ORIGINAL RESEARCH

Implementing an EHR-based Screening and Referral System to Address Social Determinants of Health in Primary Care

Pablo Buitron de la Vega, MD, MSc,*† Stephanie Losi, BS,† Linda Sprague Martinez, PhD,‡ Allison Bovell-Ammon, MDiv,† Arvin Garg, MD, MPH,* Thea James, MD,*† Alana M. Ewen, MPH,† Marna Stack, BS,† Heloisa DeCarvalho, BS,* Megan Sandel, MD, MPH,*† Rebecca G. Mishuris, MD, MPH,*† Stella Deych, BA,† Patrick Pelletier, BS,† and Nancy R. Kressin, PhD*§

Background: Social determinants affect health, yet there are few systematic clinical strategies in primary care that leverage electronic health record (EHR) automation to facilitate screening for social needs and resource referrals. An EHR-based social determinants of health (SDOH) screening and referral model, adapted from the WE CARE model for pediatrics, was implemented in urban adult primary care.

Objectives: This study aimed to: (1) understand the burden of SDOH among patients at Boston Medical Center; and (2) evaluate the feasibility of implementing a systematic clinical strategy to screen new primary care patients for SDOH, use EHR technology to add these needs to the patient's chart through autogenerated ICD-10 codes, and print patient language-congruent referrals to available resources upon patient request.

Research Design: This observational study assessed the number of patients who were screened to be positive and requested resources for social needs. In addition, we evaluated the feasibility of implementing our SDOH strategy by determining the proportion of: eligible patients screened, providers signing orders for positive patient screenings, and provider orders for resource referral guides among patients requesting resource connections.

Results: In total, 1696 of 2420 (70%) eligible patients were screened. Employment (12%), food insecurity (11%), and problems affording medications (11%) were the most prevalent concerns among respondents. In total, 367 of 445 (82%) patients with ≥1 identified needs (excluding education) had the appropriate ICD-10 codes added to their visit diagnoses. In total, 325 of 376 (86%) patients who requested resources received a relevant resource referral guide.

Conclusions: Implementing a systematic clinical strategy in primary care using EHR workflows was successful in identifying and providing resource information to patients with SDOH needs.

Key Words: social determinants of health, electronic health record, primary care

(Med Care 2019;57: S133–S139)

The impact of social determinants of health (SDOH), including education, employment, and economic hardships, on patient and population health is well-documented.[1–3] Unmet social needs contribute to poor health, increased risk of chronic diseases, and unnecessary emergency department visits and hospitalizations among patients, particularly among those living in socioeconomically disadvantaged communities in the United States.[4,5] As such, systematically addressing unmet social needs has become increasingly salient in the context of recent health policy reforms that incentivize health care systems to respond to SDOH and improve population health as a strategy for reducing excessive costs. One such policy reform is the introduction of Accountable Care Organizations (ACOs), where health systems are paid a contractually agreed upon amount per patient for all health care needs, incentivizing efficient and effective care to maintain patients' health. Similarly, acknowledging the health benefits of improving the social circumstances within which patients live, work, and grow, the Centers for Medicare and Medicaid Services (CMS) has also invested in identifying and evaluating innovative strategies for screening and addressing SDOH in clinical settings.[6]

Despite the recognized impact of SDOH on health and policies to incentivize screening, there are few electronic health record (EHR)-based systematic clinical strategies for addressing unmet social needs in primary care, particularly within large safety net hospitals. Even fewer strategies leverage EHR automation to facilitate both SDOH screening and resource referrals.

The limited evidence that exists indicates that utilizing the EHR platform can help streamline screening and resource connections in clinical settings. An Institute of Medicine committee found standardization of data collection on SDOH in patient EHRs to be critical for the use and exchange of information among providers.[7] Further, systematic inclusion of SDOH-related ICD-10 codes in EHRs improves tracking of patients' social needs.[8] Recently, strategies to document SDOH factors in the EHR have emerged in clinical settings across the country.[9,10] Even with EHRs, however, barriers to capture ICD-10 codes and refer patients to resources persist.[11] These barriers include limited time, training, and awareness of community resources among providers.[12] In addition, there are potential ethical challenges surrounding patient privacy and effectiveness and appropriateness of treatment options available.[13,14]

One purpose of this study was to understand the burden of social needs among patients in our system. Next, we examined the feasibility of implementing a systematic strategy to screen primary care patients for SDOH using EHR decision support workflows, generate ICD-10 codes from screening responses, and upon patient request, provide patient language-congruent referrals to available community and hospital-based resources.

