Original Paper

A Mobile Diabetes Prevention Intervention Among Chinese Americans at Risk for Diabetes: Qualitative Analysis of Barriers and Facilitators to Intervention Engagement

Nan Jiang[1], PhD; Jing Liu[1], PhD; Angel Mui[1], MEd; Ximin Yang[1], MPH; Crystal Teng[1], MLiS; Ariel Xiao[1], BS; Anna Wang[1], MPH; Iris Ong[1], BS; Jeannette M Beasley[2,3], PhD, MPH; Stella S Yi[1], PhD, MPH; Lu Hu[1], PhD

[1]Department of Population Health, NYU Grossman School of Medicine, New York, NY, United States

[2]Department of Medicine, NYU Grossman School of Medicine, New York, NY, United States

[3]Department of Nutrition and Food Studies, Steinhardt School of Culture, Education, and Human Development, New York University, New York, NY, United States

Corresponding Author:
Lu Hu, PhD
Department of Population Health
NYU Grossman School of Medicine
180 Madison Avenue
New York, NY, 10016
United States
Phone: 1 646 501 3438
Email: lu.hu@nyulangone.org

Abstract

Background: Chinese Americans experience a high prevalence of prediabetes and face barriers to accessing diabetes prevention services. Adapted from the National Diabetes Prevention Program, the Integrating Cultural Aspects into Diabetes Education (INCLUDE) program is a culturally and linguistically tailored mobile health (mHealth) diabetes prevention intervention for Chinese Americans. The 12-week program combines 2 to 3 educational videos per week delivered through WeChat or text messaging, biweekly coaching calls with community health workers, and weekly produce provision. A randomized controlled trial evaluated the efficacy of INCLUDE on weight loss among Chinese Americans at risk for diabetes in New York City.

Objective: This study aimed to examine barriers and facilitators to engagement in INCLUDE and elicit participants' recommendations for intervention improvement.

Methods: This study was embedded within the INCLUDE trial. Among 75 trial participants in the intervention arm, 32 were purposively selected by engagement level (high vs low) and study year (year 1 vs year 2), and 25 completed postintervention qualitative interviews between February and December 2024. Twenty participants attended 1 of 4 focus groups (4 to 7 participants per group) stratified by engagement level and study year, and 5 completed one-on-one in-depth interviews due to scheduling conflicts preventing them from focus group participation. Semistructured interviews explored 4 domains, including reasons for participation, perceptions of INCLUDE, barriers and facilitators to engagement, and recommendations for improvement. Interviews were conducted in Mandarin or Cantonese, audio-recorded, and transcribed verbatim in Chinese. Three bilingual coders (NJ, JL, and AM) conducted thematic analysis using deductive and inductive approaches.

Results: Participants had a mean age of 53.6 (SD 12.3) years; 20 of 25 (80%) were women, 13 (52%) participated in year 1, and 12 (48%) participated in year 2. Eleven (44%) participants had low engagement and 14 (56%) had high engagement. Six facilitators of engagement were identified, including motivation to prevent diabetes, trust in community organizations, perceived gains from participation, culturally and linguistically concordant content, accessibility through digital delivery, and personalized guidance and human support. Three barriers were identified, including time constraints, challenges related to the produce component, and insufficient support for translating knowledge into sustained behavior change. Participants recommended more actionable dietary guidance, additional home-based physical activity options, shorter or alternative coaching formats, and more flexible and culturally responsive produce support.

Conclusions: INCLUDE was generally well received among Chinese Americans at risk for diabetes. Future research should focus on addressing identified barriers by making diabetes prevention guidance more actionable and delivery more compatible with daily life. These findings may inform future diabetes prevention strategies for Chinese American populations.

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KEYWORDS

prediabetes; diabetes; mobile health; prevention; Chinese American

Introduction

The prevalence of diabetes has continued to rise among US adults, increasing from 11.2% in 2001-2004 to 13.5% in 2021-2023 [1]. An estimated 39.8 million US adults currently live with diabetes (including 11 million with undiagnosed diabetes) [1], of whom 90%-95% have type 2 diabetes (T2D) [2]. In addition, approximately 115.2 million US adults (43.5% of the adult population) have prediabetes, a condition characterized by elevated blood glucose above normal but below diagnostic thresholds for diabetes [3]. Each year, 5%-10% of adults with prediabetes progress to T2D [3,4]. T2D increases the risk of serious complications, including heart disease, stroke, chronic kidney disease, vision loss, and neuropathy, and is associated with reduced life expectancy [5]. Among individuals aged 50 years and older, life expectancy is 6 years shorter for those with T2D than those without diabetes [6]. Preventing diabetes among high-risk individuals is therefore essential to reducing complications and diabetes-attributable morbidity and mortality.

