Adoption of Social Determinants of Health EHR Tools by Community Health Centers

Rachel Gold, PhD, MPH[1,2]
Arwen Bunce, MA[1]
Stuart Cowburn, MPH[2]
Katie Dambrun, MPH[2]
Marla Dearing[2]
Mary Middendorf[2]
Ned Mossman, MPH[2]
Celine Hollombe, MPH[1]
Peter Mahr, MD[3]
Gerardo Melgar, MD[4]
James Davis[1]
Laura Gottlieb, MD, MPH[5]
Erika Cottrell, PhD, MPP[2]

[1]Kaiser Permanente Center for Health Research, Portland, Oregon

[2]OCHIN, Inc, Portland, Oregon

[3]Multnomah County Health Department, Portland, Oregon

[4]Cowlitz Family Health Center, Longview, Washington

[5]University of California, San Francisco, California

ABSTRACT

PURPOSE This pilot study assessed the feasibility of implementing electronic health record (EHR) tools for collecting, reviewing, and acting on patient-reported social determinants of health (SDH) data in community health centers (CHCs). We believe it is the first such US study.

METHODS We implemented a suite of SDH data tools in 3 Pacific Northwest CHCs in June 2016, and used mixed methods to assess their adoption through July 2017. We modified the tools at clinic request; for example, we added questions that ask if the patient wanted assistance with SDH needs.

RESULTS Social determinants of health data were collected on 1,130 patients during the study period; 97% to 99% of screened patients (n = 1,098) had ≥1 SDH need documented in the EHR, of whom 211 (19%) had an EHR-documented SDH referral. Only 15% to 21% of patients with a documented SDH need indicated wanting help. Examples of lessons learned on adoption of EHR SDH tools indicate that clinics should: consider how to best integrate tools into existing workflow processes; ensure that staff tasked with SDH efforts receive adequate tool training and access; and consider that timing of data entry impacts how and when SDH data can be used.

CONCLUSIONS Our results indicate that adoption of systematic EHR-based SDH documentation may be feasible, but substantial barriers to adoption exist. Lessons from this study may inform primary care providers seeking to implement SDH-related efforts, and related health policies. Far more research is needed to address implementation barriers related to SDH documentation in EHRs.

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CORRESPONDING AUTHOR
Rachel Gold, PhD, MPH
Kaiser Permanente Center for Health Research
3800 N Interstate Ave
Portland, OR 97227
Rachel.Gold@kpchr.org

INTRODUCTION

Numerous health care systems are exploring how to incorporate social needs documentation and intervention into routine care.[1-4] These efforts are based on strong evidence that patients' social and economic contexts (their social determinants of health [SDH]) shape health,[5-15] and on nascent evidence that clinic-based SDH screening and intervention can improve health.[2,16-20]

Standardized SDH screening documentation in electronic health records (EHRs) is endorsed by the National Academy of Medicine, the Medicare Access and Children's Health Information Program Reauthorization Act of 2015, the 2016 Centers for Medicare and Medicaid Services' Quality Strategy, and other professional organizations.[21-25] Such documentation is especially relevant to community health centers (CHCs), whose vulnerable patients are likely to experience social and economic risks associated with poor health.[26-36] Community health centers' past efforts to integrate social and medical needs[37] were typically ad hoc and rarely documented in EHRs.[3,4,38] Little is known about how to capture and present SDH information in CHCs' EHRs, or how to integrate EHR-based SDH documentation into CHC workflows.[19,39]

We conducted a pilot study to develop EHR-based SDH data tools for documenting and summarizing SDH screening results and making

SDH-related referrals, and then assessed adoption of these tools by CHCs. We previously described the tools' development (Table 1 for SDH data tools and domains; Supplemental Appendix 1, available at http://www.annfammed.org/content/16/5/399/suppl/DC1/, for the screening questions).[40] The tools built on the Protocol for Responding to and Assessing Patient Assets, Risks, and Experiences (PRAPARE), a national effort to develop a standardized approach to SDH documentation by CHCs. This effort prioritized SDH domains for screening in CHCs, included recommendations for presenting SDH data in EHRs,[41,42] and incorporated many of the National Academy of Medicine's SDH domains.[22] Our SDH data tools represent the Epic (Epic Systems Corp) version of PRAPARE. The tools were developed using a stakeholder-driven process, in which diverse CHC staff reviewed tool prototypes that we iterated based on their feedback. The prototypes were informed by expert knowledge of standard EHR functionalities.

