'TIS BETTER TO GIVE THAN RECEIVE?' EXPLORING THE HEALTH-RELATED BENEFITS ASSOCIATED WITH DELIVERING PEER SUPPORT: A MIXED METHODS STUDY

by

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'Tis better to give than receive? Exploring the health-related benefits associated with

delivering peer support

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Abstract

BACKGROUND: The effects of peer support (PS) on clinical and psychosocial outcomes has been extensively studied in patients with type 2 diabetes, but only minimally examined in the peer leaders (PLs) who deliver support. This thesis's *objectives* are to: examine PLs' sociodemographic and personality characteristics, assess the clinical and psychological benefits of providing support; and identify strategies to improve PS interventions.

METHODS: A sequential explanatory mixed-methods research design approach was utilized. The studies conducted for this thesis were extensions of a larger randomized controlled trial assessing the impact of PS on diabetes-related health outcomes. Fifty-two recruits completed PL training and were matched with participants on schedule availability, gender preference, and geographic proximity. PLs and participants had an initial face-to-face meeting, then weekly phone contacts in the first 3 months and bi-weekly phone contacts in the last 9 months. PLs underwent health-related assessments at baseline, 3, and 12 months. The primary outcomes were A1C and diabetes distress (DD). At study completion, PLs were deemed effective if their participants sustained and/or improved A1C and DD from baseline. The PLs' sociodemographic and personality

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characteristics were also measured. To explore PLs' perspectives, 17 PLs were subsequently invited for semi-structured interviews.

RESULTS: PLs' A1C and DD remained stable over the course of the intervention. Effective PLs had significantly lower baseline DD and significantly higher extraversion than ineffective PLs. During the interviews, PLs characterized their experiences with participants as positive, mutually beneficial, and helpful with diabetes management. Suggestions were that PLs be vigorously screened and that the PL-participant matching process take shared characteristics (e.g., demographic characteristics, diabetes-related commonalities, and life experiences) into account. Traits of successful PLs were also identified.

CONCLUSION: Delivering PS interventions may offer clinical and psychosocial benefits to the providers themselves. Further research is warranted with regard to the PL recruitment and matching process to maximize benefits for PLs and participants.

Lay Summary

Diabetes is a lifelong condition defined by a high level of blood sugar caused by insulin deficiency/insufficiency and/or resistance. High blood sugar can harm organs, blood vessels, and nerves. Adequate control of blood sugar through lifestyle changes such as exercising and eating healthily can delay these consequences and allow people with diabetes to live healthy lives. To gain the knowledge and skills required for diabetes self-management, patients newly diagnosed with diabetes usually receive education from their physicians or through classes at diabetes education centers. However, patients need lifelong support to sustain their initial gains. Considering the limitations on financial and professional resources, peer-to-peer (between two patients with diabetes) education and support may be an appropriate response to this issue. This research explores the benefits that individuals receive from delivering support to peers with the same health condition and proposes ways to optimize these programs.

Preface

The systematic review presented in Chapter 2 was conducted at Gordon and Leslie Diamond Health Care Center in Vancouver, British Columbia, Canada. Under the supervision of Drs. Tricia S. Tang and Diana Sherifali, I designed, implemented, and completed the systematic review. With the help of the librarian, Ms. Helen Brown, I designed and conducted the search strategy. I also undertook the data extraction and manuscript preparation. Amir Seyyed Askari helped with the data extraction and manuscript preparation. Rawel Sidhu's contributions included data extraction quality check and manuscript preparation.

A version of Chapter 2 has been published: Afshar, R., Tang, T. S., Askari, A. S., Sidhu, R., Brown, H., Sherifali, D. (2019). "Peer Support Interventions in Type 2 Diabetes: Review of Components and Process Outcomes." <u>J Diabetes</u>.

The research studies in Chapters 3-5 were conducted in Diabetes Education Centers associated with Vancouver General Hospital (VGH), St. Paul's Hospital (SPH), Richmond Hospital (RGH), and Vancouver Coastal Health/North Shore Chronic Disease Services. These research projects were extensions of a larger randomized controlled trial – "From clinic to community: Using peer support as a transition model for improving long-term diabetes-related health outcomes" –

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that assessed the effects of a 12-month, telephone-based, peer-led diabetes selfmanagement support (DSMS) intervention on glycemic control and diabetes distress in patients with type 2 diabetes in a specialty-care setting. The study is registered on clinicaltrials.gov (NT02804620). The principal investigator for the main trial is Dr. Tricia S. Tang. My contributions included preparation of the ethics application for submission to the UBC Clinical Research Ethics Board at the University of British Columbia and different study sites; participant and peer leader recruitment; data collection; day-to-day problem solving with the clinical trial; data analyses; and manuscript preparation.

For the purpose of my thesis, I designed and implemented the following collateral studies under the supervision of my committee members Drs. Tricia Tang, Diana Sherifali, Pat Camp, Susan Cox, and Martin Guhn. With the help of Rawel Sidhu and Amir S. Askari, I analyzed the data and reported the outcomes in chapters 3, 4, and 5. A version of chapters 3, 4, and 5 is projected to be published by 2021.

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List of Abbreviations

A1C: Glycated Hemoglobin

BMI: Body Mass Index

BP: Blood Pressure

CENTRAL: Cochrane Central Register of Controlled Trials

CINAHL: Cumulative Index to Nursing and Allied Health Literature

DCCT: Diabetes Control and Complication Trial

DD: Diabetes Distress

DDS: Diabetes Distress Scale

DEC: Diabetes Education Center

DSME: Diabetes Self-Management Education

DSMES: Diabetes Self-Management Education and Support

DSMS: Diabetes Self-Management Support

EMR: Electronic Medical Records

EPHPP: The Effective Public Health Practice Project quality assessment tool

MeSH: Medical Subject Headings

Mini-IPIP: Mini International Personality Item Pool Scale

PEP: Patient Empowerment Programme

PHQ-9: Patient Health Questionnaire scale

PICO: Population, Intervention, Comparison, Outcome

PL: Peer Leader

PLEASED: Peer-led, Empowerment-based Approach to Self-management Efforts in

Diabetes

PLT: Peer Leader Training Programs

RCT: Randomized Controlled Trial

T1DM: Type 1 Diabetes Mellitus

T2DM: Type 2 Diabetes Mellitus

TIDieR: Template for Intervention Description and Replication checklist

UKPDS: UK Prospective Diabetes Study

WC: Waist Circumference

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"Alone we can do so little, together we can do so much."

Helen Keller

After five years of intensive work, today is the day to thank those who supported me throughout my academic journey. These years were an intensive learning opportunity for me not only in the science field but also on a personal level.

I would like to thank every member of *"Team Tang"* who worked alongside me even on Christmas and New Year's Day to help me arrange and implement my thesis studies.

I would also like to express my sincerest gratitude to my mentors – Dr. Tang, Dr. Camp, Dr. Sherifali, Dr. Cox, and Dr. Guhn – who supported me along this stressful yet joyful journey. I would not have successfully completed this chapter of my life without your help and support.

Dedication

"Family and friends are hidden treasures, seek them and enjoy their riches."

Wanda Hope Carter

I would like to take this opportunity to thank my family and friends who provided love and support, which allowed me to continue my journey and not give up despite many difficulties. I will always be thankful for you all!

Chapter 1: Introduction

"Diabetes is a chronic, debilitating and costly disease associated with severe complications, which poses severe risks for families, Member States and the entire world."

United Nations General Assembly

DIABETES EPIDEMIOLOGY

One of the most common chronic diseases, diabetes affects more than 415 million people around the world and is projected to affect 612 million by 2040.¹ Canada is no exception to the global epidemic. Its diabetes prevalence was estimated at 3.4 million (9.3%) in 2015 and is projected to increase to 5 million (12.1%) by 2025 – a 44% increase.² Type 2 diabetes accounts for the vast majority of these cases (85%).³

As insulin production deteriorates with age,⁴ old age is considered a major risk factor for type 2 diabetes. However, a trend toward increasing type 2 diabetes prevalence – in parallel with the rising rate of obesity and sedentary lifestyles – is also being seen in adolescents and young adults.⁵ In fact, between 2008 to 2009 in Canada, more than 50% of the population affected with type 2 diabetes was of working age (25–64 years old).⁴

DIABETES BURDEN

Diabetes is a serious public health concern, for many reasons.³ Diabetes and its long-term complications shorten the lifespan by 5 to 15 years, limit work ability, and increase morbidity and mortality.² Compared to the general population, patients with diabetes are more prone to macrovascular and microvascular complications and non-traumatic lower limb amputations.³ In Canada, diabetes is the leading cause of acquired blindness before age 50. And 30 percent of patients with diabetes develop clinical depression.⁶

The financial costs are also extreme. According to Diabetes Canada, the cost of diabetes to the Canadian health care system was \$3.4 billion in 2016 and is projected to increase by \$5 billion by 2026.² The majority of patients with type 2 diabetes spend more than 3% of their income for their diabetes treatment.^{2,6}

DIABETES PATHOLOGY, COMPLICATIONS, AND PREVENTION

Type 2 diabetes is a chronic disease caused by abnormal metabolic regulation, with potential long-term complications.^{5,7} Development of type 2 diabetes appears to result from a complex interaction between genes and

environment.^{5,7} Abnormalities in insulin secretion and/or resistance to insulin are deemed to be the causes. These abnormalities are believed to vary among individuals: some may have a lower level of insulin secretion; others may have more resistance to insulin action.⁷

Genetics has been shown to play an important role in the development of type 2 diabetes.⁵ Individuals with one parent affected by type 2 diabetes have a 40% lifetime risk of developing the disorder; those with two affected parents have a 70% lifetime risk.⁵

Two environmental factors—the recent increase in obesity and physical inactivity—are strongly and independently linked to the higher prevalence of type 2 diabetes in westernized countries.⁸ Weight gain increases the rate of type 2 diabetes by 9% for every added kilogram. Physical inactivity independently – regardless of the patient's body weight – causes insulin resistance, leading to poorer glycemic control. ⁹⁻¹² Weight loss and physical activity have been shown to decrease the incidence of type 2 diabetes in the high-risk population by 40–60% over 3–4 years.¹³⁻¹⁶ Not surprisingly, they are also the foundation of diabetes management.^{10,11}

The major clinical burden of longstanding diabetes is its long-term microand macrovascular complications.⁵ The key role of hyperglycemia in microvascular complications – nephropathy, neuropathy, and retinopathy – was confirmed by the landmark Diabetes Control and Complication Trial (DCCT) in 1993.¹⁷ In this trial, 1441 adolescents and younger adults with type 1 diabetes were randomly assigned to conventional treatment - standard treatment at the time - or experimental treatment – intensive management with multiple daily insulin injections or use of an insulin pump with frequent blood glucose monitoring and a detailed insulin-dosage algorithm, designed to bring patients to a nearnormoglycemic state. Over the course of study, mean A1C was 7.2% and 9% for the experimental group and the conventional group, respectively, and the rate of microvascular complications was significantly lower in the experimental arm.¹⁷ A similar study, the UK Prospective Diabetes Study (UKPDS), showed the importance of intensive glucose control in preventing microvascular complications in patients who had recently been diagnosed with type 2 diabetes.¹⁸

Diabetes is also a major risk factor for macrovascular complications, including cardiovascular, cerebrovascular, and peripheral artery disease.⁵ Cardiovascular disease appears to have similar clinical and pathological

manifestations in patients with and without diabetes, but in patients with diabetes the manifestations present more aggressively, at earlier ages, and are associated with a mortality risk that is two to four times higher.⁵ The level of glycemic control, as measured by A1C, has been shown to be an independent predictor of all-cause and cardiovascular mortality in patients with diabetes. Notably, each 1% increase in A1C results in 30% and 40% increase in all-cause and cardiovascular mortality. ⁵ Although the DCCT showed a 58% decrease in cardiovascular events in patients with type 1 diabetes who exercised intensive glucose control, ¹⁹ the role of tight glycemic control on cardiovascular events in type 2 diabetes is less clear, as these patients are more likely to have other cardiovascular risk factors, such as hypertension and dyslipidemia. ⁵ The UKPDS generated the strongest evidence to date in favor of cardiovascular benefits to intensive glycemic control in type 2 patients: 15% and 13% reductions in myocardial infarction and all-cause mortality, respectively, in the intervention arm compared to the conventional group.²⁰

DIABETES MANAGEMENT

The goal of diabetes management is to reach optimal glycemic control (A1C \leq 7%), which, along with tight control of blood pressure and lipid profile (where

applicable), plays a critical role in delaying and preventing long-term diabetes complications.²¹ Individuals with diabetes should be under the care of a physiciancoordinated health care team and provided with an individualized diabetes management plan—preferably one that also involves the family. In order to attain optimal glycemic control, patients with type 2 diabetes must effectively manage their condition through lifestyle modification and/or the use of oral and injectable medications.⁷ These patients should be actively involved in planning their treatment and may benefit from attending diabetes self-management education programs.⁵

As part of diabetes management, dietary recommendations continue to evolve. Current approaches focus on calorie restriction to achieve a loss of 5-10%of body weight. A low-fat, low-carbohydrate diet has been shown to lead to weight loss, thereby improving glycemic control.⁵

Regular exercise also has a strong effect on diabetes control – aerobic and resistance exercises have been shown to improve glycemic control regardless of weight loss – but is too often overlooked.^{5,7,21} Current guidelines recommend at least 150 minutes of moderate to intense physical activity per week.²¹

Self-monitoring of blood glucose is another essential component of diabetes care. The frequency and timing of tests should be individualized based on the patient's diabetes type, medications, and length of time since diagnosis. It is recommended that recently diagnosed patients (<6 months) self-monitor more frequently as they learn how diet, exercise, and medications affect their glycemic control.^{5,21,22}

DIABETES SELF-MANAGEMENT EDUCATION AND SUPPORT

Diabetes self-management education and support (DSMES) is fundamental to the care of patients with diabetes.²³ DSMES is a continuous process that equips patients with diabetes with the knowledge and skills required for self-care behaviors and assists them with executing and sustaining these behaviors on an ongoing basis.^{23,24} The current research offers robust evidence that DSMES improves patients' self-efficacy, self-care behaviors, and glycemic control.^{24,25}

The education component, DSME, is a systematic approach designed to actively involve patients with diabetes in health-related activities and decisions, using knowledge and skills taught through patient-provider collaboration. DSME alone has been shown to improve both clinical outcomes (e.g., A1C reduction and improvement in cardiovascular risk factors) and psychological outcomes.²⁴ Patient Empowerment Programme (PEP), a study involving 27,278 patients with type 2 diabetes and no prior cardiovascular risk factors, observed decreases of 44%, 20%, and 30% in all-cause mortality, first cardiovascular episode, and stroke, respectively, in patients who received DSME.²⁶ DSME has also been shown to reduce the rate of diabetes-related hospitalizations and financial burden.²³ However, its positive impacts appear to be of short to medium duration – they usually start to diminish after 6 months.²³

To sustain the behavioral changes needed for effective diabetes management, patients need ongoing support, which traditionally has been offered by diabetes educators.²⁴ Today, constraints in financial and professional resources make it unlikely that diabetes educators or other health care professionals can meet the high demand for DSMS. Peer support – a promising and cost-effective approach in which volunteers share their knowledge and experience with peers who have the same chronic condition²⁷ – could help fill the gap.²⁸

PEER SUPPORT IN DIABETES SELF-MANAGEMENT

Peer support is described as support received from a person that shares similar characteristics with the target population and has experiential knowledge of a particular behavior or condition.²⁷ The "similar characteristics" are often age, gender, disease, or language. The reciprocity of the relationships between peer leaders and patients may benefit peer leaders in addition to patients. For example, peer leaders could benefit by enhancing their interpersonal skills and knowledge and by receiving social approval and appreciation from their patients. ^{29,30}

The effect of peer support on diabetes self-management has been tested in a variety of settings (primary care, secondary care, tertiary care, and community) using different modalities of contact (face-to-face meetings, telephone-based, and technology-based).²⁷ Several randomized control trials have shown benefits to different peer support models in diabetes, including improvements in patients' clinical and psychological outcomes and self-care behaviors.³¹⁻⁴³ Although the impact of peer support interventions on patients has been extensively studied, less attention has been directed to peer leaders as the providers of support, or to the components of these interventions.

THEORETICAL FRAMEWORK

Behavioral theories describe the mechanism of change and why a particular behavior is expected to happen. Historically, theories of social support, social

cognition, and social comparison have been used to explain the mechanisms of peer support.²⁹ In this dissertation, which mainly focuses on peer leaders, theories of social cognition and social comparison were applied to describe how a combination of internal and external factors led to sustainability or improvement of health outcomes in peer leaders in diabetes type 2 peer support studies.

Social Cognitive Theory

Social cognitive theory (Figure 1) has been utilized in diverse contexts, including community-based health-promotion programs and self-management studies for chronic diseases and emotional disorders.⁴⁴ In this theory, human behavior results from interactions among the causative triad of personal cognitive, socioenvironmental, and behavioral factors.

Personal cognitive factors are defined as one's ability to apply knowledge to self-regulate preferences and to reflect on the experience. The major constructs are: (1) self-efficacy (defined as one's confidence in her/his own ability to conduct a behavior that will result in an outcome), (2) collective efficacy (defined as one's belief in the ability of a group of people to perform a behavior that will result in an outcome), (3) outcome expectations (defined as one's judgment about the possible consequences of behaviors), and (4) knowledge (defined as one's

understanding of the risks and benefits of health-related behaviors and having enough information to perform an action).⁴⁴

Socioenvironmental factors are the physical and social determinants that encourage or discourage a behavior. The major constructs are: (1) observational learning (defined as learning by observing others' behaviors and their consequences), (2) normative beliefs (defined as cultural norms and beliefs about the social acceptability and perceived prevalence of a behavior), (3) social support (defined as perceived support that an individual receives from others), and (4) barriers and opportunities (defined as factors that ease or hinder the performance of an action).⁴⁴

Behavioral factors are the health-enhancing or health-compromising behaviors performed by an individual. The major constructs are: (1) behavioral skills (defined as the abilities necessary to perform an action), (2) intentions (defined as the aim behind new behaviors or changing current behaviors), and (3) reinforcement and punishment (defined as increasing or decreasing behaviors through the addition or removal of rewards or punishments).⁴⁴

Social Comparison Theory

Social comparison theory proposes that humans possess an innate drive to compare themselves with nonexperts who have one or more of the same background characteristics (e.g., a health condition).⁴⁵ The comparison mostly happens in cases where individuals are uncertain how to assess their performance or respond to it.⁴⁶ Depending on whether the target comparison is perceived as superior or inferior to the self, the social comparison is upward or downward. Both can have positive effects. Upward social comparison tends to produce negative feelings, which could motivate individuals to achieve more; downward social comparison often results in increased self-esteem, which may lead to selfenhancement.^{45,46}

We hypothesized that PLs, as providers of support in PS interventions, will sustain or enhance their clinical and psychosocial diabetes outcomes over the course of the study via: (1) attending the peer leader training program to boost their knowledge, skills, and confidence related to diabetes self-management behaviors (personal factors – social cognitive theory); (2) increasing the frequency of such behaviors due to mutual learning and the support, appreciation, and approval they receive from their participants (socioenvironmental and behavioral

factors – social cognitive theory); (3) applying the acquired knowledge and skills to enhance their diabetes self-management and become role models for their participants (behavioral factors – social cognitive theory); and (4) comparing themselves with their participants in terms of glycemic control and overall health (social comparison theory).

SUMMARY

Type 2 diabetes is a progressive chronic disease with potential long-term complications. The management of diabetes depends on optimal glycemic control, as well as tight control of cholesterol levels and blood pressure. Together, these interventions have been shown to prevent or delay the long-term complications of diabetes.^{5,7} Diabetes self-management education (DSME) is critical to these measures. Patients appear to benefit clinically and psychologically from DSME on topics such as healthy eating, exercise, monitoring of blood sugar, and diabetes care during illness. However, the improvements associated with self-management education mostly begin to diminish after 6 months. In order to sustain the behavioral changes required for effective diabetes control, patients required *ongoing* support.²³ Unfortunately, limited health care system resources may prevent health care professionals from providing this support. To address

these limitations, peer support—a promising and cost-effective approach to diabetes self-management—could help. The next chapter includes a comprehensive literature review of peer support interventions in type 2 diabetes, and describes the underlying elements of such interventions.



Figure 1: Social Cognitive Theory

Chapter 2: A Systematic Review of Recruitment, Training, and Health-related Outcomes for Individuals Who Deliver Peer Support in Type 2 Diabetes

SUMMARY

OBJECTIVE: This review focuses on peer leaders in peer support interventions for adults with type 2 diabetes mellitus (T2DM). The objectives are to describe the strategies used to recruit peer leaders; characterize the sociodemographic background of peer leaders; compare and contrast the various models used to train peer leaders; describe the modalities of intervention delivery; and examine the impact of peer support on peer leaders' diabetesrelated health outcomes.

