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Patient willingness to use a pharmacy-based colorectal cancer screening service: A national survey of U.S. adults

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Abstract

Background.—We aimed to understand US adults' willingness to use a pharmacy-based fecal immunochemical test (FIT) distribution service for routine colorectal cancer (CRC) screening called PharmFIT™ using Diffusion of Innovation Theory, evaluating patient's appraisals of the program's relative advantage, compatibility, and complexity.

Methods.—From March to April 2021, we conducted a national online survey of 1,045 US adults ages 45 to 75. We identified correlates of patient willingness to use PharmFIT™ using structural equation modeling.

Results.—Most respondents (72%) were willing to get a FIT from their pharmacy for their regular colorectal cancer screening. Respondents were more willing to participate in PharmFIT™ if they perceived higher relative advantage ($\hat{\beta}$=.184; $CI_{95\%}$:.055, .325) and perceived higher compatibility ($\hat{\beta}$=.422; $CI_{95\%}$:.253, .599) to get screened in a pharmacy, had longer travel times

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to their primary healthcare provider ($\widehat{\beta}$=.007; $CI_{95\%}$:.004, .010). Respondents were less willing to participate in PharmFIT™ if they were 65 years or older ($\widehat{\beta}$=−.220; $CI_{95\%}$:−.362, −.070).

Conclusion.—Most US adults would be willing to participate in PharmFIT™ for their routine CRC screening. Patient perceptions of the relative advantage and compatibility of PharmFIT™ were strongly associated with their willingness to use PharmFIT™. Pharmacies should account for patient preferences for these two traits of PharmFIT™ to increase adoption and use.

Impact.—Pharmacy-based CRC screening may be a viable public health strategy to significantly increase equitable access to screening for US residents.

Keywords

Pharmacy; Colorectal cancer screening; CRC screening; fecal immunochemical test; Cancer prevention; Preventive medicine; Diffusion of innovation

1. INTRODUCTION

The United States Preventive Services Task Force (USPSTF) recommends several colorectal cancer (CRC) screening modalities, including fecal immunochemical tests (FITs) for US adults ages 45–75 (1). Yet, CRC screening is underused, especially among medically underserved communities (2). Strategies to expanding screening outside of medical visits have the potential to help bridge this gap. Pharmacies are the most accessible healthcare setting in the US. Patients visit community pharmacies twice as often as they visit their physician's office (3). Around 90% of US residents live within five miles of a pharmacy (4) and about one-third of pharmacies serve rural or low-income communities (5). Pharmacy-based preventive services are feasible, acceptable, and can increase access to care, making pharmacies a potentially significant setting to expand this critical cancer prevention service (6–8). To date, however, little research evaluates whether patients would be willing to use pharmacy-based FIT distribution services.

Pharmacy-based CRC screening can be viewed as an innovation in FIT delivery since it is a departure from the status quo of delivering FITs through traditional healthcare systems in the US. According to Diffusion of Innovation (DOI) Theory, widespread adoption of an innovation like pharmacy-based CRC screening, which we call PharmFIT™, depends on five traits: relative advantage, compatibility, complexity, trialability, and observability (9). In our study, relative advantage is the degree to which PharmFIT™ is perceived to be better than other ways of completing routine CRC screening. Compatibility is the degree to which PharmFIT™ is perceived as being consistent with a patient's values, past experiences, and needs. Complexity is the degree to which PharmFIT™ is perceived as difficult to understand and use. Trialability is the degree to which PharmFIT™ can be experimented with on a limited basis. Observability is the degree to which the results or outcomes of using PharmFIT™ are visible. If potential adopters perceive PharmFIT™ to have greater relative advantage and compatibility and less complexity, PharmFIT™ will be more rapidly adopted. Similarly, potential adopters may be more likely to adopt PharmFIT™ if they can experiment with PharmFIT™ on a trial basis or observe the outcomes of the program. We aimed to understand US adults' willingness to use our proposed PharmFIT™ program and

to identify potential adopters of PharmFIT™ through the lens of DOI Theory. Our study focuses on understanding the perceived relative advantage, compatibility, and complexity of PharmFIT™ among potential adopters because trialability and observability are more reliably measured when a potential adopter can test PharmFIT™ and see the outcomes of using the program.

2. MATERIALS AND METHODS

2.1 Participants and procedures

Participants and sampling procedures are published in greater details elsewhere(10) and briefly described here. Our national survey included non-institutionalized US adults ages 45–75 who were members of online market research panels managed by Qualtrics. Respondents provided informed consent and completed the survey between March and April 2021. 5,534 panel members responded to the survey invitation and completed the eligibility screener. Eligible participants were U.S. adults aged 45–75, of low to average risk of developing colorectal cancer (i.e., no personal/family history of polyps, colorectal cancer, or inflammatory bowel disease) (1), and willing to use FIT for future CRC screening. Sampling quotas were applied to ensure a match to the 2010 U.S. Census for racial and ethnic groups, sex, and to oversample rural residents to represent approximately one in three respondents. A total of 1,045 adults were eligible, provided informed consent, completed the survey, and received an incentive. Sample demographic characteristics are reported Table 1. After accounting for panel members of unknown eligibility who accessed the survey but were excluded by Qualtrics because of over quotas (n=2,085), ineligible panel members (n=2,128), and excluding participants whose survey responses were flagged for data quality issues (n=229) or for speeding (n=50), the survey response rate was 62%, calculated using the American Association for Public Opinion Research Response Rate 4 (Supplemental Table S1) (11).

The institutional review board at the University of North Carolina at Chapel Hill (IRB#18-1337) approved the study protocol. A waiver of written informed consent was obtained and approved from the IRB since the survey was conducted online and was deemed minimal risk. All research was conducted in accordance with U.S. Common Rule.

