

An online training intervention for primary care providers on preparing patients for cancer treatment decisions and conversations about clinical trials: Evaluation of a pilot study using mixed methods and follow up

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Table of Contents

Original Manuscript..... 5

Supplementary Files..... 48

 Figures 49

 Figure 1..... 50

 Multimedia Appendixes 51

 Multimedia Appendix 1..... 52

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Abstract

Background: Recruitment to cancer clinical trials (CCTs) is low, particularly for underrepresented groups such as uninsured or low-income patients and individuals of minoritized race and ethnicity. A significant barrier is that treating oncologists often fail to inform patients about the possibility of clinical trial participation as an option for quality cancer care. Thus, patient inquiries about trials before starting treatment should be normalized and encouraged, particularly for underrepresented groups. Primary care providers (PCPs) are uniquely suited to do this because they interact with patients at the time of cancer diagnosis, provide ongoing care, and are trusted sources of information.

Objective: This study was designed to pilot an innovative online CCT training intervention for PCPs to increase their ability to preparing patients for cancer treatment decisions and conversations about clinical trials.

Methods: We conducted an evaluation of a pilot study using a self-guided, interactive one-hour online training intervention for PCPs with survey assessments at pre-intervention, immediate post-intervention, and 3-month follow up. We employed a mixed methods approach, incorporating both quantitative and qualitative data collection and analysis. Guided by the Kirkpatrick Evaluation model, we focused on Levels 1 (reaction), 2 (learning), and 3 (behavior).

Results: Twenty-nine PCPs completed the intervention and pre-and post- measures, with 28 PCPs completing the 3-month follow up. Eight of the 28 PCPs participated in a qualitative interview following the 3-month assessment. Participants reported high levels of satisfaction with the course. CCT knowledge and attitudes/beliefs improved following the course and were sustained at the 3-month follow up. PCPs reported willingness to communicate with patients about cancer treatment options, including CCTs, and willingness to talk with their colleagues about change in referral practices. However, fewer had actually engaged in these conversations by the 3-month follow-up. In interviews, PCPs cited limited inter-professional knowledge-

sharing and organizational constraints as barriers. Notably, PCPs reported significant change in their communication behavior with patients; a higher percentage reported communicating with patients at time of referral about cancer treatment options and clinical trials at 3-month follow up than at baseline. PCPs reported in interviews that they now felt more comfortable and empowered to have these conversations.

Conclusions: This pilot study found that a self-guided, interactive one-hour online training intervention for PCPs resulted in improved knowledge, attitudes and beliefs, and communication with patients to prepare them for discussions with oncologists about cancer treatment and cancer clinical trials. Future dissemination of this course has the potential to make an impact on cancer clinical trial accrual.

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Original Manuscript

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Conclusions: This pilot study found that a self-guided, interactive one-hour online training

intervention for PCPs resulted in improved knowledge, attitudes, and beliefs, and communication with patients to prepare them for discussions with oncologists about cancer treatment and cancer clinical trials. Future dissemination of this course has the potential to make an impact on cancer clinical trial accrual.

Keywords: cancer clinical trials; continuing medical education; continuing education; primary care providers; provider-patient communication; cancer treatment; referral practices; online learning



Introduction

Cancer treatment clinical trials (CCTs) are essential for advancing cancer treatment and ensuring quality of care for patients.[1] However, for cancer research to benefit all patients, it is critical to include participants who represent the diversity of the U.S. population. Unfortunately, participation in cancer treatment trials remains low, with an overall accrual rate of only 7.1%.[2] Moreover, only approximately 5% of trial participants are Black or Hispanic, even though these groups represent 15% and 13% of people with cancer, respectively.[3] The ongoing underrepresentation of minoritized populations in CCTs not only raises concerns about equitable access to care, but also limits the generalizability of findings across diverse patients groups.

Various barriers at the system, institutional, clinician/research team, and patient levels contribute to low CCT enrollment.[4–11] One significant barrier is that a substantial portion of eligible patients are not approached about the possibility of receiving treatment through clinical trials.[12] This issue is especially pronounced for patients from demographic groups who are typically underrepresented in trials (e.g., uninsured, racial and ethnic minoritized groups, rural),[12–19] and who experience higher cancer mortality rates.[20] Even when the option of clinical trials is discussed with eligible patients, the communication is frequently unclear or inequitable, often reflecting racial disparities in how comprehensively information about CCTs is conveyed.[21]

Research has shown that educating patients before their first oncologist visit can improve their knowledge, attitudes, and readiness for treatment decision-making, as well as increase their willingness to ask about and consider cancer treatment trials.[22] Therefore, it is important to normalize receiving treatment through clinical trials and encourage patient inquiries about trials before starting treatment, particularly for underrepresented groups. To

effectively inquire about clinical trials, patients need to understand that quality care can be provided through CCTs, asking about CCTs is encouraged and supported, their participation in treatment decisions is encouraged [23,24] and that they are capable of fulfilling this role.[8–10] Patient education can start with the patient's trusted primary care provider (PCP).

PCPs are a potential gateway facilitating access to CCTs because they interact with patients at the time of cancer diagnosis, provide ongoing care, and are trusted sources of information.[25,26] PCPs also report believing they play an important role in patient care across the cancer continuum, including being actively involved during treatment.[27] Moreover, studies have shown that a trusted physician's recommendation is a primary factor influencing patients' decisions to enroll in clinical trials when offered.[5,10,28–34], and that may even be more acute for minority populations[35]. Therefore, improving PCPs' attitudes, beliefs, and behaviors around CCTs may significantly influence patients' attitudes and openness towards participation. [36–39]

Although PCPs have expressed a desire for more of their patients with cancer to participate in CCTs, they often feel inadequately prepared to discuss trials due to their own limited understanding of CCTs as a high-quality treatment option.[40,41] Additionally, they need guidance on effectively communicating with patients about potential trial participation. This gap in knowledge and skills presents a significant opportunity to educate PCPs about CCTs and their role in preparing patients for the oncology referral. These new skills can potentially improve trial accrual and patient access, especially for underrepresented groups.

Previous research, including our own, has demonstrated that conducting education with PCPs who serve underrepresented populations can contribute to breaking down key barriers to trial participation.[42–44] This can be achieved by improving PCPs' capacity to both (1) educate recently diagnosed patients about the possibility of trial participation at the time of treatment referral to cancer care; and (2) provide decision making support to patients if advice

is sought about trial participation after the patient has already met with the oncologist.

The purpose of this study was to pilot test an innovative online training intervention for PCPs, including both practicing clinicians and trainees, designed to help them prepare patients for discussions about cancer treatment and CCTs. There are several types of CCTs including prevention, screening, behavioral, and supportive care. For the purpose of this training, however, we focused specifically on treatment trials (e.g., chemotherapy, immunotherapy). We aimed to evaluate: (1) PCPs' general impressions of the training intervention and how the intervention impacted (2) PCPs' knowledge about CCTs, (3) PCPs' perceptions of their roles in caring for patients with cancer, (4) PCPs' approach toward and communication with patients, and (5) PCPs' willingness and behaviors in enacting practice-level changes.

Methods

Study Design

A one-hour online training intervention for PCPs was developed and evaluated in a single-arm pilot study with assessments at pre-intervention, immediately post-intervention, and at a 3-month follow up. We employed a mixed methods approach, using quantitative and qualitative data collection and analysis to evaluate the training intervention.[45] We used the Kirkpatrick Evaluation model to guide our evaluation. [46] The Kirkpatrick Model proposes four sequential levels of training evaluation that become progressively more distal from the original training. We focused here Levels 1 (reaction), 2 (learning), and 3 (behavior).