METHODS

Setting

The study was conducted at Boston Medical Center (BMC), an urban, tertiary care academic medical center and the largest safety net hospital in New England. Approximately 50% of BMC patients are insured by Medicaid, and are part of the Massachusetts Medicaid (MassHealth) ACO begun in early 2018. We have had a unified EHR (Epic Systems, Verona, WI) across ambulatory, inpatient and emergency department areas since 2014. Institutional review board approval was obtained before conducting this research.

Description of Program/Intervention

This study assessed the feasibility of implementing THRIVE, an SDOH screening and referral program, in General Internal Medicine Clinics at BMC. THRIVE is not an acronym, rather it is the aspirational goal we set for partnering with our patients and brand for the program. THRIVE strives to understand social needs impacting patients' health, improve patient care by communicating social needs to care teams, provide patients with information on community resources that can mitigate their social needs and partner with our community to eliminate systemic barriers that prevent patients from *thriving*. In order to achieve these goals, we developed a strategy with the following operational components: screen for SDOH, capture responses as standard ICD-10 visit diagnosis codes in the EHR, and provide patients with resource referral guides to help address unmet social needs for which they desire help. THRIVE was modeled after pediatrics WE CARE, a SDOH screening and referral program developed by one of the coauthors (A.G.) and implemented at BMC and other urban pediatric clinics.[15]

To adapt the pediatric WE CARE screening tool for an adult population, we established an interdisciplinary committee including social science and health services researchers with SDOH experience, community engagement specialists, residents and medical students, operations managers, health care providers, a medical assistant (MA), a health literacy expert, and an IT analyst. First, based on the existing literature, the committee decided which SDOH domains to include in the screener while considering the following:
(1) Alignment of the domain between our institution and other national initiatives.
(2) Evidence the domain is associated with health outcomes.
(3) Burden of collection and sensitivity of asking about domain during patient care.
(4) Available options to help address the domain when patient screens positive.

Once the domains were selected, the committee chose questions for each of the domains. The initial screening tool was vetted with clinic staff across General Internal Medicine, Family Medicine, Obstetrics-Gynecology, and Pediatrics and 34 patients to understand their perceptions about the questions and gain insight on the acceptability of the proposed screening workflow. The main concern for clinical staff was formatting of the screener, which affected their ability to transcribe it into the EHR. Patient feedback consistently focused on 2 aspects for revision: (1) clarifying and simplifying questions; and (2) revising language to reduce stigma. On the basis of this feedback, the committee decided on the final list of domains which included: homelessness, housing insecurity, food insecurity, inability to afford medications, lack of transportation to medical appointments, utilities, caregiving, unemployment, and educational aspirations. Subsequently, the committee adapted and developed questions for each of the final domains. Questions from the pediatric WE CARE screening tool were used to screen for unemployment, caregiving, and utility needs. The "hunger vital sign" was used to screen for food insecurity.[16] The committee developed questions to screen for homelessness, housing insecurity, inability to pay for medications, lack of transportation to medical appointments, and educational aspirations. Following the patient-centered approach of WE CARE, we engaged patients by asking not just if these domains were challenges but also if they wanted help connecting to resources to address any of the 8 social needs (including education). The final THRIVE screening tool has been included in Appendix 1 (Supplemental Digital Content 1, http://links.lww.com/MLR/B663).

After the THRIVE screening tool was developed, we linked each positive SDOH screening response to an equivalent ICD-10 visit diagnosis code to capture these data in our EHR for internal reporting and invisit billing to facilitate information sharing with Massachusetts leaders. It is important to mention that education was the only SDOH that was not linked to an ICD-10 code because the question used to screen for this need did not reflect the ICD-10 code definition, which narrowly focuses on the patient's completion of high school or equivalent. In contrast, the education question on the THRIVE screening tool seeks to reduce stigma and better

align the question with current evidence on the associations between higher education and positive health outcomes by focusing on general educational aspirations, which may include education beyond high school, rather than a specific deficit. Hence we reported data derived from the THRIVE education item separately in the results section.