2.2 Measures

Survey item development.—The development of the PharmFIT™ Patient Survey is described in extensive detail elsewhere (10). Briefly, our multidisciplinary research team developed and cognitively tested new survey items or adapted items from other published sources (12–15), following several best methodological practices for survey development (16). The survey instrument contained 97 items, including screeners, prompts, and questionnaire items. The survey assessed nine different topics about respondents: CRC screening experience; healthcare utilization patterns; the pharmacy respondents typically uses for prescription medications; PharmFIT™ program design; Diffusion of Innovation; willingness to use PharmFIT™; follow-up care; telehealth; and demographic characteristics. Qualtrics pretested the survey with panel members to ensure accurate programming and item

responses. The entire survey instrument can be accessed online: https://dataverse.unc.edu/dataverse/cpcrn-4cnc-pharmfit.

Innovative attributes of PharmFIT™.—The survey first outlined proposed steps and components of the proposed PharmFIT™ screening program, assessing participant preferences for design features of the program, published elsewhere (10). Next, the survey asked participants to assess innovative attributes of PharmFIT™, as defined by Diffusion of Innovation (DOI) Theory (9). The survey prompted respondents: "Now that you have thought about the steps of getting a FIT in a pharmacy, tell us how you feel about this approach compared with other ways you can get screened. Assume this is the same FIT kit you can get from your doctor or healthcare provider. Other ways you can get screened include getting a FIT from your doctor or healthcare provider or getting a colonoscopy. Say how much you agree or disagree with the following statements." The survey assessed *Relative Advantage* of PharmFIT™. The two items assessing relative advantage demonstrated high internal consistency reliability (McDonald's-ω = 0.87; Supplemental Table S2). Next, participants appraised the *Compatibility* of PharmFIT™. The two items assessing compatibility demonstrated high internal consistency reliability (McDonald's-ω = 0.86; Supplemental Table S2). Finally, the survey asked participants to assess the *Complexity* of PharmFIT™. The two items assessing complexity demonstrated high internal consistency reliability (McDonald's-ω = 0.85; Supplemental Table S2). All 6 items had a 5-point response scale ranging from "strongly disagree" (1) to "strongly agree" (5). Confirmatory factor analysis results for the relative advantage, compatibility, and complexity latent variables are in the Supplement Figure S1.

Willingness to participate in PharmFIT™.—Next, the survey assessed respondents' willingness to participate in different steps of PharmFIT™. The survey prompted participants: "Now that you have thought about getting a FIT kit from your pharmacy for your colon cancer screening, say how much you agree or disagree with the following statements." Six items had a 5-point response scale ranging from "strongly disagree" (0) to "strongly agree" (5). The items assessed participants' willingness to: 1) have their FIT eligibility checked by a pharmacist; 2) receive instructions on how to use a FIT from a pharmacist; 3) be reminded by the pharmacy to complete their FIT; 4) discuss FIT results with a pharmacist; 5) be referred by a pharmacist for a follow-up colonoscopy after a positive FIT; and 6) overall willingness to get a FIT from the pharmacy for their regular screening. Willingness indicator exhibited high internal consistency reliability (McDonald's-ω = 0.90; Supplemental Figure S2). Confirmatory factor analysis results for the willingness latent variable are provided in the Supplemental Figure S2.

Any participant who disagreed or neither agreed or disagreed with the overall willingness item (Item #6 above) received a follow-up question assessing what stipulations needed to be made for them to endorse pharmacy-based CRC screening: 1) a doctor or healthcare provider recommendation; 2) FIT results reported by to the doctor or healthcare provider; 3) insurance covered FIT or it was low-cost; 4) no appointment needed; 5) pharmacist was trained to counsel on FITs; 6) pharmacist is trained to communicate FIT results; 7) the pharmacy had a private area to discuss FITs; 8) familiarity with the pharmacist distributing

FITs; 9) pharmacy was easier to get to than the doctor's office; 10) the pharmacy had extended hours (e.g., open during evening hours or on the weekend); 11) use the screening service on a trial basis; or (12) would not endorse.

Healthcare use and history.—The survey asked respondents about their health insurance and perceived health status, whether they have a regular source of healthcare, the time it takes to get to their healthcare provider in minutes, and recent CRC screening history. Health insurance was recoded into five categories: Private, Medicare, Medicaid, VA/TRICARE/IHS/Other, and uninsured. Medicaid and Medicare dominant coding was applied to individuals who reported multiple insurance types. The survey asked participants about their most recent CRC screening: 1) stool-based test like a FIT or Cologuard; 2) colonoscopy; 3) other type of colon cancer screening test (Sigmoidoscopy, Barium Enema, CT Colonography); 5) never had a colon cancer screening test; or 5) I can't remember. We recoded recent CRC screening history as the participant having any guideline recommended screening (1) or not having been screened or unsure (0).

The survey also assessed respondents' past experiences with pharmacy services. The survey asked respondents what type of pharmacy they typically use for healthcare needs (e.g., independent, retail chain, etc.), how much time it takes to get to their pharmacy, and which patient care services they have used at their pharmacy (e.g., vaccinations, point-of-care testing). Previous use of patient care services at the pharmacy was recoded as "No" (0) or "Yes" (1). The survey also assessed pharmacy service quality indicators familiarity, sympathy, responsiveness, personal attention, safety, and trust. These six items had a 5-point response scale that ranged from "strongly disagree" (0) to "strongly agree" (5). Service quality indicator exhibited high internal consistency (McDonald's-$\omega = 0.92$; Supplemental Table S2). Confirmatory factor analysis results for the service quality latent variable are provided in the Supplement Figure S3.

Demographic Characteristics.—The survey gathered participants' demographic characteristics including gender, educational attainment, health insurance, household income, race, ethnicity, and rural residence. Household income was recoded to increments of $40,000. Rurality was classified using Rural-Urban Continuum Codes mapped to respondent zip codes (17).

2.3 Statistical analysis

For descriptive purposes, we evaluated the proportion of respondents willing to participate in different steps of PharmFIT™ (Figure 1). We also describe the most common requirements for participants to be willing to participate in PharmFIT™ (Supplemental Table S3). Finally, we calculated the means for the relative advantage, compatibility, complexity, and willingness scales.

