The Development of a Digital Patient Navigation Tool to Increase Colorectal Cancer Screening Among FQHC Patients: Results from Iterative User-Testing

Leah C. Savage, Luz Estefhany Soto-Cossio, Francesca Minardi, Matthew Beyrouty, Julie R. Schoonover, Jay Musella, Michaela Frazier, Cristina N. Villagra, Jamilia R. Sly, Joel Erblich, Steven H. Itzkowitz, Lina H. Jandorf, Neil S. Calman, Ashish Atreja, Sarah J. Miller

Submitted to: JMIR Formative Research
on: October 03, 2023

Table of Contents

The Development of a Digital Patient Navigation Tool to Increase Colorectal Cancer Screening Among FQHC Patients: Results from Iterative User-Testing

Leah C. Savage[1] BS; Luz Estefhany Soto-Cossio[2] MD; Francesca Minardi[1] MA, MPH; Matthew Beyrouty[2, 3] MPA; Julie R. Schoonover[2] MD; Jay Musella[2] LMSW; Michaela Frazier[2] LMSW, PhD; Cristina N. Villagra[1] MPH; Jamilia R. Sly[1, 3] PhD; Joel Erblich[1, 4] PhD; Steven H. Itzkowitz[5] MD; Lina H. Jandorf[1] MA; Neil S. Calman[2, 3] MD; Ashish Atreja[6] MPH, MD; Sarah J. Miller[1, 3] PsyD

[1]Department of Population Health Science and Policy Icahn School of Medicine at Mount Sinai New York US
[2]The Institute for Family Health New York US
[3]Department of Family Medicine and Community Health Icahn School of Medicine at Mount Sinai New York US
[4]Department of Psychology Hunter College City University of New York New York US
[5]Division of Gastroenterology Department of Medicine Icahn School of Medicine at Mount Sinai New York US
[6]Comprehensive Cancer Center University of California-Davis Sacramento US

Corresponding Author:
Luz Estefhany Soto-Cossio MD
The Institute for Family Health
2006 Madison Avenue
New York
US

Abstract

Background: Federally Qualified Health Centers (FQHCs) are an essential place for underserved patients to access healthcare, including screening for colorectal cancer (CRC), one of the leading cause of cancer death in the U.S. Novel mechanisms aimed at increasing CRC screening completion rates at FQHCs (lower than national averages) are crucial.

Objective: This study conducts interactive user-testing of a digital patient navigation tool, the eNav website, designed to support FQHC patients in preparing for, ordering, and completing CRC screening tests.

Methods: We recruited English and Spanish speaking patients (N=20) at the Institute for Family Health into two iterative field tests (N=10 each). In each field test, participants engaged in a "think aloud" exercise and a qualitative interview to summarize and review their feedback. They also completed a baseline questionnaire gathering data about demographics, technology and internet use, medical history, and health literacy, and completed the System Usability Scale (SUS) and the Acceptability E-Scales. Based on participant feedback from the first field test, we modified the eNav website for the second round of testing.

Results: Survey results supported the overall usability and acceptability of the website. The average SUS score for our first field test was 75.25; for the second, it was 75.28. The average Acceptability E-Scale score for our first field test was 28.3; for the second, it was 29.2. These scores are above recommended cutoffs for usability and acceptability. During "think aloud" exercises, in both field tests, many participants favorably perceived the website as motivating, interesting, informative and user-friendly. Respondents also gave suggestions on how to improve the website's content, usability, accessibility, and appeal. Significantly, we found that some participants did not have the digital access or skills to interact with the eNav website at home.

Conclusions: Based on participant feedback on the eNav website and reported limitations to digital readiness across both field tests, we made modifications to the content and design of the website. We also designed alternative methods of engagement with eNav to increase the tool's usability, accessibility, and impact for patients with diverse needs. Next, we will test the eNav intervention in a randomized control trial to evaluate the efficacy of the eNav website for improving colorectal cancer screening uptake among patients treated at FQHCs.

(JMIR Preprints 03/10/2023:53224)
DOI: https://doi.org/10.2196/preprints.53224

Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✓ **Please make my preprint PDF available to anyone at any time (recommended).**
Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.
Only make the preprint title and abstract visible.
No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✓ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**
Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain v
Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in <a href="http

Original Manuscript

ORIGINAL PAPER

TITLE

The Development of a Digital Patient Navigation Tool to Increase Colorectal Cancer Screening Among FQHC Patients: Results from Iterative User-Testing

AUTHORS

Leah C. Savage[1], Luz Estefhany Soto-Cossio[2], Francesca Minardi[1], Matthew Beyrouty[2,3], Julie R. Schoonover[2], Jay Musella[2], Michaela Frazier[2], Cristina Villagra[1], Jamilia R. Sly[1,3], Joel Erblich[1,4], Steven H. Itzkowitz[5], Lina Jandorf[1], Neil S. Calman[2,3], Ashish Atreja[6], Sarah J. Miller[1,3,*]

1 Department of Population Health Science and Policy, Icahn School of Medicine at Mount Sinai, New York, NY, USA
2 Institute for Family Health, New York, NY, USA
3 Department of Family Medicine and Community Health, Icahn School of Medicine at Mount Sinai, New York, New York, United States
4 Department of Psychology, Hunter College, New York, NY
5 Division of Gastroenterology, Department of Medicine, Icahn School of Medicine at Mount Sinai, New York, NY, USA
6 University of California-Davis Comprehensive Cancer Center, Sacramento, California, USA

*Correspondence: Sarah Miller, PsyD, One Gustave L. Levy Place, Box 1077, Icahn School of Medicine at Mount Sinai, New York, New York, USA, 10029, Tel: 212-824-7783, Email: sarah.miller@mssm.edu

ABSTRACT

Background: Federally Qualified Health Centers (FQHCs) are an essential place for historically underserved patients to access healthcare, including screening for colorectal cancer (CRC), one of the leading cause of cancer death in the U.S. Novel mechanisms aimed at increasing CRC screening completion rates at FQHCs are crucial.

Objective: This study conducts interactive user-testing of a digital patient navigation tool, the eNav website, designed to support FQHC patients in preparing for, ordering, and completing CRC screening tests.

Methods: We recruited English and Spanish speaking patients (N=20) at an FQHC in New York City to field test the eNav Website (2 field tests; N=10 participants per field test). In each field test, participants engaged in a "think aloud" exercise and a qualitative interview to summarize and review their feedback. They also completed a baseline questionnaire gathering data about demographics, technology and internet use, medical history, and health literacy, and completed the System Usability Scale (SUS) and the Acceptability E-Scales. Based on participant feedback from the first field test, we modified the eNav website for the second round of testing.

Results: Survey results supported the overall usability and acceptability of the website. The average SUS score for our first field test was 75.25; for the second, it was 75.28. The average Acceptability E-Scale score for our first field test was 28.3; for the second, it was 29.2. These scores are above suggested cutoffs for usability and acceptability. During qualitative "think aloud" exercises, in both field tests, many participants favorably perceived the website as motivating, interesting, informative and user-friendly. Respondents also gave suggestions on how to improve the website's content, usability, accessibility, and appeal. We found that some participants did not have the digital access or skills to interact with the eNav website at home. In fact, two out of twenty total participants reported lacking access to any devices at home, and fourteen out of twenty participants experienced problems or had no access to internet at home.

Conclusions: Based on participant feedback on the eNav website and reported limitations to digital access across both field tests, we made modifications to the content and design of the website. We also designed alternative methods of engagement with eNav to increase the tool's usability, accessibility, and impact for patients with diverse needs, including those with limited access to devices or internet at home (e.g., making the website device agnostic, removing the login process, and offering patients the option to engage with eNav on a clinic-provided device). Next, we will test the eNav intervention in a randomized control trial to evaluate the efficacy of the eNav website for improving colorectal cancer screening uptake among patients treated at FQHCs.

