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Implementation of evidence-based primary cancer prevention interventions in MA community health centers: an explanatory sequential mixed methods study

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Abstract

Background More than half of cancers could be prevented by employing evidence-based interventions (EBIs), including prevention interventions targeting nutrition, physical activity, and tobacco. Federally qualified health centers (FQHCs) are the primary source of patient care for over 30 million Americans — making them an optimal setting for ensuring evidence-based prevention that advances health equity. The aims of this study are to (1) determine the degree to which primary cancer prevention EBIs are being implemented within Massachusetts FQHCs and (2) describe how these EBIs are implemented internally and via community partnerships.

Methods We used an explanatory sequential mixed methods design to assess the implementation of cancer prevention EBIs. First, we collected 34 quantitative surveys from staff at 16 FQHCs across Massachusetts to determine the frequency of EBI implementation. We followed up with 12 qualitative one-on-one interviews among a sample of staff to understand how the EBIs selected on the survey were implemented. Exploration of contextual influences on implementation and use of partnerships was guided by the Consolidated Framework for Implementation Research (CFIR). Quantitative data were summarized descriptively, and qualitative analyses used reflexive, thematic approaches, beginning deductively with codes from CFIR, then inductively coding additional categories.

Results All FQHCs indicated they offered clinic-based tobacco interventions, such as clinician-delivered screening practices and prescription of tobacco cessation medications. Quitline interventions and some diet/physical activity EBIs were available at all FQHCs, but staff perceptions of penetration were low. Only 38% of FQHCs offered group tobacco cessation counseling and 63% referred patients to mobile phone-based cessation interventions. We found multilevel factors influenced implementation across intervention types — including the complexity of intervention trainings, available time and staffing, motivation of clinicians, funding, and external policies and incentives. While partnerships were described as valuable, only one FQHC reported using clinical-community linkages for primary cancer prevention EBIs.

Conclusions Adoption of primary prevention EBIs in Massachusetts FQHCs is relatively high, but stable staffing and funding are required to successfully reach all eligible patients. FQHC staff are enthusiastic about the potential

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of community partnerships to foster improved implementation—providing training and support to build these relationships will be key to fulfilling that promise.

Keywords Nutrition, Physical activity, Tobacco, Federally qualified health centers, Community, Partnership, Cancer prevention

Contributions to the literature

- Despite the promise of health centers for advancing equity in delivery of care, little research has explored the implementation of primary prevention evidence-based interventions in these settings.
- This study revealed that evidence-based tobacco, nutrition, and physical activity interventions are frequently adopted by health centers, but reach to eligible patients is often limited.
- Barriers to offering preventive interventions in health centers included the complexity of intervention training, available time and staffing, clinician motivation, and sustainable funding.
- Partnerships are viewed favorably by health center staff, but only one health center reported using partnerships to offer evidence-based interventions. Support for partnership development as an implementation strategy is needed.

Background

More than half of cancers could be prevented by employing existing evidence-based interventions (EBIs), including prevention interventions targeting nutrition, physical activity, and tobacco [1]. Serving as the primary source of patient care for over 30 million Americans, [2] Federally qualified health centers (FQHCs) funded by the Health Resources and Services Administration (HRSA) are well-positioned to reach populations experiencing health disparities with evidence-based cancer prevention interventions [3, 4].

However, little is known about how primary cancer prevention EBIs are being implemented by FQHCs. Interventions delivered directly via clinicians such as physical activity counseling [5] and tobacco cessation like Ask, Advise, Connect [6] have shown promise. Research has also demonstrated successful implementation of cancer screening interventions in FQHCs [7–9] and HRSA now includes tobacco screening and cessation counseling as a quality metric [2]. Yet, understanding the usage of evidence-based behavioral interventions addressing nutrition, physical activity, and tobacco use, which have the potential for the prevention of cancer and other chronic diseases, is more limited. Clinical-community

linkages have been lifted up as promising opportunities for chronic disease prevention within research [10–13] and the Agency for Healthcare Research and Quality [14]. These linkages build trust and promote access to disease prevention and treatment to “improve care and support patients better than either of these sectors could do alone” [15]. The Centers for Disease Control and Prevention (CDC) presents a continuum of clinical-community linkages that includes networking for information exchange, coordinating to increase accessibility to services, cooperating to share resources, collaborating to enhance each other’s capacity, and merging to operate as one entity [16, 17]. These relationships between clinical and community settings commonly include creating referrals, partnering to deliver clinical services, and cooperating to provide wraparound services that address social determinants of health [18]. However, research has not documented what these partnerships entail in real-world practice or how they employ EBIs. The aims of this study are to (1) determine the degree to which primary cancer prevention EBIs are being implemented within Massachusetts FQHCs and (2) describe how these EBIs are implemented, both internally and via community partnerships.

Methods

Design and setting

This study is based at the Implementation Science Center for Cancer Control Equity (ISCCCE), a National Cancer Institute-funded center with collaboration between the Massachusetts League of Community Health Centers (Mass League), Harvard T.H. Chan School of Public Health, Massachusetts General Hospital, and Dana Farber Cancer Institute. The Mass League is the Primary Care Association that provides workforce development, policy analysis, information technology development, clinical quality improvement (QI), training, and education to all 52 FQHCs across Massachusetts serving approximately 1 million patients [19]. The core ISCCCE structure includes an Implementation Lab that is responsible for building the research capacity of the 31 FQHCs that share a common population management and data reporting platform.

FQHCs make comprehensive primary care accessible to millions of people by addressing common barriers

to healthcare like cost, language capacity, distance, and insurance [20]. According to a 2021 Uniform Data System (UDS) comparison of state and national data, Massachusetts FQHCs served a higher proportion of patients that identify as racial and/or ethnic minorities (67% vs 62%), a higher proportion of patients who are best served in a language other than English (43% vs. 24%), and a lower proportion of uninsured patients (12% vs 20%) than the national average. Eighty-five percent of MA FQHC patients are considered low income at $\leq 200\%$ poverty, compared to 90% nationally [2].

We used an explanatory sequential mixed methods design to assess the implementation of cancer prevention EBIs in FQHCs [21]. The study began with a quantitative survey of staff fielded between November 2020 and August 2021 to determine the frequency with which established EBIs are being implemented. These items were embedded in a broader organizational survey that assessed aspects of the inner setting, outer setting, and characteristics of the individual staff. Following the survey, we conducted qualitative one-on-one interviews from May 2021 to August 2021 with a sub-sample of staff to explore how the EBIs selected on the survey were implemented. The study was approved by the Harvard Longwood Campus Institutional Review Board. The Good Reporting of a Mixed Methods Study Checklist [22] was used to ensure study rigor.