We identified correlates of PharmFIT™ innovative attributes (e.g., relative advantage, compatibility, and complexity; Table 2) and responders' willingness to participate in PharmFIT™ (Table 3) using structural equation models (SEMs). SEM analyses used full information maximum likelihood estimation with bootstrapped resampling procedures (18). We report standardized regression coefficients ($\hat{\beta}$) for both models. The model employed

5,000 random sample draws with replacement from the existing dataset to generate bias-corrected confidence intervals (19).

We used Stata 17 (College Station, TX) for data cleaning and descriptive statistics. We used M*plus* 8.6 (Los Angeles, CA) to conduct the SEMs. Statistical tests were two-tailed with a critical α=.05. We treated bias corrected confidence intervals that did not contain zero as being statistically significant.

2.4 Data availability statement

The data generated in this study are available upon request from the corresponding author.

3. RESULTS

3.1 Survey participants demographic characteristics

The analytic sample of survey responders represented all 50 states, Washington D.C., and Puerto Rico. The respondent population averaged 59.5 years of age, was 50% female, and was primarily non-Hispanic White. The most common type of insurance reported was private followed by Medicare and Medicaid. Most participants had household incomes of less than $80,000 and reported having had a recent CRC screening (Table 1).

3.2 Willingness to participate in each step of PharmFIT™

Overall, most survey respondents (72%) were willing to participate in PharmFIT™ (Figure 1). Most were willing to discuss their eligibility for FIT with a pharmacist (67%), get instructions from a pharmacist (e.g., counseling) about how to use a FIT (76%), and receive a reminder from a pharmacist to complete a FIT (71%). Over half of participants (53%) said they would be willing to discuss FIT results with a pharmacist, while a little over one-third of participants (39%) were willing to have a pharmacists refer them for a colonoscopy after a positive FIT result. Survey respondents were most ambivalent (i.e., neither agreeing or disagreeing) about pharmacist referral for a follow-up colonoscopy (23%), discussing FIT results with a pharmacist (21%), and discussing FIT eligibility with a pharmacist (20%).

A minority of participants expressed ambivalence towards or disagreed about participating in PharmFIT™ (n=288; 28%; Supplemental Table S3). Over half of these respondents indicated that they would be willing to participate in this program if their doctor or healthcare provider recommended going to the pharmacy (57%; 163/288). Around half of respondents stipulated that FIT results must be reported back to their doctor or healthcare provider (51%; 146/288) or that the FIT should be covered by their health insurance or provided at low-cost (50%; 144/288) for them to be willing to participate in PharmFIT™. Fewer respondents rated the other stipulations as important criteria to meet before they would be willing to participate in PharmFIT™ (results shown in Supplemental Table S3). A minority of respondents (11%; 31/288) indicated that none of these stipulations would change their willingness to participate in PharmFIT™.

Addressing the top three stipulations among ambivalent or disagreeing responders (accounting for unique responses only; n=238) would increase overall patient willingness to participate in PharmFIT™ to over 95% (995/1,045).

3.3 Correlates of innovative attributes of PharmFIT™

The SEM characterizing correlates of innovative attributes of PharmFIT™ are reported in Table 2. Between 64%–70% of respondents agreed or strongly agreed to the relative advantage items (mean=3.36; SD=.99; scale ranging from 1–5) when reporting on their perceptions of this innovative trait of PharmFIT™. Respondents who completed a recent CRC screening appraised higher relative advantage of PharmFIT™ over other ways to get screened compared to respondents who had not completed a recent CRC screening ($\hat{\beta}$=.218; $CI_{95\%}$:.073, .354). Respondents who have previously used patient care services at their pharmacy appraised higher relative advantage of PharmFIT™ compared to those who had not previously used patient care services at their pharmacy ($\hat{\beta}$=.144; $CI_{95\%}$:.015, .269). Similarly, respondents who reported better perceptions of service quality also reported higher appraisals of relative advantage of PharmFIT™ ($\hat{\beta}$=.200; $CI_{95\%}$:.129, .269).

Between 73%–78% of respondents agreed or strongly agreed to the compatibility items (mean=3.99; SD=.88; scale ranging from 1–5) when reporting on their perceptions of this innovative trait of PharmFIT™. Respondents who identified themselves as Black reported lower compatibility of PharmFIT™ compared to respondents who identified as White ($\hat{\beta}$=−.223; $CI_{95\%}$:−.443, −.013). Rural respondents appraised lower compatibility of PharmFIT™ compared to urban or suburban respondents ($\hat{\beta}$=−.162; $CI_{95\%}$:−.311, .000; p=.041). Conversely, respondents who have previously used patient care services at their pharmacy appraised higher compatibility of PharmFIT™ compared to those who had not previously used patient care services at their pharmacy ($\hat{\beta}$=.136; $CI_{95\%}$:.000, .266; p=.046). Similarly, respondents who reported better perceptions of service quality also reported higher appraisals of compatibility of PharmFIT™ ($\hat{\beta}$=.216; $CI_{95\%}$:.139, .288).

Between 83%–86% of respondents agreed or strongly agreed to the complexity items (mean=4.24; SD=.74; scale ranging from 1–5) when reporting on their perceptions of this innovative trait of PharmFIT™. Female respondents appraised lower complexity for PharmFIT™ compared to male respondents ($\hat{\beta}$=.154; $CI_{95\%}$:.026, .287). Respondents who reported better perceptions of service quality also reported lower complexity of PharmFIT™ ($\hat{\beta}$=.254; $CI_{95\%}$:.178, .326). Conversely, respondents who go to department store or wholesaler pharmacies PharmFIT™ was more complex compared to respondents who go to retail chain pharmacies ($\hat{\beta}$=−.209; $CI_{95\%}$:−.413, −.015).

