



Implementing Cancer Screening Programs by Training Primary Care Physicians in India—Findings from the National Institute of Cancer Prevention Research Project ECHO for Cancer Prevention

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Abstract

In 2016, the Government of India launched a national program for screening and prevention of oral, breast, and cervical cancer. In support, the National Institute for Cancer Prevention Research (NICPR) adopted the Project ECHO (Extension for Community Healthcare Outcomes) model for training health care providers in cancer screening. We assess change in knowledge and skills among physicians attending hybrid (i.e., online and in person) NICPR-ECHO trainings and impact on implementation of cancer screening services. Prior to the start of the online phase and upon completion of 14 weeks, trainees answered a 23-item online questionnaire, including visual vignettes. We conducted descriptive and bivariate analysis of pre-post assessments from trainees participating in the online phase and wherever available report on the weekly quizzes and the hands-on workshop assessments. A total of 641 medical officers participated in the trainings from May 2019 to February 2020. Across nine cohorts of trainees, only 116 primary care physicians completed both the pre- and post-assessments. Almost two-thirds completed medical training (69.7%) and 85% were working in government healthcare facilities. Trainees reported statistically significant improvements before and after the online phase, when queried specifically on knowledge and skills using visual vignettes about oral ($p < 0.001$), breast ($p = 0.35$), and cervical cancer screening ($p < 0.001$). Study findings support the effectiveness of Project ECHO in reaching primary care physicians across the country and improving their knowledge and skills related to screening for breast, oral, and cervical cancer, with additional support needed for implementation of clinical cancer screening services.

Keywords Capacity building · Primary care physicians · Cancer screening · Project ECHO

Abbreviations

ICMR-NICPR	Indian Council of Medical Research—National Institute of Cancer Prevention and Research
ECHO	Extension for Community Healthcare outcomes
MoHFW	Ministry of Health and Family Welfare
VIA	Visual inspection with acetic acid
CBE	Clinical breast examination
OVE	Oral visual examination
MRI	Magnetic resonance imaging
FNAC	Fine needle aspiration cytology

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Background

Non-communicable diseases are responsible for a large proportion of mortality and morbidity and continue to be an important public health problem (Dandona et al., 2017). Every year approximately 1,157,294 individuals are diagnosed and 784,821 die due to cancer in India. Breast, oral, and cervical cancer are the three most common cancers occurring in India and account for 34% of all cancers within the country (Bray et al., 2018). For these cancers, screening tests have been demonstrated to help with early detection and thereby prevent mortality due to cancer. The effect on mortality, however, is dependent on widespread access and uptake of cancer screening services (i.e., implementation of cancer screening service) in the population. In an effort to address this burden, the Government of India's Ministry of Health and Family Welfare (MoHFW) introduced a national program for screening and prevention of the most common cancers (oral, breast, and cervical) in 2016 (Welfare, 2016).

In India, the central government is mainly responsible for developing national standards and sponsoring key programs, while states hold the primary responsibility for healthcare delivery. The district links the state and the local health centers and coordinates with state governments for program implementation. It is estimated that approximately 50% of the population in India receives care in the private sector, which is fragmented and does not provide contextual uniformity for studying quality of care delivery (Hazarika, 2011; Mohanan et al., 2016). The other half of the population receives care through the public health care system, depicted in a pyramidal structure (see Fig. 1). At the base, primary health care centers and sub-centers have direct interface with the community and are the primary screening facilities. The subsequent tiers represent the referral pathway after patients are screened positive, made up of the