After conducting separate analyses, we integrated the results to allow the qualitative data to enhance and provide context for the quantitative data.[47,48] This approach integrates the data for triangulation, which strengthens the validity of the findings and allows for a more comprehensive understanding of the data.[49–51] This study followed the SQUIRE 2.0 (Standards for QUality Improvement Reporting Excellence) guidelines for quality assessment

and reporting the results.[52]

Training Intervention

We collaborated with instructional designers [D.D., J.A.] from the University of Florida's E-learning, Technology, and Communications Services to develop a 60-minute online training intervention for PCPs entitled: *Preparing Patients for Cancer Treatment Decisions: The Critical Role of Primary Care Providers in Facilitating Equitable Access to Care and Clinical Trials*. The content of the intervention was based on the authors' collective research on the topic.[40–43,53] and current literature on the role of PCPs in cancer treatment and referral, barriers to CCTs, patient activation, and best practices in medical education.

The interactive, asynchronous training intervention is hosted by a primary care provider [A.N.P.] and a radiation oncologist [R.M.] who introduce content through engaging conversations and videos. Using a model of cognitive dissonance, the course introduces new information about cancer clinical trials, with the intent of helping providers realize inaccuracies in their knowledge, attitudes, and behaviors around cancer clinical trials and the referral to cancer treatment.[54,55] A clinical trials content expert [M.M.] additionally provides facts about CCTs, cancer care disparities, barriers to CCT participation, and the role of PCPs in cancer care. The four modules cover content to enhance PCPs' knowledge and communication skills surrounding cancer treatment discussions, including clinical trials and strengthening preparation related to the oncology referral process. The communication skills taught in the curriculum center on the 5Es communication model (i.e., Explore, Educate, Encourage, Engage in Planning, Emphasize Partnership), a framework designed to support patients in becoming more active participants in cancer treatment decision-making. Informed by principles of patient activation, treatment decision support, shared decision-making, and patient-centered communication, the model provides a simple mnemonic that clinicians can use to educate

patients, prepare them for oncology referrals and encourage inquiry about treatment options, including cancer treatment trials.[56–59] The learning objectives for each of the four modules are displayed in **Table 1**.

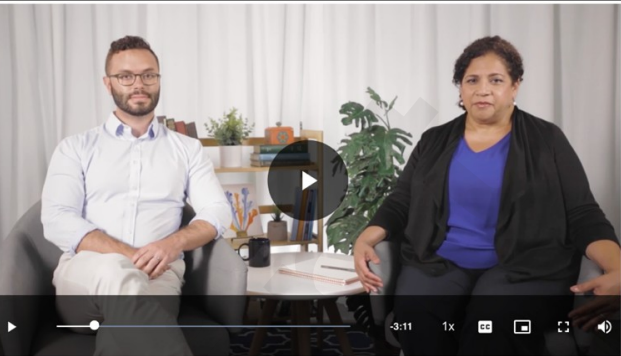
Table 1. Intervention modules and learning objectives.

Module	Learning Focus	Learning Objectives
Module 1	Disparities in Cancer Care and Clinical Trial Participation	- List the reasons why cancer treatment trials are defined as quality cancer care - Describe disparities in cancer care and in cancer treatment trial participation
Module 2	Importance of Strong PCP Role in Referrals to Cancer Treatment	- Assess the critical role of the PCP in the referral process - Assess the PCP's role in preparing patients around treatment decision-making with the specialist
Module 3	Communication Skills to Foster Patient Engagement in Cancer Treatment	Apply a 5-step communication approach to prepare patients for the specialist referral and their engagement in treatment planning
Module 4	Needed Changes with Colleagues in the Referral Process	Evaluate the need to refine organizational procedures to improve one's own referral practices for patients recently diagnosed with cancer

Throughout the modules, video vignettes featuring actors as patients and doctors further illustrate the 5Es communication model. The modules also include case studies where participants can explore patients' disease histories, backgrounds, and cancer diagnoses. Participants complete each module at their own pace. The core components of the online training intervention are displayed in **Table 2**.

Table 2. Core components of the Preparing Patients for Cancer Treatment Decisions intervention.

Core Component	Description	Example Image
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Learning modules	Includes four self-guided, interactive learning modules	 Module 1: Disparities in Cancer Care and Clinical Trial Participation © 20-30 MINUTES In this module, you will learn about disparities in cancer care and clinical trial participation, the rationale for the primary care provider's role in cancer referral, and why cancer treatment trials are a high quality treatment option. GO TO MODULE 1
Expert guidance	Clinicians and content experts introduce course content through engaging conversations and videos	
Downloadable resources	Includes an interactive 'Action Plan' checklist that clinicians can download or print	Preparing Patients for Cancer Treatment Decisions Action Plan What actions are you planning to undertake in the next 3 months to help prepare your patients with a cancer diagnosis for referral to oncology? ☒ Educate them that there is often more than one option for treatment ☐ Educate them that there is often more than one option for treatment, including the option of a clinical trial ☐ Explore their concerns about cancer care ☒ Explore their goals for cancer care ☐ Help engender trust in where I am referring them for cancer treatment ☐ Encourage them to ask questions during treatment discussions/treatment decision making ☐ Provide emotional support What other actions are you willing to take, now that you've completed the course? Learn more about available clinical trials at my institution Continue and Print PDF of Action Plan
Video vignettes	Video scenarios illustrate communication skills	

Interactive patient case studies	Embedded patient case study videos with interactive questions to assess communication skills learning	Step 2 Lisa's Appointment Information 
Communication learning model	Didactic and interactive content teach and demonstrate the 5Es Model for communication	The 5 E's Model Explore Educate Encourage/Normalize Engage in Planning Emphasize Partnership

Evaluation of the Training Intervention: Quantitative Assessments

Participants and Recruitment

We recruited PCPs to complete an online training intervention, pre- and post-intervention surveys, and a post-intervention interview. Recruitment was based on the following inclusion criteria: (1) PCPs including physicians (MDs, DOs), nurse practitioners (NPs), physician assistants (PAs), and trainees, specifically Post Graduate Year Level 2 or above in family or internal medicine residency programs with at least three months of outpatient primary care experience; (2) work in an outpatient setting; (3) have made patient referrals to specialists for cancer treatment in the past year; and (4) English speaker residing in the U.S. or its territories. Between July 2023 and December 2023, we emailed invitations that included a

study description and instructions for those interested to contact a research coordinator. The invitations were distributed through email lists provided by three partner organizations: (1) the Clinical Directors Network, a national not-for profit practice-based research network and clinician training organization; (2) Penn Medicine, an academic health system; and (3) the University of Florida's Department of Community Health and Family Medicine, and its Family Medicine and Internal Medicine Residency Programs, which are based in a large public academic health system. Once enrolled in the study, participants had up to four weeks to complete the training intervention.

Procedure

Participants completed a pre-training survey, an immediate post-training survey, and a 3-month follow up survey. Data were collected online via Qualtrics.^{XM}[60] The quantitative and qualitative phases of data collection and descriptions of each method are presented in **Table 3**.

Before beginning the training intervention, and after providing informed consent, participants were asked to complete a 44-item online survey. The pre-training survey included the following measures: Knowledge of Cancer Clinical Trials (KCCT), Cancer Clinical Trials Attitudes and Beliefs (CCTAB), Patient Communication and Referral Practices (PCRP), Willingness to Communicate (WTCO), and Willingness to Change (WTCH), all of which were informed by our previous work.[40,41,43,53] The pre-training survey also collected participant characteristics, including demographics and professional background. Immediately post-intervention, participants were asked to complete a 35-item online survey that included the KCCT, CCTAB, WTCO, WTCH measures, and were asked about intervention usability and overall course satisfaction. Completing the intervention and the pre- and post-training surveys fulfilled participants' training requirements, at which point they were compensated \$150 for their participation.

