

Inner and outer setting factors that influence the implementation of the National Diabetes Prevention Program (National DPP) using the Consolidated Framework for Implementation Research (CFIR): A Qualitative Study

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Abstract

Background: Scaling evidence-based interventions is key to impacting population health. The National DPP lifestyle change program is one such intervention that has been scaled across the United States over the past 20 years, however enrollment is an ongoing challenge. Furthermore, little is known about which organizations are most successful with program delivery, enrollment, and scaling. This study aims to understand more about the internal and external organization factors that impact program implementation and reach.

Methods: Between August 2020 and January 2021, data were collected through semi-structured key informant interviews with 30 National DPP delivery organization implementers. This study uses a qualitative cross-case construct rating methodology to assess which Consolidated Framework for Implementation Research (CFIR) *Inner* and *Outer Setting* constructs contributed (both in valence and magnitude) to the organization's current level of implementation reach (measured by average participant enrollment per year). A construct by case matrix was created with ratings for each CFIR construct by interviewee and grouped by implementation reach level.

Results: Across the 16 inner and outer setting constructs and subconstructs, the interviewees in the higher reach group provided stronger (+2) and more positive examples related to implementation and enrollment of the program, while the lower reach groups reported stronger (-2) and more negative examples across rated constructs. Four inner setting constructs/subconstructs (structural characteristics, compatibility, goals & feedback, and leadership engagement) were identified as "distinguishing" based on the difference between groups by average rating (± 5 difference between levels), the examination of the number of extreme (+2 or -2) ratings within levels, and the thematic analysis of the content discussed.

No outer setting constructs were distinguishing. Four constructs/subconstructs (incentives & rewards, learning climate, access to knowledge & information, and patient needs & resources) were not discussed in relation to implementation reach sufficiently for the rating analysis.

Conclusions: Our study identified a number of influential CFIR constructs and their impact on National DPP implementation reach. These findings can be leveraged to improve efforts in recruiting and assisting delivery organizations to increase the reach and scale of the National DPP as well as other evidence-based interventions.

Contributions To The Literature

- A large amount of resources have been dedicated to scaling up the CDC's National DPP lifestyle change program, however enrollment (reach) is an ongoing challenge.
- This is one of only a few implementation research studies of the National DPP focused on the organization level that use the CFIR construct rating qualitative methodology to explore the national implementation of this program.

- These results have broad application to understand how best to assist organizations to adopt, deliver, and scale evidence-based programs like the National DPP.
- This study builds upon CFIR research using this analysis approach and could facilitate comparisons across studies.

Background

According to 2020 data, the Centers for Disease Control and Prevention (CDC) has reported that 96 million adults (38% of the adult population) in the U.S. have prediabetes, a condition that indicates a high risk, and progression to, type 2 diabetes [1]. The National DPP lifestyle change program is an evidence-based, year-long intervention with 22 sessions led by lifestyle coaches designed to prevent the progression to diabetes in people with prediabetes [2–4]. Since its inception in 2010 the National DPP has made great strides in raising awareness for and accessibility to its evidence-based lifestyle change program for people with prediabetes including establishing the program as a covered benefit for Medicare and Medicaid beneficiaries [3, 5]. However, program reach, the number or proportion of individuals participating in program, is lower than hoped. Approximately 2,000 organizations of various types, sizes, and settings currently deliver the program across all 50 states and US territories [6, 7], but in 2017, the CDC reported that only 0.04% of the U.S. adults with prediabetes had been reached in the first 4 years of the National DPP implementation [8, 9]. When efficacious programs (like the National DPP) can reach a large number of individuals, population impact occurs [10–13]. However, while organizations are adopting the program and expanding financial coverage for participants, enrollment or reach remains a challenge and a key focus for stakeholders [14–16].

Understanding factors related to adoption, implementation, and reach of the National DPP at the organizational level is critical to scaling the program. To date, research and evaluation of the National DPP has largely focused on participant level outcomes [5, 8, 17]. These show the vast majority of participants are female (around 80%), 45 years or older, and with a prediabetes status determined by blood-based test [8, 18]. Other studies of program participants identified increasing prediabetes risk perception, health care professional referral and communication, and insurance coverage as potential key focal areas to grow participant enrollment [19]. Organization level evaluations have explored specific implementation strategies (referrals, partner networks, adaptation of materials, etc.) and have shown that use of incentives and healthcare provider-based referrals are promising practices to increase enrollment and participation [17, 20]. However, these studies focus on limited organizational characteristics, such as type and location (e.g. state), in their analyses.

In addition to intervention characteristics and program participants, other critical contextual factors internal and external to organizations may impact implementation outcomes. Chaudoir, Dugan, and Barr refer to these as organization (internal) and structural (external) level causal factors in their “Multi-Level Framework Predicting Implementation Outcomes” [21]. Further, an understanding of organization characteristics (type, size, location, etc.) and factors within and surrounding an organization that influence the delivery of programs may be useful in developing strategies for recruiting new organizations

and supporting current delivery. Thus, there is a need for in-depth and rigorous examination of organization- and structural-level causal factors and the ways they impact the implementation success of the National DPP.

