The Experiences of Self-Monitoring of Blood Glucose Usage of Adults with Type 2 Diabetes Mellitus who are not using Insulin

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THE EXPERIENCES OF SELF-MONITORING OF BLOOD GLUCOSE USAGE OF ADULTS WITH TYPE 2 DIABETES MELLITUS WHO ARE NOT USING INSULIN

By

Lucie Bouffard Dlugasch

A DISSERTATION

Submitted to the Faculty of the University of Miami in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Coral Gables, Florida

June 2009
UNIVERSITY OF MIAMI

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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The Experiences of Self-Monitoring of Blood Glucose Usage of Adults With Type 2 Diabetes Mellitus Who Are Not Using Insulin

Abstract of a dissertation at the University of Miami.

Dissertation supervised by Professor Doris Noel Ugarriza
No. of pages in text. (146)

The purpose of this study was to analyze the experiences of self-monitoring of blood glucose (SMBG) usage of adults with type 2 diabetes mellitus (T2DM) who are not using insulin. The sample consisted of 11 women and 8 men who were Caucasian Americans, 38 to 79 years of age. Data were analyzed using the grounded theory method including open and axial coding and the constant comparative method. The theory of “SMBG as a Cue in T2DM Self-Care” emerged from the data and is composed of four categories (a) Engaging, (b) Checking, (c) Responding, and (d) Establishing a Pattern.

Engaging marks the beginning of SMBG. Participants began on the recommendation of their physician and monitored between 2-6 times a day. Participants monitored because of curiosity and over time reduced or kept their initial frequency. Checking occurs when the blood glucose is obtained. Two subcategories emerged: Evaluating and Validating. The main items participants evaluated or validated were the effects of foods in relation to blood glucose levels.

Responding involves reacting to SMBG. Two subcategories emerged: Taking Action and Experiencing Emotion. Most actions involved changing foods consumed. Participants described feeling conflicted and “being bad” when not following through
with an action. Emotions such as blame and fear were experienced when blood glucose levels were higher than normal, while happiness was experienced with normal levels.

Establishing a Pattern occurs when participants decide on how often to monitor. Two subcategories emerged: Using Regularly and Using Sporadically. The pattern developed was based on obtaining “normal” blood glucose patterns or on the absence of ill symptoms of T2DM. Healthcare provider disinterest in SMBG and fingertip pain contributed to a decreased monitoring frequency. Participants described cyclical, iterative episodes of Checking, Responding, and varying their established patterns throughout their experiences with monitoring.

Participants discussed the value and struggles of SMBG in a T2DM self-care regimen. The theory of SMBG as a Cue in T2DM Self-Care could be used to guide the development of effective intervention strategies to help individuals with T2DM achieve blood glucose control which, in turn, leads to avoidance of ill symptoms and complications of T2DM.
Acknowledgement

On this long journey I have been blessed by so many people who have supported and encouraged me along the way. First, a heartfelt thanks to my dissertation chair, Doris Ugarriza, for listening, being an incredible mentor, and believing in me. I am grateful to my committee for their suggestions and guiding me in completing my dissertation. A big thanks to Dr. Hans Graber and Kent Wreder who listened and offered me technical assistance and to David Gray and Lance Brown who edited my paper. To all my many wonderful friends who checked in on me and listened to all my trials and tribulations throughout these many years and kept me sane -- a very special thanks. To my mother, the eternal optimist and cheerleader, I would have given up long ago if it was not for you!!!!!!! Mom, I love you dearly.

All my love to my three daughters, Analise, Lauren, and Nicole for understanding and being patient and cheering me on. You can now make noise, leave the office door open, and “bug” me all you want! I love you more…

To my husband, Philip, who worked as much as I did throughout these years, words are not enough to express my thanks. You were patient, tolerated my moods, and understood and supported my desire to accomplish this goal. You have always believed in me more than I have believed in myself. I love you.
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Chapter 1

Statement of Problem

Approximately 17.9 million individuals in the United States have diabetes mellitus (DM) (Centers for Disease Control and Prevention [CDC], 2008). Another 5.7 million individuals probably have DM but are not yet diagnosed (CDC, 2008). Of these individuals, 90 - 95% has type 2 DM (T2DM). DM is the seventh leading cause of death and its occurrence is related to a high morbidity. The expenditures attributable to DM in the United States in 2007 were estimated to be $174 billion, which is a $42 billion increase over five years. (American Diabetes Association [ADA], 2003; ADA, 2008). The number of individuals with T2DM and, consequently, the costs are expected to continue to grow substantially.