RESEARCH DESIGN AND METHODS: A systematic review of Englishlanguage articles was conducted using the following databases from inception to February 2018: 1) Medline, 2) PubMed, 3) EMBASE, 4) CENTRAL (Cochrane Central Register of Controlled Trials), 5) CINAHL (Cumulative Index to Nursing and Allied Health Literature), and 6) PsycINFO. Two reviewers independently screened titles or abstracts of retrieved articles, evaluated full texts of studies that met the criteria, and extracted data using the Template for Intervention Description and Replication (TIDieR) checklist.

RESULTS: In total, 19 out of 1682 retrieved articles were included in the final selection. Of these, 15 were randomized controlled trials (RCTs) and four

were cluster RCTs. Most interventions were conducted in primary care settings. Although face-to-face was the most common modality of contact among the selected studies, the rate of contacts was higher via telephone. Potential peer leaders were identified primarily through recommendations from health care professionals. The health care professionals based their recommendations on the potential peer leaders' personal interests in coaching, glycemic control, and verbal communication skills. Across the selected studies, peer leaders were mostly female with at least university education and a long history of diabetes (\geq 10 years). Peer leader training varied significantly in length and content; the two most frequent topics were communication skills and diabetes knowledge. Finally, the effect of interventions on peer leaders has been largely overlooked. Our review found only one study that evaluated the impact of peer support interventions on peer leaders' clinical and psychosocial outcomes.

CONCLUSIONS: While there is a growing body of literature on the impact of peer support on patients' clinical and/or psychosocial outcomes in diabetes, less attention has been paid to different components of these interventions, or to how these interventions affect peer leaders. In the end, we proposed suggestions

for enhancing existing peer support models, using components identified in this review.

Key words: Peer Group, Diabetes Mellitus, Systematic Review

INTRODUCTION

Optimal diabetes control requires active participation by patients in their treatment.⁵ Diabetes self-management education and support (DSMES) is a continuous process that teaches patients the knowledge and skills needed for self-care behaviours (DSME), then helps support patients as they perform and maintain these behaviours on an ongoing basis (DSMS).²³ While DSME has been shown to produce improvements in patients' clinical and psychosocial outcomes, these benefits are typically short-term and begin to diminish after 6 months.^{47,48} To sustain the benefits from DSME, patients must receive ongoing support.^{23,24}

Given the increasing prevalence of diabetes, the constraints on financial, human, and health-care resources for diabetes management, and the need for ongoing support for patients with type 2 diabetes (T2DM), efficient and low-cost interventions for these patients warrant exploration.^{23,49,50} Peer support, an inexpensive intervention model in which individuals with a medical condition receive support from non-professional others ("peers") with the same condition, has shown promise in chronic illnesses such as type 2 diabetes.²⁷ The success of peer support hinges on the knowledge and experience that peer leaders (PLs) can share with patients.²⁷ The reciprocity of relationships between PLs and patients may also benefit the PLs by enhancing their interpersonal skills and knowledge, and through the social approval, and gratitude they receive from their patients.^{29,30,51}

Although a growing body of literature has focused on the effects of peer support models on patients, less attention has been directed towards the potential health-related benefits that PLs themselves may experience as a result of this relationship. The aim of this study is to review peer support interventions in T2DM using a validated tool, the Template for Intervention Description and Replication (TIDieR) checklist,⁵² in order to identify different components of peer support interventions, including PL recruitment strategies and training programs (PLTs), PLs' socio-demographic background, modalities of peer support intervention delivery, and impact of delivering peer support on PLs' health outcomes.

RESEARCH DESIGN AND METHODS

Search Strategy

The key question of this research was formulated based on the "PICO" method. The search strategy was developed with the help of a librarian (HB) based on Medical Subject Headings (MeSH) terms and key word analyses of

studies in the field. MeSH and different combinations of free text terms were searched from inception to February 2018 in the following 6 databases: 1) MEDLINE, 2) PubMed, 3) EMBASE, 4) CENTRAL (Cochrane Central Register of Controlled Trials), 5) CINAHL (Cumulative Index to Nursing and Allied Health Literature), and 6) PsycINFO. Search results from all databases were transferred to Covidence for removing duplicates and reviewing the rest. Reference lists of selected studies were also reviewed, in order to detect other potentially pertinent studies. To learn more about the studies, we referred to their protocols when available. If papers were generated by the same study (i.e. secondary analyses), only the original paper was included in the review. In the final selection, we included only randomized controlled trials (RCTs) that were written in English and excluded papers that included any pharmacological component in the management of diabetes or that did not have information about the recruitment, training, or outcomes of PLs.

Study Screening, Data Extraction, and Quality Assessment

Prior to starting the systematic review of the literature, two reviewers (RA and AA) independently tested data screening and extraction forms for comprehension. Titles and abstracts, and full text citations were screened for
inclusion in the review. For the citations that met the criteria, study characteristics, including the TIDieR (Template for Intervention Description and Replication) checklist, were extracted by two reviewers independently. The TIDieR checklist includes a brief name of the intervention; the rationale for the intervention (why); any material and any procedures, activities, and/or processes used in the intervention (what); the providers of the intervention (who); the modes of delivery of the intervention (how); the location of the intervention (where); the number of times and the duration of the intervention (when and how much); intervention tailoring; intervention modification; and planned and actual intervention fidelity (how well).⁵² In addition, the two reviewers each used the Effective Public Health Practice Project (EPHPP) quality assessment tool for quantitative studies to assess the methodology quality of the included studies that pertain to education or counselling.⁵³ Any inconsistencies between reviewers at any point were resolved through discussion and/or by the third review author (TT).

RESULTS

Search Results

The initial search resulted in 1682 articles. Removal of duplicates reduced the number to 834 for title and abstract screening. One additional article was identified when the references of pertinent articles in the field of study were inspected. Of the 835 articles identified, 742 were deemed irrelevant, and 93 qualified for full-text review. Nineteen studies were included in the final selection, as shown in Figure 2. Common reasons for exclusion were lack of information about PLs and/or use of a study design that is not an RCT (e.g., prepost design).

Fifteen studies were RCTs and four were cluster RCTs.^{39,41,54,55} The total study population at baseline was 5636 (varied from 106 to 1299), with 3265 patients in the intervention arms (which included both peer- and health care professional–led groups), 3108 patients in the peer support groups, 2371 patients in the control groups receiving usual care, and 356 PLs.

One, eight, and ten studies were globally rated strong, moderate, and weak, respectively, by the two reviewers using EPHPP (Table 1).

Figure 2: PRISMA Flow Diagram



	Selection Bias	Study Design	Confounders	Blinding	Data Collection Method	Withdrawals and Dropouts	Global Rating
Ahmadi et al.	Moderate	Strong	Strong	Weak	Strong	Strong	Moderate
Chan et al.	Weak	Strong	Strong	Moderate	Strong	Strong	Moderate
Dale et al.	Weak	Strong	Strong	Moderate	Strong	Strong	Moderate
Debussche et al.	Moderate	Strong	Strong	Weak	Strong	Strong	Moderate
Gagliardino et al.	Moderate	Strong	Strong	Weak	Strong	Weak	Weak
Johansson et al.	Weak	Strong	Strong	Weak	Strong	Strong	Weak
Lorig et al.	Weak	Strong	Strong	Weak	Strong	Strong	Weak
Paz-Pacheco et al.	Moderate	Strong	Strong	Weak	Strong	Moderate	Moderate
Peimani et al.	Weak	Strong	Strong	Weak	Strong	Weak	Weak
Phillis- Tsimikas et al.	Weak	Strong	Strong	Weak	Strong	Moderate	Weak
Siminierio et al.	Weak	Strong	Strong	Weak	Strong	Strong	Weak
Simmons et al.	Weak	Strong	Weak	Moderate	Strong	Moderate	Weak
Smith et al.	Moderate	Strong	Strong	Weak	Strong	Strong	Moderate
Tang et al. (2014)	Moderate	Strong	Strong	Moderate	Strong	Weak	Moderate
Thom et al.	Moderate	Strong	Weak	Weak	Strong	Strong	Weak
Van der Wulp et al.	Weak	Strong	Strong	Weak	Strong	Strong	Weak
Anzaldo- Campos et al.	Moderate	Strong	Weak	Weak	Strong	Strong	Weak
Tang et al. (2015)	Moderate	Strong	Strong	Moderate	Strong	Moderate	Strong
Riddle et al.	Moderate	Strong	Strong	Weak	Strong	Strong	Moderate

Why, What, and Who?

Some studies used peer support to deliver ongoing DSME; ^{31-34,36,38} others used peer support as ongoing DSMS following short-term DSME programs.^{28,35,37,39-43,54-58} The rationales given for the peer support interventions were to improve clinical and/or psychosocial outcomes (either directly or through increasing self-efficacy ⁵⁸ or enhanced diabetes self-management ³⁹), self-efficacy, self-care behaviours, and diabetes self-management. Potential PLs were mostly identified through recommendations from health professionals ^{31,37,43,54-56,59} or through centers or databases that contained information on patients with diabetes.^{28,33,34,39,41,59} Fifteen studies defined eligibility criteria for peer leader recruitment.^{28,31-34,36,37,39,41-43,54-57}

Most studies require a personal history of diabetes as an eligibility criterion. In one study, however, a peer leader could be an individual without diabetes who had cared for or lived with a patient with diabetes.³² Peer leaders were selected primarily based on their interest in joining the study, acceptable glycemic control (A1C \leq 8.5%), with some studies requiring peer leaders to demonstrate strong communication skills - as assessed via interview.^{31,34,37,41,43,56} Only 3 studies interviewed the prospective peer leaders in person prior to selection.^{28,31,59} In addition, one study included personality traits in the PL inclusion criteria, however, it offered no further discussion of how personality traits were measured or which traits were considered.⁶⁰

PLs in all included studies received training, but the training varied significantly in content and structure. The duration of training programs ranged from 2–3 hours to 46 hours, and all training was conducted in group-based

formats. The programs were primarily led by research teams and health professionals, including certified diabetes educators, clinical psychologists, nurses, nutritionists, and, in one study, endocrinologists. The core elements of each training program, in order of frequency, were: (1) communication skills,^{28,31,34,35,37,39-43,55,56,61} (2) diabetes knowledge,^{31-35,38,42,43,54,55,57} (3) facilitation skills,^{31,34,35,37-39,42,54,55,57} (4) behavioural modification skills,^{33,35-38,40,42,57} (5) motivational interviewing,^{28,34,40-42,57,58} and (6) ethics.⁴¹ Role plays were a teaching approach often used. In most studies, the training programs were based on a curriculum, and peer leader candidates were provided with manuals, booklets, scripts, and/or notes (Table 2).

The studies used different names for PLs (e.g., "peers," "peer supporters," "peer educators," "peer leaders," "peer support facilitators," "peer coaches," and "expert patients"). For the purpose of this study, we use "PLs." In 14 studies, the PL population size was listed; sizes ranged from 1 to 127 (total = 356). Only five articles provided PLs' sociodemographic characteristics. Across these five studies, the mean age of PLs was 59.8 (9.5) years; the PLs were mostly female (66.4%); 49.6% were married; and the mean duration of diabetes was 10.8 years (8). PLs

either had type 1 or type 2 diabetes (T1DM or T2DM) ^{28,35} or were caregivers to

patients with diabetes (Table 3).³²

Table 2: Peer Leader Training Programs

	Communication Skills	Diabetes Knowledge	Facilitation Skills	Behavioral Modification Skills	Motivational Inquiry	Ethics
Ahmadi et al.	Х	Х	Х	-	-	-
Chan et al.	Х	-	-	-	-	-
Dale et al.	Х	-	-	-	Х	-
Debussche et al.	-	Х	-	Х	-	-
Gagliardino et al.	Х	Х	Х	-	Х	-
Johansson et al.	-	Х	Х	-	-	-
Lorig et al.	Х	Х	Х	Х		
Paz-Pacheco et al.	-	-	-	Х	-	-
Peimani et al.	Х	-	Х	Х	-	-
Philis-Tsimikas et al.	-	Х	Х	Х	-	-
Siminerio et al.	Х	-	-	Х	Х	-
Simmons et al.	Х	-	-	-	Х	Х
Smith et al.	Х	Х	Х	-	-	-
Tang et al. (2014)	Х	Х	Х	Х	Х	-
Thom et al.	Х	Х	-	-	-	-
van der Wulp et al.	-	-	-	-	Х	-
Anzaldo- Campos et al.	-	Х	-	-	-	-
Tang et al. (2015)	Х	Х	Х	Х	Х	-
Riddle et al.	Х	-	Х	-	-	-

Table 3: Peer Leaders' Sociodemographic Characteristics

	N	Age (mean±SD)	Female/Male (%)	Duration of Diabetes (mean±SD)	Married/Living with a Cohabitant (%)	A1C (mean±SD)
Chan et al.	33	55.6±11.5	65/35	11.3±6.7	-	7±2
Smith et al.	29	62.7±11.3	59/41	6.8±8.1	70	-
Thom et al.	24	58±8.1	66.7/65.7	10.6±12.3	29.2	6.88±0.76
Tang et al.	8	63±7.2	75/25	14.3±5	-	-

How, Where, When, and Tailoring?

Modalities of intervention were 1) face-to-face, 2) phone, 3) internet, or 4) some combination of these. The interventions were offered in groups or individually. Seven studies delivered only group-based, face-to-face interventions; two used one-on-one phone calls only; seven used a combination of group-based, face-to-face interventions and one-to-one phone calls; only one study delivered one-to-one, face-to-face interventions; and three studies had an extra component of technology (Table 4). The technology component included email correspondence and the use of smartphone applications.^{32,41,58}

Studies were conducted in a variety of settings: 10, 1, 3, and 5 studies were held in primary care,^{28,32,34,38,40,43,54,55,57,58} secondary care,³³ tertiary care,^{31,37,56} and community-based settings,^{35,36,39,41,42} respectively.

Some studies tapered the intervention, starting with more frequent sessions and reducing the frequency over the course of the study.^{28,31,32,34,55,56} The in-person meeting durations ranged from 1 hour to 2 ½ hours. The phone calls lasted 15–30 minutes. Nine studies had tailoring, which means the frequency, length, and content of sessions and phone calls were tailored to patient

needs.^{28,32,34,37,39,40,42,57,58} In one study, group members served as consultants,

scheduling and conducting the next meetings.³⁹

Table 4: Modalities of Interventions

	Face to Face	Phone Calls	Technology
Ahmadi et al.	х	-	-
Chan et al.	х	Х	-
Dale et al.	-	Х	-
Debussche et al.	х	-	-
Gagliardino et al.	Х	Х	-
Johansson et al.	х	-	-
Lorig et al.	Х	-	-
Paz-Pacheco et al.	Х	-	-
Peimani et al.	Х	Х	-
Philis-Tsimikas et al.	х	-	-
Siminerio et al.	-	Х	-
Simmons et al.	Х	Х	Х
Smith et al.	Х	-	-
Tang et al. (2014)	Х	Х	-
Thom et al.	х	Х	-
van der Wulp et al.	Х	Х	Х
Anzaldo-Campos et al.	Х	-	Х
Tang et al. (2015)	х	Х	-
Riddle et al.	х	Х	-

Implementation and Evaluation Outcomes

In 15 articles, strategies were used to ensure intervention fidelity over the period of study. In most of these studies, PLs were provided with logs, record lists, or checklists to keep records of their contacts with their patients, including the frequency, topic of conversation, and duration of contact.^{28,34,37,39-42,54,56-58} A few studies used audiotape, videotape, and direct observation of sessions (by the

research team) to assess treatment fidelity.^{35,37,38} One study evaluated the intervention fidelity using the Bellg et al. framework, which assesses aspects such as treatment design, training procedure, delivery of treatment, receipt of treatment, and enactment of treatment.⁵⁵

The peer leader retention rate, which was reported in five studies, ranged from 56% to 88%.^{30,43,55,58,59} Across all studies, 83.4% of patients completed the study (54.8%-96.7%). Simmons et al. reported that 92.6% of patients maintained contact with their PLs via telephone, but only 61.4% actually attended a peer support session.⁴¹ Smith et al. reported that 90% of patients in the intervention group were in contact with their PLs,⁵⁶ but 18% never attended a group meeting.⁵⁵

One study reported minor changes in the protocol in response to problems in conducting the research study.³³ In a cluster RCT done by Riddle et al., one cluster had to combine with another due to an insufficient number of group members.³⁹ This led to a delay in initiating the intervention for this joint cluster; as a result, the intervention lasted for only 8 months of the 12-month study.

Of the 19 studies, only one measured the health outcomes of the PLs. In this study, 79 PL candidates were recruited across three tertiary hospitals in China

- the same sites where participants were recruited. Of those, 59 completed the training program, and 33 agreed to be paired. A separate group of patients (n=60) with type 2 diabetes of similar glycemic control (A1C<8%) receiving usual care were selected as the comparison group.³⁰ At 6 months, only the group that received peer leader training reported improvements in self-care behaviors – including diet adherence and foot care – and sustained their level of glycemic control. After four years of delivering peer support, sustained A1C was noted only in the matched peer leaders group. Individuals in both the comparison group and unmatched peer leaders group experienced A1C deterioration over the duration of the study.³⁰

Future Directions in Peer Support Interventions in Type 2 Diabetes

Suggestions for the enhancement of future peer support interventions, based on the findings of this review, are italicized in Figure 3.

To improve intervention delivery, more rigorous screening of suitability is required. Some suggestions to consider are: 1) in addition to having T2DM and satisfactory glycemic control (A1C \leq 8%), PLs should possess strong and effective verbal communication skills, a proficiency that can be evaluated when interviewing prospective PLs, and 2) personality aptness may be also considered

that can be assessed by interviewing the candidates or administration of short screening personality tests. A meta-analysis found that individuals with higher scores of conscientious (on the "Big 5" personality traits – Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (OCEAN)) tend to invest more in volunteerism.⁶²

Singh et al. defined the qualities of effective teachers as a combination of knowledge of the subject, strong communication skills, and enthusiasm for teaching.⁶³ To develop these qualities in PLs, PLT programs need to cover not only the fundamentals of diabetes self-management, but also communication, facilitation, motivational interviewing, and behaviour-modification skills, which supports Tang et al.'s 46-hour PLT program.⁵⁹ Additionally, patient confidentiality, ethical considerations and a knowledge of existing resources available for patients with T2DM should also be deemed important components. Above all, future programs should tailor the length and content of the training to the objectives of the intervention. For example, interventions intending to utilize peer support as a means of ongoing DSMS would benefit from paying particular attention to motivational interviewing and behaviour modification skills as part of their PLs'

training. Alternatively, peer support programs focusing on DSME (vs. DSMS) may emphasize diabetes knowledge in its PL training instead.

Furthermore, it may not be ideal to pair patients with T2DM with peer leaders who have T1DM as these conditions are experienced very differently. Although certain aspects of diabetes self-management are common to both types, many challenges are different. For example, Daousi et al. found that, in speciality care, 52% of patients with T2DM had obesity, compared to just 16.6% of patients with T1DM.⁶⁴ Medication adherence among patients with T2DM is usually poor due to poly-pharmacy and older mean age. At the time of diagnosis, patients with T2DM may have long-term complications such as retinopathy and nephropathy, complications patients with T1DM are less likely to have. As a result, support needs and approaches to addressing those needs – may differ for patients with T1DM and T2DM. Therefore, PLs who have T2DM would likely provide more relevant support to patients with the same condition.

Current studies on peer support primarily focus on the clinical and psychosocial outcomes of patients but often overlook the effects on PLs. One reason for this lack of attention could be that, in general, PLs are expected to be under good glycemic control as a qualification for delivering support. Whether PLs

experience any benefits or harm from PLT programs and/or the reciprocity of interactions with patients may be an important area to explore.

DISCUSSION

Peer support approaches have received considerable attention in T2DM and have been shown to deliver promising clinical and psychosocial outcomes for patients. Despite the growing body of literature on patients' outcomes, little attention has been paid to peer leaders and other components of peer support interventions. We found only one study that assessed the impact of peer support interventions on PLs; it showed improvements in self-care behaviors and maintenance of glycemic control over four years.³⁰

Although patients with poor glycemic control have been shown to benefit the most from peer support,^{32,33,38,43} a majority of peer support interventions have been designed for, and implemented in, primary care offices – settings where most patients already have satisfactory glycemic control.^{34,54,55} In contrast, patients presenting to tertiary care settings tend to be poorly controlled and/or recently diagnosed, which positions them as prime candidates for peer support.