Lifestyle interventions can prevent or delay T2D onset among adults at elevated risk. The landmark Diabetes Prevention Program (DPP) demonstrated its effectiveness in reducing T2D incidence by 58% compared with placebo among adults at high risk for diabetes [7]. The intervention targets modest weight loss through physical activity and dietary modification [8] and has shown sustained, long-term effects on reducing T2D incidence at 10, 15, and 21-year follow-up [9-11]. The DPP has also been shown to be cost-effective across age groups [12]. Given its strong evidence base, the US Congress authorized the Centers for Disease Control and Prevention (CDC) in 2010 to establish the National DPP to expand access to evidence-based diabetes prevention nationwide [13]. As of 2022, more than 2100 CDC-recognized organizations were delivering the National DPP across all 50 states, the District of Columbia, and most US territories [14]. Despite this broad dissemination, engagement remains low among communities of color [15,16]. Among nearly 500,000 individuals enrolled in the National DPP between 2012 and 2019, non-Hispanic Asian Americans comprised only 3.1% of participants, compared with 64.6% non-Hispanic White participants [17]. Targeted strategies are critical to improve diabetes prevention engagement among communities of color.

Chinese Americans represent the largest Asian American population group in the United States, with an estimated 5.5 million individuals, including 2.9 million born outside the United States [18,19]. The burden of diabetes and prediabetes is substantial in this population. Among 373,098 adults aged 45-64 years in the Kaiser Permanente Northern California health plan, the prevalence of diabetes and prediabetes was significantly higher among Chinese Americans than among White individuals (men: 55.3% vs 38.8%; women: 41% vs 26.9%) [20]. A study of 2071 Chinese immigrants in New York City (NYC) found that 43.1% had diabetes or prediabetes [21]. Chinese Americans, particularly immigrants, often face adverse social determinants of health, including low income, low educational attainment, limited English proficiency, long and inflexible work hours, and restricted access to health insurance [22-25]. These factors contribute to inequitable access to diabetes prevention resources, including the National DPP [26,27]. In addition, diabetes prevention curricula often lack cultural tailoring, including attention to dietary preferences, food preparation practices, and culturally relevant recipes, and are often unavailable in languages other than English and Spanish, which may impede program uptake and sustained engagement among communities of color [28-30]. Culturally tailored and linguistically appropriate strategies are urgently needed to help Chinese Americans at high risk for diabetes to prevent the progression to T2D.

To address these barriers, we developed the Integrating Cultural Aspects into Diabetes Education (INCLUDE) program, a culturally and linguistically tailored, mobile health (mHealth) diabetes prevention intervention for Chinese Americans at high risk for diabetes [31,32]. Adapted from the National DPP, the 12-week INCLUDE intervention included 2 to 3 Chinese-language educational videos per week on diabetes prevention delivered via text messaging or WeChat (Tencent), biweekly coaching calls from bilingual community health workers (CHWs), and weekly produce (vegetable) provision for 10 weeks. By integrating culturally tailored content and personalized guidance into scalable digital delivery platforms, INCLUDE was designed to address key barriers to diabetes prevention among Chinese Americans.

We conducted a 2-arm randomized controlled trial to evaluate the efficacy of INCLUDE for weight loss among Chinese Americans at risk for diabetes residing in NYC. Beyond evaluating the efficacy, barriers and facilitators to engagement in mHealth interventions for diabetes prevention remain understudied in this population. Therefore, we conducted postintervention qualitative interviews with participants in the intervention arm to identify barriers and facilitators to intervention engagement and elicit participants' recommendations for intervention improvement. This paper reports findings from the interviews that may inform the refinement of INCLUDE and future mHealth diabetes prevention strategies for Chinese Americans.

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Methods

Study Design

This qualitative study was embedded within the INCLUDE randomized controlled trial (N=150), which was conducted among Chinese Americans aged 18-70 years who were at high risk for diabetes and resided in NYC. Focus groups and in-depth interviews were conducted among intervention participants to examine barriers and facilitators to engagement and elicit recommendations for intervention improvement.

INCLUDE Intervention and Trial Participants

The 12-week INCLUDE program included three core components: (1) 2 to 3 Chinese-language educational videos per week (approximately 5 minutes each), adapted from the National DPP curriculum and delivered via WeChat or text messaging according to participant preference. WeChat is the world's second most popular messaging app [33] and the most widely used messaging app among Chinese-speaking populations worldwide [34]; (2) biweekly coaching calls (typically 10-30 minutes) with bilingual CHWs to provide personalized goal-setting and support; and (3) weekly produce provision for 10 weeks to support healthy eating. In year 1, participants picked up produce from designated community locations during scheduled time windows. In year 2, the produce distribution model was changed to home delivery. Throughout this paper, "produce provision" encompasses community pick-up in year 1 and home delivery in year 2.

Trial participants were recruited between April 2023 and June 2024 through community partnerships, community outreach, electronic health record outreach, media advertisements, and peer referrals. Additional details about the INCLUDE intervention, the trial, and participants have been reported elsewhere [31]. Differences between the protocol and implemented procedures of this qualitative study are summarized in Multimedia Appendix 1.

Interview Participants and Recruitment

We planned 4 focus groups, one for each engagement-by-year stratum (high and low engagement in years 1 and 2), to capture variation in participant experiences [35]. Consistent with the study protocol [31], we targeted 5 to 8 participants per group, which was within the range of 4 to 8 participants recommended for focus groups [36]. From the 75 intervention participants, we purposively selected 8 participants per stratum (32 invitations in total). Engagement was assessed using study records. Video viewing was based on participants' self-reports documented by CHWs during biweekly coaching calls, and produce receipt was based on records of pick-up or home delivery. Participants who reported viewing at least 70% of the videos and received at least 70% of the produce were classified as having high engagement, and otherwise as having low engagement [31].