Three months after the intervention, participants were asked to complete an additional 34-item online survey that included the KCCT, CCTAB, PCRP, WTCO, and WTCH measures. After completing the 3-month follow-up survey, participants were compensated an additional \$45 for participation. All surveys are shown in **Multimedia Appendix 1**.

Table 3. Descriptions of data collection measures and timeline.

Measure	Pre-Training	Post-Training	3-month Follow Up
<i>Participant Characteristics.</i> A 10-item survey that asks about participants' demographics, professional background, and current professional setting.	X		
<i>Knowledge of CCTs (KCCT).</i> A 7-item measure comprising true/false statements about cancer clinical trials.	X	X	X
<i>Cancer Clinical Trials Attitudes and Beliefs (CCTAB).</i> A 4-item Likert-type measure that assesses attitudes, beliefs, and behavioral intentions related to cancer clinical trials.	X	X	X
<i>Patient Communication and Referral Practices (PCRP).</i> A 14-item measure that assesses PCPs' communication and referral behaviors before (7 questions) and after (7 questions) returning patients' initial referral to a cancer specialist to discuss treatment options.	X		X
<i>Willingness to change (WTCH).</i> A 3-item Likert-type measure that focuses on PCP's willingness to make changes in their practice	X	X	X
<i>Willingness to Communicate (WTCO).</i> A 6-item Likert-type measure that focuses on PCP's willingness to engage with patients who have a cancer diagnosis	X	X	X
<i>Intervention Usability.</i> A 5-item survey that asks about participants' device (e.g., computer tablet), browser type, and if they encountered any technical issues while taking the online course.		X	
<i>Overall Course Satisfaction.</i> A 10-item Likert-type measure where participants evaluate their training experience (e.g., content, logistics) and intervention acceptability, along with two open-ended questions for additional feedback.		X	

<i>Interview.</i> A semi-structured interview based on the quantitative survey measures, with an emphasis on exploring PCPs' experiences with the course.			X
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Statistical Analysis

Descriptive statistics were used to analyze participants' demographic characteristics. The data were analyzed using R software (Version 4.4.0).[61] Cronbach's alpha was used to measure the internal consistency among the CCTAB, WTCO, and WTCH measures and we report both individual item means and aggregated means for those measures. Frequencies (%) and mean (standard deviation) scores for all survey measures were reported. McNemar's Chi-squared test and Wilcoxon signed rank test were used to compare pre and post survey results, including 3 month-follow up. Due to the exploratory nature of this pilot study, adjustments for multiple comparisons were not made.

Evaluation of the Training Intervention: Qualitative Phase

To gain further insights into the survey results, we conducted follow-up interviews with PCPs who completed the 3-month follow-up survey.

Participants and Recruitment

At the end of the survey, interested PCPs were invited to participate in a brief online interview to discuss their experience with the course. Between December 2023 and February 2024, members of the research team [A.C., N.D.P.] contacted interested PCPs to confirm their participation and to schedule interviews.

Interview Procedure

Between December 2023 and February 2024, two authors [N.D.P., A.C.] interviewed PCPs via Zoom. The semi-structured interview guide was designed based on the quantitative

survey measures, with an emphasis on exploring PCPs' experiences with the course. Participants were asked to share their impressions of the training intervention, their attitudes and beliefs regarding the role of PCPs, and to describe any changes they had made to their practice since taking the course. The interviews were audio recorded and professionally transcribed verbatim prior to analysis. Participants who completed the interview received an additional \$50 in compensation.

Qualitative Analysis

The interview data and analysis were managed using ATLAS.ti (Version 24.1.1)[62] software. Data collection and analysis were conducted concurrently, enabling an initial rapid analysis to capture and categorize data into broad themes.[63,64] Subsequently, a comprehensive thematic analysis was conducted by the first author [N.D.P.], employing both deductive and inductive coding strategies guided by the constant comparative method.[65,66] Throughout the analysis, two authors [N.D.P., C.L.F.] met to review and discuss codes and emerging themes and to develop a codebook that guided the full thematic analysis.[65,67] Similar codes identified across all transcripts were collapsed into overarching themes, followed by axial coding to further characterize thematic properties.[67]

Data Integration

After conducting individual quantitative and qualitative analyses, we jointly interpreted the findings from both phases to enhance reporting. We report quantitative data first, which are then elaborated with the qualitative findings. When appropriate, we created joint displays to illustrate this data integration and to organize the results.[48,68]

Ethical Considerations

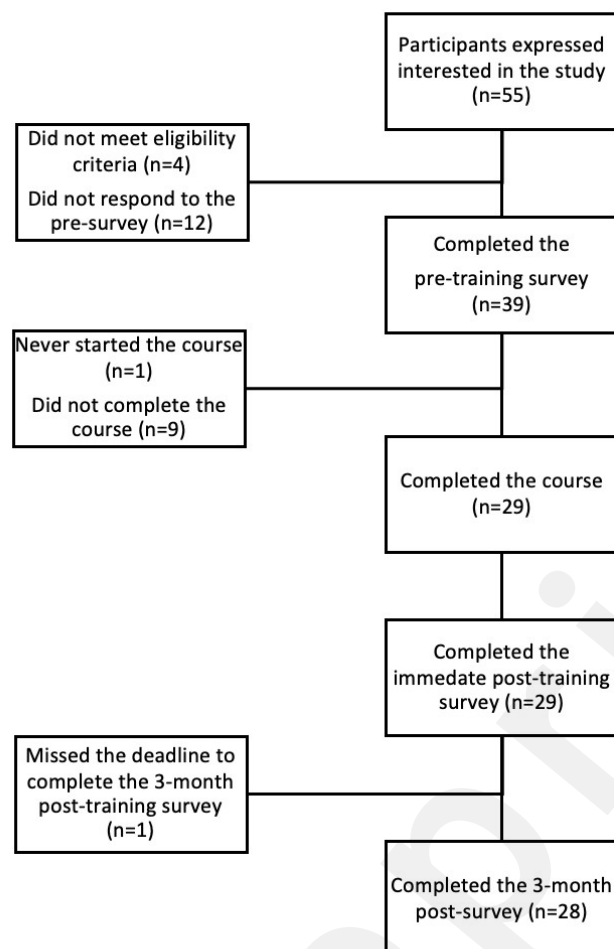
The study procedures were approved by the University of Florida Institutional Review

Board (#202200894). Prior to participating in surveys and/or interviews, participants were provided a statement of participant rights and responsibilities and given the option to opt out of the study at any time. All survey participants checked a box agreeing to participate before taking the survey. All interview participants verbally confirmed their willingness to participate and had the opportunity to ask questions before the interview.

Results

Twenty-nine PCPs completed the study and pre-and post- survey measures; the sample included 15 women (52%) and 14 men (48%). Of those, 28 completed the three-month follow up survey and eight participated in the interviews (See Figure 1). Twenty-six participants were MDs (90%); the remaining were NPs (n = 2, 7%) and DOs (n = 1, 3%). Most were physicians in training, with 17 (59%) describing themselves as residents or fellows in PGY2 (n = 7, 24%), PGY3 (n = 9, 31%), or PGY4 (n = 1, 3%). Participants described their practice areas as internal medicine (n=16, 55%), family practice (n=11, 38%), or other (n=2, 7%). Most reported their practice or training setting was an academic-affiliated hospital (n=17, 59%) or community-based and owned by an academic medical center (n=7, 24%). Complete demographic and professional characteristics of both survey and interview participants are shown in **Table 4**.

Figure 1. Diagram of study enrollment and participation.



The mixed methods findings were used to (1) characterize PCPs' general impressions of the training intervention. In addition, we use these evaluation findings to capture how the training intervention impacted their (2) knowledge; (3) perceptions of their roles in caring for patients with cancer, (4) communication with their patients; and (5) practice-level change willingness and behaviors. The quantitative results are reported first and then elaborated upon with the qualitative findings within each of the five areas of impact.