The study was guided by two implementation science frameworks. First, Proctor's Model for Implementation Outcomes [23], describes the core implementation outcomes that lay on the pathway between interventions and intended clinical patient outcomes. Our survey focused on adoption (e.g., the degree to which Massachusetts FQHCs offer EBIs) and penetration (e.g., the proportion of eligible patients offered or referred to these EBIs). The Consolidated Framework for Implementation Research (CFIR) guided our qualitative exploration [24, 25]. This determinants framework describes the potential multi-level contextual influences on EBI implementation. All domains of the framework were explored through interviews (see Appendix A) including the implementation process, characteristics of the intervention itself, characteristics of individuals (e.g., staff responsible for delivery), the inner setting (e.g., structures and culture within the FQHC), and the outer setting (e.g., influences outside the FQHC).

Quantitative surveys

Participants

The ISCCCE team invited staff members from 31 Massachusetts FQHCs to participate. We sampled one to three people within five diverse job type categories — leadership, clinical, QL, community direct-service, or

community outreach/engagement. Respondents also self-reported their roles (they could check multiple) on the survey, which includes these categories as well as management, administrative, referrals, consultation, and data support. Staff included in the survey were actively engaged in an ISCCCE pilot research study and/or participated in the Center's capacity building activities. At FQHCs where staff with specific job types were not engaged in ISCCCE activities, the primary contact was asked to provide a roster of staff names in each job type. For job types with more than 3 staff members at the FQHC, study personnel randomly selected participants using a random number generator.

For the purposes of this study, the survey used branching logic to have respondents who selected community direct-service, community outreach/engagement, or management roles complete items pertaining to EBI implementation. These roles were selected given the alignment of their positions to the community partnership aims of this study.

Measures

The research team fielded a 10–20-min online survey via REDCap. To ensure culturally appropriate engagement and build rapport with each FQHC, a Mass League leader emailed notification of the survey several days before the invitation was emailed from the ISCCCE principal investigator via REDCap. Up to three reminders to complete the survey were made by email following the initial invitation.

The survey included close-ended items to identify specific primary prevention EBIs that can be delivered by FQHCs or community-based organizations focused on nutrition, physical activity, and tobacco cessation. We included EBIs that focused on the prevention of other chronic diseases (e.g., diabetes) if the primary behavior change targets of the intervention were nutrition and physical activity. We included individual or group-delivered EBIs, drawing from The Community Guide [26] as well as input from the research team. Figure 1 includes the list of EBIs included in the survey.

Following Proctor's Model for Implementation Outcomes [23], staff were then asked to estimate the proportion of eligible people that are impacted by each intervention (i.e., penetration) on a five-point scale, ranging from "none" to "most or all." Surveys also included open-ended questions for participants to describe interventions that were not pre-specified or were "home-grown" (e.g., developed by the FQHC). We also measured participants' FQHC tenure and demographics (e.g., gender, race/ethnicity, age).

EBIs and items included on the survey were generated through consensus by cancer prevention and methods

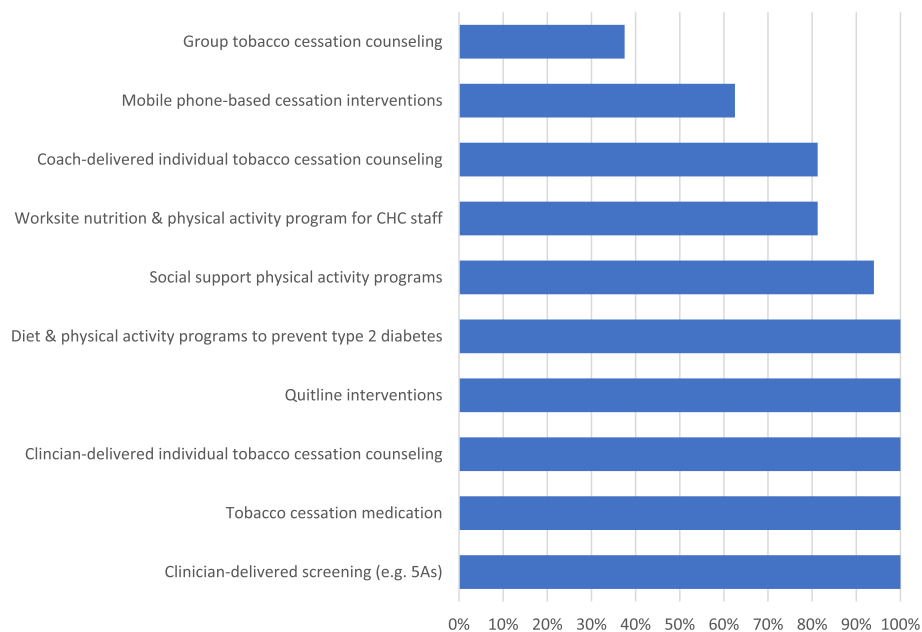


Fig. 1 Evidence-based intervention adoption at 16 Massachusetts federally qualified health centers

experts on the study team. To finalize the list of specific primary prevention EBIs included in the close-ended items and improve survey language and flow, cognitive interviews were conducted with three staff from health centers not included in the study sample.

Respondents were compensated \$25 for participation. FQHCs that were new to ISCCCE research projects also received \$100 site-level incentives to provide meals or snacks for staff.

Analysis

We calculated descriptive statistics for participants' time in current role and demographics (e.g., race, ethnicity, age, gender), as well as the number of eligible people that are offered or referred to the intervention using SAS 9.4. EBI adoption was summarized at the site level.

Qualitative interviews

Participants

Researchers invited 23 staff members (1–4/site) from 12 sites to participate in qualitative interviews, beginning with those who completed the survey and then adding interviewee referrals of individuals, such as those in quality improvement and community engagement roles who had in-depth knowledge of FQHC implementation and outreach processes for the types of prevention interventions under investigation. Interviewees included QI and population health leaders, staff managing prevention programming and community engagement activities, and

practitioners delivering interventions. Interviews were audio-recorded and then transcribed for accuracy.

Measures

We explored the experience of adoption and implementation of cancer prevention EBIs in greater depth via one-hour, one-on-one semi-structured interviews. Researchers used adoption data (i.e., which specific EBIs or “home grown” interventions were being implemented) from the quantitative survey to tailor interview guides, including structured prompts for EBIs selected in the survey for interviewees to describe how and why each of these interventions was initially adopted, implemented, and sustained. Participants were also asked whether they implemented other tobacco, nutrition, and physical activity interventions in the past or hoped to in the future. To address Aim 2, participants were asked how partners were involved in the implementation of each intervention and where intervention activities were situated (e.g., FQHC or another community setting). Contextual influences were explored using interview probes structured following CFIR to explore multilevel determinants on implementation [24, 25], Appendix A). Participants were compensated \$50 for participation in interviews.

