Barriers and Facilitators to Real-world Implementation of the Diabetes Prevention Program in Large Healthcare Systems: Lifestyle Coach Perspectives

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BACKGROUND: Group-based lifestyle change programs based on the Diabetes Prevention Program (DPP) are associated with clinically significant weight loss and decreases in cardiometabolic risk factors. However, these benefits depend on successful real-world implementation. Studies have examined implementation in community settings, but less is known about integration in healthcare systems, and particularly in large, multi-site systems with the potential for extended reach.

OBJECTIVE: To examine the barriers and facilitators to successful DPP implementation in a large multi-site healthcare system.

DESIGN: Semi-structured interviews, based on the RE-AIM framework, were conducted in person for 30–90 min each.

PARTICIPANTS: Past and present DPP lifestyle coaches in the healthcare system identified using purposive sampling.

APPROACH: Thematic analysis of qualitative data to identify key factors influencing the success of DPP implementation. An iterative consensus process was used to model the relationships among factors.

KEY RESULTS: We conducted 33 interviews across 20 clinic sites serving 12 counties. Participants described six key factors as potential barriers or facilitators to implementation, including (1) Broader Context, including the surrounding physical and sociodemographic context; (2) Institutional Context, including finances, infrastructure, and personnel; (3) Program Provision, including curriculum, administration, cost, goals, and visibility; (4) Recruitment Process, including screening and referrals; (5) Lifestyle Coaches, including their characteristics, behaviors, and morale; and (6) Cohort, including group attrition/retention and interpersonal dynamics. These factors were both highly interconnected in their impact on implementation and widely variable across sites within the healthcare system, as illustrated in our multi-level conceptual framework.

CONCLUSIONS: This study identified key factors that could serve as barriers or facilitators in the implementation of DPP in large healthcare systems, from the perspective of lifestyle coaches. With further examination, the conceptual model presented here may be used for planning and managing the implementation of group-based behavioral interventions in these settings.

KEY WORDS: real-world; Diabetes Prevention Program; implementation; semi-structured interviews.

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INTRODUCTION

The Diabetes Prevention Program (DPP)[1] was a landmark randomized controlled trial (RCT) conducted with 3234 overweight, prediabetic adults in 27 clinical centers across the USA between 1996 and 2001.[2] The trial demonstrated that an intensive, primarily 1:1 lifestyle change program promoting modest weight loss could prevent or delay the onset of diabetes by 58% compared with usual care.[3–6] Following the success of this RCT, group-based lifestyle change programs have been modeled after the DPP intervention to promote efficiency and scalability. RCTs of these group-based DPPs have demonstrated efficacy in promoting weight loss and reducing cardiometabolic risk factors among individuals at high risk for diabetes.[7–12] Given this evidence, in 2010, the U.S. Congress authorized the CDC to establish the National Diabetes Prevention Recognition Program to encourage the expansion of group-based DPP programs.[13, 14]

Factors promoting efficacy in a RCT differ from those required for successful implementation and effectiveness in clinical practice.[15] Accordingly, there has been a growing emphasis on evaluating DPP adaptations in "real-world" settings.[13] Currently, most studies evaluating DPP adaptations have been conducted in non-healthcare community settings.[9, 11, 16, 17] While studies conducted in healthcare settings provide some insight into the potential for implementing DPP within

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routine care, they are limited by their focus on an abbreviated curriculum (≤ 6 months) and use of a single-group design, and/or provide inadequate documentation of adaptations made to the original curriculum.[18–23] Compared with community settings, implementing DPP within healthcare settings could be advantageous by promoting integrated healthcare delivery and leveraging existing infrastructure (e.g., electronic medical records) for program referrals, scheduling, delivery, and documenting outcomes.[20] Accordingly, it is imperative to understand barriers and facilitators to implementing DPPs adaptions within healthcare systems to inform best practices for optimal implementation.