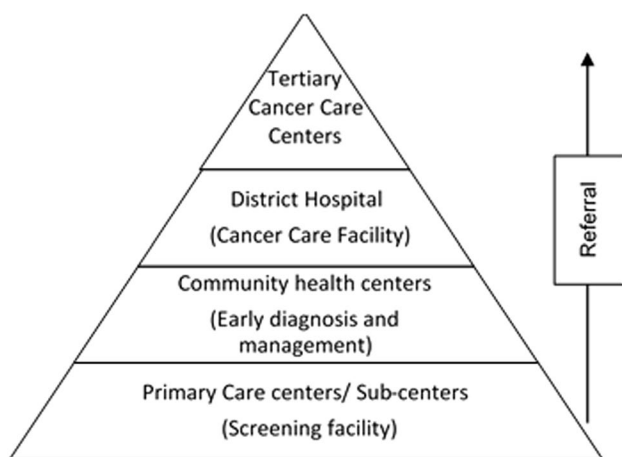


Fig. 1 Public health infrastructure in India

community health centers and/or district hospitals for diagnostic evaluations and tertiary level hospitals for specialty care. According to the National Health Profile for India in 2015, each community health center was tied to approximately 5–10 sub-centers in the communities across India (CBHI, 2015). To promote implementation of clinical cancer screening services, all types of providers (i.e., primary care and non-primary care physicians, nurses, and community health workers) need training to improve their knowledge, skills, and capacity to deliver clinical services.

The Indian Council of Medical Research—National Institute of Cancer Prevention and Research (ICMR-NICPR) is the central organization leading and supporting efforts directed at implementation of organized, population-based, cancer screening programs across India. NICPR promotes the integration of basic, clinical, and applied research for cancer prevention and control toward the goal of achieving population-level outcomes. Previous research in the context of cancer screening suggests that providers and health care systems in India do not have sufficient knowledge, training, and resources to deliver cancer screening services (Anandani et al., 2015; Khanna et al., 2019; Singh et al., 2012, 2019). One of NICPR's primary activities is to support the implementation of the national cancer control plan through training of health care providers (i.e., primary care physicians, gynecologists, nurses, and community health workers) in cancer screening and community-level cancer management.

In 2016, NICPR adopted the Project ECHO (Extension for Community Healthcare Outcomes) model for cancer screening training. ECHO provides structure for tele-mentoring providers through virtual sessions, including didactic and case-based learning formats (Arora et al., 2011).

Since its launch, Project ECHO has expanded to cover almost 50 specialty areas and is currently conducted at 366 institutions in 39 countries (<https://echo.unm.edu/locations>). A recent review highlighted studies reflecting the widespread implementation of the model internationally (McBain et al., 2019). The authors found, however, that there are very few studies that examine the impact of the ECHO model on provider behavior or service delivery. The goal of this study is to examine the change in knowledge and skills among primary care physicians attending NICPR-ECHO trainings and the impact of the training program on implementation of cancer screening services.

Methods

NICPR-ECHO Model for Cancer Screening

A detailed version of the NICPR-ECHO methods and the overall model related to training other health care providers (including dentists and gynecologists) has been published

elsewhere (Babu et al., 2020). This study focuses on primary care providers, and a short description of the ECHO curriculum is provided here to familiarize the reader with the training components. The Institutional Ethics Committee at the National Institute of Cancer Prevention and Research approved this study. The hybrid training takes place in two phases—the first phase 14-week course with weekly online sessions; the second phase is a hands-on training that takes place at NICPR, approximately 1–3 months after the online phase. Additional file 1 provides the content of the 14 online sessions along with the learning objectives per session.

The NICPR team and other Indian experts developed the curriculum with a focus on the roles and responsibilities of primary care physicians in the population-based cancer screening program implementation (Babu et al., 2020). The training modules include epidemiological data from the Global Cancer Observatory (GLOBOCAN, available at <https://gco.iarc.fr/> and produced by the International Agency for Research on Cancer) (Bray et al., 2018) and involve both global and in-country experts during the didactic portion of the online sessions. Each session begins with a presentation by an expert for approximately 20–25 min, followed by case presentations by participants, and finally a discussion around questions that the participants may have. The main objective of the case presentation was to demonstrate how cancer screening was undertaken for breast, cervical, or oral cancer/potentially cancerous lesions, by the clinician, and findings of the same. Additional information about further investigations and/or management, was also provided, if available. An aggregate of 80% score in the post-online phase assessment, participation in at least 10 sessions out of the 14, and presenting a case study are the minimum requirements for receiving a certificate and an invitation to a hands-on workshop.