This paper focuses on describing and evaluating: how 3 CHCs adopted these EHR tools designed for SDH screening documentation and action in standard workflows; facilitators and barriers to this adoption; and the SDH needs documented via the EHR tools. We believe this is the first US study on the collection of SDH data using EHR-based tools in CHCs.

METHODS

Setting

This work was conducted at OCHIN, a non-profit host of an Epic EHR for >600 primary care CHCs, the nation's largest CHC network on a single EHR system. We recruited 3 OCHIN member CHCs in late 2015, based on clinic interest in SDH screening and proximity to OCHIN's headquarters. Like most CHCs, the study clinics' patient populations are primarily publicly insured or uninsured and aged <65 years; 10% to 31% are non-white and 10% to 30% are of Hispanic ethnicity (Table 2).

Tool Implementation

In June 2016, the SDH data collection and summary tools were deployed to all OCHIN CHCs; the referral tools were deployed only in the 3 pilot CHCs because they required local customization (Table 1). We used several implementation strategies[43] to support tool adoption in the pilot CHCs. Each clinic identified an SDH champion and staff members were engaged in tool development.[40] We held 2 trainings for clinic staff before the tools' release: 8 staff from the 3 pilot sites were invited, and encouraged to invite other staff to attend; 25 people attended. We provided written materials explaining SDH, the SDH data tools and their potential uses, and paper versions of the SDH questionnaire in English and Spanish.

During tool testing and use, the pilot clinics requested several tool modifications. These were made as soon as feasible given the need to obtain stakeholder consensus and work within OCHIN's change processes. A "no follow-up needed" referral option was added in time for the initial, June 2016, tool release. Questions asking whether the patient wanted assistance with needs identified in the SDH questionnaire, and what kind of assistance (informational handout or contact from clinic staff), were requested in February 2017 and added in May 2017. Also in May 2017, we added reportable

Table 1. SDH Data Tools and SDH Domains

SDH Data Tools	Description
SDH Data Collection Tools	Included 14 SDH screening questions based on PRAPARE and National Academy of Medicine recommendations. Data collection modes included: data-entry flowsheets accessible by diverse clinic staff, a print version for patients to complete after which the data would be entered by CHC staff into a flowsheet, and an online portal form that patients could complete before the visit.
SDH Summary Tools	Patient's most recent SDH data displayed (as entered in flowsheets or elsewhere in the EHR), and past SDH-related referrals.
SDH Data Rosters	Added SDH-related data columns to the EHR's panel management tools to identify patients who (1) had a pending visit (enabling e-mailing those with online portal accounts about completing SDH screening pre-appointment); (2) had a positive SDH screen and needed follow-up; or (3) were due for SDH screening.
Problem List	Created a new SDH class of problem list diagnoses, so that users could manually categorize SDH diagnoses in the problem list.
SDH Referral Tools	Built as preference lists, to parallel the clinics' processes for making clinical referrals. Worked with pilot clinics to create preference lists of local resources for addressing specific SDH needs. Used to add information about relevant resources to the patient's after-visit summary and to identify resources that clinic staff could discuss with the patient.

SDH Domains[a]		
Alcohol use[b]	Education	Exposure to violence
Race/ethnicity[b]	Financial resource strain	Physical inactivity
Tobacco use and exposure[b]	Housing insecurity	Social isolation
Depression[b]	Food insecurity	Stress

CHC = community health centers; EHR = electronic health record; PRAPARE = Protocol for Responding to and Assessing Patient Assets, Risks, and Experiences; SDH = social determinants of health.