Patients appear to prefer telephone-based interventions due to their accessibility and flexibility. Two of the studies that used a combination of face-to-

face and telephone modalities compared how much each modality was used. Both studies found that patients and PLs were in contact more often via telephone than face-to-face (92.6% vs 61.4%; 76.6% vs 23.4%).^{41,43} Despite patients' inclination to use the telephone, more patients showed significant improvement in clinical and/or psychosocial outcomes when the interventions were entirely face-to-face (71.4%), as opposed to telephone-only (0%) or a combination of these modalities (42.8%).

Although a variety of strategies were used to enhance intervention fidelity during the studies (e.g., written reports, checklists and logs, follow-up phone calls, audio- and videotaping of sessions), no rigorous approaches were implemented to recruit suitable peer leader candidates to deliver the interventions. While three studies did interview the peer leader candidates in person as a screening strategy,^{28,31,59} two studies did not mention a screening process or eligibility criteria.^{35,58}

Only a few studies included demographic characteristics of PLs.^{30,43,55,59} On average, PLs were mostly female and had at least a university education,^{43,55,59} which is consistent with the characteristics associated with health care volunteers in general.⁶⁵

Although diabetes distress, self-management variables, and glycemic control are strongly associated with each other,⁶⁶ few peer support studies examined DD as a primary psycho-social outcome.

Based on the components of the peer support models identified in this review, some suggestions to consider in the design of future peer support interventions are as follows: 1) Include more rigorous screening protocols such as interviews to evaluate prospective peer leaders' communication skills and personality suitability. 2) Consider using a standardized PLT program that encompasses diabetes knowledge; communication, facilitation, behavioral modification, and motivational inquiry skills; codes of ethics; and community resources for patients with diabetes (e.g. educational events, support groups, etc.).⁶⁷ 3) Consider alternative modalities of contact that may yield the advantages of both telephone (accessibility and flexibility) and face-to-face (effectiveness), such as Skype, FaceTime, and social media platforms. 4) Emphasize that the effect of peer support on psychosocial outcomes (e.g., DD) is as important as its effect on clinical outcomes. And 5) include an evaluation of the impact of peer support interventions on PLs' (as well as patients') clinical and psychosocial outcomes.

This study has a few limitations. First, despite utilizing a comprehensive, rigorous search strategy across several databases, we were only able to include RCTs that were written in English. It is possible there are quality RCTs conducted in non-English speaking countries. Second, our search strategy only made use of backward – and not forward – reference searching. This may have caused us to miss some articles that were published later than the studies we identified. However, we did carefully assess the studies we found for quality and content (TIDieR). A hallmark of this study is its use of the TIDieR checklist to robustly define and report the various components of peer support interventions.

Practice Implications

As limited resources and escalating costs have put new strains on the health care system, peer support models of diabetes care have emerged as an effective, long-term, cost-efficient means of sharing experiential knowledge of diabetes self-management. There is a growing body of literature on the beneficial effects of peer support on the clinical and psychosocial outcomes of its recipients. However, considerably less attention has been paid to those providing the support – the peer leaders. Areas such as the peer leaders' demographic characteristics, how they are recruited, the training they receive, and changes in

their own health outcomes as a result of providing peer support have rarely been explored. This lack of evidence presents challenges to health care practitioners who are uncertain about how to best recruit peer leaders, which models to implement in training them, and how to effectively deliver a diabetes peer support intervention. Health care practitioners should benefit from a review of the existing literature on peer support models of diabetes care, PL recruitment strategies, and PL training programs, as well as the best components of an idealized peer support model, all of which are included in this paper. Given that peer support is often deployed within high-risk, economically vulnerable, and marginalized communities, our systematic review can assist health care providers as they design successful, evidence-based interventions for vulnerable patient populations.

Conclusion

This review examined the various components and process outcomes of type 2 diabetes peer support interventions. We found that the studies differed greatly in terms of population, aims, organization, and modality. More research is needed on the processes underlying peer support interventions and how these

processes can be optimized to improve intervention fidelity and – by extension – outcomes.

Figure 3: Components of Peer Support Interventions in Type 2 Diabetes, Adapted from the Studies Included in This Review



Chapter 3: 'Tis Better to Give Than Receive? Examining the Impact of Providing Support on Glycemic Control and Diabetes Distress at 3 and 12 Months in Peer Leaders.

SUMMARY

OBJECTIVE: The objective of this study is to examine the impact of peer support on peer leaders' glycemic control and diabetes distress at 3 and 12 months post-baseline as part of the 12-month randomized controlled trial "From clinic to community: using peer support as a transition model for improving longterm diabetes-related health outcomes."

RESEARCH DESIGN AND METHODS: This study was part of a larger randomized controlled trial (RCT) assessing the effects of a 12-month, peer-led diabetes self-management support (DSMS) intervention on long-term diabetesrelated health outcomes. Fifty-two peer leaders were recruited between May 2015, and June 2017, and were invited to attend a 30-hour training program. Peer leaders were matched with participants based on schedule availability, gender preference, and geographic proximity, and were invited to health-related assessments at baseline, 3 months, and 12 months. The primary clinical and psychosocial outcomes were A1C and diabetes distress (DD), respectively. Secondary outcomes were cardiovascular risk factors – blood pressure (BP), body mass index (BMI), and waist circumference (WC) – and depression.

RESULTS: A majority of peer leaders were male (53.8%) and married or partnered (55.8%). The peer leaders had a mean age of 57.5 \pm 11, a long history of diabetes (13.9 \pm 11 years), satisfactory glycemic control (7.0% \pm 0.9%), and a low level of diabetes distress (1.67 \pm 0.52) at baseline. Out of 52 Peer leaders, 43 (82.7%) completed the 12-month study. A1C and DD remained stable over 12 months. There was no statistically significant change in any of the secondary outcomes.

CONCLUSIONS: Findings of this study suggest that delivering support may have a stabilizing effect on glycemic control and diabetes distress over the long-term.

Key words: peer leaders, diabetes distress, A1C

INTRODUCTION

One widely used approach to promoting effective diabetes selfmanagement is diabetes self-management education (DSME) followed by diabetes self-management support (DSMS).²³ Although DSME has been shown to reduce A1C by 0.76% at immediate follow-up (with an additional 1% reduction with each additional 23.6 hours of education),^{68,69} the benefits begin to diminish after 6 months without ongoing support.²³ This concern, coupled with Canada's limited human and financial health-care resources and the projected increase in diabetes prevalence, suggests that new, less resource-intensive interventions are needed.²¹ Peer support, in which individuals with diabetes receive support from others with the same condition, has shown promise as a cost-effective model for providing ongoing support.²⁹

The relationship between peer leaders and participants hinges on their shared experiences and challenges living with their disease.²⁷ In addition to benefiting participants, this relationship may also have a positive impact on peer leaders, who could gain new skills and abilities, social approval from the recipient(s) for their help, and improvements to their self-image.^{51,70}

Although a growing body of literature examines the effect of peer support on participants' clinical and/or psychosocial outcomes, the impact of such interventions on the *peer leaders* who have diabetes has not been extensively investigated. Most studies examining the effect of peer support on peer leader outcomes have involved chronic conditions other than diabetes.^{51,71-74} For example, a survey study of 253 peer leaders in mental health in the United States reported a positive impact on peer leaders' interpersonal, social, spiritual, and professional outcomes, as well as their own recovery and mental health.⁷⁵ The only study (to our knowledge) that evaluated the effects of providing peer support on peer leaders' clinical, psychosocial, and behavioral outcomes in type 2 diabetes was conducted in Hong Kong. That study reported improvements in selfcare behaviors and maintenance of glycemic control in peer leaders over four years.³⁰ To contribute to the burgeoning area of research on peer leaders in type 2 diabetes, we carried out this study investigating the impact of delivering peer support on glycemic control and diabetes distress at 3 and 12 months postbaseline in peer leaders as part of a 12-month, Peer-led, Empowerment-based Approach to Self-management Efforts in Diabetes (PLEASED) study.

RESEARCH DESIGN AND METHODS

This study is part of an RCT examining the effects of a 12-month peer-led diabetes self-management support (DSMS) intervention on long-term diabetes-related health outcomes in a tertiary setting and was approved by the University of British Columbia Clinical Research Ethics Board.⁷⁶ For the purpose of this article, data from peer leaders are used.

PL Recruitment

Fifty-two peer leaders were recruited between May 2015, and June 2017. Recruitment strategies included: (1) recommendations from Diabetes Education Center (DEC) staff, (2) flyers posted in DECs and endocrinologists' offices affiliated with three different hospitals, (3) invitations sent to eligible patients identified from the endocrinologists' electronic medical records (EMR), (4) Vancouver Coastal Health Research Institute e-blast, (5) the Patient Voices Network newsletter, and (6) advertisements in local newspapers. To be eligible for the study, candidates had to: (1) have diabetes, (2) be \geq 21 years of age, (3) speak English, (4) have transportation to attend training, (5) be willing to commit to a 30-hour training program, (6) have a land-line telephone or mobile phone, and (7) have a self-reported A1C of 8% or less. Participants with any serious health conditions or addictions to alcohol or drugs that would impede meaningful participation were excluded.

Peer Leader Training

All interested peer leader candidates were consented and were invited to attend a 30-hour training (6 training sessions of 5 hours each) adapted from Tang et al.'s original 46-hour PLEASED (Peer-led, Empowerment-based, Approach to Self-management efforts in Diabetes) peer leader training program.⁴² The peer leader training covered five core competencies: diabetes-related knowledge, empowerment-based facilitation skills, five-step goal setting, active listening skills, and perceived self-efficacy. It also addressed the three key components of peer support: assistance in daily self-management; social and emotional support; and linkage to clinical care.

Upon successful completion of the training, each peer leader received \$400 to offset the costs associated with participation (e.g., time, travel, parking (\$120), etc.).

Exposure/Contact

Peer leaders were matched with participants based on schedule availability, gender preference, and geographic proximity. Peer leaders were required to

make at least 12 weekly contacts with their participants for the first 3 months of the intervention, and at least 18 biweekly contacts for the remaining 9 months. The first contact was face-to-face in the sites of the research study, or the participant's home or at an agreed-upon community-based location, and the remaining contacts were via telephone. Each support contact followed a general structure that included discussing recent self-management challenges; sharing feelings about these challenges; solving problems; addressing self-management questions; and setting self-management goals. Peer leaders received a stipend of \$20 per participant, per month, over the 12-month period of the study. To ensure regular contacts between peer leaders and participants, the research team periodically followed up with peer leaders.

Sample Size Estimation

The present study is part of a larger RCT examining the effects of a 12month peer-led diabetes self-management support (DSMS) intervention on longterm diabetes-related health outcomes. Based on the main trial sample size calculation, we estimate that we will need a minimum of 50 peer leaders if each peer leader takes at least 1 or 2 participant(s).

Outcomes and Measurements

Peer leaders who agreed to be paired were invited to undergo healthrelated assessments at baseline, 3 months, and 12 months. Measures included A1C (%), blood pressure (BP-mmHg), body mass index (BMI-kg/m²), and waist circumference (cm). Peer leaders were also asked to complete self-report surveys to assess diabetes distress and depression.

The primary clinical outcome was A1C, as measured by a Siemens DCA Vantage Analyzer A1C point-of-care machine – with a 0.967 correlation coefficient with lab measurements.⁷⁷ The secondary clinical outcomes included BP, BMI, and WC. BP was measured using an Omron BP785 digital monitor. Height and weight were measured using a portable Seca Stadiometer Model 217 and a digital scale Model 874, respectively. A Seca 203 ergonomic tape was used to measure WC.

The primary psychosocial outcome was diabetes distress, which was assessed using the 17-item Diabetes Distress Scale (DDS) developed by Polonsky et al.⁷⁸ DD scores of < 2, 2.0–2.9, and >=3 are suggestive of little or no distress, moderate distress, and high distress, respectively.⁷⁸ The DDS is specific to diabetes and assesses four distress-related domains: (1) emotional burden subscale, (2) physician distress subscale, (3) regimen-related distress subscale,

and (4) interpersonal distress. Depression was measured using the Patient Health Questionnaire (PHQ-9) scale, with scores of 5, 10, 15, and 20 corresponding to mild, moderate, moderately severe, and severe depression, respectively.⁷⁹

Statistics Analyses

Descriptive analysis was performed to show frequencies and distribution of characteristics across the study sample. Continuous data are presented as means and standard deviations, and categorical data are presented as frequencies. All analyses are intention-to-treat. A linear mixed effects model with adjustment for multiple comparisons was used to evaluate the changes from baseline to 3 months and 12 months for all longitudinal outcomes. The "intervention effect" of outcomes, defined as the changes from baseline to 3-month and 12-month follow-up, is estimated. Sensitivity analysis is used to ensure that the intervention effect is not affected by age, gender, or duration of diabetes.

RESULTS

Description of Peer Leaders' Baseline Characteristics

Of the 75 recruited prospective peer leaders, 58 successfully completed the peer leader training, and 52 of the 58 agreed to be paired with a participant. Of the 52 paired peer leaders, 46 completed the 3-month assessment, and 43

completed the 12-month assessment (Figure 4). For the purposes of this paper, we categorized two groups of peer leaders: (1) paired peer leaders, who completed peer leader training, were paired with a participant(s), and had at least one contact session, and (2) unpaired peer leaders, who completed the peer leader training but declined to be paired with a participant. Paired peer leaders were further divided into active peer leaders, who completed the 12-month study, and dropouts, who left the study before their final 12-month assessment. Peer leaders' baseline characteristics are provided in Table 5. Tables 6 and 7 compare the demographic characteristics of paired peer leaders, unpaired peer leaders, active peer leaders, and dropouts. There were no significant differences in baseline characteristics between groups.

Unpaired peer leaders were older and more likely to be retired than paired peer leaders; dropouts were younger and more likely to be employed than active peer leaders. While both active peer leaders and dropouts had PHQ-9 scores of less than 5, the dropouts' mean score was more than 1.5 times higher than the active peer leaders' mean score. The one peer leader who was found to have high distress belonged to the dropout group. The number of participants assigned to each peer leader ranged from 1 to 13, with a median of 1. Most peer leaders had

1 or 2 participants (57.7% and 26.9%, respectively). Only one peer leader had 13 participants.

There were no significant changes from baseline to 12 months in any of the primary or secondary outcomes before and after omission of outliers or when controlling for age, gender, and duration of diabetes.

Glycemic Control

Peer leaders maintained their A1C level through the study without any statistically significant change from baseline to 3 (P=0.47) or 12 months (P=0.81).

Cardiovascular Risk Factors

Blood Pressure

Systolic Blood Pressure

SBP decreased from baseline to 3 months and 12 months by 1.61 and 0.31, respectively; however, the changes were not statistically significant.

Diastolic Blood Pressure

DBP showed the same decreasing pattern as SBP over the course of study.

Similarly, there was no statistically significant change at any time.

Waist Circumference

WC increased from baseline to 3 months and 12 months, but the changes were not statistically significant.

Body Mass Index

BMI remained the same from baseline to 3 months, then decreased from 3 months to 12 months. The changes were not statistically significant at any time point.

Psychosocial Outcomes

Diabetes Distress

The total DD, emotional burden, interpersonal, and regimen-related scores remained stable from baseline to 3 months and 12 months. The physician-related distress score increased (indicating greater distress) from baseline to 3 months and 12 months by 0.09 and 0.08, respectively. These changes were not statistically significant.

Depression

Although the PHQ-9 score increased by 0.67 from baseline to 3 months, it returned to near the baseline level at 12 months. No statistically significant change from baseline to 3 months or 12 months was detected.

Dropouts

Of the 52 peer leaders, 6 (11.5%) dropped out of the study. Their reasons for leaving included changes in availability; dealings with difficult participants; feeling overwhelmed with the extent of participants' health problems; and having

greater responsibility than they expected as peer leaders. Please refer to Table 8

for a summary of statistical analyses.



Figure 4: Recruitment and Follow-up of Peer Leaders in a Repeated Measures Study

Table 5: Baseline Characteristics of Peer Leaders

Ν	52	
Age (years), mean ± SD	57.5±11	
Male/Female, n (%)	28/24 (53.8/46.2%)	
DM 1/DM 2, n (%)	6/46 (11.5/88.5%)	
Diabetes duration (years), mean ± SD	13.9±11	
Marital status, n (%) Never married Married or partnered Separated/divorced/widowed	8(15.4%) 29(55.8%) 15(28.9%)	
Ethnicity, n (%) Caucasian East Asian South Asian Southeast Asian Others	24(46.2%) 9(17.3%) 12(23.1%) 2(3.8%) 5(9.6%)	
Education, n (%) Less than high school High school degree University/college graduate	0(0%) 2(3.8%) 50(96.1%)	
Household income < \$20,000 \$20,000 to \$49,999 \$50,000 to \$69,999 > \$70,000	3(5.8%) 13(25%) 7(13.5%) 24(46.2%)	
Employment Status, n (%) Employed Retired	26(50%) 16 (30.8%)	
PHQ-9 score, mean ± SD	2.7±2.9	
DD score, n (%) Little or no distress Moderate distress High distress	39(75%) 12(23.1%) 1(1.9%)	
Anti-hyperglycemic medication, n (%) No medication Oral diabetes medication Insulin GLP-1 non-insulin injectable	6 (11.5%) 36(69.2%) 20(38.5%) 6 (11.5%)	
A1C, mean ± SD	7.0±0.9	
BMI, mean ± SD (metric)	30.1±6.9	
WC, mean ± SD	101.2±17.2cm	
SBP, mean ± SD (metric)	126.8±17.7	
DBP, mean ± SD	78.9±12.1	

* WC: waist circumference (cm), SBP: systolic blood pressure (mmHg), DBP: diastolic blood pressure (mmHg)

	Active	Dropouts
Ν	46	6
Age (years), mean ± SD	58.1±10.5	52.2±14.4
Male/Female, n (%)	25/21 (54.3/45.7%)	3/3 (50/50%)
DM 1/DM 2, n (%)	5/41 (10.9/89.1%)	1/5 (16.7/83.3%)
Diabetes duration (years), mean ± SD	13.8±11.9	14.2±6.1
Marital status, n (%)		
Never married	8 (17.4%)	0 (0%)
Married or partnered	25 (54.3%)	4 (66.7%)
Separated/divorced/widowed	13 (28.2%)	2 (33.3%)
Ethnicity, n (%)		
Caucasian	22 (47.8%)	2 (33.3%)
East Asian	9 (19.6%)	0 (0%)
South Asian	10 (21.7%)	2 (33.3%)
Southeast Asian	1 (2.2%)	1 (16.7%)
Others	4 (8.7%)	1 (16.7%)
Education, n (%)		
Less than high school	0 (0%)	0 (0%)
High school degree	2 (4.3%)	0 (0%)
University/college graduate	44 (95.7%)	6 (100%)
Household income		
< \$20,000	3 (6.5%)	0 (0%)
\$20,000 to \$49,999	13 (28.2%)	0 (0%)
\$50,000 to \$69,999	7 (15.2%)	0 (0%)
> \$70,000	19 (41.3%)	5 (83.3%)
Employment Status, n (%)		
Employed	23 (50%)	3 (50%)
Retired	14 (30.4%)	2 (33.3%)
PHQ-9 score, mean ± SD	2.5±2.6	4±4.9
DD score, n (%)		
Little or no distress	35 (76.1%)	4 (66.7%)
Moderate distress	11 (23.9%)	1 (16.7%)
High distress	0 (0%)	1 (16.7%)
Anti-hyperglycemic medication, n (%)	- (- ()
No medication	6 (13%)	0 (0%)
Oral diabetes medication	32 (69.6%)	4 (66.7%)
Insulin	18 (39.1%)	2 (33.3%)
GLP-1 non-insulin injectable	5 (10.9%)	1 (16.7%)
A1C, mean ± SD	6.9±0.8	7.1±1.6
BMI, mean ± SD (metric)	30.1±6.7	30.3±8.1
WC, mean ± SD	101.2±17.2	101.2±17.6
SBP, mean ± SD (metric)	126.8±18.6	127.2±8.9
DBP, mean ± SD	78.6±11.9	81.2±14.7

Table 6: Comparing the Baseline Characteristics of Active Peer leaders versus Dropouts

