinions on how the effects of SDOH should be mitigated. Participants submitted their responses via a web-based survey. Responses were summarized using descriptive statistics. A chi-square test was performed to compare responses to individual questions among physicians representing practices participating in the OCM vs. those from practices not participating in the OCM. No adjustments were made for multiple comparisons.

This study was exempt from institutional review board review.

**Patient and Public Involvement**

No patients were involved in this study.

**Results**

A total of 165 physicians were invited to participate and responded to the survey (Table 1). The primary medical specialty reported was medical oncology for 33% of respondents, hematology oncology for 65%, and other for 2%. The physicians saw a median of 20 patients per day, and the median number of years in practice for the respondents was 18. The regional location of their primary practice was reported as the South for 44% of respondents, the Midwest for 21%, the West for 8%, and the Northeast for 27%. Of the 165 practices represented, 68 (41%) were participating in the OCM value-based care model.

All participants provided answers to all 10 questions. The majority of oncologists surveyed agreed that SDOH, including financial security, food security, social isolation, housing security,
addiction, access to transportation, and patient health literacy, had a significant impact on their patients’ ability to achieve an optimal health outcome (51% selected the response strongly agree; 42% agree; 7% neither agree nor disagree; 1% disagree; 0% strongly disagree). As shown in Table 2, most of the participating oncologists said at least half of their patients were negatively impacted by SDOH (4% chose the response all or nearly all; 24% most; 40% about half; 32% few; 0% none).

The SDOH that were the most significant barriers for the patients of the oncologists surveyed are presented in Figure 1. Financial security/lack of health insurance was the response selected most often (83%), followed by access to transportation (58%), health literacy (53%), social isolation (43%), housing security (18%), addiction (12%) and food security (7%). Accordingly, the top 2 types of assistance oncologists indicated would have the greatest impact on helping their patients achieve better outcomes were assistance with the cost of medicine (79%) and assistance with transportation to clinic/physician office (57%).

When asked how often they and their staff talked to patients affected by SDOH about how these factors may be interfering with their care, 18% of oncologists surveyed selected “all the time”, while 51% selected “often”, 29% “occasionally”, 2% “rarely” and 0% “never” (Table 3). The majority of oncologists indicated that they and their staff were constrained in the amount of time they could spend assisting patients with social needs, with 34% responding that they strongly agree, 47% agree, 14% neither agree nor disagree, 5% disagree, and 0% strongly disagree.

Most oncologists agreed that assistance programs to help patients with social needs were not readily accessible: 20% chose the response strongly agree, 56% agree, 16% neither agree nor disagree, 7% disagree, and 1% strongly disagree. When asked who should have responsibility for delivering assistance programs to patients, 50% or more of oncologists surveyed indicated that
government organizations, hospitals/cancer centers, non-profit organizations and commercial 
providers/insurance companies all should be responsible; fewer than half (42%) indicated that 
responsibility should fall to pharmaceutical manufacturers (Figure 2a). Only 2% of surveyed 
oncologists believed that pharmaceutical companies should not be involved in the social needs of 
patients; most agreed that manufacturers can play a role in supporting the social needs of patients 
by offering more copay assistance programs, patient assistance programs/free drug programs, or 
patient education programs (Figure 2b).

To assess the impact of OCM participation, we explored potential differences in the perception 
of the contributions of SDOH upon patient outcomes among oncologists from OCM and non- 
OCM practices. Only a few differences were noted to be statistically significant: oncologists 
from non-OCM practices identified food security as a barrier to optimal outcomes more often 
than those from OCM practices (59% vs. 43%, p= 0.04). Twice as many oncologists from OCM 
practices identified housing security as a barrier compared to non-OCM participants (25% vs. 
12% p= 0.04). A greater proportion of OCM participants favored that hospitals and cancer 
centers should play a greater role in patient assistance programs (59% vs. 43% p<0.05).

