



Enhanced Self-Monitoring Blood Glucose In Non-Insulin-Requiring Type 2 Diabetes: A Qualitative Study In Primary Care

By: **Dana Elisabeth Brackney**

Abstract

Aims and objectives: To contribute to both theoretical and practical understanding of the role of self-monitoring blood glucose for self-management by describing the experience of people with non-insulin-requiring Type 2 diabetes in an enhanced structured self-monitoring blood glucose intervention. **Background:** The complex context of self-monitoring blood glucose in Type 2 diabetes requires a deeper understanding of the clients' illness experience with structured self-monitoring of blood glucose. Clients' numeracy skills contribute to their response to blood glucose readings. Nurses' use of motivational interviewing to increase clients' regulatory self-efficacy is important to the theoretical perspective of the study. **Design:** A qualitative descriptive study. **Methods:** A purposive sample of eleven adults recently (<2 years) diagnosed with non-insulin-requiring Type 2 diabetes who had experienced a structured self-monitoring blood glucose intervention participated in this study. Audio recordings of semi-structured interviews and photographs of logbooks were analysed for themes using constant comparison and member checking. **Results:** The illness experience states of Type 2 diabetes include 'Diagnosis,' 'Behavior change,' and 'Routine checking.' People check blood glucose to confirm their Type 2 diabetes diagnosis, to console their diabetes-related fears, to create personal explanations of health behaviour's impact on blood glucose, to activate behaviour change and to congratulate their diabetes self-management efforts. **Conclusions:** These findings support the Transtheoretical model's stages of change and change processes. Blood glucose checking strengthens the relationships between theoretical concepts found in Diabetes Self-management Education-Support including the following: engagement, information sharing and behavioural support. **Relevance to clinical practice:** Tailoring diabetes care specifically to clients' stage of their illness experience with use of self-monitoring blood glucose contributes to engagement in self-management. Motivational interviewing and collaborative decision-making using blood glucose checking increase regulatory self-efficacy for people living with non-insulin-requiring Type 2 diabetes.

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Design: A qualitative descriptive study.

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Conclusions: These findings support the Transtheoretical model's stages of change and change processes. Blood glucose checking strengthens the relationships between theoretical concepts found in Diabetes Self-management Education-Support including the following: engagement, information sharing and behavioural support.

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KEYWORDS

nursing intervention, patient-centred care, qualitative descriptive, self-management, Type 2 diabetes

1 | INTRODUCTION

The World Health Organization (2016) reports that the diagnosis of Type 2 diabetes (T2DM) continues to grow with an estimated 422 million people diagnosed worldwide. Engagement in self-care is a central concept for effective diabetes management (Eborall et al., 2015; Powers et al., 2017). Since 1993 when The Diabetes Control and Complication Trial definitively demonstrated the value of intensive therapy for reduction in complications associated with Type 1 diabetes (T1DM), SMBG has become a centrepiece of diabetes self-management. However, the benefits of SMBG in non-insulin-requiring T2DM have been questioned by some researchers, insurers and healthcare providers (Aakre, Watine, Bunting, Sandberg, & Oosterhuis, 2012; Benhalima & Mathieu, 2012; Garg & Hirsch, 2017; Ngao-suwan & Osataphan, 2015).

Diabetes organisations agree that SMBG is essential for adjusting insulin correctly; however, the American Diabetes Association's (ADA) Standards of Medical Care in Diabetes 2017 state that there is insufficient evidence regarding when to prescribe and how often to use SMBG when medication is not being adjusted. The ADA (2017) reports the strength of evidence at a level E (expert consensus or clinical experience) for use of SMBG with non-insulin diabetes therapy. They conclude that SMBG is useful when blood glucose (BG) readings are integrated into clinical and self-management plans (ADA, 2017).

There is strong evidence that the usefulness of SMBG is related to the response and management of the BG measurements by both the healthcare professional and the client (Benhalima & Mathieu, 2012; Nishimura et al., 2017; Parkin, Buskirk, Hinnen, & Axel-Schweitzer, 2012). Diabetes Self-Management Education-Support (DSME-S) is a complex intervention (Powers et al., 2017). The validity and interpretation of outcome measures included in the meta-analysis of individual patient data are disputed due to the complexity and variety of self-management interventions involved in DSME-S (Jonkman, Groenwold, Trappenburg, Hoes, & Schuurmans, 2017). Researchers will likely continue to demonstrate mixed and divergent outcomes related to the effectiveness of SMBG for improving T2DM management until there is a better consistency of the SMBG intervention and better reporting of the user context (Benhalima & Mathieu, 2012; Breland, McAndrew, Burns, Leventhal, & Leventhal, 2013). This qualitative study of Enhanced SMBG provides detailed information about a SMBG self-management intervention and provides a theoretical model of SMBG functions to guide the use of a SMBG intervention in the primary care setting. The worldwide incidence of diabetes necessitates meaningful use of SMBG to enhance engagement in diabetes self-management.

2 | BACKGROUND

Diabetes Self-Management Education-Support requires medical knowledge of diabetes and the practice of patient-centred care, shared decision-making, information sharing, behavioural support

What does this paper contribute to the wider global clinical community?

- Tailoring diabetes care specifically to the clients' stage of their illness experience with use of self-monitoring blood glucose contributes to engagement in self-management.
- Motivational interviewing and collaborative decision-making with blood glucose checking increase expressions of self-efficacy for people living with non-insulin-requiring Type 2 diabetes.
- Blood glucose checking strengthens the relationships between theoretical concepts associated with Diabetes Self-management Education-Support including the following: engagement, information sharing and behavioural support.

and coordination of care (Powers et al., 2017). Within this broader context of diabetes management, the following paragraphs provide the reader with background in the theoretical concepts specific to implementation of a SMBG intervention. The theoretical concepts presented below include patient-centred care, numeracy skills, change theory and coping.