This study aims to fill this gap by applying the Consolidated Framework for Implementation Research (CFIR) to examine the possible role these causal factors impact implementation. Over the past 12 years, CFIR, a metatheory comprised of constructs associated with implementation, has been increasingly utilized in public health research to understand diverse aspects of implementation processes and outcomes [22–24]. Within diabetes prevention and management, researchers most commonly have used CFIR to examine facilitators and barriers to program implementation [25–27]. For example, Wilcox et al. (2020) used CFIR to identify predictive constructs with implementation outcomes for a cultural adaptation of the National DPP for African-American Churches in the South [28]. To our knowledge, CFIR has not been used to examine the National DPP across organizations.

CFIR contains five domains with 39 constructs and subconstructs related to implementation [23]. Two of the five domains, the *Inner Setting* and *Outer Setting*, focus on internal organization-level and external structural-level factors. The CFIR constructs listed in the *Inner Setting* domain aim to capture the complexity within the organization related to implementation. These include constructs such as an organization's structural characteristics, culture, and readiness for implementation. The *Outer Setting* constructs provide insight into the greater environments and external context which constrain organizations or facilitate their ability to carry out the intervention. These include constructs such as cosmopolitanism, peer pressure, and external policies and incentives.

To contribute to the current knowledge of the National DPP, this study will explore the organizational- and structural-level factors (operationalized through the CFIR *Inner* and *Outer Setting* constructs) to understand relationships between these constructs and program implementation and enrollment (reach). Insights gained can inform strategies to expand the capacity of delivery organizations to increase engagement in the program and scale the program up and out nationally [5, 15, 16].

Methods

In 2019, Emory Center's Diabetes Technical Assistance and Training Center (DTTAC) was funded to study the role of Lifestyle Coaches in the implementation of the National DPP through the CDC's Division of Diabetes Translation's Innovations to Grow Enrollment and Retention (InGEAR) project. Over the last 10 years, DTTAC has directly trained over 5,000 lifestyle coaches representing over 2000 organizations across all 50 states. The National DPP implementers included in this study participated in Emory's DTTAC Lifestyle Coach and/or Master Trainer Select training programs and/or subscribed to the center's resources.

This study uses a qualitative cross-case construct rating methodology to assess which CFIR constructs contributed both in valence (positive or negative influence) and magnitude (combined influence) to the organization's current level of implementation reach (measured by average participant enrollment per

year). Between August 2020 and January 2021, data were collected through semi-structured key informant interviews with 30 National DPP delivery organization implementers (see sampling for selection criteria and procedures). This study was reviewed and determined to be exempt by the Emory University Institutional Review Board (STUDY00000658).

Sampling. DTTAC provided a list of National DPP implementers (n = 239) and their basic organization characteristics (organization type, location, level of implementation, etc.) that was generated from a call for study participation via the DTTAC mailing list and newsletter. Potential participants were stratified into groups of higher (> 85 program participants), medium (26–85 program participants), and lower (\leq 25 program participants) reach organizations based on total enrollment to date. Participant enrollment data from the CDC and DTTAC's records were used to create the higher, medium, and lower tertile ranges.

We purposively selected participants to reflect the diversity of implementers by organization type, length of program delivery, urbanicity, populations served, and size (Table 2). Due to variation in these organization characteristics, we planned to interview at least 30 participants. Thirty-nine National DPP implementers across the three organization implementation levels were selected; nine either did not respond to the invitation or declined to participate. The final sample included 30 National DPP organization key informants located in 24 states and territories. During analysis we found that after conducting the 30 interviews we had reached saturation, or the point at which no new information relating to the CFIR constructs was identified in each of the groups. Organization staff reported a range of 5 to 600 enrolled participants to date. In the analysis, to control for length of delivery, enrollment numbers were divided by years of delivery to produce the average enrollment per year for each organization. The interviewees were re-stratified by enrolled participants per year into high (36–150), medium (17–35), and low (5–16) reach levels (Table 2).

Instruments. We developed a semi-structured interview guide with questions adapted from the CFIR guide (CFIR Research Team) and studies using similar methods [29, 30]. Open-ended question topics included interviewee training and background, program implementation success in terms of reach and sustainability, and 16 questions with suggested probes for each of the inner and outer setting CFIR constructs and sub-constructs (see Additional Table 1 for interview guide). Questions were posed in a way to encourage discussion about how each construct or subconstruct has positively or negatively impacted program implementation, particularly related to the outcome of reach (enrollment numbers). For example, the culture construct question asked, "In what ways do you think your organization's culture (general beliefs, values, assumptions that people embrace) affect the implementation of the National DPP?" The probe following asked, "How does the organization's culture impact enrollment of participants in particular?"

Data Collection. Interviewees were invited to participate in a 60-minute interview using Emory's secure Zoom videoconferencing account; verbal consent and permission to audio-record were obtained prior to initiating the interview. Interviews were conducted from August 2020 to January 2021. All recordings were

transcribed by a third party, quality checked, deidentified, and uploaded into MAXQDA 2020 [31] for coding and analysis.