Discussion

In this survey of 165 practicing oncologists in the US, 93% agreed that SDOH impacted their 
patients’ ability to achieve optimal health outcomes. Two thirds of the oncologists in our study 
estimated that half or more of their patients were impacted by SDOH, with financial security and 
access to transportation representing the most significant barriers. Nearly 70% of oncologists 
reported talking to their patients about how SDOH affected their care often or all the time,
although most reported that they and their staff had limited time available to help patients with 
their social needs. Three quarters of oncologists surveyed thought that assistance programs were
not readily accessible. Most of the respondents indicated that the responsibility for providing assistance to patients with social needs fell to government organizations, hospitals, non-profit organizations and commercial payers, although pharmaceutical companies could provide support through copay assistance, free drug programs or patient education. We did not find dramatic differences in the perceptions of oncologists from OCM and non-OCM practices.

Across the broader medical community, the recognition of the importance of identifying patients at risk for poor outcomes due to SDOH is reflected in the issuance of policy statements related to screening by professional societies such as the American Academy of Family Physicians, the American Academy of Pediatrics, and the American College of Obstetricians and Gynecologists. Similarly, the American Cancer Society has published a framework for addressing SDOH, which includes recommendations for screening, to further cancer health equity. In addition, the Centers for Medicare & Medicaid Services (CMS)’s Accountable Health Community model implements screening for health-related social needs among Medicare and Medicaid beneficiaries receiving healthcare at participating sites. However, despite these recommendations, how often screening for SDOH occurs in clinical practice has not been well described. A study of 739 hospitals and 2190 physician practices in the US found that only 24.4% of hospitals and 15.6% of physician practices screened patients for the 5 specific social needs outlined in the CMS Accountable Health Communities Model (food insecurity, housing instability, utility needs, transportation needs, and interpersonal violence). For those that didn’t screen for any of the 5, the most common barriers cited were lack of time and financial resources.

To alleviate the burden of screening, several strategies have been undertaken to better capture SDOH within electronic health records (EHRs). The American Medical Association in
collaboration with UnitedHealthcare is working to create 23 new ICD-10 codes related to SDOH, including access to nutritious food, adequate and safe housing, available transportation, financial ability to pay for medications and utilities, and caregiver needs. The use of artificial intelligence (AI) also figures prominently into efforts to improve identification of SDOH for patients: natural language processing of the unstructured notes in EHRs has been shown to identify greater prevalence of tobacco use, alcohol abuse, drug abuse, depression, housing instability, fall risk, and poor social support than could be identified through administrative data. Health systems such as Mount Sinai have adopted AI solutions to pull data from unstructured notes to help identify patients at risk. Other health systems are using AI technology that integrates clinical factors from the EHR with socioeconomic factors to flag patients at risk for readmission. Decision models incorporating clinical EHR data and community-level SDOH data have demonstrated the ability to predict the need for social service referrals. Applied machine learning using SDOH data alone has also been shown to accurately predict emergency department visits or hospital admissions. Finally, in a recent pilot study, an AI decision tool that incorporated SDOH helped patients with cancer receive timely palliative care, by identifying those who were at risk for short-term mortality. The physicians in our study viewed the responsibility for assisting patients with social needs as belonging to government organizations, non-profit organizations, pharmaceutical companies, hospitals and commercial payers. In the past decade, these entities have made important strides towards mitigating the impact of SDOH on clinical outcomes through policy changes, commitments for community programs, and initiatives to support individual patients, that go beyond screening. The Affordable Care Act, enacted in 2010, requires tax-exempt hospitals to conduct community health needs assessments every 3 years and to create an implementation
strategies to improve health at the community level. Some states have also established waivers that allow Medicaid dollars to pay for interventions to support social needs of patients. Non-profits such as the Leukemia & Lymphoma Society provide co-pay assistance, travel assistance, education and community support to patients, and foundations such as the Robert Wood Johnson Foundation provide grants for programs to address food and housing insecurity, among other SDOH. Patient assistance programs provided by pharmaceutical companies, as well as patient support and adherence programs, co-pay and prior authorization support provided through hub services, are important resources for patients and providers. In addition, recent years have seen significant funding initiatives by hospitals, health systems and payers to address SDOH. From 2017-2019, direct financial investments in programs addressing SDOH in the US are estimated at $2.5 billion, involving 57 health systems and 917 hospitals across the US. The majority of the funds were focused on housing initiatives, followed by employment, education, food security, social and community context, and transportation. Commercial payers such as Anthem, Kaiser Permanente, and United Healthcare have also invested millions into affordable housing solutions, and Humana introduced their Bold Goal strategy to address food insecurity, loneliness and social isolation, and transportation barriers, recognizing that the investment is likely to result in lower healthcare costs. There is evidence to support investment in social needs leading to better health outcomes: one study found that US states with a higher ratio of social to health spending (calculated as the sum of social service spending and public health spending divided by the sum of Medicare spending and Medicaid spending) had significantly better subsequent health outcomes across multiple health measures (including mortality rates for lung cancer).
At the level of the individual oncology practice, one strategy broadly employed to address the social needs of patients has been the addition of a navigator to the care team. Nurse, social worker or counselor navigators perform tasks such as making arrangements for patient services or peer support groups, referring patients to resources, and assisting patients with low health literacy.\textsuperscript{41} Providing patient navigation is another component of the OCM value-based care model,\textsuperscript{15} an important point to note as 41% of the physicians in our study represented practices participating in the OCM. By reducing barriers to care and bridging gaps for patients with cancer who have social needs, patient navigation has been shown to improve outcomes and increase patient satisfaction.\textsuperscript{42} In addition, the creation of a financial navigator role at some oncology practices, to help patients with copay assistance applications, free drug options, and other resources to cover expenses during their care, has proven successful in reducing patient out-of-pocket costs.\textsuperscript{43}

