American Journal of
Preventive Medicine

RESEARCH ARTICLE

Interactivity in a Decision Aid: Findings From a Decision Aid to Technologically Enhance Shared Decision Making RCT

Masahito Jimbo, MD, PhD, MPH,[1] Ananda Sen, PhD,[1,2] Melissa A. Plegue, MA,[1] Sarah Hawley, PhD, MPH,[3] Karen Kelly-Blake, PhD,[4] Mary Rapai, MA,[1] Minling Zhang, MS,[6] Yuhong Zhang, BS,[1] Xiao Xie, MS,[1] Mack T. Ruffin IV, MD, MPH[7]

Introduction: Colorectal cancer screening (CRCS) remains underutilized. Decision aids (DAs) can increase patient knowledge, intent, and CRCS rates compared with "usual care," but whether interactivity further increases CRCS rate remains unknown.

Study design: A two-armed RCT compared the effect of a web-based DA that interactively assessed patient CRC risk and clarified patient preference for specific CRCS test to a web-based DA with the same content but without the interactive tools.

Setting/participants: The study sites were 12 community- and three university-based primary care practices (56 physicians) in southeastern Michigan. Participants were men and women aged 50–75 years not current on CRCS.

Intervention: Random allocation to interactive DA (interactive arm) or non-interactive DA (non-interactive arm).

Main outcome measures: Primary outcome was medical record documentation of CRCS 6 months after the intervention. Secondary outcome was patient decision quality (i.e., knowledge, preference clarification, and intent) measured immediately before and after DA use, and immediately after the office visit. To determine that either DA had a positive effect on CRCS adherence, usual care CRCS rates were determined from the three university-based practices among patients eligible for but not participating in the study.

Results: Data were collected between 2012 and 2014; analysis began in 2015. At 6 months, CRCS rate was 36.1% (95% CI=30.5%, 42.2%) in the interactive arm (n=284) and 40.5% (95% CI=34.7%, 46.6%) in the non-interactive arm (n=286, p=0.29). Usual care CRCS rate (n=440) was 18.6% (95% CI=15.2%, 22.7%), significantly lower than both arms (p<0.001). Knowledge, attitude, self-efficacy, test preference, and intent increased significantly within each arm versus baseline, but the rate was not significantly different between the two arms.

Conclusions: The interactive DA did not improve the outcome compared to the non-interactive DA. This suggests that the resources needed to create and maintain the interactive components are not justifiable.

Trial registration: This study is registered at www.clinicaltrials.gov NCT01514786.

Am J Prev Med 2019;57(1):77–86. © 2019 Published by Elsevier Inc. on behalf of American Journal of Preventive Medicine.

From the [1]Department of Family Medicine, University of Michigan, Ann Arbor, Michigan; [2]Department of Biostatistics, University of Michigan, Ann Arbor, Michigan; [3]Department of Internal Medicine, University of Michigan, Ann Arbor, Michigan; [4]Center for Ethics and Humanities in the Life Sciences and Department of Medicine, Michigan State University, East Lansing, Michigan; [6]Kidney Epidemiology and Cost Center, University of Michigan, Ann Arbor, Michigan; and [7]Department of Family and Community Medicine, Penn State Health Milton S. Hershey Medical Center, Penn State College of Medicine, Hershey, Pennsylvania

Address correspondence to: Ananda Sen, PhD, Department of Family Medicine, University of Michigan, 1018 Fuller Street, Ann Arbor MI 48104. E-mail: anandas@umich.edu.

This study is registered at www.clinicaltrials.gov NCT01514786.

0749-3797/$36.00

https://doi.org/10.1016/j.amepre.2019.03.004

INTRODUCTION

Colorectal cancer screening (CRCS) is recommended for all average-risk U.S. adults aged 50–75 years because it reduces CRC death and morbidity.[1–4] Main CRCS test options are stool blood test (SBT) and colonoscopy, unless the adult is at increased risk for CRC, in which case colonoscopy is recommended.[1,5] CRCS rates have shown an upward trend, with overall CRCS rates increasing from 34% in 2000 to nearly 63% in 2015.[6] However, millions of eligible people remain unscreened by any method.[6] No strong evidence exists that favors one CRCS test over another for reducing CRC mortality in average-risk adults.[1,6] Offering patients CRCS test options improves CRCS rates.[6,7]

Physicians are encouraged to incorporate patient values when discussing CRCS and eliciting patients' screening choice, and to counsel patients to choose the CRCS test most congruous with their risk and values.[8–11] Shared decision making (SDM) recognizes the central role of the patient–physician relationship in helping patients make such decisions.[10,12] However, SDM requires more time and resources than most physicians have, especially with multiple, competing agendas.[13–16] Also, physicians do not always correctly perceive and address those factors important to patients and may not have the training and skills to provide for an effective SDM encounter.[9,12,15,17,18]

Decision aids (DAs) may facilitate SDM by reducing patient decisional conflict, improving patient knowledge, and activating patients in decision making without increasing anxiety.[19] Studies utilizing DAs with or without other interventions have shown variable increases in CRCS adherence.[20–46] However, much is still unknown about DAs and CRCS, especially the role of interactivity in determining the patients' risk for CRC and clarifying their CRCS test preference. In particular, it is unknown whether these additional interactive elements lead to increased CRCS adherence and decision quality. Interactivity of electronic education resources is promoted to improve communications with patients, as it allows for two-way communication, synchronicity, and a personalized experience.[47–49] However, none of the examined studies compared the new technology with interactivity with a similar system without interactivity. The common comparisons were usual practice or an existing system that did not have the same content or formatting.

ColoDATES Web (CW) is an interactive DA for CRCS designed to be used prior to a clinic visit.[35,50,51] It contains an interactive tool to clarify patient preference for a specific CRCS test, and was developed through extensive formative research, including focus groups, usability testing, and a pilot RCT, which showed that 42% of previously unscreened patients using CW underwent CRCS at 6 months, compared with 20% of those who used a generic website (p=0.035). To the authors' knowledge, the pilot RCT was the first published study to show that an interactive, preference-tailored DA improved CRCS adherence compared with generic CRCS information.[21,23] However, there were several limitations. First, it was not clear which components of CW (e.g., the interactive tool to clarify patient preference for a certain CRCS test, graphics, comparison table of CRCS options) improved the CRCS rate compared with the generic website. Second, CRCS adherence was self-reported and not verified by chart audit. Third, CW did not incorporate patients' risk for CRC. As the CRCS test option is limited to colonoscopy for those with increased risk, not knowing their risk may give patients with increased risk a false sense of choice. Therefore, an interactive risk assessment component was added. Screen shots of the DA are provided in Appendix Figure 1 (available online). In this study, Decision Aid to Technologically Enhance Shared Decision Making (DATES), the authors tested CW's effectiveness for increasing CRCS adherence with Standard Web (SW), a DA that was identical to CW in all aspects except for lack of interactive components of CRC risk assessment and CRCS preference clarification. The study also assessed the effects on patient's decision quality (e.g., knowledge, attitude, preference clarification, and intent).