Table 4. Surveyed and interviewed participant characteristics.

Characteristic	Survey	Interview
Gender	N=29, n (%)	N=8, n (%)
Female	15 (52)	7 (88)
Male	14 (48)	1 (12)
Racial Identity		
White	13 (45)	2 (25)
Asian	9 (31)	4 (50)

Black or African American	2 (7)	2 (25)
Multi-race	2 (7)	0 (0)
American Indian or Alaska Native	1 (3)	0 (0)
Other	1 (3)	0 (0)
Prefer not to respond	1 (3)	0 (0)
Ethnicity		
Non-Hispanic or Latino	27 (93)	8 (100)
Hispanic or Latino	1 (3)	0 (0)
Prefer not to respond	1 (3)	0 (0)
Degree type		
MD	26 (90)	7 (87.5)
NP	2 (7)	1 (12.5)
DO	1 (3)	0 (0)
Stage of Training		
Resident or fellow	17 (59)	4 (50)
Non-resident or fellow	7 (24)	3 (37.5)
Prefer not to respond	5 (17)	1 (12.5)
Year of Training (if Resident or Fellow)		
PGY2	7 (24)	1 (25)
PGY3	9 (31)	2 (50)
PGY4	1 (3)	1 (25)
Not applicable	12 (41)	0 (0)
Missing	0 (0)	4 (50)
Practice Area		
Internal medicine	16 (55)	5 (62.5)
Family practice	11 (38)	3 (37.5)
Other	2 (7)	0 (0)
Practice or Training Setting		
Academic-affiliated hospital	17 (59)	5 (62.5)
Community-based, owned by an academic medical center	7 (24)	1 (12.5)
Community-based, independent private	2 (7)	1 (12.5)
Community hospital	2 (7)	1 (12.5)
Community-based, owned by a large, non-hospital entity	1 (3)	0 (0)
Is practice a designated Federally Qualified Health Center (FQHC)?		
Yes	15 (52)	4 (50)
No	14 (48)	4 (50)

Is your practice supported by the Indian Health Service?		
No	27 (93)	8 (100)
Yes	2 (7)	0 (0)

General Impressions of the Course

Both survey and interview findings illustrated PCPs' positive impressions of and high satisfaction with the course. Specifically, PCPs expressed satisfaction with the course content, design and functionality, course elements, and course length. Their general impressions are presented in a joint display (see **Table 5**) to depict the mixed methods results comprehensively.

Table 5. PCPs' impressions of the course

Course Characteristics	Quantitative Measures	Mean (SD)	Illustrative Quotes
Content	- Course content was relevant to my work. - The course provided an adequate evidence base to support the content. - The right amount of information was provided.	4.6 (0.5) 4.5 (0.6) 4.6 (0.5)	"The content was excellent, and the way that it was provided was also very good. I found it very useful to learn information that I didn't know before" (P1). "As a primary care doctor...some of this information...I think it was really good. It was really good content to push me to be more hands-on in my patients' cancer care process" (P3). "I thought it was kind of helpful...I'd never looked into discrepancies in cancer care. I probably could've suspected but didn't know that was a fact" (P8).
Design and functionality	- The course presented information in a clear and organized manner. - The graphics (graphs, pictures, illustrations) added to the effectiveness of the presentation.	4.7 (0.5) 4.5 (0.6)	"From an educational perspective, I thought it was designed pretty well. It was logical in the way that the modules flowed from one to the next" (P3). "I thought [the course] was really well organized and laid out, and it had a nice, I guess, sequence of training..." (P4).

Course elements	▪ The course facilitated my understanding. 4.6 (0.5) ▪ The interactive features in the course activities helped me learn. 4.4 (0.8) ▪ The clinical interactions shown in the course felt authentic. 4.3 (0.8) ▪ The clinical interactions shown in the course were relatable to me. 4.4 (0.6)	"I really enjoyed the videos, the examples, and the quiz questions, [and the] summary at the end, which I felt was helpful" (P1). "Overall, I liked [the course]. I liked how it was engaging. I liked the different scenarios, and the short videos that you could engage with, and then immediately afterwards, trying to apply that to some questions" (P3). "I really liked the case scenarios where it gave you different options for how you would respond to a patient. I thought that gave really valuable feedback in how we phrase some of the topics that we bring up" (P4).
Length of course	▪ The length of the course was appropriate. 4.7 (0.5)	"I felt [the course was] kind of straight to the point, and the topic was well laid out" (P2). "I thought that [the course] was educational and informative, and it was fairly straightforward and quick" (P8).

^aSurvey questions were scored on a five-point scale ranging from 1 = 'Strongly Disagree' to 5 = 'Strongly Agree.'

CCT Knowledge

PCPs' positive feedback about the course aligns with their significant improvement in CCT knowledge after participating in the course. Survey results (as shown in **Table 6**) indicated that PCPs' *knowledge of CCTs* (i.e., the KCCT survey) was low prior to training, with a mean score of 55% (SD 17.9%) across all seven CCT knowledge areas. Immediately post-training, PCPs' knowledge of CCTs improved significantly to a mean score of 81% (SD 12.1%; $P<.001$). This improvement from pre-training was sustained at 3-month follow up, with a mean score of

73% (SD 18.4%; $P=.005$).

Table 6. Comparison of correct responses on the pre-training and post-training KCCT survey.

True/False CCT Knowledge Questions	Pre N=29	Post N=29	3-month follow up N=28	Pre vs. post	Pre vs. 3-month follow up
	n (%)	n (%)	n (%)	P value	P value
In a cancer treatment trial, patients will receive a placebo alone or the new treatment being tested.	19 (66)	26 (90)	21 (75)	.046	.7
While about 25% of U.S. adults with cancer are eligible to participate in cancer treatment trials, only about 8% participate.	20 (69)	29 (100)	27 (96)	.008	.046
Patients determined to be eligible for cancer treatment trials are usually offered the opportunity to participate.	14 (48)	23 (79)	22 (79)	.039	.061
Patients from racial and ethnic minority groups eligible to participate in cancer treatment trials tend to be offered the opportunity to participate less frequently than are white patients.	19 (66)	25 (86)	21 (75)	0.15	0.6
When offered the opportunity to participate in a cancer treatment trial, patients from racial and ethnic minority groups agree to participate at about the same rate as do white patients.	0 (0)	5 (17)	5 (18)	.074	.074
Recommendation by a trusted physician is a primary factor influencing a patient's decision to enroll in a cancer treatment trial.	28 (97)	29 (100)	27 (96)	>.9	>.9
Federal law now requires private insurers, Medicare and Medicaid to cover routine patient care costs in most cancer treatment trials.	11 (38)	28 (97)	20 (71)	<.001	.027
Percentage of aggregated	55	81	73 (18)	<.001	.005

correct responses	(18)	(12)			
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^aP values were calculated using McNemar's Chi-squared test with continuity correction, using only the participants who completed both pre and post surveys.

^bItalic formatting indicates a statistically significant P value.

Perceptions of their Roles in Caring for Patients with Cancer

Findings demonstrated that the training intervention was effective in changing PCPs' attitudes and beliefs about their role caring for patients with cancer, which was sustained at 3-month follow up. As shown in **Table 7**, mean scores across all four items increased significantly from pre-training (mean 4.2, SD 0.6) to post-training (mean 4.6, SD 0.4; $P<.001$), as PCPs agreed they play a role in their patients' cancer care. This change was sustained at 3-month follow up (mean 4.5, SD 0.5, $P=.004$). Most significantly, PCPs were more likely to agree that they "have an important role in educating patients about the possibility of receiving cancer treatment through a clinical trial, before the referral to a specialist" immediately post-training (mean 4.5, SD 0.6; $P<.001$) compared to pre-training (mean 3.6, SD 1.0). This individual item improvement was also sustained at 3-month follow-up (mean 4.4, SD 0.6; $P<.001$).