Limitations of this study include its descriptive nature and its reliance on physicians’ estimates of the impact of SDOH on their patients and the amount of time spent by staff in assisting patients. We did not have access to any patient or practice data to support these estimates. Additionally, while the physicians in our study represented practices with broad geographic distribution across the US, we have no information on the communities where the practices are located or the representation of patients within the practices. Finally, our sample did not include radiation or surgical oncologists, which may limit the generalizability of our results.

**Conclusions**

To our knowledge, this is the first peer-reviewed publication to date to assess oncologists’ perceptions of the impact of SDOH on their patients, and their thoughts about how SDOH could
be addressed. We found that while awareness of SDOH was high (nearly all oncologists
surveyed agreed that SDOH influences their patients’ health outcomes), most oncologists did not
have the time or resources to assist their patients with social needs, and did not consider
assistance programs to be readily accessible. Recognition of the negative consequences of SDOH
burden is important, but physicians in our study lacked adequate means to resolve the issues.
Borrowing from the concept of a cancer “groundshot”, the most effective solutions may be the
simplest. For the most immediate impact on cancer morbidity and mortality, we believe that
what is needed more urgently than expensive new technology or therapeutics that may only
provide modest benefits to a small proportion of cancer patients, is to ensure that all cancer
patients are equipped with the basic necessities of life: housing and food security, access to care,
affordable treatment. While straightforward in concept, the challenge of addressing SDOH to
promote health equity and improve health outcomes is a complex, long-term endeavor. The
incorporation of patient navigators into the care team for some oncology practices has shown that
interventions targeting patients’ social needs can be effective, but larger scale interventions at the
community and national level will ultimately be needed to effect meaningful change.
Collaborative action by professional organizations such as the American Society of Clinical
Oncology, the Oncology Nursing Association and the Association of Oncology Social Work may
be one avenue to drive this change. It remains to be seen if efforts underway to improve
screening to identify patients at risk for poor outcomes due to SDOH burden, and increased
investment by hospitals, health systems and payers in initiatives targeting SDOH, will translate
into improved outcomes for cancer patients. **Contributors:** AG and BAF designed the study.
YJS analyzed the data. MEZ, AG and BAF interpreted the results. MEZ drafted the manuscript.
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Data availability statement: Data are available upon reasonable request.
1 References

2 1. World Health Organization. About social determinants of health. Accessed November 12, 2020 at: https://www.who.int/social_determinants/sdh_definition/en/

2 2. United States Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Social Determinants of Health. Accessed November 12, 2020 at: https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health

2 3. Hood CM, Gennuso KP, Swain GR, Catlin BB. County Health Rankings: Relationships Between Determinant Factors and Health Outcomes. Am J Prev Med. 2016 Feb;50(2):129-35.