Analysis

We utilized reflexive, thematic approaches, as described by Braun and Clarke [27], beginning deductively with codes from CFIR, then inductively coding additional categories using NVivo Software. To increase credibility and rigor, we

Table 1 Proportion of patients offered or referred to EBIs in Massachusetts-based FQHCs estimated by staff (N=34)

Evidence-based intervention	None	Not too many	Some	Many	Most or all
Tobacco use					
Clinician-delivered screening practices (e.g., Ask, Advice, Refer (AAR), 5 As) (N=33)	0.00%	12.12%	27.27%	27.27%	33.33%
Prescription of tobacco cessation medications (N=34)	0.00%	2.94%	38.24%	41.18%	17.65%
Clinician-delivered individual tobacco cessation counseling (N=33)	0.00%	6.06%	36.36%	48.48%	9.09%
Coach or counselor delivered individual tobacco cessation counseling (N=32)	21.88%	28.13%	18.75%	18.75%	12.50%
Group tobacco cessation counseling (N=32)	68.75%	15.63%	3.13%	6.25%	6.25%
Quitline interventions (e.g., Quitworks, 1-800-Quit-Now) (N=33)	3.03%	18.18%	36.36%	24.24%	18.18%
Mobile phone-based cessation interventions (e.g., SmokefreeTXT or other text message interventions) (N=32)	50.00%	25.00%	9.38%	12.50%	3.13%
Nutrition and physical activity					
Diet and physical activity promotion program to prevent type 2 diabetes among people who are at risk (e.g., Diabetes Prevention Program) (N=33)	3.03%	12.12%	27.27%	33.33%	24.24%
Social support physical activity program focused on building, strengthening, and maintaining social networks for behavior change (e.g., buddy system, walking groups) (N=32)	12.50%	31.25%	28.13%	15.63%	12.50%
Worksite nutrition and physical activity program for community health center staff (N=34)	32.25%	20.59%	20.59%	5.88%	20.59%

utilized researcher triangulation; interviews were coded by the principal investigator and the research project manager, who both have backgrounds conducting public health and implementation science research, to ensure deep engagement with the data and integration of multiple perspectives [28]. A third member of the research team, who has a background in medical anthropology, created summaries of codes prioritized for this analysis. Drawing on concepts of information power, we determined that our sample size would be sufficient given fairly broad research goals, a somewhat homogeneous sample (in terms of work focus), rich data collection, and strong reliance on an existing framework [29]. Interpretation of results was supported by three co-authors who are FQHC staff and researchers with extensive experience in community-based cancer implementation science. The FQHC staff provided input on three drafts of the paper; they provided feedback on the accuracy and relevance of the summaries and supporting quotes, shared additional details on the context of the partnership case example, and drew a connection to FQHC practice in the discussion.

Results

Respondents

Of the 146 staff members invited, 71 (49%) staff from 17 FQHCs completed the survey. Thirty-four staff members from 16 FQHCs selected community direct-service, community outreach/engagement, or management roles and subsequently responded to the questions of focus

for this investigation and represent the sample for this paper. Of the 16 FQHCs, 13 are based in cities and three in suburban/rural areas. Over 87% of these community-focused staff respondents identified as women. Approximately 56% identified as White, followed by Hispanic/Latino (21%), Asian (15%), and Black/African American (6%). Respondents ranged in age from 27 to 63 years (mean 41). Tenure ranged widely from under one year to 27 years of experience, with an average of 7 years in the current position. Twenty-three staff members were purposively sampled to participate in qualitative interviews. Of those invited, 12 (52%) staff from eight FQHCs participated in follow-up qualitative interviews.

Quantitative surveys

Self-reported adoption and penetration of nutrition, physical activity, and tobacco cessation EBIs at Massachusetts FQHCs appear in Fig. 1 and Table 1. All FQHCs indicated they offered clinic-based tobacco interventions, such as clinician-delivered screening practices, individual tobacco cessation counseling, and prescription of tobacco cessation medications. Quitline interventions (e.g., Quit-Works) were available at all FQHCs, but staff perceived they were not offered to many or most eligible smokers. Additionally, tobacco cessation interventions that relied on collaboration outside of the clinical visit were not implemented consistently. Only 38% of FQHCs offered group tobacco cessation counseling and 63% referred

patients to mobile phone-based cessation interventions (e.g., SmokefreeTXT).

Evidence-based diet and physical activity programs to prevent type 2 diabetes were offered at all FQHCs. However, only 57% of respondents perceived that many or most eligible patients were offered these programs. When prompted to name other programs offered, some were evidence-based (e.g., Chronic Disease Self-Management Program), but many appeared to be “homegrown” with limited evidence of effectiveness.

Qualitative interviews

Our qualitative findings are organized by intervention type (tobacco cessation, nutrition, and physical activity) and CFIR domain (implementation process, intervention characteristics, inner setting, characteristics of individuals, outer setting). We also describe how partnerships with community organizations were employed in EBI implementation.

Tobacco cessation

Implementation process

Staff reported conducting tobacco screening annually or more frequently. At most FQHCs, medical assistants (MAs) administer tobacco screenings and input results into the patients' electronic health records (EHR). Based on those results, staff discuss treatment options, including medications, provider-mediated counseling, or referrals to an external or internal cessation program. If patients are unwilling to begin tobacco cessation, they are asked about it at another time. Many FQHCs refer patients to state programs like QuitWorks to connect with tobacco cessation counselors. As COVID-19 restrictions have lifted, some FQHCs have capitalized on the adoption of telehealth to offer hybrid health services — resuming in-person visits for services that require an office assessment, while continuing to offer telehealth visits when appropriate. One Care Coordinator saw this as a facilitator to tobacco cessation implementation because it “allows us to reach patients that we wouldn't necessarily be able to reach.”

Factors that influence implementation

Intervention characteristics

Delivering tobacco interventions was described as relatively simple, but the process of training and referral added *complexity*. A few staff members noted the overall ease of conducting tobacco use screenings and counseling patients as part of EHR-mediated tobacco cessation interventions. Typically, there are templates within the EHR system that will prompt the user with standardized documentation and referral tools. It may require maneuvering through multiple boxes or pop-ups.

Participants said understanding and using the EHR was not difficult. However, some noted that too many steps deterred providers from following the intervention because it became burdensome to already overworked staff with too little time. As one staff member mentioned, “providers are just tired of clicking.” The QI Manager at another FQHC reflected on the complexity of training needed for implementing these interventions:

The screening part and the counseling part is easy for MAs and providers. What is hard is training people and retraining people... Until the end of last year, we only had one EMR trainer, she was the only one who was responsible for retraining the existing staff and training the new staff on how to document these screening tools. That is something that has been challenging for us, because one person could only do so much.

