

Adapting the Diabetes Prevention Program's Power to Prevent for implementation: a Formative Research in peri-urban setting of Bamako, Mali

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Research Article

Keywords: African diabetes, diabetes prevention and management, community health workers, DPP adaptation

Posted Date: December 16th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-2359639/v1>

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Abstract

Background: Although type 2 diabetes and cardiovascular diseases are on the rise in Africa, there are few African community-level behavior change interventions for reducing diabetes and hypertension risk. We describe the process used to develop a pilot program adapting the evidence-based CDC Diabetes Prevention Program's Power to Prevent (DPP-P2P) in two low-income urban communities in Bamako, Mali.

Methods: The 12 DPP-P2P group sessions and handouts were converted into culturally appropriate, pictorial presentations including multiple role-plays and demonstrations. Nineteen community health workers and 45 diabetic and hypertensive patients were recruited to give feedback on the sessions delivered in one-month at two community health centers. Changes in activity levels and diet were assessed by pre- and post-tests. Feedback was given after each session, and at the end, by focus groups conducted with both sets of participants. We performed a content analysis of the focus group discussion data and assessed pre and posttest differences in activity and diet using the Chi-square test, using Stata v. 15.1.

Results: Participants were very enthusiastic about the program. They suggested more emphasis on involving the family, verifying the low-cost of healthy eating, and including exercise guides. The level of inactivity (less than 1 weekly) dropped from 35.3% to 12.1% ($P=0.026$), while engaging in some form of physical activity 3 or more times in the previous week rose from 32.3% to 75.8% ($P<0.001$). Limitation of fat intake rose from 70.6.3% to 97.0% ($P= 0.004$).

Conclusion: This pilot study demonstrates the feasibility and high acceptability of adapting the DPP-P2P delivered through community health workers in a low-income periurban setting of Africa . The high attendance to different sessions, adherence to physical activities encourage for further effectiveness studies of DPP-P2P adaptation.

Background

In recent decades, the prevalence of non-communicable diseases (NCD) such as cancer, diabetes, and cardiovascular diseases (CVD) increased globally (1–3). In sub-Saharan Africa, the prevalence of diabetes and CVD increased about 20% (4–6), especially in women living in urban areas (7,8). In urban Mali, the prevalence of hypertension varies between 21% and 39%, (9,10) and the prevalence of diabetes is estimated at 11% (11). Although data on disease burden attributable to CVD in urban Africa exist, it is likely that they underestimate prevalence due to the numerous undiagnosed and diagnosed without access to care (12–15).

Identified risk factors for both diabetes and hypertension include diet, physical inactivity, smoking, and alcohol consumption (16–18), and all modifiable behaviors (18,19). Diabetic and hypertensive patients can manage their conditions when they combine medications with lifestyle changes recommended through community-based programs led by community health workers (CHWs) (20–23).

In the 1990s, several countries developed programs to prevent or delay the onset of type 2 diabetes in at risk people (24). These Diabetes Prevention Programs (DPPs) consisted of diet and exercise educational sessions delivered individually or to groups by trained health professionals (25–27). In the United States (US), the Centers for Disease Control and Prevention (CDC) has developed the Diabetes Prevention Program’s Power to Prevent program (DPP-P2P), implemented among community groups by trained CHWs (28). The DPP-P2P Program consists of 12 educational sessions led by CHWs who facilitate the adoption of dietary behavior changes and physical activity using a Small Steps, Big Rewards approach (28). More than 40 different communities have successfully implemented the DPP-P2P at Young Men’s Christian Association, churches, and community health facilities (20,29,30).

Despite the evidence of its effectiveness in community settings, there are limited adaptations of the DPP P2P program for low-income countries (31,32), with only one in progress in Africa, in South Africa (33). As in the South African program, the DPP P2P requires substantial modification to account for the large cultural and situational differences between urban West Africa and the US. In addition, the CHWs in West Africa typically have low levels of education, making it difficult for them to deliver a program based on printed instructional materials. Therefore, the objectives of this pilot study were: 1) to assess the feasibility of adapting the DPP Power to Prevent sessions and related materials for delivery by CHWs in the Malian context, and 2) to assess the response to the adapted sessions and materials with potential participants.