2 4. Organisation for Economic Co-operation and Development. OECD Health Statistics 2020. Accessed November 12, 2020 at: https://www.oecd.org/health/health-data.htm

2 5. Modern Healthcare. In Depth: Payers can't control costs without social determinants of health model. August 25, 2018. Accessed November 12, 2020 at: https://www.modernhealthcare.com/article/20180825/NEWS/180829956/in-depth-payers-can-t-control-costs-without-social-determinants-of-health-model

2 6. Modern Healthcare. In Depth: Hospitals tackling social determinants are setting the course for the industry. August 25, 2018. Accessed November 12, 2020 at: https://www.modernhealthcare.com/article/20180825/NEWS/180809949/in-depth-hospitals-tackling-social-determinants-are-setting-the-course-for-the-industry

2 7. Soni A. Top Five Most Costly Conditions among Adults Age 18 and Older, 2012: Estimates for the U.S. Civilian Noninstitutionalized Adult Population. Statistical Brief #471. April 2015.
8. Kurani SS, McCoy RG, Lampman MA, et al. Association of Neighborhood Measures of Social Determinants of Health With Breast, Cervical, and Colorectal Cancer Screening Rates in the US Midwest. *JAMA Netw Open.* 2020 Mar 2;3(3):e200618.

9. Roche LM, Niu X, Stroup AM, Henry KA. Disparities in Female Breast Cancer Stage at Diagnosis in New Jersey: A Spatial-Temporal Analysis. *J Public Health Manag Pract.* 2017 Sep/Oct;23(5):477-486.

10. Whitney RL, Bell JF, Tancredi DJ, Romano PS, Bold RJ, Joseph JG. Hospitalization Rates and Predictors of Rehospitalization Among Individuals With Advanced Cancer in the Year After Diagnosis. *J Clin Oncol.* 2017 Nov 1;35(31):3610-3617.

11. Gaubatz ME, Bukatko AR, Simpson MC, et al. Racial and socioeconomic disparities associated with 90-day mortality among patients with head and neck cancer in the United States. *Oral Oncol.* 2019 Feb;89:95-101.

12. Han X, Zhao J, Zheng Z, de Moor JS, Virgo KS, Yabroff KR. Medical Financial Hardship Intensity and Financial Sacrifice Associated with Cancer in the United States. *Cancer Epidemiol Biomarkers Prev.* 2020 Feb;29(2):308-317.

13. National Cancer Institute. Cancer Prevalence and Cost of Care Projections. Accessed November 12, 2020 at: [https://costprojections.cancer.gov/](https://costprojections.cancer.gov/)

14. National Cancer Institute. Surveillance, Epidemiology, and End Results (SEER) Program. Accessed November 12, 2020 at: [https://seer.cancer.gov/statfacts/html/common.html](https://seer.cancer.gov/statfacts/html/common.html)

15. Centers for Medicare & Medicaid Services. Oncology Care Model: Key Drivers and Change Package. June 2020. Accessed November 12, 2020 at: [https://innovation.cms.gov/files/x/ocm-keydrivers-changepkg.pdf](https://innovation.cms.gov/files/x/ocm-keydrivers-changepkg.pdf)
16. American Academy of Family Physicians Social determinants of health policy. Accessed November 12, 2020 at: https://www.aafp.org/about/policies/all/social-determinants.html

17. Council On Community Pediatrics. Poverty and child health in the United States. *Pediatrics* 2016 Apr;137(4):e20160339.

18. Committee on Health Care for Underserved Women. ACOG Committee Opinion No. 729: Importance of social determinants of health and cultural awareness in the delivery of reproductive health care. *Obstet Gynecol* 2018 Jan;131(1):e43-8.

19. Alcaraz KI, Wiedt TL, Daniels EC, Yabroff KR, Guerra CE, Wender RC. Understanding and addressing social determinants to advance cancer health equity in the United States: A blueprint for practice, research, and policy. *CA Cancer J Clin.* 2020 Jan;70(1):31-46.