METHODS

Study Population

This study was a single-blinded, two-armed RCT comparing CW (interactive arm) to SW (non-interactive arm). The tool's conceptual framework was adapted from the Theory of Planned Behavior[52,53] (Appendix Figure 2, available online). In the interactive arm, CW had two interactive components. One consisted of the Interactive Risk Assessment Tool. Patients were asked questions about their personal and family history of conditions that may increase their risk for CRC (e.g., family history of CRC). If they answered *yes* to any of them, they were notified of possible increased risk of CRC and asked to consider colonoscopy as the CRCS option. (They could proceed further to review the CRCS options if they so desired.) If they answered *no* to all questions, they were notified of average risk and recommended to proceed with reviewing CRCS options. The other component consisted of the Interactive CRCS Preference Clarification Tool. After reviewing the CRCS options, patients were provided with 12 CRCS test attributes (e.g., accuracy, not missing work, not sedated) and asked to select the three attributes most important to them. Once these three attributes were selected, the test, either colonoscopy or SBT, that best matched these attributes was presented. If the patients were at increased risk of CRC and the three top attributes were

best matched to SBT, a recommendation was posted that they may benefit more from colonoscopy. If they were of average risk, either test was recommended as a good choice. An option of not undergoing CRCS was not presented because all U.S. guidelines strongly recommend CRCS. The updated CW also had the reading level decreased from the previous 11th grade to 8th grade level. It used a renewed platform with faster speed, better graphics, and more straightforward flow, and aligned the CRCS options to those actually available in the community practice setting: colonoscopy and SBT.

The participants were patients in one of 12 community- and three university-based primary care practices (family medicine or general internal medicine; 56 total physicians) in Southeast Michigan, aged 50–75 years, and not current in CRCS. Ineligibility criteria included dementia, psychosis, previous CRC, medical contraindication to CRCS (e.g., terminal illness), and inability to read or write English. One of four research assistants designated to each practice reviewed the scheduled chronic care and health maintenance visits several weeks in advance and prepared a list of eligible patients. Blacks were oversampled to ensure a robust comparison with whites. There was no sex bias in the selection of participants. The research assistant called the patient before the scheduled visit and asked them to come to the clinic 1 hour before the scheduled visit. On the day of the visit, the research assistant met the patient in a private space identified beforehand in each office. The patient was handed a laptop with wireless connection and electronically worked through the informed consent and baseline survey, after which they were automatically randomized to the interactive or non-interactive arm. They subsequently underwent CW (interactive arm) or SW (non-interactive arm) and post-web survey. Both CW and SW were formatted in a way that recommended that the patient proceed in the following sequence: introduction, facts about CRC, risks for CRC, Interactive Risk Assessment Tool (for CW only), description of CRCS test options, comparison table of the CRCS test options, Interactive CRCS Preference Clarification Tool (for CW only), final page that asks the patient to select a CRCS test, and a summary of results. In CW, the patient could not proceed further without completing the Interactive Risk Assessment Tool or the CRCS Preference Clarification Tool. DA web use data were collected to ensure that the patient went through all of the pages. Immediately after DA use, the patient completed the post-web survey. Then, the patient met with the physician and afterward underwent a post-encounter survey (paper). Steps are summarized in Appendix Figure 3 (available online). The detailed study protocol is published elsewhere.[54] The IRB at the University of Michigan approved the data collection protocols (HUM00044733). The study is registered at https://clinicaltrials.gov (NCT01514786).

Measures

The primary outcome was the proportion of patients having received CRCS 6 months after the intervention. Secondary outcome was patient decision quality (i.e., knowledge, attitude, self-efficacy, test preference, and intent to get screened). Knowledge, attitudes, and self-efficacy were measured twice, at baseline and at the end of DA intervention (post-web). Intent and test preference were measured additionally at the end of the physician encounter. Knowledge was measured as the total number of correct responses to eight questions about CRCS. Patient attitude were measured using a number of 5-point Likert items from a validated scale.[55] Intent was scored on a 5-point ordinal scale: *Definitely Will Do*, *Will Do*, *Will Not Do*, *Definitely Will Not Do*, and *Don't Know*. At baseline, only 2.5% of the responses fell into the categories *Will Not Do* and *Definitely Will Not Do* combined. Thus, this variable was dichotomized by combining *Definitely Will Do* and *Will Do* into one category and the remaining three responses into another. Self-efficacy was measured by a 5-point ordinal item. For analysis, self-efficacy was subsequently converted to a three-category ordinal variable denoting low (*Strongly Disagree*, *Disagree*), medium (*Neither Agree nor Disagree*), and high (*Strongly Agree*, *Agree*). This was how self-efficacy was coded when used as a covariate. However, as a three-category multinomial outcome in a longitudinal setting (three time points), the comparisons became complex and hard to interpret. Thus, when treated as an outcome, low and medium self-efficacy were collapsed so that they could be treated as a dichotomous variable modeling the likelihood of high self-efficacy. Patient preference for particular CRCS test was originally collected on a five-category nominal scale: *Colonoscopy*, *Stool Blood Test*, *No Preference*, *Neither*, and *Don't Know*. This was also initially converted into a scale with three categories: (1) having a specific preference for SBT or colonoscopy formed by collapsing the first two categories, (2) not having a preference (*No Preference*, *Don't Know*), and (3) wanting neither test (*Neither*). The prevalence of the third category was extremely low (around 5%). Thus, Categories 2 and 3 were combined when considered as an outcome modeling the likelihood of having a specific preference.[56]

Demographic information, current health status (patient self-rating), and information on prior exposure to CRCS were used as covariates and were obtained from patient's medical chart and baseline survey. The baseline survey also provided estimates of degree of CRC and CRCS testing worries.[56] Another covariate used in the analyses was perceived risk, which was converted from an original 5-point scale to a dichotomy (high/medium versus low). The rationale for the analytic structure and further details about each of the measures have been described elsewhere.[34] The measures covered by each survey are summarized in Appendix Table 1 (available online).

