

Facilitators and Barriers to Implementation of a Tablet-based Digital Health Program for Colorectal Cancer Screening in Primary Care: A Qualitative Study

Mark Cromo, Aliza I. Randazzo, Mark Dignan, Kristie L. Foley, Ajay Dharod, Anna C. Snaveley, Elena Wright, Holly Brower, David P. Miller, Jr.

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Mark Cromo¹ BS; Aliza I. Randazzo² BS; Mark Dignan¹ PhD, MPH; Kristie L. Foley² PhD, MS; Ajay Dharod³ MD; Anna C. Snively⁴ PhD; Elena Wright² MS; Holly Brower⁵ PhD; David P. Miller, Jr.³ MD, MS

¹College of Medicine Department of Internal Medicine University of Kentucky Lexington US

²Department of Implementation Science Wake Forest University School of Medicine Winston-Salem US

³Department of Internal Medicine Department of Implementation Science Wake Forest University School of Medicine Winston-Salem US

⁴Department of Biostatistics and Data Science Wake Forest University School of Medicine Winston-Salem US

⁵School of Business Wake Forest University Winston-Salem US

Corresponding Author:

Mark Dignan PhD, MPH
College of Medicine
Department of Internal Medicine
University of Kentucky
760 Press Ave Room 343
Lexington
Lexington
US

Abstract

Background: Colorectal cancer (CRC) incidence and mortality rates continue to be elevated even though effective screening methods are widely available. To increase CRC screening in primary care practices, our team developed a tablet-based digital health program (mPATH®) designed to identify patients needing CRC screening, provide education, and empower patients to request a screening test via the program. Based on recommendations from clinical staff and providers in previous formative research to determine the best strategy to implement the program in primary care, we divided mPATH into two separate tablet programs: mPATH-CheckIn and mPATH-CRC.

Objective: Our objectives were to qualitatively assess facilitators and barriers to implementing and maintaining mPATH in primary care clinics.

Methods: After the practices implemented mPATH, we conducted telephone interviews with providers, clinic managers, front desk and nursing staff recruited from a subset of eight of the participating primary care clinics with varying size and degrees of adoption of mPATH. The interview was designed to collect perceived facilitators and barriers to using mPATH. All interviews were administered by a single project staff member with no prior contact with participants. Interviews were audio recorded and reviewed and respondents were offered a \$50 gift card. Two study team members independently coded each interview transcript and developed a codebook to identify meaningful categories in the database. The coders met periodically to resolve discrepancies. Data within each category were abstracted and synthesized into themes. Themes were determined inductively by prevalence and salience in the data per the principles of thematic analysis.

Results: A total of 33 interviews were completed between September 2021 and April 2023 with providers (n=8), clinic managers (n=9), nursing staff (n=8), and front desk staff (n=8). Interviews averaged 25 minutes. Barriers and facilitators identified varied among clinic sites, and by clinic role. Overall, the primary factors driving continued use of mPATH beyond 12 months were staff buy-in, potential time savings and workflow improvement. The primary barriers identified in discontinuing use were perceived lack of need for the program and technical issues. There was no significant indication that clinic size or randomization to low or high intensity bundling of intervention strategies played a role in the decision.

Conclusions: Implementation of a tablet-based CRC screening tool in primary care practices is feasible with staff buy-in and validation of potential time savings and workflow improvements but may be limited by perceived lack of need and technical issues. Clinical Trial: NCT03843957

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Facilitators and Barriers to Implementation of a Tablet-based Digital Health Program for Colorectal Cancer Screening in Primary Care: A Qualitative Study

Mark Cromo¹ Aliza Randazzo² Mark Dignan¹ Kristie L. Foley² Ajay Dharod^{2,3} Anna C. Snavely³ Elena Wright² Holly Brower⁴ David P. Miller, Jr.^{2,3}

¹Department of Internal Medicine, University of Kentucky, Lexington, Kentucky, United States