CHWs invited the selected participants by phone. Of the 32 invited, 7 declined because of time constraints and 25 participated. Twenty participants attended 1 of 4 focus groups (4-7 participants per group) and 5 completed one-on-one in-depth interviews because scheduling conflicts prevented focus group attendance.

Interview Procedures

Year 1 focus groups were conducted in February 2024, and the year 2 focus groups were conducted in December 2024. In-depth interviews took place in March 2024 for year 1 participants and December 2024 for year 2 participants. All sessions were held in private meeting rooms at community partner sites. Written informed consent, including consent for audio recording, was obtained from all participants before each session. Interviews were conducted in Mandarin or Cantonese and audio-recorded.

The interviewer was a Chinese-English bilingual and bicultural postdoctoral scholar trained in public health, with substantial experience conducting qualitative interviews with Chinese Americans. She had no role in intervention delivery and no prior contact with participants before the interviews. A second bilingual research staff member, who was also not involved in intervention delivery, assisted with note-taking during all 4 focus groups and 3 of the 5 in-depth interviews. No individuals other than study participants and research staff were present during the interviews. Focus groups lasted 55 to 93 minutes, and in-depth interviews lasted 33-83 minutes.

A semistructured interview guide (Multimedia Appendix 2) was developed based on prior qualitative studies examining barriers and facilitators to engagement in the DPP [27,37-39] and was reviewed by the investigative team. Consistent with guidance for developing qualitative interview guides [40,41], the draft guide was pilot-tested with 3 CHWs who delivered coaching calls to INCLUDE participants and was refined based on their feedback before finalization. The final guide was used consistently across all interviews.

The guide covered four primary domains: (1) reasons for enrollment, including motivations and expectations (eg, "What made you decide to enroll in the study?" "What were you hoping to gain from the program?"); (2) perceptions of the overall INCLUDE program and its core components (eg, "What did you find most or least helpful about the program?" "What did you like or dislike about the videos and coaching calls?" "In what ways, if any, did the program support your weight loss?" "What was your experience with the produce provision?"); (3) barriers and facilitators to engagement (eg, "What made it easier or harder for you to watch the videos?" "Were there times when it was difficult to complete the coaching calls?"); and (4) recommendations for improvement (eg, "If we were to run the program again, what changes would you recommend?" "What could make the program more useful?" "Would you recommend this program to others? Why or why not?"). Probes were used throughout the interviews to clarify responses and/or elicit more depth and nuanced insights.

Data Analysis

Data analysis was conducted from November 2025 to January 2026, after data collection was completed. Study team members transcribed interview audio recordings verbatim in Chinese and checked the transcripts against the recordings for accuracy. Three bilingual team members (NJ, JL, and AM) analyzed the Chinese-language transcripts using thematic analysis with both deductive and inductive approaches [42-46]. Coding was conducted in NVivo 12 (Lumivero).

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An initial codebook was developed from the interview guide, with deductive codes informed by 4 domains, including reasons for participation, perceptions of the intervention, engagement barriers and facilitators, and recommendations for improvement. Each code included a definition. The 3 coders (NJ, JL, and AM) independently coded 2 transcripts deductively using the initial codebook and created inductive open codes for concepts that emerged from the data that were related to the study aim (eg, perceptions of WeChat as the delivery platform). Coding was conducted at the sentence level, and multiple codes could be assigned to the same text segment. The coders then compared their coding, resolved discrepancies, and refined the codebook by merging overlapping codes, adding emergent codes, and clarifying code definitions until consensus was reached. The 3 coders (NJ, JL, and AM) then independently coded all remaining transcripts using the finalized codebook, with discrepancies resolved through discussion. All 9 transcripts were analyzed. No new codes emerged after the fourth transcript, and coding of the remaining 5 transcripts identified no additional codes, suggesting that code saturation had been achieved [47,48]. Saturation was assessed during analysis, not used prospectively to stop recruitment.

After coding was completed, 4 team members (NJ, JL, AM, and LH) met to review coding notes, synthesize codes, and identify themes and subthemes. Themes were refined through team discussion based on coherence and relevance to the study aims. Differences in interpretation were resolved through discussion and consensus. The team selected illustrative quotations for each theme. Following guidance on selecting and reporting quotations in qualitative research, quotations were chosen for relevance and clarity and drawn from various focus groups and in-depth interviews [49,50]. NJ translated selected quotations into English, and other team members reviewed the translations to verify accuracy. All team members involved in this process are bilingual and bicultural and have extensive experience conducting qualitative research among Chinese Americans. Transcripts, themes, and selected quotations were not returned to participants for review.

Ethical Considerations

The study protocol was approved by the New York University (NYU) Grossman School of Medicine Institutional Review Board (s22-00783) and registered at ClinicalTrials.gov (NCT05492916). Before each session, participants were informed of the purpose of the interview, potential risks and benefits, the voluntary nature of participation, and their right to withdraw at any time. Written informed consent was obtained from all participants before the interview began. At the start of each session, participants were reminded that the interview would be audio-recorded. To protect privacy and confidentiality, recordings were deidentified to remove personal identifying information and stored securely, with access restricted to the study team. Participants received a US $25 gift card upon completion.