The Evaluation of a Lifestyle Intervention Adopted for Clinical Practice for Diabetes Prevention (ELEVATE-DP) study is a large-scale examination of the implementation of a DPP adaptation within a large healthcare system. The purpose of this paper is to describe the key factors that could serve as barriers or facilitators to implementation of a group-based DPP, as reported by lifestyle coaches (LCs) who facilitate the program. LCs are central to DPP implementation, interfacing directly with program administrators, physicians, and participants. As such, they are uniquely positioned to speak to multiple levels of influence on implementation processes. Herein, we also describe potential interactions between key barriers and facilitators to offer guidance to other large healthcare systems in implementing these programs.

METHODS

Setting and Program

This study was conducted in a large healthcare system in northern California, serving approximately three million patients across 20 state counties.[24] In 2010, the healthcare system implemented a group-based DPP, the Group Lifestyle Balance™ (GLB) program, in three regional affiliates at 20 clinics across 12 counties. Regions differed in underlying sociodemographic characteristics (Fig. 1). The largest region spans seven counties, with an underlying racial/ethnic minority population of 23% Hispanic, 13% Asian, and 8% Black/African American,[25] and a median household income of $73,439.[26] The second region spans five counties, having a larger Asian population (29%)[25] and a higher average household income of $106,489[26]. The smallest region spans three counties, including a larger Hispanic population (42%)[25] and the lowest average household income of $60,170.[26]]–>

The GLB program has a 12-month structured curriculum facilitated by trained LCs.[27, 28] The program is composed of 12 weekly core sessions, followed by 4 biweekly transition sessions, and up to 6 monthly support sessions over the remainder of the year.[27] The clinical goal of the program is to achieve and maintain ≥ 7% weight loss, through healthy eating habits and physical activity.[16, 29] While clinical effectiveness may be a key indicator of successful program implementation, and one we have explored elsewhere,[30, 31] we recognize the continued debate in the implementation sciences literature regarding the multifaceted definition of implementation "success."[32] For the purpose of this analysis, we defined implementation success broadly as the ability to recruit and maintain engaged cohorts of participants in the group-based DPP program.

Data Collection

We utilized purposive sampling to identify current and former LCs employed by the health system, and contacted them by email. All contacted LCs agreed to participate in the study. Two female research associates with advanced training in qualitative research methods (CN and NS) conducted interviews at clinic sites where the program is provided between November 2017 and March 2018. The semi-structured interview guide was developed following a review of the existing literature on the implementation of group-based DPP in a range of settings and was organized using the core concepts of the RE-AIM framework[15] to explore key elements of reach, effectiveness, adoption, implementation, and maintenance. It was pilot tested with a LC who previously provided the program (Appendix 1) and edited accordingly. Interviewers collected information on LC sociodemographics, clinic resources and characteristics, and program participant referral and recruitment processes. LCs were asked about the implementation of the program at their site and the sustainability and evaluation of the program over time. While data saturation[33] was reached before completing all interviews, we continued face-to-face data collection with all available (current and former) LCs because the program has been provided for more than 10 years across multiple sites within this healthcare system. Interviews lasted 30 to 90 min and were audio recorded using encrypted voice recorders and transcribed verbatim. Research associates took notes during the interviews and, when possible, collected program flyers from each clinic site. Fact-based information collected through interviews with LCs was discussed and verified during interviews with program administrators in each of the three regions. Four program administrators were interviewed, using the same interview guide, of whom two are LCs currently providing the program.

Analysis

We conducted a thematic analysis of responses to open-ended questions, using both deductive and inductive techniques to identify key themes.[33] Using Dedoose,[34] we first reviewed the data to apply a set of deductive codes based on the RE-AIM framework and create a preliminary set of inductive codes to capture emergent ideas within and across interviews. Inductive codes were discussed, revised, and organized into a structured codebook. Two coders independently applied the codes to each interview. We then reviewed the data by both deductive and inductive codes to identify key themes within and across codes. Using an iterative consensus process, we organized themes into key factors using a conceptual framework to