The core content of the interventions was not difficult by themselves; the steps surrounding the interventions, like training staff members and fatigue towards multiple pop-up reminders, made implementation complex.

Inner setting

Various inner setting factors influence how tobacco cessation interventions are implemented. FQHCs rely on internal *IT infrastructure* like EHRs to facilitate intervention delivery. MAs enter data into pop-ups within medical records if patients need tobacco cessation interventions. These pop-ups remind providers to address the patient's tobacco use. Staff also reflected on the need for enough time to implement tobacco cessation interventions. The short visit times (averaging 10–15 min) did not typically allow for comprehensive tobacco cessation screening and counseling, a reflection of the CFIR structural characteristic construct of *work infrastructure*. A Population Health Manager explained:

We're faced with limited time during a visit. Often 15 minutes is not enough to cover a lot of things. One of the things that our providers sometimes are unclear about or there's not enough guidance is how many minutes is required to count for counseling. Is it 5? Is it 10 minutes? If it's 10 minutes, it's almost the entire visit.

The *relative priority* of the EBIs within the FQHC inner setting also emerged as an important factor influencing implementation success. Some providers need to prioritize more acute medical concerns over preventative measures, unless “[smoking] was something that was interfering with a patient's daily life.” This issue of short clinic visit time was addressed by utilizing non-physician staff at one FQHC, allowing providers to refer patients to

the clinical pharmacists, who had much more appointment availability and time to counsel patients on tobacco cessation intervention options. Another participant mentioned a past dedicated tobacco cessation counselor who no longer works at the FQHC. Now, instead, their newly established asthma clinic has a dedicated healthcare team comprised of a provider, nurse, and community health worker (CHW) that also address smoking. They said, “we’re starting to see staff and providers referring patients to this team. That’s the biggest thing, having a designated team that has a specialized focus on this area is going to be really helpful.” This example is also a reflection of the *compatibility* between tobacco treatment and the structure of the asthma clinic.

Available resources were also mentioned as a key factor in implementation success. Participants reported MAs and other non-physician staff members provide invaluable support for intervention activities. MAs typically conduct tobacco screenings and update the EHR to prompt reminder messages for providers, and in some cases, provide some tobacco cessation counseling. Without them, staff members have seen providers become overwhelmed during clinic visits and “sometimes might skip that screening or that questionnaire asking about tobacco status if [providers] feel [they] don’t have the time.” Thus, expanding the responsibility of tobacco cessation EBI delivery to include more of the healthcare team can ensure the time and attention needed to positively affect the implementation of those EBIs. Availability and use of ancillary staff for tobacco treatment reflects readiness for implementation, such that there are available resources for providing the target services.

Characteristics of individuals

Beyond the need for engaging a multidisciplinary team, participants reflected on the characteristics of individuals that have influenced the implementation of tobacco cessation EBIs. A few participants spoke about the need for healthcare providers to have the *motivation* to do the EBI and to, in turn, be encouraging in their interactions with patients. To effectively discuss cessation EBIs, providers must have the knowledge and skills around their *capability* to assess patient readiness. A Vice President shared:

If you have a provider who’s sensitive to the concept of assessing readiness and has either some motivational interviewing techniques or, from their provider interviewing skills, has an understanding of assessing that readiness, that’s going to be a better opportunity on the provider side.

Participants reported the loss of MAs, nurses, doctors, and other staff members. These shortages required others to fill roles or expand responsibilities. With fewer

MAs, providers may have had to take on more of the tobacco screening or the remaining MAs may have had to increase their workload. In either case, staffing issues like this impacted the way tobacco cessation EBIs were implemented. As one QI Manager reflected, “sometimes, when we do not have MAs, providers have to [do] all the work... Therefore, sometimes providers might skip doing the tobacco screening, because there is more that they need to work on at that visit with the patient.”

Outer setting

Common outer setting factors that affected the implementation of smoking cessation interventions included *external policies and laws* such as HRSA FQHC requirements and *local conditions* of the community. The FQHC status influences the implementation of tobacco cessation EBIs. FQHCs monitor tobacco use as a part of their required HRSA standard quality metrics. As one leader described, “tobacco use assessment intervention is one of the standard quality metrics for FQHCs. We’ve been thinking about it for the entire 15 years that I’ve been at the health center.”

Many of the FQHCs attributed their focus toward tobacco cessation interventions to *financing* requirements from different grants they had received. Some grants had explicit objectives to include smoking cessation interventions. A Director of Public Health Programs reported:

We have a grant from [the Department of Public Health] ... that’s focused on asthma prevention and control, but one of the objectives is on smoking cessation, so there are certain activities that we do to meet those grant requirements... related to being able to connect people and provide linkages to community-based support for smoking cessation.

Some staff members spoke of the need for tobacco cessation interventions because of the prevalence of tobacco use in the neighborhoods in which their FQHCs are situated. A QI Manager reflected on how *local conditions* connected the need for screening: “Tobacco screening is something I am strongly advocating. Even though the standard is to begin at 13, or in some cases 15, I always say start at 12. There is a lot of smoking, tobacco use, and vaping that’s happening in the community, especially for high school kids.”

Nutrition and physical activity Implementation process

As seen in the survey results, most staff described offering EBIs that target nutrition and physical activity. These included the Diabetes Prevention Program (DPP), Chronic Disease Self-Management Program (CDSMP),

and Diabetes Self-Management Program (DSMP). Staff reported these classes are typically led by a range of staff members, including CHWs. One FQHC operates a Wellness Center dedicated to nutrition and physical activity, which offers programs in various languages. Almost all participants spoke about strategies that have limited evidence for effectiveness on chronic disease prevention. For example, some staff described delivering nutrition or physical activity classes that were developed in house with few details how evidence-based content was incorporated and no mention of evaluation. Many FQHCs had partnerships with local food banks, food pantries, and farmers' markets. They encouraged patients to use these resources to eat healthier foods, with the primary objective of addressing food insecurity.

Factors that influence implementation

Intervention characteristics

Complexity and *adaptability* were most commonly described as influencing implementation of nutrition and physical activity EBIs. To meet the needs of a multilingual patient population, some FQHCs adapted nutrition and physical activity EBIs to be delivered in languages other than English. This was challenging as some FQHCs did not have the needed language capacity. The Director of Public Health Programs at one FQHC also identified that to administer evidence-based CDSMP classes, staff had to obtain specific training and certification. They described that this made holding these classes in different languages even more challenging:

For the CDSMP and DSMP classes, those right now are only offered in English and Spanish because there are specific requirements for being able to facilitate those classes in other languages. There's a whole lengthy set of requirements that we have to comply with in order to have staff certified to lead those classes.