Interviewee Descriptive Statistics. Interviewee organizations were categorized into one of five organization types: healthcare/hospitals, community-based healthcare (community health centers, federally qualified health centers, Indian Health Service, etc.) community-based organizations (YMCAs, local nonprofits, etc.), government agencies (state/local health departments), and other (health plans, insurers, worksite wellness programs, universities, private businesses). Descriptive statistics were run on organization characteristics including years delivering the National DPP, size based on the approximate number of people served across the entire organization annually, CDC Diabetes Prevention Recognition Program (DPRP) status for the National DPP (Full vs Pending/Preliminary status), location of the organization by US region, and race/ethnicity of the National DPP participant population at the organization (Table 2).

Coding Interviews. A deductive codebook of CFIR constructs and interview questions was developed; in vivo (inductive) codes were added as relevant topics were identified during initial coding. The codebook was tested for clarity and relevancy and refined prior to coding. Coders (LM and OM) independently coded each transcript and conducted intercoder agreement, discussing and reaching consensus where there were discrepancies in coding. Double coding and intercoder agreement was performed on one third of the transcripts (n = 10) to ensure intercoder reliability [32, 33].

Construct Rating. We used a qualitative construct rating analysis approach from Damschroder and Lowery (2013) to rate CFIR constructs related to implementation outcomes [30]. Applying this methodology, we identified distinguishing constructs among organizations with different levels of implementation reach and identified themes within those constructs that contribute to those differences.

Coded segments for each CFIR construct were exported, sorted by organization, grouped by implementation reach level, and reviewed independently by both analysts (LM and OM). All segments were assessed by construct for valence (positive or negative influence on implementation) using construct rating criteria (Table 1). Segments were scored with a -2 to + 2, a 5-point bi-polar scale; where there was more than one segment for an interview, the analysts discussed each segment and assigned an average score. Interviews that had positive statements about a construct's influence on implementation were scored with a 1 or 2 depending on the level of detail and impact on enrollment. Likewise, interviews with negative examples were scored with a -1 or -2. An equal mix of positive and negative influences received a score of zero.

Coders met weekly to discuss ratings and consensual validation was achieved through a process of deliberation and consensus. Since our sample had only one interviewee per organization, we adapted Damschroder and Lowery's methods to remove the synthesis of findings among multiple interviewees at the organization level. Once all transcripts were rated across all 16 CFIR constructs and subconstructs (a case-oriented approach, because ratings were applied within each case), both coders examined them across cases by construct (the variable-oriented approach, since each construct is compared across cases).

Analysis and Interpretation. A construct by case matrix was created that listed the ratings for each CFIR construct by interviewee and grouped by implementation reach level (Fig. 1). This stage of the analysis focused on discerning patterns across the high, medium, and low implementation reach groups. Average rating scores were calculated for each construct by reach level to identify patterns. Interviewees within each reach level were also sorted by organization type and given a summative average rating across all of the constructs to more easily identify rating differences.

Positive and negative extremes were discussed across all constructs and interviewees at every level. Four of the constructs/subconstructs were identified as *distinguishing* based on the difference between groups by average rating (generally if the difference was over $\pm .5$ between levels), the examination of the number of extreme (+ 2 or -2) ratings within levels, and through thematic analysis based on the content discussed.

Results

Organization Characteristics. Program staff from 30 unique implementing organizations were interviewed. CDC-recognized National DPP organizations designate Program Coordinators who supervise daily operations of the program, provide guidance and support to lifestyle coaches, and monitor and submit all program data to the CDC. Of these, all but one were Program Coordinators and 26 served in a combination of roles as Program Coordinators, Lifestyle Coaches, and/or Master Trainers for the National DPP.

About one third (9) of interviewees were from healthcare or hospital settings, followed by a near equal number from community-based healthcare (5, 17%), and other types of organizations (6, 20%) (Table 2). The majority of organizations were in the initial (13, 43%) or intermediate (13, 43%) phases of delivery and held Pending/Preliminary CDC DPRP status (20, 67%). There was consistent representation across the organization size categories and geographic regions. The vast majority have National DPP participants from White (80%), Black (70%), and Hispanic/Latino (63%) racial and ethnic backgrounds. Fewer organizations reported serving Alaska Native/Native American (27%) and Asian/Pacific Islander (27%) participants in their programs. These racial and ethnic demographics reflect national-level participant data, where White, Black and Hispanic participants make up the majority of enrollees [8].

Representation across levels of implementation reach by organization type was also fairly consistent. In terms of years delivering the program, those in the higher reach group had delivered the program for the longest number of years, while the medium and lower reach groups included many organizations in the initial delivery phase (0–2 years). The higher reach group also tended to include those from larger organizations and more often with full DPRP recognition status.