Patients indicated on the screening tool if they would like resources for each domain. Consistent with the WE CARE model, we developed 1-page resource referral guides (Appendix 2, Supplemental Digital Content 2, http://links.lww.com/MLR/B664) for each domain to provide information of preferred local community and hospital resources to address each social need. Resources for the Boston metropolitan area were created in collaboration with Health Leads, an organization that connects families in Boston with resources that address their social needs. Health Leads used their database of information on the most effective (based on quality rankings) community resources to address social needs in our population. In addition, focus groups with "high touch" care team members including care coordinators, patient navigators, social workers, case managers, and community health workers were conducted. During the focus groups, care team members provided information on resources they regularly use for patient referrals. The information from the Health Leads database and the care team members was combined to create referral guides. All documents were translated from English into Spanish, Haitian Creole, and Portuguese as these represent the most common languages of our primary care patients.

In March 2017, before integrating the screening tool and process into the EHR, we piloted a paper-based model in one General Internal Medicine Adult primary care clinic. During the paper pilot, we reviewed workflow with frontline staff (front desk staff, MAs, and nurses) to identify implementation barriers. We did this by conducting morning huddles with staff to obtain feedback on aspects to improve. We also met with providers, including residents, on a weekly basis to understand their barriers. The paper pilot taught us the resources required to sustain and expand a paper-based intervention were not sufficient. The primary barriers to sustainability and scalability were the lack of time from providers to manually add SDOH ICD-10 codes to the EHR and lack of resources for the time-intensive data collection and reporting process. MAs also reported being overwhelmed by manually looking for language appropriate resource referral guides when the patient requested help with a social need. To overcome these obstacles, we sought leadership approval to develop additional EHR functionality to address barriers identified by providers and MAs. As a result, we developed automated processes to populate SDOH ICD-10 codes in the EHR and to generate language appropriate resource referral guides. In addition, we developed automated dashboards to reduce the time-intensive burden of the data collection and reporting process.

In August 2017, we implemented THRIVE into clinical workflows in primary care clinics. The workflow is as follows:

(1) At check-in, front desk staff hands a language-congruent paper screener to all new patients who speak English, Spanish, Portuguese, or Haitian Creole. Patients speaking other languages are not screened at this time.

(2) Upon rooming of the patient, MAs document patient responses to the SDOH screener into the patient's EHR. For patients with low-literacy levels, MAs verbally read the questions to the patients and record responses. If the patient screens positive for an SDOH domain, the EHR automatically generates an order set which applies appropriate ICD-10 codes to the encounter visit diagnoses. If the patients ask to be connected to resources, the EHR automatically queues up an order set to print out the relevant patient resource referral guides. The MA pends the order set for the provider to electronically sign upon signing other orders placed for the patient during that visit.

(3) When providers log into the patient's chart, the pended SDOH orders can be found in the *orders* section of the visit and the ICD-10 codes are found in the *visit diagnoses* section. Providers sign the orders which generate printouts of the relevant prewritten resource referral guides.

(4) Upon review of the positive SDOH screening responses, the provider may also refer the patient to a care coordinator/patient navigator (specialists in connecting patients with social needs resources) to further support connection to resources.

Primary care units in General Internal Medicine (GIM) (n = 6 clinics) began using THRIVE with all new patients in August 2017.

To understand the burden of social needs among our patient population, we assessed the following:

(1) Proportion of patients who were screened to be positive for at least one social need.

(2) Proportion of patients with positive responses for each SDOH domain.

(3) Proportion of patients who requested to be connected to at least one resource.

(4) Proportion of patients who requested to be connected to each resource.

We used the following metrics to assess the feasibility of the process:

(1) Proportion of patients screened compared with total number of patients eligible for screening. Screening was considered complete if the patient answered ≥ 2 questions in the screening tool.

(2) Proportion of correct entries for a subset of 85 paper screening results that were transcribed into the EHR.

(3) Proportion of signed provider ICD-10 code orders compared with number of positive patient screens.

(4) Proportion of signed provider orders for SDOH resource referral guides compared with number of patients requesting help connecting to resources.

(5) Time expended by MAs to upload the screener in the EHR.

The results for this study are from descriptive analyses.