2.1 | Patient-centred care

Internationally, healthcare organisations express support for patient-centred care (McCormack et al., 2015). However, the meaning of patient-centred care and its sharing of power within the health professional and patient relationship has yet to be fully realised in practice (Fredericks et al., 2012). McCormack and McCance (2010) provide a detailed explication of their well-developed framework for person-centred nursing. Their conceptualisation can guide the understanding of patient-centred care and provide a common language for its exploration. Their four interconnected constructs of person-centred nursing include prerequisites, care environment, person-centred processes and outcomes (p. 3).

Person-centred processes are one of the four constructs that contributes to the patient-centred nursing framework. This construct supports the nurse delivering care while working within an individual's values and beliefs to facilitate shared decision-making. People's life experiences influence their health and health behaviours in ways that may not be overt to healthcare providers. McCormack and McCance's (2010) conceptualisation of person-centred processes emphasises holistic care with engagement in sympathetic presence to meet identified patient needs. Listening to people's illness narratives is one example of a person-centred process that embodies sympathetic presence and provides the nurse with insight into a person's values and beliefs.

Frank (1995) identified and interpreted four common illness narratives these include the following: restitution narrative, chaos narrative, quest narrative and the testimony. According to Frank,

restitution narratives dominate our society and tell an illness story with a time sequence. For example, "I found out I have diabetes, I still have elevated blood sugar; but, I am losing weight and will be healthy soon." In contrast, a chaos narrative is disorganised and expresses the emotion of being overwhelmed. Similar to the restitution narrative, the quest narrative describes a person's journey but includes expressions of both acceptance of an illness and a life transformed in response to illness. The testimony is quite different from the previous three narrative forms. Instead of a story, the body itself is the description of the person's identity with the illness experience. For example, the statement, "I am a diabetic," is a testimony. Frank's thesis for healthcare providers is that being a witness to a person's illness narrative is an important means of supporting the person experiencing an illness. Eliciting illness narratives as a practice of sympathetic presence allows people with diabetes to experience and express self-liberation, consciousness raising and coping mechanisms as outcomes of patient-centred care. Using these interpretations of the self and health provide an ontological knowledge structure that contributes to people's success as self-managers and to the provision of patient-centred care.

2.2 | Numeracy skills

Clients' numeracy skills contribute to their response to their BG readings. Numeracy skills build upon each other. Schapira et al. (2008) developed a conceptualisation of health numeracy as a triangle divided into three levels. The base of the triangle contained primary numeracy skills such as counting and adding. The middle section contained applied numeracy skills such as dosing medication correctly. And, the highest level contained interpretive numeracy. They defined the interpretive domain as, "The ability to understand the strengths and limitations of numbers to represent health or disease states, the efficacy of an intervention, or other expected health outcomes" (Schapira et al., 2008, p. 507). Interpreting BG values is a complex numerical skill to communicate and to comprehend. For example, the normal range of BG values varies in relation to eating. A BG value of 65 mg/dl (3.6 mmol/L) is normal after a prolonged fast and/or prior to a meal. However, the same reading is abnormal in the 2 hr after eating. The healthcare provider's communication of this contextual interpretation of numerical data requires time and effective educational strategies. Likewise, the client's contextual understanding of the numerical BG readings requires experience for effective application. Therefore, the efficacy of SMBG is influenced by both the healthcare provider's ability to communicate numerical information and the client's application and interpretation of that information. In a systematic review of health literacy and diabetes outcomes, three of the 32 included studies examined health literacy levels and self-management behaviours (Al Sayah, Johnson, Majumdar, Williams, & Robertson, 2013). The strength of evidence was considered low for support of health literacy and its influence of diabetes outcomes and Al Sayah et al. (2013) report no impact of health literacy on SMBG frequency, self-management behaviours or medication adherence. Researchers

concluded that methodological issues with confounding variables and low-powered studies limited the ability to draw conclusions from the review (Al Sayah et al., 2013). Health numeracy may improve people's decision-making for diabetes self-management with a positive impact on their metabolic control. In addition, none of the studies in the Al Sayah et al. (2013) review included measures of interpretive numeracy as described by Schapira et al. (2008). Diabetes self-management involves responding to a wide variety of personal health information as well as understanding how to translate what is observed in health behaviour.

2.3 | Change theory

The Transtheoretical model for behaviour change recognises readiness to learn as essential for taking action and making changes (Prochaska & DiClemente, 1983). Motivational Interviewing (MI), an intervention for behavioural change, was founded on principals from the Transtheoretical model. The spirit of MI supports people as they make positive health behaviour choices. MI involves four processes: focusing, engaging, evoking and planning. Researchers have strong evidence that MI is beneficial to harm reduction related to alcohol and drug use (Lenz, Rosenbaum, & Sheperis, 2016). One component of MI, engagement, has demonstrated benefit for diabetes-related health behaviour change (Miller & Rollnick, 2002; Náfrádi, Nakamoto, & Schulz, 2017). Copeland, McNamara, Kelson, and Simpson (2015) examined the efficacy of MI mediators on nonaddiction health-related behaviours. They reported that limitations in the studies ($n = 37$) selected for review prevented identification of a causal chain between MI and health behaviour outcomes (Copeland et al., 2015). Despite these limitations, Copeland et al. (2015) concluded that the spirit of MI improved engagement (motivation and change talk) which in turn improved health outcomes.