Keywords: digital navigation, digital health, FQHC, colorectal cancer, cancer screening

INTRODUCTION

Colorectal cancer (CRC) is the second most deadly cancer, with more than 1.9 million new cases and 935,000 CRC-related global deaths annually [1]. Due to recent increases in early age onset CRC, the

United States Preventive Services Task Force (USPSTF) lowered the recommended age for average risk adults to begin CRC screening to 45 (previously 50) [2]. Several tests can screen for CRC including at home stool-based tests (e.g., high sensitivity guaiac-based fecal occult blood testing, fecal immunochemical test, multi-targeted stool DNA testing) and visual tests (e.g., colonoscopy, flexible sigmoidoscopy). Recent data indicate that, among individuals 45 years and older, only 59% of adults are up to date with CRC screening [3]. Even more concerning, some patient populations are less likely to complete CRC screenings, including patients who receive care at federally qualified health centers (FQHCs). In fact, among patients treated at HRSA-funded community health centers, including FQHCs, only 41.9% of adults aged 50-75 have completed a CRC screening within the recommended time frame [4]. When including individuals aged 45-50, the CRC screening rates at FQHCs are likely even lower. In a national effort to reduce CRC morbidity and mortality, the National Colorectal Cancer Roundtable (NCCRT), a coalition of more than 1,500 organizations, launched the “80% in Every Community” initiative with the goal of increasing the national CRC screening rate to 80% [5]. It is particularly important that we prioritize CRC screening among patients who are at greater risk of being unscreened, including the many patients treated at FQHCs.

Patient navigation is an evidence-based intervention designed to help individuals better navigate complex healthcare systems and overcome barriers to care. In terms of CRC screening, patient navigators can assist with the scheduling of appointments, provide education, provide motivational support, explain instructions for completing screening tests, and assist with follow-up care [6]. More than a decade of clinical trials, including studies conducted in FQHC and community healthcare settings, have demonstrated that patient navigation can significantly improve CRC screening rates [7-16]. Despite the proven effectiveness of patient navigation for improving CRC screening uptake, patient navigation is not widely integrated into FQHC settings. Dr. Freund posited that: “patient navigation systems are more likely to be found and marketed in systems caring and targeting patients who are insured, employed and educated. Paradoxically, if patient navigation is an effective modality for improving care, there is a risk of it increasing rather than eliminating health disparities” [17].

Although cost-effective [18, 19], patient navigation typically requires economic resources (i.e., hiring and training of staff), limiting its ability to be widely integrated and sustained in standard clinical care, particularly in low resourced healthcare settings such as FQHCs. Moreover, research suggests that clinicians and staff working at FQHCs have increasing rates of burnout [20, 21] and may not have adequate time to navigate patients comprehensively for CRC screening. Digital patient navigation, or patient navigation delivered via electronic media, is a novel form of patient navigation that holds promise for overcoming barriers to person-led navigation. Specifically, digital navigation may be a low cost, accessible solution to improve CRC screening among patients treated at FQHCs. Importantly, patients can access digital patient navigation platforms from multiple locations and at convenient days/times. While digital patient navigation will likely not replace person-led patient navigation and the literature is mixed, it is possible that this intervention could reduce the workload and burden of patient navigators and providers through workflow changes and the optimization of technology [22].

Although results are mixed [23], findings support the efficacy of digital patient navigation, as it becomes an increasing research focus in health care. Researchers at an FQHC in Philadelphia saw a significant increase in CRC when sending patients FIT kits via mail and multiple “behaviorally informed” SMS alert reminders, as compared to providing current routine care (a simple SMS alert) only [24]. Similarly, researchers at the University of Chicago found that no show-rates were lower and the level of adequate bowel preparation for screening colonoscopies was significantly improved when comparing a text messaging program with “timed-release instructions” to usual care only [25].

Finally, another study found that digital navigation was shown to be an independent predictor of colonoscopy completion, with highly engaged patients four times more likely to complete colonoscopy [26]. These studies provide initial support for the application and potential impact of digital navigation, especially text messaging, on CRC screening uptake. More research is needed to better understand the impact of digital navigation interventions, especially those that incorporate novel features (e.g., videos, website).

In a collaborative effort to improve CRC screening uptake in the FQHC setting, our study team developed a novel digital navigation intervention, eNav, which expands on previous research testing text-based digital navigation. The eNav intervention includes an educational website and follow up text messages. The intervention is drawn from the Health Belief Model (HBM) [27] and aims to impact HBM-informed constructs (e.g., perceived benefits/barriers, perceived susceptibility, perceived severity) and, in doing so, improve CRC screening completion. Significantly, the study team conceptualized, developed, and iteratively user-tested eNav in close collaboration with community stakeholders. This ongoing partnership is integral in ensuring that an equity lens informs the eNav website and that it is appropriate for FQHC patients [28]. Our study team hypothesized that the eNav intervention will help improve CRC screening uptake among patients treated at FQHCs. The first step in this program of research was to conduct user-testing in order to examine the usability and acceptability of the website component of the eNav intervention with FQHC patients. This paper presents initial data from the iterative user-testing of the eNav website. This user-testing study is part of a larger research project aiming to test the efficacy of the eNav intervention (website and follow up text messaging) in an FQHC environment within a randomized control trial (RCT).

METHODS

The investigative team for this study represents a partnership between the Icahn School of Medicine at Mount Sinai, an academic medical center, and the Institute for Family Health, an FQHC network with clinics throughout New York City and the mid-Hudson Valley. Drawing from existing literature and the HBM, the investigative team developed the first iteration of the eNav website.

Description of the first iteration of the eNav website:

We designed the eNav website as a digital navigation tool for patients who are due/overdue for CRC screening and have an upcoming primary care appointment at an FQHC. To maximize reach and impact, the interactive website is offered in English and Spanish, delivers information over time (via text, graphics, and close captioned videos), and allows patients to select a screening test. The eNav website contains the following components:

(1) Information

On the primary landing pages, the eNav website offers information about CRC including: (1) CRC and its risk factors; (2) polyps; (3) signs and symptoms of CRC; (4) the role of screening in reducing CRC risk; and (5) the importance of screening for all people over the age of 45. The website also includes a “Frequently Asked Questions” page and an “Additional Information" page that provides more detailed information about CRC (e.g., instructions for completing CRC screening tests).

(2) Decisional support

Although findings are mixed, previous research has shown that CRC screening completion rates may improve when patients are given a choice of which test to complete [29]. As such, the eNav website includes a “screening options” page that provides information via text, images, and animated videos about three commonly used CRC screening tests – FIT, FIT-DNA and colonoscopy. The website also

provides a table comparing the requirements patients should be aware of for each test (e.g., collecting a stool sample at home for FIT and FIT-DNA, going to a clinic/hospital for the colonoscopy procedure), acknowledging barriers patients may face for each test. Crucially, the website makes clear that for some patients, a colonoscopy may be the test recommended by their provider. Significantly, information about coverage of the costs related to each procedure is also included (e.g., most insurance plans cover the cost of a screening colonoscopy).

(3) Motivational support

An integral component of the eNav website is motivational support for completing colorectal cancer screening, offered through a "My Why" video that features patients from diverse backgrounds and their reasons for completing CRC screening. The eNav website encourages users to identify their own reasons for wanting to get screened for CRC.

(4) Risk assessment

Not all patients are eligible for stool-based testing. For example, some patients with symptoms (e.g., rectal bleeding) or certain risk-factors (e.g., Lynch syndrome) may need a colonoscopy rather than a stool-based test. To facilitate conversations between patients and providers about CRC screening options, the eNav website includes a risk assessment that helps determine whether patients are eligible for stool-based testing. Although not a comprehensive risk assessment, the tool assesses whether patients have symptoms of colorectal cancer (e.g., blood in the stool, unexplained weight loss) as well as a personal and/or family history of conditions that can increase the risk of developing CRC (e.g., Lynch syndrome). After completing the risk assessment, patients receive an output that outlines their CRC screening options. If patients do not report any symptoms and/or any potential risk factors, the eNav website offers patients a choice to request a stool-based screening (i.e., FIT, FIT-DNA) or a visual screening (i.e., screening colonoscopy). Of note, if patients are flagged as possibly being inappropriate for stool based testing, the eNav website recommends that these patients talk to their primary care provider about the most appropriate screening option. Furthermore, the results from the risk assessment are then sent to the treating primary care provider and can be used to guide shared decision making about CRC screening. The questions and responses for the risk assessment were adapted (with permission) from the Colorectal Cancer Alliance CRC screening quiz [30]. The content of the questions was also guided by the C5 Colon Cancer Prevention Risk Assessment and Screening Form [31]. Our investigative team and clinical partners, including family physicians and gastroenterologists, reviewed the final risk assessment.