[a] Wording defined in Supplemental Appendix 1, available at http://www.annfammed.org/content/16/5/399/suppl/DC1/.

[b] Information on these domains is routinely documented elsewhere in the EHR so they were not included in the SDH data collection tool flowsheet. Responses, however, were pulled into the SDH summary tool.

Table 2. Patient and Visit Characteristics of Patients Seen During the Study Period, and of Those Screened for SDH, by Clinic

	Clinic A		Clinic B		Clinic C	
Patient Characteristics	**Total Patients No. (%)**	**Screened Patients No. (%)**	**Total Patients No. (%)**	**Screened Patients No. (%)**	**Total Patients No. (%)**	**Screened Patients No. (%)**
Number of patients	4,208 (100.0)	602 (14.3)	2,126 (100.0)	379 (17.8)	3,741 (100.0)	149 (4.0)
Race						
American Indian/AK Native	122 (2.9)	14 (2.3)	56 (2.6)	9 (2.4)	39 (1.0)	0 (0.0)
Asian	50 (1.2)	5 (0.8)	30 (1.4)	4 (1.1)	494 (13.2)	9 (6.0)
Black/African American	62 (1.5)	8 (1.3)	31 (1.5)	5 (1.3)	303 (8.1)	9 (6.0)
Native Hawaiian/PI	39 (0.9)	6 (1.0)	15 (0.7)	5 (1.3)	21 (0.6)	2 (1.3)
White	3,798 (90.3)	541 (89.9)	1,726 (81.2)	322 (85.0)	2,569 (68.7)	105 (70.5)
Multiple races	73 (1.7)	12 (2.0)	88 (4.1)	13 (3.4)	70 (1.9)	4 (2.7)
Unknown	64 (1.5)	16 (2.7)	180 (8.5)	21 (5.5)	245 (6.5)	20 (13.4)
Hispanic						
Yes	403 (9.6)	40 (6.6)	627 (29.5)	75 (19.8)	531 (14.2)	22 (14.8)
No	3,710 (88.2)	545 (90.5)	1,457 (68.5)	292 (77.0)	3,110 (83.1)	121 (81.2)
Unknown	95 (2.3)	17 (2.8)	42 (2.0)	12 (3.2)	100 (2.7)	6 (4.0)
Sex						
Female	2,416 (57.4)	315 (52.3)	1,287 (60.5)	200 (52.8)	1,898 (50.7)	42 (28.2)
Male	1,792 (42.6)	287 (47.7)	837 (39.4)	178 (47.0)	1,843 (49.3)	107 (71.8)
Unknown	0 (0.0)	0 (0.0)	2 (0.1)	1 (0.3)	0 (0.0)	0 (0.0)
Age: 1st study period visit, y						
18-29	1,069 (25.4)	169 (28.1)	544 (25.6)	42 (11.1)	817 (21.8)	48 (32.2)
30-49	1,793 (42.6)	241 (40.0)	872 (41.0)	142 (37.5)	1,478 (39.5)	69 (46.3)
50-64	1,173 (27.9)	170 (28.2)	551 (25.9)	140 (36.9)	1,009 (27.0)	27 (18.1)
≥65	173 (4.1)	22 (3.7)	159 (7.5)	55 (14.5)	437 (11.7)	5 (3.4)
Homeless status						
Yes	64 (1.5)	7 (1.2)	72 (3.4)	13 (3.4)	55 (1.5)	1 (0.7)
No	1,858 (44.2)	198 (32.9)	713 (33.5)	114 (30.1)	1,299 (34.7)	44 (29.5)
Unknown	2,286 (54.3)	397 (65.9)	1,341 (63.1)	252 (66.5)	2,387 (63.8)	104 (69.8)
Migrant/seasonal worker						
Yes	13 (0.3)	3 (0.5)	47 (2.2)	0 (0)	7 (0.2)	0 (0)
No	1,911 (45.4)	200 (33.2)	728 (34.2)	131 (34.6)	936 (25.0)	24 (16.1)
Unknown	2,284 (54.3)	399 (66.3)	1,351 (63.5)	248 (65.4)	2,798 (74.8)	125 (83.9)
Primary payer						
Medicaid	2,957 (70.3)	416 (69.1)	1,189 (55.9)	193 (50.9)	2,313 (61.8)	84 (56.4)
Medicare	455 (10.8)	52 (8.6)	215 (10.1)	78 (20.6)	567 (15.2)	13 (8.7)
Other public	11 (0.3)	2 (0.3)	9 (0.4)	0 (0.0)	5 (0.1)	0 (0.0)
Private	264 (6.3)	39 (6.5)	299 (14.1)	40 (10.6)	94 (2.5)	4 (2.7)
Uninsured	521 (12.4)	93 (15.4)	414 (19.5)	68 (17.9)	762 (20.4)	48 (32.2)
Primary language						
English	3,915 (93.0)	582 (96.7)	1,703 (80.1)	330 (87.1)	2,761 (73.8)	126 (84.6)
Spanish	189 (4.5)	6 (1.0)	418 (19.7)	48 (12.7)	336 (9.0)	12 (8.1)
Other	56 (1.3)	6 (1.0)	4 (0.2)	1 (0.3)	639 (17.1)	11 (7.4)
Unknown	48 (1.1)	8 (1.3)	1 (0.0)	0 (0.0)	5 (0.1)	0 (0.0)
Veteran status						
Yes	118 (2.8)	26 (4.3)	87 (4.1)	17 (4.5)	78 (2.1)	10 (6.7)
No	4,049 (96.2)	566 (94.0)	2,032 (95.6)	360 (95.0)	3,358 (89.8)	112 (75.2)
Unknown	41 (1.0)	10 (1.7)	7 (0.3)	2 (0.5)	305 (8.2)	27 (18.1)
Diabetes status						
Yes	557 (13.2)	68 (11.3)	279 (13.1)	110 (29.0)	531 (14.2)	7 (4.7)
No	3,651 (86.8)	532 (88.4)	1,847 (86.9)	269 (71.0)	3,210 (85.8)	142 (95.3)
Unknown	0 (0.0)	2 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
New/established patients						
New patients	699 (16.6)	311 (51.7)	239 (11.2)	57 (15.0)	1,251 (33.4)	142 (95.3)
Established patients	3,509 (83.4)	291 (48.3)	1,887 (88.8)	322 (85.0)	2,490 (66.6)	7 (4.7)