2.4 | Coping

Self-efficacy is a belief about oneself and one's world that has many influences on future behaviour while also being influenced by the environment, past experience and other people (Bandura, 1997). According to Bandura (1997), efficacy beliefs are variable across several dimensions including the following: level of complexity, generality and strength. Of the three self-efficacy dimensions, strength is a more powerful predictor of self-efficacy than complexity or specificity (Bijl, Poelgeest-Eeltink, & Shortridge-Baggett, 1999). Strength is characterised by the degree of tenacity with which one holds to self-efficacy beliefs and results in perseverance (Bandura, 1997). Diabetes health professionals explore clients' decisional balance and efficacy beliefs during diabetes self-management (Steinberg & Miller, 2015). Theoretically, the action of planning to overcome barriers increases the strength of self-efficacy beliefs (Schlenk & Boehm, 1998). However, many studies of self-efficacy report mixed results of its effect on health behaviour (Copeland et al., 2015). Instead, a person's perseverance is more predictive of positive health behaviour than the health behaviour's level of complexity.

Self-regulating efficacy, with its emphasis on perseverance, appears to have a good fit with the self-care demands of a chronic disease such as DM. However, many quantitative studies of DM and self-efficacy do not measure the self-regulatory functions of initiating, recovery and maintenance efficacy. Instead, researchers generally focus on efficacy related to performing self-management actions in isolation (Náfrádi et al., 2017). Qualitative studies have described people's DM self-management as fluid (Rayman & Ellison, 2004). This finding that people cope with T2DM by moving in and out of performing DM self-management behaviours is consistent with the theoretical descriptions of self-regulating efficacy. The concept of regulatory self-efficacy is important to the theoretical perspective of this study as it is concerned with people's future and ongoing health behaviour.

These four theoretical concepts (patient-centred care, numeracy skills, change theory and coping) are foundational for understanding and evaluating studies of SMBG interventions and outcomes. Additional empirical studies examining the use of SMBG for diabetes management are discussed along with the qualitative findings from the Enhanced SMBG study in the discussion section of this report.

3 | METHODS

The aim of the Enhanced SMBG study was to describe the experience of people with non-insulin-requiring T2DM in a structured SMBG context. As described by Sandelowski (2010), the researcher used qualitative description with a naturalistic approach to study these experiences. Participant narratives and BG logbooks from individual interviews were obtained with purposive sampling. These data were analysed using content analysis with thematic clustering, constant comparison and member checking to represent the illness experience of people with T2DM. This inductive interpretive description of the interviews and BG logbooks contributes to the development of theoretical and practical understanding of the role of SMBG for self-management. SMBG in T2DM exhibits characteristics of complexity and context dependence which are congruent with qualitative methodology. An interpretive descriptive approach allowed the exploration of phenomena holistically, while also focusing on the client experience (Thorne, Kirkham, & O'Flynn-Magee, 2004). The use of qualitative methodology was implemented to avoid early reduction in data that may have inadvertently prevented a fuller understanding of the SMBG experience for people with T2DM.

3.1 | Setting

3.1.1 | Structured SMBG

All people diagnosed and treated for T2DM were managed with a structured SMBG intervention at the primary care medical office where all study participants received their medical care (Table 1). The term "structured" can have several meanings. In this setting, structured meant that SMBG was used purposefully with the client

and healthcare provider agreeing on a checking frequency and the purpose of the checking. Paired BG readings and/or 2-hr postprandial checking for diabetes management. Paired BG checking was performed before and after an activity such as eating or an exercise activity. The structured SMBG intervention was enhanced by combining principles of MI with the BG checking. The four processes of MI included the following: engaging, focusing, evoking and planning (Steinberg & Miller, 2015). BG checking was used to facilitate each of these processes (Table 2). This practical intervention conformed to each participant's insurance benefit and coverage of diabetes supplies. All of the participants were eligible to obtain 100 check strips every 3 months through either public or private insurance. All people with T2DM including study participants experienced this structured SMBG at the primary care medical office.

3.2 | Participants

Purposive sampling represented three different A1C ranges (Monnier, Colette, Dunseath, & Owens, 2007). The researcher invited five people in each of three A1C categories to participate in the study. Eleven of the fifteen agreed to participate (Table 3). The seven female and four male participants were all recently diagnosed (<2 years) with non-insulin-requiring T2DM. Most participants were self-described "country folk," with farming backgrounds and whose parents and grandparents had lived in the southern Appalachian Mountains. Consistent with current understanding of the T2DM disease process, the three obese (BMI >30) participants were also the youngest participants. The three normal weight (BMI <25) participants were also the oldest. Sampling continued until data saturation was achieved as determined by the researcher and endorsed by the advisory committee.

3.3 | Ethical considerations

A university institutional research review board provided ethics approval for the study. All participants were informed of the study and provided written consent to digitally record the interview and to photograph BG logbooks. Data were deidentified to protect the privacy and confidentiality of participants. While the topic of SMBG was unlikely to create strong emotional reactions, participants were reminded during the interview that they were not required to continue if the conversation created discomfort for them. None of the participants appeared distressed or asked to stop the interview.