Method

Study site

Bamako, the capital city of Mali, had a population of about 2.5 million inhabitants in 2019 (34) with one of the highest growth rates in Africa (35) visible in the city’s extension of informal settlements in peri-urban areas (36). We selected two peri-urban low-income neighborhoods of Bamako, the community health centers of Koulouba and Taliko to pre-test the DPP-P2P materials. Koulouba and Taliko sub-district community health centers (CSCOMs) serve respectively 31,278 and 41,684 inhabitants. The medical officer at each CSCOM was invited to support the study by assisting in the provision of space for the planned group sessions and in preparation of a list of diabetics and hypertensive patients seen at the CSCOM.

Adaptation of the DPP-P2P group sessions and related materials for use in Bamako

We reviewed the 12 DPP-P2P group sessions to determine how they should be revised to be consistent with the cultural and economic context experienced by potential participants in Bamako. All session material were translated into French, the official written language used in Mali, along with guidelines for subsequent verbal translation into Bambara (a local Manding language that serves as the lingua franca

of southern Mali). We converted the CHW training manual and reference materials into pictorial elements, and the session guidelines into PowerPoint presentations. Most importantly, we needed to make the materials culturally sensitive, featuring African participants eating African food and exercising in a typical urban African environment. For instance, most people in low-income peri-urban setting of Bamako have a low-literacy level, and those who are literate usually do not read labels. So, the sessions on label reading and calorie counting are not relevant. Instead of calorie counting, we adopted the concept of reporting portions, aiming to standardize how people measure their portions of rice and other main dietary elements. A major change in approach was needed to accommodate the social realities of shared food preparation and eating from a common bowl in Bamako households. Many households have multiple adult women, some co-wives in polygamous marriages, and others siblings or relatives, and they share cooking responsibilities. In addition, the consent of the male household head was recognized as being essential for any major change to the family's diet. Therefore, we wanted to provide guidance for involving the head of household and all women and sharing cooking responsibilities in the household.

Assessment of Feasibility for Delivery of the Adapted Sessions by CHWs

We invited 24 CHWs actively supporting their respective health sub-districts to participate in the pilot study. Of these, 10 from Taliko and 9 from Koulouba, (mainly female) agreed to participate in the DPP-P2P pilot study. These CHWs are community volunteers who receive task-oriented training for social mobilization, outreach for mass vaccination or drug administration campaigns, support for child and maternal nutrition services. The research team met with the participating CHWs at their respective community health centers (CSCOM), to explain the objectives and potential outcomes of the study. We conducted a focus group with them to assess their preliminary reactions to the proposed program. The focus groups were conducted in the lingua franca of Bamako, Bambara, and lasted about an hour. The discussions were led by a moderator assisted by two research team members and covered five themes: 1) experience and knowledge of diabetes; 2) interest in a program supporting lifestyle change; 3) understanding about working in group; 4) perception of issues associated with making lifestyle changes; 5) suggestions for what others might need to help them change their lifestyle. Audio recordings of the discussions were professionally transcribed from Bambara into French and then analyzed using Content Analysis. (37)

Assessment of Acceptability of the DPP-P2P adaptation with Potential Participants

A quasi-experimental pre and post-test was designed to assess the acceptability of the adapted sessions and material in terms of diet and exercise behavior changes. With the assistance of the CHWs, the research team invited potential participants to learn about the pilot study. Forty-five individuals (mainly female) consented to participate in the pilot study. They had an average age of 49, 58% had been

diagnosed with diabetes, and 71% were hypertensive, with an average of 8 years since their diagnosis. Participants received snacks, drinks and transportation reimbursement.

The role plays and activities of the twelve sessions were finalized after receiving feedback from the CHWs via their focus group. The CHWs were trained to assist the researchers in facilitating the sessions with the participants. At each community health facility (CSCOM), sessions were conducted 3 times a week for 4 weeks and consisted of PowerPoint presentations, group discussions, and role plays. Sessions were conducted in Bambara. Participants were introduced to the first 3 sessions as one group, and then they were split based on their neighborhood proximity into two groups: a physical activity group and a diet group. Sessions were held on alternate weekdays, with the physical activity group receiving sessions 4, 5, and 6, and the diet group sessions 7, 8, and 9. All groups participated in sessions 10, 11, and 12. Each session lasted 3 hours and began with a round table discussion with participants, to obtain feedback on both easiness and difficulties they encountered when applying lessons learned during the previous session. The session closed with participants providing verbal feedback on the session itself.