3.4 Correlates of PharmFIT™ willingness

The SEM characterizing correlates of willingness to participate in PharmFIT™ are reported in Table 3. Respondents indicated a mean willingness score of 3.64 (SD=.89) on a scale of 1–5. Respondents who appraised higher relative advantage ($\hat{\beta}$=.184; $CI_{95\%}$:.055, .325) and compatibility of PharmFIT™ ($\hat{\beta}$=.422; $CI_{95\%}$:.253, .599) were more willing to participate in PharmFIT™. Respondents who identified as Asian were more willing to participate in PharmFIT™ compared to respondents who identified as White ($\hat{\beta}$=.171; $CI_{95\%}$:.007, .339). Respondents who had longer travel times to their healthcare provider were more willing to participate in PharmFIT™ ($\hat{\beta}$=.007; $CI_{95\%}$:.004, .010). Respondents who have previously used patient care services at their pharmacy were more willing to

use PharmFIT™ compared to those who had not previously used patient care services at their pharmacy ($\hat{\beta}$=.193; $CI_{95\%}$:.094, .295). Additionally, respondents who reported better perceptions of service quality were more willing to participate in PharmFIT™ ($\hat{\beta}$=.068; $CI_{95\%}$:.011, .129). Conversely, respondents aged 65–75 were less willing to participate in PharmFIT™ compared to respondents aged 45–64 ($\hat{\beta}$=−.220; $CI_{95\%}$:−.362, −.070).

4. DISCUSSION

Pharmacy-based CRC screening has shown to be an effective population health intervention in other countries like Spain (20,21) and Italy (22). In the US, limited pilots of pharmacy-based CRC screening interventions have been conducted (23) or are underway (24). We have conducted qualitative studies that suggest that PharmFIT™ would be acceptable among patients (25), primary care providers (26), and pharmacists (27). The PharmFIT™ Patient Survey is the first national study to evaluate US adults' willingness to use a pharmacy-based CRC screening service we named PharmFIT™. Our overarching goal in developing PharmFIT™ is to complement current CRC screening efforts by expanding access to FIT for those who are currently not being reached by traditional FIT distribution methods. Our findings support widespread acceptability and potential adoption of PharmFIT™ among US adults eligible to use FIT for their routine colorectal cancer screening. Additionally, our study provides several program design and delivery considerations or recommendations to pharmacies, healthcare providers, and public health professional who are interested in implementing pharmacy-based CRC screening services for their communities.

First, pharmacies interested in implementing a CRC screening program like PharmFIT™ should partner with primary care providers (PCPs) in their catchment area to bolster patient care coordination. Respondents were generally willing to be screened for eligibility, be counseled by a pharmacist on FIT use, and be reminded by the pharmacy to complete their kits. However, respondents were more ambivalent about discussing FIT results with or receiving a colonoscopy referral from a pharmacist. These findings are consistent with qualitative interviews we conducted with patients (25), PCPs (26), and pharmacists (27). The variation in willingness to participate in different steps of PharmFIT™ also mirrors findings of design preferences for pharmacy-based FIT delivery and follow-up (10). By-in-large, patients' willingness for pharmacists to be included in certain FIT delivery steps are likely due to familiarity and interactions with pharmacists and an understanding of their clinical roles. Patients typically interact with pharmacists to pick up prescription medications or receive vaccinations and are accustomed to the eligibility screening, counseling, and reminders that are routine parts of pharmacy practice. While pharmacists are trained to interpret laboratory test results and do make outside referrals for follow-up care, patients may be less comfortable with their pharmacist performing these tasks. It could be that this patient population is not accustomed to getting a referral from a non-physician health professional or may not view the pharmacist as a core member of their healthcare team due to the typically transactional nature of pharmacy-based patient care services and would require a culture shift in how patients perceive health services in community pharmacies. The lack of experience with or awareness of pharmacist capacity to provide these additional services is further exemplified in the top two stipulations made by respondents unwilling to

participate in PharmFIT™, that they would only be willing to participate in PharmFIT™ if they receive a referral from their PCP to pick up FITs from the pharmacy or that FIT results were reported to their provider. As such, pharmacies that implement PharmFIT™ should attend to these care coordination factors to capture a broader screening eligible population who may be initially hesitant to participate in screening outside of primary care.

Second, framing pharmacy-based CRC screening as relatively advantageous over other screening approaches, compatible with patients' needs, and not complex to use may be a fruitful way of promoting this service with screening-eligible adults. Most respondents agreed with survey items assessing these innovative attributes of PharmFIT™. Of note, respondents who had previous CRC screening experience thought PharmFIT™ had higher relative advantage over other screening methods. These findings continue to support the notion that pharmacies tend to be more convenient to access care compared to primary care clinics. Patients often note that pharmacies' longer operating hours, shorter travel times, convenient locations, and ability to see patients without appointments are important accessibility features. Additionally, adults are more likely to go to pharmacies than doctor's offices to refill prescription medications (28) creating more opportunities to interact with pharmacy staff and be screened. As such, PharmFIT™ program design should optimize for these innovative traits, and pharmacies that provide CRC screening services should communicate these features among eligible patients. While overall appraisals of compatibility of PharmFIT were high, Black and rural respondents appraised lower compatibility of PharmFIT™ compared to White and urban respondents. These respondents may view care in pharmacies to be of lower quality care compared to primary care clinics or lack of familiarity with getting patient care services in pharmacies. Further studies should be conducted to understand the factors that drive perceptions of PharmFIT™ compatibility in these subpopulations.

PharmFIT™ could also be bundled with other preventive services, like flu vaccination, to make the program more attractive (29). Previous use of pharmacy services was also associated with higher relative advantage and compatibility, and perceptions of service quality were positively associated with all three innovative attributes. Aside from setting characteristics, familiarity, trustworthiness, and responsiveness are established characteristics in good patient-provider relationships (30). As such, pharmacy business practices should incentivize structural changes to care delivery models that encourage pharmacy staff to increase patients' comfort with using pharmacy-based patient care service provision.