3.4 | Data collection

Over a period of 4 months (October to January), the researcher interviewed the eleven participants individually with an open-ended interview guide. To explore the experience of living with T2DM and the use of SMBG, the researcher asked each participant, "Tell me about being diagnosed with diabetes. What is the earliest memory of diabetes that you have?" These types of "grand tour" questions allowed the participants to describe their own illness experience, and

TABLE 1 Diabetes Education and Motivational Interview Guide with SMBG

Visit #/Day	Visit focus	SMBG objectives and motivational interviewing (MI)	SMBG pattern
Visit 1 Day 0	Instruct in SMBG testing. Focus on a brief explanation of disease process Provide BG goals for fasting/premeal and 2 hr after meals	Purpose: Discover when problem BG readings occur and answer the unspoken client question, "Do I really have a problem?" Establish a working relationship—Engaging and Planning	Day 1 Bedtime Day 2 Fasting and 2 hr after breakfast Day 3 Before mid-day meal and 2 hr after mid-day meal Day 4 Before evening meal and 2 hr after evening meal Day 5 Off Day 6 Off Day 7 Off (Patient's choice—after exercise? After a snack? Stressed?) Week 2 Repeat starting at Day 1
Visit 2 Day 14	Identify problem times from 2 weeks of testing Focus on Nutritional guidelines Set patient-centred goals Ask patient to bring a 3-day dietary diary to next visit	Purpose: Discover the dietary contribution to elevated BG MI: Focusing and planning	Test once daily at problem time for 2 weeks Or Test twice daily, before and 2 hr after a meal 3 days a week and fasting 1 day following the day that the evening meal was tested
Visit 3 Day 28	Review BG results and Diet diary Ask patient in what ways the BG testing and diet diary help them in DM self-management Focus on Activity guidelines Set patient-centred goals. Ask patient to bring activity diary to next visit	Purpose: Determine whether BG checking benefits BG goal achievement MI: Focusing, evoking and planning	Set BG testing based on patient answers Not helpful: Ask patient to test based on practitioner needs Helpful: Continue with patient determined testing
Visit 4 Day 90	Answer patient questions Review progress towards activity and dietary goals Set patient-centred goals Focus on patient goals (activity, dietary and stress management)	Purpose: Discover if behaviour changes improved my BG readings, weight, activity or dietary habits MI: Planning	Check HbA1c Patient-centred BG testing guidelines HbA1c <6.5% lifestyle change alone HbA1c 6.5–6.9% consider Metformin HbA1c ≥7.0% start Metformin

TABLE 2 Transtheoretical model (TTM) stages and processes, diabetes illness experience and chronic disease self-management mechanisms and outcomes

TTM Stage of change	TTM Change process	Evidence of the Chronic disease mechanism-knowledge	Evidence of the Chronic disease mechanism-motivation	Chronic disease Outcomes
Precontemplation <i>Diagnosis</i> —"I look to the Lord for strength"	Consciousness raising	"The numbers say I have diabetes"		
Contemplation <i>Diagnosis</i> —"I look to the Lord for strength"	Dramatic relief Self-efficacy	"Now there are no question marks" "I am some sort of okay"	"I can do something about it"	Coping
Action <i>Behaviour Change</i> —"I can control it. It doesn't have to control me"	Decisional balance Self-efficacy	"I just don't know why it does that" "Figuring it out"	"I can control it. It doesn't have to control me."	Coping Change
Maintenance <i>Routine</i> —"It is not like that anymore"	Self-liberation Stimulus control Dramatic relief	"The numbers make me do" "I like to know where I am at."	"The numbers make me do" "I don't want to end up like my ..." "I am doing something about it" "I make my numbers"	Coping Self-efficacy

then to move into the role of SMBG as the interview progressed and took shape (Liamputtong, 2011). Responses in one interview would influence questions asked in a subsequent interview. For

example, in an early interview, a participant spoke about her diabetes-related fears. Other participants were then directly asked about fears if they did not initiate this topic. In this way, the

TABLE 3 A1C groupings with age and BMI

A1C grouping	Age	BMI Obesity++/ overweight+	Mean age	Mean BMI
A1C ≤6.4% (≤46.4 mmol/mol) (n = 4)	59	26.1+	62	25.7
	59	26.6+		
	64	27.4+		
	67	22.7		
A1C 6.5%–7.0% (47.5–51.9 mmol/mol) (n = 3)	56	42.3++	65	31.6
	67	29.7+		
	73	22.8		
A1C >7.0% (>53.0 mmol/mol) (n = 4)	47	42.3++	58	31.4
	49	33.3++		
	63	25.1+		
	73	24.9		

interviews evolved over time. Central questions included, “How does blood sugar checking help you manage diabetes?, How does checking your blood sugar effect how you feel about yourself or diabetes?, What do you understand about your blood sugar readings?” Although the central questions in the interview guide remained constant for all of the interviews, the focus of understanding remained imbedded in the context of the participant’s life even as the researcher worked to understand the meaning, context and function of a given SMBG experience.

Interviews were digitally recorded and logbooks were collected for material evidence of the SMBG experience. Seven participants brought glucometers and logbooks; these were photographed or photocopied, and became part of the data set for each participant. Written notes about the logbooks and photocopies of the logbooks were made of selected materials.

3.5 | Data analysis

Data analysis began with the writing of memos following the first participant interview. The memos generally took the following form: analytical notes including self-critique, impressions of significance, common and unique themes and topics to investigate further. Notes were made during the interview and afterwards with an emphasis on other areas to explore in the subsequent interviews. Participants were asked to clarify or expand on their statements. Tentative findings or experiences were directly clarified or explored with later participants.