RESULTS

Between August 2017 and January 2018, GIM clinics screened 70% of all new patients (1696 patients screened of

TABLE 1. Demographics

Characteristics	Patients (N = 1522*) [n (%)]
Age at the time of visit [mean (SD)] (y)	40 (15.0)
Sex	
Male	790 (51.9)
Female	732 (48.1)
Ethnicity	
American Indian/Native American	6 (0.4)
Asian	61 (4.0)
Black/African American	607 (39.9)
Declined/not available	357 (23.5)
Hispanic or Latino	2 (0.1)
Native Hawaiian/Pacific Islander	3 (0.2)
Other	3 (0.2)
White	483 (31.7)
Primary language	
Cape Verdean/Port Creole	47 (3.1)
English	1169 (76.8)
Haitian Creole	124 (8.2)
Portuguese	16 (1.1)
Spanish	166 (10.9)

Dates of service: August 28, 2017–January 25, 2018.
*Demographic data are available for 1522 of 1696 screened patients.

2420 new patients). Only 5 of 2420 patients (<1%) refused to answer the screener. Among a subset of 85 paper screening responses, 75% were reliably transcribed by MAs into the EHR. Demographic information was available in the medical record for 1522 of the 1696 screened patients. The mean age of patients screened was 40 (SD, 15) years and 51.9% were male. Thirty-nine percent of patients were black/African American, 31.7% were white, 4% were Asian. Less than 1% of patients were American Indian/Native American, Hispanic or Latino, Native Hawaiian/Pacific Islander, or other (Table 1).

Twenty-six percent of patients responded positively to ≥ 1 social need(s) (445/1696, excluding the education domain).

Employment (12%), food insecurity (11%), and problems affording medications (11%) were the most prevalent SDOH domains among respondents. In terms of additional domains [including the education domain (N = 519)], 18% indicated they were interested in more education, 8% reported housing insecurity, 7% reported homelessness, 7% reported problems paying for transportation to medical appointments, 6% reported utility needs, and 3% reported hardships related to caring for a child or elder (Fig. 1). Patients *requested resources* for education (11%), housing, employment, and affording medications (all 8%) more often than other resources. Five percent of patients who screened negative for all social needs requested resources.

Eighty-two percent of patients who responded positive for a social need (excluding education) had ICD-10 codes added to their visit diagnoses (367/445). Of the 1696 patients screened, 22% requested help connecting to resources (n = 376). Of patients requesting resources, 86% received a resource referral guide (n = 325) (Fig. 2).

Results from the time study showed MAs expended an average of 1 minute to enter responses from the screening into the patient's medical record.

DISCUSSION

Our results showed that unemployment, food insecurity, and affording medications were the most commonly reported SDOH among BMC patients and that implementing a screening and referral process to address and document SDOH is feasible in our primary care practice. In addition, the results indicate that integrating a systematic clinical strategy using EHR workflows to address SDOH is feasible and may be acceptable in our urban safety net primary care setting. Patients and providers were willing to participate in the screening process, resulting in a high compliance rate among providers and a low refusal rate among patients. The screening and
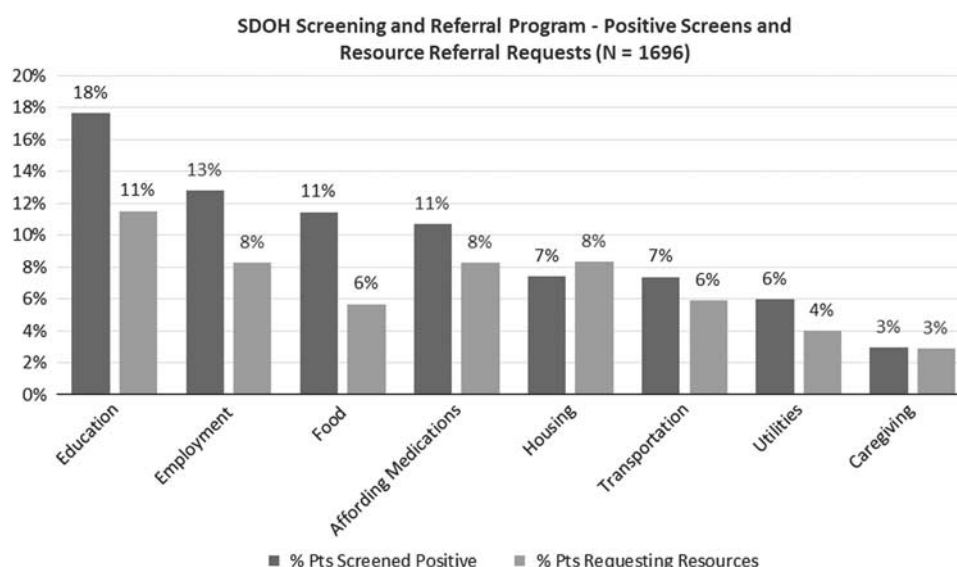