Statistical Analysis

Demographic and baseline measures were compared between study arms using chi-square and independent sample *t*-tests. The main outcome of screening was compared across the study arms under the framework of a logistic regression. The primary covariate of interest was the study arm. The model was further adjusted for measures of test worries, cancer worries, perceived risk, duration of DA use, increased risk for CRC, prior exposure to CRCS, current health, sex, age, and race. Two separate models were explored that controlled for knowledge, attitude, self-efficacy, intent, and test preference measured at baseline and end of study.

To investigate whether the intervention had any effect on the secondary outcomes, each was analyzed under a mixed-model framework. Models for the outcomes of knowledge and attitude used linear mixed models, whereas the measures of self-efficacy, test preference, and intent were analyzed using a logistic random effects regression model. The primary covariates in each model were time, group, and the time X group interaction. The clustering within each subject was accounted for by a random subject-level intercept. Model for knowledge was controlled for demographic factors such as age, race, sex, current health status, and prior CRCS exposure. Models for all other secondary outcomes were

additionally controlled for cancer and test worries, perceived risk, and the baseline measures of other secondary outcomes. A parallel analysis was carried out using the time-dependent versions of knowledge, attitude, and self-efficacy as covariates.

RESULTS

Patients were recruited from May 2012 to September 2014. Recruitment results based on CONSORT are presented in Appendix Figure 4 (available online). No harms or unintended effects were noted. Web use data showed that patients reviewed all screens in the DAs. Patient satisfaction regarding DA use was similarly high in both arms (Appendix Table 2, available online). Demographic and baseline characteristics of study participants are shown in Table 1. Recruitment was very close to the target of 600. Participants mean age was 58 years, and slightly more than half were white (55.1%) and women (56%). The non-interactive arm had slightly older participants (M [SD]=58 [6.9] years vs 57 [6.8] years, p=0.04), more women (62% vs 50%, p=0.006), and higher prior CRCS exposure (60% vs 51%, p=0.04) than

Table 1. Demographic and Baseline Characteristics of Study Participants

Variable	Overall (*n*=570)	Control (*n*=286)	Intervention (*n*=284)	*p*-value
Age, years, M (SD)	57.7 (6.9)	58.3 (6.9)	57.1 (6.8)	**0.04**
Race				0.70
White	313 (55.1)	157 (55.1)	156 (55.1)	
Black	208 (36.6)	107 (37.5)	101 (35.7)	
Other	47 (8.3)	21 (7.4)	26 (9.2)	
No answer (missing)	2	1	1	
Sex				**0.006**
Women	320 (56.1)	177 (61.9)	143 (50.4)	
Current health				0.21
Excellent	48 (8.4)	30 (10.5)	18 (6.3)	
Very good	175 (30.7)	83 (29.0)	92 (32.4)	
Good	213 (37.4)	109 (38.1)	104 (36.6)	
Fair	113 (19.8)	57 (19.9)	56 (19.7)	
Poor	21 (3.7)	7 (2.5)	14 (4.9)	
Prior exposure to CRCS				**0.04**
Yes	318 (55.8)	172 (60.1)	146 (51.4)	
Baseline knowledge, M (SD)	4.6 (1.8)	4.6 (1.9)	4.7 (1.8)	0.49
Baseline attitudes, M (SD)	17.0 (2.8)	16.8 (2.9)	17.1 (2.6)	0.26
Baseline cancer worries, M (SD)	5.4 (1.9)	5.3 (1.9)	5.6 (1.9)	0.05
Baseline test worries, M (SD)	8.3 (2.4)	8.3 (2.5)	8.4 (2.3)	0.53
Baseline perceived risk				0.31
Low	285 (50.0)	150 (52.5)	135 (47.5)	
Medium	227 (39.8)	105 (36.7)	122 (43.0)	
High	58 (10.2)	31 (10.8)	27 (9.5)	
Baseline self-efficacy				0.79
Low	138 (24.2)	66 (23.1)	72 (25.3)	
Medium	142 (24.9)	71 (24.8)	71 (25.0)	
High	290 (50.9)	149 (52.1)	141 (49.7)	
Baseline test preference				0.48
Has preference	286 (50.2)	150 (52.5)	136 (47.9)	
No preference	254 (44.6)	123 (43.0)	131 (46.1)	
Neither	30 (5.3)	13 (4.5)	17 (6.0)	
Baseline intend to be screened				0.98
Yes	357 (62.6)	179 (62.6)	178 (62.7)	
Increased CRC risk				
Yes	202 (35.4)	106 (37.1)	96 (33.8)	0.42

Note: Boldface indicates statistical significance (p<0.05). Data presented as *n* (%) unless otherwise indicated.
CRC, colorectal cancer; CRCS, colorectal cancer screening.

interactive arm participants. Study arms were comparable in all other baseline measurements.

Six-month chart audit data were finished in March 2015 and available for 549 participants, of which 548 CRCS statuses were determined. More than one-third (38%) of participants received CRCS within 6 months of study enrollment. CRCS rate was not significantly different between the two arms (41% non-interactive vs 36% interactive, p=0.29). To determine that either DA increased CRCS adherence compared with no DA, 440 patients across the three university-based clinics who were eligible but did not participate in the study were analyzed for CRCS adherence 6 months after the invitation. These patients were comparable in sex distribution (59% female vs 57% female in study, p=0.57), but slightly older (M [SD]=57.6 [6.5] vs 55.9 [6.3] in study, p=0.002) compared with the study participants from the same sites. This "usual care" group had significantly lower (p<0.001) screening rates (19%) during the same time period compared with the 207 patients enrolled in these sites within both arms (47% non-interactive, 41% interactive). There was a significant association between race and CRCS rate. Overall, the CRCS rate in blacks was significantly lower than that in whites (28% vs 47%, p<0.001). CRCS rate between the non-interactive arm and the interactive arm remained similar for blacks (p=0.71) and whites (p=0.29).

