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Original Research

Exploring the Outcomes of a Pilot Education Program Tailored for Adults With Type 2 Diabetes and Mental Illness in a Community Mental Health Care Setting

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Key Messages

- The experience of mental illness symptoms and the socioeconomic implications that often co-occur require health-care providers to adapt tailored diabetes education care strategies.
- Effectively supporting patients to gain diabetes self-management skills required may need to extend beyond the counselling room and into patients' environments and activity settings.

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ABSTRACT

Objectives: People with mental illness and type 2 diabetes are more likely to experience diabetes complications than the general population. Diabetes management can be improved with tailored lifestyle intervention content. The purpose of this pilot study was to investigate diabetes insights of mental health-care patients after participation in a tailored education intervention.
Methods: A 12-session diabetes education program was created to address the learning needs and challenges that people with mental illness may experience. The program was assessed through conducting interviews with 6 participants combined with quantitative data to describe the population. Interviews were transcribed verbatim, assessed for quality and coded to identify relationships and meanings between identified themes.
Results: Throughout the year of participation, blood sugar control and physical activity level improved for some and worsened for others. Weight remained stable and dietary intake patterns appeared to improve overall. Participants described the appropriateness of the teaching strategies and program structure developed, and all improved their understanding about diabetes and gained practical self-management knowledge. Opportunities for program improvement included extending care beyond the counselling room to address financial limitations, incorporating a practical activity component and creating opportunities for social support. Additionally, leaving some sessions as patient directed would further individualize education care.
Conclusions: Our study offers a concrete education program strategy that aligns with Diabetes Canada's self-management education guidelines to support the provision of diabetes care for people with mental illness. Modifying program delivery may help to curtail the increasing rates of morbidity and mortality currently observed in this population.

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RÉSUMÉ

Objectifs : Les personnes atteintes d'un trouble de santé mentale et du diabète de type 2 sont plus susceptibles d'avoir des complications liées au diabète que les personnes de la population générale. Un contenu d'intervention adapté sur le mode de vie peut rendre possible une meilleure prise en charge du diabète. Le but de la présente étude pilote était d'examiner les points de vue des patients diabétiques sur les soins de santé mentale après leur participation à une intervention éducative adaptée.

Méthodes : Nous avons créé un programme d'éducation sur le diabète de 12 séances pour répondre aux besoins éducatifs et surmonter les difficultés que les personnes atteintes d'un trouble de santé mentale peuvent rencontrer. Nous avons évalué le programme à l'aide d'entrevues menées auprès de 6 participants conjointement aux données quantitatives pour décrire la population. Les entrevues ont été transcrites textuellement, ont fait l'objet d'une évaluation de la qualité et ont été codées pour cerner les relations et les significations entre les thèmes retenus.

Résultats : Au cours de l'année de la participation, quelques participants ont connu une amélioration de la maîtrise de leur glycémie et de leur niveau d'activité physique alors que d'autres participants ont connu une détérioration. Le poids est demeuré stable et les modèles de consommation alimentaire ont semblé dans l'ensemble s'améliorer. Les participants ont décrit la pertinence de l'élaboration des stratégies d'enseignement et de la structure du programme, et ont tous eu une meilleure compréhension du diabète et acquis de meilleures connaissances pratiques sur la prise en charge autonome. Les possibilités d'amélioration du programme étaient notamment l'élargissement des soins au-delà du bureau de counselling pour pallier les contraintes financières, l'intégration d'une composante pratique de l'activité et la création de possibilités pour recevoir du soutien social. De plus, le maintien de quelques séances dont le contenu est axé sur le patient permettrait d'individualiser davantage les soins éducatifs.

Conclusions : Notre étude offre une stratégie concrète pour un programme d'éducation qui s'harmonise aux lignes directrices sur l'éducation à la prise en charge autonome de Diabète Canada pour favoriser la prestation des soins aux diabétiques atteints d'un trouble de santé mentale. La modification de la prestation du programme peut aider à freiner l'augmentation des taux de morbidité et de mortalité actuellement observés dans cette population.

Introduction

People with mental illnesses, such as schizophrenia and major mood disorders, and type 2 diabetes are 3 to 4 times more likely to experience early mortality than the general population (1). The higher prevalence of type 2 diabetes (2), along with increased rates of complications from suboptimal blood sugar control, are factors that contribute to reduced life expectancy (3).

Many factors appear to lead to the adverse diabetes outcomes in people with mental illness. For instance, some medications for mental disorders increase blood sugars by causing increased appetite, weight gain and insulin resistance (4). People with mental illness also tend to have reduced physical activity and poorer diets than the general population (5). Reduced access to diabetes care services may, in part, be related to gaps in diabetes knowledge (6,7). People with mental illness are more likely to have lower health literacy than the general population (6,8). Studies have also found that mental illness and diabetes are both conditions that can reduce cognitive function, which limits problem-solving abilities and processing speed; all of these factors can interfere with understanding information (8–10).

Poorer self-care is often observed even when diabetes education has been received and patients are knowledgeable (11–13). This may be from challenges related to mental illness that can limit ability to eat healthfully and engage in activity (6,14,15). Unemployment and low income may reduce the ability to afford to follow diabetes self-management guidelines (6,13–16). Additionally, people with mental illness are more likely to lack social networks that reinforce positive diet and lifestyle behaviours (10,11), and social isolation can further impede dietary intake (17).

In consideration of diverse diabetes self-care challenges and needs that may be experienced, Diabetes Canada's self-management education guidelines emphasize the importance of appropriately tailoring education content (18,19). Factors recommended to consider include the individual's learning ability, readiness to receive information and make changes, literacy level, socioeconomic status and other health-related challenges. Additionally, diabetes support for people with mental illness is recommended to include coping skills training, motivational interventions and stress management strategies (18).

Absence of using approaches to address these factors may explain why education is not always effective for people with mental illness. For example, providing too much information at one time may become overwhelming and can leave patients feeling confused about diabetes management guidelines (12,20). Following a rigid agenda without room for discussion can result in participants becoming disengaged because content is not tailored to their needs (20). Finally, assuming that knowledge alone can facilitate behaviour change without accounting for participant's skills, available resources and interests has shown to be ineffective (13,20).