Even with an explosion of scientific understanding of the pathophysiology, prevention, control, and treatment, helping individuals manage T2DM remains a challenge for nurses. Traditional treatment is insufficient in prevention and control. The importance of engaging, empowering, and helping individuals to self-manage T2DM is considered a key in the successful management of T2DM (Kennedy, 2001; Peel, Douglas & Lawton, 2007; Renard, 2005).

Self-monitoring of blood glucose (SMBG) was introduced approximately 30 years ago as part of a treatment plan to empower individuals with T2DM to make necessary lifestyle or pharmacologic changes to achieve blood glucose control (Sonksen, Judd, & Lowy, 1978; Walford, Fale, Allison, & Tatersall, 1978). Achieving blood glucose control, in turn, leads to avoidance of ill symptoms and microvascular (retinopathy, neuropathy and nephropathy) and possibly macrovascular (ischemic heart

According to the ADA clinical practice recommendations (2009), engaging in SMBG is considered a tool for individuals to adjust dietary therapy, exercise, and medication to achieve specific blood glucose goals more easily. Additionally, SMBG can be used in detecting hypoglycemic episodes (ADA, 2009).

Despite the years of SMBG use, the role of SMBG for individuals who use insulin infrequently or take oral agents only or controlled by dietary means only continues to be unclear and based on expert consensus or clinical experience and not on adequate research (ADA, 2009). Yet, SMBG continues to be a regular recommendation in practice guidelines. One of the Healthy People 2010 national objectives is to increase the frequency that individuals with T2DM perform SMBG to at least once a day (U.S. Department of Health & Human Services, 2000).

SMBG can be invasive, painful, and expensive. In 1998, accountants at the Kaiser Permanente Northern California Region, deemed SMBG strips the fourth largest outpatient pharmacy expense (M.B. Davidson, 2005). In 2002, nearly one-half billion dollars were spent on behalf of Medicare clients who were not taking insulin. The expenses were for reagent strips, lancets, lancing devices, meters, batteries, and calibration solutions or chips (M.B. Davidson, 2005).
Most of the clinical recommendations for the use of SMBG for individuals with T2DM who are not using insulin are based on research with individuals with type 1 DM (T1DM) who require lifelong insulin administration or with individuals with T2DM who use insulin (Welschen, et al., 2005). Researchers of SMBG have primarily focused on trying to determine the optimal frequency and timing of performing SMBG with most using hemoglobin A1C (HgA1C) as an outcome (Harris, 2001; Hoffman et al., 2002; Murata et al., 2003). While research to understand the effects of SMBG on the HgA1C value is important, the researchers failed to explain how and why some individuals achieve blood glucose control with SMBG use and others do not (McAndrew, Schneider, Burns, & Leventhal, 2007). Likewise, understanding practice patterns and characteristics of those who engage in SMBG provides insight into groups to target but again this knowledge is insufficient to explain the reasons for the practice patterns or why some individuals engage in SMBG and others do not.

Performing SMBG has the potential to empower and provide valuable information to an individual with T2DM. This empowerment can lead to better self-management which in turn would lead to blood glucose control and reduction of ill symptoms and complications of T2DM. Blood glucose control has been associated with a reduction in microvascular and possibly macrovascular complications of T1DM and T2DM (Gerich, 2005; The ACCORD Group, 2008; The ADVANCE Group, 2008; The DCCT Research Group, 1993; UKPDS Group, 1998).

Little is known about the value individuals with T2DM who are not using insulin place on performing SMBG or what they think about SMBG and the information obtained from monitoring (McGeoch, Derry, & Moore, 2007; Peel et al., 2007).
Cognitive factors are considered primary mediators of health behavior performance (Conner & Norman, 1998). Basing the effectiveness of SMBG solely on HgA1C may be inappropriate as SMBG, in itself, does not improve blood glucose control. SMBG is only useful if the information obtained is actually used to help an individual adhere to a regimen or make healthier lifestyle choices. With a better understanding of SMBG, healthcare providers may be able to develop better SMBG practice guidelines. Knowledge regarding SMBG psychosocial experiences can then be incorporated into SMBG educational curriculums and more effective recommendations.