The analysis continued with clustering units of meaning across interviews to form 21 themes. The recorded interviews continued to be analysed by coding units of meaning using the constant comparison technique, at the same time focusing on the whole of the life story that the participant discussed. The thematic groupings were discussed and analysed with another qualitative researcher experienced in diabetes education and management. Next, general and unique themes from all the interviews were selected and formed into a composite around three broader time periods in the diabetes

experience: ‘Diagnosis,’ ‘Behavior change,’ ‘Routine checking.’ In addition, the visual data were incorporated into the analysis. Finally, an interpretation of the SMBG experience was developed and represented using participant language and theoretical groupings.

3.6 | Validity and reliability/rigour

Prior to implementing the study, the researcher identified bias in her own practice. The researcher believed that BG checking added financial and emotional burden to the management of T2DM and wondered if it was necessary for people with T2DM to check. The desire to improve the life of people living with diabetes motivated this inquiry. The research process including focused listening and data analysis using the step-by-step analytical process to form themes from participant data demonstrated the logical consistency of the method (Fereday & Muir-Cochrane, 2006). The interpretive description was presented as a diagram and shown to five people who had participated in the study and one person who had also experienced structured SMBG but had not participated in the study. The researcher asked these six participants to consider their own experience with self-monitoring and how their experience was similar to and/or different from the diagram. The diagram was revised with new language based on the participants’ recommendations (Figure 1). This process of member checking developed congruence between the researcher’s constructs and the experience of common sense in the everyday life of participants (Fereday & Muir-Cochrane, 2006). In this way, adequacy of the diagram was supported. Future adoption of the findings for diabetes practice will be further evidence of adequacy.

Finally, the results reported here are true to the participants’ own language and directly quoted with acknowledgement of the context surrounding each narrative. This representation of the data and findings demonstrated rigour by preserving the participants’ illness narrative. The process of interviewing, concurrent clarification and exploration of both spoken and unspoken experiences of SMBG, self-reflection, thematic analysis of transcripts, comparing and contrasting interviews, generating findings, member checking findings, returning to the interviews and summarising each as a whole resulted in a descriptive interpretation of the experience of SMBG for people with non-insulin-requiring T2DM who experienced structured SMBG.

4 | RESULTS

This study identified explanations as to how people with T2DM benefit from checking their BG. Disease process and family history both impacted the experience and narratives of SMBG. Those with the lowest A1C (≤6.4%; 46.4 mmol/mol) expressed more concern over unexplained fasting hyperglycaemia than those with the highest A1C (≥7.0%; 53.0 mmol/mol). In addition, those with the lowest initial A1C (≤6.4%; 46.4 mmol/mol) values expressed less acceptance of their diagnosis when compared to those with the highest A1C

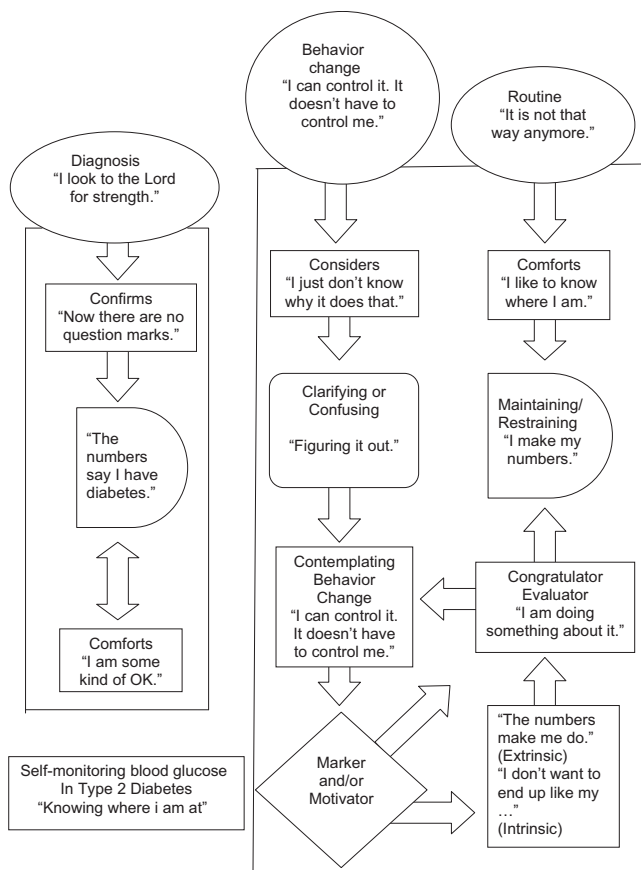


FIGURE 1 Self-monitoring blood glucose functions by illness stage

($\geq 7.0\%$; 53.0 mmol/mol). Second, the experience of having or not having family members with diabetes appeared to shape participants response to diagnosis. Despite these observed variations, the narratives surrounding the diagnosis of diabetes were similar across the groups.

Three distinct client contexts defined the client's use of SMBG, and represent that SMBG meaning and use changed overtime for the participants in this study. The first context is 'Diagnosis,' the second is 'Behavior change,' and the third is 'Routine checking.' The functions of SMBG for these participants were dependent on both the external environmental context of SMBG (structured or otherwise) and the clients' context. The experience of using SMBG generated the following themes within each of these common clients' SMBG contexts.