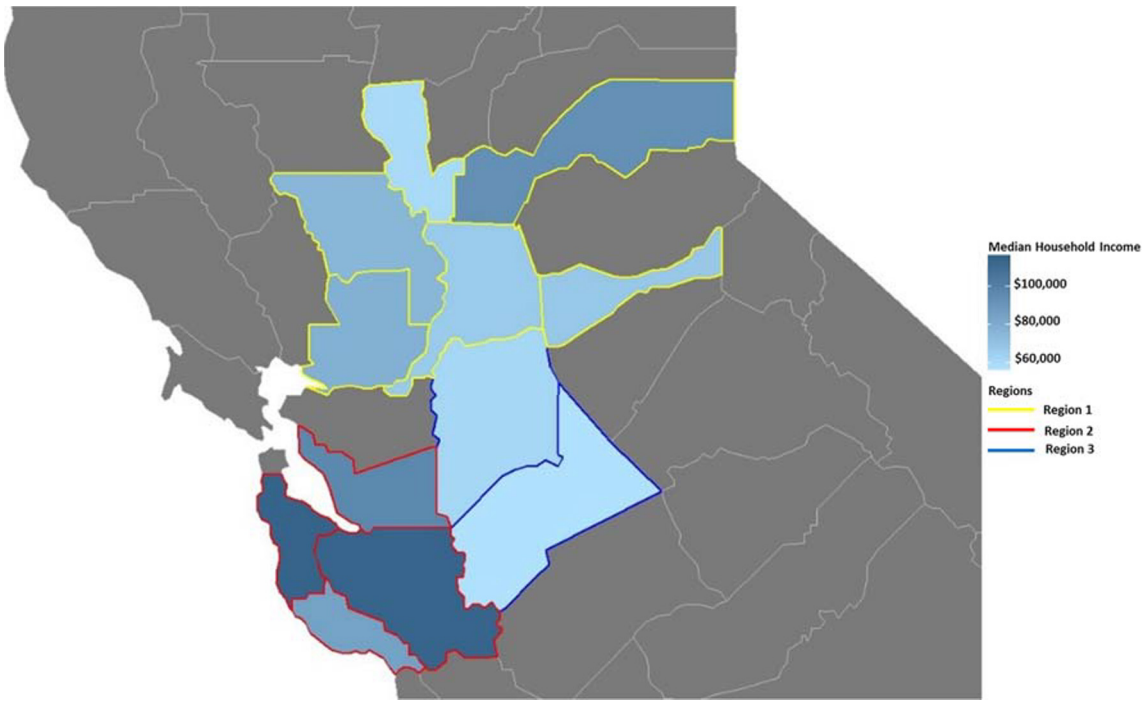

Figure 1 Median household income for regions with GLB clinics (2016). Azar, K.M.J., Nasrallah, C., Szwerinski, N.K., Petersen, J.J., Halley, M.C., Greenwood, D., Romanelli, R.J. Implementation of a group-based diabetes prevention program within a healthcare delivery system. BMC Health Serv Res. 2019;19(1):694. doi: https://doi.org/10.1186/s12913-019-4569-0. The map was developed using 2012–2016 American Community Survey 5 years estimated for 2016 (ACS) for median household income (https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_DP03&src=pt).

illustrate relationships among themes. Finally, we sorted all coded excerpts by their relevant themes and identified exemplary quotes illustrating how each key factor served as a barrier or facilitator to program implementation. Study activities were approved by this healthcare system's Institutional Review Board.

RESULTS

Overview

We conducted 33 interviews with LCs. Participant demographics are summarized in Table 1. We identified six key factors, representing facilitators or barriers to implementation success: (1) Broader Context, (2) Institutional Context; (3) Program Provision; (4) Recruitment Process; (5) Lifestyle Coach; and (6) Cohort. Relationships among these factors are illustrated in Figure 2. Below, we summarize themes within each factor and provide exemplary quotes. Additional representative quotes for each factor and underlying themes are in the appendices (Appendix 2A-F).