Few studies have been implemented to examine the experiences of SMBG of adults with T2DM who are not using insulin (Bjorness et al., 2003; Hjelm, Nyberg & Apelqvist, 2001; Peel et al., 2007; Peel, Parry, Douglas & Lawton, 2004; Stewart et al., 2004). Of the few studies, most had populations consisting of individuals with DM using insulin (Hjelm et al., 2001; Stewart et al., 2004). Most of the studies lacked a theoretical framework (Bjorness et al., 2003; Franciosi et al., 2001; Hjelm, et al., 2001; O’Kane, Bunting, Copeland & Coates, 2008; Peel et al., 2004; Stewart et al., 2004). Methodological flaws made data interpretation difficult (Hjelm et al., 2001; Peel et al., 2004). Other limitations of these studies were the focus on individuals with T2DM who were newly diagnosed (Peel et al., 2004) and only evaluating whether individuals adjusted their therapy shortly after they obtained their blood glucose level (Bjorness et al., 2003).

Therefore, this well-designed qualitative study was conducted to describe the process and experiences of SMBG. A qualitative research method, such as grounded theory used in this study was and is the best way to collect and analyze data about
complex phenomena such as feelings, thought processes, and experiences associated with SMBG.

**Purpose**

The purpose of this study was to analyze the experiences of SMBG usage of adults with T2DM who are not using insulin. A second purpose was the possible development of a theory of self-monitoring of blood glucose which could be used to guide the development of effective intervention strategies to help individuals achieve blood glucose control.

**Research Question**

The question guiding this research study was “What are the experiences of SMBG usage of adults with T2DM who are not using insulin?” Questions that were asked during the interviews included:

1. What were your SMBG experiences when you first started monitoring?
2. Have your experiences with monitoring changed over time? If so, how?
3. What are some things that negatively or positively influence your decision to monitor?
4. What thoughts do you have when you see your blood glucose value (from self-monitoring)?
5. What do you learn from self-monitoring?
6. How does the feedback from SMBG fit in with what you are doing for your DM?

A grounded theory design was used for the study. In grounded theory methodology the research question provides focus and clarity about the phenomenon of interest (Speziale & Carpenter, 2007). Consistent with grounded theory methodology, the study focus was refined as data were generated. While the questions were asked of
all participants, the study focus was refined through the use of the technique of the constant comparative method used in grounded theory. When using the constant comparative method the researcher conducts an interview and analyzes the interview prior to proceeding with any further interviews. This technique is used with each interview. Findings from the interviews serve as a basis for guiding subsequent interviews.

Grounded theory, as a qualitative method, is useful in analyzing phenomena where little or no research has been done (Corbin & Strauss, 2008; Stern, 1980). The emphasis in grounded theory on analyzing structure (why) and process (how) is particularly useful in capturing the dynamic, evolving, and complex nature of the health behavior of SMBG. The experiences of SMBG are dynamic as individuals engage in the act of SMBG usually several times a day to several times a week. Individuals also engage in SMBG over extended periods of time. SMBG can be a complex health behavior. Grounded theory methods are suited to capturing the essence of SMBG as a dynamic, evolving and complex process.

Summary

This study was undertaken to describe and analyze the experiences of SMBG usage of adults with T2DM who are not using insulin. A theory of SMBG was generated using grounded theory methodology. The chapter that follows provides a theoretical overview of SMBG and a review of the literature regarding SMBG. Subsequent chapters present the study design, findings, and the discussion of the findings.
Chapter 2

Theoretical Framework

SMBG Overview

A multitude of techniques and devices exist to increase peoples’ awareness and focus on their performance in many health and illness states. With this knowledge, individuals can then make self-care decisions related to their health state (Mossavar-Rahmani et al., 2004; Renard, 2005). Individuals can share the information they obtained through self-monitoring with their healthcare providers who can also provide feedback regarding the self-monitoring data and guide individuals on how to engage in healthier behaviors (Bergenstal & Gavin, 2005; J. Davidson, 2005).