CFIR Construct Findings

The Construct Rating Matrix provides the CFIR ratings for each inner and outer setting construct by organization interviewee grouped by implementation reach level (Fig. 1). Overall, the majority of interviewees were net positive in terms of their implementation examples across all of the constructs (Fig. 1 Interviewee Average Score). However, the interviewees in the higher reach group provided stronger (+2) and more instances of positive examples across all constructs related to implementation and enrollment, while the low reach group stronger (-2) and more instances of negative examples across all rated constructs. Four constructs/subconstructs (incentives & rewards, learning climate, access to knowledge & information, and patient needs & resources) were not discussed in relation to implementation reach sufficiently in the interviews to conduct the construct rating and were omitted from the matrix. The following four *inner setting* constructs/subconstructs were identified as distinguishing: structural characteristics, compatibility, goals & feedback, leadership engagement. No *outer setting* constructs were distinguishing. The following results will highlight these constructs with discussion of the thematic analysis of the coded segments and supporting quotes.

The Structural Characteristics *construct is comprised of many traditional measures of context and organization characteristics (organization size, type, location, etc.).* Among the interviewees, *Structural Characteristics* often involved discussions of organization infrastructure for the program (physical space, staff size, etc.). As this construct contains a multitude of dimensions, interviewees frequently described both positive and negative examples, resulting in many mixed ratings. This construct appears to distinguish the high and medium reach level organizations from the low reach group. In the medium and high reach levels, interviewees often discussed both the benefits and challenges of implementation related to structural characteristics. For example, this interviewee highlights how the size of the organization can both help and hinder National DPP implementation:

“So, we're a pretty big organization. [...] There are pros and cons to everything. I think our size is a pro just because we have a large population, like a patient population, in which to draw from. [...] One thing that can make it a barrier, though, as far as trying to get referrals and spread the word is when it's a huge organization and there's a lot going on, sometimes it is hard to get the message across when there's just so much other stuff going on.” Interviewee M2, Medium Reach, Healthcare

However, among the low reach group, the vast majority of the coded *Structural Characteristics* segments were rated negatively. These interviewees reported difficulties with limited infrastructure for the program, lack of staff and staff time, challenges with developing referral systems, and administrative/bureaucratic hurdles due to their organization type. For example, this interviewee from a local government agency shared the challenges involved with applying for and implementing grants for the program:

“[...] for us to start applying for a grant, we somewhere in our process have to involve the city council. And in addition to that process once the city council okays on us applying for the grant, we receive the grant. Now we have to implement that grant into the city's budget. So that becomes really tedious and becomes a really huge pain as opposed to a nonprofit.” Interviewee L9, Low Reach, Government Agency

Across all cases, the most salient dimension of the *Structural Characteristics* construct was organization type and how it impacted their reach to populations, available infrastructure/resources, administrative

processes, and reputation in the community.

Compatibility is a subconstruct of *Implementation Climate* and relates to how the intervention fits within the organization and its existing workflows, systems, and services. High and medium reach groups more often yielded strong positive examples of *Compatibility* impacting implementation, compared to those in the low reach group. Interviewees describing positive examples of the influence of *Compatibility* on implementation often mentioned that their organization offered complementary programs to the National DPP (e.g., diabetes self-management, nutrition education, fitness classes, etc.). This allowed them to more easily adopt and implement the National DPP. As described by one high reach organization interviewee (Interviewee H8, High Reach, Health Insurer & Employer), "it's a nice complement and it nicely rounds out the services that we offer."

In the strongest positive examples, interviewees shared how other programs within their organization referred program participants to the National DPP and vice versa. They also gave positive examples of how the National DPP was embedded in their workflows and systems via the electronic health records (EHR) or other referral processes, all of which supported enrollment efforts. Two high reach group interviewees described challenges introducing the National DPP into their organization systems, but by taking time to educate key leaders and staff about the program, they were able to overcome those *Compatibility* challenges and succeed with implementation.

Conversely, in strong negative examples of *Compatibility*, interviewees struggling to implement the National DPP described how it was different from the typical services and programs provided by their organization and was not embedded into their current systems.

"We have to force it to fit. Do I feel like it – I feel like it needs to be a part of the entire process, like if someone's coming in for one particular service they should be screened for being at risk of having Type 2 Diabetes. And we've done it, but it's only been during specific times and then it goes away. [...] So I would love to see it more integrated into all of the programs." – Interviewee L7, Low Reach, Government Agency
Across all reach levels there were some additional themes related to *Compatibility*. A commonly voiced complaint was how time consuming and burdensome the data reporting to the CDC DPRP is compared to other evidence-based interventions implemented at their organizations. Lastly, in a few cases, interviewees shared that their organization had a large number of chronic disease programs and this created challenges for staff to remember to refer to the National DPP. While complementary programs was a strength for some, it was also possible for the National DPP to get buried and forgotten when so many programs were available.