The two adjusted analyses using either the baseline or the end-of-study measurements of knowledge, self-efficacy, attitudes, intent, and test preference as covariates yielded very similar results. Here, the findings from the model using the end-of-study measurements are reported. The study arm was not significantly associated with any outcome. Race, baseline health status, prior exposure to CRCS, post-web self-efficacy, and post-encounter intent were all significantly associated with CRCS (Table 2). Blacks were significantly less likely to be screened than whites. Patients who self-rated their health to be higher had previous CRCS, had higher self-efficacy, and had higher intent had higher odds of CRCS adherence.

The time X group interaction term was not significant for each of the secondary outcomes. There was no significant difference between the two arms. In either arm, there was a statistically significant improvement across time, the extent of which was quite similar. Thus, in reporting the tables, the interaction term was dropped and the group-averaged time effect was presented. Similarly, the group coefficient denotes the effect averaged across all time points.

These were measured at two time points, baseline and post-web. Mean knowledge score was significantly higher at post-web (M [SD]=6.1 [1.7]) versus baseline (M [SD]=4.6 [1.8]) (Table 3). Knowledge was also higher in blacks (compared with whites), women, individuals with higher self-reported health, and those who had CRCS previously. Women had a higher mean attitude score compared with men. Attitudes surrounding CRCS improved significantly at post-web (M [SD]=17.3 [2.2] vs 16.9 [2.8]). Overall attitude was inversely related to age and test worries, whereas increased health, perceived risk, knowledge, and self-efficacy were all positively associated with CRCS attitudes. Odds of having high self-efficacy were higher at post-web versus baseline (OR [SE]=6.50 [1.58]). There was a racial difference with regard to this outcome, as blacks had higher odds than

Table 2. Demographic and Sociocognitive Characteristics Associated With CRCS

Characteristics	Logistic regression of CRCS status after 6 months (n=514)	
	OR (95% CI)	p-value
Study arm		
Non-interactive	ref	—
Interactive	0.94 (0.63, 1.39)	0.741
Age	0.99 (0.96, 1.02)	0.623
Race		
White	ref	—
Black	0.45 (0.29, 0.71)	**0.001**
Other	1.14 (0.57, 2.27)	0.716
Female	1.14 (0.77, 1.69)	0.516
Current health	1.36 (1.10, 1.69)	**0.005**
Increased risk	1.08 (0.70, 1.67)	0.712
Prior exposure	1.75 (1.14, 2.68)	**0.010**
Web duration	0.99 (0.97, 1.00)	0.082
Knowledge[a]	1.05 (0.92, 1.19)	0.479
Attitude[a]	0.99 (0.90, 1.09)	0.810
Cancer worries[a]	0.97 (0.87, 1.09)	0.673
Test worries[a]	0.99 (0.89, 1.09)	0.827
Perceived risk[a]		
Low	ref	—
Medium	1.08 (0.68, 1.70)	0.748
High	1.04 (0.57, 1.89)	0.908
Self-efficacy[a]		
Low	ref	—
Medium	0.86 (0.41, 1.82)	0.697
High	1.58 (0.80, 3.10)	0.184
Intent to be screened[b]	1.90 (0.98, 3.67)	0.056
Test preference[b]		
Preference	ref	—
No preference	1.23 (0.59, 2.56)	0.582
Neither	0.36 (0.04, 3.42)	0.371

Note: Boldface indicates statistical significance (p<0.05).
[a]Measured at post-web.
[b]Measured at post-encounter.
CRCS, colorectal cancer screening.

Table 3. Changes in Knowledge, Attitudes, and Self-Efficacy

	Knowledge (*n*=568)		Attitudes (*n*=568)		Self-efficacy (*n*=568)	
Variable	**B (SE)**	***p*-value**	**B (SE)**	***p*-value**	**OR (SE)**	***p*-value**
Study arm						
Non-interactive	ref	—	ref	—	ref	—
Interactive	0.20 (0.12)	0.10	0.16 (0.17)	0.35	0.93 (0.30)	0.81
Time						
Baseline	ref	—	ref	—	ref	—
Post-web	1.46 (0.08)	**<0.001**	0.37 (0.09)	**<0.001**	6.50 (1.58)	**<0.001**
Age	0.01 (0.01)	0.78	−0.04 (0.01)	**0.001**	0.98 (0.02)	0.52
Race						
White	ref	—	ref	—	ref	—
Black	−0.36 (0.13)	**0.006**	−0.07 (0.19)	0.72	4.69 (1.82)	**<0.001**
Other	−0.17 (0.23)	0.46	−0.48 (0.32)	0.13	2.67 (1.56)	0.09
Sex						
Male	ref	—	ref	—	ref	—
Female	0.37 (0.12)	**0.002**	0.36 (0.17)	**0.04**	0.64 (0.21)	0.16
Current health	0.24 (0.06)	**<0.001**	0.09 (0.09)	0.34	1.77 (0.32)	**0.001**
Prior CRCS exposure						
No	ref	—	ref	—	ref	—
Yes	0.26 (0.13)	**0.045**	0.21 (0.18)	0.26	1.91 (0.66)	0.06
Baseline perceived risk						
Low	—	—	ref	—	ref	—
Medium	—	—	0.70 (0.19)	**<0.001**	1.09 (0.38)	0.82
High	—	—	0.59 (0.30)	**0.047**	1.83 (1.05)	0.29
Baseline cancer worries	—	—	0.01 (0.05)	0.88	1.01 (0.09)	0.95
Baseline test worries	—	—	−0.19 (0.04)	**<0.001**	0.59 (0.05)	**<0.001**
Baseline knowledge	—	—	0.25 (0.05)	**<0.001**	1.19 (0.11)	0.06
Baseline self-efficacy						
Low	—	—	ref	—	—	—
Medium	—	—	0.70 (0.24)	**0.004**	—	—
High	—	—	1.51 (0.23)	**<0.001**	—	—
Baseline attitude	—	—	—	—	1.40 (0.09)	**<0.001**

Note: Boldface indicates statistical significance ($p<0.05$).
CRCS, colorectal cancer screening.

whites of having high self-efficacy. The odds of having higher self-efficacy were also noted in those with better self-reported health and baseline knowledge, and lower for those having increased test worries.

Odds of having a specific CRCS test preference were significantly higher at both post-web and post-encounter compared with baseline (Table 4). Having high self-efficacy at baseline also increased the odds of having a specific CRCS test preference. Odds of intending on being screened also rose significantly at post-web and post-encounter compared with baseline. Older participants had slightly lower odds of intending to get screened, while blacks had significantly higher odds of intent than whites. Higher values of baseline attitudes toward CRCS, higher self-efficacy, and high perceived risk at baseline were associated with higher odds of intent.