continues

AK = Alaska; PI = Pacific Islander.

Table 2. Patient and Visit Characteristics of Patients Seen During the Study Period, and of Those Screened for SDH, by Clinic *(continued)*

	Clinic A		Clinic B		Clinic C	
Visit Characteristics	**Total Patients No. (%)**	**Screened Patients No. (%)**	**Total Patients No. (%)**	**Screened Patients No. (%)**	**Total Patients No. (%)**	**Screened Patients No. (%)**
Number of visits	13,990 (100.0)	611 (4.4)	8,162 (100.0)	385 (4.7)	16,281 (100.0)	149 (0.9)
Type of practioner						
MD, DO, Locum Tenens	2,686 (19.2)	7 (1.1)	3,892 (47.7)	209 (54.3)	7,663 (47.1)	149 (100.0)
NP, PA	8,827 (63.1)	24 (3.9)	2,577 (31.6)	76 (19.7)	4,399 (27.0)	0 (0.0)
RN, LPN, CHN	1,359 (9.7)	187 (30.6)	1,427 (17.5)	79 (20.5)	2,428 (14.9)	0 (0.0)
MA	1,049 (7.5)	1 (0.2)	59 (0.7)	0 (0.0)	109 (0.7)	0 (0.0)
BHS, LCSW	...	0 (0.0)	181 (2.2)	18 (4.7)	1,550 (9.5)	0 (0.0)
Eligibility specialist	...	392 (64.2)	...	0 (0.0)	...	0 (0.0)
Other	69 (0.5)	0 (0.0)	26 (0.3)	3 (0.8)	132 (0.8)	0 (0.0)
Clincian status						
Primary care clinician	7,119 (50.9)	22 (3.6)	4,439 (54.4)	204 (53.0)	9,151 (56.2)	145 (97.3)
Other	6,871 (49.1)	589 (96.4)	3,723 (45.6)	181 (47.0)	7,130 (43.8)	4 (2.7)