²Department of Implementation Science, Wake Forest School of Medicine, Winston-Salem, North Carolina, United States

³ Department of Internal Medicine, Wake Forest School of Medicine, Winston-Salem, North Carolina, United States

⁴Department of Biostatistics and Data Science, Wake Forest University School of Medicine, Winston-Salem, NC, United States

⁵School of Business, Wake Forest University, Winston-Salem, NC, United States

- ORC IDs (not needed until publication, but just wanted to start gathering):
- Mark Cromo: 0000-0002-5699-3844
- Aliza Randazzo: 0009-0008-5722-2532
- Mark Dignan: 0000-0002-2657-6775
- David Miller: 0000-0001-7879-4427
- Kristie Foley: 0000-0002-3759-4581
- Ajay Dharod: 0000-0002-8033-9009
- Anna Snavely: 0000-0001-6916-4255
- Elena Wright: 0000-0003-1492-6114
- Holly Brower: 0000-0003-3503-9194

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Keywords: clinical decision support; mobile health technology; electronic health records; medical informatics applications; primary health care

ClinicalTrials.gov registration number NCT03843957.

1. Introduction

Colorectal cancer (CRC) is the third most common cancer diagnosed among men and women in the US and is also the second most common cause of death from cancer[1]. The United States Preventive Services Task Force recommends that average-risk adults be screened for CRC starting at age 45 using any of several proven effective tests. In the United States, the most commonly used screening tests are stool-based tests and colonoscopy. Unfortunately, while colorectal cancer screening rates have increased in recent decades, they remain relatively low[2] and fall below the 80% in every community goal promoted by the National Colorectal Cancer Roundtable and the American Cancer Society[3].

Multi-level barriers contribute to low CRC screening rates[4]. Anxiety, missing work and the need to have a driver prevents some individuals from having a colonoscopy[5]. Some patients are unaware of the availability of stool-based screening tests or the ability of screening to prevent cancer by identifying and removing precancerous lesions[6,7]. Several decision aids for CRC screening have been developed and tested. However, primary care clinicians report they lack the time needed for shared decision making[8-10]. To meaningfully improve uptake of CRC screening, easily implemented interventions are needed that address patient, provider and system barriers without requiring additional time from providers[11].

Our team previously developed and tested a tablet-based app (mPATH) that identifies patients overdue for CRC screening, educates them about their options, and allows them to request a screening test via the program. In a prior randomized controlled trial, mPATH doubled the proportion of patients who completed CRC screening[12]. To determine the optimal strategy for implementing the app in routine care, we conducted formative research with clinical staff and providers[13]. Based on their input, we divided the app into two separate tablet programs: mPATH-CheckIn and mPATH-CRC. mPATH-CheckIn was provided to patients by front desk staff at check-in and they were asked to complete it in the waiting room. mPATH-CheckIn included the health system's mandated screening items for depression, fall risk, and intimate partner violence. An Applied Programming Interface (API) connection to the EHR imported prior CRC screening history. For age eligible patients with no record of current CRC screening, mPATH-CheckIn asked additional questions to determine if screening had been completed outside the health system and if the patient had risk factors that would change screening recommendations. Those patients indicated as eligible or due for screening on mPATH-CheckIn, were then provided a separate tablet (mPATH-CRC) by nursing staff when they transitioned from the waiting room to an exam room, which displayed a screening decision aid video and closed by allowing patients to request a screening test, either a FIT or a colonoscopy. mPATH-CRC then immediately sent an electronic health record (EHR) in-basket message to the provider alerting them that the patient used the program and summarizing the outcome. When the provider arrived in the exam room, a pop-up alert let the provider order the requested CRC screening test with minimal clicks.