Results

Participant Characteristics

Participants had a mean age of 53.6 (SD 12.3) years, and most were women (20/25, 80%). Thirteen participants (13/25, 52%) were enrolled in year 1 and 12 (12/25, 48%) in year 2. Eleven participants (11/25, 44%) were classified as having low engagement and 14 (14/25, 56%) as having high engagement. Additional participant characteristics are presented in Table 1.

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Table 1. Participant characteristics (N=25).

Characteristics	Total (N=25)	Focus group 1 (n=7)	Focus group 2 (n=4)	Focus group 3 (n=5)	Focus group 4 (n=4)	In-depth interview (n=5)
Year 1 participants, n	13 (52%)	7	4	0	0	2
Year 2 participants, n	12 (48%)	0	0	5	4	3
Sex, n						
Male	5 (20%)	3	0	2	0	0
Female	20 (80%)	4	4	3	4	5
Age (years), mean (SD)	53.6 (12.3)	57.3 (12.1)	53.5 (14.7)	58 (11.1)	50.5 (12.7)	46.4 (12.6)
Years of residence in the United States, mean (SD)	20.3 (12.5)	25.9 (13.2)	22.3 (15.3)	18.2 (13.9)	12 (6.5)	19.6 (12.1)
English proficiency, n						
Very well	1 (4%)	1	0	0	0	0
Less than very well	24 (96%)	6	4	5	4	5
Education, n						
Less than high school	14 (56%)	3	1	4	3	3
High school graduate	5 (20%)	1	1	0	0	2
More than high school	6 (24%)	3	2	1	1	0
Marital status, n						
Married or cohabitating	20 (80%)	6	4	3	3	4
Other	5 (20%)	1	0	2	1	1
Employment status, n						
Employed	13 (52%)	3	2	3	1	4
Unemployed	4 (16%)	1	1	0	2	0
Retired	8 (32%)	3	1	2	1	1
Engagement, n						
Low	11 (44%)	0	4	5	0	2
High	14 (56%)	7	0	0	4	3

Facilitators to Program Engagement

Table 2 summarizes the major facilitators of engagement. Facilitators included motivation to prevent diabetes, trust in community organizations, perceived gains from participation, culturally and linguistically concordant content, accessibility through digital delivery, and personalized guidance and human support.

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Table 2. Themes and sample quotations from qualitative interviews among participants: Facilitators and barriers to engagement and recommendations for improvement.

Themes	Quotations
Facilitators to engagement	
Motivation to prevent diabetes	• "Both my parents have diabetes, and my grandparents did too. So I've been really worried that it might run in the family. When I heard about this program, I thought it would be helpful, so I signed up." [FG[a] 4; year 2] • "I wanted to learn more about how to prevent diabetes." [FG 1; year 1] • "A lot of people in my family have diabetes, and I've always worried that I might get it too." [P[b] 23; year 2]
Trust in community organizations	• "I came across the [INCLUDE[c]] program on the WeChat public account of PCR [community-based organization]. Ms. N [founder of PCR] told us about it, so I decided to sign up." [*P* 22; year 1] • "They had a talk about the [INCLUDE] program at CPC [community-based organization], and I happened to hear about it, so I came to participate." [FG 4; year 2]
Perceived gains from participation[d]	• "My blood sugar used to be high, around 7.3. Now it's down to 6.3 and has stayed at that level for the past six months. It [INCLUDE] helped a lot." [FG 1; year 1] • "The videos about diet were really helpful. I used to eat pretty greasy food, but after watching the videos, I've started eating much lighter." [FG 3; year 2] • "Before [enrollment], when we went grocery shopping, we might look at nutrition labels, but not very carefully. If we hadn't watched the videos, we probably wouldn't have paid much attention to them. After watching the videos, we started reading the labels more carefully, checking how much fat and how many calories things had." [FG 4; year 2] • "Before, I ate greasier foods or fatty meat. After watching the videos, I started making some improvements." [*P* 23; year 2]
Culturally and linguistically concordant content	• "The videos covered everything, from exercise to diet. Overall, they fit very well with Chinese Americans' lifestyle." [FG 4; year 2] • "I thought they [program videos] were all good, easy to understand." [FG 1; year 1]
Accessibility through digital delivery	• "Being able to watch the videos via WeChat anytime is much better than having to learn at a scheduled, fixed time. It's really convenient." [*P* 22; year 1] • "The videos are always there [in my WeChat chat history] so I can watch them whenever I have time. It's very convenient." [*P* 24; year 2] • "We use WeChat all the time. People don't use text messages nearly as much, so WeChat is definitely more convenient than text messaging." [FG 3; year 2] • "WeChat feels more trustworthy to us. Text messages might be just as convenient, but we usually assume they're scams." [*P* 25; year 2]
Personalized guidance and human support	• "[During the coaching calls], she asked about my diet, pointed out which foods were high in sugar, encouraged me to eat more vegetables, and guided me on portion sizes. It was very helpful." [FG 1; year 1] • "She [the CHW] helped relieve my stress. I even looked forward to her calls. It felt like she genuinely cared about me." [FG 4; year 2] • "When he called, he would first ask whether it was a good time to talk and whether I was free. I really appreciated that. If I didn't have time, he would reschedule the call. It felt like a kind of supervision and reminder, and it gave me more motivation to stick with the changes." [FG 1; year 1]
Barriers to engagement	
Time constraints	• "Sometimes when I was on the call, my child was next to me making noise. It was difficult to talk. The calls were fairly long, and I didn't always have that much time because I had to take care of my child." [*P* 21; year 1] • "When I'm taking care of my child, things can get hectic and it's hard to take the calls." [FG 4; year 2]
Unmet needs related to produce provision	• "The variety of vegetables was okay, but most of them weren't fresh." [*P* 25; year 2] • "We had to drive to Costco to pick up the vegetables, which wasn't very convenient. The biggest issue for me was the timing. Because I have to take care of my grandson and pick him up from school, it just didn't work." [FG 1; year 1] • "A lot of the vegetables are common in Western diet. I don't recognize them and don't know how to cook them, so I ended up just throwing them away." [FG 2; year 1]