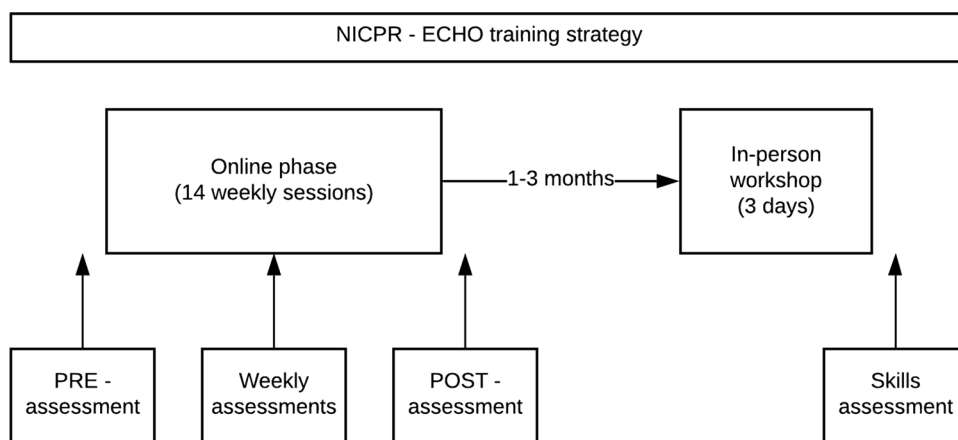
The three-day hands-on workshops, conducted by NICPR in collaboration with national experts, focus on teaching trainees practical skills related to conducting the screening tests. For example, on the first day, trainees

learn to prepare 5% acetic acid, insert a vaginal speculum, perform visual inspection with acetic acid (VIA), and document the test results. On the second day, trainees learn skills related to breast cancer screening and on the third day they learn how to perform and document the Oral Visual examination (OVE) as well as communication skills and how to break bad news. Although the training program does not provide continuing medical education credits, participants consider an ICMR certification of their attendance at the course very valuable in terms of their professional development. Certifications from national organizations such as ICMR highlight excellence in professional development for many primary care physicians. Such certifications can be important to showcase when undergoing renewals for their licensure and for promotion requirements. A score of 80% or above on the skills assessment leads trainees to receive a completion certificate for the hands-on phase.

Assessing Training Impact

Figure 2 provides an overview of the NICPR-ECHO training strategy for primary care providers and the time points at which trainees undergo assessments. Prior to the start and again upon completion of the online phase, trainees answer a 23-item questionnaire, developed by NICPR-ECHO project team and administered online via SurveyMonkey (Additional file 2). Additional file 3 provides an overview of the constructs measured and sample questions, and the full survey is available upon request (please contact the corresponding author). During the weekly sessions, trainees answer a short 5-item survey to assess their knowledge on the content of the session, both before and after each session, also via SurveyMonkey. At the end of the hands-on workshops, experts evaluate trainees for their skills in performing the screening tests for cervical, breast, oral cancers, and tobacco cessation counseling.

Fig. 2 Overview of the training strategy and assessment



Data Analysis

The data presented in this paper were analyzed using SPSS version 21 and primarily provide descriptive and bivariate analysis of the pre-post assessments of the online phase. To the extent possible, we provide descriptive data on the weekly sessions and the in-person workshops.

Results

Trainee Characteristics

Since the introduction of the NICPR-ECHO in 2016, 641 primary care physicians have participated in the trainings, across nine cohorts of trainees. This study presents data from 116 trainees (of the total 641 trainees) who completed both the pre- and post-assessments, representing 6 cohorts of trainees (trained from May 2019 to February 2020). While

this paper focuses only on the 18% of trainees that completed the pre- and post-assessments, additional information related to low participation and completion rates is discussed in a previous publication in which it was found that the attrition was high among non-specialists, male participants and public sector doctors (Dhanasekaran et al., 2020a, 2020b). The main reasons for quitting the course were high workload in the health facilities and poor internet connectivity.