The qualitative findings shed light on these results by illustrating PCPs' perceived role in caring for patients with cancer. After the 3-month follow up, PCPs described fulfilling three key roles: (1) *partner*, (2) *educator*, and (3) *interpreter*. However, they also acknowledged struggling or feeling restricted in these roles due to *expertise boundaries*.

Table 7. Comparison of pre-training and post-training on the CCTAB.

Question	Pre N=29	Post N=29	3-month follow up N=28	Pre vs. post	Pre vs. 3-month follow up
	Mean (SD)	Mean (SD)	Mean (SD)	P value	P value
Health care providers like me have an important role in educating patients that there is often more than one option for treatment, before the referral to a specialist.	4.2 (0.8)	4.6 (0.5)	4.5 (0.6)	.008	.067

Health care providers like me have an important role in educating patients about the possibility of receiving cancer treatment through a clinical trial, before the referral to a specialist.	3.6 (1.0)	4.5 (0.6)	4.4 (0.6)	<.001	<.001
Health care providers like me have an important role in supporting patients' decision to participate in a cancer treatment trial.	4.4 (0.7)	4.7 (0.5)	4.6 (0.6)	.065	.3
Health care providers like me can make a difference in the quality of cancer care our patients receive.	4.6 (0.6)	4.7 (0.5)	4.5 (0.6)	.11	.8
Mean of aggregated CCTAB questions	4.2 (0.6)	4.6 (0.4)	4.5 (0.5)	<.001	.004

^aSurvey questions were scored on a five-point scale ranging from 1 = 'Strongly Disagree' to 5 = 'Strongly Agree.'

^bCronbach's alpha for the four CCTABS questions is 0.82.

^cP values were calculated using Wilcoxon signed rank test with continuity correction, using only the participants who completed both pre- and post-surveys.

^dItalic formatting indicates a statistically significant P value.

PCP as Partner

PCPs explained how they can fulfill roles beyond offering medical expertise by being partners. They emphasized the importance of *being a consistent source of support* by remaining involved in patients' cancer journeys: "As a primary doctor, you really want to make your patient feel that you're there. You're not leaving. ... You still want to be a part of whatever plan is going to occur" (PCP2). Another PCP highlighted the collaborative nature of this ongoing support, stating, "You have to look forward and make a plan, let [patients] know that they take one step, I take one step forward, and we're kind of in tandem" (PCP7). PCPs also discussed *providing emotional support*, including helping patients manage their emotions and "the mental health issues that come along with [a] cancer diagnosis and cancer treatment, in general" (PCP1). Another PCP explained: "When you initially tell the patient they're kind of like

flabbergasted, and they're in a state of shock. ... They're just thinking 'I'm going to die,' so I...try to help the patient get through the emotions, that initial shock" (PCP6).

PCP as Educator

PCPs also discussed having roles as educators, where they focused on preparing patients for consultations with specialists by *discussing treatment options*, including introducing the possibility of receiving care through a CCT. PCPs emphasized being more proactive after the training intervention, more often ensuring their patients are adequately informed to engage with specialists:

[The course] helped me to focus more on general treatment ideas, like radiation, surgery, chemotherapy, and sort of introduce them to those different treatment options so that then they could take that information and ask their oncologist and oncology surgeons about what is truly available to them, including clinical trials (PCP4).

A PCP additionally described *exploring patients' understanding* of their treatment options, including clarifying misconceptions: "Whether it's clinical trials or normal treatment, it's important to explore [the patient's] understanding of what's going on, then you can kind of course correct, educate them on what actually might be happening and maybe where there'd be misconceptions" (PCP7).

PCP as Interpreter

PCPs described taking on an interpreter role which centered on enhancing patients' comprehension of medical information. PCPs described *being a "go-between"* (i.e., a bridge) by acting as intermediaries who can interpret information provided to patients by oncologists and other cancer specialists:

[Patients] should come to me if they have questions, concerns, don't understand something, because I am great at being a go-between in terms of reading notes and/or contacting

oncologists, surgeons, interpreting things for them...and analyzing their options with them in ways that they understand. (PCP5)

PCPs also recognized their role in *translating medical information*, like medications and lab results, to “kind of frame [the information] in terms the patient may know, just because some of the language isn't as clear all the time” (PCP8). They recognized the value of making information more accessible for patients despite not specializing in cancer themselves:

As a patient, it's very overwhelming...but that's kind of like why I'm here. I can try to interpret, maybe, better what's going on. ... Like medications. What is it? What does it do? I mean, obviously, I'm not a specialist. I don't know the ins and outs of everything, but I think kind of interpreting labs, a patient, a lot of times, they don't [understand]. ... Just maybe a more kind of hands-on understanding for the patient. (PCP2)

PCPs Navigating Expertise Boundaries

Finally, despite completing the training intervention, PCPs emphasized still struggling with expertise boundaries. They admitted that their *lack of specialized knowledge* in oncology made them cautious about discussing cancer-related topics in detail:

I think the challenges as just a PCP...is that I just don't have that knowledge of oncology, in specific. I don't know enough about that specific clinical trial or that specific diagnosis, the prognosis, and things like that. ... Due to the lack of expertise, it makes it hard to communicate. (PCP1)

PCPs further highlighted feeling the constraints of *role limitations* in guiding patients through complex cancer treatment decisions: “Oftentimes the questions [that patients are] asking about the treatments are very nuanced...I think there's only so much that the primary care doctor can answer” (PCP7).

Communication about Treatment Options

Survey findings demonstrated the training intervention enhanced PCPs' *willingness to communicate* with their patients about cancer treatment options in general, including CCTs (**Table 8**). Mean scores across 6-items increased significantly from pre-training (mean 4.4, SD 0.5) to immediate post-training (mean 4.7, SD 0.5; $P<.007$). This improvement was not sustained at 3-month follow up. However, one item, PCPs' willingness to "educate these patients about the possibility of receiving treatment within a cancer clinical trial" showed significant improvement at 3-month follow up (mean 4.4, SD 0.6; $P=.035$) when compared to pre-training (mean 4.0, SD 0.8).

Table 8. Comparison of pre-training and post-training on the WTCO survey.

Variable	Pre N=29	Post N=29	3-month follow up N=28	Pre vs. post	Pre vs. 3-month follow up
	Mean (SD)	Mean (SD)	Mean (SD)	P value	P value
I am willing to explore patients' concerns about cancer treatment.	4.4 (0.5)	4.7 (0.5)	4.5 (0.5)	.011	.6
I am willing to educate these patients that there is often more than one option for treatment.	4.4 (0.7)	4.7 (0.6)	4.5 (0.6)	.041	.7
I am willing to educate these patients about the possibility of receiving treatment within a cancer clinical trial.	4.0 (0.8)	4.6 (0.6)	4.4 (0.6)	.003	.035
I am willing to encourage these patients to ask questions of the specialist about different treatment options.	4.6 (0.6)	4.7 (0.5)	4.4 (0.7)	.3	.3
I am willing to encourage these patients to ask questions of the specialist about receiving treatment within a cancer clinical trial.	4.4 (0.6)	4.7 (0.5)	4.5 (0.5)	.14	.6

I am willing to emphasize my role as a partner throughout these patients' cancer care.	4.6 (0.5)	4.7 (0.5)	4.6 (0.6)	.2	.8
Mean of aggregated WTCO variables	4.4 (0.5)	4.7 (0.5)	4.5 (0.5)	<i>.007</i>	.5

^aSurvey questions were scored on a five-point scale ranging from 1 = 'Strongly Disagree' to 5 = 'Strongly Agree.'

^bCronbach's alpha for the three WTCH questions is 0.91.