Broader Context

"Broader Context" includes two themes: Potential Participant Supply and Accessibility. The first refers to the ways in which sociodemographics of a clinic's underlying population can serve as barriers or facilitators to program success. For example, LCs reported that the general income and education level of the surrounding community shaped participants' interest in and reaction to the program. Because of out-of-pocket program fees, lower income could be a barrier to participation, whereas higher income could be a facilitator. For example, "*We just have a lot of patients…and they probably may be a little more affluent compared to some of our other locations, so they can afford to pay for it*." [LC7-1]. Some LCs reported that patients with more years of formal education reacted negatively to the program because they perceived the content to be too basic, for example, "*We have a high educational level society in this area. A lot of people looked at the curriculum and gave us some negative feedback that a lot of that they know already*." [LC25-2]. Additionally, higher population density made filling classes easier, whereas lower population density made classes more difficult to fill.

The second theme, Accessibility, refers to factors that influence patients' ability to attend program sessions, including clinic location, local traffic patterns, and access to transportation. For example, proximity to large population centers was viewed as a facilitator to program success. As LC14-2 described, at one clinic, "*We have a lot of patients that live on that side of town... It was a good spot for those folks that live in that area*." Conversely, for clinics in more remote areas and/or along a route prone to traffic congestion, LC14-2 described this as a barrier, *"It's kind of far – there's a lot of traffic going from there to here... it's just impossible to think that someone would want to drive this way."* (Appendix 2A).

Table 1 Lifestyle Coach Characteristics

	Region 1	Region 2	Region 3	Overall
	N = 10	*N* = 21	*N* = 2	*N* = 33
Age				
Mean (SD)	43.5 (11.7)	49 (7.4)	54 (17)	47.5 (9.6)
(Min; Max)	(27; 60)	(34; 61)	(42; 66)	(27; 66)
Gender				
Female, *n* (%)	10 (100%)	20 (95.2%)	2 (100%)	32 (97%)
Current occupation/title				
Registered dietitian	9 (90%)	20 (95.2%)	2 (100%)	31 (93.9%)
Certified health/diabetes educator	10 (100%)	17 (81%)	1 (50%)	28 (84.8%)
Registered nurse	1 (10%)	1 (4.8%)	0 (0.0%)	2 (6.1%)
Years working at Sutter Health				
Mean (SD)	4.7 (2.5)	9.8 (6.5)	14.3 (8.1)	8.5 (6.1)
Range (Min; Max)	(1; 8)	(2; 29)	(8.5; 20)	(1; 29)
Years facilitating DPP				
Mean (SD)	2.9 (2.2)	3.2 (1.8)	4 (4.2)	3.1 (2)
Range (Min; Max)	(0.25; 7)	(1; 6)	(1; 7)	(0.25; 7)
Training received				
Formal—University of Pittsburgh	1 (10%)	13 (61.9%)	2 (100%)	18 (51.4%)
Formal—not University of Pittsburgh	0 (0.0%)	1 (4.8%)	0 (0.0%)	1 (2.9%)
Online training	0 (0.0%)	4 (19.1%)	0 (0.0%)	4 (11.4%)
Peer-to-peer	8 (80%)	3 (14.3%)	0 (0.0%)	11 (31.4%)
Don't know	1 (10%)	0 (0.0%)	0 (0.0%)	1 (2.9%)

Institutional Context

"Institutional Context" includes themes of Infrastructure, Personnel, and Financing. Regarding infrastructure, some LCs described access to a suitable meeting space as a facilitator, whereas others described space limitations as a barrier, preventing classes from being scheduled despite participant demand. LCs also described the importance of having access to a well-equipped classroom (e.g., projector, white board). Finally, co-location of the program in a healthcare system was exclusively described as a facilitator to program success, allowing participants to take care of other healthcare needs at the same location. As LC13-2 described, "*It makes it easy because we see patients here already for one-on-one counseling, and so then they knew to come here and meet here; it's conveniently located*."