N	Unpaired Peer Leaders	Paired Peer Leaders
N	0	52
Age, mean \pm SD	64./±13.5	57.5±11
Male/Female, n (%)	4/2 (66.7/33.3%)	28/24 (53.8/46.2%)
DM1/DM2, n (%)	0/6 (0/100%)	6/46 (11.5/88.5%)
Diabetes Duration (years), mean ± SD	13.3±12.5	13.9±11
Marital status, n (%)		
Never married	0 (0%)	8(15.4%)
Married or partnered	5 (83.3%)	29(55.8%)
Separated/divorced/widowed	1 (16.7%)	15(28.9%)
Ethnicity, n (%)		
Caucasian	3 (50%)	24(46.2%)
Fast Asian	0 (0%)	9(17 3%)
South Asian	2 (22 2%)	12/22 19/1
South Asian	2 (33.3%)	12(23.1/0)
Southeast Asian	1 (10.0%)	2(3.8%)
Others	0 (0%)	5(9.6%)
Education, n (%)		
Less than high school	0 (0%)	0(0%)
High school degree	1 (16.6%)	2(3.8%)
University/college graduate	5 (83.3%)	50(96.1%)
Employment Status, n (%)		
Employed	2 (33.3%)	26(50%)
Retired	4 (66.6%)	16 (30.8%)
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Table 7: Comparing the Demographic Characteristics of Unpaired and Paired Peer leaders
Outcome	Baseline	3-month-baseline	12-month-baseline
A1C (%)	7.0 (5.2-10)	0.14 (-0.15 to 0.44) P = 0.47	0.07 (-0.22 to 0.37) P = 0.81
SBP (mmHg)	126.8 (95-177.5)	-1.61 (-6.33 to 3.10) P = 0.69	-0.31 (-5.03 to 4.41) P = 0.99
DBP (mmHg)	78.9(57.5-109)	-1.56 (-4.940 to 1.80) P = 0.51	-1.17 (-4.54 to 2.20) P = 0.69
BMI (kg/m2)	30.1 (20.5-53.1)	0.06 (-0.34 to 0.47) P = 0.92	-0.23 (-0.64 to 0.17) P = 0.36
WC (inch)	101.2 (67.5-147.3)	0.35 (-0.29 to 0.99) P = 0.41	0.31 (-0.33 to 0.96) P = 0.47
DDS	1.67 (1-3.6)	0.01 (-0.11 to 0.13) P = 0.98	0.01 (-0.11 to 0.13) P = 0.98
Emotional burden	1.8 (1-5.4)	-0.02 (-0.17 to 0.14) P = 0.95	-0.06 (-0.22 to 0.09) P = 0.62
Interpersonal	1.7 (1-4)	-0.02 (-0.98 to 0.21) P = 0.98	0.02 (-0.20 to 0.24) P = 0.98
Physician	1.3 (1-3)	0.09 (-0.28 to 1.52) P=0.28	0.08 (0.41 to 1.28) P=0.43
Regimen	1.8 (1-3.2)	0.02 (-0.17 to 0.22) P = 0.96	-0.01 (-0.19 to 0.21) P = 0.99
PHQ-9	2.7(0-13)	0.67 (-0.22 to 1.56) P = 0.17	0.04 (-0.85 to 0.93) P = 0.99

Table 8: Changes in Clinical and Psychosocial Outcomes at Baseline and 3-month and 12-month Follow-ups

DISCUSSION

The effect of peer support interventions on the clinical and psychosocial outcomes of participants has received considerable attention; what is less well understood is the impact of these interventions on the individuals who deliver the support. This study sought to investigate this impact. Our cohort of peer leaders started the study with a mean A1C and mean diabetes distress level that were both at target. Following 12 months of providing emotional and behavioral support to participants struggling with self-management, the mean A1C and diabetes distress levels of peer leaders remained at target. In other words, the lack of change was a favorable outcome. Moreover, most cardiovascular risk factors were within recommended guidelines at the beginning of the study and remained within normal range until the end. (The exception was BMI that was not within recommended guidelines at the study's beginning, and remained essentially unchanged.) Indeed, in the context of medicine, "no news is good news."

To date, only one other study has considered the effects of peer support on peer leaders in diabetes. In Hong Kong, Yin et al. examined the effects of providing peer support across 79 individuals with diabetes who were recruited to be peer leaders. Of these 79 individuals, 59 completed peer leader training and were divided into two groups: 26 who attended peer leader training but refused to become peer leaders (refused trainees), and 33 who attended the training and agreed to become peer leaders (agreed trainees). These groups were then compared with 60 individuals with diabetes who did not attend peer leader training (usual care). The authors found that, compared to the other two groups, the agreed trainees more successfully sustained their A1C over 4 years of the

study.³⁰ Unlike our repeated measures observational study, the quasi-experiment design used by Yin et al. allowed for the comparison of within-group A1C changes across the 3 groups. In addition, the larger sample size enabled them to discern statistically significant differences among the groups. However, if we isolate the changes in the Yin et al. study to the "agreed trainee" group, their results are consistent with our own.

Considering that the peer leader's A1C and diabetes distress were at target at baseline, this allowed for minimal room for improvement through the course of the study. In fact, our peer leaders' sustained A1C throughout the study could be interpreted as a desirable outcome given that diabetes is a progressive disease in which A1C increases, on average, by approximately 0.2% per year. Thus, anything less than a 0.2% increase may constitute an improvement.⁸⁰ In addition, The Action to Control Cardiovascular Risk in Diabetes Study found that intensive therapy in type 2 diabetes (designed to achieve A1C < 6.0%) increases the mortality rate and does not decrease major cardiovascular events – especially in geriatric populations.⁸¹ This suggests that, for our leaders (many of whom are geriatric), further tightening of A1C control might not add benefits and could even be detrimental. The benefits that peer leaders received by attending the training and interacting with participants may have also influenced outcomes other than A1C and diabetes distress. In Yin et al.'s study, the peer leaders who completed the training program significantly improved on diet adherence and foot care. In a systematic review and meta-analysis of the effects of volunteering on volunteers' physical and mental health, no impact on volunteers' physical health was observed, but volunteers did have a lower mortality rate, higher life satisfaction, and higher well-being. Furthermore, qualitative research on other chronic illnesses (e.g., human immunodeficiency virus [HIV] and multiple sclerosis [MS]) found that assisting others helped peer leaders enhance their personal growth, empowerment, confidence, self-awareness, and self-esteem.^{51,82}

Peer leaders had a mean age of 57.5 years with a mean duration of diabetes of 13.9 years. Paired peer leaders were primarily male, married, and university/college graduates. Four additional studies – two in primary care, one in community settings, and one in tertiary care – have also reported baseline demographic characteristics for peer leaders in peer support interventions in type 2 diabetes.^{30,43,55,59} In these studies, peer leaders were largely older,^{43,55,59} female,^{43,55,56,59} and – on average – had a shorter history of diabetes than did our

leaders.^{43,55,56} The differences in the study setting, modality of contact, and time commitment might play a role in the observed discrepancies across the four studies. For example, the peer leader population in our study, like that of Chan et al.'s telephone-based study, was primarily younger than those in face-to-face or combined (telephone and face-to-face) studies – modalities that might be perceived as more time-consuming. Interestingly, peer leaders who successfully completed the study tended to be older than those who dropped out. This could again be attributed to the greater time availability of older PLs. The younger prospective peer leaders might have thought that a telephone-based intervention would require a minimal time commitment, only to later encounter timeconsuming challenges in contacting participants and scheduling calls.

This study has several limitations. First, it was a repeated measures observational study, and the sample size may have been too small to detect significant changes over the course of study. Larger sample sizes and controlled trials are required for further investigations. Second, we did not test the A1C levels of prospective PLs at the time of recruitment, and instead relied on selfreported numbers as one of the recruitment eligibility criteria. Consequently, 11.5% of peer leaders had A1C > 8% at baseline. Third, the number of assigned

participants significantly differed from one peer leader to another based on the peer leaders' availability and interest. As a result, some peer leaders had a higher amount of participant contacts than the rest. Fourth, while some peer leaders might have strictly adhered to the frequency and interval of contacts that were outlined in the study protocol and might have followed the instructions and strategies taught in the peer leader training program, others may have been more lax .⁸³ This discrepancy might have varied the impact of the study from one pair to another. Lastly, although our study dropout rate is within the range of other studies, ^{30,43,55,58,59} the loss of peer leaders might have attenuated the power of our statistical analyses.

To our knowledge, this is the first study in North America to examine the impact of providing peer support on peer leaders in a telephone-based peer support intervention for adults with type 2 diabetes.

IMPLICATIONS FOR FUTURE RESEARCH

The findings of this study warrant further research on the impact of providing support on peer leaders in peer support interventions. Similar to Yin et al., our study was conducted in a tertiary setting. Further investigations are needed to: (1) examine the impact of such interventions on peer leaders

delivering support to participants in other settings (e.g., primary care and community-based); (2) compare the peer leaders' sociodemographic characteristics in different settings using various modalities of contact and investigate why interested candidates differ, if any divergence exists; and (3) explore reasons for variation in sociodemographic characteristics in peer leader training completers who are not paired with participants, peer leader training completers who are paired with participants, and dropouts.

Although the present study demonstrates that peer leaders sustained their glycemic control and diabetes distress levels during the year they took part in a peer support intervention in type 2 diabetes, the benefits they receive may extend beyond the clinical or psychosocial outcomes we assessed. A mixed method research design is needed to define the relevant outcome measures and to systematically examine the impact of such interventions on peer leaders. Chapter 4: A Winning Combination: Exploring the Demographic and Personality Characteristics of Effective Peer Leaders for the Enhancement of Peer Leader Selection and Pairing Models

SUMMARY

OBJECTIVE: The purpose of this study is to investigate the demographic and personality characteristics of peer leaders participating in a 12-month randomized controlled trial examining the effects of peer-led diabetes self-management support (DSMS) on long-term diabetes-related health outcomes.

RESEARCH DESIGN AND METHODS: This cross-sectional study is part of a larger randomized controlled trial assessing the effects of a 12-month peer support intervention on long-term diabetes health outcomes. In total, 52 peer leaders were recruited between May 2015 and June 2017. Eligible candidates were English-speaking adults (age \geq 21) with diabetes, with a self-reported A1C \leq 8%, who had access to a phone and transportation, and who were willing to attend a 30-hour training program. Successful graduates of the training program were paired with participants. Only peer leaders who had at least one participant complete the baseline and 12-month assessments were eligible to be included in the study. Thirty-seven of 51 paired PLs met this criterion. These 37 PLs were asked to fill out a self-reported survey on their sociodemographic characteristics (age, gender, income, education, etc.) and a Mini-IPIP scale that measured their "Big Five" personality traits. We categorized peer leaders as effective if their

participants sustained or improved their A1C and Diabetes Distress (DD) scores from baseline to 12 months, and as ineffective if their participants worsened in any of these parameters.

RESULTS: Of the 37 peer leaders, 20 were deemed to be effective. The majority of effective peer leaders were male, married, employed, and highly educated. The mean age for effective PLs was 59.8 (SD=12.5). All PLs scored highest on agreeableness and lowest on neuroticism. The effective PLs had a significantly lower baseline DD score (P=0.02) and a significantly higher extraversion score (P=0.03), compared to the ineffective group.

CONCLUSION: Peer leaders typically scored high in agreeableness and low in neuroticism. Extraversion, indicating sociability and positive affect, emerged as the personality trait that best corresponded with peer leader effectiveness. **Key words:** peer leader, personality, effectiveness

INTRODUCTION

In peer support interventions, volunteer peer leaders provide ongoing support to participants to help them with their emotional health, as well as initiate and maintain self-management improvements .^{27,59} These interventions have shown promise in promoting better chronic disease self-management.²⁷ Research has shown that volunteers in health care settings (e.g., hospice care) are generally well-educated, female, and of high economic status.⁸⁴ The volunteers also share certain personality traits, such as lower levels of neuroticism and higher levels of extraversion.^{84,85} One meta-analytic review found that the "Big 5" personality traits – Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (OCEAN) – were strongly correlated with performance motivation. Individuals who score high in certain traits may be better suited to setting aspirational goals and achieving program objectives.⁸⁶ Another study found that the presence of certain personality traits in volunteers can be used to predict the volunteers' performance and the success of the programs they are involved in.⁸⁷ Specifically, volunteers who are narcissistic and self-centered tend to volunteer for shorter durations, while those who are perfectionist, obsessive,

and conscientious maintain high standards for themselves and others – enhancing the quality of their work.⁸⁷

There is a growing body of literature on how peer-led interventions affect their participants,^{29,31-34,37-39,41-43,57,88} but the research on how to best recruit peer leaders and pair them with participants – especially peer leaders in *diabetes* – is very limited.^{30,43,55,59} This is a critical gap in the literature, as the quality of the intervention is directly correlated with the quality of the peer leader.

To our knowledge, no other study has explored the personality characteristics of peer leaders in peer support interventions in type 2 diabetes. This study fills this gap in the literature by evaluating the personality characteristics of peer leaders in the 12-month, tertiary-care, telephone-based Peer-led Empowerment-based Approach to Self-management Efforts in Diabetes (PLEASED) study,⁴² and proposes a model for selecting and pairing peer leaders based on their demographic and personality characteristics.

RESEARCH DESIGN AND METHODS

A detailed description of the study is published elsewhere. A summary is provided below.⁷⁶

This study, which has been approved by the University of British Columbia Clinical Research Ethics Board, is part of a randomized controlled trial (RCT) on the effects of a 12-month peer-led diabetes self-management support (DSMS) intervention on long-term diabetes-related health outcomes in a tertiary setting.⁷⁶ For the purpose of this article, we only included peer leaders that had at least one participant complete both the baseline and 12-month assessments.

Peer Leader Recruitment and Training

We recruited 52 peer leaders from May 2015 to June 2017. Recruitment strategies included flyers posted in the Diabetes Education Centers (DECs) and endocrinologists' offices of three nearby hospitals, recommendations from DEC staff, invitations sent to eligible patients identified from the endocrinologists' electronic medical records, Vancouver Coastal Health Research Institute e-blast, announcements in the Patient Voices Network newsletter, and advertisements in local newspapers. To be eligible for selection as a peer leader, a candidate had to (1) be diagnosed with diabetes, (2) be at least 21 years of age, (3) speak English, (4) have transportation to attend training, (5) be willing to commit to a 30-hour training program, (6) have a landline telephone or mobile phone, and (7) have a self-reported A1C of 8% or less. The exclusion criteria included any serious health conditions or addictions to alcohol or other drugs that could hinder meaningful participation in the study. Prospective peer leaders were consented and asked to participate in a 30-hour training program adapted from Tang et al.'s original 46-hour PLEASED (Peer-led, Empowerment-based, Approach to Self-management efforts in Diabetes) program.⁵⁹

Intervention

Peer leaders who successfully completed the training were paired with intervention participants based on mutual availability, gender, and geographical proximity. Participants were required to have type 2 diabetes and be 20 years or older, and were recruited from tertiary care. The first contact between the peer leader and participant was face-to-face at a site of the research study, participant's home, or an agreed-upon location in the community. After this initial contact, the peer leaders were then required to telephone their participants weekly in the first 3 months of the study, and biweekly in the last 9 months.

Outcomes and Measures

Peer leaders were asked to fill out a self-reported survey that asked for their sociodemographic characteristics (e.g., age, gender, income, education, immigrant status, time since immigration), and to complete the Diabetes Distress

Scale (DDS), Patient Health Questionnaire (PHQ-9), and Mini International Personality Item Pool (Mini-IPIP) Scale, which is used to measure the "Big Five" personality traits.

The Mini-IPIP is a shorter, 20-item version of the 50-item International Personality Item Pool Five-Factor Model measure. Scores range from 20 to 100. The internal consistency across different studies is acceptable ($\alpha \ge 0.6$), and the test-retest correlations are similar to the parent measure.⁸⁹ The PHQ-9, a nineitem instrument for measuring and evaluating depression, was used to measure depressive symptomology among peer leaders, with scores of 5, 10, 15, and 20 corresponding to mild, moderate, moderately severe, and severe depression, respectively.⁷⁹ The DDS is a 17-item self-reported instrument scored on a six-point Likert scale. It consists of four subscales (emotional burden distress, physicianrelated distress, regimen-related distress, and interpersonal distress) that together yield a total diabetes distress score. For our study, scores of less than 2, 2 to 2.9, and 3 and higher indicated no distress, moderate distress, and high distress, respectively.⁷⁸

The participants were invited to undergo assessments at baseline, 3 months, and 12 months. The assessment battery included an A1C test and the 17-item Diabetes Distress Scale (DDS) survey.

Data Analysis

We categorized peer leaders as effective if their participants sustained or improved their mean A1C and DD scores from baseline to 12 months, and as ineffective if their participants worsened in these metrics. We compared the baseline characteristics between the two groups of peer leaders using chi-square for categorical variables and ANCOVA for continuous variables. Use of ANCOVA allowed us to control for the number of peer leaders' participants.

Peer Leader Effectiveness Score

We scored peer leader effectiveness based on two continuous variables: (1) the difference between participants' mean 12-month and baseline A1C; and (2) the difference between participants' mean 12-month and baseline DD scores. As diabetes is a progressive disease and higher DD is associated with poorer glycemic control, sustaining A1C and DD is perceived as a clinically desirable outcome.^{66,80} The greater the difference for either of these two variables, the higher (or lower) the peer leader's *effectiveness score* was deemed to be. Later, we estimated the

correlation coefficient to assess the relationship between personality traits and the peer leaders' effectiveness score.

RESULTS

Peer Leaders' Baseline Sociodemographic Characteristics

Of the 37 peer leaders included in this study, most were male (54%); married or partnered (54%); university or college graduates (97.3%); and employed part- or full-time (84%). The mean A1C was 7% (SD=0.8). Ages ranged from 34 to 79 years, with the mean being 59.5 years (SD=10). The mean years of living with diabetes was 14.2 (SD=12.7). The mean DD score (1.6±0.4) suggested low levels of diabetes distress. Although most peer leaders had just one (49%) or two (32%) participants, some had more, and one had 13.

Of the 37 peer leaders, 20 were categorized as effective. Effective peer leaders were predominantly Caucasian and had lower household income, a lower employment rate, and fewer years diagnosed with diabetes than did ineffective peer leaders. Ineffective peer leaders had tighter glycemic control (6.8 (0.7), versus 7.1(1) for effective leaders) but a higher PHQ-9 score (2.7(3), versus 2.1(2.2) for effective leaders). In general, the only significant difference in baseline characteristics between the groups was the total DDS score and two of its subscales – emotional burden and regimen distress. All three scores were significantly higher for ineffective peer leaders. Table 9 displays baseline characteristics of effective versus ineffective peer leaders.

Personality Characteristics

Peer leaders generally scored high on agreeableness and lowest on neuroticism (agreeableness > openness > conscientiousness > extraversion > neuroticism). The same pattern was seen in both effective and ineffective peer leaders. When the two groups of peer leaders were compared, effective peer leaders scored significantly higher on the "extraversion" trait. Initially, no significant relationship was found between any of the personality traits and peer leaders' effectiveness scores. However, a closer examination of the A1C data revealed an outlier: a peer leader whose two participants' A1C decreased by nearly 50%. After eliminating this outlier from the analyses, we found a strong positive relationship between extraversion and A1C improvement from baseline to 12 months (P-value = 0.05). Table 10 and Table 11 show the correlation coefficient between peer

leaders' personality characteristics and effectiveness. Table 12 compares the Big 5

Personality Traits of effective and ineffective peer leaders.

Table 9:	Baseline	Demoaraphic	Characteristics of	of Effective	versus Inet	ffective Pee	r Leaders
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Measures	Peer Leaders	Effective Peer Leaders	Ineffective Peer Leaders	P-value
Ν	37	20	17	-
Age (years), mean (SD)	59.5 (10)	59.8 (12.5)	59.1 (6.2)	0.65
Male/Female, n (%)	20/17 (54%/46%)	11/9 (55%/45%)	9/8 (53%/47%)	1.0
DM 1/DM 2, n (%)	4/33 (11%/89%)	3/17 (15%/85%)	1/16 (6%/94%)	0.61
Diabetes duration (years), mean (SD)	14.2 (12.7)	13.9 (11.5)	14.6 (14.3)	0.81
Marital status, n (%) Never married Married or partnered Separated/divorced/widowed	6 (16%) 20 (54%) 11 (30%)	3 (15%) 10 (50%) 7 (35%)	3 (18%) 10 (59%) 4 (23%)	0.82
Ethnicity, n (%) Aboriginal Caucasian East Asian South Asian Southeast Asian Others	0 (0%) 17 (46%) 8 (22%) 9 (24%) 1 (3%) 2 (5%)	0 (0%) 11 (55%) 2 (10%) 4 (20%) 1 (5%) 2 (10%)	0 (0%) 6 (35%) 6 (35%) 5 (29%) 0 (0%) 0 (0%)	0.43
Education, n (%) Less than high school High school degree University/college graduate	0 1 (2.7%) 36 (97.3%)	0 1(5%) 19 (95%)	0 0 17 (100%)	1.0
Household income, n (%) <20,000 20,000 to 49,999 50,000 to 69,000 ≥70,000	2 (5%) 9 (24%) 6 (16%) 17 (47%)	2 (10%) 7 (35%) 3 (15%) 6 (30%)	0 (0%) 2 (12%) 3 (18%) 11 (65%)	0.08
Employment, n (%) Full-time Part-time Retired	20 (54%) 11 (30%) 6 (16%)	9 (45%) 7 (35%) 4 (20%)	11 (65%) 4 (23%) 2 (12%)	0.54

A1C, mean (SD)	7.0 (0.8)	7.1 (1)	6.8 (0.7)	0.41
DD, mean (SD)	1.6 (0.4)	1.4 (0.3)	1.8 (0.5)	0.02
Emotional Burden	1.7 (0.6)	1.4 (0.4)	1.9 (0.7)	0.02
Physician Distress	1.3 (0.5)	1.2 (0.5)	1.4 (0.5)	0.31
Regimen Distress	1.7 (0.5)	1.5 (0.4)	1.9 (0.6)	0.03
Interpersonal Distress	1.6 (0.7)	1.5 (0.5)	1.7 (0.9)	0.47
PHQ-9, mean (SD)	2.4 (2.5)	2.1 (2.2)	2.7 (3)	0.44
Neuroticism, mean (SD)	2.2 (0.6)	2.2 (0.6)	2.1 (0.5)	0.60
Extraversion, mean (SD)	3.1 (0.8)	3.3 (0.7)	2.8 (0.8)	0.02
Openness, mean (SD)	4.0 (0.7)	4.0 (0.8)	4.0 (0.6)	0.73
Agreeableness, mean (SD)	4.3 (0.6)	4.2 (0.7)	4.3 (0.5)	0.59
Conscientiousness, mean (SD)	3.8 (0.5)	3.8 (0.6)	3.8 (0.5)	0.59

Table 10: Correlation Coefficient between Peer Leaders' Personality Characteristics and Effectiveness Based onA1C Difference from Baseline to 12 Months.