Most of the nutrition and physical activity EBIs were conducted in person at FQHCs. Some FQHCs were able to successfully adapt these programs to virtual or hybrid offerings amidst the pandemic and provided tablets as needed so that patients could continue to access these programs. According to most participants, the interventions themselves were not difficult to implement. However, it was challenging to recruit patients for these EBIs and keep them coming to the classes because of the time commitment. A Population Health Manager reported:

We had a couple of rounds on one of the chronic disease self-management programs through the Stanford Model a few years back. That was one of the offerings we had for our patients... It's six weeks,

two-hour classes. It's very hard to recruit and retain patients in that program.

Like the challenges faced with implementing tobacco cessation EBIs, participants mentioned that the design of existing EMR documentation and referral functionality could be burdensome and complex for providers with already overwhelming workloads and short clinic visit times per patient. A Director of Performance Improvement worried that providers may be tempted to ignore such pop-ups, "these EMR prompts sometimes run the risk of overload or getting ignored because there are too many of them".

Inner setting

The structural characteristic of *work infrastructure* emerged as important for the implementation of nutrition and physical activity EBI. The workflow of nutrition and physical activity interventions at most FQHCs starts from the moment the patient interacts with front-facing staff like MAs. These staff members take weight measurements, blood pressure, and other health indicators and input them into the patient's EHR. Similar to tobacco cessation interventions, EHRs are programmed to alert or remind providers to address nutrition and physical activity if a health metric falls within a certain range (e.g., a BMI > 30 may trigger a pop-up).

Nutritionists, MAs, and other dedicated staff members are further influential in implementation as key *available resources* that promote and actively prioritize nutrition and physical activity EBIs. A clinical nutritionist at one FQHC contributes to education for patients who may still have follow-up questions not addressed in their short primary care visit. A Population Health Manager described a unique collaboration: "working alongside with the nutritionist, our clinical pharmacist is very well utilized. She's an add-on for our nutrition program that can also provide some more education."

Characteristics of individuals

Overall, staff reported positive attitudes and *motivation* to deliver the nutrition and physical activity EBIs. A Clinical Assistant described the DPP: "it's an amazing program. Everybody should do it [laughs]. It's well-being for the patient...The situation that we're living now, it makes it a little bit harder, but it's not impossible. Where there's a will, there's a way." The Care Coordinator at another FQHC described the importance of having dedicated personnel with specialized skills support delivery: "I do think our nutritionist is a good resource, and that she's very useful, and that patients enjoy seeing her." However, the Quality Manager at another FQHC reflected that having a skilled team to help with EBIs does not matter if

providers are not aware of their existence and thus do not have the *capability* to make a referral. They said:

We actually have a pretty decently-sized case management team. I think there's five of them. If the providers aren't utilizing them or don't know how, then it doesn't really matter. We are trying to build up a strong program where everyone understands how to utilize that team and how to refer to them. Same with the nutritionists.

Health care providers must know of the resources within their own workplace so that they can refer patients for nutrition and physical activity care as needed.

Outer setting

Staff recognize that they serve a diverse range of patients with varying economic and educational circumstances, as well as different language needs. *Patient needs* are understood through interactions with front-facing staff, word of mouth, and a general survey of the population. They address these needs by tailoring nutrition or physical activity classes to be culturally appropriate and held in languages spoken by their patient population.

Influences in the outer setting, like *external policies and financing* through grant and insurance requirements, help to prioritize some EBIs. A few FQHCs received the MDPH 1817 grant from the CDC [30] that supports programs and activities to prevent and manage type 2 diabetes. One FQHC received funding from the Healthy Living Center of Excellence, which they used to support reimbursement for patients who completed physical activity classes. However, staff reported that grants can be transient, which makes resources for interventions fleeting at times. Some staff members remembered when they had more support, infrastructure, and resources for a particular intervention. When the grant ended, the intervention activities also ceased.

Implementing tobacco cessation and nutrition and physical activity EBIs at FQHCs depended on many factors, including the complexity of the intervention itself, the workflow and resources of the FQHC, the various key players supporting intervention delivery and referral, and policy and community influences outside the walls of the FQHC.

Partnerships

Few participants reported *partnerships and connections* with community organizations for cancer prevention when prompted during interviews. Some said they made connections through membership in an Accountable Care Organization (ACO). For example, a staff member mentioned connecting to a community development corporation and an asthma support program through their ACO. Staff at other FQHCs attributed partnerships to

the grants they have received. However, grant-facilitated partnerships have the potential to dissolve when the funding ends. A Patient Educator described how the end of funding impacted the implementation of EHR-mediated interventions at their FQHC:

We also receive[d] funding from the Prevention and Wellness Trust Fund... We did build a partnership with the agency who do[es] smoking cessation. We did have the workflow built by DPH... to refer patient[s] directly to our EMR system. When the funding end[ed] in 2018, we did not want to continue to do that workflow or that referral process because they don't have anybody to manage that. We stop[ped], and we go back to the routine to do it manual[ly].

Some staff commented on collaborations or agreements with local gyms and farmers' markets to promote nutrition and physical activity and recognized the value of partnering with community-based organizations to increase community awareness of FQHC resources available. However, partnership for delivery of EBIs was rarely discussed. Some staff showed interest in developing partnerships with community organizations in the future. Leveraging new partnerships fostered during the pandemic was mentioned by a QI Manager: "especially with COVID. We were lucky enough to form more relationships with our various community partners. That really is going to drive this". However, the specifics of how FQHCs might partner for EBI delivery were unclear. A Director of Performance Improvement shared:

I always think we can benefit from working with community partners. I don't think I know exactly what's out there, what other health centers are doing... I would be interested in hearing about whether some of the other health centers have figured anything out. I'm sure that there's ways that we could benefit from partnerships.

While most participants did not report active community partnerships for delivering cancer prevention EBIs, an FQHC in Western Massachusetts stood out as a positive case example. This FQHC staff discussed partnerships at various levels of engagement, ranging from networking to exchanging resources and sharing information to collaborating with people from local community organizations for EBI delivery. For example, staff from a local grassroots community-based organization and a regional faith-based social services organization co-facilitate nutrition and physical activity classes for patients at the FQHC. The FQHC is also well-connected with their local Public Health Institute from whom they have received tobacco cessation resources. A FQHC

leader described how they leverage the community relationships to connect patients with resources: “we have a whole directory of community-based resources and national helplines...that are focused on smoking cessation that our CHWs will connect people with as needed.”