FIGURE 1. SDOH screening and referral program—positive screens and resource referral requests. SDOH indicates social determinants of health.

Total patients at Boston Medical Center GIM clinics
August 28, 2017 – January 25, 2018

N = 2420

Refusals

N = 5 out of 2420
(0.2%)

Patients screened using the screening tool

N = 1696 out of 2420 (70%)

Patients who screened positive for one or more social needs

Including education domain:
N = 519 out of 1696 (31%)
Not including education domain:
N* = 445 out of 1696 (26%)

Patients who requested resources for one or more social needs

N = 376 out of 1696 (22%)**

Patients with ICD 10 codes recorded in EHR

N* = 367 out of 445 (82%)

Patients who received resource referral guide

N = 325 out of 376 (86%)

*Excludes Education domain responses (n=74), as positive responses are not directly linked to having a social need and do not have an associated ICD 10 code.

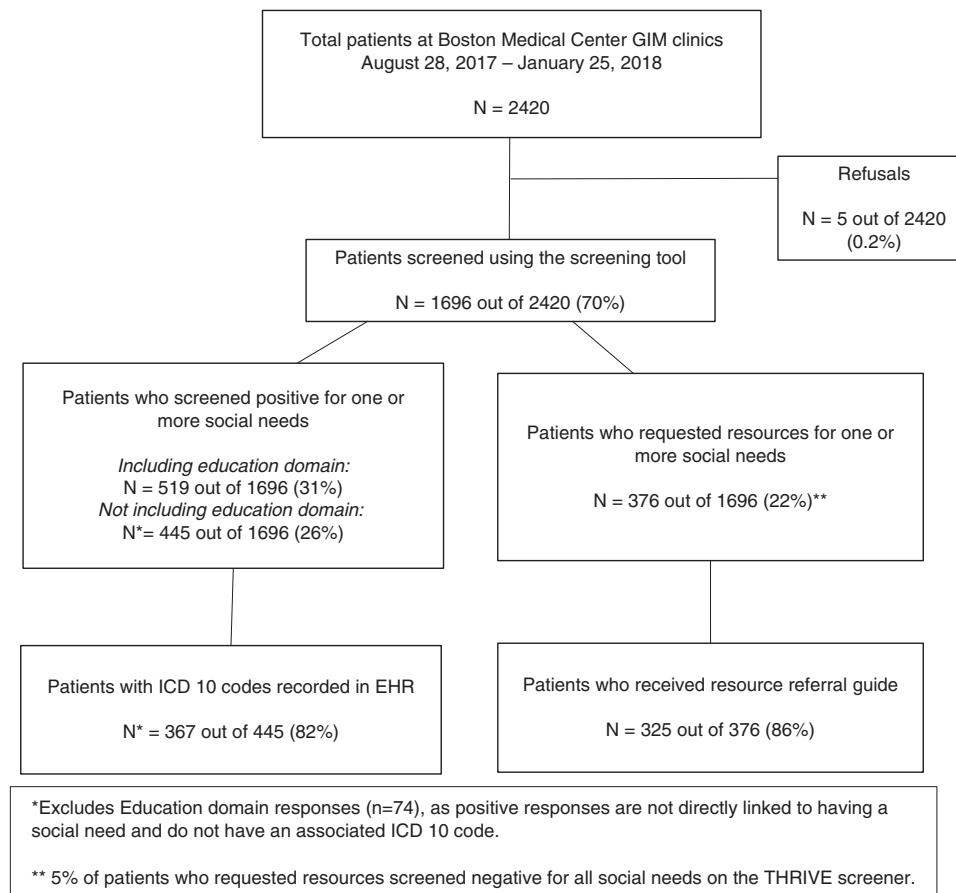** 5% of patients who requested resources screened negative for all social needs on the THRIVE screener.