(5) Option to request a CRC screening test

If patients are deemed appropriate for stool-based testing through the risk assessment, they will be prompted to select a CRC screening test: FIT, FIT-DNA, or colonoscopy. If a patient requests a CRC screening test, a provisional order will be placed in the patients' chart. The treating primary care provider will then review and finalize all orders. Importantly, all patients, regardless of risk level, will have the chance to discuss CRC screening with their provider at their upcoming primary care visit.

(6) Text reminders + instructions

The eNav intervention is composed of the eNav website and follow up text messages. In addition to viewing the website, patients will receive a series of text message reminders to help navigate them to get screened for CRC. The text message content is tailored to the patients' risk level and requested test. For example, patients who request a FIT test are messaged that their order has been placed, are

instructed to pick up the FIT test at their appointment, are reminded to complete the test after their appointment, and are given information on how to receive another test, if needed. The text messages also contain hyperlinks to instructions (graphic and text) on how to effectively prepare for and complete the CRC screening tests. See Appendix 1 for text messaging content and dosing.

Procedures:

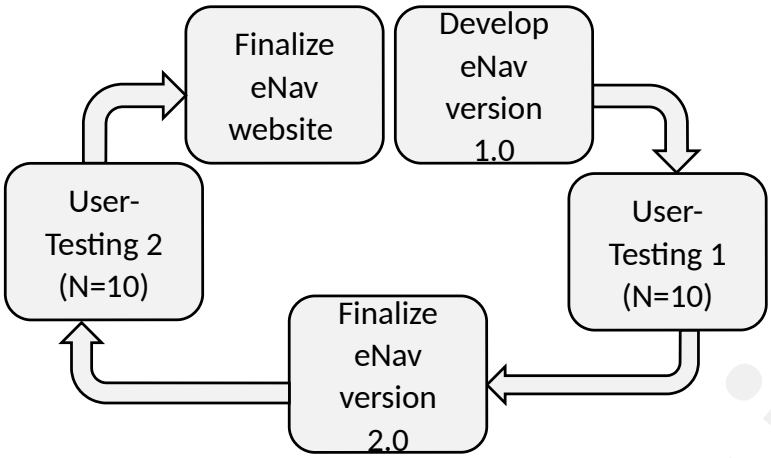


Figure 1 Iterative eNav website user-testing procedures across Field Test 1 (December 2022) and Field Test 2 (May 2023).

As demonstrated in Figure 1, two field tests (N=10 participants per field test) were conducted to gather feedback on the eNav website from FQHC patients. The first field test was conducted in December of 2022 and the second was conducted in May of 2023. For each field test, study team members distributed flyers in an FQHC clinic waiting room and lobby in New York City to recruit patients to participate in the study. If patients expressed interest in the study, they met with a research coordinator in a private room to complete the informed consent process. After providing informed consent, patients were asked to view and interact with the eNav website on a study-provided computer and/or on their personal device (e.g., smartphone). The participants engaged in a "think aloud" exercise, during which they were asked to provide their feedback, in real time, on the eNav website. During the think aloud exercise, study team members produced behavioral note summaries, comprised of their observations of participants' behaviors and any challenges interacting with eNav. After the think aloud exercise, the participants engaged in a brief qualitative interview to provide additional feedback about the eNav website (e.g., suggestions for change). The think aloud exercises and interviews were audio-recorded. Although the text message reminders and instructions component of the intervention was not comprehensively field-tested, participants also commented on the frequency of text messaging that they would appreciate after requesting a CRC screening test. Finally, participants in each field test completed a questionnaire that assessed demographic information, technology and internet use, medical history (e.g., history of having CRC screenings), and health literacy.

The study team used the results of the first field test to refine the content and improve the user-experience of the website to create eNav version 2.0. Then, this second iteration of the eNav website was field-tested on a new set of participants using the same procedures to confirm that the new iteration of the app containing modifications informed by the first field test was both usable and acceptable. The results from the second field test were again used to refine and finalize the eNav website.

Participants:

Patients were eligible to participate in the user-testing if they were: 1) treated at an FQHC; 2) age 45-75; 3) English or Spanish speaking; 4) able to provide consent. Patients were excluded if they were

hearing or vision impaired. Participants who completed the first field test were not eligible to participate in the second. In total, the sample size for the first two field tests was 20 patients.

Measures:

Medical/demographics: A brief survey was used to assess participant demographics (e.g., age, race, ethnicity, sex), medical history (e.g., previous CRC screening), and technology ownership/use. The survey questions were adapted from demographics surveys used in our team's previous research and from questions from the PEW Research Center [32, 33].

Usability: The System Usability Scale (SUS) [34-37] evaluated the usability of the eNav website. The SUS includes ten items scored on a 5-point Likert scale (1=strongly disagree; 5=strongly agree) and demonstrates strong reliability (Cronbach's alpha = 0.91). We did not alter the content of the SUS questions but did adapt the language of the SUS from "this system" to "this website" so that it was applicable to eNav.

Acceptability: The Acceptability E-Scale [38] assessed the acceptability of the eNav website. The e-Scale is composed of six questions scored on a 5-point Likert scale and demonstrates adequate reliability (Cronbach's alpha = 0.76). We adapted the language of the e-scale from "this computer program (ESRA-C)" to "this website." Furthermore, we expanded the question, "How understandable were the questions?" to be, "How understandable were the questions about your health on the website (e.g., risk assessment)?" and altered the item, "Was the amount of time it took to complete this computer program (ESRA-C) acceptable?" to be, "Was the amount of time it took to navigate this website acceptable?" We also shortened the question "How helpful to you was this computer program (ESRA-C) in describing your symptoms and QOL?" to "How helpful was this website?"

Health Literacy: To evaluate participants' health literacy, we used one question of the BRIEF scale [39]. The BRIEF scale is composed of four questions, but previous research studies [40] have demonstrated that one screening question may be sufficient for detecting limited and marginal health literacy skills in clinic populations: "How confident are you filling out medical forms by yourself?"

Data Analysis

We used qualitative description to analyze the think aloud exercise and qualitative interview data [41-43]. To analyze the data, study team members transcribed the audio recordings of the think aloud exercises and qualitative interviews. Then, two study team members coded each transcript and behavioral note summary into "endorsed features" and "problems/suggestions for change." A third coder resolved all discrepancies. After the first round of coding, the study team developed a coding scheme and codebook based on the "endorsed features" and "problems/suggestions for change" commonly identified by participants. Study team members then completed a second round of coding to identify subthemes including content, design/style, usability/acceptability, and motivation. Once again, each transcript was double coded; a third coder resolved discrepancies.

We applied descriptive statistics to analyze the medical/demographic information. To analyze the SUS score, we summed a contribution score for each item. Then, we multiplied the total score by 2.5 to produce an overall score ranging from 0 to 100. An SUS score greater than 68, the mean score, is considered above average usability [37, 44-47]. To analyze the website's acceptability, the scores on the Acceptability e-Scale were summed to produce an overall score ranging from six to thirty. According to the literature, a score of 80% or higher (total score of 24 or higher) is considered acceptable.