The participants' pre-post changes in diet and physical activity behaviors were assessed by a 26 question, multiple choice survey administered before session 1 and after session 12. The pre-test also included questions about challenges they faced in changing their lifestyle behavior after being diagnosed with their condition. Research team members assisted illiterate participants in completing the surveys. Descriptive analysis of demographic information and pre- and post-test differences in activity and diet were assessed using Stata v. 15.1.

Focus groups were conducted after the post-test survey to obtain overall feedback on the program's acceptability and to elicit suggestions for further improvements to the adaptation. These focus groups used the same methodology described above for the focus group with CHWs.

The study protocol was approved by the Ethics Committee of the Faculty of Medicine and Dentistry and the Faculty of Pharmacy of the University of Bamako (USTTB) as an exempt study.

Results

Focus groups with the CHWs

Experience and knowledge of diabetes and hypertension: The CHWs had heard about hypertension and diabetes, and most knew someone with one of these diseases. They observed that the diseases are more likely to occur if others in the family have the disease. Recently, however, they felt the hereditary basis was not necessary, as more people were getting the disease, even young people. One participant said :

They say that hypertension is a disease for the elderly, but we notice today that there are young people who have hypertension which explains that it is not a disease of the elderly alone.

There was a consensus that salt was linked to hypertension, and sugar to diabetes, and that sports were supposed to help control both. CHWs wanted a better understanding of the diseases and their risks, so that they can really educate and motivate people when talking about the behavior change.

...it is said that if you practice sports or if you deprive yourself of salt in the evenings, you will not have hypertension. We do not understand this because very recently a ten-year-old child was diagnosed at our CSCOM with hypertension. We would like to know how these diseases arise, and what is the difference between those figures that go up and that go down [on blood pressure machines].

Suggestions for behavior change: Participants started with proposals to cut down salt, and then some added sugar, sweets, and sweet drinks.

The change can be to go without salt or sugar, and to take medicine when needed if we receive this recommendation.

We must try to diversify our meals by reducing the consumption of salt. Cooks tend to put lots of salt-concentrated bouillon cubes in the sauce (typically made from dehydrated vegetables or meat stock, a small portion of fat, monosodium glutamate, salt, and seasonings, shaped into a small cube).

Eliminating salty concentrated bouillon cubes was discussed in both groups, but reducing oil was mentioned only once. Cutting down rice consumption (portion size) was only mentioned once, and no one suggested increased consumption of fruits and vegetables.

When asked about the practice of exercise and physical activity, most thought this was for young people and not for elderly.

Young people who have blood pressure can do sport, but old people should have their diabetic sugar apart.

Suggestions for physical activity were mostly to walk at home in the compound or neighborhood, but also bicycling, including stationary bike.

How to motivate change: Involving family and close friends were mentioned several times in both groups. Participants said that making changes in diet for one individual was not easy. Any changes in diet must be for the whole family, necessarily involving the head of the household in the decision to change. Also, all the cooks in the household must agree to the changes. For example, reducing salt-concentrated bouillon cubes will be challenging, since this is a way of cooking on a limited budget.

...it would be very good to involve a close person, it can be the spouse, or a child. The latter can remind you repeatedly while encouraging you...

How to motivate participation in the program: They suggested that referral by a doctor might be necessary to motivate the partner or a support person in the household to attend and participate.

However, they agreed that program participants still will need the CHWs to explain what needs to be done and visit them in their homes to provide support.

Findings from the CHW focus groups helped to identify where role plays would be more relevant than words to explain behavior changes, and what aspects of lifestyle change should be considered in the sessions. Table 1 displays a grid showing the original group sessions for DPP-P2P and how they were adapted in this formative research.

Feedback from Participants on the adapted DPP-P2P Sessions

After one month of implementation of the adapted DPP-P2P sessions, the session attendance rates were over 96%, and this attendance rate suggests a high level of interest in the program. In the end of program focus group, participants made helpful suggestions about the format and messages of the proposed adaptation of the DPP-P2P program for use in Bamako. Table 2 summarizes feedback from participants on the sessions. They stressed the importance of involving the family, especially all women preparing food for the household. They felt more confident about increasing their exercise levels than changing their diet but agreed that support from the CHWs was key to these changes. Their suggestions were used to improve the adapted sessions for the subsequent effectiveness study.