Measures	Effectiveness Correlation Coefficient ¹	P-value ¹	Effectiveness Correlation Coefficient ²	P-value ²
Neuroticism	- 0.10 (- 0.34 – 0.31)	0.92	- 0.13 (- 0.44 – 0.20)	0.43
Extraversion	- 0.11 (- 0.42 – 0.22)	0.51	- 0.32 (- 0.59 – 0.01)	0.05
Openness	- 0.01 (- 0.33 – 0.31)	0.94	+ 0.10 (- 0.23 – 0.42)	0.54
Agreeableness	- 0.05 (- 0.37 – 0.27)	0.75	- 0.01 (- 0.34 – 0.32)	0.94
Conscientiousness	- 0.11 (- 0.42 – 0.22)	0.51	- 0.03 (- 0.35 – 0.30)	0.87

¹Effectiveness including outliers

² Effectiveness excluding outliers

Table 11: Correlation Coefficient between Peer Leaders	' Personality Characteristics and Effectiveness Based on
DD Difference from Baseline to 12 Months.	

Measures	Effectiveness Correlation Coefficient	P-value
Neuroticism	- 0.02 (- 0.35 – 0.30)	0.88
Extraversion	- 0.01 (- 0.32 – 0.33)	0.96
Openness	- 0.01 (- 0.34 – 0.31)	0.94
Agreeableness	0.30 (- 0.03 – 0.57)	0.07
Conscientiousness	- 0.03 (- 0.35 – 0.3)	0.85

Measures	P for Between Group Difference	Mean Difference (Confidence Interval)
Neuroticism	0.50	- 0.13 (- 0.50 – 0.25)
Extraversion	0.03	- 0.55 (-1.06 – - 0.27)
Openness	0.87	0.04 (- 0.42 – 0.49)
Agreeableness	0.65	0.08 (- 0.30 – 0.47)
Conscientiousness	0.78	0.05 (- 0.32 – 0.42)

Table 12: Comparing Big 5 Personality Traits Between Effective and Ineffective Peer Leaders

DISCUSSION

There is a growing body of literature on the effects of peer support interventions on participants' health-related outcomes in chronic disease selfmanagement. Less attention has been directed to peer leaders; their sociodemographic characteristics or personality traits; or the selection models used to recruit them. Inquiries in these areas may enhance the effectiveness of peer support interventions. New data may be especially useful in the context of one-on-one, face-to-face, telephone-based interventions, where finding the best possible matches is critical to success.

Consistent with Caidwell et al., our peer leaders (both effective and ineffective) were largely Caucasian and had high levels of education.⁸⁴ In contrast to Caidwell et al., our peer leaders were predominantly men, employed full-time, and of higher income.⁸⁴ These differences in peer leader composition may be

attributed to our comparatively small sample size, or to differences in clinical setting: hospice care in Caidwell et al. versus diabetes self-management in our case.

When we compared the groups in our study, we found that the number of peer leaders who were retired or employed part-time was higher – although not significantly so – in the effective group than in the ineffective group. Thus, peer leaders in the effective group may have had additional time to help their participants. Effective peer leaders also scored significantly lower in total DD and two of its subscales – emotional burden and regimen distress – than did ineffective peer leaders, even though ineffective peer leaders had lower A1C (albeit by a statistically insignificant amount). This suggests two possibilities: (1) individuals whose DD is lower in the subscales associated with managing the personal and regimen-related demands of diabetes (the emotional burden and regimen distress subscales, respectively) might have better diabetes-related coping skills, which may equip them to better help others with diabetes selfmanagement; and (2) peer leaders need not have optimal glycemic control to be effective. A1C is used mostly as an eligibility criterion for peer leaders' selection and may have limited usefulness in predicting peer leaders'

effectiveness.^{31,34,37,43,56} Diabetes distress seems to be a better predictor. Future peer support studies may consider these findings when establishing their criteria for peer leader recruitment.

Our findings also suggest that individuals with high levels of agreeableness and low level of neuroticism were more likely to sign up as peer leaders. Agreeableness is indicative of altruistic behaviors, sympathy, generosity, and warmth⁹⁰ – while neuroticism is suggestive of negative affect (e.g., sadness, anxiety, anger) and poor reactions to undesirable situations (e.g., threat, loss, frustration).⁹⁰ What makes these individuals "effective" (as defined in this article) may be their level of extraversion.⁹⁰ This finding is similar to Bruck et al.'s account of a strong significant correlation between volunteers' extraversion and their quality of work.⁹¹

We observed no statistically significant relationship between extraversion and the percentage of A1C improvement from baseline to 12 months, but when we omitted the one outlier—the peer leader whose participants' glycemic control improved by more than 50% throughout the study—we noticed a strong trend between these two variables. The lack of statistical significance between extraversion and A1C improvement in the initial analyses before the omission of the outlier might be partly attributable to our study's telephone-based modality of contact, which may allow peer leaders who are lower in extraversion to succeed.

Peer leaders are the foundation of peer support interventions. To enhance the efficacy of such interventions, robust models for selecting peer leaders and for matching peer leaders with participants must be defined. Our findings suggest that low diabetes distress could be an important, underutilized selection criterion for prospective peer leader candidates. Satisfactory glycemic control (A1C<8%) could remain a criterion in peer leader selection models, to ensure that peer leaders possess a minimum level of diabetes self-management knowledge; however, our results suggest that *optimal* glycemic control (A1C \leq 7%) is not necessarily suggestive of peer leaders' effectiveness. For studies that are focused on clinical outcomes (e.g., improvements in A1C), peer leader candidates with higher extraversion scores should be recruited. Therefore, we recommend that peer leader candidates undergo a personality test, and that peer recruitment and peer pairing models incorporate the results. Recruiting effective peer leaders may increase not only intervention success rates but also participants' and peer leaders' retention rates.

This study is not without limitations. First, its small sample size could have attenuated the power of our statistical analyses. Second, participants were not assigned in equal numbers to peer leaders. As a result, some peer leaders might have allocated more time overall or had less time to spend with individual participants. To address this gap, we used ANCOVA to control for the number of participants. Lastly, we defined effectiveness based on the improvement in participants' DD and A1C from baseline to 12 months; however, there might be other factors that participants see as important to peer leaders' effectiveness (such as level of satisfaction from peer leader-participant interaction). Further qualitative research is needed on the participants' point of view.

What distinguishes this study is that – to our knowledge – it is the first to examine the personality traits of peer leaders, and the first to propose adjustments in selection models for recruiting peer leaders and pairing them with participants in diabetes interventions.

IMPLICATIONS FOR FUTURE RESEARCH

The findings of our study support the inclusion of novel, less utilized evaluation metrics for the selection and recruitment of peer leaders in diabetes peer-support interventions. Contrary to convention, optimal glycemic control may

not be an accurate metric for predicting the success of a peer leader candidate. Other selection metrics, such as personality assessments, may be more predictive of success and should be considered in the selection of peer leaders. For example, future interventions should consider preferentially recruiting peer leaders that demonstrate high extraversion. Another potential – and underutilized – selection metric may be low diabetes distress.

While the findings of this paper provide some guidance on an effective peer leader selection strategy, further research on this topic is warranted. Specifically, future investigations should aim to illustrate what attributes – in addition to personality and diabetes distress – indicate potential success for peer leaders, and what additional measures – outside of participants' clinical and psychosocial outcomes – can be used to quantify a peer leader's success. These findings, ideally supported by mixed-methods research with a larger sample size, would allow us better optimize peer leader recruitment and participant pairings to improve outcomes.

Chapter 5: Qualitative Study: Exploring Peer Support in Type 2 Diabetes from the Peer Leaders' Perspectives

SUMMARY

OBJECTIVE: To explore the peer leaders' (PLs') perspectives on core components of a 12-month telephone-based peer support intervention in type 2 diabetes (T2DM) in a tertiary-care setting.

METHODS: A sequential explanatory mixed-methods approach was utilized. A purposive sample of seventeen PLs was recruited based on PLs' and their participants' A1C changes from baseline to 12 months. They were then divided into four groups: (1) mean PLs' and participants' A1C improved, (2) mean PLs' and participants' A1C worsened, (3) mean PLs' A1C improved while participants' A1C worsened, and (4) mean PLs' A1C worsened while participants' A1C improved. Three to five PLs were interviewed in each category. Audio files were transcribed verbatim. The transcripts were analyzed using the qualitative descriptive approach.

FINDINGS: Overall, PLs reported mutually beneficial and reciprocal relationships with participants. They encountered challenges in maintaining the regular contacts with participants and in motivating them to make lifestyle changes. The program facilitated PLs' personal diabetes control by raising awareness and encouraging them to make positive lifestyle modifications. They

mostly perceived their diabetes control as inferior to that of their family members and friends with T2DM (upward social comparison), and as superior to that of their participants (downward social comparison). These perceptions, together with the desire to motivate their participants, led some PLs to make behavioral changes. To improve the program, PLs suggested having more frequent but shorter training sessions and reducing the amount of reading and composition. They asked for additional support from the research team, and for more frequent face-to-face contacts with participants.

CONCLUSION: Overall, the program seems to have benefited the PLs, and the PLs were satisfied with the intervention design. However, our intervention, like most programs of this kind, had some limitations, which similar studies in the future will need to address.

Key words: peer leader, peer support, mixed methods research

INTRODUCTION

To achieve optimal diabetes control, patients with type 2 diabetes require diabetes self-management education and support (DSMES) – a continuous process that provides them with the knowledge, skills, and support they need in order to initiate and maintain self-care behaviors on an ongoing basis.²³ The need for long-term support for these patients, together with the limited resources in the health-care system, necessitates research on efficient, low-cost interventions.^{23,49,50} One such intervention, peer support, allows individuals with chronic health conditions to interact with others who have experience with the same condition.⁹² Through these interventions, participants receive social and behavioral support while learning to cope with the demands of disease management.⁹³ In addition to being cost-effective, such interventions have shown promise in improving diabetes self-management not only in patients with type 2 diabetes^{24,29,32,36,55} but also in peer leaders with the disorder (who may improve their diabetes management through interactions with their participants).^{30,94} When two individuals are paired via a peer support intervention, they are likely to engage in social comparison – defined as "the process of thinking about information about one or more other people in relation to the self."⁹² The target

of comparison – in this case, the participant or peer leader – is either perceived as superior to self (upward comparison) or inferior to self (downward comparison).⁹³ For peer leaders, social comparison is more likely to be downward.⁹³ This type of comparison may occasionally cause individuals to experience negative emotions, as it reveals that their situation could be worse. However, it more often prompts self-evaluation and self-enhancement,⁴⁵ which can lead to health benefits for the individual.

The scientific literature to date has mostly investigated the health care professionals' and participants' experiences during the peer support intervention and has devoted much less attention to the peer leaders' experiences. To our knowledge, there is only one diabetes study that qualitatively investigates the peer leaders' experiences/opinions during the intervention period. Accordingly, the first objective of this study is to use face-to-face interviews to collect and examine the peer leaders' thoughts about the different components of the intervention, the characteristics of an effective peer leader, and their experiences during the support-delivery period. A second objective is to investigate how social comparison in a telephone-based peer support intervention affects the peer leaders' diabetes self-management in a tertiary care setting.

RESEARCH DESIGN AND METHODS

This qualitative study follows a larger randomized controlled trial study evaluating the effects of a 12-month peer-led diabetes self-management support intervention on diabetes-related health outcomes. The detailed description of the study is published elsewhere.⁷⁶ A brief summary is written below. To inform the present research question, we utilized an explanatory sequential model using a qualitative descriptive approach.⁹⁵⁻⁹⁹

Peer Leader Recruitment and Training

In total, 52 peer leaders were recruited from May 2015 to June 2017. Eligible candidates were required to have diabetes, be \geq 21 years of age, speak English, have access to transportation to attend training sessions, be amenable to committing to a 30-hour training program, possess a land-line or mobile phone, and have a self-reported A1C \leq 8% (A1C is an indicator of glycemic control over the past 3 months. The normal A1C range for healthy individuals is below 6%; A1C \leq 7% is considered optimal glycemic control for patients with diabetes.).

Interested individuals were consented and subsequently attended a 30hour training (consisting of 6 sessions of 5 hours each) adapted from Tang et al.'s original 46-hour PLEASED (Peer-led, Empowerment-based, Approach to Selfmanagement efforts in Diabetes) peer leader training program.^{67,100} The training was designed to cover the knowledge and skills that peer leaders would need to help their participants make diabetes-related lifestyle changes. The three key components of peer support addressed during the trainings were as follows: (1) assistance in daily self-management, (2) social and emotional support, and (3) linkage to clinical care. Some of the strategies that PLs were trained to use in order to motivate their patients for lifestyle modifications were: (1) active listening, (2) empowerment-based facilitation strategies, (3) reflective listening, (4) goal setting, (5) action plans, and (6) problem solving.

Intervention

Upon completing the training program, the peer leaders who were willing to be paired were matched with participants based on schedule availability, gender, and geographic proximity. They were then invited to a face-to-face session to get acquainted with their participant. Peer leaders contacted their participants weekly by phone in the first 3 months, then biweekly by phone for the last 9 months.

Semi-Structured Interviews

After the 12-month study, peer leaders were divided into four categories

based on the changes in their own and their participants' A1C over the course of the study: group 1 ($\downarrow\downarrow$), in which mean peer leaders' and participants' A1C both improved; group 2 ($\uparrow\uparrow$), in which mean peer leaders' and participants' A1C both worsened; group 3 ($\downarrow\uparrow$), in which mean peer leaders' A1C improved while participants' A1C worsened; and group 4 ($\uparrow\downarrow$), in which mean peer leaders' A1C worsened while participants' A1C improved. (Note that arrows reflect A1C levels, so a down arrow represents an improvement.) Out of 52 peer leaders, a purposive sample of 17 – three to five from each category – were recruited and invited to attend a semi-structured interview conducted by two interviewers.¹⁰¹⁻ ¹⁰³ At the beginning of the interviews, peer leaders were asked to fill out a short survey. The interviewers (BM, AA) then asked the peer leaders questions from the interview question guide. They began with open-ended questions designed to explore the peer leaders' perceptions of the purpose of the study and the different phases and components of the intervention. As needed, the interviewers followed up with probing questions in order to further clarify the peer leaders' responses or to ensure that the peer leaders understood the original questions. Interviews lasted approximately 20 to 45 minutes. We continued to interview until saturation was achieved in every group except group 3, where the

number of peer leaders was limited.¹⁰⁴

Analysis Process

The recordings were transcribed verbatim. Transcripts were qualitychecked for accuracy and analyzed using NVivo 12 Software. Qualitative descriptive analysis was used to assess the semi-structured interview data.⁹⁵ All the guality-checked transcripts were uploaded to the NVivo 12 software. The categories were predefined and identified based on the findings of the quantitative phase. These predefined categories were created in the software. Two authors (RA and ASA) reviewed the transcripts line by line to code the data and identify statements for each predetermined category; dragged and dropped the appropriate texts to the relevant folder; looked for emerging themes; and created the nodes (themes) in the NVivo software. The similar responses in each node were counted and then grouped together to find a description of the pattern. Upon completion, the results were merged, and the differences were sorted by consensus. Ultimately, a detailed description of the peer leaders' experiences was generated and compared across the four groups.

Data Trustworthiness

In order to endorse the credibility, transferability, and dependability of the

data, we used triangulation of data methods and triangulation of investigators.¹⁰⁵ We reviewed the field notes and treatment fidelity forms that were completed by peer leaders during the quantitative phase. We also asked different team members to interview and analyze the data, and took their various perspectives into consideration.

Ethical Considerations

This study is approved by the University of British Columbia Clinical Research Ethics Board. Informed consent was obtained from peer leaders, who were provided a small honorarium for their participation. To respect peer leaders' confidentiality, numbers or pseudonyms were used to refer to peer leaders throughout the article.

FINDINGS

Description of the Sample

The mean age of interviewed peer leaders was 61.3 years (range=48 to 79; SD=8.9). The mean number of years lived with diabetes was 15.3 (range=2 to 59; SD=13.7), and the mean A1C level was 7.0 (range=5.8 to 8.8; SD=0.9). Of the 17 interviewed peer leaders, 58.8% (n=10) were male and 41.2% (n=7) were female. Peer leaders were largely Caucasian (58.8%; n=10); employed (41.2%; n=7), and
married or partnered (47.1%; n=8). All were highly educated. Although most peer leaders had 1 (35%) or 2 (35%) participant(s), the number of assigned participants differed significantly from one peer leader to another (from 1 to 13). Please refer to Table 13 and Table 14 for details.

 Table 13: Interviewed Peer Leaders' Characteristics at Baseline (N=17)

Age (years), mean ± SD	61.3±8.9
Male/Female, n (%)	10/7 (58.8%/41.2%)
DM 1/DM 2, n (%)	1/16 (5.9%/94.1%)
Diabetes duration (years), mean ± SD	15.3±13.7
Marital status, n (%) Never married Married or partnered Separated/divorced/widowed	3(17.6%) 8(47.1%) 6(35.3%)
Ethnicity, n (%) Caucasian East Asian South Asian	10(58.8%) 3(17.6%) 4(23.5%)
Education, n (%) University/college graduate	17(100%)
Household income (n=15) < \$20,000 \$20,000 to \$49,999 \$50,000 to \$69,999 > \$70,000	1(5.9%) 4(23.6%) 3(17.7%) 7(41.2%)
Employment status, n (%) Employed Retired Other A1C mean + SD	7(41.2%) 6 (35.3%) 4 (23.5%) 7 0±0 9

Table 14: Peer Leaders' and Participants' A1C changes from baseline to 12 months

Group 1 (↓↓)				
PL ID	PL's A1C (Baseline)	PL's A1C (12 months)	Participant's A1C (Baseline)	Participant's A1C (12 months)
PL No. 1	8.4	6.8	12.6	6.4
PL No. 2	8.5	7	10.3	9
PL No. 3	6.9	6.4	7.4	7.2
PL No. 4	6.5	5.3	7.8	5.4
PL No. 5	6.2	5.6	8.4	7.7
Group 2 (↑↓)				
PL ID	PL's A1C (Baseline)	PL's A1C (12 months)	Participant's A1C (Baseline)	Participant's A1C (12 months)
PL No. 6	6.9	7.3	7	6.9
PL No. 7	7.8	11.8	8.1	7.5
PL No. 8	6.9	7.4	8.2	7.7
PL No. 9	5.9	6.1	10.3	8.4
PL No. 10	7.2	7.8	7.7	7.3
Group 3 (↓↑)				
PL ID	PL's A1C (Baseline)	PL's A1C (12 months)	Participant's A1C (Baseline)	Participant's A1C (12 months)
PL No. 11	7.2	6.4	9.6	11.6
PL No. 12	8.8	8.7	9.5	9.7
PL No. 13	7.3	5.9	6	6.8
Group 4 (↑↑)				
PL ID	PL's A1C (Baseline)	PL's A1C (12 months)	Participant's A1C (Baseline)	Participant's A1C (12 months)
PL No. 14	5.8	6.1	6.3	9.1
PL No. 15	6.8	7.8	6.4	6.9
PL No. 16	6.4	6.9	5.8	6.4
PL No. 17	6.1	6.2	3.9	6.7

Peer Leader Training Program

In this section, we asked for the peer leaders' opinions on different elements of the training program, including the diabetes knowledge sessions presented by health care professionals, the communication and motivational inquiry skills training, and the group exercises.