4.1 | Diagnosis experience

First, the diagnosis of diabetes was either expected or unexpected. The diagnosis itself was experienced as a "shock," a "relief," or a "wake-up call." Participants worked to find an explanation for why they had diabetes and in a crisis stated, "I look to the Lord for strength." Several participants explicitly stated that because of diabetes they no longer felt invincible. However, most were able to easily perform the SMBG check, and this made them express

statements of competence, "It's just a little prick." Participants who struggled to believe they had diabetes reported that SMBG confirmed their diagnosis by removing, "question marks." As the experience of diabetes created a fear of loss of health, SMBG provided assurance to participants when they were able to see their readings and know they were "some kind of O.K.." While the diagnosis of diabetes frightened many of the participants, as one participant said about SMBG, "Well, ah... it is kind of fun, I think, when you can see how your body is reacting to different things." Another said, "I don't know what I would do without it....Like if I have had a really bad 2 or 3 days. I like to do the lunch time just to know that there is some time in my day when it is normal."

Most of the participants expressed ways in which checking improved their anxiety related to diabetes being out of control. People used the SMBG for security to "play it safe." Most found the information helped them know where they were and this provided a feeling of comfort. One participant explained how she moved her checking to a time when she could more reliably achieve a "normal" reading because these readings made her feel more secure.

All participants had been asked to check twice a day for 3 days a week and not check for 3–4 days (Table 1). Most people did not like this schedule of checking because it made them feel uneasy on the off days. Most participants responded with a desire to check three or four times a day. Wanting to check more frequently was often related to the desire for the reassurance that BG readings brought.

Although most participants indicated a desire to check more often, one man stated that he was not checking according to the structured SMBG guideline because he often forgot to check. In addition, two women were not checking according to the structured SMBG guideline due to cost concerns. One participant described how the cost of checking "closed a door" for her. She was not currently checking her blood sugar due in part due to not wanting to file an insurance claim. She believed avoiding a claim would prevent her insurance company from having knowledge of her diabetes diagnosis. All participants who followed up had improved their A1C values despite the January endpoint of the study, when seasonal variations historically inflate A1C values (Dasgupta et al., 2007).

4.2 | Behaviour change experience

The experience of SMBG in the context of 'Behavior change' expressed the active problem-solving theme of "figuring it out." Participants who experienced the structured SMBG model often found the BG readings surprising. These participants were actively attempting to understand what contributed to the readings that they obtained. One common theme was confusion, "I just don't know why it does that." As participants worked to understand their readings, SMBG readings confronted them with questions such as "what is it about your digestion or whatever makes it do that?" In addition, SMBG caused them to consider new information in a variety of life situations, sometimes surprising participants that "one little item could make it go so high." Participants would contemplate behaviour

change in response to their readings. After weeks of monitoring, her BG response to eating and exercise one woman began taking Metformin to treat T2DM. Seeing the response, her BG had to the medication helped her accept medical treatment for diabetes. Participants expressed positive self-statements about diabetes such as, "I can control it. It doesn't have to control me." Finally, the participants spoke of the motivating nature of SMBG, "The numbers make me do."

Participants most often discussed SMBG in relation to how it informed dietary changes. However, stories of the impact of stress and exercise on BG readings were also told by the participants. Self-monitoring itself changed eating habits in ways not previously known to this investigator. The anticipation of checking blood glucose 2 hr postprandial prevented after-meal snacking. One person also seemed to believe that she had to eat to check her blood sugar. She had a previous pattern of not eating breakfast or mid-day and so she often ate these meals to check her reading 2 hr afterwards.

Participants' narratives provided numerous examples of how SMBG functioned to support their health behaviour change. Many times adopting new health behaviour began with a moment of insight experienced with SMBG. Participants then experimented with SMBG in their life context and with new health behaviours to "figure out" how their body responded. The process of health behaviour change was similar across behaviours related to healthy eating, being active, handling stress and smoking cessation. Each of these is key elements of self-management. The process was fluid. The BG numbers played a role in their figuring out of their body's response to various contexts.

4.3 | Routine checking experience

The experience of 'Routine checking' was expressed as "I make my numbers." In the 'Routine checking' context, there was less evidence of active behaviour change. For these participants, SMBG meant "I am doing something about it," "I am competent," "I am in control," and "I know it is not that way anymore." Participants did not want to check less than once a day if they could afford check strips. To them, SMBG meant they were in control and doing something about their health behaviours, "It is not that way anymore." In the 'Routine checking' context, participants said they had new health behaviours that checking encouraged them to "walk a little more," "eat a little less" and also provided them with comfort that they were "doing something" about their condition.

The congratulating and comforting function of SMBG motivated the "figuring it out" of behaviour change and the ongoing maintenance work of routine by rewarding those who could "make their numbers." A male participant provided insight into how SMBG functioned as a visual cue to motivate behaviour by keeping diabetes out in the open when other physical symptoms of the disease were not evident. As behaviour change became routine, SMBG functioned to maintain healthy behaviours and restrain less healthy behaviour.

In summary, SMBG functioned to confirm diagnosis "the numbers say I have diabetes"; comfort "I am some kind of O.K." and "I

like to know where I am at"; cause consideration of health behaviour "I just don't know why it does that"; and congratulate "I am doing something about it." All of the participants, even the one participant who had not yet accepted his diagnosis, provided narrative evidence of adopting new health behaviours. SMBG contributed to pattern identification during all three time periods in a meaningful way.