Finally, our study provides some preliminary insight of who may be early adopters of pharmacy-based CRC screening services like our proposed PharmFIT™ program. Accounting for perceptions of the innovative attributes of PharmFIT™, younger survey respondents, those who had longer travel times to see their healthcare providers, those who had previously used pharmacy-based patient care services, and those who had higher perceptions of services quality in pharmacies were more willing to use PharmFIT™. Compared to older adults (65+), younger adults may be more willing to try PharmFIT™ due to younger people's tendency to be more adaptable and open to change, earlier exposure to learn about and use pharmacy-based services, and higher risk tolerance to try innovations.

As mobility may be an important barrier for older adults accessing screening services, pharmacies may be able to increase adoption of CRC screening by providing services such as home delivery and mailed FITs. These types of services can bolster equitable access to care by being patient-centered while also strengthening older adults perceptions of quality care (31). Additionally, we found that Asian respondents were more willing to participate in PharmFIT™ compared to White respondents. CRC screening rates among Asians are lower compared to Whites (32), which may point to an opportunity for PharmFIT™ to increase screening participation in this population. However, Asians in the US represent an incredibly diverse group that is geographically dispersed, and future studies focused on these subpopulations would be warranted.

4.1 Strengths and limitations

Our study has notable strengths, including a national sample of FIT-eligible adults with good representation from groups with rural residence and lower incomes. Our survey included novel items examining various motivating factors associated with patients' willingness to use pharmacy-based CRC screening services (e.g., PharmFIT™) grounded in DOI Theory. Our analysis was strengthened by using SEM, allowing us to model latent variables, account for measurement error in survey items, and apply nonparametric tests to account for observation bias. Our study is limited by a cross-sectional study design that prevents us from establishing temporal relationships among variables, thus limiting our causal inferences to associations. Additionally, PharmFIT™, at the time of fielding the survey, was a conceptual patient care service, thus survey participant's responses are perceptual and attitudinal. Pragmatic implementation considerations, like out-of-pocket costs incurred by patients, could not be assessed and would likely impact participation in this program. Future research conducted by our team will evaluate the effectiveness of the PharmFIT™ intervention, including an implementation cost analysis, in several pharmacies to elicit real world experiences among patients and providers using this service.

4.2 Conclusions

Community pharmacies have broadened their patient care services over the decades, playing an increasingly central role in patient-centered care and public health. Notably, pharmacies have expanded their services to cancer prevention and control that include HPV vaccination and tobacco cessation. As acceptability of pharmacy-based patient care services has grown, so have opportunities to address important health inequities in access to evidence-based preventive care. This study, along with other formative research conducted by our investigator team (10,25,27,33), highlights the role pharmacies can play in cancer prevention. Our findings warrant further investigations through feasibility pilots and implementation trials that test the effectiveness of pharmacy-based CRC screening in the general adult population eligible for screening using FIT.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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REFERENCES

1. Davidson KW, Barry MJ, Mangione CM, Cabana M, Caughey AB, Davis EM, et al. Screening for colorectal cancer: US preventive services task force recommendation statement. JAMA. 2021;325:1965–77. [PubMed: 34003218]
2. National Colorectal Cancer Roundtable. Data & Progress [Internet]. 2023 [cited 2023 Aug 24]. Available from: https://nccrt.org/data-progress/
3. Valliant SN, Burbage SC, Pathak S, Urick BY. Pharmacists as accessible health-care providers: quantifying the opportunity. JManag Care Spec Pharm 2022;28: 85–90 [PubMed: 34949110]
4. Berenbrok LA, Tang S, Gabriel N, Guo J, Sharareh N, Patel N, et al. Access to community pharmacies: A nationwide geographic information systems cross-sectional analysis. J Am Pharm Assoc (2003). 2022;
5. Kelling SE. View of Exploring Accessibility of Community Pharmacy Services. Inov Pharm. 2015;6:Article 210.
6. San-Juan-Rodriguez A, Newman TV, Hernandez I, Swart ECS, Klein-Fedyshin M, Shrank, et al. Impact of community pharmacist-provided preventive services on clinical, utilization, and economic outcomes: An umbrella review. Prev Med. 2018;115:145–55. [PubMed: 30145351]
7. Lindsey L, Husband A, Nazar H, Todd A. Promoting the early detection of cancer: a systematic review of community pharmacy-based education and screening interventions. Cancer Epidemiol. 2015;39:673–81. [PubMed: 26272518]
8. Thomson K, Hillier-Brown F, Walton N, Bilaj M, Bambra C, Todd A. The effects of community pharmacy-delivered public health interventions on population health and health inequalities: A review of reviews. Prev Med. 2019;124:98–109. [PubMed: 30959070]
9. Rogers EM. Diffusion of preventive innovations. Addict Behav. 2002;27:989–93. [PubMed: 12369480]
10. Brenner AT, Waters AR, Wangen M, Rohweder C, Odebunmi O, Marciniak MW, et al. Patient preferences for the design of a pharmacy-based colorectal cancer screening program. Cancer Causes Control. 2023;1–14.
11. The American Association for Public Opinion Research. Standard definitions: Final dispositions of case codes and outcome rates for surveys. 9th ed. AAPOR; 2016.
12. Shah PD, Calo WA, Marciniak MW, Golin CE, Sleath BL, Brewer NT. Service quality and parents' willingness to get adolescents HPV vaccine from pharmacists. Prev Med. 2018;109:106–12. [PubMed: 29330033]
13. Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS). National Health and Nutrition Examination Survey Questionnaire [Internet]. NHANES 2019–2020. [cited 2022 Dec 15]. Available from: https://wwwn.cdc.gov/nchs/nhanes/continuousnhanes/default.aspx?BeginYear=2019
14. Gilkey MB, Calo WA, Moss JL, Shah PD, Marciniak MW, Brewer NT. Provider communication and HPV vaccination: The impact of recommendation quality. Vaccine. 2016;34:1187–92. [PubMed: 26812078]
15. Pankratz M, Hallfors D, Cho H. Measuring perceptions of innovation adoption: the diffusion of a federal drug prevention policy. Health Educ Res. 2002;17:315–26. [PubMed: 12120847]
16. Boateng GO, Neilands TB, Frongillo EA, Melgar-Quiñonez HR, Young SL. Best practices for developing and validating scales for health, social, and behavioral research: A primer. Front Public Health. 2018;6:149. [PubMed: 29942800]