I would not have known what to do and what to not to do if I had not
done the training: All peer leaders agreed that the training program was relevant
to their responsibilities during the study, the components of the training were
beneficial and practical, and that the research team achieved the primary training
goal, which was to equip peer leaders with specific sets of skills (e.g.,
communication, facilitation, motivational inquiry) that were vital to the
intervention. The educational sessions conducted by invited speakers – a certified
diabetes educator, a dietitian, an endocrinologist, a fitness educator, and a
psychologist – helped give the peer leaders the skills and confidence they needed
to encourage participants to make lifestyle modifications and improve their
diabetes control. Their overall impression was that the training program was
comprehensive, well-organized, and instructive.

Peer Leader Training Sessions – Quotes		
Peer Leader No. 4	<i>"I would have not known what to do and what not to do If I had not done the training."</i>	
Peer Leader No. 11	<i>"It was [a] really well-organized very comprehensive program. It was very educational and very practical also. We did a lot of activities [including a] very rich book they gave us about diabetes."</i>	

Peer Leaders-Participant Contact

In this section, we asked the peer leaders for their thoughts about using the telephone as the main modality of contact and about the frequency of contact

with their participants (one initial introductory face-to-face session, 12 weekly phone calls for the first three months, and 18 biweekly phone calls for the rest of the year).

Modality of Contact

Face-to-face contact is better, but the chances of failure are higher: The

peer leaders concurred that face-to-face was the ideal modality of contact, but

noted that barriers such as weather, physical presence, and geographical distance

sometimes made such meetings impractical. They generally agreed that a

combination of face-to-face and telephone contacts would be best.

Modality of Contact – Quotes	
Peer Leader No. 7	<i>"Face-to-face [contact] is better, but the chances of failure [are] higher. A combination is acceptable, with more frequent face-to-face sessions."</i>
Peer Leader No. 17	"Combination of telephone and face-to-face is fine. It's essential to meet the person at the start, and then it depends on both parties' lives."

Only one peer leader preferred telephone over other modalities of contact; another PL preferred meeting face-to-face.

Frequency of Contact

Should the frequency of contact be defined based on individuals' unique

needs? The majority of peer leaders were satisfied with the frequency of contact.

A few peer leaders suggested less frequent contacts due to the 12-month

duration of study, but others thought weekly contacts might be more effective

because biweekly contacts are infrequent enough for participants to go "off

track."

Frequency of Conta	ct – Quotes
Peer Leader No. 5	"I think it's important that we met initially. In a way, it might have been good to meet throughout [the study] once or twice. I think initially [for the first few months] once a week, and then the two-week intervals are good."
Peer Leader No. 10	<i>"I thought that it was actually fine the way it was, with a minimum of biweekly contacts."</i>

A few peer leaders underscored the importance of being flexible in the

frequency of contacts and tailoring the frequency to participants' needs.

Frequency of Contact – Quotes		
Peer Leader No. 2	"I was in contact with her as many [times] as it took."	

Peer Leaders

Peer Leaders Motivation to Participate

The goal of this section was to look into peer leaders' motivations for

participating in the program, and to determine whether different motives among

the four groups might have affected the clinical outcomes for peer leaders and

their participants.

Does personal motivation triumph over altruism? When peer leaders

discussed their reasons for attending the program, three themes emerged: (1)

personal gains; (2) altruism; and (3) referrals.

Some peer leaders joined the program for personal reasons: to compare their diabetes control to that of other peer leaders and participants, and to push themselves to invest more effort in their diabetes self-management in order to keep up with family members and friends with type 2 diabetes. They took part in the program because they hoped to learn more about self-care and diabetes management while helping their participants.

Some entered the program with altruistic intentions of giving back to the

community and using their communication skills and positive personality

characteristics to help others.

And some participated mostly because they were referred by physicians or diabetes educators who thought they had exceptional skills and knowledge to share with others with type 2 diabetes.

Motivation for Pa	rticipation – Quotes
Peer Leader No. 2	<i>"I wanted to give something back to the country that was good to me. I got something out of it I can be quite selfish."</i>
Peer Leader No. 4	"My mother, she was a blood sugar patient for 30 years and she's not on the insulin. Maybe that was my motivation, that 'Hey, she has done that and why shouldn't I?' [I] can live healthy as long as I control sugar."
Peer Leader No. 5	<i>"I attended the program because I knew I had to learn more about myself. I thought I had a lot of good skills to offer It is not all altruistic."</i>
Peer Leader No. 8	<i>"I found [out] about it from my doctor and he said I might be a good candidate for this."</i>

Peer Leader Experiences

In this section, we explored the peer leaders' experiences during the intervention, including challenges they overcame and benefits they gained.

Peer leaders were pleased overall with the study and their participants. In describing their experience, peer leaders often highlighted three factors: (1) their participants' motivation to change; (2) the quality of relationship(s) with their participant(s); and (3) the impact of the study on their own diabetes control.

Two-way street and an interactive relationship: They described their relationships with participants as reciprocal, interactive, and collaborative, with ample sharing of ideas and diabetes knowledge, and mainly believed that their gains exceeded their expectations. They learned from the interactions, including the participants' personal accounts and struggles. *"I really really learned a lot, not just academically, but … from my peers,"* said one peer leader.

Did we get along like a house on fire? Peer leaders' experiences depended partly on how motivated their participants were to change. Some were satisfied with their participants and their progress over the course of study; others felt challenged by their participants' lack of motivation to change or even set up meetings. A number of peer leaders realized that the experience benefited their

diabetes control awareness; a few felt that their accomplishments were limited to psychosocial and not clinical outcomes.

How may I stop getting into a rut being a diabetic? Peer leaders described three main benefits of the study: (1) as an eye-opener to the consequences of poorly controlled diabetes and the benefits of diabetes self-management improvement; (2) as a means to enhance their diabetes knowledge; and (3) as an avenue to psychosocial benefits.

The majority of peer leaders noticed that their participation served as a warning about shortcomings in their diabetes self-management and as a reminder of the repercussions of uncontrolled diabetes. One remarked that he had been able to *"clean up [his] own life in the process of [helping] somebody else."* Peer leaders noted that their diabetes self-management improvement transpired at different stages of the study: (1) in the course of peer leader training program; (2) after the training and prior to the start of the intervention, as they prepared to coach their participants; and (3) during the intervention period, through the exchange of information and ideas with participants.

Peer leaders' knowledge of diabetes increased significantly over the course of the study. "I learned a lot more about diabetes than [from] having been a

diabetic for more than 17 years," one recalled. Some perceived their learning as

mainly an accumulative process that occurred during the training sessions and in

their interactions with their participants.

They described the psychosocial benefits as "reinforcement," "psychosocial

satisfaction through helping others," and "reducing the feeling of isolation by

resonating with someone who suffers from the same health condition and

struggles with the same challenges."

Peer Leader Experiences – Quotes	
Peer Leader No. 5	<i>"I really enjoyed it. I found it was a really collaborative kind of thing. I looked at it as a two-way street and an interactive relationship."</i>
Peer Leader No. 9	<i>"it was more an eye opener, as they opened up and talked about their personal challenges."</i>
Peer Leader No. 13	<i>"It varied. Four of them were really easy to get a hold of … Three guys, they were all highly motivated … and I found I got as much from them as I gave them – I thought that was reciprocal."</i>
Peer Leader No. 17	<i>"In one way, it was very positive, because we got along like a house on fire In another way, I'm not sure how much I actually helped her. I know I made somewhat of a difference, but I don't know if I made a difference in the A1C. But in life – yes."</i>

Peer Leader Experiences – Quotes		
Peer Leader No. 5	<i>"I learned a lot more about diabetes [from this program] than [from] having been diabetic for more than 17 years Being a peer counselor made me want to be a really good example, in other words, walk the walk I felt it was a responsibility that I owed both of us."</i>	
Peer Leader No. 6	"For me, we exchanged information and ideas on how to manage So, I feel that it helps both ways – as a peer leader and participant. It's uplifting when you can help people and they thank you and they say, 'Wow, it's working for me.'"	
Peer Leader No. 9	<i>"I really learned a lot through studying all the resources, especially the personal accounts from the participants, their struggles and everything."</i>	
Peer Leader No. 10	"Honestly, I know nobody with diabetes except me, right, so it's kind of nice to know there's other people out there and you can help [them] and	

kind of understand what's going on with you."		
Peer Leader Experiences – Quotes		
Peer Leader No. 9	"It's like warning bells for me, like [if] you don't do this, you're going to be	

Leader No. 9	"It's like warning bells for me, like [if] you don't do this, you're going to be having this problem."
	"Well, I became more aware that I was in a rut and that perhaps it would be a good idea to get out of that rut – and I did fairly well. And I am more aware of what we eat."

Peer Leader Experiences – Quotes

Peer Leader No. 1	"I am conscious of what I'm putting in my body I exercise at home and
	[am] aware of my body more."
Peer leader No. 2	"I cleaned up my own life in the process of helping somebody else. 'Wow, I actually received more than I gave.' I made the changes that I was trying to place on the other person, and I realized, before I'm able to teach someone or motivate somebody, I gotta be sure and certain of myself, and perfect my behavior, and participate in the program."

Peer Leader Experiences – Quotes

Peer Leader No. 6	"It gave me more empathy Overall, [it] improved [my] health and gave
	[me] satisfaction that [I] can do something for others."
Peer Leader No. 12	<i>"I'm not sure it has affected me a great deal. But I do see the study as positive, because I also thought a lot more about my own diet and I have upped my own exercise."</i>

Peer Leader Experiences – Quotes	
Peer Leader No. 17	<i>"Just giving me an interest outside myself and outside my house</i> <i>Especially with retirees, that's really important, having avenues outside your own house."</i>

I don't know if I made a difference in the A1C; but in life – yes!

Because the peer leaders had different motivations for attending the

program, they also had distinct perceptions about what constituted a successful

change for them and their participants. A number of peer leaders considered

improvement in their own and their participants' A1C as a success; a few said

helping others was rewarding and made them feel uplifted; some felt they had made a difference in a participant's life by being present, whether or not a diabetes-related outcome was achieved. Only a few peer leaders seemed to have intuited the purpose behind the study – to evaluate the impact of providing support on their and their participants' primary diabetes-related clinical and psychosocial outcomes – but all felt that they somehow benefited by participating.

Every participant brought her or his own unique culture, background, school of thought, and understanding of the study objectives to the study, and this contributed to the strength of the group.

Challenges

Discipline is the hardest part: Peer leaders discussed challenges that arose for them at (1) the personal level; (2) their participants' level; and (3) the study level. On the personal level, some peer leaders struggled with the discipline required to contact their participants regularly over the 12-month course of the study. At the participants' level, peer leaders struggled to involve and motivate their participants to make changes. At the study level, peer leaders were unable to master all of the aspects of diabetes self-management that were taught during the peer leader training program.

Challenges – Quotes	
Peer Leader No. 5	"The challenges were the length of time. I felt a year was too long. Toward the end [because we had developed a friendship] there were times when I could have done better than I did. I could have done one or two follow-ups that I didn't do."
Peer Leader No. 9	"Trying to connect with her was difficult."
Peer Leader No. 14	<i>"I had a couple of challenges with a couple [I] couldn't really get them motivated to change [They] weren't interested really in changing the routine."</i>
Peer Leader No. 15	<i>"It was almost as if his mind was already made up, and I would say he dropped out of the program because it really was not going to do anything for him, as far as he was concerned."</i>

Effective Peer Leaders

In this section, we explored the peer leaders' perspectives on the outcome

measures that are used to gauge peer leaders' effectiveness and on factors that

make for effective peer leaders (including personality characteristics).

Outcome Measures

The peer leaders defined effectiveness based on two benchmarks: 1)

participants' A1C improvement, and 2) participants' diabetes knowledge

enhancement.

A1C improvement as the main benchmark: The peer leaders believed that

improvement in participants' A1C level is one of the most – if not the most – important outcome measure for peer leader effectiveness because A1C is the main index of glycemic control. Some peer leaders also considered "diabetes knowledge" to be an important outcome measure, since knowledge building is

part of the reciprocal relationship between peer leader and participant.

Outcome Measures for Evaluation of Effective Peer leaders – Quotes	
Peer Leader No. 10	"In terms of any other improvement or sort of benchmarking we have to have a goal and the A1C, unfortunately, we all live with it, so that's the primary number you have some relationship with, and then
	everything else after that."

Characteristics

It definitely takes more than some certain personality characteristics to become an effective peer leader: The peer leaders perceived effective peer leaders as individuals who possess certain personality characteristics and interpersonal skills. The personality characteristics included empathy, patience, assertiveness, open-mindedness, and compassion. Translated to the Big Five – a theory that identifies five distinct traits (openness, conscientiousness, extraversion, agreeableness, neuroticism) – the characteristics and skills valued by peer leaders mostly fall under extraversion, conscientiousness, and openness. The peer leaders stressed that effective peer leaders should also be nonjudgmental, motivational, and positive; display a sense of humor; make themselves available for their participants; possess strong interpersonal, communication, listening, organizational, and time management skills; and have a strong command of English (preferably native English speakers).

Characteristics of Effective Peer Leaders – Quotes

Peer Leader No. 8 "I don't think on a one-on-one interaction, extraversion matters very much."

Social Comparison as a Mechanism of Change

In this section, we looked into peer leaders' motivation to make behavioral changes and explored the role of social comparison in those changes. In the theory of social comparison, patients with chronic conditions actively compare their chronic disease management and control with others with the same condition. When comparing themselves with participants whose control is superior (upward social comparison), the peer leaders may feel motivated to do more to reach a similarly high level of control; when comparing themselves to participants whose control is inferior (downward social comparison), the peer leaders may feel motivated to do more to reach a similarly high level of control; when comparing themselves to participants whose control is inferior (downward social comparison), the peer leaders may feel encouraged to make positive changes to prevent their disease from advancing to the level of their participants, <u>or</u> the peer leaders could become discouraged and allow their control to worsen.

Downward and upward social comparisons are forms of external motivation.¹⁰⁰ Participants could also change as a result of internal motivation. Internal motivation is based on behaving well for its own sake.¹⁰⁶ A number of peer leaders utilized both subtypes of external motivation (upward and downward social comparisons). They sought to improve their diabetes control in order to match that of family members or friends (upward social comparison), then worked to ensure that their diabetes control stayed superior to that of participants who had suffered diabetes complications (downward social comparison). Some peer leaders maintained or improved their glycemic control as they prepared to coach their participants, so that they could demonstrate superior diabetes control (downward social comparison). There was only one peer leader who perceived his glycemic control as inferior to his participant's (upward social comparison).

A few peer leaders credited internal motivations (e.g., two-way exchanges of information; the desire to be healthy in general) for their changes in their diabetes self-management.

Social Comparison o	Social Comparison as a Mechanism of Change	
Peer Leader No. 1	<i>"[I] helped [my] participant to manage her diabetes." [downward social comparison]</i>	
Peer Leader No. 5	"I tried not to compare them to each other as they're individuals, nor did I compare myself to them. I had a stake in their positive growth [and] they had a stake in mine. I learned as much from them as they did from me." [internal motivation]	
Peer Leader No. 12	"Positive changes were related to [my] personal desire to be healthy and well and [my] recent success in paramedic exams." [internal motivation]	
Peer Leader No. 14	"The only difference I feel is I may have more knowledge, but we encourage each other and motivate each other to do better." [downward social comparison]	

 Peer Leader No. 16
 "[I] kept myself as controlled by diet and exercise. [My] participant is still a regular [follower], but [has] better-controlled sugar levels." [upward social comparison]

Peer Leaders Opinion on Future Direction of Intervention

Peer Leader-Participant Pairing Guidelines

We asked our peer leaders what factors (besides availability, gender

preference, and geographic proximity) researchers should consider when pairing

peer leaders with participants in order to make peer support interventions

successful.

Some sort of approximation in life is essential for pairing: The peer leaders

suggested three factors: (1) similarities in personal characteristics such as age,

gender, background (e.g., social, job, family status, etc.), expectations, and

personality; (2) diabetes-related commonalities such as stage of disease and the

extent of diabetes knowledge; and (3) similar life circumstances.

Peer Leader-Participant Pairing Guidelines – Quotes	
Peer Leader No. 2	<i>"The research team have to know the peer leaders fairly well to pair them with participants. Similar personalities having some sort of approximation of levels in their life."</i>
Peer Leader No. 5	"Matching [peer leaders] and peers who are both on insulin would be good."
Peer Leader No. 9	<i>"I guess if people are more similar, in outlook in life, it might work better."</i>
Peer Leader No. 10	<i>"I would say that a little bit more emphasis on managing the expectations of both sides [is needed], so they're a little bit more clear on what the expectations are."</i>
Peer Leader No. 14	"You guys need to learn or get to know the peer leaders as well. Get to

know our traits, so that when you're interviewing your participants, you know us, so then you get to know who to pair."

Research Team Support Contact

In this section, we explored the peer leaders' point of view on the support

they received from the research team and their expectations of the research

team.

I needed more support... A number of peer leaders needed more support

from the research team over the year of study. The peer leaders believed that

regular face-to-face meetings should have been scheduled with the research

team, so that peer leaders could more directly discuss their challenges and seek

advice.

Research Team Support Contact – Quotes		
Peer Leader No. 13	"I thought everyone did their job well, but the structure [of research team contact] could have been better [with] peer leaders and one of you folks here just to discuss things, or to get once a month for that. I prefer face-to- face, obviously."	
Peer Leader No. 17	"Probably a bit more contact from the group to see where you are at."	

They also asked for a single point of contact who would be available

throughout the study to answer questions or address difficulties.

Research Team Support Contact – Quotes	
Peer Leader No. 1	"I felt there was enough support But I wouldn't know who to talk to.
	Every time I come in, [it's] 'But who are you?' It's always someone else
	that's calling me."

Dropouts

In this section, we asked our peer leaders for their opinions on what the research team could have done to lessen the peer leader and participant drop-out rate.

To decrease peer leader dropout rate, the peer leaders suggested 1)

recruiting suitable candidates through robust screenings; 2) establishing a better

matching system to find appropriate pairs; 3) withholding payments until the end

of the study; 4) inviting effective peer leaders to mentor newly graduated

individuals; 5) providing peer leaders with more support; and 6) conducting

sessions where peer leaders can meet and share their challenges and suggestions.

Peer Leader Dropouts – Quotes	
Peer Leader No. 9	<i>"I guess maybe … if you've had people that were successful and you keep them on … then when you bring on new ones, you have them interact with them, maybe that will help."</i>
	"I guess peer leaders could be brought together Then people could tell about problems they've encountered and how they were able to solve it or if we could learn from some successful peer leader who [is] doing so well and could talk about it and give us tips or whatever."
Peer Leader No. 17	"Get peer leaders together at three months to share their experience Hand out some advice and suggestions to peer leaders."

To decrease the participant dropout rate, peer leaders suggested 1) implementing robust screenings before participants' recruitment and pairing; 2) recruiting participants with flexible schedules and availability; 3) limiting the number of participants to no more than five per peer leader; 4) adding more face-

to-face meetings between telephone contacts; 5) having the study organizers

follow up regularly with both participants and peer leaders; 6) showing

appreciation for participants' time and effort through non-monetary rewards; and

7) introducing newly enrolled participants to previous participants who benefited

from the program.

Participant Dropouts – Quotes	
Peer Leader No. 6	<i>"I would say that they would only get \$30. But I think it would be good to reward participants not by money."</i>
Peer Leader No. 9	"The same thing with patients, when you have new patients come in, and you have patients that are in the program already, and they're successful or doing better, and you have them interact with those patients."
Peer Leader No. 16	"I think definitely, maybe look towards someone that has more comparable personality traits or someone that can get along Some people do have issues with being matched with a male or a female or maybe there's some racial issues too maybe this person's a bit of a bighead or maybe [it's] the age thing."

Program Improvement

We ended the interviews by asking peer leaders for their recommendations

on how to improve similar studies in the future.

The peer leaders recommended increasing the frequency of training

sessions but decreasing their duration; shortening the diabetes knowledge

component and making it suitable to everyone's learning ability; and integrating

technology into the program (e.g., having an online library). They suggested that

the training be held in larger groups consisting of candidates with similar backgrounds, so that the candidates can benefit more from class discussions. Peer leaders would have also appreciated feedback from health-care professionals during the training; refresher training; and sessions where frequently asked questions could be addressed.