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Themes	Quotations
Insufficient support for translating knowledge into sustained behavior change	• "The videos were helpful, and what they said all made sense, but I just couldn't keep it up. My routine isn't very disciplined…Regarding my diet, since I work in a restaurant, I really can't control what I eat. I just eat whatever the restaurant offers. I have no choice." [*P* 24; year 2] • "Because I am working, and I'm a bit lazy, I really haven't made time for exercise." [*P* 22; year 1] • "My child is only a little over two years old, so I spend most of my time caring for him. That leaves very little time for myself, and things like exercise are not really feasible…. I like sweets a lot. That's so hard to control. How should I manage the craving?" [*P* 21; year 1]
Recommendations for improvement	
Program videos	• "If you could lay out all meals for the day, like what we should eat for this meal, the next one, and each meal tomorrow, and put it into a clear meal plan. That would be much better." [FG 2; year 1] • "I think it would be great to add a "do-with-me" exercise component, where we follow along with a workout video every day. Even just five minutes a day together would be good." [FG 4; year 2] • "If it's something simple I can do at home, I can follow along. I don't really have time to go outside to exercise, like running. With my long work hours, it's very hard to make time for outdoor exercise." [*P* 21; year 1] • "It would help if the key points were clearly listed, kind of like a PPT, and then briefly explained in the video. I forget things easily, so after watching a video once, I often need to go back and watch it again. A brief written summary would really help." [FG 4; year 2]
Biweekly coaching calls	• "Every two weeks is kind of too frequent for me. I don't really see much change in that time. And I'd prefer if the calls could be kept under 20 minutes." [*P* 22; year 1] • "I don't really want long phone calls. Maybe you could send the questions via WeChat, and I'll answer them and send them back." [FG 4; year 2] • "It doesn't have to be a phone call. It could be something else, like just sending a survey link that I can fill out online. That would be more convenient for me, because sometimes I don't have time for a call." [FG 2; year 1]
Produce provision	• "It would be better to have more vegetables that Chinese people are familiar with, things we actually eat as our daily diet." [*P* 21; year 1] • "Is there something like a voucher specifically for purchasing vegetables? It might be better to provide a voucher so we can choose the vegetables we prefer." [*P* 24; year 2]

[a]FG: focus group.

[b]P: participant.

[c]INCLUDE: Integrating Cultural Aspects into Diabetes Education.

[d]Perceived gains were self-reported and not verified as part of this qualitative study.

Motivation to Prevent Diabetes

Participants generally described enrolling in INCLUDE to better manage personal risk and prevent progression to diabetes. Concerns were frequently noted due to elevated blood glucose results, family history, and observing friends or relatives living with diabetes and its complications. Participants also articulated clear expectations before enrollment, emphasizing a desire to gain knowledge and skills to improve glycemic indicators, increase physical activity, improve diet, and reduce body weight. This strong prevention-oriented motivation was described as promoting initial uptake and sustained engagement.

Trust in Community Organizations

Participants learned about INCLUDE through trusted community-based organizations or health care practices serving Chinese American communities. Familiarity with these organizations increased participants' willingness to enroll. Participants also noted that the program's affiliation with a research institute and its explicit focus on Chinese Americans enhanced its perceived credibility and relevance, which contributed to their decision to enroll.

Perceived Gains From Participation

Participants described perceived benefits as reinforcing engagement. Reported benefits included increased knowledge about diabetes prevention, such as how to incorporate physical activity into daily routines, apply the 2-1-1 dietary guidance for balanced eating (which emphasizes structuring meals around the plate method of 2 portions of vegetables, 1 portion of protein, and 1 portion of carbohydrates), evaluate portion sizes, and interpret nutrition labels. Participants also reported applying what they learned to make behavior changes, including establishing new exercise routines, following dietary guidance consistently, monitoring portion sizes, and reading nutrition labels during grocery shopping. Additional perceived benefits

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included household spillover, such as dietary changes adopted by family members after exposure to shared program content, and progress toward weight loss and blood glucose goals. These perceived benefits appeared to increase the perceived value of the program and support continued engagement.

Participants reported increased confidence in their ability to manage diabetes risk and sustain behavioral changes, and described feeling more capable of staying on track. The produce provision component was described as supporting healthier eating by increasing the amount and variety of vegetables available at home, which served as reminders to eat more vegetables. Overall, participants described perceived benefits of improved knowledge, skills, confidence, and health behaviors as key reasons for remaining engaged in the program.