5 | DISCUSSION

The Enhanced SMBG findings interpret the SMBG functions across three common diabetes illness experiences. These qualitative findings have future research and clinical implications. The findings are helpful in interpreting findings of SMBG studies. For example, Young et al. (2017) in a random control trial reported that SMBG had no significant impact on 1-year diabetes outcomes in people with non-insulin-requiring T2DM. Their SMBG intervention employed once daily use of a glucometer that provided advice in response to BG readings at goal, or mildly and very elevated. These messages were primarily statements such as "This number is a bit off target. Remember to check again tomorrow morning before eating" (p. 9 e-supplement 2). Although health technology such as activity trackers and calorie counters shows promise for distinct behavioural health tasks such as exercise and diet, this particular glucometer technology did not engage with the complexity of the diabetes illness experience. The glucometer's artificial intelligence was unable to collaborate in the wax and wane of diabetes self-management that people living with diabetes experience. The complexity of the diabetes illness experience may explain the variation in research reports testing the efficacy of SMBG. In addition, studies of structured SMBG often do not acknowledge the important role of the clients' support system (Dwarswaard, Bakker, Van Staa, & Boeije, 2016). These variables confound the evidence for BG checking efficacy (Al Sayah et al., 2013; Copeland et al., 2015).

Evidence from the Enhanced SMBG study supports the use of SMBG for self-management of diabetes. Hooft, Dwarswaard, Jedeloo, Bal, and Staa (2015) diagram the connections between contexts, mechanisms and outcomes of self-management for chronic conditions. The diagram represented three core outcomes present in chronic conditions including behavioural change, coping and self-efficacy (Hooft et al., 2015). The mechanisms identified by Hooft et al. (2015) included knowledge, skills and motivation. All of these outcomes and mechanisms were evident in the illness experience narratives of participants in the Enhanced SMBG study. Structured SMBG provided knowledge and motivation that support behaviour change, coping and self-efficacy.

The three time periods of the diabetes illness experience are consistent with the Transtheoretical model and stages of change theory (Table 2). Following a diagnosis of diabetes, Enhanced SMBG participants experienced stages of precontemplation or contemplation. Either by never expecting a diagnosis of diabetes (precontemplation) or by anticipating that diabetes would be part of their life due to family experiences with the condition (contemplation). Once

diagnosed, the SMBG functioned to confirm that BG was not normal even when the client did not feel in any way ill. Most participants moved into the action stage, 'Behavior change,' and used SMBG to explore how modifications in diet, exercise and/or medication impacted their BG readings. Consistent with the maintenance stage, many participants continued to check BG during 'Routine checking.' During this stage, participants used SMBG to make small adjustments in their routines to stay on track. Unlike studies that reported no behaviour change occurring in response to SMBG (Benhalima & Mathieu, 2012; Blevins, 2013; Young et al., 2017), the Enhanced SMBG participants describe restraining and maintaining health behaviours during 'routine' testing. This internal process of regulatory efficacy may be difficult to measure and perhaps contributes to the appearance of inaction in response to SMBG. This demonstrates the day-to-day evaluation and problem-solving potential of SMBG even in the absence of overt behaviour change.

The Enhanced SMBG findings contribute to the theoretical understanding of the role of SMBG as a cue to action in diabetes self-management. Dlugasch and Ugarizza (2014) discuss SMBG as a cue in T2DM self-care. Their model includes checking (evaluating/validating), establishing a pattern (regular or sporadic) and responding (feeling emotions and taking actions). All of these actions were evident in the participants of the Enhanced SMBG study. These participants clearly described that their SMBG feelings and behaviours differed with stages of the participant's diabetes illness experience.

Clinically, nurses can listen for the client's "But now" statements that indicate a quest narrative and the clients' adoption and maintenance of a new way of living with their chronic condition. In response, nurses have an opportunity to provide a strong emotional base with a regulatory self-efficacy question such as, "how likely are you to continue with this change?" Followed by asking the client, "why is your confidence not lower?," these questions provide clients with an opportunity to make positive self-statements and supports them as they continue to maintain their health routines. In addition to strengthening self-efficacy, the following paragraphs include suggestions for improving the effectiveness of SMBG for engagement with self-management.

5.1 | Acknowledge common client experiences

One goal of the structured SMBG guideline was to identify when BG was most problematic. Participants did not like finding BG problems and did not like checking after a meal due to the elevations in the BG values. Their goal in checking was to provide comfort during a time when they felt extremely threatened by a diagnosis they associated with death, loss of limb and suffering. Despite this discomfort, most participants eventually became confident enough to begin "looking for trouble." Acknowledging the common desire to check for comfort normalises, this feeling for clients may be the first step towards an open discussion of the participant's readiness to begin checking for health behaviour change instead of checking for comfort alone. Next, use the MI technique, decisional balance:

"What are the good aspects about not checking for BG problems? What are the not so good aspects?." Nurses should shape how they introduce problem-solving, recognising that checking to identify problem BG readings is difficult, but necessary, for clients. These findings are consistent with the clients' expectation that healthcare providers use SMBG information to change diabetes therapy, and providers' expectation that clients use SMBG information to change their health behaviour (Peel, Douglas, & Lawton, 2007). Awareness of these differences in client and provider perceptions is critical to shared understandings that have the potential to improve health communication. Acknowledging feelings and negotiating clearly communicated goals for SMBG is likely to strengthen the efficacy of SMBG for metabolic control in T2DM (Powers et al., 2017).

5.2 | Let the numbers do the talking

Participants expressed satisfaction with the factual and exploratory approach used to teach them about their T2DM. Although those with the lowest A1C (A1C \leq 6.4%; 46.4 mmol/mol) had the most difficulty believing their diagnosis, they said that seeing the numbers helped confirm their DM diagnosis. Perceived treatment efficacy is particularly problematic for people with T2DM (Polansky & Skinner, 2010). Starting with SMBG to learn about diabetes may support the acceptance of medical treatment. Allowing a period of time for participants to check their BG at different times and under different situations appeared to improve their acceptance of a diabetes diagnosis and treatment. In this way, the diabetes illness experience of taking medication was clearly supported with SMBG.