Ethical considerations:

The study was performed in line with the principles of the Declaration of Helsinki. Study procedures were reviewed and approved by the Icahn School of Medicine at Mount Sinai's Institutional Review Board. Informed consent was obtained from all individual participants included in the study. All

study data were stored in Health Insurance Portability and Accountability Act–compliant secure servers and were deidentified prior to analysis. Participants were compensated with a $50 gift card for their time and effort.

RESULTS

Demographic results for Field Tests 1 and 2:

We enrolled 10 participants in Field Test 1 and 10 participants in Field Test 2. See Table 1 for demographic information and medical history for both field tests.

Table 1. Demographic characteristics of Field Test 1 sample (N=10) and Field Test 2 sample (N=10) for eNav website user-testing study

	Field Test 1		Field Test 2	
Demographic Category	**N**	**%**	**N**	**%**
Field Test 1: Age Range = 52-69 years; Mean = 61.3 years old (SD=5.66) Field Test 2: Age Range = 54–74 years old; Mean = 62.8 years old (SD=5.98)				
Language				
English	8	80	4	40
Spanish	2	20	6	60
Race				
White	0	0	1	10
American Indian/ Alaska Native	1	10	0	0
Black / African American	3	30	4	40
Other	6	60	5	50
Ethnicity				
Non-Hispanic or Latino	6	60	4	40
Hispanic or Latino	4	40	6	60
Gender				
Male	4	40	1	10
Female	6	60	9	90
Employment				
Not employed	8	80	6	60
Employed	2	20	4	40
Past completed colorectal cancer screening test				
Colonoscopy	6	60	9	90
FIT	2	20	0	0
FIT-DNA	2	20	0	0
Stool-based test, unsure which one	0	0	1	10
Family history of colorectal cancer				
Yes	2	20	1	10
No	8	80	9	90
Confidence filling out medical forms alone				

A little bit confident	0	0	1	10
Somewhat confident	4	40	0	0
Quite a bit confident	1	10	1	10
Extremely confident	5	50	8	80
Marital Status				
Married/Domestic Partnership	3	30	4	40
Separated	2	20	0	0
Widowed	1	10	1	10
Single (never married/in a domestic partnership)	4	40	5	50
Highest Level of Education Completed				
< High school	2	20	3	30
High school (12th grade)	2	20	3	30
Some college	4	40	3	30
College	2	20	0	0
Missing	0	0	1	10
Health Insurance				
No insurance	0	0	4	40
Private Health Insurance	1	20	0	0
Medicare (including Health First)	1	10	0	0
Medicaid	4	40	3	30
Medicare and Medicaid	2	20	0	0
Other (Metroplus)	1	10	0	0
Other (United Healthcare)	1	10	1	10
Other (Undefined)	0	0	2	20
Estimated Total Household Income				
Less than $10,000	1	10	0	0
$10,000 to $19,999	0	0	1	10
$20,000 to $29,999	1	10	2	20
$30,000 to $39,999	0	0	1	10
$40,000 to $49,999	0	0	1	10
$50,000 or more	1	10	2	20
Prefer not to answer	7	70	3	30

Field Test 1 Results:

Technology Access and Use

Of the participants who completed the first field test, only 70% (N=7) had a smartphone. Of the respondents (N=3) who reported not having or being unsure if they had a smartphone, two reported using no other devices at home and one used a tablet. Interestingly, of the two participants who reported not having or being unsure if they had a smartphone as well as not using any other devices, both reported using the internet, one through cellular data and one through public Wi-Fi. Although the majority of the participants in the first field test (90%) reported using the internet, the quality of the internet was variable. Of the first field test sample, 10% reported having no access to the internet

at home, 60% reported having slow internet speed and 20% reported having interrupted internet. In fact, only 20% of the participants reported that they had no problems with their home-internet.

Health Literacy

Regarding health literacy, all participants reported a certain degree of confidence completing medical forms independently; four considered themselves “somewhat confident” (4, 40.0%), one said they were “quite a bit confident” (1, 10.0%), and five reported feeling “extremely confident” (5, 50.0%) with the task.

Usability and acceptability:

The average SUS score for our first field test was 75.25, which is well above the mean SUS score (i.e., the suggested cutoff for usability). The average Acceptability E-Scale score for our first field test was 28.3, which is higher than the recommended cutoff for acceptability, and close to the maximum score of 30.

Feedback from think aloud exercises, behavioral note summaries, and qualitative interviews:

In Table 2, we separated positive and negative feedback on the eNav website from Field Test 1 into the following themes: “content,” “usability/acceptability,” “design/style,” and “motivating.”

Table 2. Positive and negative qualitative feedback on eNav website from Field Test 1 study sample (N=10)

Field test 1: Positive feedback		
Theme	*Subthemes*	*Example quotes / Behavioral observations*
Content	• Interesting • Important • Informative • Easy to understand • Diverse representation	“I like it. You can't get no plainer than that. You explained everything. You know why you need to do it and how it needs to be done, you know, in all different kinds of ways...it's very, very interesting, Like I said, there's a lot of stuff I learned for myself just watching this, that I didn't even know. I'm grateful that I took the time to watch it, and I guarantee that anybody that watches this, they're going to learn a lot from it, and change their life.” “The fact that it is such a step by step showing the individual tests that are available and how applicable it is to each, how different it is to each individual...is great...” “This is wonderful. I like the different races in here to show...Beautiful, bravo, that video was outstanding. Outstanding in so many ways. Hitting the ethnic groups, you know, different cultures, everybody.” "I've never seen a website quite like this before."
Usability and Acceptability	• User-friendly	“It is easy to navigate, and the videos are very attractive and educative.” "I believe that even the person that is not tech savvy will be able to... it's pretty straightforward."

		"It's ideal for a person that's busy on the go, so you are stopping for a minute, you're going through a video, and you can fill out a form one two three.”
Design	• Style/Design	"I like the website, and the color is perfect... the videos are very attractive and educative." “It feels great...You know, the welcoming faces. They are not frowning or anything. They're quite content, which is nice." “I like the animated [videos]. I think it's cute. It's like it's friendly.”
Motivation	• Motivating • Shareable	“I’m interested more than ever before to get checked out.” "It's really good, I like it, it will make you get less scared. And it helps you to be more, you know, let me go and do this, it is encouraging. Now I'm going home now to talk to my husband, because you know, he needed to do a colonoscopy and he won't put in.” “...this right here conveys the convenience and the ease of testing so that people won't be scared of the process.” “As she said that knowledge is power is good...”
Field Test 1: Negative feedback and suggestions for change		
Theme	*Subthemes*	*Example quotes / Behavioral observations*
Content	• More information • Lay language • Address ambivalence	“I think there should be a little more information about what is cancer...That's what seems to be missing, you know what I'm saying? Because this right here also assumes the listener and the reader knows what cancer is" “What I want to know is like some people like to get the colonoscopy, right, you have to pay for it, you have to have the medical insurance, some people don't have medical insurance, so how do they get it done if they don't have medical insurance?” “What does [CRC] look like, how does it start? Where does it come from? How does it develop? ... And there are food products that you eat, and you don't know they're harming you… I want to see how it is? how does it start?” *Translated from Spanish: [“¿Cómo se ve, como empieza [el cáncer colorrectal? ¿De donde proviene? ¿Cómo se desarrolla? Y hay productos alimenticios que tú comes y no sabes que te están haciendo daño... Yo quiero ver ¿cómo es? ¿ Cómo empieza?”]*
Usability and Acceptability	• Limited technology skills or technology	Not all patients requested a CRC screening test [behavioral observation]

	ownership; variability in tech literacy • Accessibility • Alternative versions	"Most people, a lot of people, like older people, they don't have experience with the computer. To know more, they have to go on the computer, there should be other ways for them to learn about this…[Doing it on the phone] would be perfect." "I am tech savvy to navigate through it, however, there are a lot of individuals that are not. And remember when you're hitting the low-income areas, that's a toughie right there. It would be great to put it in the hospital and have like some volunteers walk them through it."
Design	• Style/Design • Congratulations card	"You want to keep it comprehensive and concise, you know, appealing, you know, wonderful, friendly, you know? So this is just a little bland right now. It can be jazzed up a little bit." "Maybe a little cute card at the end thanking them for that? You know, a very nice little card that opens, a virtual card, thanking them for caring, for caring about yourselves with something like that."
Motivation	• More urgency	"Should be a little more dramatic, with more emphasis on the seriousness of symptoms... not enough drama here about the actual condition, the harmful condition like blood, vomiting and pain." "I also think that you should put somebody that has cancer and somebody that don't have the cancer, so you could compare how the how it looks. OK, so you can I have an idea. You know, some people need to get scared because a lot of people don't do the test."