DISCUSSION

This study addressed whether interactivity of DA about CRCS made a difference. The interactivity allowed patients to determine whether they were at increased risk for CRC and to engage in an exercise to clarify their preference for a specific CRCS test. These interactive elements did not result in higher CRCS adherence, as CW (interactive DA) and SW (non-interactive DA) had similar CRCS rates. Review of web use data pulled automatically at the time of patient participation showed that the patients reviewed all elements of CW and SW, including the interactive elements in CW. Also, the DA was set up in a way that the patient could not proceed to additional steps without completing the interactive elements. To ensure that the DA had a positive impact on CRCS, data from eligible but non-participating patients in the three

Table 4. Changes in Test Preference and Intent

	Test preference (*n*=566)		Intent (*n*=568)	
Variable	**OR (SE)**	***p*-value**	**OR (SE)**	***p*-value**
Study arm				
Non-interactive	ref	—	Ref	—
Interactive	0.97 (0.18)	0.87	0.84 (0.24)	0.53
Time				
Baseline	ref	—	ref	—
Post-web	8.94 (1.78)	**<0.001**	3.49 (0.71)	**<0.001**
Post-encounter	19.71 (4.79)	**<0.001**	20.34 (5.80)	**<0.001**
Age	1.03 (0.02)	0.05	0.94 (0.02)	**0.01**
Race				
White	ref	—	ref	—
Black	1.46 (0.31)	0.076	2.27 (0.77)	**0.02**
Other	0.93 (0.32)	0.82	1.76 (0.92)	0.28
Sex				
Male	ref	—	ref	—
Female	1.02 (0.19)	0.90	1.10 (0.32)	0.75
Current health	1.14 (0.11)	0.20	1.17 (0.18)	0.31
Prior CRCS exposure				
No	ref	—	ref	—
Yes	1.22 (0.25)	0.32	1.49 (0.46)	0.20
Baseline perceived risk				
Low	ref	—	ref	—
Medium	0.84 (0.17)	0.39	0.90 (0.28)	0.75
High	0.81 (0.26)	0.52	3.87 (2.21)	**0.02**
Baseline cancer worries	1.01 (0.05)	0.86	1.01 (0.08)	0.87
Baseline test worries	0.99 (0.05)	0.85	0.87 (0.06)	0.06
Baseline knowledge	1.07 (0.06)	0.18	1.17 (0.10)	0.05
Baseline self-efficacy				
Low	ref	—	ref	—
Medium	0.76 (0.21)	0.32	2.18 (0.85)	**0.04**
High	0.56 (0.15)	**0.03**	6.70 (2.75)	**<0.001**
Baseline attitude	1.01 (0.04)	0.76	1.25 (0.07)	**<0.001**

Note: Boldface indicates statistical significance ($p<0.05$).
CRCS, colorectal cancer screening.

university-based clinics were compared. The latter usual care group had a significantly lower CRCS adherence rate at 6 months. Although there is a possibility that the usual care patients would have behaved differently in other practices, it is notable that the difference in CRCS rate between the two arms and the usual care group was even more significant when the comparison was limited to the three university-based practices.

In the pilot RCT, the interactive DA was compared with a generic website not designed as a DA and was publicly available (http://preventcancer.org/colorectal/; no longer available online).[35] The graphics and reading levels were different from the interactive DA. In the current study, the non-interactive DA was identical in content to the interactive DA and had a lower reading level and a more refined and user-friendly interface[54] (Appendix Figure 1, available online). By making everything identical in the two DAs, except the interactivity, it is likely that having a user-friendly DA with graphics that are easy to comprehend and lower reading levels made the inclusion of labor- and cost-intensive interactive tools for risk assessment and CRCS preference clarification unnecessary. It is notable that both arms in the current study approached the CRCS rate of the pilot RCT intervention arm. The impact of the pilot RCT may have come from a better overall user experience with better information content and clarity of presentation rather than the interactive CRCS preference clarification tool. Recent systematic review and meta-analysis concluded that DAs improve CRCS over no information, but not necessarily over general CRCS information.[21] Also, there is conflicting evidence about whether tailoring messages and providing explicit clarification in DAs improve decision quality, let alone health outcomes.[57] This study

showed that providing interactive elements in a DA did not further improve CRCS adherence over a non-interactive DA. This was despite linking the results from the interactive risk assessment to differentiate CRCS option recommendation for those with average versus increased CRC risk, a feature even more tailored than a previous study that linked risk assessment to DAs on CRCS.[36,37] The important message for researchers and DA developers is to make sure the content of the intervention and control DA is matched. The influential component may not be the essential ingredient that was hypothesized and designed. Given that DA implementation is low in actual practice, more efforts are needed to improve practice adoption of DA rather than producing a "perfect" DA.[58]

There are other possible explanations for the lack of effect of interactivity. At the end of their use, both DAs asked the patient to choose a CRCS test. This was also asked in all three surveys: baseline before the DA intervention, post-web immediately after the DA intervention, and post-encounter immediately after the visit with the physician. Asking to make a choice and multiple questions about preference may have affected the patient's perception regarding preference and intent. However, the presence of multiple data points is also a strength of the study. It is also possible that the subsequent discussion and thus SDM with the physician was different in the two arms following the intervention, thus negating the effect of the interactivity. However, the secondary outcomes that looked at patient knowledge, attitude, self-efficacy, preference, and intent were similar immediately after the DA use in both arms, as well as preference and intent after physician encounter.

Notably, blacks had higher knowledge, self-efficacy, and intent than whites. This difference persisted through all three surveys (baseline, post-web, post-encounter), showing that the DA and subsequent physician encounter had an equally positive effect on both racial groups. Despite this, blacks had a lower CRCS rate compared with whites. Factors outside the control of this study likely affected the outcome. To examine this, insurance status as proxy for access to screening was analyzed. Compared with whites, blacks were more likely to have Medicare/Medicaid or no insurance than private insurance. Incorporating insurance status into the model, however, the racial difference remained significant with similar magnitude. Previous studies have raised lack of time and lower SES as additional barriers to CRCS among blacks.[59] These factors could not be examined in this study.