Table 1 provides the demographics of the trainees, where available. Overall, 69% were male. Trainees were between age 26 and 63 years (average age = 39.2 years). Almost two-thirds of trainees had completed medical training (Remaining medical officers from Primary Health Centres were trained in alternative medicine) (69.7%) and 85% worked in government healthcare facilities. The western region of India had the most trainees ($n = 31$, 26.7%). Of the 116 trainees, 25 (21.6%) participated in the in-person workshops. Workshop participants were between 25 and 55 years of age, and approximately half ($n = 13$) were female. Similar to the

Table 1 Demographic characteristics of the trainees

Demographic characteristics	Online phase ($N = 116$) n (%)	Hands-on workshop ($N = 25$) n (%)
Gender		
Male	81 (69.8)	12 (48.0)
Female	35 (30.1)	13 (52.0)
Total	116 (100.0)	25 (100.0)
Age, in years		
25–35	19 (38.0)	2 (40.0)
36–45	17 (34.0)	1 (20.0)
46–55	13 (26.0)	2 (40.0)
> 55	1 (2.0)	0 (00.0)
Total	50 (100) ^a	5 (100) ^a
Education		
Graduates (MD equivalent)	72 (70.5)	13 (61.9)
Post graduates	30 (29.4)	8 (38.0)
Total	102 (100.0) ^a	21 (100.0) ^a
Practice setting		
Government	99 (85.3)	20 (80.0)
Private	17 (14.6)	5 (20.0)
Total	116 (100.0)	25 (100.0)
Region		
North region (includes Delhi, Haryana, Jammu and Kashmir, Punjab, Rajasthan, Uttar Pradesh)	21 (18.1)	4 (16.0)
South region (includes Andhra Pradesh, Karnataka, Kerala, Puducherry)	15 (12.9)	6 (24.0)
East region (includes Assam, Bihar, Odisha, West Bengal, Tripura)	35 (30.1)	9 (36.0)
West region (includes Dadar and Nagar Haveli, Goa, Gujrat, Maharashtra)	31 (26.7)	3 (12.0)
Central region (includes Chhattisgarh, Madhya Pradesh)	14 (12.0)	3 (12.0)
Total	116 (100)	25 (100.0)

^aInformation not available for all participants, since they chose not to answer these questions in the survey

online phase, the majority were medical graduates (61.9%) and worked in government healthcare facilities ($n = 20$, 80%). Among the Indian States/Union Territories, Tripura, in Eastern India, was the most common state of origin ($n = 7$, 28%).

Assessment on Weekly Quizzes

Additional file 4 shows the total number of respondents from six trained cohorts that answered the weekly quizzes. Since complete data were not available from all cohorts, we focused our analysis on cohort 9 that enrolled 114 trainees. To receive an invitation to the hands-on workshop, participants needed to score at least 80% on the weekly quizzes. On average, 35% of trainees scored above 80% on the post-weekly quizzes.

Assessment of Online Training: Knowledge of Screening Among Participants

Table 2 shows the overall change in knowledge scores between pre- and post-assessments for the online phase. Trainees reported statistically significant improvements when queried specifically on knowledge and skills using visual vignettes about oral and cervical cancer screening. Although there were changes in the positive direction for knowledge regarding breast cancer screening, these changes were not statistically significant. One question assessed confidence in cervical cancer screening, where there was a significant improvement in the confidence of trainees after the online phase (Mean = 2.24, SD = 0.71) than before the training (Mean = 1.22; SD = 0.10); $t(df,82) = 9.57, p \leq 0.001$.

Assessment of Online Training: Implementation of Cancer Screening Services

When asked about their motivation to participate in the course, most trainees (52.6%) reported wanting to gain the ability to implement screening in their practice settings. Only 30.2% noted that they wanted to gain more knowledge and the remaining approximately 16% wanted to become

more confident in cancer screening. We also assessed their perception about implementation of cancer screening services in their practice settings. When queried about whether medical officers were currently providing cancer screening services, the total percent of trainees reporting not screening at pre-test fell from 27.6 to 21.6% at post-assessment. For those who did not provide cancer screening on the post-test, 25.9% trainees reported the lack of consumables and equipment and 17.2% reported the lack of trained health care providers as reasons for not providing cancer screening services at their practice settings.