Solutions to identified problems

Drawing directly from the qualitative and quantitative results of the first field test, we made the following changes to the eNav website:

(1) Include additional information. To address patient queries, we added more content (via graphics, texts, videos) to provide more information about CRC and the different CRC screening tests.

(2) Emphasize the "request test" cue to action. Some patients did not select a test, so we emphasized and highlighted the button to request a test.

(3) Improve accessibility of technology: We removed functions that require an elevated level of tech literacy (e.g., login page). Patients will also have the option to come into the clinic and receive assistance using a clinic-provided device to complete the risk assessment and request a test in advance of their primary care appointments.

(4) Offer engagement boosters: Patients who do not complete the eNav risk assessment within 7 days of their primary care appointment will be sent a message with a link directly to the risk assessment and the "screening options" video (eNav lite). If patients still do not complete the risk assessment within two days of their appointment, they will be sent a message with the

"screening options" video and a phone number that they can call to complete the risk assessment and request a test (eNav with assistance).

(5) Enhance style: We added bolder colors and included stock photos of people rather than doctors.

(6) Improve accessibility of content: We made the font bigger and bolder.

(7) Address ambivalence: We added content to address patients' ambivalence, particularly surrounding getting a colonoscopy. For example, we added references to resources about colonoscopy, a video about the colonoscopy procedure, and another video with a patient testimonial from someone who had a colonoscopy.

(8) Emphasize urgency: We added a "five facts about colorectal cancer" section highlighting relevant morbidity and mortality statistics. We also included a patient testimonial from a cancer survivor about their experience being diagnosed and treated for colorectal cancer.

Field Test 2:

We conducted another field test to understand patients' perceptions of the modifications we made based on the first field test as well as the usability and acceptability of the updated website. We enrolled another 10 participants in Field Test 2.

Technology Access and Use

In the second field test, all of the participants (100%) reported having a smartphone. Additionally, all participants (100%) reported using the internet. Similarly to the first field test, however, the quality of the internet was variable. In fact, only 40% reported having no problems with the internet; 50% reported experiencing slow internet and 30% reported experiencing interrupted internet.

Health Literacy

In terms of health literacy, one participant considered themselves a little bit confident filling out medical forms by themselves (1, 10.0%), one said they were quite a bit confident (1, 10.0%), and eight reported feeling extremely confident (8, 80.0%) with the task.

Usability and acceptability

After excluding one participant with a missing value, the average SUS score for our second field test was 75.28, which is above the mean SUS score or the established cutoff for usability. The average Acceptability E-Scale score for our second field test was 29.2, which is higher than the recommended cutoff for acceptability and near the maximum score of 30. Furthermore, both scores improved marginally between the first and second field test; the SUS score increased from 75.25 to 75.28 and the Acceptability E-Scale score increased from 28.3 to 29.2, confirming that the second iteration of the eNav website remained highly usable and acceptable.

Feedback from think aloud exercises, behavioral note summaries, and qualitative interviews

In Table 4, we again separated positive and negative feedback on the eNav website from Field Test 2 into the following themes: "content," "usability/acceptability," "design/style," and "motivating."

Table 3. Positive and negative qualitative feedback on eNav website from Field Test 2 study sample (N=10)

Field Test 2: Positive feedback		
Theme	*Subthemes*	*Example quotes / Behavioral observations*
Content	• Interesting • Important • Informative • Easy to	"Yeah, I feel good. Health is important, and it's important to know things like this." "Well, I really liked it. You informed me. and also gave me more information about things, it has also given me

	understand • Diverse representation	more guidance on the things that I should look for..." *Translated from Spanish: [“Bueno en verdad me ha gustado. Por qué me ha informado.. y también más información de cosas, me ha dado más orientación sobre las cosas que yo debo de buscar...”]* “Everything, I loved it! I liked the screening stories, and I also liked the information about food, diet, exercise and also the part about what we should do to prevent. Prevention. It is very good, because we as individuals can avoid that. Not smoking, not using alcohol and you can prevent it so you don't get that cancer. It's very interesting." *Translated from Spanish: [“Todo ¡Me encantó!, Me gustó la historia de la detección y me gustó también lo de la comida, la dieta, el ejercicio. Lo que uno debe hacer para prevenir. La prevención. Está muy bien. Porque uno puede evitarlo, no fumando, no usando alcohol y uno lo puede prevenir para que no le de cáncer. Está muy interesante.”]*
Usability and Acceptability	• User-friendly	“Because you see people talking about their story, sometimes we don't like to read...” "I like the videos because if people don't know feel comfortable with the computer, but with videos, they're just watching them, and there are people who don't know how to read or something and listen to it." *Translated from Spanish: [“Los videos me gustan, por qué si la gente no sabe mucho con la computadora. Pero con los videos, los está viendo, y hay gente que no sabe leer o algo y lo escucha."]* "That's all easy to understand. I could see it here on my phone and I see it well." *Translated from Spanish: ["Todo eso está fácil de entender. Lo pude ver acá en mi teléfono y lo veo bien."]*
Design	• Style/Design	"It's very colorful. It's not boring...bright colors are good." “It's very good.” *Translated from Spanish: ["Está muy bien."]* “Oh, great! So far everything is great, very clear, and efficient and effective."
Motivation	• Motivating • Shareable	“I think it was very informative. It wasn't something that you'd be like, worried or nervous about. The presentation

		was enlightening and uppy.” “It’s good, gives you, you know, courage.” "This page I am going to share it with my daughters, my friends, so that they can also read it." *Translated from Spanish: [“Esta página se la voy a pasar a mis hijas a mis amistades, para que ellos también la lean."]* “Yeah, I feel good. Health is important, and it's important to know things like this.”
Field Test 2: Negative feedback and suggestions for change		
Theme	*Subthemes*	*Example quotes / Behavioral observations*
Content	• Technical language • More information • Lay language	What is Lynch Syndrome? *Translated from Spanish: ["Qué es el Síndrome de lynch?"]* “The only thing. FIT and FIT-DNA, they need to explain, what is the difference between those two. Yeah, everybody knows what colonoscopy is. But they didn't explain why the FIT and the FIT-DNA are different.” “I think [the doctor in the video] could have went into a little more detail...She said, if you have this if you had that... she could have said.. well, maybe covered a little more on symptoms.”
Usability and Acceptability	• Lack of technology ownership • Limited technology skills • Technical glitch	Not all patients requested a CRC screening test [behavioral observation] Some patients asked for the research coordinators to show eNav to them because they were struggling to navigate the website and the risk assessment on the computer [behavioral observation] Generally, patients were more comfortable scrolling through the website and navigating the risk assessment on their phones [behavioral observation] "Why don't you navigate this thing? Because I'll just tell you what my answer is." A glitch in the “request your test” button on one page led participants to a 404 error instead of the risk assessment [behavioral observation]
Design	• Style/design • Font style	"I feel like [the font]'s a little small." *Translated from Spanish: ["Siento que [la letra] es un*

		poquito pequeña."]
Motivation	• More urgency	"I think [the website] could be more powerful." “Sometimes it's better to shock people into the reality of the condition...If you value your life, you have to [get screened]." “These people are a little too soft for the seriousness of what we are talking about.” "I mean you could have more you have a couple more stories. You know, other people to tell them what they went through with, that, you know…But maybe with the screening, more testimonials.. And how they are doing now, like the survivor story, experience.”