^cP values were calculated using Wilcoxon signed rank test with continuity correction, using only the participants

who completed both pre- and post-surveys.

^dItalic formatting indicates a statistically significant P value.

Survey results also showed the training intervention influenced PCPs' self-reported *patient communication and referral practices* immediately post-training and at 3-month follow up. As shown in **Table 9**, seven items on the PCRCP measure focused on the 5Es model from the curriculum (i.e., Explore, Educate, Encourage, Engage in Planning, Emphasize Partnership; see **Table 2**). We asked PCPs about their communication in two different contexts of seeing patients: (1) before making an initial patient referral and (2) after patients returned following their referral appointment. After training, PCPs reported improvements in both contexts. Specifically, they reported discussing cancer treatment options with a higher percentage of patients in the before making a referral (i.e., Context 1). Overall, six out of seven items showed improvement with the most significant changes seen on the two items focusing specifically on CCTs. PCPs reported educating a higher percentage of patients "about receiving treatment with a cancer clinical trial" 3 months after completing the training intervention (Pre-training: mean 15%, SD 20.2%; 3-month follow up: mean 48%, SD 30.5%; $P<.001$). They also reported educating a higher percentage of patients to "encourage inquiry about receiving treatment through a cancer clinical trial" (Pre-training: mean 22%, SD 29.4%) at 3-month follow up (mean 62%, SD 34.9%; $P<.001$). When surveyed about their behaviors after patients returned following their referral appointment (i.e., Context 2), these same two items were the only ones

that showed significant improvement.

Findings from the interviews expand on these results by illustrating how PCPs' approach to patient communication evolved after the course. Collectively, they reported an increased sense of self-efficacy, feeling more comfortable and empowered in discussing cancer treatment options with patients. PCPs emphasized the importance of three goals in their approach: (1) engage patients; (2) empower patients; and (3) promote equity. PCPs described using specific communication approaches to achieve each of these goals.

Table 9. Comparison of pre-training and 3-month follow-up on the PCRP.

Characteristic	Pre N=29 M (SD)	3- Month N=28 M (SD), P value	Pre N=29 M (SD)	3- Month N=28 M (SD), P value	Illustrative Quotes
<i>For patients diagnosed with cancer in the past three months...</i>	<i>Prior to making a referral, approx. what percentage of patients did you:</i>		<i>After patients returned following their initial referral, approx. what percentage did you:</i>		
Explore concerns about cancer treatment in general	59.8 (35.9)	75.4 (27.1) <i>P = .034</i>	62.3 (38.6)	53.4 (44.3) <i>P = .4</i>	"[The course] reaffirmed the importance of leveraging the primary care relationship ... A lot of my patients circle back to ask about my opinions before starting a specific type of cancer treatment (P3)."
Educate about cancer treatment in general	54.8 (32.7)	73.4 (34.2) <i>P = .006</i>	56.9 (35.0)	58.1 (42.6) <i>P = .6</i>	"[Patients are] meeting these oncologists for the first time and...these are people I've known for years, so it makes sense that I also still have a role in making sure that they understand clinical trials, but also the treatment options that have been made available to them by the oncologist" (P7).
Educate about receiving treatment with a cancer clinical trial	15.2 (20.2)	47.9 (30.5) <i>P < .001</i>	23.3 (32.4)	50.4 (40.7) <i>P = .003</i>	

Encourage inquiry about treatment options	68.8 (37.6)	83.8 (28.0) <i>P = .038</i>	59.6 (37.8)	64.4 (41.5) <i>P = .7</i>	“It helped me to focus more on general treatment ideas, like radiation, surgery, chemotherapy, and sort of introduce [patients] to those different treatment options so they could take that information and ask their oncologist...about what is truly available to them, including clinical trials” (P4).
Encourage inquiry about receiving treatment through a cancer clinical trial	21.7 (29.4)	61.6 (34.9) <i>P < .001</i>	19.6 (25.9)	55.9 (43.1) <i>P < .001</i>	
Engage in helping patients plan these inquiries with a specialist	48.3 (37.2)	70.2 (30.2) <i>p = .007</i>	47.8 (40.2)	61.0 (42.7) <i>p = .13</i>	“Putting on people's radars...the availability of trials and asking patients to talk to specialists about the potential to participate in trial was valuable (P5).”
Emphasize partnership as patients go through cancer care	80.7 (32.6)	83.6 (29.4) <i>p = .6</i>	73.2 (36.0)	69.5 (41.4) <i>p = .7</i>	“I kind of felt like I needed to do a better job on being more intentional about the follow-ups. ... Maybe having more check-ins to see how the treatment is going, how their mental health is doing and stuff like that is important. So that was one thing I've been trying to do is schedule more follow-ups during their active cancer treatment (P3).”

^aEach question was answered as a percentage, ranging from 0-100.

^bP values were calculated using Wilcoxon signed rank test with continuity correction, using only the participants who completed both pre- and post-surveys.

^cItalic formatting indicates a statistically significant P value.

Engage Patients

First, PCPs described a shift in practice after taking the course, working to engage patients in informed discussions about treatment options, including CCTs, rather than deferring these conversations to oncologists. They emphasized taking a proactive approach by initiating discussions about treatment options. One PCP explained: “[The course] helped me to be more aware [of treatment options], so I can at least have that conversation with the patient” (PCP2).

Another reflected: “[The course] certainly opened my eyes to the fact that [treatment options] should be mentioned, something I would not have previously done” (PCP8). PCPs also highlighted encouraging consideration of clinical trials when communicating with patients about their cancer treatment options: “After the course, I’m just more likely to bring up clinical trials, whether there’s a clinical trial [available] or not” (PCP7). A PCP added: “My approach, it changed a little bit, to the point that I’m more willing to talk to [patients] a little bit more about [CCTs], rather than just immediately just defer everything to oncology” (PCP1).

Empower Patients

Next, PCPs highlighted their efforts in empowering patients to “take ownership of their own healthcare” (PCP4). PCPs discussed prompting patients to thoroughly *explore treatment options*, ensuring they are aware of the possibilities available to them. One PCP explained: “I ... either encourage them to at least take a look at what that [treatment] option is for them or encourage them to deep-dive into that option” (PCP1). Moreover, PCPs emphasized encouraging their patients to *ask specialists questions about treatment options*: “

[I tell patients], “I can answer as many questions as I can, but the ones that I can’t...you can go back to the oncologist and ask them.” So, I actually encourage them to ask more treatment discussion and decision-making questions with their oncologist. (PCP7)

Promote Equity

Finally, PCPs discussed being more aware of the importance of promoting equity when discussing cancer treatment options. PCPs described *tailoring patient communication* to incorporate patients’ diverse needs and to actively engage those who are part of groups who are underrepresented in clinical trials:

[Before the course] I didn’t realize...that there is a discrepancy on, for example, race, and those that participate in clinical trials. ... When I see that patient, I now know that I

should actively engage them and talk to them about clinical trials and prime them before they go into see the oncologist, for example. ... If you know where...the lack of utilization is, you can kind of intervene and make it more of an active conversation with the patients. (PCP7)

PCPs also highlighted being “far more cognizant” (PCP5) after the course about *facilitating patients’ access* to treatment options to ensure “patients are getting offered the same [care] as everyone else” (PCP2). One PCP emphasized:

I was appreciative that the [course] modules focused on [disparities in CCT participation], and I am trying to be more equitable in the care that I provide to my patients as well, by being sure that I offer all the treatment options. ... You never know how much that could change someone’s life. (PCP4)

PCPs’ Practice-Level Changes

We also examined PCPs’ willingness or ability to enact practice-level changes when referring patients to cancer specialists (**Table 10**). At post-test, PCPs reported high levels of willingness to enact these changes (mean 4.3, SD 0.6). However, at 3-month follow up, PCPs reported lower levels of agreement, although still above midpoint, with statements indicating that they had these conversations (Mean 3.7, SD 0.8). Notably, although 24 PCPs completed the course’s interactive Action Plan, none of those interviewed reported printing the plan for future reference which was provided as a direction in the course. Five stated they didn’t have access to a printer, two mentioned being too busy, and one did not provide an answer.