Culturally and Linguistically Concordant Content

Participants described the program content as culturally relevant and indicated that this sense of fit encouraged continued engagement. Cultural tailoring was referenced in relation to dietary preferences, Chinese cooking methods, culturally familiar recipes, and guidance for eating during Chinese holidays. Participants described the dietary guidance as practical and feasible to apply in daily life. They also noted that the use of simple, lay language in the videos and coaching calls facilitated comprehension and supported participation.

Accessibility Through Digital Delivery

Participants generally described WeChat-based delivery as easy to access, and many noted that this convenient accessibility supported both enrollment and sustained engagement. Participants characterized WeChat-based video delivery as compatible with daily life because WeChat was their most commonly used platform for communication and social networking. Digital delivery also allowed them to watch videos at their own pace and at times that were convenient for them, and WeChat facilitated sharing program content with family members and friends.

When asked to compare WeChat with SMS delivery, participants described WeChat as the more acceptable platform, with one participant indicating no preference between WeChat and SMS. Habitual WeChat use made it easier to notice and engage with program content, whereas concerns about scam messages through SMS reduced comfort with accessing SMS-delivered information.

Personalized Guidance and Human Support

Participants described the biweekly coaching calls as an important source of personalized guidance and accountability. They noted that CHWs tailored goals to individual needs and preferences, reviewed progress, identified challenges, and collaboratively brainstormed solutions. Participants described the calls as user-centered, professional, and caring, and noted that the human interaction complemented the video content. They also noted that calls could be scheduled flexibly and rescheduled when needed, and that these biweekly check-ins provided reminders, encouragement, social support, and sustained motivation. Overall, personalized support through coaching calls was viewed as facilitating continued engagement in the program.

Barriers to Program Engagement

Three primary barriers to engagement emerged, including time constraints, unmet needs related to produce provision, and insufficient support for translating knowledge into sustained behavior change.

Time Constraints

Time constraints were identified as a barrier to completing the biweekly coaching calls. Although calls typically lasted 10-30 minutes and scheduling was flexible, participants reported difficulty participating because of competing responsibilities. Participants with childcare or caregiving responsibilities described challenges finding **uninterrupted time for calls, while those** with **long, inflexible work schedules** reported limited daytime availability.

Unmet Needs Related to Produce Provision

Participants identified several barriers related to the produce component. Although they valued receiving free vegetables, participants in both year 1 and year 2 raised concerns about produce quality and cultural relevance. They reported that some produce was not fresh and that certain items were unfamiliar or not culturally relevant, making them unsure how to prepare or incorporate them into meals.

Logistical barriers differed by the study year. In year 1, participants were required to pick up produce from designated community locations during scheduled time windows. Participants described difficulties when pick-up sites were far from home, service hours were limited, or pick-up times conflicted with work or caregiving responsibilities, making consistent participation in this component challenging. In year 2, the produce distribution model was changed to home delivery. Although this reduced the pick-up logistical barriers experienced in year 1, year 2 participants still reported logistical challenges, particularly difficulty coordinating delivery times with drivers and limited flexibility in delivery scheduling.

Insufficient Support for Translating Knowledge Into Sustained Behavior Change

Participants described difficulty translating dietary and physical activity guidance into sustained behavior change, which reduced motivation to continue viewing program videos. Although participants acknowledged the importance of healthy eating and regular physical activity, they reported challenges applying the guidance consistently in daily life due to fatigue, work-related stress, long-standing dietary habits (eg, carbohydrate-heavy meals), and cravings for sweets. Participants also expressed uncertainty about what specific foods to eat as part of a healthy meal, suggesting that the guidance did not always provide enough concrete, actionable detail for day-to-day implementation.

Participants also noted that much of the physical activity guidance emphasized outdoor activities, such as walking, which they described as less feasible during winter months and for individuals with childcare or caregiving responsibilities, long work hours, older age, or physical limitations. The lack of

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practical home-based or indoor exercise options reduced the perceived relevance of some video content and affected engagement with video viewing.

In addition, participants working in restaurants described having limited control over what they ate during work hours, as meals were often determined by workplace food offerings. Even when motivated to follow the recommendations, they found adherence difficult within these food environments. This mismatch between program guidance and participants' lived realities reduced the perceived applicability of some video content and weakened motivation to continue watching the videos.

Recommendations for Intervention Improvement

Program Videos

Participants recommended structured meal plans and visual examples of balanced meals (eg, sample menus illustrating balanced breakfast, lunch, and dinner) to make dietary guidance easier to apply. They also suggested more home-based or indoor physical activity options, "do-with-me" exercise sessions to support motivation, and concise written summaries for those unable to watch the full videos.

Biweekly Coaching Calls

Participants recommended shorter calls and alternative formats to reduce time and scheduling burden. Suggested options included brief surveys or check-ins supplemented by WeChat-based messaging support, which participants viewed as more feasible for those with limited availability.

Produce Provision

Participants in both year 1 and year 2 recommended improving produce freshness, increasing the availability of culturally familiar vegetables, and providing simple cooking guidance to support preparation and use. Year 1 participants also suggested more flexible pick-up arrangements and home delivery. Although home delivery was implemented in year 2, participants in year 2 continued to request greater scheduling flexibility. Across both years, participants proposed grocery vouchers as an alternative to produce provision to better accommodate individual food preferences and logistical needs.