Pre-post Changes in Behavior among Participants

After one month of group session implementation, there were significant changes in the proportions of participant self-reported adoption of the recommended dietary and physical activity recommendations (Table 3). There were significant increases in those wanting to eat more healthy and be more active, and they had already begun to limit fat intake and increase their exercise levels.

Discussion

The formative research process used in developing our adaptation of the DPP-P2P program faced many challenges: Conversion of the DPP materials from English to French to Bambara, modification of tools for delivery by low-literacy CHWs, expansion of interactive elements to the group sessions, use of pictorial communication tools, adaptation of the materials from the US to Malian context.

Acceptability of DPP adaption studies has been examined using attendance rates, transportation to attend program sessions, dropout rates, and completing the diet and activity tracking documents (32). In this study, 96% of the participants attended the twelve sessions, reflecting a high level of interest in the program.

A key adaptation was to convert the social support session to one devoted to the importance and strategy for involving the head of the family, along with other women sharing cooking. In Mali where polygamy is

common, family support is paramount, because in Malian extended families, families' members eat from common bowls, with the adult women of the household taking turns cooking for the whole family. The household head is usually the one who approves of and provides the money for purchasing the day's food. In this situation, cooking a special meal for a single diabetic family member can mean extra cost, as well as the necessity to prepare two separate sauces for the family, one for the diabetic and one for everyone else. Thus, it would make more sense for the whole family to eat a sauce prepared according to healthy eating recommendations, which would benefit not only any persons with diabetes but also those who may be at risk for diabetes or hypertension. In the qualitative feedback provided by the participants, involvement of the family was considered an important aspect of the program. Other DPP adaptation studies have received positive feedback for eliciting family support (32,38,39) and more generally of social support for diabetes control efforts (40).

Even though they had been diagnosed with diabetes and received an initial set of recommendations from their doctor, the adapted DPP sessions exposed the participants to a new way of looking at their role in controlling diabetes. They reported learning about ways that they could change their diet that they felt they could do. While they continued to be wary of changes that might cost more, they recognized that it could be possible with the tips they received from the program. They had begun to limit fat intake. More importantly, the program's stress on involving everyone cooking meals made changing their diet surmountable. As one said, it is not a question of cost but habit.

The greatest behavioral changes in the short duration of the pilot program were in exercise. The participants' approval of the overall program was evidenced in their hope that this program could be made available to a much larger population. Findings from the pre and post-test show significant improvement in engaging in physical activity as well as being selective in what they eat. The reported changes in behavior may also reflect the participants' growing desire to learn how to control diabetes. As in other studies, this change in their views on controlling diabetes may reflect a better understanding of the concrete steps they can take to achieve control. While we do not have a comparison group of those who did not participate in the program, the increased adoption of at least some of the diet and exercise recommendations after the short month's exposure to guidance suggests that a longer and more complete exposure to the sessions could result in even more participants making behavior changes to support their control goals. Even though they are preliminary, our findings reflect those of Baghaei et al. who found that illiterate diabetes participants were more than 8 times likely to adhere to self-care behaviors after receiving behavior change education sessions compared to those who are literate (41).

The feedback from the CHWs and participants, combined with the review of changes in behavior observed during the pilot, show that our adaptation is well-received. Their comments and experience suggest that the next and more complete Malian adaptation of the DPP-P2P modules incorporate both more time and more participatory elements.

Limitations

This study has limitations. First, as a pilot test of the feasibility of implementing a DPP adaptation, we offered the program to a very small group of participants. Very few males participated, so we were not able to assess how gender might influence their response to the program. This sample size was too small to permit any detailed data analysis of their response to the program. Second, all of the participants were selected by the CSCOM medical officers as having diabetes or hypertension. Therefore, it is not a test of prevention but rather of control. Third, the feasibility trial was carried out over a period of one month, which is fast enough for feedback but not fast enough for promoting some of the most important recommended behavioral changes, specifically for diet and portion size. Thus, we did not expect major changes in dietary patterns, and we did not weigh the participants or collect any biomarkers. Fourth, all data reported by the participants were self-reported, rather than directly measured. They may have reported what they thought the researchers wanted to hear. In addition, in this fairly non-literate group of participants, they may have been unaccustomed to surveys and may not have fully understood the questions or the answer choices. These limitations were addressed in the ongoing clinical effectiveness trial of PPD-Mali.