We conducted a cluster randomized type III hybrid implementation-effectiveness trial in 18 community-based primary care practices to evaluate a "low touch" versus a "high touch" bundle of implementation strategies[15]. Low touch clinics received an onsite training session on use of the app and access to ongoing technical support. High touch clinics received the same support plus at-elbow support on the day the program was launched in the clinic, including periodic coaching calls throughout the 6-month implementation time period, and regular audit and feedback reports on program use. We observed initial moderate use of the CheckIn program and low use of the CRC program. Use of both programs decreased over time[14].

Following completion of the randomized trial, we conducted this qualitative study to better understand the implementation outcomes observed. Because practices were using two different tablet programs (mPATH-CheckIn and mPATH-CRC) with different workflows and goals, a unique opportunity existed to examine the facilitators and barriers to implementing tablet-based programs in primary care practices. This report summarizes the qualitative study results with the goal of sharing lessons learned that could help others seeking to implement digital health programs in care.

2. Methods

2.1 Recruitment

We selected eight primary care clinics from the 18 enrolled in the randomized trial, varying by practice size and degree of mPATH adoption with the aim to interview key informants from each primary care clinic to gather opinions on mPATH implementation. We included practice size as a selection criterion because it was hypothesized that implementation barriers and facilitators could vary by practice size. Our sample included three small (1-3 provider) and five large (>3 providers) size clinics. The sample included clinics that continued use of mPATH through the 12-month implementation period and those that discontinued use. Characteristics of the 8 clinics selected for interviews are shown in Table 1.

Table 1. Clinic Characteristics

Clini c	Size	High/Low touch	# of clinical personnel	Used mPATH for 12 months	Discontinued mPATH use before 12 months.
A	Large	High	26	X	
B	Small	High	8	X	
C	Large	High	23	X	
D	Large	Low	14		X
E	Small	High	12	X	
F	Large	Low	16		X
G	Large	Low	16		X
H	Small	Low	12		X

2.2. Interview Development.

Semi-structured interview guides were developed by the investigators and pretested to ensure clarity. Separate interview guides were developed for a) Front Desk or Administrative staff and b) Clinical Personnel or Practice Managers. Because the front desk and administrative staff did not interact with the mPATH-CRC program, their interview guide only asked about mPATH-Checkin, while the Clinical Personnel and Practice Managers interview guide included questions about both mPATH-Checkin and mPATH-CRC. Interview guides were designed to collect descriptive data on the interviewee and explore the following constructs: 1) Overall assessment of the effectiveness of mPATH-Checkin for screening for depression, fall risk, and home safety; and effectiveness of mPATH-CRC for CRC screening ; 2) Perceived barriers/facilitators as related to mPATH and clinic flow; 3) Impact of mPATH on screening and clinic operations; 4) Resources /Training that were provided to support implementation; 5) Program Champion & Leadership functioning; and, 6) Scale-Up/Dissemination. All interviewees were also asked to describe the impact of COVID-19 on implementation of mPATH. The study was reviewed by the Wake Forest School of Medicine Institutional Review Board and the University of Kentucky IRB, through a reliance agreement. Prior to beginning the interviews, all participants gave verbal consent.

2.3 Data collection, management, and analyses.

Study personnel reached out to the clinics and potential interviewees were identified through the clinic champion --a primary contact at the clinic who was responsible for promoting mPATH internally and ensuring its' use by clinic staff. Clinic interviewees included providers, nursing staff, front desk/administrative staff, and the clinic manager (in most cases, the clinic manager was also the clinic champion). All interviewees were offered a \$50 gift card as compensation for their time. Because we had previously conducted extensive usability testing of the app with patients, this study focused on providers and clinic staff[15]. To avoid influencing the randomized trial results,

interviews were conducted after one-year implementation data collection was completed, or after they stopped using the program, if earlier. All interviews were administered by telephone by a single independent project staff member with no prior contact with participants. Interviews were audio recorded, transcribed, de-identified and reviewed. Transcripts were imported into ATLAS.ti to store and manage the data. Two study team members, (A.R., M.C.) inductively developed a codebook to identify meaningful categories of the database. Each transcript was independently coded by the two study team members who met periodically to resolve discrepancies and revise the codebook as needed. Response saturation was identified when interview responses were repetitive rather than providing new information. The interview data were analyzed and differences among participant groups (providers, nursing staff, clinic managers, front desk staff) were labeled. Data within each category were abstracted and synthesized into themes. Themes were determined inductively by their prevalence and salience in the data per the principles of thematic analysis.