However, even when comprehensive education interventions are designed for people with type 2 diabetes and mental illness, minor but clinically insignificant improvements in blood sugar and weight measurements are often observed (21). Therefore, the objective of this study was 2-fold. First, it was to examine the effectiveness of an education intervention created for people with mental illness using knowledge gained from the literature and previous focus groups conducted by the authors. The second was to investigate the experience of mental health-care patients who participated in the intervention. Findings can inform clinicians on how to modify diabetes care to better meet the needs of patients with mental illness.

Methods

This pilot study has been reviewed and approved by the Western University Health Sciences Research Ethics Board.

Study design

A tailored diabetes education intervention was implemented at a community mental health organization that had previously been partnering with a local diabetes education program in London, Ontario, Canada, to provide diabetes education to mental health patients. The rationale for this program modification was to better meet patient learning needs and improve health outcomes.

Mental health patients receiving care as usual along with all new program referrals were enrolled in the tailored diabetes education intervention. The education was delivered between November 2017 and December 2018. Education sessions were provided by a registered dietitian (RD), certified diabetes educator (CDE) and a mental health registered nurse (RN). The mental health registered nurse (RN) received training by becoming familiar with the Diabetes Canada's clinical practice guidelines (18) and shadowing the RD CDE and an RN CDE at their community diabetes education workplaces for practical knowledge.

Data were gathered through 1-on-1 qualitative interviews with patients who voluntarily consented to participate upon completion of the education program. Quantitative data are reported to describe the population.

Preliminary diabetes education intervention development

Prior to creating the diabetes education intervention, a needs assessment was conducted to inform the design of an appropriately tailored diabetes education program for people with mental illness. This included a literature search to identify effective lifestyle education program components (22–25). Additionally, focus groups with mental health-care patients and providers were held to learn patient perspectives about barriers they experienced (6,26). Information collected informed the incorporation of the following teaching strategies: 1) accommodate cognitive function and information processing level, 2) simplify information provided, 3) engage in participatory learning with participants, 4) help patients see how they can apply the guidelines, 4) provide motivation, 5) enhance positive social support and 6) address mental health symptoms. Practical approach tips to achieve these teaching strategies are summarized in Table 1.

Table 1
Recommended teaching strategies to consider when providing diabetes education to patients with mental illness

Teaching strategy	How to achieve
Accommodate cognitive function/ information processing level	• Discuss learning style and literacy level • Speak at the patient's pace • Leave silence and wait for patients to respond • Provide information in moderation
Simplify information provided	• Explain concepts without grey areas (i.e. use if-then statements) • Define terms (i.e. what is high blood sugar, moderation) • Provide demonstrations (i.e. portion sizes using food models) • Use handouts with visual supports • Avoid repetition without elevating concepts to a more challenging level
Participatory learning	• Have conversations about diabetes education topics instead of teaching a lesson • Support application of knowledge (i.e. ask the patient questions)
Help patients see how they can apply guidelines	• Demonstrate portion sizes using food models or hand method • Discuss healthier cooking methods, ingredients to choose more often • Help plan routines around meal timing and physical activity • Discuss budgeting and food purchasing skills • Problem-solve around lifestyle change challenges
Provide motivation	• Discuss how behaviours are/can visibly enhance health • Create patient-centred goals • Use motivational interviewing strategies • Offer check-ins to keep patients on track
Enhance positive social support	• Teach about communicating support needed within social network
Address mental health symptoms	• Avoid all or nothing thinking, i.e. promote moderation

Diabetes education intervention content and delivery

A diabetes education program and corresponding manual were created in accordance with teaching strategies previously noted, Diabetes Canada's clinical practice guidelines (18) and Health Canada's guidelines for Healthy Eating and Active Living. Four teaching modules were designed to address pillars of diabetes education self-management. The first module, Understanding Diabetes, had the objective of providing patients with insight on how behaviour can impact health outcomes. Topics discussed included the pathophysiology of diabetes, how diabetes management can improve outcomes, blood sugar targets and the importance of further preventing complications through regular screening and following sick day management guidelines. The second module, Nutrition, had the goal of helping patients understand dietary patterns associated with blood sugar control, while building practical skills and knowledge to incorporate necessary changes. In consideration of the higher prevalence of heart disease in people with mental illness (27), a session reviewing dietary guidelines for heart health was included in the Nutrition module. The third module, Physical Activity, had the objective of providing awareness of activity level and health benefits associated with engaging in regular activity. The fourth module, Behaviour, was designed to develop thoughts and behaviours that positively contribute to mental health and healthy eating. Sessions explored the relationship between food and mood; how to address emotional eating, sleep hygiene and stress management; how to overcome barriers to physical activity and how to stay motivated to maintain behaviour changes. Table 2 further describes the modules and education sessions.

Picture-based education material with simple language was provided at each session to be suitable for a lower literacy level and impaired cognitive function. Materials from health organizations such as Diabetes Canada, Health Canada and the Registered Nurse's Association of Ontario were primarily used in combination with resources created by one of the authors (A.C.). Sessions were 60 min in duration and were attended once monthly over a 12-month period. Topics were divided between the RN and the RD, as indicated in Table 2.

Both health-care providers reviewed the research supporting the diabetes education intervention development. During the initial session, getting to know patients' learning styles and literacy levels through discussion enabled the clinicians to identify which