The study has several strengths. First, information was collected on sociobehavioral factors that are potential drivers of patient preference and intent and based on a conceptual model applied from a validated theory. Second, information was collected in the small to moderate–sized practice settings in communities of varying socioeconomic profiles, making the conclusion broadly applicable. Third, blacks were intentionally over-represented in the study, providing a robust analysis of racial effects. Fourth, all patients received the DA intervention immediately before the visit with their physicians, minimizing the effect of time lapse and involvement of others. Finally, it is one of the first practice-based RCTs that investigated the combined effect of broad patient characteristics with DA in potentially changing knowledge, attitude, preference, and intent regarding CRCS.

Limitations

The study also has limitations. First, it was a comparative effectiveness study and did not have true usual care control. The authors were employed by the academic institution that oversaw the three academic practices, and thus could obtain data on patients who did not participate in the study with permission from the IRB. This usual care group was slightly older, yielding a statistically significant *p*-value, primarily due to the tightness of the age distribution. CRCS rates within these clinics, after adjustment for sex and age, still differed significantly, with ORs >3 for either comparison (usual care group versus interactive arm and usual care group versus non-interactive arm). Similar data were not obtained from other practices owing to the lack of similar privilege. There is a possibility that the non-participating patients had baseline sociobehavioral factors that were less correlated with CRCS adherence. The community offices' usual care rates may have been higher than the academic practices, but very unlikely. The community offices are more likely to have lower usual care CRCS rates because they do not have the resources of academic offices in large integrated health systems. Recent reports of baseline CRCS rates in a community health center range from 9.7% to 67.2% (median, 30.6%) in 12 community health centers across multiple urban areas.[60]

CONCLUSIONS

A user-friendly DA led to positive changes in patient knowledge, attitude, self-efficacy, preference, intent, and CRCS adherence. Interactivity to determine risk and clarify CRCS option preference did not affect the outcome. A simple, user-friendly DA may be just as effective as a more complex interactive DA.

ACKNOWLEDGMENTS

We thank the practices and clinicians who participated in this study. We also thank Kathleen Lawrence, Lauren Schleicher, Ronald Trendler, and Krystle Woods, the clinical research coordinators who assisted in the study.

This study was funded by the National Cancer Institute (R01CA152413). They had no role in the design, conduct, analysis, write-up, or decision to submit for publication. The IRB at the University of Michigan approved the data collection protocols (HUM00044733).

Drs. Jimbo and Sen had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Author responsibilities are as follows: study concept and design: Jimbo, Sen, Ruffin; acquisition, analysis, or interpretation of data: all authors; drafting of the manuscript: Jimbo, Sen, Plegue, Ruffin; critical revision of the manuscript for important intellectual content: all authors; intellectual content: all authors; statistical analysis: all authors; obtained funding: Jimbo; study supervision: Jimbo.

Dr. Sen serves as a Statistics Editor for the *American Journal of Preventive Medicine*. He had no involvement in the peer review and decision-making processes for this paper.

Preliminary results of this manuscript were presented at the 38th Annual Meetings of the Society for Medical Decision Making and the 44th Annual Meeting of the North American Primary Care Research Group.

No financial disclosures were reported by the authors of this paper.

SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2019.03.004.