Conclusion

This pilot study demonstrates the feasibility and acceptability of adapting the DPP-P2P for low-income participants in peri-urban African settings such as for Bamako. The response of the CHWs to the pilot showed that it was feasible to conduct group sessions using the materials adapted for this context. The response of the participants to the program further demonstrated its feasibility and acceptability. Although the study duration was too short and the sample too small to assess its potential effectiveness for promoting behavior change, the findings encourage pursuing further refinements and piloting of this DPP-P2P adaptation.

List Of Abbreviations

CDC: Centers for Disease Control and Prevention

CHWs: community health workers

CSCOM: community health centers

CVD: cardiovascular diseases

DPP: diabetes prevention program

DPP-P2P: diabetes prevention program's power to prevent

NCD: non-communicable diseases

p : probability

PPD-Mali: diabetes prevention program in Mali

US: United States

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Ethics Committee of the Faculty of Medicine and Dentistry and the Faculty of Pharmacy of the University of Bamako (USTTB) as an exempt study (#2019/132/CE/FMPOS)

Consent for publication

All participants provided written consent to publication of their anonymous data.

Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available due the small sample size and risk of breach of confidentiality but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

Funding

This study was funded through a Health Partners International Institute innovation fund award. The funder had no role in the design of the study and collection, analysis, interpretation of data, or in writing the manuscript.

Authors' contributions

S.F., S.D., and H.O.B. designed the study. S.F. and S.D. obtained funding. A.B., B.M., and L.D. collected the data. S.F., H.O.B., and L.D. analyzed and interpreted the data. L.D. and S.F. were major contributors to the writing of the manuscript. All the authors reviewed the manuscript, read and approved the final manuscript.

Acknowledgements

The study authors gratefully acknowledge Professor Peter Winch of Johns Hopkins University for his critical revision of the manuscript. We would also like to thank the Fogarty International Center for supporting Lancina Doumbia for his PhD studies under the grant 2D43TW008652.

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Tables

Table 1 Adaptation of the DPP-P2P sessions for Bamako pilot test

Original DPP-P2P sessions	Malian adaptation	Major elements added or changed
1. Welcome to the DPP program	1. Welcome to PPD-Mali	<p>Insert “What is Diabetes? educational materials from Santé Diabète Mali (SDM)</p> <p>Simplify description of DPP outcomes</p> <p>Presentations and tools in French with illustrations using Bamako pictures</p>
2. Small Steps lead to Big Rewards (SSBR)	2. Small Steps for you and your spouse	<p>Adapt SSBR game plan and food and activity trackers with local pictures</p> <p>SSBR flipchart story to Halimatu & Amadou, per SDM pamphlet</p> <p>Add role plays and games illustrating spouses supporting each other</p>
3. Getting started with your plan	3. Engage the family for social support	<p>Adapt Benefits of Social Support module (# 10) for engaging family head</p> <p>Develop role plays to build confidence for introducing program to family head and co-wives.</p>
4. Move More	4. Move More- At home and outside	<p>Exercise demos from Malian exercise coach</p> <p>Videos of Senegalese women exercising and dancing</p>
5. Reduce your calorie intake	5. Small steps toward healthy eating	<p>Introduce healthy eating concepts using adapted Malian healthy eating “spotlight” charts</p> <p>Include a recommended weekly menu, using glycemic index of Malian sauces</p>
6. Control temptation	6. Eat less but better	<p>Adaptation of DPP session 9, with more emphasis on portion sizes</p> <p>Convert calorie counting to portion size and sauce type for the food tracker</p> <p>Role play to estimate portions consumed from communal pot</p>
7. Resolve problems	7. Resolving problems	Additional role plays and discussions on handling flagging motivation to change
8. Four keys to eating out	8. Five keys to healthy eating out	<p>Remove items pertaining to reading menus</p> <p>Substitute recommendations on street food and buying food outside home and during celebrations and family gathering</p>