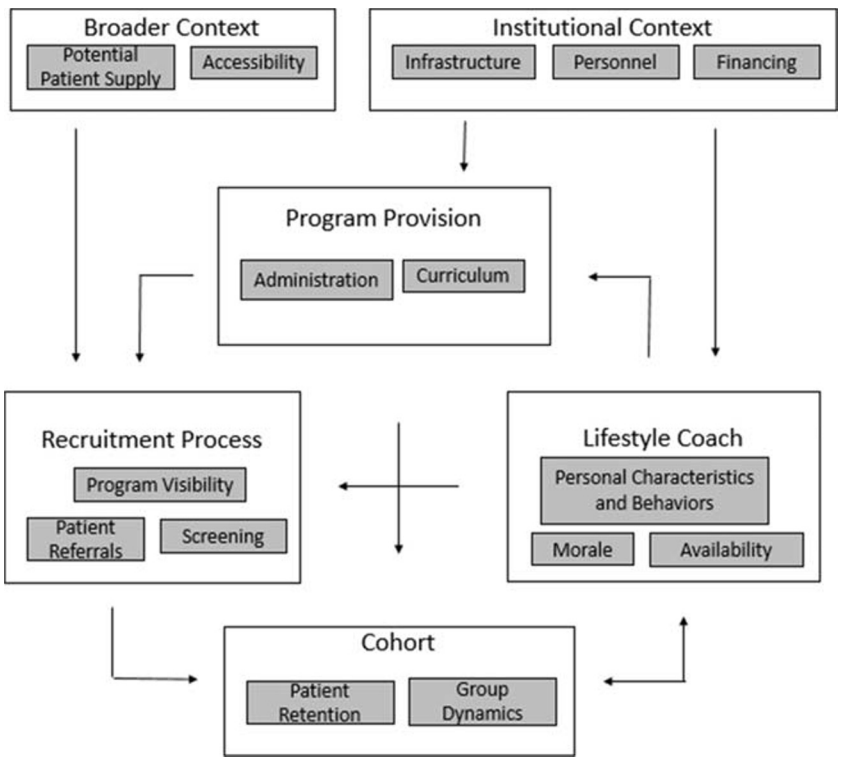

Figure 2 Conceptual framework. Large white boxes represent major key factors, while smaller gray-shaded boxes represent themes within the factors. Arrows represent influence of one factor on another.

Regarding Personnel, LCs reported that having adequate staff to support the program was an essential facilitator, whereas lack of support made it difficult to keep up with program administrative tasks and to take on additional tasks, such as calling participants between sessions to check-in. For example, LC30-2 described how, "*We have a very supportive staff, and if we ask for help we always have that*," while LC2-2 stated, "*We don't have a lot of administration or administrative help. So, things like calling [participants] to remind them…. that can be difficult*." Regarding Financing, resources allocated to the program determined the availability of support staff. In general, LCs expressed financing as a barrier, with no comments from LCs indicating that they felt program financing at their site was sufficient (Appendix 2B).

Program Provision

"Program Provision" includes the characteristics of the DPP group-based program as implemented at a given site. Central themes include the Curriculum and Administration of the program. While some LCs believed the curriculum provided many examples relevant to participants' lives, others felt the examples were not practical or applicable. For example, LC16-1 states, "*I think the lessons are very applicable...what we learned in class applies to their own life*." Conversely, LC23-2 describes how, "*Each session starts with a story of someone who has diabetes, and a lot of people in the class don't have diabetes or pre-diabetes, so it's more for weight loss than it is for pre-diabetes, at least [for] most of my patients*." The focus on goal-setting in the curriculum also was viewed as either a positive organizing characteristic that helped to motivate patients or as a barrier to patient engagement and retention in the program, such that the programmatic goals for weight loss were either too ambitious or not ambitious enough depending on an individual's goals.

The theme of Administration was addressed by the LCs as an important contributor to implementation success. Finding the right time of day to provide program sessions that worked for participants was identified as critical to patient engagement. LCs also identified the frequency of class offerings as an important facilitator, particularly in the post-core phase of the program. LCs expressed varying opinions regarding the length of the curriculum. For example, LC13-2 expressed, "*I think that people lose motivation after the first six months… the sessions are provided once per month*." On the other hand, LC28-2 felt that, "*Patients were looking for a longer-term class instead of just one-on-one, one or two sessions, a little more structured program*."