REFERENCES

1. U.S. Preventive Services Task Force. Screening for colorectal cancer. www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/colorectal-cancer-screening2. Published 2016. Accessed March 16, 2019.
2. Mandel JS, Bond JH, Church TR, et al. Reducing mortality from colorectal cancer by screening for fecal occult blood: Minnesota Colon Cancer Control Study. *N Engl J Med.* 1993;328(19):1365–1371. https://doi.org/10.1056/NEJM199305133281901.
3. Kronborg O, Fenger C, Olsen J, Jorgensen OD, Sondergaard O. Randomised study of screening for colorectal cancer with faecal-occult-blood test. *Lancet.* 1996;348(9040):1467–1471. https://doi.org/10.1016/S0140-6736(96)03430-7.
4. Hardcastle JD, Chamberlain JO, Robinson MH, et al. Randomised controlled trial of faecal-occult-blood screening for colorectal cancer. *Lancet.* 1996;348(9040):1472–1477. https://doi.org/10.1016/S0140-6736(96)03386-7.
5. Levin B, Lieberman DA, McFarland B, et al. Screening and surveillance for the early detection of colorectal cancer and adenomatous polyps, 2008: a joint guideline from the American Cancer Society, the US Multi-Society Task Force on Colorectal Cancer, and the American College of Radiology. *CA Cancer J Clin.* 2008;58(3):130–160. https://doi.org/10.3322/CA.2007.0018.
6. American Cancer Society. Colorectal cancer facts and figures 2017–2019. www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/colorectal-cancer-facts-and-figures/colorectal-cancer-facts-and-figures-2017-2019.pdf. Published 2017. Accessed March 16, 2019.
7. Inadomi JM, Vijan S, Janz NK, et al. Adherence to colorectal cancer screening: a randomized clinical trial of competing strategies. *Arch Intern Med.* 2012;172(7):575–582. https://doi.org/10.1001/archinternmed.2012.332.
8. Briss P, Rimer B, Reilley B, et al. Promoting informed decisions about cancer screening in communities and healthcare systems. *Am J Prev Med.* 2004;26(1):67–80. https://doi.org/10.1016/j.amepre.2003.09.012.
9. Ling BS, Moskowitz MA, Wachs D, Pearson B, Schroy PC. Attitudes toward colorectal cancer screening tests. *J Gen Intern Med.* 2001;16(12):822–830. https://doi.org/10.1046/j.1525-1497.2001.10337.x.
10. Sheridan SL, Harris RP, Woolf SH. Shared Decision-Making Workgroup of the USPSTF. Shared decision making about screening and chemoprevention: a suggested approach from the U.S. Preventive Services Task Force. *Am J Prev Med.* 2004;26(1):56–66. https://doi.org/10.1016/j.amepre.2003.09.011.
11. Smith RA, Andrews KS, Brooks D, et al. Cancer screening in the United States, 2017: a review of current American Cancer Society guidelines and current issues in cancer screening. *CA Cancer J Clin.* 2017;67(2):100–121. https://doi.org/10.3322/caac.21392.
12. Elwyn G, Edwards A, Kinnersley P, Grol R. Shared decision making and the concept of equipoise: the competences of involving patients in healthcare choices. *Br J Gen Pract.* 2000;50(460):892–899.
13. Flocke SA, Frank SH, Wenger DA. Addressing multiple problems in the family practice office visit. *J Fam Pract.* 2001;50(3):211–216.
14. Jaen CR, Stange KC, Nutting PA. Competing demands of primary care: a model for the delivery of clinical preventive services. *J Fam Pract.* 1994;38(2):166–171.
15. Elwyn G, Edwards A, Kinnersley P. Shared decision-making in primary care: the neglected second half of the consultation. *Br J Gen Pract.* 1999;49(443):477–482.
16. Edwards A, Elwyn G. Inside the black box of shared decision making: distinguishing between the process of involvement and who makes the decision. *Health Expect.* 2006;9(4):307–320. https://doi.org/10.1111/j.1369-7625.2006.00401.x.
17. McQueen A, Bartholomew LK, Greisinger AJ, et al. Behind closed doors: physician-patient discussions about colorectal cancer screening. *J Gen Intern Med.* 2009;24(11):1228–1235. https://doi.org/10.1007/s11606-009-1108-4.
18. Ling BS, Trauth JM, Fine MJ, et al. Informed decision-making and colorectal cancer screening: is it occurring in primary care? *Med Care.* 2008;46(9 suppl 1):S23–S29. https://doi.org/10.1097/MLR.0b013e31817dc496.
19. Stacey D, Legare F, Lewis K, et al. Decision aids for people facing health treatment or screening decisions. *Cochrane Database Syst Rev.* 2017;4:CD001431. https://doi.org/10.1002/14651858.CD001431.pub5.
20. Jimbo M, Rana GK, Hawley S, et al. What is lacking in current decision aids on cancer screening? *CA Cancer J Clin.* 2013;63(3):193–214. https://doi.org/10.3322/caac.21180.
21. Volk RJ, Linder SK, Lopez-Olivo MA, et al. Patient decision aids for colorectal cancer screening: a systematic review and meta-analysis. *Am J Prev Med.* 2016;51(5):779–791. https://doi.org/10.1016/j.amepre.2016.06.022.
22. de Haan MC, de Wijkerslooth TR, Stoop E, et al. Informed decision-making in colorectal cancer screening using colonoscopy or CT-colonography. *Patient Educ Couns.* 2013;91(3):318–325. https://doi.org/10.1016/j.pec.2013.01.004.
23. Dolan JG, Frisina S. Randomized controlled trial of a patient decision aid for colorectal cancer screening. *Med Decis Making.* 2002;22(2):125–139. https://doi.org/10.1177/02729890222063017.
24. Frosch DL, Legare F, Mangione CM. Using decision aids in community-based primary care: a theory-driven evaluation with ethnically diverse patients. *Patient Educ Couns.* 2008;73(3):490–496. https://doi.org/10.1016/j.pec.2008.07.040.
25. Griffith JM, Fichter M, Fowler FJ, Lewis C, Pignone MP. Should a colon cancer screening decision aid include the option of no testing? A comparative trial of two decision aids. *BMC Med Inform Decis Mak.* 2008;8:10. https://doi.org/10.1186/1472-6947-8-10.
26. Griffith JM, Lewis CL, Brenner AR, Pignone MP. The effect of offering different numbers of colorectal cancer screening test options in a decision aid: a pilot randomized trial. *BMC Med Inform Decis Mak.* 2008;8:4. https://doi.org/10.1186/1472-6947-8-4.
27. Jerant A, Kravitz RL, Rooney M, Amerson S, Kreuter M, Franks P. Effects of a tailored interactive multimedia computer program on determinants of colorectal cancer screening: a randomized controlled