Table 2
Diabetes education protocol

Module	Objective	Session description
Understanding diabetes	• Build insight about diabetes and ability for health behaviours to change outcome	Session 2 (RN): Pathophysiology of diabetes • What is diabetes discussion • The role of diet, activity and medications in controlling blood sugars to slow progression of diabetes and prevent complications • Blood sugar targets required for complication prevention Session 3 (RD): Hypoglycemia • Risk factors of hypoglycemia, symptoms and recommended treatment Session 6 (RN): Understanding how diabetes medications work Session 7 (RD): Sick day management guidelines Session 8 (RN): Foot care • How to care for feet • Supporting yearly screening Eye care • How eyes work and how diabetes-related complications occur • Supporting yearly screening
Nutrition	• Understand how dietary intake can control blood sugars and slow the progression of diabetes • Acquire practical nutrition and food preparation knowledge	Session 3 (RD): How diet helps to control blood sugars • Food sources of carbohydrates, fat, protein and fibre and how combining nutrients at meals can control blood sugars and slow the progression of diabetes • Recommended meal timing • Recommended portion sizes per meal period using healthy plate and hand method Session 5 (RD): Healthy eating when shopping and preparing food • Healthy choices at the grocery store • Cost of healthier food choices and budgeting • Eating away from home Session 7 (RD): Label reading • Health Canada's label reading guidelines to focus on: saturated and trans-fats, sodium, fibre and added sugars Alcohol consumption • Review of Diabetes Canada's guidelines, and nutrient content of alcoholic beverages Session 11 (RD): Heart health • Dietary intake strategies to lower cholesterol
Exercise	• Increase awareness of sedentary behaviour • Increase level of physical activity	Session 4 (RN): Physical activity • Benefits of physical activity and guidelines • Resistance activity • Setting up for success by measuring and tracking activity
Behavioural	• To develop thoughts and behaviours that positively contribute to mental health and healthy lifestyles	Session 9 (RD): Food, mood and emotional eating • Awareness of physiological hunger and satiety • Discussion of how food affects mood and alternative methods for coping with stress and mental health symptom management • Behaviours that are associated with cravings Session 10 (RN): Overcoming barriers to physical activity discussion • Sleep hygiene • Stress management • How stress affects nutrient needs and how to cope with stress Session 12 (RN): Staying motivated • Positive behaviour changes review and maintenance discussion

RD, Registered dietitian; *RN,* Registered nurse.

teaching strategies outlined in Table 1 to use when delivering program content. For example, when a participant was unable to read the nutrition labels, the general concept of how to use the percent daily value was explained using pictures, and the remainder of the time was spent discussing specific examples of foods usually consumed. Further individualization of the diabetes education program content was achieved by discussing patient's diabetes-related health goals and providing an overview of the diabetes education program content. The order of sessions was modified as needed. For example, the heart health section was prioritized for participants most concerned about heart disease. Topics not relevant to patients were omitted. A 3-day food record was reviewed at the first appointment with the RD, and dietary intake was discussed at subsequent sessions to individualize content provided within the nutrition module.

Study participants

Sixteen patients were enrolled in the tailored diabetes education program at the community mental health organization. Patients met the inclusion criteria for the research study if they 1) had diabetes or prediabetes, 2) had $\geq$1 mental illness (defined as schizophrenia, schizoaffective disorder, bipolar disorder or major depressive disorder), 3) completed the 12 education sessions and 4) independently managed their diabetes while living in the community (defined as being responsible for taking medications, meal preparation, managing physical activity levels and checking blood sugars on own). Patients were excluded if they 1) were not responsible for managing their own diabetes (i.e. require support for daily diabetes self-care activities), 2) experienced pregnancy or medication changes that would impact weight and blood sugar

levels and 3) were diagnosed with a learning disability or deaf/blind impairment that would require further tailoring of education approaches. Eleven patients met the criteria and were invited to voluntarily participate in the research study by a research student who contacted them by phone. Seven patients consented to having their outcome measure data to be used, and 6 patients consented to participating in an interview to provide feedback. One patient was a new referral, and 6 patients had been receiving diabetes education care as usual at the time the tailored diabetes education program started.

Data collection

Participant charts were reviewed retrospectively for the outcome measures taken over the course of the diabetes education program.

Individual interviews were conducted by a research student at a community health organization easily accessed by public transportation in London, Ontario. A $20 honorarium was provided to participants. A series of semistructured questions with prompts to stimulate meaningful conversation were asked. Please see Supplementary Appendix 1 for the list of questions included.

Interviews were transcribed verbatim and reviewed concurrently with data collection to assess quality. To facilitate participant recall, modifications included leaving silence as an opportunity for reflection and providing the diabetes education program outline as a prompt for participants to elaborate on specific program components.

Descriptive measures

Blood sugar control: Glycated hemoglobin (A1C) was the primary outcome measure because it is a reliable estimate of blood sugar over an 8- to 12-week period, and estimates the risk of developing diabetes-related complications (18). A1C was measured using a calibrated DCA 2000 system (Bayer) at baseline and every 3 months.

Anthropometrics: Anthropometric measurements were assessed as a secondary outcome measure. Weight gain from psychotropic medications contributes to the increased risk of type 2 diabetes observed in people with mental illness (25). Conversely, losing 5% to 10% of body weight is associated with improved blood sugar control and reduced cardiovascular risk (18). Furthermore, weight monitoring measures are recommended by Health Canada because higher body mass index (BMI) and waist circumference correlate with type 2 diabetes among other metabolic comorbidities, such as heart disease and hypertension (18).

Anthropometric measurements taken included height and weight. Body mass index (BMI) was calculated at baseline and every 3 months using the equation of BMI = kg/m^2. Waist circumference was measured at baseline and at the end of the education program by placing a measuring tape horizontally and snugly around the waist, just above the hipbones (28).

Diet assessment: Dietary intake was assessed using the UK Diabetes and Diet Questionnaire (UKDDQ), a reliable and valid tool designed to assess individual diet (29). The questionnaire asks about various food frequencies and dietary intake patterns. A total of 20 responses are scored between A and F, where A is the healthiest dietary behaviour and F is the least healthy. To quantify and compare results, lettered scores were assigned the following numerical values: A=6, B=5, C=4, D=3, E=2 and F=1; from there a total score was calculated. Higher scores reflect healthier dietary intake and habits, and increased scores suggest improvement.

Physical activity assessment: Physical activity was assessed using the short form version of the International Physical Activity Questionnaire, which has been further validated for use in people with schizophrenia (30). The questionnaire involves a self-report of the frequency and duration of various intensities of physical activity (vigorous, moderate, walking and sitting) participants have engaged in over the past 7 days.

Data analysis

Axial coding was used to analyze data from individual semi-structured interviews. This process involved making connections between open code categories to combine similar concepts (31). To critically evaluate data, transcripts were reviewed for comments that went against identified themes. Axial codes were further refined by analyzing relationships and meanings among the identified themes. This created the emergence of global themes that related to the diabetes education program teaching strategies used to create the intervention. Two authors (A.C. and C.S.D.) developed the open codes independently and came to consensus through discussion regarding the axial and global themes.