Finally, LCs identified high cost and lack of insurance coverage as barriers to participation in the program, whereas others highlighted insurance coverage as a facilitator to recruitment. For example, LC9-1 described how, in her county, "*Our Medi-Cal has really good coverage for [group DPP]. There's no out-of-pocket cost to the patient*," while LC2-2 stated, "*It's very frustrating…the challenges are I think cost…we cannot get it covered by anyone.*" Relatedly, some LCs reported that having participants pay for the program, particularly upfront, increased their motivation to attend sessions (Appendix 2C).

Recruitment Process

"Recruitment Process" refers to the methods and procedures used to identify and recruit participants. This includes three themes: Program Visibility, Patient Referrals, and Screening. Program Visibility is driven by advertising to the broader patient population (face-to-face or flyers) and through other types of educational classes provided at the clinic. However, advertising too broadly—for example online—was considered counterproductive, resulting in many patients applying who were considered a poor fit for the program. LCs were frustrated by lack of time available to promote the class to both patients and physicians.

Physician referrals are the primary way in which patients are recruited to the program. Many LCs described this as a barrier to participant recruitment, and they described their efforts to inform physicians about the program as critical to its sustainability. As LC12-1 described, "*We don't do a very good job of pushing the classes. We don't have time for that and physicians probably don't even know about the classes*." LCs perceived physicians as not referring to the program because they lack knowledge about the program and/or the time (e.g., "*It falls off their radar when they're managing everything else*" [LC9–1]), and not necessarily a willingness refer.

Finally, the screening process is vital, as improper or lack of screening could undermine group dynamics and jeopardize program success. Program participant screening is inconsistent across clinic sites. A majority of LCs reported not using screening tools. Some used a pre-assessment questionnaire to screen for specific eligibility criteria, including patients' physical health (e.g., prediabetes), expectations, readiness to change, weight loss goals, and comfort with group settings. This pre-assessment questionnaire was also used to identify ineligible patients (e.g., those with physical limitations, such as inability to move or exercise, or mental health problems, such as eating disorders and depression). As LC25-2 described, "*Doing pre-assessments with everybody to make sure they're good group members and that they didn't have any other disordered eating behaviors. Those are the main challenges, but we still face those*." LCs perceived the screening process as essential to ensuring that individuals in the cohort were the right fit for the group-based format. The impact of screening on cohort success is discussed further in the "Cohort" section (Appendix 2D).

Lifestyle Coach

The LCs themselves are instrumental to successful implementation, with themes including the Availability of LCs to facilitate the program, an individual LC's Personal Characteristics

and Behaviors, and overall Morale. Specifically, LCs reported that the availability of sufficiently trained LCs with the time to run the program was critical. They described multiple cases in which lack of LC availability led to the program being put on hold or shut down altogether, for example, "*We had some changes in my schedule…and I am not able to work the evening hours, and we don't have another [LC] who's trained to do it, so we did not offer it at this site this year.*" [LC28-2].

LCs also identified personal characteristics and behaviors as vital. They described the importance of familiarizing oneself with the curriculum and supplementing the curriculum to meet a cohort's particular interests. Additionally, they described their efforts to provide individual attention between sessions for all participants to maintain motivation. LCs also described the importance of being an engaging group leader to facilitate patient involvement. However, LCs also reported that behaviors that made the classes successful also could be barriers to long-term program sustainability if they were not allotted sufficient time to do this work, including developing supplemental materials, reviewing patients' food logs and weekly physical activity, and other administrative tasks.

The workload and time constraints also affected the LCs' morale. If a LC was excited and motivated by his or her current cohort, s/he was more likely to deliver the program successfully, whereas a LC who was burnt out or challenged by a particular cohort or participant was unlikely to successfully provide the program or was at risk leaving the position, leading to LC turnover. LC14-2 summarizes these issues: "*It's tough because…we're invested in our patients. So you take on 12 new patients long-term, it's like you're invested in them and it's an emotional kind of thing. Maybe if…all I did was teach [group DPP] classes I can do it. But to do that in other elements of my job personally, I just get burnt out.*" (Appendix 2E).