AK = Alaska; BHS = behavioral health specialist, CHN = community health nurse; DO = doctor of osteopathy; LCSW = licensed clinical social worker; LPN = licensed practical nurse; MA = medical assistant; MD = doctor of medicine; NP = nurse practitioner; PA = physician's assistant; PI = Pacific Islander; RN = registered nurse.

text shortcuts to help document domains for when the patient was given SDH-related information or to document if assistance with SDH needs was declined.

Data Collection and Analyses

We conducted a concurrent[44] mixed-methods analysis of the pilot clinics' adoption of the SDH data tools from activation in June 2016 through July 2017. The study was extended from 12 to 13 months to assess initial impacts of the tool changes described above. Quantitative and qualitative data were collected simultaneously. Preliminary results from each informed subsequent data collection (eg, discrepancies between interview descriptions of clinic workflows and corresponding quantitative data were further explored in site visits). Final results were compared to validate and confirm analytic interpretations.

Quantitative data, including patient demographic and visit characteristics, were extracted from OCHIN's EHR to describe adult patients (aged ≥18 years) who had SDH data documented in the EHR, or (for comparison) had ≥1 ambulatory visit at a pilot site during the study period. SDH data documented in the EHR was used to describe the prevalence of potential SDH needs. EHR data were also used to quantify SDH-related referrals and problem list diagnoses.

Qualitative data collection included: workflow observation (6 days) and interviews (n = 24) with diverse care team members involved in collecting and acting on SDH information; and observations of discussions among clinic decision-makers to understand clinic processes of implementing SDH tool use, and barriers and/or facilitators. Data collection and analysis were iterative and inductive; emergent understanding and questions from preliminary findings were explored. Analyses utilized deductive and inductive coding.[45] *A priori* codes (conceptual categories) were created for staff role, tool type, and workflow step (eg, data collection, action, reporting) and data-driven codes (eg, specific barriers/facilitators, role of clinic leadership) were identified through data immersion. Analysis followed the constant comparative method[46]; new data were compared with previously collected/coded data to detect commonalities/differences, and to develop nuanced understandings of clinic experiences. Once coding was complete we created clinic-specific summaries for cross-site comparison. Regular study team meetings and discussions with stakeholders informed each step of analysis and results interpretation.

This study was approved by the Kaiser Permanente Northwest Institutional Review Board.

RESULTS

Implementation

Each clinic first screened a limited population of patients, then scaled up. Clinic A first tested their workflows with a few randomly chosen patients per day, then added all new patients plus those completing annual insurance reauthorizations, and eventually added patients receiving care coordination, HIV services, and behavioral health services. Clinic B began with patients in their diabetes and Hepatitis C case management programs, then added patients aged 65 years and older. Clinic C first screened new patients seen by a single provider, stopped for a time to address

barriers related to staff access to and knowledge of the tools, then adopted screening clinic-wide in July 2017, after study data collection had stopped. All 3 clinics: (1) adapted their workflows as needed; (2) principally used the paper-based SDH screening questionnaire, necessitating a data entry workflow step that impacted when the data were available in the EHR; and (3) sought to minimize the primary care provider's role in SDH documentation, and in making SDH-related referrals. Supplemental Appendix 2 gives detailed descriptions of the clinics' target populations and workflow iterations (Supplemental Appendix 2, available at http://www.annfammed.org/content/16/5/399/suppl/DC1/).