Self-monitoring may occur through the use of reflective writing such as journaling or through the use of devices that provide information on a variety of physiological measures. Journaling notes can be kept in a written or an electronic format. Individuals who journal might gain insight into their behavior and use the information to make changes. Additionally, with electronic journaling, data collected can be transmitted across long distances. These data can be shared with a healthcare professional who can provide feedback about performance and status (Kwon et al., 2004). Many devices are available to help individuals self-monitor a variety of physiological measures. These devices include, but are not limited to (a) blood glucose monitors, (b) scales to measure weight, (c) portable coagulometers used in self-adjusting anticoagulant therapy (Schulman, 2005), (d) portable blood pressure cuffs (Cappuccio, Kerry, Forbes, & Donald, 2004), (e) peak expiratory flow devices to help individuals with asthma make management decisions (Powel & Gibson, 2005), (f) thermometers to measure
temperature, and (g) infrared temperature sensors to measure lower extremity
temperature to prevent ulcerations (Lavery et al., 2004).

SMBG was introduced approximately 30 years ago as a tool to allow individuals,
as opposed to healthcare professionals only, to assess blood glucose status. Researchers
(Sonksen, et al., 1978; Walford, et al., 1978) initially investigated SMBG use in
individuals with DM who were using insulin. Eventually SMBG use became part of the
standard of care for individuals with T1DM and T2DM regardless of insulin
administration (ADA, 2009). By performing SMBG and knowing their blood glucose
status, individuals with T2DM are able to regulate the administration of their own
medication, and engage in healthy behaviors such as exercise and eating healthier (Ipp,
Aquino, & Christenson, 2005; Renard, 2005). Engaging in healthy self-care behaviors is
the primary method for individuals with T2DM to achieve blood glucose control (Ipp et
al., 2005; Peel et al., 2007; Watkins et al., 2000).

Blood glucose control is a fundamental outcome of a successful T2DM
management plan. Maintenance of tight blood glucose control can improve quality of life
and avoid or decrease microvascular (retinopathy, neuropathy and nephropathy) and
possibly macrovascular (ischemic heart disease, cerebrovascular disease and peripheral
vascular disease) complications that occur with T2DM (Gerich, 2005; The ACCORD
Group, 2008; The ADVANCE Group, 2008; The DCCT Research Group, 1993;
UKPDS Group, 1998). The microvascular complications begin at the onset of the
development of chronic hyperglycemia. Macrovascular complications may begin prior to
the diagnosis of DM. Identification of persons at risk for DM and early diagnosis of DM
are critical because vascular dysfunction due to impaired fasting glucose levels probably
begins 10 to 12 years before a DM diagnosis (ADA, 2009). Cardiovascular risk factors are the leading cause of morbidity and mortality in T2DM (Gerich, 2005; Laakso & Lehto, 1997).

The two primary techniques for evaluating blood glucose control are HgA1C and SMBG measurements. HgA1C levels are the standard for evaluating long term blood glucose control. The HgA1C level represents the fraction of hemoglobin that results from linkage (glycation) of glucose to erythrocyte cell hemoglobin. Average erythrocyte lifespan is 120 days and therefore, the HgA1C is reflective of prevailing and average blood glucose level over 2-4 months (ADA, 2009; Jeffcoate, 2003; Renard, 2005). HgA1C levels are not reflective of specific variations, frequent shifts, or wide excursions in daily blood glucose levels. HgA1C levels are, however, a reliable indicator of overall blood glucose status and can be used as a measure of treatment therapy (Renard, 2005). Additionally, the HgA1C has a strong predictive value for the incidence of DM complications (ADA, 2009). The HgA1C has been well correlated with mean plasma glucose level and that relationship is demonstrated in Table 1 (Nathan, et al. 2008)

<table>
<thead>
<tr>
<th>HgA1C mmol/L</th>
<th>Estimated Average Glucose mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0</td>
<td>126</td>
</tr>
<tr>
<td>6.5</td>
<td>140</td>
</tr>
<tr>
<td>7.0</td>
<td>154</td>
</tr>
<tr>
<td>7.5</td>
<td>169</td>
</tr>
<tr>
<td>8.0</td>
<td>183</td>
</tr>
<tr>
<td>8.5</td>
<td>197</td>
</tr>
<tr>
<td>9.0</td>
<td>212</td>
</tr>
<tr>
<td>9.5</td>
<td>226</td>
</tr>
<tr>
<td>10.0</td>
<td>240</td>
</tr>
</tbody>
</table>
SMBG measurements, on the other hand, are reflective of actual “real time” blood glucose levels at the time of testing. In contrast to HgA1C, SMBG levels are reflective of specific variations, frequent shifts, and wide excursions in daily blood glucose levels that occur in DM. The ability for individuals with T2DM to have immediate feedback regarding their blood glucose levels allows individuals to evaluate the circumstances surrounding daily blood glucose variations and implement therapeutic modifications.