FIGURE 2. Feasibility of social determinants of health screening and referral strategy. EHR indicates electronic health record; GIM, General Internal Medicine.

referral workflow in the EHR facilitated documentation of ICD-10 codes and streamlined the provision of resources to patients requesting additional information.

Our successful implementation may be associated with 4 important factors: getting support from institutional leadership, adequately leveraging EHR features[9] and workflows to minimize the time required by clinic staff and providers, soliciting and incorporating feedback from key stakeholders (including patients) before piloting or disseminating, and sharing relevant data with frontline practice managers and staff weekly.

As shown in previous feasibility studies, an iterative process which includes a pilot phase before implementing an SDOH program is necessary for ensuring provider compliance, patient satisfaction, and effective EHR integration.[4,10] Piloting the process in paper form and collaborating with Operational and IT leadership helped us to identify and anticipate major barriers in our workflow and develop a more streamlined and automated solution by leveraging the functionality of our EHR. This helped us to avoid spending time and resources on developing and redeveloping the EHR solution. We used EHR functionality to automate as many workflow elements as possible to decrease the time burden on clinic staff, particularly providers, and address patient needs. With IT support, we were

also able to develop an automated process to share implementation data with practice managers and participating clinics daily. This helped practice managers identify workflow gaps and develop targeted strategies to improve workflow compliance on a weekly basis.

One of the major challenges when implementing new clinical strategies in primary care is obtaining stakeholder buy-in.[17–19] By aligning our work with the strategic mission of the hospital, which is to identify root causes of chronic instability and utilization among patients and match resources against them to break chronic cycles, we were able to obtain buy-in from hospital leadership to designate IT resources to our program. Subsequently, we attained buy-in from primary care providers and clinic staff by actively soliciting their feedback in development of the SDOH strategy and incorporating their solutions to improve the program. Barriers, including those documented in previous studies, were addressed through this process.[14]

Specific barriers addressed during this process included provider training, clinical workflow and time constraints, and accommodations for patients with low-literacy levels or who speak a language not currently offered. First, we conducted trainings with clinical teams in each clinic using the THRIVE tool before implementation and provided consistent feedback

during rollout. In feedback sessions with staff during rollout, they identified, and we addressed, key reasons patients were not screened, including: clinical staff learning curves, lack of training of float staff who cover when front desk staff are unavailable, and providers' perceptions that screening will increase their wait time. Second, to address time and complexity barriers, we updated the process to a one-click protocol that an MA is able to complete in <1 minute while they are recording patient vital signs at the beginning of the visit. Finally, for patients speaking languages other than the ones available, we applied for resources to translate the screening tool into these languages in the future.

There are several limitations to the study. First, only new patients presenting to primary care went through the screening and referral process. Established patients were not included in this feasibility study in order to avoid overwhelming clinic staff and to better learn about the barriers before gradually scaling up to all patients by 2018. Clinic staff, however, reported difficulty identifying some new patients which reduced the number of patients screened. Although screening new patients for SDOH is beneficial to understand patients' needs and new patients have fewer expectations for previsit paperwork, patients new to a clinic may be apprehensive about disclosing this type of information to a new provider. In addition, our new patients are generally younger than established patients and, therefore, may be less socially or medically complex. Second, although most of the patients who requested assistance with social needs received a resource referral guide, we do not know how many patients actually connected with a resource and from those, how many were able to adequately address their social need. We are currently calling a sample of patients who received a resource guide to understand their experience connecting to a resource after completing the screening and referral process. We also recognize that some patients may have low health literacy and therefore may be unable to understand the resources provided. Finally, our study was conducted in one hospital utilizing one specific EHR platform, which may limit the generalizability of our findings.

This study demonstrates the feasibility of implementing a systematic strategy to address unmet SDOH in primary care settings using EHR decision support workflows. The process used to develop this strategy and the success of its implementation may have implications at the individual, organizational, local, and policy levels. On the organizational level, it will help us to expand our understanding of the complexity of the population we serve and to characterize their "social determinants" burden. Providers could use this information to better personalize treatment plans and direct patients to resources available in the hospital and community.[20] This could positively impact adjustments for risk and support upstream resources to eliminate gaps patients face which alter their quality of life. In turn, this may affect health outcomes or utilization, which we will examine in the future.