Solutions to identified problems

Since the goal of the second field test was to improve eNav in preparation for testing the website within a randomized control trial, we implemented the following solutions to address the major problems highlighted by participants:

1. **Include additional information:** To address participants’ desire for more information on selected topics, we created a glossary with in-text pop-ups throughout the website to define medical terminology. We also bolded/highlighted information about symptoms and expanded the informational content included throughout the website (e.g., about CRC disparities, CRC risk factors, the differences between FIT and FIT-DNA).
2. **Update risk assessment:** We altered the risk assessment language (e.g., the description of colorectal cancer symptoms) to be clearer, more detailed, and more descriptive. We also added “don’t know” to the “none of the above” answer options. In addition, we changed the functionality of the risk assessment so that it is more user-friendly (e.g., automatically directs patients to the top of the next question.)
3. **Emphasize urgency:** We emphasized the colorectal cancer survivor testimonial by placing it in a more prominent part of the website. We also added questions about patients’ own motivations for screening to the “Patient Stories” page.
4. **Improve content accessibility:** In order to improve accessibility, we enlarged font size of text throughout the website, included videos at the top of the pages, and removed large sections of text.
5. **Enhance style/design/usability:** Since many patients seemed more comfortable on their phones, we improved the presentation of the eNav website on phones.
6. **Fix technical difficulties:** Patients encountered minor technical difficulties (e.g., an error page); we collaborated with the developers to fix these technical glitches on the back end of the website.

DISCUSSION

This study, conducted in an FQHC setting, iteratively user tested a digital patient navigation tool,

eNav, which aims to increase CRC screening uptake among patients receving care at FQHCs. The eNav intervention, informed by the HBM, is novel in its integration of follow up messaging with a digital platform through which patients can learn about and select a CRC screening test. Significantly, patients' risk assessment answers and, if applicable, test selections are sent to their healthcare team so that their engagement with eNav is integrated into their care. It was critically important to field test the eNav in an FQHC setting to ensure that the website was appropriate for the intended users.

Overall, the results of our study found the eNav website to be highly acceptable and user-friendly. In both field tests, the usability and acceptability scores (as measured by the System Usability Scale and the Acceptability e-Scale) exceeded suggested cutoffs and improved marginally between the first and second field tests after significant website changes to address earlier user commentary. Furthermore, during both field tests, respondents described the website favorably. For example, many participants stated that eNav was motivating, interesting, informative, and user-friendly. In both field tests, participants suggested including more content on the website to ensure that it conveyed all necessary information about CRC screening and the seriousness of colorectal cancer. In addition, respondents gave suggestions on how to improve the website's usability, accessibility, and overall appeal. We used participants' qualitative feedback to inform modifications to the intervention, especially in terms of content, design, and style, to ensure that the website has maximum acceptability and usability.

A key takeaway from the field tests is that some participants lacked the digital access needed to interact with the eNav website at home. The literature shows that technology use has grown exponentially in the last decade; however, disparities in technology access and use remain [48]. For example, according to the PEW Research Center, as of 2021, 43% of families with household incomes less than $30,000 in the U.S. do not have home broadband services and 41% do not have a desktop or laptop computer. Indeed, 27% of adults in lower-income households report using the internet only on their smartphones [48]. In our sample, we found that there was demonstrated variability in access to and quality of technology. While almost all of our sample (95%) had access to internet, the majority of participants in both field tests reported some problems with their internet, including slow internet speed and interrupted service. Beyond digital access, some participants explained that they were concerned that members of their communities, especially older patients, would not have the skills needed to navigate the website on their own, especially on computers.

To maximize accessibility, including for patients with lower digital access and skills, and to ensure we are not inadvertently widening disparities in CRC screening completion, we designed the eNav intervention to be device agnostic and require minimal technology skills. Based on the results of the field testing, we made additional modifications to the eNav intervention in order to improve accessibility and usability for patients with limited digital readiness. First, we moved all videos to be at the top of each website page. Furthermore, and most notably, we removed the login process from the website; patients are now able to access the website directly and only need to enter in their information to complete the risk assessment. In addition, as previously explained, patients who do not engage in the eNav intervention will be offered engagement boosters called "eNav lite" (text-based) and "eNav with assistance" (navigator assisted) that can help them complete the risk assessment. Finally, patients who do not have access to technological devices at home (e.g., computer, smartphone, tablet) or who would prefer not to interact with eNav at home will have the option to view the website in-person, on a clinic-provided device. These modifications are important not only for patients who struggle with technology access and literacy, but also for patients who may prefer simplified forms of communication. In sum, we made these modifications, alongside the previously mentioned refinements of the content and design of the eNav intervention, to increase the

usability, accessibility, and impact of the intervention for patients with diverse needs.

Limitations

Since we recruited patients from one FQHC clinic, convenience sampling is a limitation of this study. Patients who chose to participate in our research study may not fully represent the FQHC patient population. Furthermore, all participants were over the age of 50, so there was not representation from patients in the recently expanded age range for screening (i.e., age 45-50). A third limitation is that all participants in both field tests had completed a CRC screening in the past, although two participants in field test one and one participant in field test two were due for screening at the time of recruitment. The inclusion of patients who had never completed a CRC screening would have strengthened the study. Included patients, however, were able to draw from their previous experience with CRC screening to provide valuable feedback. Furthermore, this study was limited by the exclusion of patients with vision or hearing impairment; future research regarding digital navigation for patients with disabilities is essential. A final limitation of the study is that participants' responses may have been impacted by social desirability. In particular, the participants viewed and interacted with the eNav intervention with a member of the research team present. The presence of the research staff, as well as the overall study context, may have influenced participants to respond in a favorable or positive way. In order to mitigate a social desirability bias, we encouraged candor and explained that the team was specifically seeking negative feedback and suggestions for change.

Conclusions

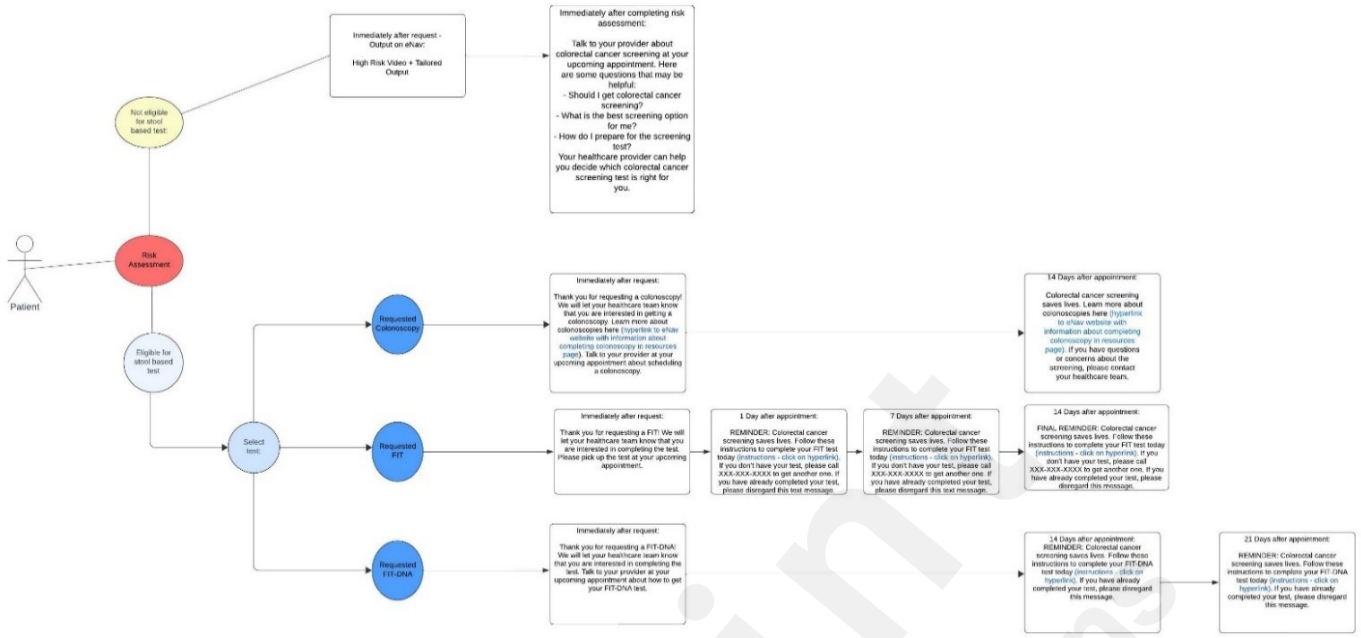
The iterative field testing confirmed the overall usability and acceptability of the eNav website. Furthermore, qualitative and quantitive feedback directly informed modifications to the intervention. The RCT will formally evaluate the efficacy of eNav for improving CRC screening uptake among patients treated at FQHCs.