SDH Screening Documentation and Referrals

Social determinants of health data were collected on 1,130 patients, representing 4% to 18% of adult patients with an ambulatory visit at the pilot clinics during the study period (Table 2 and Table 3). Most screened patients (97% to 99%) indicated a potential SDH need in ≥1 SDH domain; prevalence of needs by domain was similar across sites (Table 4). Among screened patients whose responses indicated ≥1 potential SDH need, 211 (19%) received an SDH-related referral. Referral workflows varied by clinic, differentially impacting our ability to determine SDH domains associated with referrals. In Clinic A, patients were referred to community services chosen from the referral tool, linked to an SDH-related diagnosis code, thus facilitating matching referrals to specific needs (Table 4). Clinics B and C routed most SDH referrals to community health workers or similar staff; these internal referrals generally lacked the information required to match them to a specific SDH need. In the 3 months after we added questions asking whether patients wanted help with SDH needs, Clinic A screened 68 patients, and Clinic B 182 patients, of whom 62 and 178 (respectively) indicated ≥1 SDH need; 15% of Clinic A patients and 21% of Clinic B patients with a documented need requested help.

Table 3. Patients Screened for SDH Over Time, by Study Clinic (N = 1,130)

	Distinct Patients Screened, No.		
Month	Clinic A (n = 602)	Clinic B (n = 379)	Clinic C (n = 149)
Jul 2016	1	26	9
Aug 2016	32	13	31
Sep 2016	84	8	19
Oct 2016	78	7	19
Nov 2016	78	4	27
Dec 2016	70	22	12
Jan 2017	78	23	19
Feb 2017	52	21	13
Mar 2017	33	10	0
Apr 2017	21	51	0
May 2017	30	101	0
Jun 2017	28	31	0
Jul 2017	17	62	0

SDH = social determinants of health.

Note: Clinic C data based on encounters with 1 provider. SDH screening stopped in Clinic C in February 2017 for reassessment of workflows and EHR access policies.

Barriers and Facilitators

Facilitators to using EHR tools to document SDH included a clinic champion who was trusted, EHR-savvy, able to customize EHR views to support workflows, and willing to use adoption data to iterate workflows. Making it known that SDH data might address reporting requirements increased staff motivation. Key barriers included perceptions that EHR-based SDH data tools: (1) created a fragmented view of the patient, with relevant data in multiple places, and did not readily support documenting a narrative about a given patient; (2) could add a layer of difficulty to collecting and acting on SDH data; (eg, due to lack of staff EHR expertise, the tools' customized nature, differences in EHR security access by staff role, and the need for new EHR competencies from some staff); and (3) necessitated a data entry step if SDH information were collected on paper. Referral workflows were seen as too time-consuming, especially when no follow-up was planned; and, until questions asking whether patients desired follow-up for SDH needs were added, the high positive screening rate yielded an unmanageable follow-up workload (Supplemental Appendix 3, available at http://www.annfammed.org/content/16/5/399/suppl/DC1/).

DISCUSSION

Our results raise important questions about the feasibility of EHR-based SDH documentation per national recommendations. The argument for such documentation is compelling: SDH profoundly impact health, so providers should know about social factors that might increase their patients' health risks, or hinder their ability to follow care recommendations. An expanding base of literature shows that SDH screening and referral (via paper-based documentation) is associated with improved health outcomes.[2] Since most health care systems document and track most patient information in EHRs, SDH data should also be in EHRs. Social determinants of health documentation in EHRs could enable care plan adjustments/referrals to social services, and tracking such referrals' results. Furthermore, this documentation could support evaluation of how community referrals impact health and help identify resource gaps