Results

Description of the population

The study sample consisted of 7 individuals in total, 2 of whom had prediabetes (29%) and the remaining 5 had type 2 diabetes (71%). More than one-half were men (57%, n=4), and had a mean age of 63±11 years. In terms of ethnicity, 71% of study participants were Caucasian. Over 86% had a known psychiatric diagnosis, with schizophrenia being the most prevalent (Table 3).

Health status scores

A1C scores for the 7 participants show that blood sugar control improved for some and worsened for others. One participant's blood sugar level reduced steadily throughout the education intervention, whereas the remaining 6 participants' scores fluctuated. In the prediabetes group, average A1C varied between 6.05% and 5.6%. A1C in the type 2 diabetes group varied between 6.42% and 6.54% (Figure 1).

BMI values remained the same for the prediabetes and type 2 diabetes groups (Figure 2). Between time 1 (T1) and time 4 (T4), the prediabetes group BMI ranged from 39.5 to 41.8 kg/m^2. Over this same period, average BMI ranged between 32.4 and 32.9 kg/m^2 in the type 2 diabetes group.

Dietary intake patterns appeared to improve overall upon comparison of the pre- and post-UKDDQ scores for the 6 participants who completed the questionnaire at both time points

Table 3
Demographics of study participants (N=7)

Variable	Value
Sex	
Female	42.9 (3)
Male	57.1 (4)
Average age, y	63.3±11.3
Ethnicity	
Caucasian	83.3 (5)
Southeast Asian	16.7 (1)
Mental health diagnosis	
Schizophrenia	66.7 (4)
Schizoaffective disorder	16.7 (1)
Mood disorder	16.7 (1)

Note: Values are % (n) or mean ± SD.

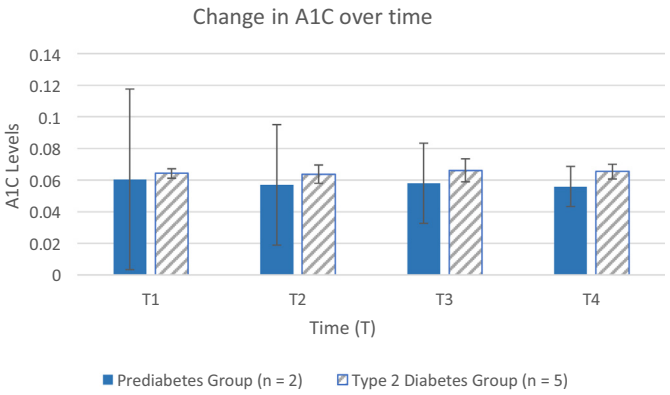

Figure 1. Change in A1C over time with 95% confidence interval. *A1C*, glycated hemoglobin. *T1*, time 1; *T2*, time 2; *T3*, time 3; *T4*, time 4.

(Table 4). At the beginning of the education program, the average score was 82.8, which increased to 91.8 out of a possible 120 points. Upon comparing individual scores, 4 participants improved their score by 1 to 36 points. The 2 participants with the highest scores at the beginning of the program (100 and 108) reduced in score by 2 to 3 points.

Individual item scores postintervention showed that questions 9, 10, 13, 16, 18 and 19 were the highest scored because 6 to 7 participants scored an A or B. Conversely, questions 7, 8 and 14 had the lowest scores; 4 participants selected D, E or F.

Physical activity level worsened for 4 participants. Two participants dropped from a high to moderate level of activity. A third participant declined from moderate to low level of activity. The fourth was low at both measurement points, with a further reduction in the score at the end of the intervention. Comparatively, 2 participants had an increase in physical activity level. One participant who scored 0 increased their score at the end of the intervention to a low activity level. The second participant increased from a low to moderate level of activity. In both those with prediabetes and type 2 diabetes over time, International Physical Activity Questionnaire scores on average decreased (Figure 3).

Qualitative data

Thematic analysis of participant feedback highlighted diabetes education program teaching strategies and topics that facilitated a better understanding of diabetes and how to engage in self-care activities. Participants also shared opportunities to address additional education and support needs, and barriers that prevented making behaviour changes.

Table 4
Summary of UK Diabetes and Diet Questionnaire scores

	Preintervention	Postintervention
Patient 1 score	40	76
Patient 2 score	83	84
Patient 3 score	87	97
Patient 4 score	100	98
Patient 5 score	79	105
Patient 6 score	108	105
Average	82.8	91.8

Theme 1: Tailored education strategies taught how to achieve behaviour change

Participants spoke about grasping diabetes concepts regarding the pathophysiology of the disease and how diet and lifestyle can be used to improve outcomes throughout the interviews.

Accommodate cognitive function and information processing level by simplifying information provided and engaging in participatory learning: Participants commented on the way that diabetes education concepts were explained helped improve self-management knowledge. Some recounted how providing simple information supported learning. For example, one participant commented that it was helpful to receive information in moderation, stating the following: “The diabetes support was more piece by piece instead of like very brief overview and then dumped with a lot of you know whole bunch of handouts and paperwork and thing.”

Some described improved understanding of how diabetes works. For example,

One participant explained, “Now, I have knowledge and wisdom of diabetes. . . They educated me quite a bit about blood sugar and how it functions. How the sugar functions on the inside of your body.” Another talked about grasping the concept of blood sugar monitoring targets, stating, “[the RD] showed me the tests that I had and put it down to my words, the way I talk and that.”

Others talked about learning strategies to improve diabetes self-care management when concepts were explained without grey areas. For example, one participant explained, “they helped me quite a bit about the Canada’s Food Guide, and what I can eat, and what I can’t eat.” Another participant similarly recounted, “yeah, they stood out to me very much, what to eat and what not to eat. . . Heart and stroke, that is really important, supposed to be a vegetarian two days a week.”