5.3 | Clients value routine checking

As the novelty of SMBG wore off, people began to be able to predict how their body would respond to various foods or activities. The structured SMBG guideline attempted to move people to paired checking 3 days a week. However, participants were reluctant to check less than once a day even though some participants stated that one check alone did not provide enough information. They did not want to save 1 day's check strip to check twice on 3 days. They wanted to check as a reminder to prevent diabetes from becoming "out of sight, out of mind" but they no longer had strong emotional reactions to elevated blood sugar readings. If readings were elevated, participants considered eating a little less or differently and exercising more. This finding is in contrast to the report that people checking once daily do not respond to their BG readings (Wang et al., 2012; Young et al., 2017). These participants stated that they could "make their numbers" but they were less confident that they would. None of the participants wanted to check less often than daily if they could afford the check strips. Some researchers have suggested structuring SMBG by taking a seven-point profile for 3 days. This strategy would consume a 3-week's supply of check strips in 1 week and is in conflict with this expressed need of these participants. The routine of checking helped keep them in line with their own goals. Participants criticised others with T2DM who were not checking

because checking was perceived as evidence of taking control of diabetes.

5.4 | Listen to the journey

Structured SMBG frames BG checking as an exploration of the body's response to eating, activity, medication and stress. Participants stated that the personal nature of their health care was important to them. One participant described it as "It is the listening that I want." Another participant found it helpful that information was presented to her factually and then she was asked to see what she could do. She described this as "not patronizing." The belief "I can do that" reflects the need for control that is common to illness experiences in general (Kleinman, 1988). The desire to have diabetes care personalised is consistent with researchers who reported that it is the relationship more than the educational classes that are important for behaviour change (Furler et al., 2008). One participant was critical of a former healthcare provider who pointed him to the Internet for diabetes-related information. Staff, Garvin, Wiréhn, and Yngman-Uhlin (2017) concluded that Non-Nordic immigrants requested individually tailored diabetes management. Likewise, participants in this study expressed a desire to have their T2DM management personalised to their lives. Diabetes healthcare providers can learn to help those early in the disease process to appraise T2DM through SMBG.

Understanding the functions of SMBG in T2DM can guide nurses as they work with clients to improve diabetes health outcomes. Most healthcare providers have a preference for the "problem solving" function of SMBG. However, clients benefit from a healthcare provider who identifies the realities of clients' illness experience and supports clients as they make decisions, seek understanding of diabetes and make health behaviour choices. In the spirit of MI, client-centred collaboration recognises and incorporates the SMBG functions to enhance engagement with self-management.

5.5 | Limitations

The participants in this study do not represent a population. The structured SMBG intervention was necessarily relational and it is not known how or if this relationship influenced the findings. The findings of this study cannot support a correlation or cause and effect relationships between SMBG and diabetes health outcomes. The participants were newly diagnosed (<2 years) and may not represent the experience of people with long-standing diabetes.

6 | CONCLUSION

The model of SMBG functions by illness stage (Figure 1) illustrates the participants' experience with Enhanced SMBG. Focused listening contributed to this interpretive description of the T2DM illness experience. Nurses can identify the client's SMBG context using the model of SMBG functions and using MI to guide collaborative

decisions surrounding the application of SMBG for DSME-S. This study adds to the understanding of the fluctuating role of BG checking during three states of the T2DM illness experience ('Diagnosis,' 'Behavior change,' and 'Routine checking'). The study adds a new finding that self-monitoring creates unique personal explanations of how health behaviour impacts BG readings. The study corroborated findings that people check BG to confirm their T2DM diagnosis, to console their diabetes-related fears, to activate behaviour change and to congratulate their diabetes self-management efforts. In addition, these findings support the logical adequacy of the Transtheoretical model and change theory for clinical practice (Table 2). This study corroborates other research related to the use of SMBG during diagnosis and behaviour change. It is novel in its presentation of evidence related to how SMBG maintains healthy behaviour change and restrains old habits even when it may appear that nothing is being "done" with the readings. The model of SMBG functions by illness stage provides an interpretive description of this client-centred process.

7 | RELEVANCE TO CLINICAL PRACTICE

Healthcare providers can guide the use of SMBG to best serve the joint needs of both the client and the provider by identifying the clients' responses to their BG readings and engaging the client with the use of MI to support self-management. In a joint position statement, the ADA, American Association of Diabetes Educators and the Academy of Nutrition and Dietetics, acknowledges that people with T2DM need clear communication and collaboration for effective diabetes self-management (Powers et al., 2017). The evidence-based, client-centred and cooperative approach to use of structured SMBG as described in this study prepares and supports a client for his/her diabetes self-management.

Future research that measures the impact of structured SMBG should consider the context of the BG checking when evaluating the impact of checking on behaviour (Jonkman et al., 2017). In addition, the model of SMBG functions by illness stage (Figure 1) may benefit researchers evaluating content and construct validity for T2DM SMBG measures. Differences may exist between those who do and those who do not use SMBG as part of their T2DM management. Further research of clients' who do not use SMBG to regulate their diabetes self-management would contribute to a broader understanding of diabetes self-management.

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CONFLICT OF INTEREST

No conflict of interest is identified.

CONTRIBUTIONS

Study design: DEB; data collection and analysis: DEB; and manuscript preparation: DEB.

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