Acknowledgements: This pilot study was supported by the National Cancer Institute of the National Institutes of Health under award number R01CA24981.

Data Availability: The data analyzed during this study are included in this published paper. The raw data sets are not publicly available because of patient privacy protection.

Conflicts of Interest: Ashish Atreja is the scientific founder of Rx.Health, and holds patent for the RxUniverse software platform that is a licensed technology from Icahn School of Medicine at Mount Sinai to Rx.Health, Inc (New York, NY). Steven Itzkowitz receives consulting fees and research support from the Exact Sciences Corp., research support from Freenome, and consulting fees from Geneoscopy. Drs. Atreja and Itzkowitz were not involved in data gathering or analysis.

Appendix 1: Follow up text messaging content and dosing for eNav intervention.



References

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA: A Cancer Journal for Clinicians. 2021;71(3):209-49.
2. Mehta SJ, Morris AM, Kupfer SS. Colorectal Cancer Screening Starting at Age 45 Years—Ensuring Benefits Are Realized by All. JAMA Network Open. 2021;4(5):e2112593-e.
3. Roundtable NCC. DATA & PROGRESS: American Cancer Society; [Available from: https://nccrt.org/data-progress/.
4. Administration HRaS. 2021 Health Center Data 2021 [Available from: https://data.hrsa.gov/tools/data-reporting/program-data/national/table?tableName=Full&year=2021.
5. Roundtable NCC. 80% IN EVERY COMMUNITY: American Cancer Society; [Available from: https://nccrt.org/80-in-every-community-2/.
6. Prevention CfDCa. New Hampshire Colorectal Cancer Screening Program: Patient Navigation Model for Increasing Colonsocopy Quality and Completion. A Replication Manual.; 2016.
7. Christie J, Itzkowitz S, Lihau-Nkanza I, Castillo A, Redd W, Jandorf L. A randomized controlled trial using patient navigation to increase colonoscopy screening among low-income minorities. J Natl Med Assoc. 2008;100(3):278-84.
8. Green BB, Wang CY, Anderson ML, Chubak J, Meenan RT, Vernon SW, Fuller S. An automated intervention with stepped increases in support to increase uptake of colorectal cancer screening: a randomized trial. Ann Intern Med. 2013;158(5 Pt 1):301-11.
9. Green BB, Anderson ML, Wang CY, Vernon SW, Chubak J, Meenan RT, Fuller S. Results of nurse navigator follow-up after positive colorectal cancer screening test: a randomized trial. J Am Board Fam Med. 2014;27(6):789-95.
10. Jandorf L, Gutierrez Y, Lopez J, Christie J, Itzkowitz SH. Use of a patient navigator to increase colorectal cancer screening in an urban neighborhood health clinic. J Urban Health. 2005;82(2):216-24.
11. Lasser KE, Murillo J, Lisboa S, Casimir AN, Valley-Shah L, Emmons KM, et al. Colorectal cancer screening among ethnically diverse, low-income patients: a randomized controlled trial. Arch Intern Med. 2011;171(10):906-12.
12. Myers RE, Bittner-Fagan H, Daskalakis C, Sifri R, Vernon SW, Cocroft J, et al. A randomized controlled trial of a tailored navigation and a standard intervention in colorectal cancer screening. Cancer

Epidemiol Biomarkers Prev. 2013;22(1):109-17.
13. Percac-Lima S, Grant RW, Green AR, Ashburner JM, Gamba G, Oo S, et al. A culturally tailored navigator program for colorectal cancer screening in a community health center: a randomized, controlled trial. J Gen Intern Med. 2009;24(2):211-7.
14. Ritvo PG, Myers RE, Paszat LF, Tinmouth JM, McColeman J, Mitchell B, et al. Personal navigation increases colorectal cancer screening uptake. Cancer Epidemiol Biomarkers Prev. 2015;24(3):506-11.
15. Jandorf L, Braschi C, Ernstoff E, Wong CR, Thelemaque L, Winkel G, et al. Culturally targeted patient navigation for increasing african americans' adherence to screening colonoscopy: a randomized clinical trial. Cancer Epidemiol Biomarkers Prev. 2013;22(9):1577-87.
16. Roland KB, Milliken EL, Rohan EA, DeGroff A, White S, Melillo S, et al. Use of Community Health Workers and Patient Navigators to Improve Cancer Outcomes Among Patients Served by Federally Qualified Health Centers: A Systematic Literature Review. Health Equity. 2017;1(1):61-76.
17. Freund KM. Patient navigation: the promise to reduce health disparities. J Gen Intern Med. 2011;26(2):110-2.
18. Jandorf L, Stossel LM, Cooperman JL, Graff Zivin J, Ladabaum U, Hall D, et al. Cost analysis of a patient navigation system to increase screening colonoscopy adherence among urban minorities. Cancer. 2013;119(3):612-20.
19. Ladabaum U, Mannalithara A, Jandorf L, Itzkowitz SH. Cost-effectiveness of patient navigation to increase adherence with screening colonoscopy among minority individuals. Cancer. 2015;121(7):1088-97.
20. Friedberg MW, Reid RO, Timbie JW, Setodji C, Kofner A, Weidmer B, Kahn K. Federally Qualified Health Center Clinicians And Staff Increasingly Dissatisfied With Workplace Conditions. Health Aff (Millwood). 2017;36(8):1469-75.
21. Hayashi AS, Selia E, McDonnell K. Stress and provider retention in underserved communities. J Health Care Poor Underserved. 2009;20(3):597-604.
22. Thomas Craig KJ, Willis VC, Gruen D, Rhee K, Jackson GP. The burden of the digital environment: a systematic review on organization-directed workplace interventions to mitigate physician burnout. Journal of the American Medical Informatics Association. 2021;28(5):985-97.
23. Coronado GD, Rivelli JS, Fuoco MJ, Vollmer WM, Petrik AF, Keast E, et al. Effect of Reminding Patients to Complete Fecal Immunochemical Testing: A Comparative Effectiveness Study of Automated and Live Approaches. Journal of General Internal Medicine. 2018;33(1):72-8.
24. Huf SW, Asch DA, Volpp KG, Reitz C, Mehta SJ. Text Messaging and Opt-out Mailed Outreach in Colorectal Cancer Screening: a Randomized Clinical Trial. Journal of General Internal Medicine. 2021;36(7):1958-64.
25. Solonowicz O, Stier M, Kim K, Kupfer S, Tapper E, Sengupta N. Digital Navigation Improves No-Show Rates and Bowel Preparation Quality for Patients Undergoing Colonoscopy: A Randomized Controlled Quality Improvement Study. J Clin Gastroenterol. 2022;56(2):166-72.
26. Trivedi P, Geng E, Mehta D, Garg S, Rogers J, Kakkar S, et al. Sa650 DIGITAL NAVIGATION FOR COLONOSCOPY: AN AUTOMATED INTERVENTION TO DECREASE COLONOSCOPY NO-SHOWS. Gastroenterology. 2021;160:S-582.
27. Champion VL, Skinner CS. The Health Belief Model. In: Glanz K, Rimer BK, Viswanath K, editors. Health Behavior and Health Education. San Francisco: Jossey-Bass; 2008.
28. Miller SJ, Sly JR, Alcaraz KI, Ashing K, Christy SM, Gonzalez B, et al. Equity and behavioral digital health interventions: Strategies to improve benefit and reach. Translational Behavioral Medicine. 2023;13(6):400-5.
29. Inadomi JM, MD, Vijan S, MD, MS, Janz NK, PhD, Fagerlin A, PhD, Thomas JP, BS, Lin YV, RN, MA, et al. Adherence to Colorectal Cancer Screening: A Randomized Clinical Trial of Competing Strategies. Archives of Internal Medicine. 2012;172(7):575-82.
30. Alliance CC. Take the screening quiz: Colorectal Cancer Alliance; [Available from: https://quiz.getscreened.org/#.
31. Coalition NYCCCC. Colon Cancer Prevention Risk Assessment and Screening Form: NYC Health; [Available from: https://www.nyc.gov/assets/doh/downloads/pdf/cancer/colon-cancer-screening-form.pdf.
32. Anderson M. Technology Device Ownership: 2015. Pew Research Center; 2015 10/29/2015.
33. Perrin A. Mobile Technology and Home Broadband 2021. 2021 06/03/2021.
34. Summers S, Watt A, editors. Quick and dirty usability testing in the technical communication