Ethics Approval

Study participants were informed of their rights to participate; risks and benefits and financial disclosures were declared. A waiver of signed informed consent was approved by the IRB. The Wake Forest School of Medicine Institutional Review Board approved this study IRB00048919. The study was also approved by the University of Kentucky Office of Research Integrity under an alliance agreement.

3. Results

A total of 33 interviews were completed between September 2021 and April 2023 with providers (n=8), clinic managers (n=9), nursing staff (n=8), and front desk staff (n=8). Interviews averaged 25 minutes in length. Study staff identified the most prevalent facilitators and barriers to mPATH implementation described by interview participants according to the methods described above. While some implementation facilitators and barriers were common to both mPATH-Checkin and mPATH-CRC, there was some divergence of opinions on the two as described below.

3.1 Implementation Facilitators

3.1.a. Staff and Provider buy-in

Staff-buy in was identified as a significant factor in the success of mPATH implementation. Clinic staff were initially hesitant about implementing a new program and new workflows to accommodate mPATH, but this concern was alleviated with experience using the program.

Clinic A (Provider): I think that the biggest challenge would be, people worried about their workflow, and doctors are like everybody else. They do a lot of things just because that's the way they do it. Implementing anything new maybe makes everyone a little nervous, but I think in general, everybody felt the way I did, that it didn't disrupt workflows any significant way, so it was probably scary at the beginning, and didn't prove to be much trouble, and once you do a new thing for a little while, you are okay.

Buy-in from front desk staff was noted as important in mPATH-Checkin, because they were responsible for cleaning, storing, charging and distributing mPATH-CheckIn tablets, instructing patients on usage, answering patient questions, and preparing the tablets for each patient. Provider buy-in was very important for implementation of mPATH-CRC as they felt responsible for CRC screening in their eligible patients. Nursing staff bridged both mPATH-Checkin and mPATH-CRC implementation workflows and buy-in from them was important for smooth implementation and

transition between both tablets. mPATH-CheckIn had the most impact on nursing staff because it saved them time and improved their workflow, which, in-turn, increased their buy-in to the program.

3.1.b. Training/Support

Interviewees found the in-clinic training sessions to be effective, especially the “hands-on” aspect of being able to test the tablets.

Clinic E (Management): Yes, when we got trained on it, it was, basically, real-time training, and so she [mPATH research team staff] would come in and help us on a day when we had patients. She walked through one patient with us, and just be there, step by step.

3.1.c. Leadership Support/Champion

Prior to implementation, each clinic identified a champion to lead implementation efforts. The practice manager or clinical coordinator was often identified as the champion. Staff recognized the importance of the clinic champion role and also felt that mPATH implementation was well supported at the clinic leadership level.

3.1.d. Efficiency/workflow/Time savings

Interviewees agreed that mPATH-CheckIn was a significant time saver and improved workflow during patient check-in and rooming, as patients answered questions directly into the tablet and answers were transferred from the tablet directly into the EHR.

Clinic G (Nurse): Oh, 'cause it saves so much time between them already answering them, and they just pull it over into our system. Versus me going through each question myself and having to put those answers in. I just pull it over in there, and I didn't have to go into any of those questions and open it up and ask.

Interviewees agreed that mPATH-Checkin standardized and automated the assessment process and allowed more patients to be screened for depression, falls, and household violence and abuse than occurred with previous workflows.