Goals & Feedback is a subconstruct of *Implementation Climate* and refers to the degree to which goals are clearly communicated, acted upon, and fed back to staff, as well as the alignment of that feedback with goals. We asked interviewees to discuss how enrollment goals (target number of participants to recruit each year) set by them or leaders at their organization impacted their implementation efforts. This construct was distinguishing among reach groups by the presence and communication of enrollment goals. The majority of the high implementation organizations (n = 9, 82%) had formal enrollment goals

set by organization leadership or the program coordinator. In comparison, only four (40%) of the medium and three (33%) low reach interviewees reported having enrollment goals.

Overall, interviewees did not provide many details on how enrollment goals impact implementation, but when they did it was very clear how goals facilitate enrollment. One high reach group interviewee described how goals motivate the staff to increase their referrals and enrollment,

“[...] we always have a goal, an enrollment goal. So we always reach the goal and we have a waiting list. There's always a waiting list and as I said, that's something that we're very proud of. [...] it's nice to have the number, I like numbers. Tell me what you want, I'll go for that number.” – Interviewee H3, High Reach, Community-Based Healthcare

For organizations that did not have formal enrollment goals, interviewees mentioned other goals such as achieving CDC DPRP recognition status, billing Centers for Medicare & Medicaid Services (CMS)/becoming a Medicare DPP supplier, training their staff to implement the program, general diabetes prevention in their communities, or focusing on the retention of their current cohorts first before attempting to enroll more participants. One interviewee from a medium reach organization said because their focus is on establishing a process for billing CMS, they are not concerned about enrollment and prefer a small cohort at the moment.

Multiple interviewees that currently did not have enrollment goals said they were interested in setting formal enrollment goals. In some cases, interviewees had their own personal enrollment goals, not set by their leadership or organization. While the interviews focused on pre-COVID-19 implementation, a few interviewees mentioned how COVID-19 had disrupted their implementation and therefore currently enrollment goals were not a priority.

Leadership Engagement is *a subconstruct of Readiness for Implementation and refers to the commitment, involvement, and accountability of leaders and managers with the implementation of the program*. This construct appeared numerous times throughout most interviews. While the majority of interviewees simply said they have “support” from their leadership, when asked to describe this support in terms of *Leadership Engagement* their examples varied greatly. Examples of *Leadership Engagement* included: leadership being aware of all program activities and events, making presentations to promote the program, connecting with other organization leaders/partners for the program, facilitating internal organization processes (e.g. board approvals, system establishment) for the program, obtaining resources including adequate staffing for the program, and providing the program for free to organization employees.

Leadership Engagement was a distinguishing construct as high and medium reach cases had more strong positive examples of *Leadership Engagement* compared to the low reach cases. High and medium reach interviewees also more often connected *Leadership Engagement* with positive examples of successful enrollment efforts and growing the infrastructure for the program.

“Our leadership has been great [...] I'll just give an example when we were going to be Medicare suppliers or applying for Medicare reimbursement. [...] And because we had physicians on our board and people that knew about the program, they knew about the process even with Medicare we really had buy-in there because they were able to explain it [...] So they really came together and got everybody on board and we were able to get those numbers and submit the application.” – Interviewee H6, High Reach, Community-Based Organization

Low reach groups had more mixed experiences with this construct. Leadership was described as not being engaged enough; not doing enough to understand the program, and taking a “hands off” approach. One interviewee described this as a gap in leadership knowledge about the National DPP:

“[...] I think leadership – just to actually sit down and know – understand the program a little bit better and understanding the goals that are attached to it and understanding the work that's needed to get done.

That's it. I think that's where the gap comes in.” – Interviewee 8, Low Reach, Government Agency

The key message from all interviewees across reach levels was that *Leadership Engagement* is highly desired and appreciated when available. Leadership support and knowledge of the program was discussed as a strong facilitator in implementing and scaling the program.

Discussion

This study applied CFIR to examine the internal and external organization factors influencing National DPP implementation. The four distinguishing constructs from the inner setting (structural characteristics, compatibility, goals & feedback, and leadership engagement) indicate that there are multiple factors internal to the organization that can impact implementation and enrollment success. Our findings are consistent with other studies that have found that some of these same constructs influence successful implementation – particularly within the inner setting domains such as leadership engagement and the implementation climate subconstructs [29, 30, 34, 35].

Similar to previous research, positive *Leadership Engagement* on implementation involved going beyond surface level support of the program and was highlighted by taking an active role in understanding the program, attending program events, promoting the program, and providing resources [29, 30, 34]. The distinguishing implementation climate subconstructs of *Compatibility*, *Relative Priority*, and *Goals and Feedback* indicated that for organizations at higher reach levels, the National DPP fit better with existing services, health promotion programs, and systems, was prioritized by the organization leadership, and had formal enrollment goals outlined.