Table 2 provides a comprehensive integration of qualitative and quantitative findings.

Discussion

This mixed methods study of primary cancer prevention EBIs provides an exploration of nutrition, physical activity, and tobacco use interventions in Massachusetts FQHCs. All FQHCs surveyed offered evidence-based clinician-delivered screening and counseling, Quitline interventions, tobacco cessation medication, and diet/

Table 2 Integration of quantitative and qualitative findings on EBIs for primary cancer prevention among Massachusetts FQHCs

	Tobacco use	Nutrition and physical activity
FQHC adoption	<ul style="list-style-type: none"> - 100% FQHCs offered clinician-delivered screening (e.g., 5As) and counseling, Quitline interventions, and tobacco cessation medication - 81% FQHCs offered coach-delivered tobacco cessation counseling - 63% FQHCs offered mobile phone-based cessation interventions - 36% FQHCs offered group tobacco cessation counseling 	<ul style="list-style-type: none"> - 100% FQHCs offered diet and physical activity programs to prevent type 2 diabetes - 94% FQHCs offered social support physical activity programs - 81% FQHCs offered worksite nutrition and physical activity programs for FQHC staff
Patient penetration	<ul style="list-style-type: none"> - 33% staff reported most/all eligible patients offered clinician-delivered screening (e.g., 5As) - < 25% staff reported most/all eligible patients offered all other tobacco use interventions - 50% staff reported none/few eligible patients offered coach-delivered tobacco cessation counseling - 75% staff reported none/few eligible patients offered mobile phone-based cessation interventions 	<ul style="list-style-type: none"> - 25% staff reported most/all eligible patients offered diet and physical activity programs to prevent type 2 diabetes - < 25% staff reported most/all eligible patients offered all other nutrition and physical activity interventions - > 33% staff reported none/few eligible patients offered social support physical activity programs
Key CFIR contextual factors influencing implementation (can act as both barriers or facilitators)	<ul style="list-style-type: none"> Intervention characteristics: Complexity of trainings and referrals Inner setting: Structural characteristic: IT infrastructure (e.g., EHR) Structural characteristic: Work infrastructure (e.g., visit time, workflows) Relative priority Available resources: (e.g., staff dedicated to implementation) Characteristics of individuals: Motivation (e.g., to deliver the EBI among clinical staff) Capability (e.g., knowledge and skills to assess patient readiness) Outer setting: External policies and laws (e.g., FQHC HRSA requirements) Financing (e.g., grant requirements) Local conditions 	<ul style="list-style-type: none"> Intervention characteristics: Complexity of recruitment, retention, and training Adaptability based on culture and language Inner setting: Structural characteristic: Work infrastructure (e.g., visit time) Available resources (e.g., staff dedicated to implementation) Characteristics of individuals: Motivation (e.g., to deliver the EBI among clinical staff) Capability (e.g., awareness of resources available among clinical staff) Outer setting: Patient needs (e.g., language access) External policies and laws (e.g., insurance requirements) Financing (e.g., grant requirements)
Partnerships	<ul style="list-style-type: none"> Only one FQHC reported partnerships for tobacco EBIs — partnerships primarily for referrals to outside resources 	<ul style="list-style-type: none"> Only one FQHC reported partnerships for nutrition and physical activity EBIs — partnerships for co-delivery of evidence-based programs at FQHC
Integration	<ul style="list-style-type: none"> All FQHCs offered evidence-based clinician-delivered screening and counseling, Quitline interventions, and tobacco cessation medication. Most offered coach and mobile-delivered tobacco cessation counseling, but few offered group tobacco cessation. Although tobacco cessation EBIs were available, they were rarely offered to most eligible patients. Contextual factors influencing the impact of these EBIs are the complexity of trainings and referral systems, limited visit times and effective workflows, limited dedicated staffing, and sustained financing 	<ul style="list-style-type: none"> All FQHCs offered diet/physical activity programs that were developed to prevent type 2 diabetes and most offered social support physical activity interventions and worksite programs. Although nutrition and physical activity EBIs were available, they were rarely offered to most eligible patients. Contextual factors influencing the impact of these EBIs are the complexity of recruitment and referral, adaptation of the EBI to local context and language needs, limited visit times and dedicated staffing, and sustained financing

physical activity programs that were developed to prevent type 2 diabetes. Most FQHCs offered coach and mobile-delivered tobacco cessation counseling and social support physical activity interventions. Group tobacco cessation counseling was offered at only one-third of FQHCs. Although EBIs were available, they were rarely offered to most eligible patients. Follow-up qualitative data explain the ways in which context impacts EBI implementation. We found multilevel factors influenced implementation across all intervention types — from the complexity of the intervention (e.g., complicated and in-depth trainings), to available resources (e.g., time and staffing) in the inner setting, to motivation and capability of clinicians, to external policies, laws, and financing in the outer setting. Staffing issues and structural characteristics in the inner setting were some of the most prevalent factors discussed in both tobacco cessation and nutrition/physical activity and highlighted the fact that EBI implementation often started well before providers saw patients. While partnerships and connections were described as valuable to many staff, only one FQHC reported using partnerships for the referral and delivery of primary cancer prevention EBIs.

FQHCs excel at providing in-house preventive clinical care. This is, in part, because they are required by HRSA to collect Uniform Data System quality of care measures for practices like colorectal and cervical cancer screening annually to assess the impact and drive QI [2]. However, adoption and penetration data revealed EBIs that depend on collaboration outside of the office visit had less uptake and patient reach. This is likely due to the need for more focused expertise, patient time, and coordination required for behavior change interventions like group tobacco cessation counseling and social support physical activity programs. FQHCs may not always have the infrastructure (e.g., staffing, training capacity, ongoing funding) to deliver cancer prevention EBIs in a sustainable or standardized way. Partnerships with community organizations could increase delivery of these more comprehensive EBIs when staff capacity to meet patient volume and FQHCs workflows and visit times are not compatible with delivery. While only one FQHC described working with community partners to deliver EBIs, this was not for a lack of interest among others. There are a wealth of partnership opportunities in the communities where FQHCs are located, but the challenge comes with having the resources and team dedicated to operationalizing these partnerships through collaborative agreements and development of organized bi-directional referral systems [18].