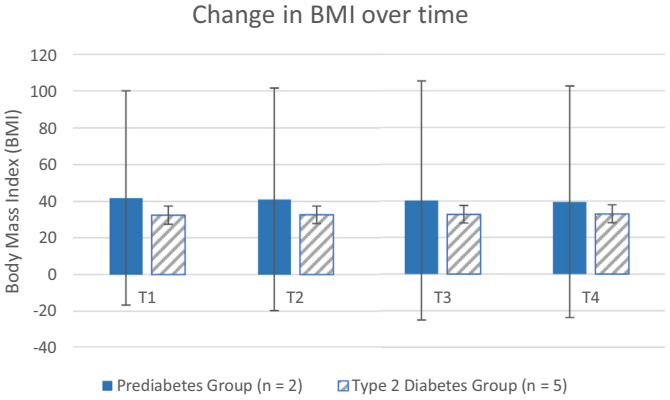

Figure 2. Change in body mass index over time with 95% confidence interval.

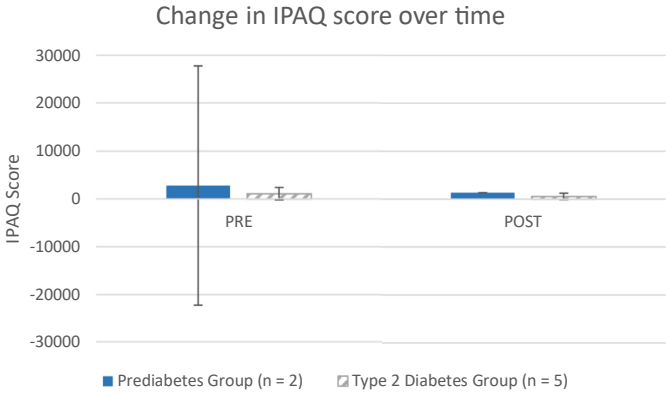

Figure 3. Change in IPAQ score over time with 95% confidence interval. *IPAQ*, International Physical Activity Questionnaire; *POST*, postintervention; *PRE*, preintervention.

Participants also commented on how helpful the visual handouts were, describing their ability to return to material previously discussed for periodic review. One participant explained, "part of it and forgetfulness sort of a side effect of it, so I have to constantly look back and look at my notes about what is what is good and what is not." Another participant associated receiving handouts with feeling less stressed about managing diabetes, stating, "when I get the handouts and stuff like that, I read them and it takes the stress away." Similarly, a third participant reviewed the handouts upon returning home from education sessions: "We go through the learning and then I would be given a sheet with that information and suggestions that the nurse or dietitian would make and add it to the sheet. . . So I could take it home and learn it."

Finally, participants shared that more diabetes self-management knowledge was gained through this tailored program when compared with the usual care model provided previously. This highlights the importance of designing education sessions in a way that elevates concepts to a new level to build on knowledge gained without repetition. For example, one participant explained:

> [The other program was] less informative. They were good for what they were, but they didn't go as in depth. . . and I got more out of the CMHA than I did the [other] session. They are more comprehensive. . . with all the details and I appreciated that, it was a part of a learning curve that really helped. So I wouldn't change it. . . I understood the disease and how to live with it.

Similarly, another participant, who earlier shared participating in diabetes education programs previously, described now having a better understanding of how diabetes works: "Well they just talked about the blood sugar and how it affects the body. . . the pancreas and liver, and how it affects the body, and how it slows the cells, and such like that. . . Well I didn't know anything about that until they told me."

Help patients see how they can apply guidelines: All participants talked about receiving practical tips on how to make diet and lifestyle changes according to the guidelines was helpful to learn how to improve self-management. Many described diet strategies that included increasing fibre, decreasing added sugar intake and modifying portion sizes. For some, reading labels achieved this knowledge acquisition. For example, one participant explained how he uses the nutrition facts label to identify the amount of sugar added to products:

> Participant: "The ideas that they gave you to umm put your sugar and how do you look after yourself by the umm thing on the package."
>
> Interviewer: "Oh, like a nutrition label?"
>
> Participant: "Found that very helpful."

Similarly, another participant described how the nutrition facts label can guide choices made at the grocery store: "I can tell on the box. With corn flakes an example, I can tell how many calories and how many fibres are in the box of cereal."

Others learned through conversations during the education modules about how to make better choices. For example, one participant recounting her strategy of reducing sugar-sweetened beverage and grain product intake and choosing whole grains more often, described:

> Yeah, I made a few changes. I drank a lot more water than I did before. . . I watch my sugar intake and watch some things that aren't good for me. Muffins, umm anything with sugar. I learned not to have any white flour, or white rice, or white pasta. . . I thought juices were good for me, but the juice has a lot of sugar, so I have been mixing and how to dilute my juice with water to cut down sugar content, and not to have too much juice.

Another participant talked about learning how to choose healthier items at take-away places frequented: "Like the food and the like when we go to Subway she said not to go with ummm cut meat, go to with turkey instead, so I learned that. And I learned how much it is in and all that kind of stuff. And then at Timmies. . . they have the different things for the muffins and stuff like that. . . It tells you. . . which one is the best one to go for."

A third participant described his approach "to be careful and not eat anything with too much sugar" and watching "fruits not to eat, that is supposed to be best for you."

Other participants recounted modifying their diet according to discussions about portion sizes and balanced meals. Helpful visual aids described included food models, hand-portion method and the healthy plate guide. For example, one participant recounted, "Well, part of the discussion with the dietitian was about whether or not the types of meals, and portion sizes and that sort of thing was, what I should be eating, and so I did get information about that. . . Making sure that I say get more complete range of food in my diet."

One participant also talked about making changes to portion sizes and meal timing and spacing, sharing that, "I was eating more than I should and I cut down and I just have, I just have one bowl of stuff, and then I can have something at bed time."

Discussing healthier cooking methods and ingredients to choose more often helped one participant to cook more, recounting "the ideas, umm sometimes they would give you recipes that you could follow, and stuff like that. Umm I am starting to cook more."

Finally, problem-solving about how to increase physical activity helped participants stay active during the wintertime (where the average daily high temperature between December and March is 3°C). One participant explained, "I am just getting out now because of the winter. . . I couldn't walk that far. . . But then I went and exercised on the hallways [of my] apartment building."