A diagnosis of T2DM is made when the fasting plasma glucose is ≥ 126 mg/dl or when there are symptoms of hyperglycemia and a casual (non-fasting) plasma glucose of ≥ of 200 mg/dl (ADA, 2009). The blood glucose goal recommendations for adults with diagnosed T2DM are an HgA1C of < 7.0 mmol/L (normal 4.0-6.0 mmol/L); preprandial glucose of 70-130mg/dl and a postprandial glucose of <180 mg/dl. Maintenance of HgA1C and blood glucose levels in the aforementioned ranges is associated with a reduction in microvascular and macrovascular complications (ADA, 2009). In the UK Prospective Diabetes Study (1998) each 1% reduction in HgA1C resulted in a 37% decrease in risk for microvascular complications.

SMBG, as a technique, involves the placement of a drop of capillary blood onto a reagent strip for analysis with a monitor. The blood is obtained by pricking the fingertip or forearm with a needle (lancet). The result obtained is reflective of immediate blood glucose status (Bergenstal & Gavin, 2005). The amount of blood needed can vary from as much as ≥ 5 µl to as little as 0.3 µl. The time needed to get a result can range from as short as 5 seconds to as long as 30 seconds (Bode, 2005).

Prior to obtaining a blood sample, the monitor needs to be turned on and prepared for blood analysis. The skin to be pricked should be cleansed. The amount of time and
skill needed to prepare a monitor varies by the type and brand. The monitor also needs maintenance and quality checks in order to obtain the most accurate results (Renard, 2005). Monitor preparation and maintenance may include cleaning, calibration, and battery replacement. Quality checks, such as checking strip expiration and proper storage, need to be performed. Troubleshooting skills may be necessary when problems arise. Data such as blood glucose levels, medication, meals eaten, and so forth can be stored into the memory of some monitors. This information can then be downloaded to a computer for review and printing (Benjamin, 2002).

Performing SMBG from a technical standpoint may be viewed as painful, inconvenient and difficult to understand (Craddock & Hawthorn, 2002; Peel et al., 2007; Reed, Ashton, Lawrence, Hollinghurst, & Higgs, 2003). Non-invasive technologies (i.e. obtaining blood without skin pricking) of SMBG have been developed but are not yet tested and available for widespread use (Klonoff, 2005). Monitors with voice synthesizers for individuals unable to read monitors are also being developed.

Education is crucial in proper performance of SMBG (J. Davidson, 2005; Reed et al., 2003; Renard, 2005). National standards for T2DM self-management education (DSME) have been created by a national task force that includes federal agencies, organizations and federally funded programs involved with T2DM. The standards were developed to define quality DSME (Mensing et al., 2006). One of the 10 standards is a list of core topics to be covered in DSME. One of the topics is the monitoring of blood glucose and using the results to improve control. The exact content and manner in which blood glucose monitoring is taught is not specified but rather left up to individual centers and providers to develop and teach.
Education might be taught in a group format or one-to-one led by a healthcare professional such as a nurse, physician, or nutritionist. Long term support from a healthcare provider or educator is important to continually foster an understanding of self-monitoring (J. Davidson, 2005; Ipp et al., 2005; Renard, 2005). Periodic evaluation of technical performance is also essential (ADA, 2009; Reed et al., 2003; Renard, 2005). Combining educational activities with behavioral strategies is important to enhance lifestyle changes (Whittemore, 2000). One of the DSME standards specifies that instructors need specialized training in behavioral interventions, teaching and learning skills, and counseling skills (Mensing et al., 2006).