Strengths of this study include its mixed methods approach for developing a comprehensive understanding of EBI implementation — with only one type of data, we

would have an incomplete picture of the state of primary cancer prevention in FQHCs. For instance, qualitative findings revealed the contextual factors that help explain the limited reach of EBIs even when adoption was high. Situating the study within the ISCCCE infrastructure, including qualitative interviews, and engaging FQHC co-authors ensured that the data collected and reported centered the perspectives of FQHC staff. However, the study is not without limitations. We collected data at the height of the COVID-19 pandemic, which led to lower response rates than expected. Although questions asked staff to report on practices prior to the pandemic, answers may have been impacted by changes in FQHC offerings. Reports of penetration are only captured at the clinic level and are based on self-report survey data that could be biased or incomplete and are limited to sites in Massachusetts; future research should compare these estimates to data collected through EHR systems across a broader geographic area and at the provider level (when appropriate) for more precise and generalizable results. Situating the FQHC staff perspectives on the CDC continuum [16, 17], clinical-community linkages were typically viewed as “partnerships” only when they entailed collaboration. In fact, several interviewees reported they did not consider less intensive information exchange and coordination like referral as partnerships. Thus, the future research on clinical-community partnership should use more precise language.

Our findings highlight key considerations for research and practice. First, the study highlighted that FQHCs may not have the infrastructure to deliver nutrition, physical activity, and tobacco cessation EBIs in a sustainable or standardized way to reach all patients, pointing to the importance of exploring creative solutions for internal integration and collaboration with partners in practice. With limited resources for implementation, aiming to align EBIs with existing programs or initiatives could allow for more efficient integration. Coupling interventions together allows for shared resources within the organization. Our findings reveal how critical it is to have a dedicated FQHC team available to manage delivery of EBIs internally and/or manage partnerships for bi-directional collaboration. Integrating metrics and establishing goals for these EBIs into ongoing QI work would allow for a team approach as well as provide additional transparency, ongoing learning, and improvement across the FQHC. Research suggests there are strategies that could improve the practice of referral to external resources for EBIs such as workflows with referral pathways built in, removal of system defaults/alerts that add burden, addition of deferral options for clinicians, and ongoing training and support for sustained referrals and

partnerships [18, 31]. Engaging FQHC and partner staff in the design of these linkages is critical for successful real-world implementation [31]. Successful sustainability of these strategies for delivery of primary cancer prevention EBIs should involve a community of practice with a policy focus to share best practices and collectively advocate for resources needed for feasible implementation in the long term.

Future research should explore the nuances between FQHC-based EBI delivery vs. services offered via referral building on studies of social determinants of health referral adoption [32]. An extension of this implementation science research would be to determine the distinction between offering and actual utilization of cancer prevention EBIs. Our findings and the minimal body of research we build upon [10–13], highlight the importance of increasing evaluation of EBIs and homegrown programs within FQHC and community settings. Such practice-based evidence will help establish better understanding of what strategies are most feasible, accessible, and effective for addressing cancer prevention [33]. Identifying only one FQHC as having strong community linkages points to the need for future research to design and test implementation strategies that foster partnership for delivery of EBIs. For example, our team is currently designing a toolkit for FQHCs to develop community advisory boards to accelerate collaboration, coordination, and outreach for EBI delivery in FQHCs.

Conclusion

Health center adoption of primary cancer prevention EBIs is relatively high in Massachusetts. However, stable staffing and sustainable resources are required to successfully reach all patients. Relying on cyclical funding sources means these essential services can be treated as optional and program churn can impact providers' knowledge of what is available at any given time. FQHCs need support to offer complex EBIs that have more limited adoption and often necessitate adaptation for language and local context. FQHC staff are enthusiastic about the potential of community partnerships to foster improved implementation — defining the range of possibilities for these linkages and providing training and support to build these relationships to support evidence-based prevention will be key to fulfilling that promise.

Abbreviations

CDC	Centers for Disease Control and Prevention
CDSMP	Chronic Disease Self-Management Program
CFIR	Consolidated Framework for Implementation Research
CHW	Community health worker
DPP	Diabetes Prevention Program

DSMP	Diabetes Self-Management Program
EBI	Evidence-based intervention
EHR	Electronic health record
EMR	Electronic medical record
FQHC	Federally qualified health center
HRSA	Health Resources and Services Administration
ISCCCE	Implementation Science Center for Cancer Control Equity
MA	Medical assistant
QI	Quality improvement

Acknowledgements

The study team thanks Dan Gundersen and Ruth Lederman for quantitative data management support. Thanks also to Mass League staff, Susan Dargon-Hart and Leslie Pelton-Cairns, who helped recruit participants. This study would not have been possible without the engagement and diverse insights of FQHC staff across the state of Massachusetts.

Authors' contributions

RL conceived of the study, led the pilot proposal that was part of the ISCCCE P50 grant proposal for funding from the National Cancer Institute, and is the principal investigator of the study. KE led the writing of the ISCCCE P50 grant proposal and is M-PI. RL, SR, RN, JD, and KM contributed to the development of the study design and analysis plan of the study. JD and RL led recruitment along with Mass League partners. RL managed study staff, ensured study compliance, and led meetings. RL, JD, and KM conducted all data management and analysis. CT, CH, and AM contributed to the interpretation of study results. All authors contributed to drafting and approving the final manuscript.

Funding

This study is funded by the National Cancer Institute P50 CA244433-01.

Availability of data and materials

The data collected and analyzed during the current study are available from the corresponding author on reasonable request and will be shared in accordance with Cancer Moonshot funding policies.

Declarations

Ethics approval and consent to participate

This study has been approved by the Harvard Longwood Area Office of Human Research Administration. The Harvard Longwood Area Office of Human Research Administration granted a waiver of documentation of consent for adult FQHC staff participants because the research presents no more than minimal risk to participants and involves no procedures for which written consent is normally required outside of the research context. Verbal consent was collected for qualitative interviews and consent language was built into introductory survey text.

Consent for publication

Consent for including de-identified individual quotations was gathered as part of the interview verbal consenting procedures. The confidentiality section of the consent script read: "The transcript of this interview will be stripped of your name. We will not report your name or company in any published results, but rather use job titles or roles." We followed this approach in this paper and further anonymized data with more generic job titles (e.g., "leader") when titles were deemed too specific and identifiable by the study team.

Competing interests

The authors declare that they have no competing interests.