Discussion

Principal Findings

This study is among the first to examine barriers and facilitators to engagement in a culturally tailored mHealth diabetes prevention intervention for Chinese Americans, an understudied population with a high prevalence of prediabetes and multiple barriers to prevention services. The study also elicited participants' recommendations for intervention improvement. INCLUDE was generally well received. The findings extend the literature by identifying factors that facilitate or impede engagement and highlighting areas for improvement among Chinese Americans at high risk for diabetes. These insights may inform future diabetes prevention strategies for Chinese American communities.

Participants' desire to prevent diabetes and their trust in community organizations and health care practices serving Chinese American communities emerged as important facilitators of enrollment. Established relationships with these organizations appeared to enhance trust and increase participants' willingness to enroll. These findings are consistent with prior research in other communities of color. For example, a qualitative study conducted in rural Hawaii among Native Hawaiian, other Pacific Islander, and Filipino women found that motivation to prevent progression to T2D and recruitment through usual care teams and trusted community members facilitated enrollment in the National DPP [38]. These findings suggest that leveraging trusted community and health care partnerships may be important for improving reach and uptake of DPPs among Chinese Americans.

Participants generally described INCLUDE as acceptable, in part because of its cultural tailoring. They valued dietary guidance that incorporated culturally familiar foods and Chinese cooking methods, which enhanced the program's perceived relevance and fit. This finding is consistent with prior studies documenting preferences for culturally tailored National DPP content among Hispanic men [51] and the importance of cultural fit in programs serving South Asian individuals [28]. It also aligns with a systematic review of 37 studies of digital interventions for prediabetes and diabetes management, which identified cultural and language mismatches as barriers to engagement and cultural tailoring as a facilitator [52]. Similarly, a systematic review of 34 qualitative studies of digital interventions for a broad range of health issues found that cultural and linguistic appropriateness facilitated intervention uptake among culturally and linguistically diverse populations [53]. A recent systematic review and meta-analysis of 14 studies of digital interventions among culturally and linguistically diverse adults with prediabetes suggested that cultural adaptation should extend beyond language translation to address practical cultural elements and social structures [54]. This study provides evidence from Chinese Americans, suggesting that culturally and linguistically concordant content may support engagement with mHealth diabetes prevention interventions.

Participants also viewed WeChat-based delivery as highly compatible with their daily lives. The ability to access program content at their own pace and at a time that was convenient for them appeared to support engagement, particularly among individuals with demanding work schedules and substantial caregiving responsibilities. This finding aligns with a qualitative systematic review, which identified familiar digital technology and convenient, flexible access as facilitators to uptake of digital health interventions among culturally and linguistically diverse populations [53]. WeChat was already embedded in participants' routine communication practices and was perceived as more trustworthy than SMS. Previous research among Chinese immigrants who smoke has documented high WeChat use, with 94% reporting WeChat use and 90% reporting daily use, and found that WeChat was used more frequently than SMS and other social media platforms [55]. Participants also raised concerns about scam text messages and phone calls, a documented issue in Chinese American communities and consistent with public scam alerts issued by the US Federal Communications Commission [56]. These findings suggest that selecting a familiar, culturally appropriate, and trusted digital

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platform may strengthen the reach and engagement of DPPs among Chinese Americans.

Consistent with prior research in other communities of color [38], participants viewed CHW coaching calls favorably and described them as an important source of social support and personalized guidance. Participants reported that the calls enhanced motivation, reinforced accountability, and helped sustain their engagement in the program. Sustaining engagement remains a challenge for digital health interventions delivered through SMS or mobile apps, despite their potential to improve accessibility [57]. Systematic reviews of mobile lifestyle interventions have identified limited human support and insufficient personalization as determinants of low engagement [58,59]. Similarly, a systematic review of digital interventions for prediabetes and diabetes highlighted personalized support as a facilitator of engagement and inadequate personalization as a barrier [52]. By combining digital video delivery with biweekly CHW coaching that provides human support and tailored feedback, INCLUDE addresses common limitations in digital health interventions and offers a promising model that may strengthen intervention engagement.

Participants also described multiple perceived benefits from participation, which appeared to reinforce continued engagement. These included self-reported gains in diabetes prevention knowledge, improvements in health behaviors (eg, establishing regular exercise routines), and spillover effects within households. Participants also reported perceived progress toward weight-loss goals and blood glucose management, as well as greater confidence in their ability to reduce diabetes risk and sustain behavior changes over time. These findings suggest that perceived usefulness and tangible benefits may support engagement by increasing the program's perceived value.

The study also identified barriers to engagement. Although coaching calls were generally viewed favorably, participants described difficulty completing scheduled calls when they competed with childcare, other caregiving responsibilities, or long and inflexible work schedules. Similar barriers have been documented among underserved participants to engaging in the National DPP [27,28,38]. Findings suggest that even relatively low-burden human support may be difficult to sustain when it depends on scheduled phone contact.

The knowledge-to-action gap also emerged as a barrier to engagement. Participants described difficulty translating video content into concrete and sustained behavior change, which in turn reduced their motivation to continue viewing the videos. Challenges in following physical activity recommendations were attributed to fatigue and stress related to work and caregiving responsibilities, whereas difficulties following dietary guidance were related to long-standing eating habits, cravings for sweets, and limited control over workplace food choices. These barriers are consistent with those reported among low-income National DPP participants [27].