20. Centers for Medicare & Medicaid Services. Accountable Health Community model. Accessed November 12, 2020 at: https://innovation.cms.gov/innovation-models/ahcm

21. Fraze TK, Brewster AL, Lewis VA, Beidler LB, Murray GF, Colla CH. Prevalence of Screening for Food Insecurity, Housing Instability, Utility Needs, Transportation Needs, and Interpersonal Violence by US Physician Practices and Hospitals. *JAMA Netw Open.* 2019 Sep 4;2(9):e1911514.

22. American Medical Association press release. New ICD-10 codes will help physicians tackle social barriers to care. April 2, 2019. Accessed November 12, 2020 at: https://www.ama-assn.org/practice-management/digital/new-icd-10-codes-will-help-physicians-tackle-social-barriers-care

23. Navathe AS, Zhong F, Lei VJ, et al. Hospital Readmission and Social Risk Factors Identified from Physician Notes. *Health Serv Res.* 2018 Apr;53(2):1110-1136.
24. Healthcare IT News. How Mount Sinai is using AI to unlock social determinant data in the EHR. June 17, 2019. Accessed November 12, 2020 at: https://www.healthcareitnews.com/news/how-mount-sinai-using-ai-unlock-social-determinant-data-ehr

25. Northwell Health press release. Northwell to use Jvion’s AI software to address patient readmissions. January 29, 2019. Accessed November 12, 2020 at: https://www.northwell.edu/news/northwell-to-use-jvion-s-ai-software-to-address-patient-readmissions

26. Novant Health press release. Novant Health launches program with prescriptive analytics leader Jvion. September 2, 2020. Accessed November 12, 2020 at: https://www.novanthealth.org/home/about-us/newsroom/press-releases/newsid33987/2419/novant-health-launches-program-with-prescriptive-analytics-leader-jvion-.aspx

27. Kasthurirathne SN, Vest JR, Menachemi N, Halverson PK, Grannis SJ. Assessing the capacity of social determinants of health data to augment predictive models identifying patients in need of wraparound social services. J Am Med Inform Assoc. 2018 Jan;25(1):47-53.

28. Chen S, Bergman D, Miller K, Kavanagh A, Frownfelter J, Showalter J. Using applied machine learning to predict healthcare utilization based on socioeconomic determinants of care. Am J Manag Care. 2020 Jan;26(1):26-31.

29. Gajra A, Zettler M, Kish J, et al. Impact of augmented intelligence (AI) on utilization of palliative care (PC) services in oncology. J Clin Oncol 2020: 38 no. 15_suppl., 12015.
30. Requirements for 501(c)(3) Hospitals Under the Affordable Care Act – Section 501(r).
   Accessed November 12, 2020 at: https://www.irs.gov/charities-non-profits/charitable-organizations/requirements-for-501c3-hospitals-under-the-affordable-care-act-section-501r

31. Alderwick H, Hood-Ronick CM, Gottlieb LM. Medicaid Investments To Address Social Needs In Oregon And California. Health Aff (Millwood). 2019 May;38(5):774-781.

32. Leukemia & Lymphoma Society. The Leukemia & Lymphoma Society website. Accessed November 12, 2020 at: www.lls.org

33. No authors listed. Funding To Improve Social Determinants Of Health. Health Aff (Millwood). 2019 Sep;38(9):1589-1590.

34. Yezefski T, Schwemm A, Lentz M, Hone K, Shankaran V. Patient assistance programs: a valuable, yet imperfect, way to ease the financial toxicity of cancer care. Semin Hematol. 2018 Oct;55(4):185-188.

35. Horwitz LI, Chang C, Arcilla HN, Knickman JR. Quantifying Health Systems' Investment In Social Determinants Of Health, By Sector, 2017-19. Health Aff (Millwood). 2020 Feb;39(2):192-198.