To date, there is a lack of evaluation of the National DPP using CFIR constructs; however, other lifestyle change programs also focused on physical activity and nourishment behaviors to achieve weight loss have been studied using CFIR [30, 36–38]. These studies have also found a heavy emphasis on the inner setting when exploring program implementation successes and challenges. Related the outer setting, their results described challenges with billing and program reimbursement/financing policies. Our study did not find any outer setting constructs distinguishing between reach levels; however, there were notable

themes that emerged from the data around the importance of external partnerships, understanding participant needs, benefits of learning from and competing with other National DPP delivery organizations, and challenges with reimbursement programs (like Medicare DPP). Likewise, the constructs that were not rated (incentives & rewards, learning climate, access to knowledge & information, and patient needs & resources), also provided other insights into the program, such as examples of program participant barriers and challenges, however they did not talk in enough detail about these influences on implementation and enrollment to be included in this analysis.

The findings of this study have the potential to facilitate implementation of the National DPP. While the National DPP provides guidance on the standard infrastructure needed for organizations to deliver the program (*Structural Characteristics*) and the importance of partnerships (*Cosmopolitanism*), previously there has been less of a conversation about organization compatibility, priorities, goal setting and feedback, and active leadership engagement which we identified as important in this study [39, 40]. The CDC should consider inclusion of CFIR-related constructs such as leadership engagement in the CDC DPRP Organizational Capacity Assessment, a suggested tool that delivery organizations use at the time of adoption. The assessment is primarily focused on the minimum requirements to deliver the program (e.g. classroom space, equipment, staff requirements) but does not help identify which organization characteristics may be particularly suited to reach a large number of participants and successfully scale. The current version does include about many of the CFIR constructs including the ones identified as distinguishing in our study. For example, there is no discussion of how well the program “fits” within an organization’s current programs and services or how the program would be prioritized if implemented. Inclusion of these constructs could assist with identifying key gaps in organization adoption readiness, enrollment, and scalability [41, 42].

To support low reach delivery organizations, the CDC and other National DPP technical assistance providers should consider guidance and resources to increase program compatibility, prioritization, goal setting, and leadership engagement. However, the main program implementers may not have control over these conditions. For example, a frequently mentioned challenge in the relative priority construct was limited staff and staff time dedicated to the program. Organizations may require more assistance and resources from the CDC and others to ensure adequate staff are not only hired and properly trained, but that their time is dedicated sufficiently to the National DPP. These considerations may also be applicable to other evidence-based programs as well.

Future Research. More research is required to understand how internal and external organization factors influence implementation in order to continue to scale the National DPP. While this study did not identify any outer setting constructs as distinguishing, the outer setting construct, *Cosmopolitanism*, has appeared in National DPP studies focused on referrals from providers, health systems, and other community partners [17, 20, 40]. Organizations with strong external partnerships were able to leverage this into increased referrals to their programs. Our study may not have found outer setting constructs as distinguishing because the interviewees focused more heavily on the inner setting constructs and interviewees reported mostly neutral and positive experiences regardless of reach level (Fig. 1). Additional

research may be warranted to explore how the outer setting may affect the National DPP or other chronic disease programs. Likewise, future research should also include exploration of the other CFIR domains (intervention characteristics, process, and characteristics of individuals) to provide a holistic perspective on factors related to reach.

It is challenging to compare the National DPP to other programs using CFIR, as researchers have focused on different dimensions of CFIR constructs, often times based on relevant factors for the specific program. For example in the Cannon et al. 2019 study, the *Culture* construct was operationalized as implementation staff turnover [43], whereas in our study we focused on an organization's general beliefs, values, assumptions. This is a shortcoming of CFIR itself which has been criticized as very complex and multi-dimensional, and requiring more nuanced detail [44]. The developers of CFIR have announced a second version of the framework with the goal of addressing this criticism and other gaps that may be helpful to use in subsequent studies [45].

Measuring CFIR constructs quantitatively is a growing area that has great potential to assist with understanding the relationship between implementation factors and outcomes [46, 47]. Implementation science researchers have started testing quantitative measures for CFIR constructs, however more work is needed in this area to fully understand the validity and reliability of these constructs, how they are operationalized in practice, and their associations with implementation outcomes [48–52]. CFIR quantitative measures have typically examined relationships between constructs and shorter term implementation (e.g. adoption) rather than later-term outcomes like sustainability [21]. Using CFIR measures across the continuum of implementation will be critical to assess differences in key factors related to outcomes in the pre-adoption, early adoption, and maintenance phases [53].

Strengths & Limitations. Strengths of this study include *a priori* use of CFIR constructs and instruments, highly trained qualitative researchers and coders, rigorous double coding and analysis of data, and the application of the construct rating methods employed by other researchers. However, this study had several limitations that should be considered. First, there are 2,000 + organizations delivering this program nation-wide, and our study included only 30 in our sample, therefore results may be limited. In addition, we recruited from Emory's DTTAC contact list and while this population is very large and diverse, there may be implementation differences between this group and the larger National DPP population of implementers because of the training and technical assistance they receive from Emory.