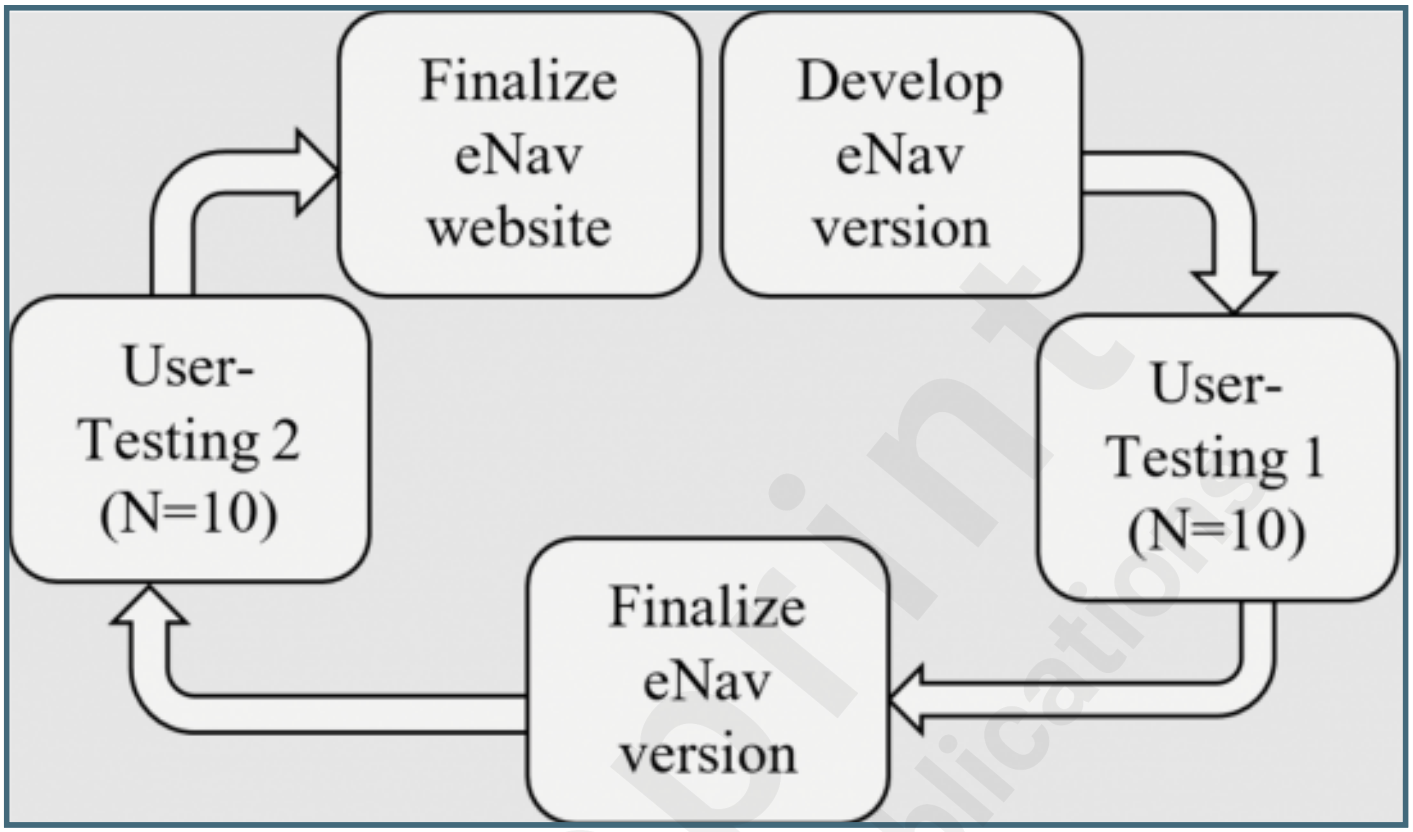
classroom. 2015 IEEE International Professional Communication Conference (IPCC); 2015 12-15 July 2015.
35. Borsci S, Federici S, Lauriola M. On the dimensionality of the System Usability Scale: a test of alternative measurement models. Cogn Process. 2009;10(3):193-7.
36. Brooke J. SUS: A quick and dirty usability scale. Usability Eval Ind. 1995;189.
37. Brooke J. SUS: a retrospective. Journal of Usability Studies. 2013;8:29-40.
38. Tariman JD, Berry DL, Halpenny B, Wolpin S, Schepp K. Validation and testing of the Acceptability E-scale for web-based patient-reported outcomes in cancer care. Appl Nurs Res. 2011;24(1):53-8.
39. Haun J, Luther S, Dodd V, Donaldson P. Measurement variation across health literacy assessments: implications for assessment selection in research and practice. J Health Commun. 2012;17 Suppl 3:141-59.
40. Wallace LS, Rogers ES, Roskos SE, Holiday DB, Weiss BD. Brief report: screening items to identify patients with limited health literacy skills. J Gen Intern Med. 2006;21(8):874-7.
41. Sandelowski M. What's in a name? Qualitative description revisited. Res Nurs Health. 2010;33(1):77-84.
42. Sandelowski M. Whatever happened to qualitative description? Res Nurs Health. 2000;23(4):334-40.
43. Sullivan-Bolyai S, Bova C, Harper D. Developing and refining interventions in persons with health disparities: the use of qualitative description. Nurs Outlook. 2005;53(3):127-33.
44. Bangor A, Kortum P, Miller J. Determining what individual SUS scores mean: adding an adjective rating scale. J Usability Studies. 2009;4(3):114–23.
45. Usability.gov. System Usability Scale (SUS) [Available from: https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html.
46. Sauro J. Measuring U [Internet]2011. Available from: https://measuringu.com/sus/.
47. Hyzy M, Bond R, Mulvenna M, Bai L, Dix A, Leigh S, Hunt S. System Usability Scale Benchmarking for Digital Health Apps: Meta-analysis. JMIR Mhealth Uhealth. 2022;10(8):e37290.
48. Vogels EA. Digital divide persists even as Americans with lower incomes make gains in tech adoption. 2021 06/22/2021.

Supplementary Files

Untitled.
URL: http://asset.jmir.pub/assets/c403330d833f90e66b9b96c9dc1794ef.docx

Figures

Iterative eNav website user-testing procedures across Field Test 1 (December 2022) and Field Test 2 (May 2023).



Multimedia Appendixes

Follow up text messaging content and dosing for eNav intervention.
URL: http://asset.jmir.pub/assets/d935ca115367d1bd1fa6c6fe6c01a5c5.png