The qualitative findings further illuminate underlying factors contributing to PCPs’ hesitancy or unwillingness to implement practice-level changes. Most PCPs reported facing systemic barriers, specifically highlighting (1) *limited inter-professional knowledge-sharing* and (2) *organizational constraints*.

Table 10. Comparison of pre-training and post-training on the WTCH survey.

Post-Survey, N = 29		3-Month Follow-Up Survey, N = 28	
Item	Mean (SD)	Item	Mean (SD)
I am willing to make needed changes to whom I refer my patients for cancer care, in order to improve their access to cancer treatment trials.	4.3 (0.7)	I have made changes to whom I refer my patients for cancer care, in order to improve their access to cancer treatment trials.	3.9 (1.0)
I am willing to talk with colleagues in my practice about needed changes in how we educate our patients with cancer prior to referral.	4.3 (0.7)	I have talked with colleagues in my practice about needed changes in how we educate our patients with cancer prior to referral.	3.7 (1.0)
I am willing to talk with colleagues in my practice about needed changes to whom we refer our patients for cancer care, in order to improve their access to cancer treatment trials.	4.3 (0.6)	I have talked with colleagues in my practice about needed changes to whom we refer our patients for cancer care, in order to improve their access to cancer treatment trials.	3.5 (0.9)
Mean of aggregated WTCH variables	4.3 (0.6)		3.7 (0.8)

^aSurvey questions were scored on a five-point scale ranging from 1 = 'Strongly Disagree' to 5 = 'Strongly Agree.'

^bCronbach's alpha for the three WTCH questions is 0.9.

Limited Inter-Professional Knowledge-Sharing

First, PCPs cited how limited inter-professional knowledge-sharing within their practice environments is a barrier to discussing and enacting change for improving cancer care and referral practices. Instead, PCPs shared "we kind of just do our own thing" (PCP2). PCPs emphasized that a *lack of collaboration opportunities* made informal or formal discussions within their practice settings scarce:

Part of the course involved talking with colleagues about best ways to advocate for our patients and potentially system-change stuff for advising patients about clinical trials. ...

Loved the idea, but ... We typically work at our individual desks through lunch and rarely

get together and talk. ... When we do have staff meetings, they are typically putting out the biggest fires then the smallest fires, rather than things that would address this particular topic. (PCP5)

This challenge was compounded by *time constraints* as PCPs noted the difficulty in finding moments amidst busy schedules to discuss referral practices or share insights from training:

In clinic we're just always so busy. There aren't really many opportunities for any major interprofessional collaboration. I mean, if you have a medical question or something, of course, yes, you can ask your colleague, but as far as just sharing information, usually the days are pretty jam-packed. (PCP6)

Organizational Constraints

Second, PCP described being limited by *organizational constraints*, particularly within large institutions where high specialization diminishes the perceived need to refine referral practices. A PCP explained: "We're at a large academic institution, things are so specialized that we just assume our patients are going to get very high-quality cancer care...often our main objective is to get our patients to the oncologist as quickly as possible" (PCP3). Institutional policies such as set referral practices further reduce the flexibility needed to refine these processes:

We do get pretty stuck here with referring. We have oncologists at [my institution] that we refer to and then if they feel they don't have adequate options available, the oncologist usually refers the patient out [to another institution] which is right across the street from us. So, it is sort of a closed community. (PCP4)

PCPs further expressed having *limited power* to make changes within their current roles, pointing to obstacles like systemic barriers and hierarchical structures:

The healthcare system and the clinic schedule, in general, are very overwhelming, and

there are a lot of burdens, as the PCP... So, I think it's the system structure, in general, makes it difficult to make the changes, and it's just not encouraging enough to really motivate me to make the changes. (PCP1)

Another PCP cited hierarchical barriers as limiting their ability to effect change: "Because I'm a resident, this is a little bit trickier, honestly. I think when I'm attending, I'll have more structural influence on how things are practiced" (PCP7). Finally, *fiscal policies* impacted PCPs' ability to refine their referral practices:

Some of our referral practices are going to be based off what type of insurance [a patient has]. Or for us, like I mentioned at [my institution], our clinical decision-making is oftentimes within the realm of what [our institution] is willing to cover. (PCP4)

Discussion

Principal Findings

This mixed methods pilot study provides a comprehensive evaluation of an innovative online training intervention aimed at enhancing PCPs' knowledge, attitudes, and communication and practices regarding referrals to cancer care and CCTs. The Kirkpatrick Evaluation model[46] provides a helpful framework for these evaluation findings. It is widely used in medical education to assess the outcomes of training and learning programs.

Level 1 of the Kirkpatrick Evaluation model focuses on user reaction to the training intervention. Participants had high levels of satisfaction with the training intervention and reported high scores and positive comments about various aspects. Although satisfaction is important for participant engagement, it is not necessarily sufficient to produce desired changes.

Kirkpatrick's Level 2 focuses on learning as the next important outcome. Prior to the intervention, PCPs demonstrated relatively low levels of CCT knowledge, averaging less than

55% correct across seven knowledge items, consistent with our earlier assessments of PCPs' understanding of clinical trial concepts.[40] We found that PCPs' knowledge about CCTs improved significantly after the intervention and was sustained at the 3-month follow up, replicating what our team found in a prior study of PCPs in the NYC area.[40] This improvement is particularly important given PCPs' previously self-identified limitations in cancer-specific knowledge.[33,41] Our evaluation also found an improvement in self-reported attitudes and beliefs about their role in working with cancer patients, which was sustained at 3-month follow up, as well as willingness to communicate with their patients about CCTs, although this willingness to communicate was not sustained at 3-month follow up. However, willingness may be less important than actual behaviors.

With a foundation of change in knowledge, attitudes, and behavioral intentions, Kirkpatrick's Level 3 examines the impact of the educational intervention on behavior. According to our survey data, PCPs reported using the communication skills taught in the course with a higher percentage of patients about cancer treatment and cancer clinical trials at 3-month follow up than they did before the training within the context of making an initial referral for cancer care. The only one of the seven communication items on the PRCP that did not increase was *Emphasize partnership as patients go through cancer care*. There may have been a ceiling effect on this item as the baseline was already high. With respect to communication skills with patients who have already met with an oncologist, only two of the seven items on the PRCP saw significant increases and these two items focused specifically on the discussion of CCTs as a potential treatment option. It may be that the other items are not as relevant for a patient who has already had their initial meeting with the oncologist.

Another type of behavior we assessed was participants' willingness to change their referral behavior at post-test and reports of these behavior changes at 3-month follow up. As these are slightly different concepts, we did not compare them; however, it was not unexpected

to see lower scores on actual behavior change than intention.

Overall, the qualitative data underscored the positive impact that the training intervention had on the participating PCPs in terms of their evaluation of the intervention, their learning and their behavior change. The qualitative data highlighted ways in which the intervention facilitated a more informed and patient-centered approach to care by increasing PCPs self-efficacy and confidence.

In addition to these positive outcomes, PCPs expressed some barriers to changing their CCT communication behaviors. They voiced concerns about their perceived lack of cancer expertise despite the course addressing the boundary of what PCPs should be expected to discuss. In our prior work, PCPs expressed a similar reluctance to discuss cancer treatments with patients, [40] further highlighting a need to expand education regarding the role of PCPs in encouraging patients to engage in decision making about their cancer treatment, including the consideration of CCTs. Importantly, the training does not suggest that PCPs determine patient eligibility for specific trials, but rather prepares them to initiate supportive, patient-centered conversations that help patients feel empowered to ask questions and engage in screening discussions with their oncology team. Primary care providers can also support patients by reviewing lab or imaging results, helping to translate complex findings into accessible language, and explaining how these may relate to cancer treatment decisions or clinical trial eligibility without making determinations about eligibility themselves.