Original DPP-P2P sessions	Malian adaptation	Major elements added or changed
9. More volume, fewer calories	9. Drink water, not sodas	<p>Add a separate module on drinking water, part of DPP session 9.</p> <p>Messages on reducing alcohol and beer, and restricting sweetened tea and juices</p>
10. Have a healthy heart	10. Healthy heart diet	<p>Adaption of DPP session 10 with a pictorial introduction to hypertension</p> <p>Add Stoplight on foods messaging, to avoid “Stop” and limit “Caution” foods</p> <p>Emphasize reducing salt, bouillon cubes, and sugars</p>
11. Benefit from social support	11. How to keep your family motivated	<p>Adaption of DPP session 12, with more emphasis on motivation of spouse.</p> <p>Additional discussion on gaining support from family and neighbors</p> <p>How to re-start the small steps, whether exercise or diet</p>
12. Prepare for the long term	12. Looking backward to look forward	<p>Adaptation of session 12</p> <p>Celebration to thank each other, the spouses, the family, and the CHWs</p>

DPP = diabetes prevention program, PPD-Mali = diabetes prevention program in Mali, CHWs = community health workers, SSBR = small steps lead to big rewards

Table 2 Participants’ feedback on the adapted DPP-P2P sessions

Major themes	Participants' feedback
<i>Importance of involving the family</i>	Participants reached out to the family heads and other family members about modifying diet for the whole family and had to learn how to address criticisms. Managing these communications was considered a key for success. It is necessary to involve all the cooks including co-wives in the diet change. They had to learn to continue, ignoring criticism so that they would not become discouraged. They agreed that it is important to continually remind oneself and others in the family that the objective is one's own health.
<i>Maintaining constant costs when changing their diet</i>	Changes in diet should not increase family head's budget. Cooks need advice on how to prepare healthy food without additional costs. They agreed that one could cut costs, such as salt-concentrated bouillon cubes, which would allow this money to be used for vegetables to put in the sauces. Instead of everyone purchasing lunch or snacks separately, they could pool the money and use it to buy vegetables for the whole family.
<i>Yet, cost is not the biggest obstacle</i>	One participant noted, "It is not so much a matter of cost as habit." They wondered how to apply recommendations for portion size and calories when meals are served from a shared bowl. All agreed that changing the content of collective meals requires group solidarity, so that habits are changed for all and for a long duration.
<i>Controlling diet is a continuous struggle but not impossible</i>	After participating in the sessions, they now understood the importance of dietary diversity and balance. They were also pleased to learn about good alternatives to rice, such as the traditional millet paste or le "tô malien" which had been abandoned by many now living in Bamako.
<i>Changing physical activity can be done</i>	All agreed that this was much easier to do and indeed they had started immediately with this after the first three sessions. Some had also started walking, by themselves or with their husbands. At Taliko, they had started weekly walking/dancing groups. They suggested that the program should find a coach to mentor these groups in their exercise plans so that their activities are more effective. Several participants said they had already started to feel the good results of regular exercise.
<i>The Game Plan to track their planned and actual changes in nutrition and exercise</i>	They liked the idea of a game plan, because it will help them continue to work for good results
<i>Importance of the CHWs in supporting the behavior change</i>	Participants congratulated the CHWs who encouraged them in making changes. They were impressed that the CHWs had already started talking with their neighbors and friends about making changes. Their hope would be for the project to reach a large population, not just a selected few

CHWs = community health workers

Table 3 Pre-test vs. Post-test Healthy Behaviors and Objectives of Participants and *p* value

Healthy Behavior	<u>Pre-test</u>	<u>Post-test</u>	<i>p</i>
	N=34	N=33	
Limits fat intake	70.6%	97.0%	0.004*
Limits how much eaten	61.8%	54.6%	0.549
Not active in past week	35.3%	12.1%	0.026*
Active 3+ days in past week	32.3%	75.8%	<0.001**
Vigorous activity when active	38.5%	61.5%	0.058
Objectives			
Lose weight	76.5%	90.0%	0.116
Eat more healthy	44.1%	71.4%	0.022*
Be more active	41.2%	68.6%	0.022*
Learn how to control diabetes	44.4%	55.6%	0.120

p = probability, **p* < .05. , ***p* < .001.