Clinic E (Provider): I do feel like it's made the screening part much easier and faster, and we've been able to screen more patients.... Typically, we wouldn't get the chance to ask the questions just because of time and things like that. Typically, now they just do it in the waiting room when they're checking in. I feel like a large majority of our patients are getting screened now.

3.1.e. Patient Truthfulness

Patient truthfulness was noted by a significant number of interviewees as an important benefit of mPATH-Checkin, specifically regarding depression questions. Staff perceived that asking depression questions on the tablet instead of verbally helped patients be more open and forthcoming with their answers. Based on interview responses, more patients with depression symptoms were identified through the tablet-based depression questionnaire than with previous procedures.

Clinic C (Nurse): I think it actually helps the patient sometimes. It's easier for them just to answer the question on the [tablet] rather than verbalize it 'cause sometimes they're embarrassed to verbalize it to someone in-person. I think it's easier for them just to answer it on the [tablet].

3.1.f. Increased Patient Knowledge

Interviewees overall felt that the mPATH-CRC module with its educational video improved patient knowledge of CRC screening and the screening options available. It helped to clarify the importance of screening and helped generate questions and open the discussion when the provider entered the exam room.

Clinic F (Provider): I think that the content behind...[mPATH-CRC]...of giving our patients a visual, kind of audio/video on education with colon cancer screening, why they should be screened, and how they can do that is really helpful because I do that education with my patients, but some people learn better in a different manner, so that gives them a more visual or auditory way to learn. Then, they have, of course, the opportunity to ask more questions.

3.1.g. Potential Impact on CRC Screening

Interviewees expressed that they believed that mPATH-CRC helped to increase CRC screening or at least had the potential to increase screening.

Clinic C (Provider): I think the people that were on the fence of doing any type of screening, I think it did help do some screening. I think before our people said, nope, I'm not doing that—and I think after the mPATH, more people were open toward it.

3.2 Implementation Barriers

Analysis of the interviews also identified barriers to implementing mPATH in their clinics.

3.2.a. Tech Issues/EHR Limitations

Although overall, interviews indicated that mPATH-Checkin improved workflow, several interviewees (Clinics B and G) voiced concerns about occasional data transmission errors between mPATH-Checkin and the clinic EHR.

Clinic G (Provider): There seemed to be an intermittent problem with the Medicare wellness visit when we used the mPATH for check-in. It would pull in some erroneous values. We weren't able to figure out if that was part of mPATH or something else...

Typically, when an issue arose where data was missing, staff would revert to their previous workflow of asking patients the CheckIn questions verbally and then manually entering the data into the EHR.

There was also a perception that mPATH failed to recognize patients who received CRC screening outside the health system. Two clinics (A and F) with high numbers of patients who received screening outside the health system reported issues with mPATH-CRC properly identifying patients' CRC screening status.

Clinic A (Provider): ...almost all of our people are screened with outside of [University] system, and mPATH can't see it. mPATH almost always tells me my patient hasn't had a screen, and I just have to look anyway and see that they have, and then I have to make sure that it's documented in a way that's acceptable to our system, but being on the periphery like this, I don't think mPATH stops me from basically having to do that same process and look. It always tells me they don't have it, and most of them do. If our patients were getting it through a [University] gastroenterologist and it was in our [EHR], I think that would be different, but it doesn't seem to identify the ones of ours that are done in community clinics, outside of

our network.

This added to staff burden as the provider or nurse had to double check/verify screening status of each patient before giving the patient the mPATH-CRC tablet.

3.2.b. Lack of need/demand for the program

Specific to mPATH-CRC, while interviewees were generally positive about the potential of the program to improve patient knowledge and potentially help increase screening rates, a majority reported that they infrequently used mPATH-CRC, primarily due to patient eligibility factors. Clinics reported that many of their patients were outside of screening age or were up to date with CRC screening due to a previous colonoscopy within the last 10 years.