Individuals performing SMBG need to have sufficient cognitive capacities to use a monitor (J. Davidson, 2005). Cognitive capacities are necessary to understand how to use a device and interpret the values obtained (J. Davidson, 2005; Ipp et al., 2005; McGeoch et al., 2007). Interpretation of values and how to use the values to implement and adjust lifestyle and other therapeutic changes are critical to the successful implementation of SMBG use (ADA, 2009; Blonde & Karter, 2005; Peel et al., 2007; Renard, 2005).

The levels obtained from SMBG might be complex to interpret. The result obtained from SMBG is reflective of immediate blood glucose status and many factors relate to blood glucose status. Individual factors such as diet, medication, exercise, stress, and illness and T2DM disease state should be considered when interpreting blood glucose levels (Linekin, 2002; Renard, 2005). Varying the timing of SMBG can provide insight into the effect of food, exercise, and medication; therefore, performing SMBG at different times during the day and week can be beneficial in providing a more
comprehensive blood glucose profile. The optimal frequency for SMBG performance has not been established (ADA, 2009; Blonde & Karter, 2005; Renard, 2005). Also, malfunctioning equipment or improper performance during blood sampling can falsely alter a level obtained.

The consequences of SMBG performance might be physiological in nature, such as improved HgA1C which is an indicator of blood glucose control or psychosocial such as empowerment, motivation, and feedback. SMBG, however, does not directly affect blood glucose status but rather provides information from which action may be taken. SMBG is purported to empower individuals to become better self-managers. The empowerment in SMBG is postulated to occur by increasing an individual’s awareness. With the information provided through SMBG an individual can decide whether action is necessary or not (Bergenstal & Gavin, 2005; Ipp et al., 2005; Renard, 2005). SMBG is reported to serve as a motivational tool to initiate behavioral change (Bergenstal & Gavin, 2005; J. Davidson, 2005; Renard, 2005). Self-monitoring, however, only provides documentation and not necessarily a change in any condition (Ipp et al., 2005).

Literature Review

SMBG Practice Patterns

Researchers (Bjorness et al., 2003; Hjelm et al., 2001; Karter, Ferrara, Darbinian, Ackerson & Selby, 2000; Price, 1993; Skelly et al., 2005; Stewart et al., 2004; Vincze, Barner, & Lopez, 2004;) have attempted to identify variables that influence SMBG practice patterns, characteristics of those who monitor and those who do not and barriers to engagement in SMBG. Individuals who use medication therapy for T2DM engage in SMBG more often than those who are on diet therapy only (Bjorness et al., 2003; Skelly
et al., 2005; CDC, 2007). Those who use insulin, whether they have T1DM or T2DM monitor more often than those using oral medications only (Bjorness et al., 2003; CDC, 2007; Hjelm et al., 2001; Stewart et al., 2004). Individuals with T1DM engage in monitoring more often and do so more frequently than do individuals with T2DM (Karter et al., 2000; Vincze et al., 2004). Recommendations from a healthcare provider might lead to engagement or to abandonment of SMBG (Peel et al., 2007; Price, 1993; Skelly et al., 2005). However, the frequency recommended by a professional and what is actually practiced might differ significantly (Ruggiero et al., 1997; Vincze et al., 2004). The ADA (2009) recommends that SMBG should be performed up to three times a day for individuals using multiple insulin injections. The ADA (2009) does not have any optimal frequency recommendations for individuals who use insulin infrequently or are on noninsulin therapies or using dietary therapy alone. In a cross-sectional study of 41,363 adults with DM who were treated pharmacologically, Karter and colleagues (2000) found that 67% of individuals with T2DM do not perform SMBG at the frequency recommended by the ADA. The ADA, during the time frame of the study, recommended that individuals with T2DM who were treated pharmacologically engage in SMBG once daily (Karter, et al., 2000).