pilot study in physician offices. *Patient Educ Couns.* 2007;66(1):67–74. https://doi.org/10.1016/j.pec.2006.10.009.
28. Kim J, Whitney A, Hayter S, et al. Development and initial testing of a computer-based patient decision aid to promote colorectal cancer screening for primary care practice. *BMC Med Inform Decis Mak.* 2005;5:36. https://doi.org/10.1186/1472-6947-5-36.
29. Leone LA, Reuland DS, Lewis CL, et al. Reach, usage, and effectiveness of a Medicaid patient navigator intervention to increase colorectal cancer screening, Cape Fear, North Carolina, 2011. *Prev Chronic Dis.* 2013;10:E82. https://doi.org/10.5888/pcd10.120221.
30. Lewis CL, Brenner AT, Griffith JM, Pignone MP. The uptake and effect of a mailed multi-modal colon cancer screening intervention: a pilot controlled trial. *Implement Sci.* 2008;3:32. https://doi.org/10.1186/1748-5908-3-32.
31. Lewis CL, Golin CE, DeLeon C, et al. A targeted decision aid for the elderly to decide whether to undergo colorectal cancer screening: development and results of an uncontrolled trial. *BMC Med Inform Decis Mak.* 2010;10:54. https://doi.org/10.1186/1472-6947-10-54.
32. Miller DP Jr, Spangler JG, Case LD, Goff DC Jr, Singh S, Pignone MP. Effectiveness of a web-based colorectal cancer screening patient decision aid: a randomized controlled trial in a mixed-literacy population. *Am J Prev Med.* 2011;40(6):608–615. https://doi.org/10.1016/j.amepre.2011.02.019.
33. Pignone M, Harris R, Kinsinger L. Videotape-based decision aid for colon cancer screening: a randomized, controlled trial. *Ann Intern Med.* 2000;133(10):761–769. https://doi.org/10.7326/0003-4819-133-10-200011210-00008.
34. Pignone M, Winquist A, Schild LA, et al. Effectiveness of a patient and practice-level colorectal cancer screening intervention in health plan members: the CHOICE trial. *Cancer.* 2011;117(15):3352–3362. https://doi.org/10.1002/cncr.25924.
35. Ruffin MT 4th, Fetters MD, Jimbo M. Preference-based electronic decision aid to promote colorectal cancer screening: results of a randomized controlled trial. *Prev Med.* 2007;45(4):267–273. https://doi.org/10.1016/j.ypmed.2007.07.003.
36. Schroy PC 3rd, Emmons K, Peters E, et al. The impact of a novel computer-based decision aid on shared decision making for colorectal cancer screening: a randomized trial. *Med Decis Making.* 2011;31(1):93–107. https://doi.org/10.1177/0272989X10369007.
37. Schroy PC 3rd, Emmons KM, Peters E, et al. Aid-assisted decision making and colorectal cancer screening: a randomized controlled trial. *Am J Prev Med.* 2012;43(6):573–583. https://doi.org/10.1016/j.amepre.2012.08.018.
38. Smith SK, Trevena L, Simpson JM, Barratt A, Nutbeam D, McCaffery KJ. A decision aid to support informed choices about bowel cancer screening among adults with low education: randomised controlled trial. *BMJ.* 2010;341:c5370. https://doi.org/10.1136/bmj.c5370.
39. Steckelberg A, Hulfenhaus C, Haastert B, Muhlhauser I. Effect of evidence based risk information on "informed choice" in colorectal cancer screening: randomised controlled trial. *BMJ.* 2011;342(7810):1–7. https://doi.org/10.1136/bmj.d3193.
40. Trevena LJ, Irwig L, Barratt A. Randomized trial of a self-administered decision aid for colorectal cancer screening. *J Med Screen.* 2008;15(2):76–82. https://doi.org/10.1258/jms.2008.007110.
41. Wolf AM, Schorling JB. Does informed consent alter elderly patients' preferences for colorectal cancer screening? Results of a randomized trial. *J Gen Intern Med.* 2000;15(1):24–30. https://doi.org/10.1046/j.1525-1497.2000.01079.x.
42. Reuland DS, Ko LK, Fernandez A, Braswell LC, Pignone M. Testing a Spanish-language colorectal cancer screening decision aid in Latinos with limited English proficiency: results from a pre-post trial and four month follow-up survey. *BMC Med Inform Decis Mak.* 2012;12:53. https://doi.org/10.1186/1472-6947-12-53.
43. Clouston K, Katz A, Martens PJ, et al. Does access to a colorectal cancer screening website and/or a nurse-managed telephone help line provided to patients by their family physician increase fecal occult blood test uptake? Results from a pragmatic cluster randomized controlled trial. *BMC Cancer.* 2014;14:263. https://doi.org/10.1186/1471-2407-14-263.
44. Duren-Winfield V, Onsomu EO, Case DL, Pignone M, Miller D. Health literacy and computer-assisted instruction: usability and patient preference. *J Health Commun.* 2015;20(4):491–498. https://doi.org/10.1080/10810730.2014.976322.
45. Reuland DS, Brenner AT, Hoffman R, et al. Effect of combined patient decision aid and patient navigation vs usual care for colorectal cancer screening in a vulnerable patient population: a randomized clinical trial. *JAMA Intern Med.* 2017;177(7):967–974. https://doi.org/10.1001/jamainternmed.2017.1294.
46. Miller DP Jr, Denizard-Thompson N, Weaver KE, et al. Effect of a digital health intervention on receipt of colorectal cancer screening in vulnerable patients: a randomized controlled trial. *Ann Intern Med.* 2018;168(8):550–557. https://doi.org/10.7326/M17-2315.
47. Kreps GL, Neuhauser L. New directions in eHealth communication: opportunities and challenges. *Patient Educ Couns.* 2010;78(3):329–336. https://doi.org/10.1016/j.pec.2010.01.013.
48. McDermott MS, While AE. Maximizing the healthcare environment: a systematic review exploring the potential of computer technology to promote self-management of chronic illness in healthcare settings. *Patient Educ Couns.* 2013;92(1):13–22. https://doi.org/10.1016/j.pec.2013.02.014.
49. Stellefson M, Chaney B, Barry AE, et al. Web 2.0 chronic disease self-management for older adults: a systematic review. *J Med Internet Res.* 2013;15(2):e35. https://doi.org/10.2196/jmir.2439.
50. Ruffin MT 4th, Creswell JW, Jimbo M, Fetters MD. Factors influencing choices for colorectal cancer screening among previously unscreened African and Caucasian Americans: findings from a triangulation mixed methods investigation. *J Community Health.* 2009;34(2):79–89. https://doi.org/10.1007/s10900-008-9133-5.
51. Fetters MD, Ivankova NV, Ruffin MT, Creswell JW, Power D. Developing a web site in primary care. *Fam Med.* 2004;36(9):651–659.
52. Ajzen I. The theory of planned behavior. *Organ Behav Hum.* 1991;50:179–211. https://doi.org/10.1016/0749-5978(91)90020-T.
53. Ajzen I. Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior.. *J Appl Soc Psychol.* 2002;32:665–683. https://doi.org/10.1111/j.1559-1816.2002.tb00236.x.
54. Jimbo M, Kelly-Blake K, Sen A, Hawley ST, Ruffin MT 4th. Decision aid to technologically enhance shared decision making (DATES): study protocol for a randomized controlled trial. *Trials.* 2013;14:381. https://doi.org/10.1186/1745-6215-14-381.
55. Tiro JA, Vernon SW, Hyslop T, Myers RE. Factorial validity and invariance of a survey measuring psychosocial correlates of colorectal cancer screening among African Americans and Caucasians. *Cancer Epidemiol Biomarkers Prev.* 2005;14(12):2855–2861. https://doi.org/10.1158/1055-9965.EPI-05-0217.
56. Jimbo M, Sen A, Plegue MA, et al. Correlates of patient intent and preference on colorectal cancer screening. *Am J Prev Med.* 2017;52(4):443–450. https://doi.org/10.1016/j.amepre.2016.11.026.
57. Syrowatka A, Krömker D, Meguerditchian AN, Tamblyn R. Features of computer-based decision aids: systematic review, thematic synthesis, and meta-analyses. *J Med Internet Res.* 2016;18(1):e20. https://doi.org/10.2196/jmir.4982.
58. Lin GA, Halley M, Rendle KA, et al. An effort to spread decision aids in five California primary care practices yielded low distribution, highlighting hurdles. *Health Aff (Millwood).* 2013;32(2):311–320. https://doi.org/10.1377/hlthaff.2012.1070.
59. Williams R, White P, Nieto J, et al. Colorectal cancer in African Americans: an update. *Clin Transl Gastroenterol.* 2016;7(7):e185. https://doi.org/10.1038/ctg.2016.36.
60. Baker DW, Liss DT, Alperovitz-Bichell K, et al. Colorectal cancer screening rates at community health centers that use electronic health records: a cross sectional study. *J Health Care Poor Underserved.* 2015;26(2):377–390. https://doi.org/10.1353/hpu.2015.0030.