PCPs also relayed broader systemic challenges in their work settings that hindered making behavioral changes. The interview data helped to explain lower scores on the willingness to change referral practices, as PCPs explained the systematic barriers hindering collaborative efforts among healthcare professionals; these barriers in turn hindered their ability to integrate new knowledge and practices into their clinical settings.

Implications for Practice

Our findings underscore the need for ongoing education to address PCPs' gaps in the knowledge and skills needed to effectively communicate with patients about the potential of participating in CCTs as a high-quality treatment option. The evaluation of this educational intervention suggests that sustained change in knowledge, attitudes, and behavior can be achieved through an engaging, self-directed online intervention. As this training intervention is easily scalable, further dissemination may be able to positively impact quality of care and participation in clinical trials.

Limitations and Future Research

As this was a pilot study, the sample size was small, though not too small to have enough power to detect significant results. Notably, the majority of participants were trainees working in academic settings, which may influence the generalizability of findings to the broader population of practicing PCPs. Furthermore, their receptiveness to the training and self-reported outcomes may not fully reflect the attitudes and behaviors of more experienced PCPs. Future research using a larger and more diverse sample of practitioners, including both trainees and practicing PCPs, would allow us to look for differences in evaluation metrics among different types of PCPs (residents, practicing physicians, PAs and NPs). This study is also limited by its reliance on self-reported measures. Future research could incorporate patient interviews to provide additional insights into the effectiveness of the intervention from the patients' perspectives. Employing larger, more diverse samples to validate the intervention's effectiveness across different practice settings and demographics is also recommended. Furthermore, including more follow up surveys (e.g., 6 months, 12 months) could evaluate the sustained impact of educational interventions on PCPs' knowledge retention and clinical practices over time. While this study identified several systemic barriers that may hinder CCT

recruitment, addressing these challenges was beyond the scope of this pilot intervention. Future research should explore multi-level strategies to overcome these barriers and support sustained changes in clinical practice. This study, while focused on oncology referrals, is intended to be proof of concept for an intervention that can be adapted for other disease areas requiring specialist referrals, such as cardiology, rheumatology, and gastroenterology.

Conclusions

This pilot study found that a self-guided, interactive one-hour online training intervention for PCPs improved their knowledge about CCTs and attitudes and beliefs regarding their role in discussing treatment options with patients. It also enhanced PCPs' ability to communicate with patients about CCTs and prepare them for subsequent steps in the referral process, including discussions with specialists. Following further testing of the training intervention in a larger sample can lead to future dissemination with the potential to improve cancer clinical trial accrual, especially among underrepresented groups. Furthermore, this study underscores the effectiveness of targeted educational interventions in equipping PCPs with the knowledge and confidence to communicate with patients about the potential of trial participation as a high-quality treatment option.

Authors' Contributions

Conceptualization: CLB, MM, ESW, MSH

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Investigation: A Crowe

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Conflicts of Interest

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Multimedia Appendix 1

Full surveys including demographic questions.

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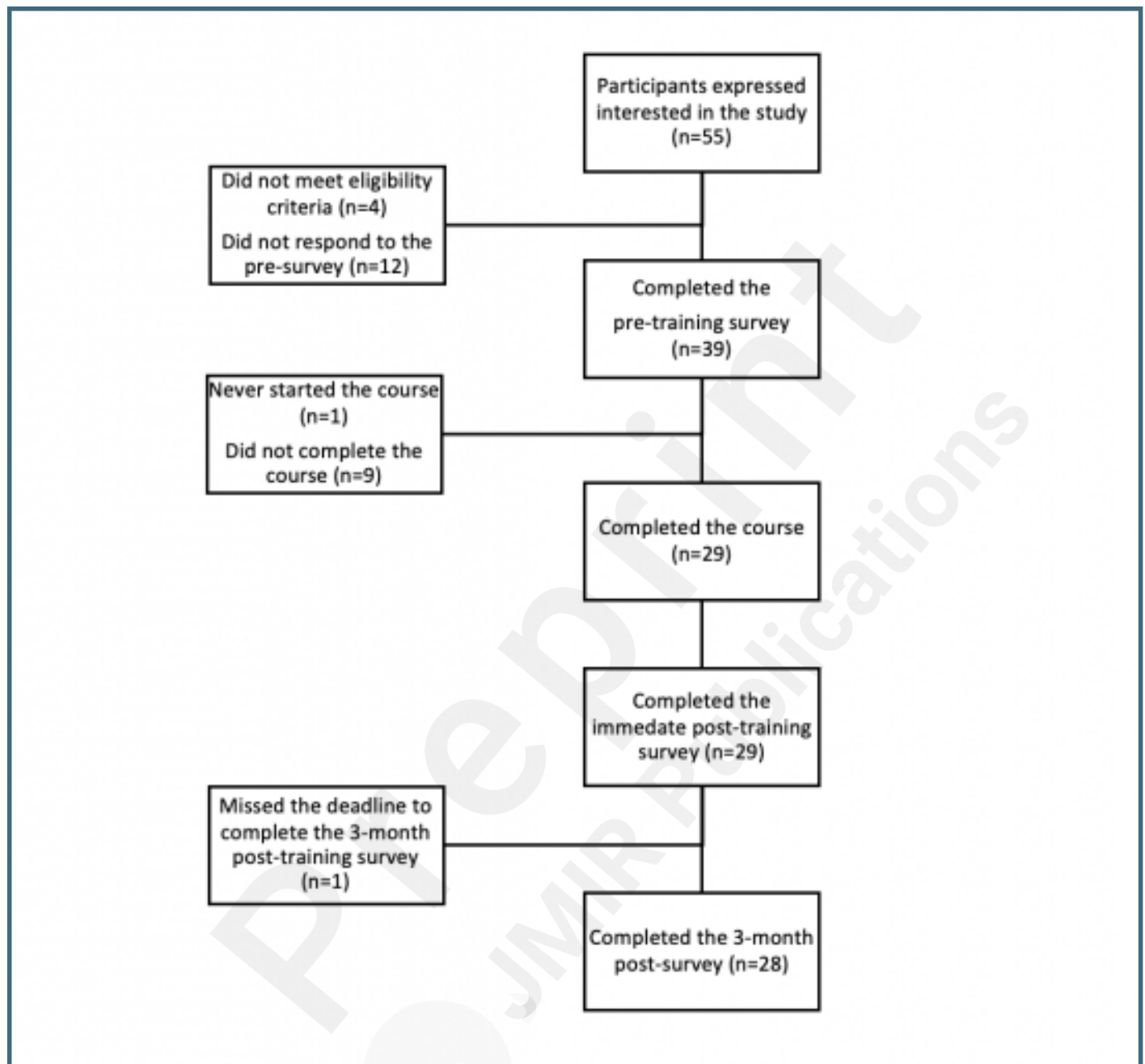
Abbreviations

CCT: Cancer Clinical Trial
CCTAB: Cancer Clinical Trials Attitudes and Beliefs
KCCT: Knowledge of Cancer Clinical Trials
PCP: Primary Care Provider
PCRP: Patient Communication and Referral Practices
PGY: Post-graduate Year
WTCH: Willingness to Change
WTCO: Willingness to Communicate

Supplementary Files

Figures

Diagram of study enrollment and participation.



Multimedia Appendixes

Description of measures.

URL: <http://asset.jmir.pub/assets/ac8fc02f59510f88d7a572445f9c8ce1.docx>