Second, only one interview was conducted per organization. Other papers using this construct rating method typically include 2–3 interviewees per organization [29, 30]. However, we were able to talk with 30 different organizations which is a higher number of unique organizations than is typical for this analysis. Instead of depth within organizations, we focused on breadth across a diverse range of organizations and focused on the best possible informant to answer our questions (the Program Coordinator). In order to capture the diversity in National DPP implementation, we did not limit organizations based on a specific number of years of delivery for recruitment. Instead we operationalized reach using the average enrollment per year of delivery. Reach numbers were self-reported by the interviewee and we did not have

access to the programmatic data to confirm or examine changes in enrollment over the years of delivery. While imperfect, using the average enrollment per year helps compare implementation success across organizations.

For this study we only focused on the inner and outer setting constructs of CFIR and decidedly focused on the organization-level perspective, which limits our understanding of the other dimensions of implementation (intervention characteristics, process, and characteristics of individuals). Lastly, in early 2020 the COVID-19 pandemic disrupted the National DPP, a largely in-person program, greatly. We did try to limit our interview discussions to pre-COVID implementation, but this was an unignorable outer setting/external factor. It is hard to say how much of the discussion of these topics was impacted by implementers who found themselves in a “survival/adaptation mode” at the time of the interview.

Conclusions

This study found that there are a number of CFIR inner setting constructs that impact implementation reach of the National DPP. This understanding can be leveraged to improve efforts in recruiting and assisting delivery organizations to increase the reach and scale of the program. This is one of only a few studies of the National DPP at the organization level and to use the CFIR construct rating qualitative methodology to explore the national implementation of this program. More focused attention to program compatibility, prioritization, setting program goals, and leadership engagement has the potential to improve program implementation. Furthermore, these results have broader application to understand how best to assist organizations to adopt, deliver, and scale evidence-based programs.

Abbreviations

CDC

Centers for Disease Control and Prevention

CFIR

Consolidated Framework for Implementation Research

CMS

Centers for Medicare & Medicaid Services

DPP

Diabetes Prevention Program

DPRP

Diabetes Prevention Recognition Program

DTTAC

Diabetes Training and Technical Assistance Center

EHR

Electronic Health Record

InGEAR

Innovations to Grow Enrollment and Retention

Declarations

Ethics approval and consent to participate: This study was reviewed and provided exemption by the Emory University Institutional Review Board (STUDY00000658).

Consent for publication: Not Applicable.

Availability of data and materials: De-identified qualitative data is available by reasonable request to the corresponding author. Quantitative data was from DTTAC databases which are not publicly available.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: LM – design, conception, analysis, interpretation, and writing of the manuscript. OM – data collection, analysis, interpretation, and major contributor in writing the manuscript. MK, RH, SP, LB, MBW, CE reviewed all study protocols and instruments, assisted with interpretation of findings, and contributed in writing the manuscript. All authors read and approved the final manuscript.

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Tables

Table 1
Rating Criteria

Rating	Criteria
-2	Participant describes with detail how the construct is a negative/impeding influence on implementation related particularly to participant enrollment
-1	Participant makes statements about the construct as a negative influence/impeding influence on implementation generally
0	Mixed – participant describes both positive and negative statements about the construct in regards to general implementation and/or enrollment
1	Participant makes statements about the construct as a positive influence/facilitating influence on implementation generally
2	Participant describes with detail how the construct is a positive influence/facilitating influence on implementation related particularly to participant enrollment
X	Purely descriptive, no impact upon implementation or enrollment was described
M	Construct was not discussed during the interview

Table 2
Interviewee Organization Characteristics by Implementation Reach

	Implementation Reach			
	Low	Med	High	Total (%)
<i>Implementation level based on reach calculated as the average number of participants enrolled per year.</i>	5–16/yr	17–35/yr	36–150/yr	
<i>Number of Interviewees</i>	9	10	11	30
Organization Type (n)				
Healthcare/Hospitals	3	4	2	9 (30%)
Community-based healthcare	2	1	2	5 (17%)
Community-based organizations	-	2	3	5 (17%)
Government agencies	3	1	1	5 (17%)
Other: Health insurers, Employers, Academia	1	2	2	6 (20%)
Years Delivering the National DPP (n)				
0–2 Years: Initial Delivery Phase	6	5	2	13 (43%)
3–4 Years: Intermediate Delivery Phase	2	5	6	13 (43%)
5+ Years: Long-term Delivery Phase	1	-	3	4 (13%)
Organization Size (n)				
0–1,000 people served annually across all services & programs	1	3	1	5 (17%)
1,001–10,000 people	4	5	2	11 (37%)
10,001–100,000 people	4	1	2	7 (23%)
Over 100,000 people	-	1	5	6 (20%)
<i>missing</i>			1	1 (3%)

	Implementation Reach			
CDC DPRP Recognition Status ^a (n)				
Pending/Preliminary	7	8	5	20 (67%)
Fully Recognized	2	2	6	10 (33%)
Geographic Region in US (n)				
Northeast	3	1	2	6 (20%)
Southeast	3	4	3	10 (33%)
Midwest	-	1	3	4 (13%)
Southwest	3	2	1	6 (20%)
West	-	1	2	3 (10%)
Other (US Territories)	-	1	-	1 (3%)
Populations Served (n)				
White/Caucasian	7	8	9	24 (80%)
Black/African-American	7	5	9	21 (70%)
Hispanic/Latino	7	4	8	19 (63%)
Alaska Native/American Indian	3	-	5	8 (27%)
Pacific Islander/Asian	2	2	4	8 (27%)
^a For more details on CDC's DPRP recognition status requirements see – https://www.cdc.gov/diabetes/prevention/requirements-recognition.htm				