17. U.S. Department of Agriculture. Rural-Urban Continuum Codes [Internet]. Economic Research Service. [cited 2022 Oct 2]. Available from: https://www.ers.usda.gov/data-products/rural-urban-continuum-codes.aspx
18. Muthén LK, Muthén BO. Mplus Users' Guide (1998–2017). 8th ed. Los Angeles: Muthén & Muthén; 2017.
19. Mackinnon DP, Lockwood CM, Williams J. Confidence Limits for the Indirect Effect: Distribution of the Product and Resampling Methods. Multivariate Behav Res. 2004;39:99. [PubMed: 20157642]
20. Burón A, Grau J, Andreu M, Augé JM, Guayta-Escolies R, Barau M, et al. Colorectal Cancer Early Screening Program of Barcelona, Spain: Indicators of the first round of a program with participation of community pharmacies. Medicina Clínica (English Edition). 2015;145:141–6.
21. Santolaya M, Aldea M, Grau J, Estrada M, Barau M, Buron A, et al. Evaluating the appropriateness of a community pharmacy model for a colorectal cancer screening program in Catalonia (Spain). J Oncol Pharm Pract. 2017;23:26–32. [PubMed: 26563130]
22. Deandrea S, Deandrea S, Valle P, Battisti F, Brusa, Mantellini P, et al. The community pharmacy integration in colorectal cancer screening: the Italian model. Popul Med. 2023;5.
23. Potter MB, Gildengorin G, Wang Y, Wu M, Kroon L. Comparative effectiveness of two pharmacy-based colorectal cancer screening interventions during an annual influenza vaccination campaign. J Am Pharm Assoc. 2010;50:181–7.
24. WKYT. Kentucky is first state with pharmacist-led colon screening [Internet]. 2022 [cited 2023 Jan 20]. Available from: https://www.wkyt.com/2022/11/20/kentucky-is-first-state-with-pharmacist-led-colon-screening/
25. Ferrari RM, Atkins DL, Wangen M, Rohweder CL, Waters AR, Correa S, et al. Patient perspectives on a proposed pharmacy-based colorectal cancer screening program. Transl Behav Med. 2023;ibad057.
26. Brenner AT, Rohweder CL, Wangen M, Atkins DL, Ceballos RM, Correa S, et al. Primary care provider perspectives on the role of community pharmacy in colorectal cancer screening: a qualitative study. BMC Health Serv Res. 2023;23:892. [PubMed: 37612656]
27. Shah PD, Atkins DL, Ittes A, Ferrari R, Rohweder C, Wangen M, et al. How Pharmacists would design a pharmacy-located colorectal cancer screening program. Poster presented at 13th Annual Conference on the Science of Dissemination and Implementation in Health, December 15–17, Washington D.C. 2020.
28. Berenbrok LA, Gabriel N, Coley KC, Hernandez I. Evaluation of frequency of encounters with primary care physicians vs visits to community pharmacies among medicare beneficiaries. JAMA Netw Open. 2020;3:e209132. [PubMed: 32667653]
29. Potter MB, Ackerson LM, Gomez V, Walsh JME, Green LW, Levin TR, et al. Effectiveness and reach of the FLU-FIT program in an integrated health care system: a multisite randomized trial. Am J Public Health. 2013;103:1128–33. [PubMed: 23597357]
30. Worley MM. Testing a pharmacist-patient relationship quality model among older persons with diabetes. Res Social Adm Pharm. 2006;2:1–21. [PubMed: 17138498]
31. Shiyanbola OO, Mott DA, Croes KD. The structural and process aspects of pharmacy quality: older adults' perceptions. Int J Clin Pharm. 2016;38:96–106. [PubMed: 26499502]
32. American Cancer Society. Colorectal Cancer Facts & Figures [Internet]. 2022 [cited 2023 Aug 27]. Available from: https://www.cancer.org/research/cancer-facts-statistics/colorectal-cancer-facts-figures.html
33. Waters A, Wangen M, Odebunmi O, Rohweder C, Ferrari R, Wheeler S, et al. Piloting a community pharmacy-based colorectal cancer screening program (PharmFIT): Findings from stakeholder engaged implementation planning and process mapping. Poster presented at Society for Implementation Research Collaboration Conference, September 8–10, San Diego, CA. 2022.