36. Anthem Blue Cross press release. Anthem Blue Cross takes action amid pandemic to address California housing crisis. August 3, 2020. Accessed November 12, 2020 at: https://www.bcbs.com/press-releases/anthem-blue-cross-takes-action-amid-pandemic-address-california-housing-crisis

37. Kaiser Permanente press release. Announcing $200M impact investment to address housing crisis. May 18, 2018. Accessed November 12, 2020 at:
38. United Healthcare press release. UnitedHealthcare’s Investments in Affordable Housing to Help People Achieve Better Health Surpass $400 Million. March 26, 2019. Accessed November 12, 2020 at: https://www.unitedhealthgroup.com/newsroom/2019/2019-03-26-uhc-affordable-housing-path-metro-villas.html

39. Humana. 2020 Bold Goal Progress Report. Accessed November 12, 2020 at: https://populationhealth.humana.com/2020-bold-goal-progress-report/

40. Bradley EH, Canavan M, Rogan E, et al. Variation In Health Outcomes: The Role Of Spending On Social Services, Public Health, And Health Care, 2000-09. *Health Aff (Millwood)*. 2016 May 1;35(5):760-8.

41. Wells KJ, Valverde P, Ustjanauskas AE, Calhoun EA, Risendal BC. What are patient navigators doing, for whom, and where? A national survey evaluating the types of services provided by patient navigators. *Patient Educ Couns.* 2018 Feb;101(2):285-294.

42. Kline RM, Rocque GB, Rohan EA, et al. Patient Navigation in Cancer: The Business Case to Support Clinical Needs. *J Oncol Pract.* 2019 Nov;15(11):585-590.

43. Monak M, Bell K, Whitt A. Development of a financial navigation program to ease the burden of financial toxicity. *J Clin Oncol* 2019;37(15, Suppl):6565-6565.

44. Gyawali B, Sullivan R, Booth CM. Cancer groundshot: going global before going to the moon. *Lancet Oncol.* 2018 Mar;19(3):288-290.
1 Tables

2 Table 1. Characteristics of Survey Respondents

| Characteristic                                                   | Number and % of Respondents |
|-----------------------------------------------------------------|------------------------------|
| **Practice setting**                                            |                              |
| Solo, privately owned, community                               | 13 (8%)                      |
| Small, privately owned, community (2-5 physicians)              | 27 (16%)                     |
| Medium-sized, privately owned, community (6-10 physicians)      | 17 (10%)                     |
| Large, privately owned, community (>10 physicians)              | 24 (15%)                     |
| Community practice, owned by a larger entity (e.g., hospital or academic center) | 20 (12%)                     |
| Community-based hospital                                       | 16 (10%)                     |
| Medical center or cancer center                                | 17 (10%)                     |
| Academic center or affiliated teaching hospital (defined as having a large teaching system) | 30 (18%)                     |
| Other                                                          | 1 (1%)                       |
| **Primary medical specialty**                                  |                              |
| Medical oncology                                               | 55 (33%)                     |
| Hematology oncology                                            | 107 (65%)                    |
| Other                                                          | 3 (2%)                       |
| **Average number of patients seen per day**                    |                              |
| 1-5                                                            | 9 (5%)                       |
| 6-10                                                           | 4 (2%)                       |
| 11-15                                                          | 34 (21%)                     |
| 16-20                                                          | 59 (36%)                     |
| >20                                                            | 59 (36%)                     |
| **Years in practice**                                          |                              |
| 1-5                                                            | 13 (8%)                      |
| 6-10                                                           | 23 (14%)                     |
| 11-15                                                          | 31 (19%)                     |
| 16-20                                                          | 43 (26%)                     |
| >20                                                            | 55 (33%)                     |
| **US region**                                                  |                              |
| Northeast                                                      | 45 (27%)                     |
| Midwest                                                        | 34 (21%)                     |
| South                                                          | 73 (44%)                     |
| West                                                           | 13 (8%)                      |
| **Participation in the Oncology Care Model**                   |                              |
| Yes                                                            | 68 (41%)                     |
| No                                                             | 97 (59%)                     |
Table 2. Responses to the question: In your opinion, what portion of your patients are negatively impacted by social determinants?

| Response     | Number and % of Respondents |
|--------------|------------------------------|
| All or nearly all | 7 (4%)                     |
| Most         | 40 (24%)                    |
| About half   | 66 (40%)                    |
| Few          | 52 (32%)                    |
| None         | 0 (0%)                      |