3.2.c. Efficiency/Workflow/Time Barriers

There were some barriers noted that impacted workflow, specifically the transition between the mPATH-Checkin and mPATH-CRC tablets. Since patients were given mPATH-Checkin in the waiting room, and then mPATH-CRC after they were taken back to an exam room, any delays at the front end of the workflow had the potential to carry over to the back end. This particularly occurred with patients with limited tech skills who took a longer time with the tablets.

Clinic G (Provider): I feel like, for our patients that were more technologically inclined, it, in some cases, was able to help facilitate that data gathering more quickly. For other patients, that were less technologically inclined, we found that often they hadn't made it through or had only partially made it through the questionnaire. Then the MAs [medical assistants] would go back in and redo the process.

For mPATH-CRC specifically, several clinics said that the 5-minute screening decision aid video was too long and had a negative impact on workflow, especially provider workflow.

Clinic A (Nurse): Because I personally liked that they can watch the video, but some of our providers do not like it, because it obviously delays them going into the room a little bit. That's the main hiccup that we've had is just the providers have to wait however many minutes. I don't remember how many minutes the video is, but they haven't wanted to do that.

3.3 COVID-19

Interviewees acknowledged that there were intervals of time when they did not use mPATH due to the pandemic or there were lengthy delays in implementing the program. About half the interviewees reported patients were concerned about germs and touching the tablets. The tablet cases were antibacterial and clinics had tablet cleaning protocols in place to disinfect the tablets between patient use and this was communicated to patients, which may have alleviated some fears. Clinics also had protocols in place during the pandemic to keep sick patients out of waiting rooms and/or use separate entrances to the clinic which limited the distribution of tablets to only well patients with access to the waiting room which limited the scope of the project in some of the clinics.

3.4. Overall Recommendation of mPATH

Providers and staff from four clinics reported that they were still using mPATH at the time of their interview, while one clinic E reported continuing use of mPATH-Checkin only. Interviewees from three clinics reported that they had discontinued use of the program at the time of their interview. However, those that discontinued the program reported that they liked it and would have continued using it if it was up to them individually. The decision to discontinue the program was

often made by other clinic leadership not interviewed or was a group decision amongst providers and staff as a whole. All interviewees were positive about recommending that other clinics should at least try mPATH to determine if it was a good fit for them.

4. Discussion

4.1 Principal Results

We found that clinical staff and providers' opinions about implementing a tablet-based screening program were impacted by how well it was incorporated in existing workflows and the additional value it delivered. Clinic staff and providers reported the mPATH-CheckIn program outperformed the mPATH-CRC program in both these areas. Those interviewed found mPATH-Checkin to be more beneficial than mPATH-CRC as a time saver and as a way to streamline and improve efficiency in the patient data collection process at check-in. mPATH-Checkin also provided clinics with an easy-to-use technology for increasing their quality metrics for depression, fall risk, and household violence and abuse, which seemed to serve as a motivator for clinics, especially the clinical staff.

While clinic staff interviewed expressed appreciation for the concept of mPATH-CRC "in theory", the application was challenging to implement due to a variety of factors. Providers were most opinionated on mPATH-CRC compared to nursing staff, perhaps due to providers expressing their feeling of "ownership" and "responsibility" for ensuring their patients were up to date with CRC screening. Nursing staff interviewed had a very limited or peripheral role in the CRC screening process – primarily reviewing patient screening history and notifying providers if the patient was due for screening. Providers interviewed seemed more resistant to changing their current workflows to accommodate mPATH-CRC and often indicated that "they do what mPATH-CRC does anyway", seeing it as a duplication or add-on to their existing preferred process. Another major factor in implementing mPATH-CRC was the belief that most patients were already up to date with CRC screening and did not need mPATH-CRC. Finally, since mPATH-Checkin was intended to be used with every patient over age 18, and mPATH-CRC was intended to be used just with those patients over age 50 who were due for screening, reflecting guidelines in place at the start of the study, the more sporadic use may have impacted clinics' comfort level with the mPATH-CRC program as it wasn't routinely used patient after patient.