Table 4. Screening Results and Referral Rates

Study Clinic	Patients Screened, No.	Screened Patients With		SDH Domain	Domains for Patients With Positive Screen, No. (%)	Patients With Positive Screen and Matching	
		Positive SDH Screen, No. (%)	SDH Referral, No. (%)			SDH Referral[a], No. (%)	Problem List dx, No. (%)
A	602	583 (96.8)	141 (23.4)	Financial resource strain	426 (70.8)	105 (24.6)	22 (5.2)
				Housing insecurity	206 (34.2)	60 (29.1)	19 (9.2)
				Food insecurity	331 (55.0)	91 (27.5)	22 (6.6)
				Intimate partner violence	175 (29.1)	1 (0.6)	0 (0.0)
				Inadequate physical activity	311 (51.7)	0 (0.0)	0 (0.0)
				Social isolation	433 (71.9)	12 (2.8)	4 (0.9)
				Stress	436 (72.4)	0 (0.0)	2 (0.5)
B	379	367 (96.8)	26 (6.8)	Financial resource strain	277 (73.1)	1 (0.4)	0 (0.0)
				Housing insecurity	103 (27.2)	3 (2.9)	0 (0.0)
				Food insecurity	216 (57.0)	0 (0.0)	0 (0.0)
				Intimate partner violence	94 (24.8)	0 (0.0)	0 (0.0)
				Inadequate physical activity	167 (44.1)	0 (0.0)	0 (0.0)
				Social isolation	235 (62.0)	0 (0.0)	0 (0.0)
				Stress	253 (66.8)	0 (0.0)	2 (0.8)
C	149	148 (99.3)	44 (29.5)	Financial resource strain	107 (71.8)	3 (2.8)	1 (0.9)
				Housing insecurity	56 (37.6)	3 (5.4)	1 (1.8)
				Food insecurity	86 (57.7)	2 (2.3)	0 (0.0)
				Intimate partner violence	36 (24.2)	0 (0.0)	0 (0.0)
				Inadequate physical activity	63 (42.3)	0 (0.0)	0 (0.0)
				Social isolation	111 (74.5)	1 (0.9)	0 (0.0)
				Stress	107 (71.8)	1 (0.9)	8 (7.5)

dx = diagnosis; EHR = electronic health record; SDH = social determinants of health.

[a] Referrals were matched to screening domains based on evaluation of EHR documentation associated with the referral order, including type and/or specialty of the referral provider and diagnoses associated with the referral.

in a community, enabling advocacy[47] and other steps to address health disparities.

Before benefits can be fully realized, the unique challenges of EHR-based SDH documentation and referral-making must be understood and addressed.[1,39,48] Some barriers identified in this study parallel those of other efforts to collect patient-reported data using EHRs, such as difficulties with staff training and turnover, and workflow optimization.[49-57] While some aspects of the tools were not widely adopted, this is common to such efforts[58-61]; adoption of new EHR tools can take time. Some barriers to SDH screening are likely to occur regardless of the technology used, for example, staff concerns about SDH screening when little intervention is possible. Our findings are consistent with those of a prior case study on EHR-based SDH documentation.[62] SDH documentation, review, and referral-making in EHRs can be feasible and useful, but is challenging to adopt.[63] Despite the many identified challenges to adopting all of the SDH data tools, the study clinics did successfully document SDH in the EHR, and continued to do so post-study. Referral documentation proved especially challenging. Therefore, to meet the growing national emphasis on EHR-based SDH documentation and referral, numerous factors must be considered.