Another participant described finding a recreation centre: "They give me information where I can go and exercise. . . Which is really important for your body and mind and stuff like that. Like [there is a] club [that] has a pool. . . that I can join. If I join the [gym] I can get the pool and exercise with the equipment. . . Especially in the winter time when I can't get out that much."

Provide motivation: Participants recounted the helpfulness of education strategies aimed at building motivation. For instance, many described feeling empowered by learning about how certain behaviours can enhance health. As an example, one participant talked about gaining motivation to increase activity after a discussion about how it can help with blood sugar levels: "I know I have things that are under my control and I have things that aren't. Trying to work on the things that are under my control. . . I know I have a lot of you know, there is a lot I could do physically, that we have talked about today. . . I realize that the other things like physical activity are the only other things I can do right now."

One participant described being motivated to engage in diabetes self-care activities because of knowledge gained throughout the program, sharing: "I enjoyed the eating process, what to eat and when, and the explanation of what diabetes is all about. . . I really enjoyed that. And the amount that exercise would play. And I liked the fact that everything was so well put by both the dietitian and the nurse as to how I could help myself with diabetes."

Finally, one participant valued checking in with health-care providers regarding blood sugar management, and described finding motivation to engage in self-care from attending education sessions:

> I myself find it is really hard for me to at home, personally, to keep a directful eye on my blood sugars. . . They would take my blood sugars for every three months and all that. I liked it when I was able to talk to them directly every month about it because of the different changes. . . [To] have someone to remind me that this is what I am here to do, I need to do this for my own life, and all that. So just to have the support there and being reminded of it continuously it does help.

Address mental health symptoms: Participants talked about having an overlap between their mental health symptoms and diabetes care, and finding it helpful that the diabetes education program addressed both.

One case explained how feeling paranoid about their health was addressed by establishing a rapport with health-care providers:

> It felt like having the support there, to be able to talk to someone on a regular basis, and all that for that I can double check with them on everything. Because of my paranoia and all that I like to have the ability to ask someone on a continuous long term basis, like monthly and all that. . . The support being there gave me comfort to know, that there is someone there walking with me mentally and out there that I can meet with once a month so and I can talk to them about my concerns, using my ability to maintain a more stable environment for me.

Additionally, some participants talked about experiencing sugar cravings and emotional eating, and that learning strategies to manage was helpful. For example, one participant talked about managing cravings through balanced eating to minimize the amount of sugar consumed:

> Certain mushrooms are good, like cottage cheese is good for schizophrenia. Plus, it is good for my diabetes, too, so I don't eat that much sugar. . . I watch what I eat and I don't go, I don't enjoy sweets actually but I need them, I get cravings for them sometimes [at night], that can't be helped. . . I usually get something to eat to fill my stomach, stuff like that. A sandwich would do.

One participant talked about eating in response to stress, and found it helpful to acknowledge it is not physiological hunger:

> Unfortunately, lifestyles are the biggest problems with me because I have a habit of when I get stressed I go on food binges. My constant over eating and all that, because of my emotions. So choosing healthier, lower productive foods, sometimes is a very hard choice. . . I think of what [the dietitian] told me about umm emotional eating, what you need to know when you are really hungry and when you are not really hungry and all that.

Finally, another participant commented on the importance of having their overall mental health acknowledged while learning about managing diabetes: "There are benefits to having a program specifically for mental health clients. . . it helps to be in a program where there is some understanding of whatever the specific issues that you are dealing with. Including the rest of you rather than just your blood sugars."

Theme 2: Outstanding education and support needs

Additional topics of interest: Although many participants recounted learning a lot about diabetes and how to manage blood sugar levels, 2 had unanswered questions about how diabetes works. One participant wished to learn more about how diabetes progresses after experiencing an increase in blood sugar levels during the education program: "How things progress with A1C and getting into the. . . first of all starting the prediabetes ranges, and then getting into the type 2 diabetes range. . . That is something I didn't anticipate when starting the program that it would continue to get worse."

Another participant continued to wonder whether diabetes can be reversed, querying, "Is there a way to reverse it? Probably not. But there probably are other ways of knowing things umm that can help, much is more, but can get rid of it all together, but I doubt that even exists." A third participant also had further questions about how to prevent amputations, stating, "I know it can get to a point where you can lose your arm or your legs, but sometimes that can be a bit shocking, so if there was a way to lower that down, but bring that information forward that would be ok with me."

Further individualize sessions: Although some participants described finding the practical tips and ideas shared during the education program helpful, others felt the advice was unrealistic to apply. For example, one participant found it difficult to use recipes with unfamiliar ingredients, stating: "[The dietitian] gave me good recipes, but some of the things called for in the recipes I didn't know how to use it in the recipe. But it is not what I eat every day. . . I didn't know like turmeric, I didn't know how to handle it or how to use it. . . More recipes in my line, how I eat, and what I would eat."

As another example, one participant shared that consuming the amount of carbohydrates recommended at meals resulted in blood sugar levels increasing: "Some [program] structure is fine, but some question I have, like about my diet that would reflect my attitude to food. . . They asked me to eat more [carbohydrates], so I did, but my sugars went up, so I had to drop that."

Other participants talked about preferring more personalized knowledge and information. For example, a participant explained an ongoing need for support with choosing and preparing affordable meals:

> Also umm when it comes to umm to people with umm individual decision making, financial and food prep, food picking and all that. May I ask that may be something that has to be individually talked about with a person, and all that, to go over, I know they kind of went over it maybe once and that is where it gets kind of screwy because people are, because of the world changing so much, so quickly and all that, more advice may be required to do it yourself.

A participant recounted outstanding questions regarding personalized requirements of vitamins, minerals and electrolytes, stating:

> More comprehensive about vitamins and minerals for our bodies. Which is important for me because, like I said, I have medical problems and stuff like that. . . Like I take salt cause I am always low in salt, I don't take very much in of salt, so I take pickles and eat them 2-3 times per day. I get dizzy spells and muscle spasms, heart palpations and shortness of breath. You don't have enough salt that is what happens, if it gets worse you black out or whatever, you collapse.

Finally, 2 participants commented on the length of education sessions. One stated that 1 h was "sometimes a little too long." Another would have preferred to be informed of the schedule for the sessions, recounting, "I never knew the timing of the sessions, I was never told that it is 20 minutes or 30 minutes or what it was supposed to be."