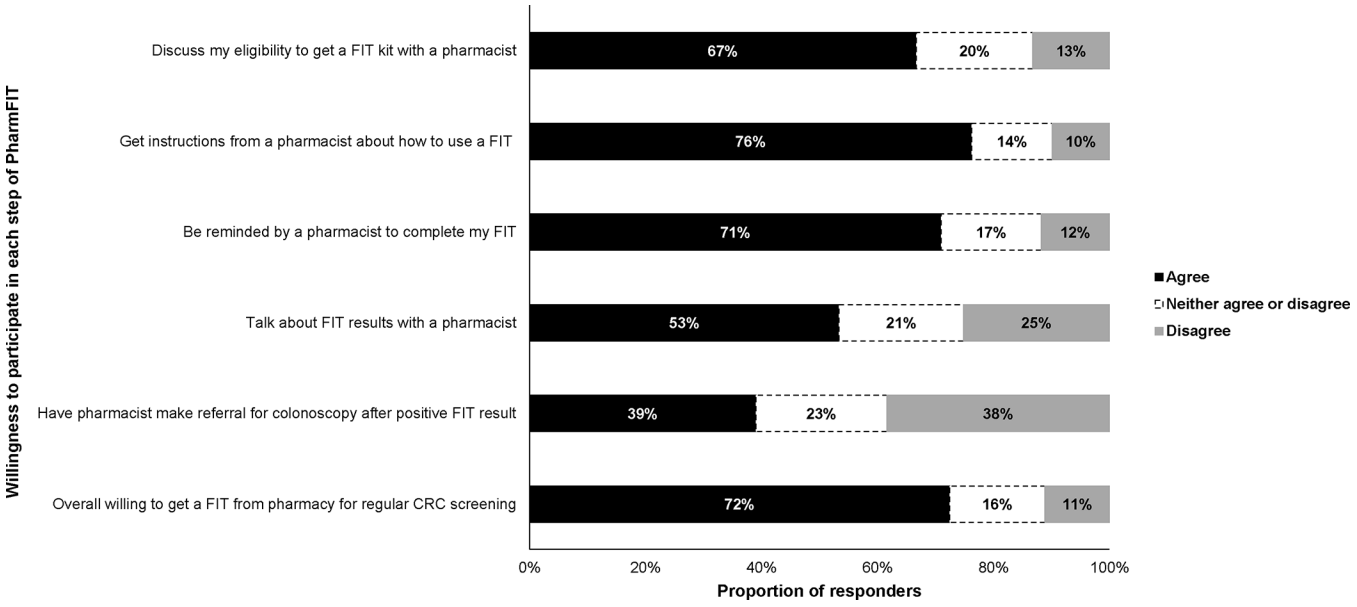

Figure 1.

Willingness to participate in different steps of PharmFIT™ (n=1,045). Proportion of survey responders who agreed or disagreed to be willing to participate in different steps of PharmFIT™.

Table 1.

Survey responders' sociodemographic characteristics (n=1,045)

	n* (%) or *avg (SD)
Sociodemographic characteristics	
Age	
45–64	696 (67)
65–75	329 (33)
Gender	
Male	523 (50)
Female	522 (50)
Race	
White	770 (74)
Black	134 (13)
Asian	68 (7)
Multiracial or other race	73 (7)
Ethnicity	
Hispanic or Latino/a	126 (12)
Not Hispanic or Latino/a	919 (88)
Rurality	
Urban or suburban	731 (70)
Rural	314 (30)
Educational attainment	
High school, GED, or less	217 (21)
Some college or associates degree	408 (39)
College degree	259 (25)
Graduate education or higher	161 (15)
Household Income	
<$40,000	403 (39)
$40,000 - $79,999	370 (35)
$80,000 or more	272 (26)
Healthcare use and history	
Insurance status [A]	
Private	407 (39)
Medicare	332 (32)
Medicaid	163 (16)
VA/TriCare/IHS/Other	81 (8)
Uninsured	60 (6)
Perceived health status	
Excellent	77 (7)
Very good	301 (29)
Good	443 (42)

	n* (%) or *avg (SD)
Fair	190 (18)
Poor	34 (3)
Colorectal cancer screening history	
Recent screening	689 (66)
No recent screening or not known	356 (34)
Established regular healthcare provider	
No	112 (11)
Yes	933 (89)
Travel time to healthcare provider (mins)	18.7 (14.2)
Pharmacy typically used for healthcare needs	
Retail chain (e.g., CVS, Walgreens, Rite Aid)	515 (49)
Grocery store (e.g., Kroger, Albertsons)	164 (16)
Department store or wholesaler (e.g., Walmart, Costco)	166 (16)
Clinic or hospital pharmacy	90 (9)
Independently owned pharmacy	110 (11)
Previous use of patient care services in pharmacy	
Influenza or other vaccinations	346 (33)
COVID-19 vaccination	130 (12)
COVID-19 testing	56 (5)
Smoking or tobacco cessation	22 (2)
Genetic testing	15 (1)
Travel medicine consultation	19 (2)
Chronic disease management and education, such as for diabetes, heart disease, or obesity	55 (5)
Urgent care	47 (5)
Other patient care service	31 (3)
Travel time to pharmacy (mins)	13.1 (12.9)
Perceptions of service quality at pharmacy [B]	3.87 (.83)

Note. Percentages are rounded to nearest whole number.

A: two participants did not report their insurance status.

B: Perceptions of service quality at pharmacy scale ranged from 1 to 5.

Table 2.

Correlates of innovative attributes of PharmFIT™ (n=1,043)

	Relative advantage		Compatibility		Complexity[A]	
	$\widehat{\beta}$	$CI_{95\%}$	$\widehat{\beta}$	$CI_{95\%}$	$\widehat{\beta}$	$CI_{95\%}$
Sociodemographic characteristics						
Age						
45–64	*ref*		*ref*		*ref*	
65–75	−.110	[−.294, .080]	−.126	[−.316, .070]	−.162	[−.351, .051]
Gender						
Male	*ref*		*ref*		*ref*	
Female	.074	[−.056, .199]	.123	[−.010, .248]	.154	[.026, .287]
Race						
White	*ref*		*ref*		*ref*	
Black	−.190	[−.406, .035]	−.223	[−.443, −.013]	−.166	[−.377, .035]
Asian	−.093	[−.325, .148]	−.046	[−.269, .167]	−.275	[−.570, .014]
Multiracial or other race	.091	[−.190, .350]	−.019	[−.311, .265]	.054	[−.263, .343]
Ethnicity						
Not Hispanic or Latino/a	*ref*		*ref*		*ref*	
Hispanic or Latino/a	−.045	[−.253, .166]	.031	[−.176, .251]	−.089	[−.305, .131]
Rurality						
Urban or suburban	*ref*		*ref*		*ref*	
Rural	−.094	[−.242, .056]	−.162[B]	[−.311, .000]	−.145	[−.299, .013]
Educational attainment						
High school, GED, or less	*ref*		*ref*		*ref*	
Some college or associates degree	−.083	[−.255, .092]	−.049	[−.223, .128]	.039	[−.138, .233]
College degree	−.094	[−.298, 112]	−.069	[−.281, 136]	−.052	[−.259, .139]
Graduate education or higher	−.199	[−.431, .037]	−.144	[−.388, .088]	−.007	[−.236, .239]
Household Income						
<$40,000	*ref*		*ref*		*ref*	
$40,000 - $79,999	.048	[−.116, .209]	−.010	[−.166, .156]	.054	[−.119, .226]