Figures

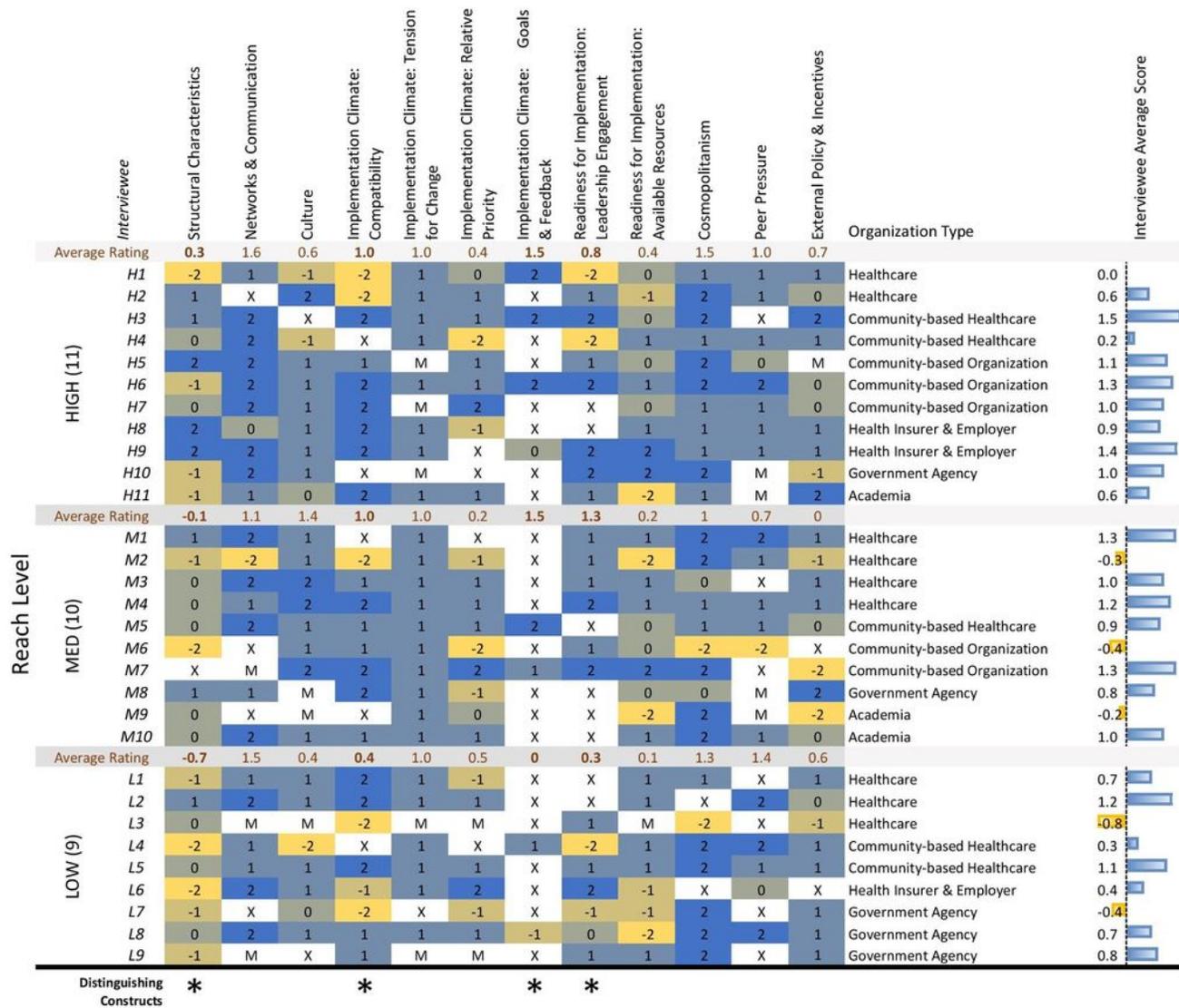


Table Legend	
2	Participant describes with detail how the construct is a positive/facilitating influence on implementation related particularly to participant enrollment
1	Participant makes statements about the construct as a positive/facilitating influence on implementation generally
0	Mixed – participant describes both positive and negative statements about the construct in regards to general implementation and/or enrollment
-1	Participant makes statements about the construct as a negative/impeding influence on implementation generally
-2	Participant describes with detail how the construct is a negative/impeding influence on implementation related particularly to participant enrollment
X	Descriptive only
M	Missing, construct was not discussed in the interview
*	Construct distinguishes between reach levels

Figure 1

Construct Rating Matrix

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [AdditionalTable1InterviewGuideQuestions.docx](#)
- [SRQRChecklist.docx](#)