Program Improvement – Quotes	
Peer Leader No. 1	<i>"If you can get peer leaders [who are] all pretty [much the] same they can form a team of their own in a sense that they are [able] to relate to one another."</i>
Peer Leader No. 7	<i>"Information [provided in PL training] is so much Some people might not be able to grasp it."</i>

Moreover, they recommended including more frequent face-to-face sessions between the telephone calls and using additional modalities of contact, such as Skype and FaceTime.

Program Improvement – Quotes					
Peer Leader No. 2	"Let's stick to Skype It worked perfectly."				

While one peer leader suggested reducing the length of the study to seven

or eight months, another believed that one year might not be long enough to help

the more challenging participants improve their diabetes management. Another

peer leader wanted the research team to balance the number of participants

among peer leaders.

Program Improvement – Quotes				
Peer Leader No. 5	<i>"I would make [the study] shorter. The seven months would be ideal. I think [the PL training] would've been better in a larger group, to get more interaction and more feedback and more suggestions."</i>			
Peer Leader No. 10	<i>"I think a year in some ways is too short because [the participants] are coming from different backgrounds [and] have their own challenges So, it may just take longer for them to realize and see more positive control."</i>			

Four Group Comparisons

What distinguishes the four groups from one another is the peer leaders' motivations for joining the study. Individuals who intended to enhance their diabetes knowledge and gauge their control against others generally improved their control by the end of the intervention period (internal motivation). Those whose glycemic control deteriorated over the course of the study were mainly motivated by referrals by physicians or diabetes educators (external motivation). Improvements in A1C were also seen in the peer leaders whose glycemic control was satisfactory ($\leq 8\%$) but not optimal ($\leq 7\%$) at the beginning of the intervention. In contrast, peer leaders who started the program with on-target A1C were unable to improve their glycemic control.

The peer leaders in group 1 ($\downarrow \downarrow$) seemed more cognizant of the repercussions of poor glycemic control. They reinforced their words with behaviors and were deemed the most adept at translating their knowledge to tangible improvement in self-care behaviors. This, in turn, allowed them to act as role models for their participants. In other groups, peer leaders mostly talked about improving diabetes-related knowledge, implementing self-care behaviors, and achieving psychosocial benefits through their interactions with participants.

Peer leaders in groups 1 ($\downarrow \downarrow$) and 4 ($\uparrow \downarrow$) indicated that their participants were better able to fulfill their goals. This aligns with the results of quantitative analyses showing that the participants of peer leaders in these groups indeed improved their A1C, while the participants of peer leaders in groups 2 ($\uparrow \uparrow$) and 3 ($\downarrow \uparrow$) did not.

More of the peer leaders in group 4 ($\uparrow\downarrow$) said their participants were resistant to change. Surprisingly, the group 4 participants improved their glycemic control the most during the study period. Also, the group 4 PLs ($\uparrow\downarrow$) requested significantly more support from the research team than the other groups did. A possible explanation for this is that the peer leaders in this group, having become aware of their increasing A1C levels during the course of the study, realized that they themselves needed more support in order to improve or sustain their glycemic control.

In group 3, one of the peer leaders had type 1 diabetes. As a result, this group was expected to have a longer mean diabetes duration than other groups.

Table 15: Four Group Comparisons

PL Groups	Motivation	Experience (Positive vs. Challenges)	Impact on PLs' Diabetes Control	Mechanism of Change	Sociodemographic Characteristics
Group 1 (↓↓)	Gauging their diabetes control	Positive: Improving their diabetes care Challenges: Participants' level (contact and reluctance to change) and study levels	Eye-opener to the consequences of poorly controlled diabetes; backing up their words with actions to translate their knowledge to tangible improvements	<i>Downward social</i> <i>comparison*</i> ; Internal motivation	Mean age: 66 years old Male: 60% Married: 60% Mean Diabetes duration: 14 years Mean A1C: 7.3%
Group 2 (↑↑)	Referrals	Positive: Educational benefits Challenges: Participants' level (contacts)	Enhancing their diabetes knowledge; gaining psychosocial benefits	Downward social comparison*	Mean age: 57.2 years old Male: 25% Married: 50% Mean Diabetes duration: 14 years Mean A1C: 6.3%
Group 3 (↓↑)	Learning and sharing knowledge	Positive: Educational benefits Challenges: Participants' level (contact and reluctance to change)	Eye-opener to the consequences of poorly controlled diabetes; psychosocial benefits	<i>Downward social</i> <i>comparison*</i> ; Internal motivation	Mean age: 56.3 years old Male: 66.7% Married: 33.3% Mean Diabetes duration: 26.7 years Mean A1C: 7.7%
Group 4 (↑↓)	Varied	Positive: Educational and psychological benefits Challenges: Participants' level (reluctance to change)	Psychosocial benefits	Downward social comparison*; upward social comparison	Mean age: 62.8 years old Male: 80% Married: 40% Mean Diabetes duration: 11 years Mean A1C: 6.9%

*Dominant mechanism of change in the group.

DISCUSSION

The impacts of peer support interventions on participants with type 2

diabetes have been well investigated, but the effects of these interventions on

peer leaders' have not. Little is known about the peer leaders' clinical and

psychosocial outcomes, or about how these interventions encourage peer leaders to change their behaviors. The objective of this study is to explore a peer support intervention from the perspective of the peer leaders, to share the peer leaders' feedback on how to improve such interventions, and to evaluate the role of social comparison in diabetes self-management among peer leaders.

Peer leaders were generally satisfied with the intervention and reported positive experiences. They found their interactions with participants to be mutually beneficial and reciprocal, despite facing challenges in contacting and motivating their participants.

Peer leaders found that the program increased their awareness of their diabetes control and motivated them to make positive lifestyle modifications. The majority of peer leaders perceived their diabetes control as inferior to family members or friends with type 2 diabetes, and this initially motivated them to participate in the study. Most peer leaders perceived their control as superior to that of the participants they were assigned in the study. This perception, and their desire to motivate their participants, led them to make behavioral changes throughout the intervention.

To enhance the intervention, the peer leaders proposed a training program with more frequent but shorter sessions and less reading and composition. They suggested more frequent face-to-face sessions with participants and additional support from the research team during the intervention period.

Logistics of Study

Consistent with other studies, the peer leaders in our study were generally pleased with the training and training materials; they felt that both were well-suited to their responsibilities during the intervention.^{94,107} They suggested abridging the diabetes knowledge component; this would bring the training more in line with the Paul et al. study, where the training was brief, no final assessment was given, and the main emphasis was on *providing support* and not diabetes education.¹⁰⁷ The peer leaders in our study also recommended that more technology be integrated into the training program (e.g., PowerPoints, video clips, interactive online activities, online library), to accommodate personal preferences and differences in learning styles.

The peer leaders agreed that, given the barriers to face-to-face contacts, the telephone was satisfactory as the main modality of study; this is consistent with other studies where telephone-based communication is described as a

"personalized process" or "putting [on] more of a human face." ^{107,108} However, to enhance relationships with participants, peer leaders suggested that more frequent face-to-face sessions be scheduled (e.g., every 3 months).

Peer leaders also suggested that the research team provide future peer leaders with more structured support (e.g., meetings with the project coordinator every few months, or convening peer leaders occasionally to share their struggles). This suggestion is in line with the findings of another study, which offered peer leaders the opportunity to meet regularly with project coordinators. In that study, peer leaders gave positive feedback about their interactions with the research team.¹⁰⁷

In our study, peer leaders also highlighted the importance of using similarities in 1) personal characteristics, 2) stage of diabetes, and 3) life circumstances to effectively pair peer leaders and participants. This is in line with the Heisler et al. study, where peers were paired based on level of diabetes, self-care goals, and problems recognized in their survey responses.⁹⁴ The qualitative analyses of that study showed that poor matches might have resulted from lack of similarity in the peer leaders' and patients' challenges and availability.⁹⁴

Suggestions for increasing the peer leader/participant retention rate in our study included introducing newly enrolled peer leaders/participants to accomplished peer leaders/participants from the past, implementing robust screenings during recruiting, creating suitable pairs, replacing monetary with nonmonetary rewards, and providing structured support to peer leaders.^{107,109}

Peer Leaders

Baseline characteristics

Comparing the baseline characteristics across the four groups, we noticed that peer leaders in the first and third group – where peer leaders improved their glycemic control – had a higher mean A1C (>7% and <8%) at baseline that might have enhanced their motivations to join the study. Given their level of glycemic control at baseline, there might have been more room for improvement compared to the other two groups where their mean A1C at baseline was right on target (\leq 7%).

Motivation

The main motivations to become peer leaders were (1) *personal gains*; (2) *altruism*; and (3) *referrals*. Most of the peer leaders whose glycemic control improved joined the study for selfish reasons; the peer leaders whose glycemic control did not improve were motivated by referrals or sought to gain personal 120 benefits while helping others. This suggests that peer leaders who intend to make a difference in their own lives are more likely to improve their own glycemic control.

Experiences

The peer leaders' overall experience was overwhelmingly positive. They received psychosocial satisfaction and enhanced their diabetes self-management. Their greatest challenges were in contacting participants and motivating them to modify their lifestyles. This is consistent with another study in which some of the peer leaders were more motivated than their matches.⁹⁴

Most of the peer leaders in group 1 ($\downarrow\downarrow$) exchanged information with their participants and made lifestyle changes in order to better model diabetes selfmanagement behaviors. In other groups, most peer leaders exchanged information about strategies for behavioral changes but did not make such changes themselves. A similar peer-led telephone-based intervention in type 2 diabetes, which was designed to increase physical activity, resulted in participants becoming more receptive to the idea of physical activity but had a limited impact in terms of behavior change.¹¹⁰ The result of that study might be applicable to peer leaders as well as participants in similar peer support interventions. Impact

The peer leaders generally identified three effects that the study had on them: 1) enhancing diabetes knowledge; 2) appraising the benefits of optimal glycemic control; and 3) receiving psychosocial benefits from helping peers. They mainly agreed that their awareness of diabetes and its long-term complications significantly increased through their study participation,¹¹¹ and that this has encouraged them to focus more on their own health shortcomings. Some peer leaders modified their behaviors before asking their participants to do so. Others said that helping others during the study increased their feelings of satisfaction and decreased their feelings of isolation.

Like the peer leaders in the Goldman et al. (2013) and Paul et al. (2013) studies, the group 1 peer leaders found that the study empowered them to shift to a healthier lifestyle.^{107,112} Like the peer leaders in the Plotnikoff et al. study, peer leaders in groups 2–4 mostly benefited from the educational component.¹¹⁰ **Effective Peer Leaders**

Peer leaders believed that improvements in the participants' A1C, or diabetes-related knowledge should be used to measure peer leader effectiveness. Personality characteristics of effective peer leaders included extraversion, conscientiousness, and openness, based on the Big Five personality model. Some 122 peer leaders preferred to set boundaries with their participants; this was similar to the Goldman et al. study, where some peer coaches desired to set boundaries in their role as an advisor and supporter.¹¹²

Role of Social Comparison

Of the many factors that influence self-management and control, comparison with peers seems to be one of the strongest.¹¹³ Individuals may perceive their control as superior (downward social comparison) or inferior (upward social comparison). Those who are motivated via social comparison have been shown to have better diabetes self-management than individuals who are internally motivated.¹⁰⁰

In this study, peer leaders said that, to enhance their control, they were more likely to compare themselves with someone whose control is superior (upward social comparison). However, peer leadership did not afford them many such opportunities: consistent with other studies in chronic health conditions, the peer leaders mostly perceived their diabetes control as superior to that of their participants (downward social comparison).^{100,114} Our peer leaders said the study made them more aware of the repercussions of poor glycemic control; this resulted in behavioral changes by at least some of them.

Suggestions to Enhance Peer Leader Selection and Peer Leader-Participant Match

Based on the findings of the study, we designed a two-step peer leader selection and one-step peer leader-participant matching model to enhance future peer support interventions in type 2 diabetes.

The two-stage peer leader selection model includes a brief online screening survey (as indicated in Appendix G) that consists of the following: (1) the last A1C value in the previous 6 months; (2) MINI diabetes distress scale (Appendix E); and (3) select Mini-IPIP measures (Appendix G). Subsequent to the screening, eligible candidates will be invited to an in-person interview, during which their communication skills will be assessed using the Active Listening Observation Scale (ALOS-global – Appendix G). This should help ensure their suitability for the role.¹¹⁵

In order to establish appropriate peer leader-participant matches, peer leaders and participants will be asked to: (1) complete a survey, at the outset, that asks about sociodemographic characteristics, their diabetes stage and its complications, and any life experiences they would like to share with the other party; and (2) provide feedback on their match after the first few contacts, to evaluate whether the pairing is a good fit.

CONCLUSION

The current study enhances our knowledge of peer leaders' experiences in a peer-led intervention and the role of social comparison in peer leaders' diabetes self-management.

In the initial quantitative phase of this sequential explanatory study, we found that peer leaders maintained their main diabetes health-related outcomes over the study period. This was partly explained by our qualitative findings about the contributing factors that led to sustained positive outcomes. Peer leaders felt that their attendance enhanced their knowledge of diabetes and in some cases motivated them to implement lifestyle modifications.

Additionally, in the quantitative phase, effective peer leaders (i.e., leaders whose participants' A1C and DDS improved from baseline to 12 months) had a significantly lower baseline DD score (P=0.02) and a significantly higher extraversion score (P=0.03), compared to the ineffective group. The qualitative findings suggest that possessing certain personality characteristics is only one of many factors that contribute to peer leaders' effectiveness. Other determinants, such as interpersonal skills, are equally significant.

The findings of these studies underline the need for further mixed methods

studies with larger sample sizes.

Limitations and Strengths

This study is not without limitations. First, peer leaders were interviewed at different timepoints after completing the study. However, the interviews were able to reflect the perceived experiences of the peer leaders. Second, although peer leaders reported overwhelmingly positive experiences, it would have also been beneficial to interview the participants, to obtain a more comprehensive understanding of the study's impact. Third, one of our categories had only three peer leaders. Due to the small sample, we could not reach saturation in that group. Finally, we utilized purposeful sampling (based on peer leaders' A1C) to be able to compare the findings across the four groups of peer leaders. Although focus groups might have yielded richer data considering the objectives of study, we proceeded with semi-structured interviews to fully respect the study participants' confidentiality.

The strength of this study stems from the fact that, to our knowledge, it is one of the few studies to explore the peer leaders' experiences in delivering support and to examine the role of social comparison in peer leaders' diabetes self-management in a peer support diabetes intervention.

Chapter 6: Integrated Discussion

Effective diabetes self-management consists of diabetes self-management education (DSME) followed by ongoing diabetes self-management support (DSMS). Although DSME improves A1C at the immediate follow-up, the benefits start to diminish after six months. In the face of limited financial and human resources and escalating costs on an already strained health care system, peer support models of diabetes care have emerged as an effective, long-term, costefficient means of sharing experiential knowledge of diabetes self-management. The peer support models have been conducted in a variety of settings (community, primary, secondary, and tertiary care), using various frequencies and modalities of contact. A growing body of literature examines the impact of peer support on health-related outcomes for patients with diabetes. However, considerably less attention has been given to those providing the support—the "peer leaders." Little is known about their demographic characteristics, how they are recruited, the training they receive, or how their health outcomes change as a result of providing peer support. This lack of data poses challenges for researchers who are considering how to best recruit peer leaders, which models to implement in training them, and how to effectively deliver a diabetes peer support intervention.

In Chapter 2, I conducted a comprehensive literature search to define the components of peer support interventions in type 2 diabetes and to confirm the need for further examination of 1) peer leaders' characteristics; 2) the impact of peer support interventions on peer leaders; and 3) ways to enhance treatment fidelity in these interventions. To date, only five articles mentioned peer leaders' sociodemographic characteristics at baseline. The effect of interventions on peer leaders was largely overlooked: only one study evaluated the impact of peer support interventions on peer leaders' clinical and psychosocial outcomes. To address this gap in the literature, I applied a mixed methods research design and reported the results of this research in Chapters 3–5.

In Chapter 3, the impact of delivering support on peer leaders' clinical and psychosocial outcomes was assessed in a 12-month telephone-based peer support intervention recruiting adults with type 2 diabetes affiliated with a specialty-care setting. Seventy-five peer leaders, all English-speaking adults with type 1 or type 2 diabetes, were recruited and invited to participate in a 30-hour peer leader training program. Fifty-eight graduated from the training program,

and fifty-two were interested in continuing and being paired with participants. The peer leaders' first contact with each participant was face-to-face, followed by 12 weekly telephone contacts in the first 3 months and 18 biweekly telephone contacts in the remaining 9 months.

The impact of providing support on peer leaders' main diabetes-related clinical and psychosocial outcomes was evaluated by measuring A1C and DD at three timepoints (baseline, 3 months, and 12 months) over the 12-month course of the study. The results suggest that providing support might be as beneficial as receiving it. The peer leaders sustained their level of glycemic control throughout the study in spite of diabetes being a progressive disease in which A1C increases, on average, by approximately 0.2% per year.^{80,116} Their overall DD and other cardiovascular risk factors remained stable over the 12 months. Out of the four subcategories of DDS, the peer leaders did exhibit an increase – albeit an insignificant one – in physician-related distress. One possible explanation for this is that, in attending the training program and interacting with their participants, the peer leaders became more aware of shortcomings in the diabetes care they were receiving from health care professionals.

In Chapter 4, the sociodemographic and personality characteristics of
effective peer leaders – defined as those whose participants' A1C and DD sustained or improved from baseline to 12 months – were investigated, and suggestions for peer leader selection and pairing were proposed. The results demonstrated that the effective peer leaders had satisfactory glycemic control (mean A1C: 7.1%), while ineffective peer leaders had optimal glycemic control (mean A1C: 6.8%). The effective leaders also scored significantly lower on DD than the ineffective peer leaders did. A higher level of extraversion was detected in effective peer leaders and was positively associated with participants' A1C improvement. The findings of this study suggest that additional layers of screening are needed to determine prospective peer leaders' suitability for the role. These screenings may include evaluating candidates' personality traits via interviews, assessing of their level of diabetes distress, and considering their glycemic control prior to recruitment. To help ensure that peer leaders possess essential diabetes knowledge, a satisfactory level of glycemic control (A1C <8%) should be considered as an inclusion criterion. However, our findings suggest that optimal glycemic control (A1C <7%) is not necessarily an indicator of peer leaders' effectiveness.

In Chapter 5, a descriptive qualitative study was conducted to learn about

peer leaders' experiences during the support-delivery period, to uncover their perspectives on different components of the intervention, and to elicit their suggestions for improvement. Seventeen peer leaders were interviewed.

The interviewed peer leaders found the peer leader training program and its components beneficial, practical, and pertinent to their responsibilities, and endorsed a combination of face-to-face and telephone as the preferred modality of contact. Although the peer leaders felt that the frequency of contact was sufficient to address their participants' needs, they would have preferred more flexibility in the number and timing of the contacts. Overall, peer leaders described their experiences during the support delivery as positive, and their relationships with their participants as mutually beneficial and reciprocal. The majority of peer leaders believed that their attendance enhanced their diabetes control. They attributed their enhanced control to greater awareness of their diabetes management, feeling motivated to improve their control before coaching their participants, and striving for the level of control of their role models (family members/friends). Peer leaders acknowledged the importance of possessing a certain set of personality characteristics – extraversion, conscientiousness, and openness - in their role as "coaches." They defined their

effectiveness based on the improvements they helped make in their participants' A1C and diabetes knowledge.

The findings of the qualitative phase shed light on the results of the quantitative phase. In Chapter 3, the impact of providing support on peer leaders' main diabetes-related clinical and psychosocial outcomes was evaluated over 12 months. The qualitative findings in Chapter 5 uncovered multiple factors that may have contributed to the sustained outcomes. For example, the peer leaders' said their diabetes self-management was enhanced as a result of their attending the training program and coaching and exchanging information with their participants. Overall, the peer leaders perceived their relationship with participants as reinforcing better diabetes control in themselves.

In Chapter 4, we defined peer leaders' effectiveness based on their participants' A1C and DD scores from baseline to 12 months. The qualitative findings in Chapter 5 established change in participants' glycemic control as one of the most important measures of peer leaders' effectiveness, but not the only one.

In the same chapter, we compared the personality characteristics of effective and ineffective peer leaders, and noted that effective peer leaders

scored significantly higher on extraversion. The qualitative data further suggested that although certain personality traits could be used in peer leader selection to reinforce the quality of peer leader–participant relations, decrease the study drop-out rate, and enhance the participants' and peer leaders' clinical and psychosocial outcomes, these traits are not the only determinants to consider. The peer leaders concurred that other factors such as similar life circumstances also contribute to the peer leader–participant relationship.