When planning for implementation, ensure that new staff are trained in SDH workflows. Consider whether upgrades or other EHR changes may impact SDH tool use and/or necessitate additional training. Ensure that the correct staff have security access to the tools for the envisioned workflow and appropriate training. Consider conducting a staged rollout of SDH documentation to help identify needed changes in planned workflows. When designing SDH workflows, try to create workflows where data are entered directly in the computer (by staff at point of data collection or through a patient portal). If the workflows involve paper-based data collection, specify staff and the timeframe for data entry, and consider that timing of data entry will impact when, how, and by whom the data can be accessed and used. Consider that the completed paper form does not reveal how a patient scored on the SDH domains; this scoring is not easily identifiable until the data are in the EHR. Make the review of individual patients' SDH data explicit in workflows and emphasize how to locate the summary tools in trainings. If warm hand-offs (eg, referrals to

community health workers) are desired in the referral workflow, consider: needed staffing, transitions, and rooms; what to do if the right staff person is not available; when to collect SDH data to support this workflow; and different timing options for the hand-off. Consider using roster tools to iteratively review and adjust workflows as necessary.

When designing EHR tools for SDH, vendors and programmers should ensure that documentation identifies if patients (with a SDH need) want assistance with addressing the need and what kind of assistance they want. Consider using text shortcut tools to document provision of community resource materials or referrals provided by SDH topic (this does not provide agency details, but is a fast and easy way to document SDH referrals). Also, consider having the ability to label referrals as "no follow-up needed" when appropriate. Design documentation tools that seamlessly integrate into existing clinic workflows. Expand approaches to documenting patient-reported data without requiring staff data entry (eg, patient portals, data collection computer tablets in clinic waiting and exam rooms, data collection through phone texts). Improve EHRs' capacity to provide updated lists of community resources, and to document and track referrals to those resources.

Limitations

We could not calculate rates of SDH screening documentation among targeted patients because the study clinics' target populations changed during the study period, the dates of these changes were unclear, and target criteria were not easily extracted from the EHR. These differentially targeted groups also underlie variation in the characteristics of screened vs unscreened patients, so such differences cannot be interpreted as related to EHR-based SDH screening. The groups initially targeted for screenings were chosen by the clinics for pragmatic reasons, in that they were relatively easy to identify. Therefore, it is unlikely that the high rate of positive screening results reflects the patients targeted for screening.

It is possible that our count of screened patients may be low, and prevalence of SDH needs among screened patients may be higher than in the clinics' overall population, as some data from paper surveys were likely not entered into EHRs, especially if no SDH needs were identified. For example, some clinic counts of patients screened did not match our quantitative data from the EHR; further, we observed that data entry workflows were not always standardized. Similarly, referral rates are likely underestimated; qualitative data suggests that community resource referrals were often documented in chart notes rather than in discrete fields in the EHR, so could not be readily tracked quantitatively. We were unable to assess changes in SDH status, care quality, or biomarkers, as the study sites chose to conduct SDH documentation annually within a 1-year analysis period. We were unable to quantify how often the SDH summary was accessed, or by whom, because no data entry was involved in use of this tool. The SDH screening measures used here have not been validated as predictive of specific outcomes; far more research is needed in this area. Finally, this pilot study involved a single EHR system; the tools and workflows discussed here may not be transferable to other systems.

CONCLUSION

This pilot study is the first to formally test adoption of EHR-based SDH data documentation, review, and action in CHCs, and is one of the first in any clinical setting. Our results suggest that SDH documentation in EHRs is feasible; however, for the benefits of systematic EHR-based SDH documentation to be realized, barriers to adoption of EHR tools must be addressed. Results may be informative to CHCs and other primary care providers seeking to implement SDH-related efforts, especially if SDH documentation becomes required or associated with financial incentives. Far more research is needed in this area, including: optimal methods for collecting SDH data into EHRs at or before clinic visits; strategies for implementing EHR-based SDH documentation and review into standard workflows; and optimal methods for linking clinics to community services and maintaining resource lists. The systematic EHR documentation and management of SDH needs could impact CHC patients' health, but optimizing such EHR tools and integrating them smoothly into clinic workflows will require addressing substantial knowledge gaps.

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Key words: social determinants of health; electronic health records; community health centers; implementation

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