Barriers to performing SMBG or performance of SMBG with less frequency are lower educational level, increased out of pocket expense for supplies to monitor, difficulty with English (CDC, 2007; Karter, et al., 2000; Vincze et al., 2004) smoking, and alcohol use (Karter et al., 2000). Men monitor less often than do women (CDC, 2007; Karter et al., 2000). In a cross-sectional study of 44,181 adults with DM, Karter and colleagues (2000) found the longer the duration of a diagnosis of DM (odds ratio, 1.2
for T1DM and 1.1 for T2DM CI 95%; \( p < .05 \) the less often an individual will engage in SMBG but Hjelm and colleagues (2001) found the opposite i.e., the longer the duration of disease, the more likely SMBG was performed regularly (24.4% vs. 18.2%, \( p = .00 \)). Individuals who are African American, Hispanic American, or Asian/Pacific Islander were found not to monitor as often as Caucasians (Karter et al., 2000). For the Hispanic American and Asian/Pacific Islander groups, the decrease in monitoring frequency was attributed to difficulties in English language fluency. The researchers did not discuss possible reasons for decreased monitoring by African Americans. In a cross-sectional survey of 698 adults over the age of 65, Skelly and colleagues (2005) found no differences in monitoring frequency between African Americans versus Caucasians (odds ratio .66, CI 95%, \( p = .094 \)) and Native Americans versus Caucasians (odds ratio 1.0, CI 95%, \( p = .98 \)).

Discovery of practice patterns and characteristics of those who engage in SMBG provides directions about groups to target. Identification of barriers is important in understanding issues related to access, however, this information is inadequate to fully understand the role SMBG plays in T2DM self-management (Peel et al., 2007).

**SMBG Frequency and Timing**

Most publicized and accepted clinical recommendations of SMBG are based on research on evaluating the optimal frequency and timing in SMBG performance in relationship to blood glucose control. The recommendations for SMBG use are also based on research with individuals with T1DM who require lifelong insulin administration or with individuals with T2DM who use insulin (Welschen et al., 2005). SMBG, as a tool to achieve blood glucose control, is effective for individuals with T1DM...
and T2DM on insulin but, there is considerable controversy regarding its efficacy for individuals with non-insulin treated T2DM (Blonde & Karter, 2005; Coster, Gulliford, Seed, Powrie, & Swaminathan, 2000; Farmer et al., 2007; Ipp et al., 2005; McAndrew et al., 2007; McGeoch et al., 2007; Sarol, Nicodemus, Tan, & Grava, 2005; O’Kane et al., 2008; Welschen et al., 2005).

The results of two current and large reviews indicated that SMBG may be effective in fostering behaviors used in controlling blood glucose for individuals with T2DM but only in certain circumstances (McAndrew et al., 2007; McGeoch et al., 2007). These two reviews contained the summary results of all the research reviewed; however, meta-analysis was not conducted. McGeoch and colleagues (2007) reviewed three randomized clinical trials and 13 observational studies published since 1990. All participants in the studies had T2DM who were managed with oral medications and/or diet alone, had a HgA1C reported, and were diagnosed with T2DM for at least six months. All studies had a sample size of at least 50.

Because of the clinical heterogeneity of the studies, the reviewers were unable to perform a quantitative analysis. Instead, a qualitative analysis was performed by evaluating whether the results of the reviewed studies demonstrated an association between SMBG use and HgA1C. An association was defined as an appropriate statistical improvement. The reviewers found a statistically significant lower HgA1C with SMBG usage but only in the two larger randomized trials (Schwedes, Siebolds, & Mertes, 2002; Guerci et al., 2003). In the observational studies (e.g. Davis, Bruce, Davis, 2006; Karter et al., 2006; Soumerai et al., 2004) with larger sample sizes, which also tended to have participants with higher than normal initial HgA1C, there was an association seen
between SMBG and lower HgA1C. In the smaller observational studies (e.g. Rindone, Austin, & Luchesi, 1997; Weiland, Vigil, Hoffman, & Janis, 1997), with initial lower HgA1C, no association was found between HgA1C and SMBG use. The reviewers, therefore, concluded that SMBG may be beneficial in certain circumstances such as in individuals with poor blood glucose control or as an educational tool.

McAndrew and colleagues (2007) reviewed 9 cross-sectional studies, 9 longitudinal studies, and 11 randomized controlled trials that were published between 1990 and 2006. The purpose of the review was to evaluate the impact of SMBG on HgA1C levels and to explore mediators and moderators of SMBG within a self-regulation framework. All participants had T2DM and were not on insulin. The reviewers found data from the cross-sectional and longitudinal studies were inconclusive. Data from 6 (Guerci et al., 2003; Kibriya, Ali, Banik, & Azad Khan, 1999; Kwon et al., 2004; Rutten, van Eijk, de Nobel, Beek, & van der Velden, 1990; Schwedes et al., 2002; Seaton, 1996) of the 9 randomized clinical trials reviewed demonstrated a statistically significant reduction in HgA1C in participants who engaged in SMBG. The reviewers were unable to formulate a conclusion regarding mediators and moderators because there were not enough studies to evaluate these variables. The reviewers commented that a lack of inclusion of the study of mediators and moderators in SMBG performance reflects a bias in the way randomized clinical trials are conducted in behavioral studies (McAndrew et al., 2007).