Ultimately, the peer leaders' main suggestions for enhancing the program included the following: 1) given that the main role of peer leaders is to provide support to their participants, the diabetes knowledge component of the training session should be shortened; 2) the program should include more face-to-face contacts along with the telephone calls; 3) peer leaders should receive regular support calls from or meetings with the research team; 4) in order to pair peer leaders and participants successfully, personal, diabetes-related, and life circumstances similarities should be considered.

How to implement and translate this new knowledge into clinical practice?

In a health care system that has limited resources and faces increasing costs, PS interventions have emerged as an effective, long-term, cost-efficient

model of care for patients with diabetes.^{23,50,117} A growing body of literature documents the effects of PS on the clinical and psychosocial outcomes of recipients, but considerably less attention has been paid to those providing the support – the peer leaders. Little is known about their demographic characteristics, how they are recruited, or how their own health outcomes change as a result of providing peer support.^{30,43,55,59} This lack of information can present challenges to health care practitioners who are uncertain about how to best recruit and train PLs and how to effectively deliver a diabetes PS intervention. The results of this thesis will help health care practitioners design and enhance the delivery of PS models of diabetes care.

Most PS studies to this point have focused on potential PL candidates' personal history of diabetes and acceptable glycemic control as the eligibility criteria.^{31,34,37,41,43,56,118} Only a few studies have considered the use of communication skills and personality traits in peer leader selection.^{28,59,60,118} In the quantitative phase of this mixed methods study, we found a significant relationship between peer leaders' effectiveness and a certain personality trait (extraversion), and in the qualitative phase, we observed an emphasis, by peer

leaders, on the importance of interpersonal skills as another determinant that would enhance peer leader recruitment.

Although several studies have reported peer leaders' baseline characteristics (i.e., age, gender, duration of diabetes, marital status, and A1C), none has mentioned peer leaders' DD score.^{43,55,56,59} The findings of this thesis also suggest that there is a significant association between the diabetes distress score and peer leaders' effectiveness, and no significant association between A1C and peer leader's effectiveness.

Many studies have evaluated the effect of PS interventions on participants' diabetes-related main clinical and psychosocial outcomes, but only one study (before this one) has assessed the impact of delivering PS on peer leaders' outcomes.³⁰ In that study, PLs showed improvement in their self-care behaviors and sustainment in their glycemic control over 4 years.³⁰ The findings of the present study are consistent with this. They suggest that providing support had a stabilizing impact on peer leaders' glycemic control and diabetes distress over one year.

PS is an effective, cost-efficient model that can be implemented and integrated into our healthcare system in populations and areas where the need

for such interventions is greatest. Peer support is often deployed within high-risk, economically vulnerable, and marginalized communities. Our findings can assist health care providers as they design successful, evidence-backed interventions for vulnerable patient populations in underserved districts.

In conclusion, researchers and policy makers who are designing future peer support interventions may wish to consider the findings of this dissertation, which serve as the foundation for these suggestions: 1) peer leader selection criteria should be outlined clearly, and additional layers of screening should be considered, including interviews that assess candidates' suitability, communication skills, and personality traits; 2) the length and components of peer leader training programs should be tailored to the primary objective of the peer support intervention – DSME or DSMS; 3) frequency of contacts may be tailored to each participant's individual needs; 4) extra attention should be paid to the strategies for pairing peer leaders and participants, especially in one-onone peer support interventions; and 5) the impact of peer support interventions on peer leaders' clinical and psychosocial outcomes should be assessed further. Integration of these suggestions into future peer support programs may add to their effectiveness in chronic disease self-management.

To improve peer support intervention fidelity and participants' and peer leaders' retention rates, further research is needed on peer leader selection and pairing models. Further investigation is also warranted on the impact of various peer support interventions on peer leaders' clinical and psychosocial diabetesrelated health outcomes in diverse settings. Ideally, these studies would use a controlled trial design and have a larger sample size.

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Appendices

Appendix A: Chapter 2 – Peer Leaders' Questionnaire

SECTION A: DEMOGRAPHICS

Please answer every question by filling in the blank(s), circling the correct answer, or checking the correct box(s).

1.	What is your age? years old
2.	What is your gender?1 Male2 Female
3.	Which country, were you born in?
4.	If you were not born in Canada, how long have you lived in Canada?
5.	What year were you first told you had diabetes? (Please enter the year)
6.	How old were you when you were first told you had diabetes?
7.	What is your marital status?
	1 Never married
	2 Married
	□ ₃ Unmarried but living with partner
	4 Separated/Divorced
	5 Widowed

8. What is your ethnic origin? (check all that apply)

1 Aboriginal

2	Arabic
3	East Asian (Chinese, Korean, Japanese)
4	South Asian (Bangladesh, Pakistan, Indian)
5	Southeast Asian (Vietnamese, Cambodian)
6	White
7	Native Hawaiian or other Pacific Islanders
8	Other

9. What is your highest level of education?

1	Less than high school
2	High school graduate (or equivalent)
3	Some college or technical school
4	College graduate
5	Graduate degree(s)

10. What is your total pre-tax household income?



11. Which of the following best describes your current employment status? (check one box)

1	Full-time job
2	Part-time job
3	Unemployed or laid off
4	Homemaker
5	In school
6	Retired
7	Other

SECTION B: COPING WITH DIABETES

<u>During the last month</u>, how much of a problem has each of the following been for you?

		Not a Problem	Minor Problem	Moderate Problem	Somewhat Serious Problem	Serious Problem	Very Serious Problem
a.	Feeling that diabetes is taking up too much of my mental and physical energy every day.	1	2	3	4	5	6
b.	Feeling that my doctor doesn't know enough about diabetes and diabetes care.	1	2	3	4	5	6
С.	Feeling angry, scared, and/or depressed when I think about living with diabetes.	1	2	3	4	5	6
d.	Feeling that my doctor doesn't give me clear enough directions on how to manage my diabetes.	1	2	3	4	5	6
e.	Feeling that I am not testing my blood sugars frequently enough.	1	2	3	4	5	6
f.	Feeling that I am often failing with my diabetes regimen.	1	2	3	4	5	6
g.	Feeling that friends or family are not supportive enough of my self-care efforts.	1	2	3	4	5	6
h.	Feeling that diabetes controls my life.	1	2	3	4	5	6
i.	Feeling that my doctor doesn't take my concerns seriously enough.	1	2	3	4	5	6

j.	Not feeling confident in my day-to-day ability to manage diabetes.	1	2	3	4	5	6
k.	Feeling that I will end up with serious long-term complications, no matter what I do.	1	2	3	4	5	6
Ι.	Feeling that I am not sticking closely enough to a good meal plan.	1	2	3	4	5	6
m.	Feeling that friends or family don't appreciate how difficult living with diabetes can be.	1	2	3	4	5	6
n.	Feeling overwhelmed by the demands of living with diabetes.	1	2	3	4	5	6
0.	Feeling that I don't have a doctor who I can see regularly about my diabetes.	1	2	3	4	5	6
р.	Not feeling motivated to keep up my diabetes self-management.	1	2	3	4	5	6
q.	Feeling that my friends or family don't give me the emotional support that I would like.	1	2	3	4	5	6

Over the past 2 weeks, how often have you been bothered by each of the following problems? (Circle your answer)

		Not at all	Several Days	More than half the days	Nearly every day
a.	Little interest or pleasure in doing things.	0	1	2	3
b.	Feeling down, depressed, or hopeless.	0	1	2	3
С.	Trouble falling or staying asleep, or sleeping too much.	0	1	2	3
d.	Feeling tired or having little energy.	0	1	2	3
e.	Poor appetite or overeating.	0	1	2	3
f.	Feeling bad about yourself-or that you are a failure or have let yourself or your family down.	0	1	2	3
g.	Trouble concentrating on things such as reading the newspaper or watching television.	0	1	2	3
h.	Moving or speaking so slowly that other people could have noticed. Or the opposite-being so fidgety or restless that you have been moving around a lot more than usual.	0	1	2	3
i.	Thoughts that you would be better off dead, or of hurting yourself in some way.	0	1	2	3

NOTE: If you checked "Several days" please discuss this as soon as possible with your health care provider, go to the nearest emergency room, or dial 911.

Appendix B: Chapter 2 – Peer Leaders' Clinical Values Form

Subject ID:

Measurements					
Height					
Weight	BMI				
Waist Circumference					

Blood Pressure					
First Reading					
Systolic	Diastolic				
Second Reading					
Systolic Diastolic					
Average					
Systolic	Diastolic				

Appendix C: Chapter 3 – Mini International Personality Item Pool (Mini-IPIP) Scale

		Very Inaccurate	Moderately Inaccurate	Neither Inaccurate nor Accurate	Moderately Accurate	Very Accurate
a.	I keep in the background.	1	2	3	4	5
b.	l get chores done right away.	1	2	3	4	5
с.	I have difficulty understanding abstract ideas.	1	2	3	4	5
d.	I feel others' emotions.	1	2	3	4	5
e.	I seldom feel blue.	1	2	3	4	5
f.	I talk to a lot of different people at parties.	1	2	3	4	5
g.	I make a mess of things.	1	2	3	4	5
h.	I have vivid imagination.	1	2	3	4	5
i.	I sympathize with others' feelings.	1	2	3	4	5
j.	I am relaxed most of the time.	1	2	3	4	5
k.	I don't talk a lot.	1	2	3	4	5
١.	l like order.	1	2	3	4	5
m.	I am not interested in abstract ideas.	1	2	3	4	5
n.	I am not really interested in others.	1	2	3	4	5
0.	I have frequent mood swings.	1	2	3	4	5
p.	I am the life of the party.	1	2	3	4	5
q.	I often forget to put things back in their proper place.	1	2	3	4	5

r.	I do not have a good imagination.	1	2	3	4	5
S.	I am not interested in other peoples' problems.	1	2	3	4	5
t.	I get upset easily.	1	2	3	4	5

Appendix D: Chapter 5 – Semi-Structured Interviews

Peer Leader Pseudonyms	Interview Time and Date	Interviewer
Peer Leader No. 1	12 PM on July 30, 2018	Bushra Mahmood
Peer Leader No. 2	4 PM on July 9, 2018	Bushra Mahmood
Peer Leader No. 3	9 AM on July 7, 2018	Bushra Mahmood
Peer Leader No. 4	6 PM on July 16, 2018	Bushra Mahmood
Peer Leader No. 5	12 PM on July 7, 2018	Ayman Azhar
Peer Leader No. 6	4:30 PM on July 17, 2018	Ayman Azhar
Peer Leader No. 7	10 AM on July 7, 2018	Ayman Azhar
Peer Leader No. 8	3:30 PM on July 11, 2018	Ayman Azhar
Peer Leader No. 9	12 PM on July 7, 2018	Bushra Mahmood
Peer Leader No. 10	9 AM on July 7, 2018	Ayman Azhar
Peer Leader No. 11	11:30 AM on July 10, 2018	Bushra Mahmood
Peer Leader No. 12	6 PM on July 16, 2018	Ayman Azhar
Peer Leader No. 13	11 AM on July 16, 2018	Bushra Mahmood
Peer Leader No. 14	12 PM on July 12, 2018	Bushra Mahmood
Peer Leader No. 15	11 AM on July 9, 2018	Bushra Mahmood
Peer Leader No. 16	2 PM on July 9, 2018	Bushra Mahmood
Peer Leader No. 17	12 PM on July 16, 2018	Ayman Azhar

Appendix E: Chapter 5 – Study Diagram Depicting Explanatory Sequential Mixed Methods Design (QUAN \rightarrow qual)

Quantitative Data Collection	 Repeated Measure Observational Study 	 Survey Results on PLs' Glycemic Control and Diabetes Distress at Baseline, 3 Months, and 12 Months
Quantitative Data Analysis	 SPSS Software Descriptive Analysis Linear mixed effects model 	 Descriptive Analysis of PLs' Socio-Demographic Characteristics Changes in A1C and Diabetes Distress from Baseline to 12 Months
Sample Selection; Interview Guide Development	 Purposefully Selecting PLs from the QUAN Phase for Qualitative Phase Developing Interview Guide for the Qualitative Phase 	 Interview Protocol and Interviews
Qualitative Data Collection	 One-on-One Semi- Structured Interviews with 17 PLs who participated in the QUAN Phase Qualitative Descriptive Design 	 Text Data (Interview Transcripts)
Qualitative Data Analysis	 Qualitative Descriptive Analysis NVivo Qualitative Software Coding and Identifying Themes 	 Codes and Themes
Integration of the Quantitative and Qualitative Findings	 Interpretation and Explanation of the QUAN and qual Findings 	DiscussionImplicationFuture Research

Appendix F: Chapter 5 – Semi-Structured Interview Guide and Survey

SECTION A: SEMI-STRUCTURED INTERVIEW GUIDE

Introduction: Hello! I hope you all are doing well! It is an honor to have you here today. Thanks for coming and accepting our invitation to participate in the research project "From clinic to community."

[Outline what will happen and how long it will take.] We are conducting a semistructured interview today. The purpose of today's interview is to share your experiences with us. This will help us improve our program. Introduce yourself to the peer leader and mention your role in the study. Add brief description of informed consent. (The interviewer will pass the two copies of consent forms to the participant, explaining that the white copy is for the study's record and the yellow paper is the peer leaders' copy. Then, she/he will start reading the consent form loudly.) Ask if there are any questions.

Please let me know if you don't feel comfortable answering any of the questions. In this case, we will move to the next question.

Experiences as a peer leader:

- How many participants do you have?
- How long have you been a peer leader?
- What has been your experience in working with your participants up until now? (The facilitator writes participants' experiences on the board.)
- Would you mind telling us about positive aspects of your experience?
- Would you mind telling us about challenges you have encountered?
- What, if anything, would you change to make this experience better, if you had the opportunity to step back in time?
- What are your thoughts about telephone versus face-to-face contacts?
- What is the optimal frequency for peer leader and participant contacts?
- What are the behavioral goals that your participant(s) were most interested in achieving?
- What changes, if any, did your participants make? (Now, the facilitator passes small pieces of papers to the peer leader.)

- Would you please jot down 3 ways that this study has affected you as both a peer leader and as a person with diabetes?
- What are some of the things that you noted?
- Some of you previously mentioned that being a peer leader has helped you with your diabetes management. Please tell us about this, if any of you have had the same experience with our study.

Questions about peer leader training:

- How relevant was the peer leader training that you received to working with your participants?
- How can we improve our training sessions?
- What advice would you give to a peer leader who wants to start the program tomorrow?

Questions about the characteristics of an effective peer leader: [*Before asking any questions, please define what you mean by effective peer leader* (improvement in their participants' A1C or diabetes distress score).]

- What characteristics do you think an effective peer leader should have?
- In your opinion, what other criteria should be considered in defining effective peer leaders?
- In our preliminary analyses, effective peer leaders scored higher in conscientiousness and extraversion. [*Define conscientiousness and extraversion for them if needed.*] What are your thoughts about this?
- What does a peer leader need to do to be conscientious/extraverted? Why does it matter if a leader is conscientious/extraverted?
- Are there any other personality characteristics that you think are necessary for effective peer leaders?

Miscellaneous questions:

- Why did you attend the program?
- What criteria/characteristics do you think we should use for pairing peer leaders and participants?
- What do you think we can do to decrease the drop-out rate?

Closing:

• Are there any other points that you want to make?

Thanks for coming and being a part of our study! Please contact us if you have any concerns.

SECTION B: <u>SEMI-STRUCTURED INTERVIEW SURVEY</u>

Subject ID: Date: Time:

Please answer the following questions:

- 1. How did your glycemic control change over the course of the study?
- 2. Do you know how your participant(s) did over the course of the study?
- 3. If your participant improved, did it affect your glycemic control and what was that?
- 4. If your participant's glycemic control worsened over the last year, did it affect you and what was that?
- 5. If you have made any positive changes, what do you relate them to?
- 6. If you haven't made any positive changes, or things declined, what do you relate them to?
- 7. Where do you see yourself in comparison to your participant?

Appendix G: Chapter 6 – Peer Leader Selection and Pairing Models

PEER LEADER SELECTION MODEL

Peer leaders will be screened and recruited via a two-stage process.

- I. In the initial phase, screening would be online and may include the following items at the minimum:
 - a. Screening Diabetes Distress Scale (< 3)
 - b. Select Mini-IPIP (high level of agreeableness (>4); low level of neuroticism (<2.5); and high level of extraversion (>3))
 - c. A1C (≥7% and <8%)
- II. The prospective peer leaders who met the initial screening criteria should then be invited to an in-person interview to assess their communication skills using the Active Listening Observation Scale (ALOS-global),¹¹⁵ to ensure their suitability for the role.
- III. Please refer to the following two modified scales below.

SECTION A: SCREENING DIABETES DISTRESS SCALE

Living with diabetes can sometimes be tough. There may be many problems and hassles concerning diabetes and they can vary greatly in severity. Problems may range from minor hassles to major life difficulties. Listed below are 2 potential problem areas that people with diabetes may experience. Consider the degree to which each of the 10 items may have distressed or bothered you DURING THE PAST MONTH and circle the appropriate number. Please note that we are asking you to indicate the degree to which each item may be bothering you in your life, NOT whether the item is merely true for you. If you feel that a particular item is not a bother or a problem for you, you would circle "1." If it is very bothersome to you, you might circle "6."

	Not a problem	A slight problem	A moderate problem	Somewhat serious problem	A serious problem	A very serious problem
Feeling overwhelmed by the demands of living with diabetes.	1	2	3	4	5	6
Feeling that I am often failing with my diabetes routine.	1	2	3	4	5	6

SECTION B: SELECT MINI-IPIP SCALE

This test measures your BIG5 personality, one of the most popular scientific measures of personality. You will be asked to evaluate the extent to which you agree with following statements. Please answer honestly with regard to how you see yourself in the present moment, not how you would like to be in the future. There are no incorrect answers nor any personality profile that is inherently more desirable than another.

	Very inaccurate	Moderately inaccurate	Neither inaccurate nor accurate	Moderately accurate	Very accurate
I keep in the background.	1	2	3	4	5
I feel others' emotions.	1	2	3	4	5
I seldom feel blue.	1	2	3	4	5
I talk to a lot of different people at parties.	1	2	3	4	5
I sympathize with others' feelings.	1	2	3	4	5
I am relaxed most of the time.	1	2	3	4	5
l don't talk a lot.	1	2	3	4	5
I am not really interested in others.	1	2	3	4	5
I have frequent mood swings.	1	2	3	4	5
I am the life of the party.	1	2	3	4	5
I am not interested in other peoples' problems.	1	2	3	4	5
I get upset easily.	1	2	3	4	5

SECTION C: ACTIVE LISTENING SKILLS

Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Given participant time and space to present the problem.	1	2	3	4	5
Thoroughly explores and identifies all aspects of the problem.	1	2	3	4	5
Listens attentively.	1	2	3	4	5
Is not distracted during the conversation.	1	2	3	4	5
Is not offhand, hurried, or dismissive.	1	2	3	4	5
Expresses understanding verbally and non-verbally.	1	2	3	4	5
Makes an effort to state back understanding of what the other is communicating.	1	2	3	4	5
Uses open-ended questions.	1	2	3	4	5
Avoid giving advice or expressing judgements.	1	2	3	4	5

PEER LEADER-PARTICIPANT PAIRING MODEL

Peer leaders and participants will be paired based on their personal preferences (i.e., gender, age, location, etc.) Below is a questionnaire created based on the results of the study:

SECTION A: SOCIO-DEMOGRAPHICS

1.	What is your age?	years ol	d
2.	What is your gender?	1 Male	2 Female
3.	What is your marital st	tatus?	
			1 Never married
			2 Married/Partnered
			□ 3 Separated/Divorced
			4 Widowed

4. What is your ethnic origin? (check all that apply)

1	Aboriginal
2	East Asian



5. What is your highest level of education?

1	Less than high school
2	High school graduate (or equivalent)
3	University graduate or higher

6. Which of the following best describes your current employment status?


SECTION B: DIABETES-RELATED QUESTIONS

- 1. How long have you been diagnosed with diabetes?
- 2. What type of diabetes do you have?



3. Do you take any medication for your diabetes?

1	Yes
2	No

4. Do you inject any type of insulin for your diabetes?

1	Yes
2	No

a. If yes, how long have you been on insulin?

5. Do you use any other types of injection for your diabetes?

1	Yes
2	No

6. Do you have amputations as a result of your diabetes?

	Yes
2	No

7. Are you on dialysis?

1	Yes
2	No

8. Do you have any neuropathy (numbness, tingling, or burning pain in your toes, fingers, feet, or legs)?



9. Do you have trouble seeing as a result of diabetes?

1	Yes
2	No

SECTION C: LIFE EXPERIENCE

1. Are you currently experiencing a particular life circumstance or challenge that you would prefer your peer leader has related experiences in (e.g., pregnancy, disability, demanding job, etc.)? Please be specific.