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Received: 14 February 2023 Accepted: 2 August 2023

Published online: 24 August 2023

References

- Emmons KM, Colditz GA. Realizing the potential of cancer prevention — the role of implementation science. *N Engl J Med*. 2017;376(10):986–90.
- National Health Center Program Uniform Data System (UDS) Awardee Data. Available from: <https://data.hrsa.gov/tools/data-reporting/progr-am-data/national> Cited 1 Feb 2023
- Allen CL, Harris JR, Hannon PA, Parrish AT, Hammerback K, Craft J, et al. Opportunities for improving cancer prevention at federally qualified health centers. *J Cancer Educ*. 2014;29(1):30–7.
- Brewer LC, Woods C, Patel A, Weis J, Jones C, Abbenyi A, et al. Establishing a SARS-CoV-2 (COVID-19) drive-through collection site: a community-based participatory research partnership with a federally qualified health center. *Am J Public Health*. 2021;111(4):658–62.
- Marcus BH, Goldstein MG, Jette A, Simkin-Silverman L, Pinto BM, Milan F, et al. Training physicians to conduct physical activity counseling. *Prev Med*. 1997;26(3):382–8.
- Shorey Fennell B, Cottrell-Daniels C, Hoover DS, Spears CA, Nguyen N, Piñeiro B, et al. The implementation of ask-advise-connect in a federally qualified health center: a mixed methods evaluation using the re-aim framework. *Transl Behav Med*. 2023;ibad007. <https://academic.oup.com/tbm/advance-article-abstract/doi/10.1093/tbm/ibad007/7098040?redirectedFrom=fulltext>.
- Adams SA, Rohweder CL, Leeman J, Friedman DB, Gizlice Z, Vanderpool RC, et al. Use of evidence-based interventions and implementation strategies to increase colorectal cancer screenings in federally qualified health centers. *J Community Health*. 2018;43(6):1044–52.
- Holcomb J, Rajan SS, Ferguson GM, Sun J, Walton GH, Highfield L. Implementation of an evidence-based intervention with safety net clinics to improve mammography appointment adherence among underserved women. *J Cancer Educ*. 2023;38(1):309–18.
- Maxwell AE, DeGross A, Hohl SD, Sharma KP, Sun J, Escoffery C, et al. Evaluating uptake of evidence-based interventions in 355 clinics partnering with the colorectal cancer control program, 2015–2018. *Prev Chronic Dis*. 2022;19(19):E26.
- Fiechtner L, Puente GC, Sharifi M, Block JP, Price S, Marshall R, et al. A community resource map to support clinical-community linkages in a randomized controlled trial of childhood obesity, eastern Massachusetts, 2014–2016. *Prev Chronic Dis*. 2017;6(14):E53.
- Balcázar HG, de Heer H, Rosenthal L, Aguirre M, Flores L, Puentes FA, et al. A promotores de salud intervention to reduce cardiovascular disease risk in a high-risk Hispanic border population, 2005–2008. *Prev Chronic Dis*. 2010;7(2):A28.
- Sequist TD, Taveras EM. Clinic-community linkages for high-value care. *N Engl J Med*. 2014;371(23):2148–50.
- Tossas KY, Reitzel S, Schifano K, Garrett C, Hurt K, Rosado M, et al. Project COALESCE—an example of academic institutions as conveners of community-clinic partnerships to improve cancer screening access. *Int J Environ Res Public Health*. 2022;19(2):957.
- Clinical-Community Linkages [Internet]. [cited 2023 Jun 2]. Available from: <https://www.ahrq.gov/ncepcr/tools/community/index.html>
- Clinical-Community Relationships Measures (CCRM) Atlas. Available from: <https://www.ahrq.gov/prevention/resources/chronic-care/clinical-community-relationships-measures-atlas/index.html> Cited 2 Feb 2023
- Centers for Disease Control and Prevention. Community-clinical linkages for the prevention and control of chronic diseases: a practitioner's guide. Atlanta, GA; 2016. Available from: <https://www.cdc.gov/dhds/pubs/docs/CCL-Practitioners-Guide.pdf> Cited 2 Feb 2023
- Centers for Disease Control and Prevention. Community-clinical linkages: implementing an operational structure with a health equity lens. Atlanta, GA; 2020. Available from: https://www.cdc.gov/dhds/pubs/docs/CCL_Health_Equity_Guide-508.pdf Cited 2 Feb 2023
- Ramanadhan S, Daly J, Lee RM, Kruse GR, Deutsch C. Network-based delivery and sustainment of evidence-based prevention in community-clinical partnerships addressing health equity: a qualitative exploration. *Front Public Health*. 2020;26(8):213.
- Massachusetts League of Community Health Centers: Mission & Role. Available from: <https://www.massleague.org/About/MissionAndRole.php> Cited 2 Feb 2023
- What is a Community Health Center?. NACHC. Available from: <https://www.nachc.org/about/about-our-health-centers/what-is-a-health-center/> Cited 23 Jun 2023
- Creswell JW, Creswell JD. Research design: qualitative, quantitative, and mixed methods approaches. SAGE Publications; 2017;305:1–273.
- O'Cathain A, Murphy E, Nicholl J. The quality of mixed methods studies in health services research. *J Health Serv Res Policy*. 2008;13(2):92–8.
- Proctor E, Silmere H, Raghavan R, Hovmand P, Aarons G, Bunger A, et al. Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda. *Adm Policy Ment Health Ment Health Serv Res*. 2011;38(2):65–76.
- Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implement Sci*. 2009;4(1):50.
- Damschroder LJ, Reardon CM, Widerquist MAO, Lowery J. The updated Consolidated Framework for Implementation Research based on user feedback. *Implement Sci*. 2022;17(1):75.
- The Guide to Community Preventive Services (The Community Guide). 2023. Available from: <https://www.thecommunityguide.org/index.html> Cited 2 Feb 2023
- Clarke V, Braun V. Successful qualitative research : a practical guide for beginners. *Success Qual Res*. 2013;1–400.
- Tracy SJ. Qualitative quality: eight “big-tent” criteria for excellent qualitative research. *Qual Inq*. 2010;16(10):837–51.
- Malterud K, Siersma VD, Guassora AD. Sample size in qualitative interview studies: guided by information power. *Qual Health Res*. 2016;26(13):1753–60.
- DP18–1817 | Diabetes | CDC. 2022. Available from: <https://www.cdc.gov/diabetes/programs/stateandlocal/funded-programs/dp18-1817.html> Cited 2 Feb 2023
- Zehner ME, Kirsch JA, Adsit RT, Gorrilla A, Hayden K, Skora A, Rosenblum M, Baker TB, Fiore MC, McCarthy DE. Electronic health record closed-loop referral (“eReferral”) to a state tobacco quitline: a retrospective case study of primary care implementation challenges and adaptations. *Implement Sci Commun*. 2022;3(1):107.
- Gold R, Bunce A, Cowburn S, Dambrun K, Dearing M, Middendorf M, et al. Adoption of social determinants of health EHR tools by community health centers. *Ann Fam Med*. 2018;16(5):399–407.
- Green LW. Making research relevant: if it is an evidence-based practice, where's the practice-based evidence? *Fam Pract*. 2008;25(suppl_1):i20–4.

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Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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