Create opportunities for social support: One participant talked about a need for social support through peer groups, recounting how previous participation in a nutrition group reduced symptoms of paranoia when group members provided decision-making support:

> That is what the Nutrition Group was for me, both a support and a place where I can ask random questions and talk to them about my concerns instead of asking the same person. Sometimes it requires more than one answer in order make a decision for a person like me…. That is because of the paranoia results, so I need to double check with everything and it makes me feel comfortable that there was something out there like that with that group.

In contrast, another participant commented on preferring individual sessions, sharing, "cause I talk don't talk out and I don't usually, when there are 2 or 3 people I normally don't talk out in public, I am shy (laughs). I don't know what to say, I am nervous when I'm with other people." This suggests that not every patient needs social support created from group settings.

Theme 3: Ongoing financial barriers prevented diabetes self-care changes

Participants talked about living on a limited income as a barrier to making dietary changes discussed. For example, one participant explained, "Sometimes foods were expensive so I avoided those. . . The price of food made a difference to the diabetes, cause diabetes foods are expensive, and it's like the cheaper foods are more sugar and more salty." Another participant talked about not following dietary recommendations to save money to go on a trip, explaining:

> Participant: "Sometimes I can't do it, I live with my boyfriend and we are trying to save money. . . We are going away."
>
> Interviewer: "So what kind of things are you not spending your money on that you used to? Is it food or anything like that?"
>
> Participant: "Umm vegetables and umm things like that."

In recognition that fresh produce costs more, one participant suggested that it would be helpful to discuss where these foods are more affordable: "I am on a fixed income, and so that would help me to know where to buy the best and the freshest. So we may go to [the farmer's market] some weekends, because they mostly have the freshest veggies and stuff."

Discussion

The purpose of this pilot study was to investigate patient experiences after participation in a type 2 diabetes education intervention tailored to the learning needs of people with mental illness. Our study is unique in that it was a collaboration between 2 community agencies: a diabetes education program and a mental health-care organization. Bringing diabetes care to a mental health-care setting can help to overcome siloing of mental health and diabetes care. This tends to occur because although mental health-care nurses see patients frequently, they may not view diabetes care as their role, and often lack diabetes management skills and knowledge (7,12,32,33). Furthermore, such partnerships can increase access to diabetes education and care because mental health-care patients are often not referred to services (7).

This pilot study is also unique in that the needs assessment conducted to develop the education program incorporated insights from both mental health-care patients and providers (26), along with evidence from related literature. Based on this, strategies were developed to address literacy level and individual learning needs, teach about lifestyle changes while considering socioeconomic limitations and support coping strategies for challenges related to stress or symptoms of mental illness. Analysis of our qualitative data and results from the UKDDQ of the 6 participants who completed the questionnaire both before and after the intervention suggests that the teaching strategies and program structure developed were appropriate. Although 6 participants received prior diabetes education, all talked about gaining a better understanding about diabetes and practical knowledge to improve self-management. Correspondingly, participants with the lowest diet scores at baseline (between 40 and 87 out of 120 points) improved at the end of the intervention (76 to 97 out of 120 points).

Strategies used in our study align with suggestions in the literature about how to tailor lifestyle education for people with mental illness because diabetes knowledge alone is not adequate to improve blood sugar management (10,12). Studies suggest that individualized, practical knowledge about how to make lifestyle changes in accordance with self-management guidelines should be provided (11,15,18,23,34). Additionally, the simplicity of information should be tailored to individual learning needs while elevating concepts to a more challenging level (35,36). As such, Hempler et al (20) found participants with mental illness more engaged in learning about health management when given the opportunity to direct discussions, and when individual skills and resources were considered. Incorporating stress management techniques and coping skills training are additional suggestions on how to successfully tailor diabetes care for people with mental illness (18).

Other community diabetes education programs designed using similar education approaches for people with mental illness show mixed results on the ability to improve outcome measures. A 24-week Diabetes Awareness and Rehabilitation Program administered by McKibbin et al (37) did not find the average reduction in A1C (−0.5%) in the treatment group significant. However, participants significantly lost a mean total of 5 lbs (2.3 kg), and increased physical activity level. Similarly, a 16-week pilot trial conducted by Sajatovic et al (38) for the Targeted Training in Illnesses Program found a significant improvement in dietary behaviours. However, there was no change in weight, and 67% of participants had an improvement in A1C, contributing to an overall A1C reduction of −0.3%. In a third community-based education program, the Targeted Training in Illnesses Program was modified to include 48 weeks of telephone maintenance calls. A1C for the treatment group did not reduce significantly (−0.3%), and there was no significant difference in the Diabetes Self-Care Activities Questionnaire despite improved diabetes knowledge (39). Finally, a systematic review considering the ability for lifestyle education programs for people with mental illness to improve activity levels showed mixed results (40).

These findings collectively suggest the complexity of ongoing self-management decisions and behaviours required to manage blood sugars (18). The presence of additional factors related to mental health and social determinants of health can create further diabetes management challenges (6). In addition, the burden of managing a chronic disease along with other factors related to the social determinants of health can reduce quality of life, if engaging in diabetes care activities or facing self-care challenges are perceived to adversely impact physical, emotional or social well-being (41). In our study, participants expressed financial constraints as an unaddressed barrier to follow recommended diabetes self-care behaviours. These verbalized concerns align with post-intervention UKDDQ scores: more than one-half of participants scored a D or lower because of a higher frequency of consuming high-fat cheese and processed meats, and not consuming fatty fish at least 2 times per week. This suggests a challenge in accessing low-cost convenient protein options. Furthermore, all 6 participants who completed the pre- and post-UKDDQ increased their

fruit and vegetable intake. The 7 completed UKDDQ scores at postanalysis showed that many did not incorporate produce daily by the end of the program: 4 participants scored B or higher for vegetable intake and 3 participants for fruit intake. However, 6 to 7 participants scored an A or B for questions that involved eliminating unhealthy items (snack foods, savory pastry and alcohol), choosing healthier alternatives of equal cost (whole grain bread) and adopting the behaviour of having breakfast within 2 h of waking.