Table 3. Responses to the question: Among patients affected by social determinants, how often do you or your staff talk to them about how these factors may be interfering with their care?

| Response     | Number and % of Respondents |
|--------------|------------------------------|
| All the time | 29 (18%)                    |
| Often        | 84 (51%)                    |
| Occasionally | 48 (29%)                    |
| Rarely       | 4 (2%)                      |
| Never        | 0 (0%)                      |
Figure Legends

Figure 1. Responses to the question: Which social determinants are the most significant barriers for your patients? (Please select your top 3.) *Includes lack of health insurance.
Figure 2a. Responses to the question: Who should have responsibility for delivering assistance programs to patients? (Please select all that apply.)

Figure 2b. Responses to the statement: I believe pharmaceutical manufacturers can play a role in supporting the social needs of patients by offering more: (Please select all that apply.)
Figure 1. Responses to the question: Which social determinants are the most significant barriers for your patients? (Please select your top 3.) *Includes lack of health insurance.

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STROBE Statement—checklist of items that should be included in reports of observational studies

| Item No. | Recommendation | Page No. | Relevant text from manuscript |
|----------|----------------|----------|------------------------------|
| **Title and abstract** | | | |
| 1 | *(a)* Indicate the study’s design with a commonly used term in the title or the abstract | 2 | Line 7 |
| | *(b)* Provide in the abstract an informative and balanced summary of what was done and what was found | 2 | Lines 7-23 |
| **Introduction** | | | |
| 2 | Explain the scientific background and rationale for the investigation being reported | 5-6 | Lines 2-23 and 1-9 |
| **Objectives** | 3 | State specific objectives, including any prespecified hypotheses | 6 | Lines 9-13 |
| **Methods** | | | |
| 4 | Present key elements of study design early in the paper | 6-7 | Lines 16-23 and 1-11 |
| 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 6-7 | Lines 16-23 and 1-11 |
| 6 | *(a)* **Cohort study**—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up | 6 | Lines 16-23 |
| | **Case-control study**—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls | 6 | Lines 16-23 |
| | **Cross-sectional study**—Give the eligibility criteria, and the sources and methods of selection of participants | 6 | Lines 16-23 |
| 7 | *(b)* **Cohort study**—For matched studies, give matching criteria and number of exposed and unexposed | n/a | n/a |
| | **Case-control study**—For matched studies, give matching criteria and the number of controls per case | n/a | n/a |
| 8* | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 6-7 | Line 23, and 1-5 |
| 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 6-7 | Line 23, and 1-5 |
| 9 | Describe any efforts to address potential sources of bias | 6 | Lines 19-23 |
| 10 | Explain how the study size was arrived at | 6 | Lines 16-23 |

Continued on next page
### Quantitative variables
Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why.

### Statistical methods
- **(a)** Describe all statistical methods, including those used to control for confounding
- **(b)** Describe any methods used to examine subgroups and interactions
- **(c)** Explain how missing data were addressed
- **(d)** *Cohort study*—If applicable, explain how loss to follow-up was addressed
- *Case-control study*—If applicable, explain how matching of cases and controls was addressed
- *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
- **(e)** Describe any sensitivity analyses

### Results

#### Participants
- **(a)** Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
- **(b)** Give reasons for non-participation at each stage
- **(c)** Consider use of a flow diagram

#### Descriptive data
- **(a)** Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
- **(b)** Indicate number of participants with missing data for each variable of interest
- **(c)** *Cohort study*—Summarise follow-up time (eg, average and total amount)

#### Outcome data
- **Cohort study**—Report numbers of outcome events or summary measures over time
- *Case-control study*—Report numbers in each exposure category, or summary measures of exposure
- *Cross-sectional study*—Report numbers of outcome events or summary measures

#### Main results
- **(a)** Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
- **(b)** Report category boundaries when continuous variables were categorized
- **(c)** If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period

Continued on next page
Other analyses 17  Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion

Key results 18  Summarise key results with reference to study objectives

Limitations 19  Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias

Interpretation 20  Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence

Generalisability 21  Discuss the generalisability (external validity) of the study results

Other information

Funding 22  Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.