In an open text format, we also asked trainees to report other reasons why they did not provide cancer screening services at their settings. The most common reasons reported were ongoing prioritization of diabetes and hypertension screenings and providing cancer screening services in the form of camp-based community campaigns instead of during routine clinic visits. At the post-test, in an open text format, we also asked trainees to report on the total number of individuals they had screened. A crude analysis of these open text data suggests approximate numbers of 12,766 individuals screened for breast cancer, 167,882 for oral cancer, and 4025 for cervical cancer. To address the cancer control continuum, we asked the trainees whether they referred screen positive individuals to a tertiary center for diagnostic follow-up. Approximately 97% reported referring patients. Among those who did not refer, the most common reason noted was the referral center being too far for patients to reach.

Assessment of the Hands-on Workshop

Additional file 5 contains the skills assessments tool that covers an assessment of all three cancers, breast, cervical, and oral. Experts and the NICPR team, at the end of the 3-day hands-on workshop, conduct the skills assessment using a pre-defined checklist. The requirement for being in person for the hands-on workshop and securing funding for travel and back-up for ongoing workload were significant barriers for physicians trained across the country. Of the 116, only 25 (21.5%) trainees completed the workshops and

Table 2 Change in knowledge, skills, and confidence in cancer screening among primary care physicians that trained in the online phase

Concepts measured (no. of items)	Pre-assessment Mean (SD)	Post-assessment Mean (SD)	<i>p</i> value
Overall knowledge (16 items)	8.2 (1.86)	9.8 (1.91)	0.001*
Knowledge about national cancer screening program (4 items)	2.8 (0.96)	3.4 (0.72)	0.001*
Knowledge in screening for oral cancer (5 items)	2.9 (0.93)	3.4 (1.06)	0.001*
Knowledge in screening for breast cancer (4 items)	1.8 (0.88)	1.7 (0.88)	0.353
Knowledge in screening for cervical cancer (4 items)	1.7 (0.84)	2.1 (0.88)	0.001*

* $p < 0.001$, statistically significant results on a paired *t*-test

scored at least an 80% score on their assessments to receive a workshop completion certificate.

Discussion

The data collected from this study suggest that the NICPR-ECHO training program for primary care physicians improved the knowledge, skills, and confidence in delivering cancer screening services according to the MoFHW guidelines, in the short term. These findings are similar to improvements reported among dentists and gynecologists undergoing ECHO trainings (Dhanasekaran et al., 2020a, 2020b; Nethan et al., 2020). The study, however, shows no statistical difference in primary care physicians' implementation of cancer screening services in their healthcare organizations, at the end of the 3-month training compared to when they enrolled in the program. This highlights a critical gap in promoting cancer prevention objectives in India and indicates the need for further research to explore the barriers to implementation of cancer screening services in the national and the regional and/or local context. Similar training to practice gaps, for evidence based interventions have been noted in the context of behavioral health in the United States (Beidas & Kendall, 2010). The ECHO model is well suited to the Indian context in that it offers a virtual platform, is cost effective, and provides the ability to train physicians over a wide geographical spread in a limited time period. Globally, ECHO programs have shown evidence in improving provider knowledge and skills for treatment for several medical conditions such as hepatitis C (12), multiple sclerosis (13), and behavioral disorders (14). Despite the growing number of studies evaluating ECHO, a recent systematic review by McBain and colleagues concluded that the evidence of effectiveness was modest compared to the widespread implementation of the model internationally. (McBain et al., 2019) Specifically, the authors of the review raised an important question of whether the ECHO model could go beyond improving knowledge to actually influence provider behavior and build capacity for implementation of clinical services, a distinction which is supported by findings from this study.