People with chronic mental illness are more likely to live in low-income situations related to a higher prevalence of unemployment that causes reliance on social assistance (16,42). As a result, people with mental illness may not allocate limited funds to more expensive food items, such as fruits and vegetables, and may find it challenging to purchase food in general (6,15). In the Knyahnytska et al (13) ethnographic study, mental health patients found it challenging to meet diabetes management expectations because of scarce resources. To purchase healthier food choices recommended, some patients cut food portions or reduced intake to 1 meal per day.

Placing a greater focus on providing support to overcome such financial challenges is needed. Research suggests that it is possible to reduce intake of processed foods and make healthier choices within a limited budget (43,44). Strategies required include grocery shopping at affordable stores, cooking homemade recipes and incorporating affordable proteins (i.e. legumes) and less-processed grain products (i.e. corn, oatmeal) (44). Such changes would require clinicians to collaborate with patients, and diabetes care may need to extend into the grocery store and kitchen to support patients with choosing recommended foods and how to use them in new recipes. Such an approach was demonstrated by Teachout et al (34), where mental health patients living in a supportive housing residence received weekly diabetes education, and staff assisted with meal planning, shopping and food preparation. After 6 months, 100% of participants lost weight, and fasting blood glucose levels improved such that 40% of all measurements were within the recommended range. Participants in the Yarborough et al (11) study similarly expressed the helpfulness of low-cost cooking demonstrations.

Physical activity is an essential component of blood sugar management because it increases insulin sensitivity (45). This is important especially for people who are older or who have had diabetes for many years because these factors are associated with a reduced ability for the pancreas to make insulin (46). To improve physical activity outcomes, participants would likely benefit from a practical component because programs that pair counselling and activity have been associated with greater improvements in activity level (40).

Opportunities to further individualize information and address additional topics of interest in our study suggest that following a structured program limits the ability to let patients guide diabetes education according to their needs. This concept aligns with Diabetes Canada's recommendation to tailor education through enabling patients to self-identify problems and needs for self-care (18). Adopting this approach would support patients to make decisions from a place of empowerment because information provided would consider patient priorities, needs and feelings (47). Therefore, it would be helpful to leave some sessions unplanned, giving patients more opportunity to direct their education care.

Our education program could further improve by providing patients with an opportunity to receive social support. People with mental illness are more likely to have reduced social support networks and low levels of perceived available support (6,11,17). Providing peer support for patients with mental illness can enable learning from people whom patients identify with, provide insights on how changes can impact longevity, encourage activity and create an environment where participants have a sense of belonging and feel supported (11,20,36).

Limitations

A limitation of our study is the low rate of patient participation that resulted in a sample size too small for statistical analysis. Additionally, 6 participants had been receiving diabetes education care prior to participation in this intervention. As such, it is not possible to be certain that changes in outcome measures were related to our diabetes education program. The generalizability of our study findings may be further limited because 1 participant in the study sample had a major mood disorder, and our study focused on a population living within a specific geographic region. Furthermore, many patients did not participate in the study upon completion of the diabetes education intervention, raising the question of how patient experiences voiced and outcomes measured may have been different. Additionally, people with mental illness are more likely to experience homelessness or have limited access to food or cooking facilities (13,48). This can result in relying on community meal programs that do not consistently align with diabetes diet recommendations (13). The participants did not discuss such challenges, which may be a reflection of our sample. It will be important for future research to explore the additional diabetes self-management education needs of patients who are experiencing homelessness and housing instability. These populations would face additional challenges of adequate food storage and limited access to cooking facilities. Taken together, the lack of diversity within this sample suggests the need for research to include diverse groups, such as those who are experiencing homelessness. Regardless of these limitations, our study findings align with similar research exploring tailored diabetes education programs for people with mental illness. This suggests similarities between our study sample and mental health patients as a whole.

Finally, in consideration with feedback from patients, further modifications can more appropriately tailor the provision of diabetes education for patients with mental illness. Future research should seek to investigate how a modified program can improve outcomes within a larger diverse population.

Conclusions

This study sought to create a tailored diabetes education program for people with mental illness informed by patient and provider perspectives. Several teaching strategies and counselling approaches were used to provide patients with a better understanding of diabetes, provide patients with practical knowledge on how to follow guidelines and build motivation to facilitate behaviour change. The knowledge participants talked about gaining, and improvements in dietary patterns and habits, suggest effectiveness of our approach. Patient feedback also highlighted opportunities for program improvement. To address financial limitations that prevent recommended dietary changes, a module for meal planning and budgeting may be helpful. Additionally, hands-on group modules should be added to create opportunities for social support while extending care beyond the counselling room. These would include cost-effective cooking and grocery shopping sessions, and a practical activity component to complement discussions regarding the benefits of physical activity. Creating sessions with patient-directed content would also further individualize education care. Finally, future research should measure changes in quality of life because it may contribute to diabetes treatment plan adherence and blood sugar management (49). Incorporation of these suggestions in future diabetes education interventions for patients with mental illness would likely further improve diabetes outcome

measures. This may, in turn, improve the increasing rates of morbidity and mortality currently observed in this population.

Supplementary Material

To access the supplementary material accompanying this article, visit the online version of the *Canadian Journal of Diabetes* at www.canadianjournalofdiabetes.com.

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Author Disclosures

Conflicts of interest: None.

Author Contributions

A.C. and C.S.D. led the conception, design, analysis and interpretation of the data and the writing of the manuscript and supervised the acquisition of the data. D.L. contributed to the quantitative data analysis and the writing of the manuscript. All authors read and approved the final manuscript.

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Supplementary Appendix 1

Diabetes education program participant interview questions

1) If I could start by asking about your health, and by health, I mean not only the absence of disease, but also physical, mental and social well-being. Would you say your health is excellent, very good, good, fair or poor?
2) How long have you had diabetes?
3) How did you like participating in the diabetes education program?
4) What other types of diabetes education have you received?
5) If you compare your experience between this program and [usual care], which program do you feel helped you the most and what was it about that program that helped you more?
6) What were the important changes that you made to your diet and/or activity from participating in this diabetes education program?
7) Is there anything that could be added to the diabetes education program that would help you use what was learned?
8) If you could make a change to the program, what would be different?