At the local level, we are actively using this information to better understand the burden of SDOH in our population and develop partnerships with community organizations that provide resources for the most prevalent social needs of our patients. We recognize that creating and updating resource information and developing resources for patients with low-literacy levels and who speak other languages is an ongoing challenge. Because of the importance of curating up-to-date resources, BMC decided to create its own "resource directory" that uses quality ratings to organize resources that help with social needs. This directory will update the community resources lists every 6 months.

Finally, we can use this information to improve local policies around SDOH by identifying gaps in community, city, and state resources.

REFERENCES

1. Braveman P, Gottlieb L. The social determinants of health: it's time to consider the causes of the causes. *Public Health Rep.* 2014;129(suppl 2):19–31.
2. Walker RJ, Smalls BL, Campbell JA, et al. Impact of social determinants of health on outcomes for type 2 diabetes: a systematic review. *Endocrine.* 2014;47:29–48.
3. Fuchs VR. Social determinants of health: Caveats and Nuances. *JAMA.* 2017;317:25–26.
4. Byhoff E, Cohen AJ, Hamati MC, et al. Screening for social determinants of health in Michigan Health Centers. *J Am Board Fam Med.* 2017;30: 418–427.
5. Berkowitz SA, Hulberg AC, Hong C, et al. Addressing basic resource needs to improve primary care quality: a community collaboration programme. *BMJ Qual Saf.* 2016;25:164–172.
6. Alley DE, Asomugha CN, Conway PH, et al. Accountable health communities—addressing social needs through Medicare and Medicaid. *N Engl J Med.* 2016;374:8–11.
7. Institute of medicine's committee on the recommended social and behavioral domains and measures for electronic health. Capturing social and behavioral domains and measures in electronic health records phase 2. 2014. Available at: www.nationalacademies.org/hmd/~/media/Files/Report Files/2014/EHR-phase-2/EHRfindingsrecs.pdf. Accessed January 5, 2018.
8. Gold R, Cottrell E, Bunce A, et al. Developing electronic health record (EHR) strategies related to health center patients' social determinants of health. *J Am Board Fam Med.* 2017;30:428–447.
9. Gottlieb LM, Tirozzi KJ, Manchanda R, et al. Moving electronic medical records upstream incorporating social determinants of health. *Am J Prev Med.* 2015;48:215–218.
10. Pinto AD, Glattstein-Young G, Mohamed A, et al. Building a foundation to reduce health inequities: routine collection of sociodemographic data in primary care. *J Am Board Fam Med.* 2016;29:348–355.
11. Adams E, Hargunani D, Hoffmann L, et al. Screening for food insecurity in pediatric primary care: a clinic's positive implementation experiences. *J Health Care Poor Underserved.* 2017;28:24–29.
12. Garg A, Dworkin PH. Surveillance and screening for social determinants of health: the medical home and beyond. *JAMA Pediatr.* 2016;170: 189–190.
13. Gottlieb L, Sandel M, Adler NE. Collecting and applying data on social determinants of health in health care settings. *JAMA Intern Med.* 2013;173: 1017–1020.
14. Garg A, Boynton-Jarrett R, Dworkin PH. Avoiding the unintended consequences of screening for social determinants of health. *JAMA.* 2016; 316:813–814.

15. Garg A, Toy S, Tripodis Y, et al. Addressing social determinants of health at well child care visits: a cluster RCT. *Pediatrics*. 2015;135: e296–e304.
16. Hager ER, Quigg AM, Black MM, et al. Development and validity of a 2-item screen to identify families at risk for food insecurity. *Pediatrics*. 2010;126:e26–e32.
17. Wagner EH, Austin BT, Von Korff M. Organizing care for patients with chronic illness. *Milbank Q*. 1996;74:511–544.
18. Wagner EH, Austin BT, Davis C, et al. Improving chronic illness care: translating evidence into action. *Health Aff*. 2001;20:64–78.
19. Kilbourne AM, Schulberg HC, Post EP, et al. Translating evidence-based depression management services to community-based primary care practices. *Milbank Q*. 2004;82:631–659.
20. Kressin NR, Chapman SE, Magnani JW. Patient-centered approaches to adherence as a gateway to reducing disparities. *Circulation*. 2016;133: 2583–2592.