Cohort

The "Cohort" is defined as a single group of participants in a specific cycle of the program, and includes two themes: Patient Retention and Group Dynamics. Patient Retention was described as playing a key role in a participant's success or failure in the program. For example, LC7-1 explained, "*The more sessions they attend, the better…they stay engaged and ask questions if they don't understand things.*" While participant engagement with the group was considered key to success, the group could also serve to discourage those who return after an absence. LC3-2 states, "*If they're not doing well, then they're embarrassed, and they don't come back.*"

Group Dynamics of the cohort are important for the learning environment and help motivate participants to attend. Yet, when a cohort contains participants who are a poor fit for the group-based nature of the program (either due to their personality or their specific weight loss needs), it can be challenging for the entire cohort, including the LC. Indeed, LCs described cases in which the cohort as a whole did not develop a good rapport, despite the LC's efforts (e.g., "*You do get a bum class once in a while…Where you're just like, 'Ugh. No one's losing weight! This is awful!'*" [LC15–2]), and other cases where group dynamics were excellent and provided all members with support (e.g., "*They learned from one another. They seemed to really learn and to keep each other's morale up*" [LC29–2]) (Appendix 2F).

The Interconnectedness of Barriers and Facilitators

A central aspect of the analysis was the interconnectedness among the six key factors, as illustrated in the multi-level framework in Figure 2, drawing from key concepts in RE-AIM[15] and other existing implementation frameworks.[32, 35, 36] These relationships also are referenced throughout in the exemplary quotes provided in Appendix 2 Tables 2A-F.

The Broader Context influences the Recruitment Process, as LCs expressed how a large population of eligible, potential participants could facilitate recruitment. The Institutional Context impacts both Program Provision and the LCs, as LCs noted that lack of space, administrative support, and/or sufficient allocation of their own time for the program directly challenges the sustainability of the program. LCs also described ways in which the Program Provision, including costs and scheduling, influence the Recruitment Process.

LCs described their own direct influence on many aspects of Program Provision, including setting the schedule, supplementing curriculum information, and leading class sessions. LCs also expressed the effect they had on the Recruitment Process and on each Cohort. LCs' direct efforts to engage physicians for referrals and to identify eligible patients affected Recruitment Process, while their ability to successfully apply appropriate screening criteria was essential in shaping a successful Cohort. Additionally, the Cohort, through adherence to program recommendations, participation in group discussions, and success in meeting goals, in turn, affected the morale of LCs.

Finally, the Recruitment Process also directly affected the Cohort. Program visibility, frequency of referrals, and specific criteria used in the screening process, together, shaped the Cohort and its dynamics. Consequently, challenges or success in the Recruitment Process may affect the Cohort's success.

DISCUSSION

Our study reveals six key factors that are potential barriers or facilitators to implementation of group-based DPP in a large healthcare system. Based on these results, we propose a multi-level conceptual framework, mapping the hypothesized relationships among key factors. Our results demonstrate that successful implementation requires the recognition of unique barriers and facilitators encountered at individual sites within a large healthcare system. Importantly, these findings provide a number of practical lessons, listed in Table 2, which could

Table 2 Practical Recommendations by Key Factor

Key factor	Practical recommendations for implementation
Broader Context	Assess size and sociodemographic characteristics of potential participant population prior to implementation Plan location of programing to maximize accessibility, taking into consideration location of population centers and relevant local traffic patterns
Institutional Context	Secure, tangible and concrete leadership support as well as institutional commitment Identify champions among clinical and administrative leadership Budget for sufficient personnel resources, accounting for session planning and patient follow-up between sessions Ensure sufficient and appropriate space is available to minimize burden and maximize comfort for patients and LCs
Program Provision	Minimize costs and maximize insurance coverage for the patient whenever possible Assess appropriateness of curriculum relative to the potential participants' characteristics and goals (e.g., diabetes prevention vs. weight loss)
Recruitment Process	Plan and streamline referral process to avoid physician burnout and backlog Develop and implement standardized screening procedures to ensure program-patient fit
Lifestyle Coach	Consider extent to which LCs will be encouraged or discouraged from making adaptation to the curriculum, and under what circumstances Document any adaptations or changes made for future evaluation Regularly assess LCs for burnout
Cohort	Build in processes for patient feedback and revision of the institutional context (including personnel support), program provision, recruitment process, and LC's approach based this feedback

inform implementation of group-based lifestyle programs in other healthcare systems across the nation. System-wide implementation may be a goal of a healthcare system; however, success of the program will depend on addressing the needs and resources at each clinic site.