The produce component also emerged as a barrier to engagement, although its nature differed by delivery model. In year 1, participants picked up produce at designated community locations during scheduled time windows and reported difficulties related to distance from pick-up sites, limited service hours, and conflicts with work and caregiving schedules. In year 2, produce was delivered directly to participants' homes. This change reduced pick-up barriers, but did not fully eliminate logistical barriers. Participants continued to report scheduling conflicts and limited flexibility in coordinating delivery times with drivers. Across both years, participants raised concerns about produce freshness, cultural relevance, and preparation of unfamiliar vegetables. These findings suggest that refining the produce component requires attention not only to pick-up and home-delivery logistics but also to food quality, cultural preferences, and practical food preparation support.

Implications for Intervention Refinement

Participants' recommendations offer concrete directions for refining the intervention. Requests for sample meal plans, visual examples of balanced meals, home-based exercise options, and "do-with-me" sessions point to a need for applied skill-building beyond information. This aligns with social cognitive theory, which holds that modeling and guided practice build self-efficacy [60]. For coaching, participants suggested shorter calls and WeChat check-ins to reduce time burden. Time constraints and participant burden are major barriers to engagement in lifestyle interventions [61]. Future studies may explore how to further reduce time and participation burden while achieving the same intervention effects. For produce support, preferences for fresher, culturally familiar vegetables, simple preparation guidance, flexible delivery, and grocery vouchers underscore that engaging the target community early in the design phase is essential.

Limitations and Strengths

This study has several limitations. First, participants were predominantly Chinese Americans born outside the United States who enrolled in the INCLUDE trial and were recruited in NYC. Therefore, findings may have limited generalizability to US-born Chinese Americans, individuals who decline or withdraw from trial participation, and those residing in other geographic areas. Second, we purposively selected participants to capture variation in engagement level rather than to achieve demographic representativeness. Nevertheless, the sample included a high proportion of women and individuals with less than a high school education. Findings might not be generalizable to men or those with higher educational attainment. Future research should prioritize recruitment from groups underrepresented in the current sample, including men and individuals with higher educational attainment, to examine factors that impede or facilitate engagement in mHealth diabetes prevention interventions among Chinese Americans. Third, although the interviewer had no role in intervention delivery and used a semistructured guide that explicitly elicited participants' experiences and perceptions of the intervention, responses may still have been influenced by social desirability. Finally, self-reported perspectives may be subject to recall bias, and perceived behavioral and health benefits were not verified as part of this qualitative study. Despite these limitations, this study provides in-depth insights into barriers and facilitators to engagement in a culturally and linguistically concordant mHealth diabetes prevention intervention for Chinese Americans, an understudied population with a high prevalence

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of prediabetes and multiple barriers to accessing prevention services.

Conclusions

This study identified important barriers and facilitators to engagement in a culturally tailored mHealth diabetes prevention intervention among Chinese Americans at risk for diabetes, and elicited participants' recommendations for intervention improvement. The intervention was generally well received. Factors such as cultural tailoring, accessible digital delivery, and personalized human interaction can potentially enhance patient engagement. Future refinement should incorporate more actionable dietary guidance, additional home-based physical activity options, flexible coaching, and culturally responsive produce support. Addressing these barriers may further strengthen engagement and optimize diabetes prevention efforts in this underserved population.

Data Availability

The data generated and analyzed during this study are available from the corresponding author on reasonable request.

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Generative AI Use

ChatGPT (version 5.5; OpenAI) was used to assist with language editing and manuscript refinement and to cross-check whether reported prevalence and population estimates were current. All sources and numerical estimates were independently verified by the authors against the original sources, and all manuscript content was reviewed and approved by the authors.

Authors' Contributions

Conceptualization: NJ, JL, AM, LH
Data Curation: NJ, JL, AM, LH
Formal analysis: NJ, JL, AM
Funding acquisition: LH
Investigation: NJ, JL, AM, LH
Methodology: NJ, JL, AM, LH
Project administration: LH
Resources: NJ, JL, AM, LH
Software: NJ, JL, AM
Supervision, LH
Validation: NJ, JL, AM, LH
Visualization: NJ
Writing – original draft preparation: NJ, JL, AM, LH
Writing – review and & editing: NJ, JL, AM, XY, CT, AX, AW, IO, JMB, SSY, LH

Conflicts of Interest

LH reports holding stock in Tencent Holdings Limited, which owns WeChat, from February 2021 to September 2024. The authors declare that they have no other conflicts of interest related to this work. SSY serves as a Strategic Advisor to Re:Culture Health, a startup focused on perimenopausal health among Asian American women.

Multimedia Appendix 1

Variations between the published INCLUDE protocol and implemented procedures of qualitative interviews among participants.
[DOCX File , 30 KB-Multimedia Appendix 1]

Multimedia Appendix 2

Qualitative interview guide among participants of the INLCUDE intervention.
[DOCX File , 28 KB-Multimedia Appendix 2]

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Abbreviations

CDC: Centers for Disease Control and Prevention
CHW: community health worker
DPP: Diabetes Prevention Program
INCLUDE: Integrating Cultural Aspects into Diabetes Education
mHealth: mobile health
NYC: New York City
NYU: New York University
T2D: type 2 diabetes

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