Three specific considerations influence the implementation of an organized, population-based, cancer screening program in India. First, the proposed guidelines are to implement the cancer prevention program in an existing public healthcare delivery system that has historically been designed to provide maternal and child healthcare. However, maternal and child healthcare delivery have different objectives and functions than cancer screening programs (i.e., services are typically sought out by the patient, are limited to discrete time periods in a patient's life, do not typically need referral systems, and require different skill

sets). A move to incorporate cancer prevention and control into this system will require implementation support (i.e., training, resources, staff, etc.) for primary care clinicians and their teams, including community health care workers since this is a new activity included in the public health system. Second, cancer screening presents a challenge for implementation because its success requires completion of several steps beyond the initial screening test (i.e., diagnostic testing, appropriate referrals, and treatment). Therefore, understanding the delivery of the screening process and available evidence regarding screening in the context of the healthcare, cultural, and geographical setting can be crucial for successful implementation and utilization of services. Third, the implementation of cancer screening programs can only be successful if providers are knowledgeable, skilled, and confident in delivery services and if healthcare systems are well resourced and ready for implementation with appropriate policy and stakeholder support, supported by the Multilevel Influences on Cancer Care Delivery Model (Taplin et al., 2012). Aligning both the provider's and the healthcare organization's capacity requires a systematic implementation approach that is currently missing from the proposed organizational framework.

As noted above, a range of barriers may impede the behavioral change in health professionals, including the healthcare settings in which they practice. Change in clinical practice in low- and middle-income countries requires the use of strategies that target either the health care organizations or healthcare workers. Very limited evidence currently exists on strategies that target healthcare organizations. (Pantoja et al., 2017) For strategies targeting health care workers, previous research suggests that compared to no intervention, internet based learning and educational workshops improve health workers knowledge, but it is unclear on whether such strategies improve health professionals' skills, behaviors, and whether this leads to improved patient outcomes. (Cook et al., 2008; Pantoja et al., 2017; Vaona et al., 2018) However, interactive education (such as that delivered in NICPR-ECHO) or when combining interventions such as audit and feedback with educational meetings, are more effective than educational meetings alone. Similarly, the use of interactive techniques (audit and feedback, academic detailing, outreach) are most effective for changing physicians care and patient outcomes. (Bloom, 2005) Changes in healthcare professional behaviors and settings may happen if implementation strategies address specific barriers and tailored interventions have shown more effectiveness than no interventions or dissemination of guidelines alone. (Baker et al., 2015) Careful investigation of the context and the determinants is a prerequisite for the implementation strategies to be effective in changing clinician behaviors and lead to practice change. Based on the current study findings and the given challenge to study the complexity, we must commit to

the process of choosing strategies, developing and refining strategies, and studying the effectiveness of strategies that lead to implementation outcomes (Powell et al., 2019). Successful implementation of cancer screening services through the public health system in India also requires the use of specific implementation theories, methods, and measures that can provide a systematic approach (Damschroder, 2020; Kislov et al., 2019).

Strengths and Limitations

Parallel to other studies published on the NICPR-ECHO program, this study contributes findings showing improvements in knowledge noted in primary care physicians (Basu et al., 2017; Dhanasekaran et al., 2020a, 2020b; Nethan et al., 2020). Despite seeing changes in knowledge and attitudes, there were very minimal changes reported in terms of providing cancer screening services and further research is needed to determine meaningful changes in knowledge that result in implementation of cancer screening services. Although the model reached several hundred physicians across the country, only 21.5% were able to sustain their participation throughout the online sessions and ensure in-person participation in the workshop (reasons outlined elsewhere (Dhanasekaran et al., 2020a, 2020b)). We also acknowledge other limitations of this study, which revolve around the pre-post, one group design for the evaluation of the ECHO program. Participants may have learned about cancer screening from other sources than the ECHO training, which could have influenced improvements noted on the post-test. Additionally, the testing itself may have affected the participant's responses at the post-test.

Conclusion

The NICPR-ECHO training model is an important first step toward the implementation of cancer screening services in India, as per the national guidelines (Varon et al., 2021). Study findings support the effectiveness of the ECHO model in reaching primary care physicians across the country and improving their knowledge and skills related to screening for breast, oral, and cervical cancer, which are significant public health problems in India and other low- and middle-income countries. After the training, very few primary care physicians mentioned implementing cancer screening services highlighting barriers that require further study and development of complementary implementation strategies, in addition to addressing retention challenges. Study findings could inform the development and refinement of training for cancer screening programs in low- and middle-income countries.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s43477-021-00032-1>.

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