Our results also demonstrate that when implementing a group-based DPP adaptation within a large healthcare system, local program administrators and LCs must be given the flexibility to adapt the program to address challenges specific to their region and/or clinic. Moreover, clinic sites require sufficient institutional support for the program to be responsive to the unique needs of their patient population. That said, adaptations made to address local needs should be balanced with efforts to maintain program fidelity across all sites.

Further, recognition of the interconnectedness of the key factors shaping implementation is key to anticipating potential barriers, harnessing potential resources (i.e., facilitators), and correctly identifying the true source of problems, should they arise, in the implementation process. Our conceptual model highlights the interconnectedness of key factors and multiple different levels of influence, each which could serve as a critical facilitator or barrier to implementation success. In the current literature on factors affecting implementation of health interventions, considerable heterogeneity exists in the key factors highlighted in implementation science frameworks. A recent systematic review [34] found that individual provider and organizational factors are the constructs most often assessed by implementation studies, while structural-level and patient-level factors were least likely to be examined. In recent years some implementation frameworks have posited multi-level constructs;[15, 37, 38] however even highly comprehensive multi-level frameworks[35, 39] omitted factors directly related to patients.[34]

Without taking the full context into account, interventions intended to improve implementation could not address only one piece of the process without addressing all root causes. While our framework draws on concepts found in other key implementation models in the literature,[15, 32, 36, 39] it is novel in its integration of ecological, organizational, programmatic, interpersonal, and patient-level factors, including the sociodemographic characteristics of the potential participant population, the importance of the screening process in identifying appropriate participants, and the interpersonal dynamics of the cohort itself. In practice, our conceptual framework could be used in implementation planning to anticipate barriers and facilitators in advance, as a tool for identifying root causes of challenges in the initial implementation process, and/or as a model for evaluation. If an upstream factor is functioning as a barrier, this could in turn impact all downstream factors and implementation success overall. Addressing this impasse requires the identification of primary causes and attending to barriers at all levels. For example, focusing on additional training of LCs as a strategy to improve implementation could result in some success, but this would not address issues of provision of resources or patient demand. Future studies should evaluate the relationships among factors identified in this conceptual model using additional methods. With further examination, this model could provide a roadmap for planning new interventions, anticipating potential barriers, and increasing the likelihood of successfully implementing a DPP program in a large healthcare organization.

Limitations

We report perspectives from LCs providing the program and several program administrators, but do not have perspectives from others (e.g., physicians, patients), who may have different opinions. The implementation of this program at this system has been underway for 10 years, which presents a challenge in terms of parsing contemporary from historical issues, the latter of which might have been resolved. Further, while we draw data from 20 sites, there could be unique aspects of this program within the larger health system's organization that are not generalizable to other large healthcare systems that rely, for example, on different payment structures. Finally, because this paper focuses on facilitators and barriers to implementation, we did not address how these factors affect patient outcomes. Future analyses are designed to address these issues.

Conclusions

The integration of group-based DPP adaptations into large healthcare systems has the potential to dramatically increase

access to a benchmark program for diabetes prevention in the USA. This study identified key factors that could serve as barriers or facilitators in the implementation of DPP in large healthcare systems, from the perspective of lifestyle coaches. With further examination, the conceptual model presented here may be used for planning and managing the implementation of group-based behavioral interventions in these settings.

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Data Availability *The dataset, which includes participants' transcripts, is not publicly available due to confidentiality policies.*

Compliance with Ethical Standards:

Conflict of Interest: *The authors declare that they do not have a conflict of interest.*

Consent for Publication: *All participants provided written consent before participating in the study, which included consent to publish anonymous quotes from individual participants.*

Disclaimer: *This was an investigator-initiated study by Sutter Health Research. No sponsor or funding source had a role in the design or conduct of the study; collection, management, analysis, or interpretation of the data; or preparation, review, or approval of the manuscript.*

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