The main factors driving continued use of mPATH beyond 12 months were staff buy-in, time savings and workflow improvement. While 3 large clinics and 1 small clinic discontinued use of the program before the 12-month point, there were no indicators that clinic size played a role in the decision. These findings are similar to other reports on adoption of decision making and cancer screening in primary care[17-19]. Provider preference along with organizational and system-level characteristics support or inhibit implementation of systems like mPATH[20].

4.2 Limitations

The project was implemented in clinics all within the same health system and same EHR system, which may have impacted opinions, perceptions, and technical issues around connectivity and integration. While we sought candid interview responses by ensuring confidentiality and using an external interviewer, social desirability bias may have affected responses. The fact that the project was being conducted in the same health system in which the research team resides may have also impacted responses. As stated previously, we interviewed practices after all quantitative implementation outcome data was collected, which was one year from program launch. This time delay may have impacted respondents' memories and perceptions of the initial training and implementation activities. Lastly, because we previously found the program had excellent patient usability^{14,16} and staff were responsible for handing out the program, we did not include patients in our interviews. Patient-level factors not identified by clinical staff may have affected implementation.

4.3 Comparison with prior work

Our findings are consistent with previous research in which it was found that self-administered screening with a tablet-based app outperformed verbal screening in detecting patients with concerns that could warrant immediate clinical attention[13,17]. While decision tools to increase prostate, breast and cervical screening have been developed and tested, relatively few tools have been developed for CRC screening barriers, such as patient knowledge about screening options and concerns about specific tests, and providers' lack of time to address screening[8-10]. There have been numerous clinical trials to increase colorectal cancer screening with digital decision aids, but most are quantitative in nature and any qualitative work focuses on the patient perspective. Our study appears to be unique in focusing solely on the clinical provider and staff perspective. However, similar results can be found in studies involving other screenable cancers, with potential time savings and workflow improvements at top of mind for clinical staff when considering implementation of new decision aids or digital tools.

4.4 Conclusions

When implementing tablet-based digital health programs in primary care clinics, demonstrating the programs' ability to improve care, fit in usual workflows, and ideally save time is critical. Providing hands-on training prior/at the start of implementation and identifying a suitable clinic champion can help increase buy-in and comfort with the program. For decision aids related to cancer or other health screenings, the demand for the program should be weighed against potential barriers to ensure that the program can be implemented and sustained effectively. Review of potential implementation facilitators and barriers can help maximize the uptake of digital health programs and enhance continued use.

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Author Contributions

M.C and A.R. developed the interview guide and conducted interviews, conducted complete analysis of the data and were major contributors in writing the manuscript. K.L.F. and E.W. contributed to the interview and focus group guides and was a major contributor in writing the manuscript. M.B.D. and A.D. contributed to the interview guide and to writing the manuscript. A.C.S. contributed to writing the manuscript. D.P.M. contributed to the interview guides and was a major contributor in writing the manuscript. All authors read and approved the final manuscript.

Conflict of Interest

D.P.M. and A.D. are co-inventors of mPATH. D.P.M., A.D., and Wake Forest University Health Sciences have an ownership interest in the mPATH app. Neither D.P.M. nor A.D. participated in data collection or analysis. K.L.F. reports grants from National Cancer Institute, during the conduct of the study; A.C.S. reports grants from NIH/NCI, during the conduct of the study; grants and personal fees from Shattuck Labs, outside the submitted work; the other authors declare that they do not have a conflict of interest to report. A.D. reports grants from National Cancer Institute, during the conduct of the study; D.P.M. reports grants from National Cancer Institute, during the conduct of the study.

Data Availability

Due to the nature of this qualitative study, data sharing is not applicable to this article as no datasets other than transcripts were generated or analyzed during the current study.

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