	Relative advantage		Compatibility		Complexity[A]	
	$\widehat{\beta}$	$CI_{95\%}$	$\widehat{\beta}$	$CI_{95\%}$	$\widehat{\beta}$	$CI_{95\%}$
$80,000 or more	.105	[−.075, .290]	.029	[−.149, .215]	.104	[−.088, .302]
Healthcare use and history						
Insurance status						
Private	*ref*		*ref*		*ref*	
Medicare	−.063	[−.268, .134]	−.023	[−.223, .168]	.110	[−.111, .309]
Medicaid	−.189	[−.409, .031]	−.200	[−.433, .026]	−.083	[−.303, .134]
VA/Tricare/IHS/Other	−.287	[−.599, .030]	−.173	[−.462, .123]	−.140	[−.468, .192]
Uninsured	.148	[−.139, .431]	.076	[−.196, .330]	.256	[−.066, .544]
Colorectal cancer screening history						
No recent screening or not known	*ref*		*ref*		*ref*	
Recent screening	.218	[.073, .354]	.006	[−.128, .148]	−.092	[−.240, .062]
Established regular healthcare provider						
No	*ref*		*ref*		*ref*	
Yes	−.116	[−.345, .119]	−.119	[−.329, .102]	.003	[−.226, .220]
Travel time to healthcare provider	.002	[−.003, .006]	−.003	[−.008, .002]	−.003	[−.009, .001]
Pharmacy typically used for healthcare needs						
Retail chain (e.g., CVS, Walgreens)	*ref*		*ref*		*ref*	
Grocery store (e.g., Kroger, Albertsons)	−.072	[−.249, .098]	−.087	[−.281, .104]	−.122	[−.320, .074]
Department store or wholesaler (e.g., Walmart, Costco)	−.108	[−.305, .080]	−.102	[−.285, .085]	−.209	[−.413, −.015]
Clinic or hospital pharmacy (e.g., Kaiser)	−.193	[−.481, .095]	−.151	[−.428, .125]	−.178	[−.460, .084]
Independently owned pharmacy	.046	[−.165, .280]	−.126	[−.372, .115]	−.128	[−.350, .113]
Use of patient care services in pharmacy						
No	*ref*		*ref*		*ref*	
Yes	.144	[.015, .269]	.136[C]	[.000, .266]	.089	[−.045, .222]
Perceptions of service quality at pharmacy	.200	[.129, .269]	.216	[.139, .288]	.254	[.178, .326]

Notes. Structural equation model conducted under full information maximum likelihood (FIML) estimation procedures. Latent variables: Relative advantage, compatibility, complexity, and perceptions of service quality at pharmacy. Grey highlights indicate statistically significant coefficients.

$\widehat{\beta}$: Standardize regression coefficient. $CI_{95\%}$: 95% Confidence Interval. All confidence intervals are bias corrected.

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[A]Positive regression coefficients indicate lower perceptions of complexity. Negative regression coefficients indicate higher perceptions of complexity.

[B]p=.041

[C]p=.045

Table 3.

Correlates of willingness to use PharmFIT™ (n=1,043)

	$\widehat{\beta}$	$CI_{95\%}$
Innovative attribute of PharmFIT ™		
Relative advantage	.184	[.055, .325]
Compatibility	.422	[.253, .599]
Complexity	.134	[−.001, .275]
Sociodemographic characteristics		
Age		
45–64	*ref*	
65–75	−.220	[−.362, −.070]
Gender		
Male	*ref*	
Female	−.068	[−.164, .034]
Race		
White	*ref*	
Black	.098	[−.072, .272]
Asian	.171	[.007, .339]
Multiracial or other race	.042	[−.186, .243]
Ethnicity		
Not Hispanic or Latino/a	ref	
Hispanic or Latino/a	.009	[−.150, .138]
Rurality		
Urban or suburban	ref	
Rural	−.013	[−.138, .096]
Educational attainment		
High school, GED, or less	ref	
Some college or associates degree	−.048	[−.191, .094]
College degree	.013	[−.153, .172]
Graduate education or higher	−.096	[−.292, .092]
Household Income		
<$40,000	ref	
$40,000 - $79,999	.015	[−.112, .143]
$80,000 or more	−.073	[−.144, .137]
Healthcare use and history		
Insurance status		
Private	ref	
Medicare	−.021	[−.164, .131]
Medicaid	.118	[−.056, .288]
VA/Tricare/IHS/Other	.024	[−.169, .233]

	$\widehat{\beta}$	$CI_{95\%}$
Uninsured	.095	[−.169, .323]
Colorectal cancer screening history		
No recent screening or not known	ref	
Recent screening	.026	[−.080, .137]
Established regular healthcare provider		
No	ref	
Yes	−.114	[−.287, .073]
Travel time to healthcare provider	.007	[.004, .010]
Pharmacy typically used for healthcare needs		
Retail chain (e.g., CVS, Walgreens)	ref	
Grocery store (e.g., Kroger, Albertsons)	.023	[−.121, .162]
Department store or wholesaler (e.g., Walmart, Costco)	.064	[−.088, .213]
Clinic or hospital pharmacy (e.g., Kaiser)	−.033	[−.233, .166]
Independently owned pharmacy	−.061	[−.230, .092]
Use of patient care services in pharmacy		
No	*ref*	
Yes	.193	[.094, .295]
Perceptions of service quality at pharmacy	.068	[.011, .129]

Notes. Structural equation model conducted under full information maximum likelihood (FIML) estimation procedures. Latent variables: PharmFIT™ willingness, relative advantage, compatibility, complexity, and perceptions of service quality at pharmacy. Grey highlights indicate statistically significant coefficients.

$\widehat{\beta}$: Standardize regression coefficient. $CI_{95\%}$: 95% Confidence Interval. All confidence intervals are bias corrected.