The results of two meta-analyses of randomized clinical trials (Sarol et al, 2005; Welschen et al., 2005) indicate that SMBG might have a beneficial effect on HgA1C in participants with T2DM who are not using insulin. Welschen and colleagues (2005)
reviewed six randomized clinical trials done to evaluate the effect of SMBG relative to usual care without SMBG. The outcomes in the studies were blood glucose control, quality of life and well-being, patient satisfaction, and hypoglycemic episodes. The results of only one study (Guerci et al., 2003) contained information on hypoglycemic episodes and two studies (Guerci et al., 2003; Schwedes et al., 2002) contained reports on some data on quality of life and satisfaction. Of the six studies chosen for the meta-analysis, only two (Allen, DeLong, & Feussner, 1990; Davidson, Castellanos, Kain, & Duran, 2005) were considered to be of high quality by the reviewers. There were many limitations in the trials. In three of the studies (Allen et al., 1990; Fontbonne et al., 1989; Guerci et al., 2003) participants did not receive standard instructions and sample sizes varied greatly among the studies from 12-345 participants per study. Baseline HgA1C values varied from 8.2 - 12.4 mmol/L. The reviewers were unable to perform a meta-analysis due to the heterogeneity of patient characteristics, interventions, and outcomes among the studies. A qualitative analysis, however, was conducted by the reviewers who concluded that SMBG had a moderate effect on blood glucose control. The reviewers did not delineate how they conducted the qualitative analysis.

Sarol and colleagues (2005) performed a meta-analysis of eight randomized clinical trials (Davidson, Castellanos, & Kain, 2004; Estey, Tan & Mann, 1990; Fontbonne et al., 1989; Guerci et al., 2003; Jaber, Halapy, Fernet, Tummalapalli, & Diwakaran, 1996; Kwon et al., 2004; Muchmore, Springer, & Miller, 1994; Schwedes et al., 2002) to evaluate the difference in HgA1C reduction in individuals with non-insulin T2DM who perform SMBG and those who do not. These researchers analyzed five of the same studies as in the Welschen et al., (2005) meta-analyses.
The reviewers deemed three (Estey, et al., 1990; Jaber et al., 1996; Kwon et al., 2004) of the eight studies to be of low quality. The reviewers found the other five studies (Davidson et al., 2004; Fontbonne et al., 1989; Guerci et al., 2003; Muchmore et al., 1994; Schwedes et al., 2002) to be of moderate quality. The possible bias that might have occurred because of the diverse treatment regimens was evaluated through sensitivity analyses. Sample size and baseline HgA1C were not as varied as in the Welschen and colleagues (2005) review. All the studies were short-term (range 3-10 months). The reviewers found that interventions with SMBG produced an additional 0.39% reduction in HgA1C compared to non-self-monitoring groups using a fixed effects model and 0.42% using a random effects model. The reviewers concluded that, in the short-term and when integrated with educational advice, SMBG as an adjunct might contribute to improving blood glucose control.

Authors of one other meta-analysis (Coster et al., 2000) concluded that the effects of SMBG in T2DM with HgA1C as an outcome are questionable. Coster and colleagues (2000) estimated that monitoring reduced HgA1C by 0.25% (95% CI). Coster and colleagues (2000) analyzed four randomized clinical trial (Estey et al., 1990; Fontbonne et al., 1989; Wing et al., 1986; Muchmore et al., 1994). The samples in the research studies analyzed, as opposed to the samples used in Welschen and colleagues (2005) and Sarol and colleagues (2005) included individuals who also used insulin. In one of the trials (Fontbonne et al., 1989), SMBG versus urine glucose monitoring was compared. The reviewers found all of the studies to be of low quality. The studies had many methodological deficiencies such as a lack of variable definition, poor or lack of measurement reliability and validity and unclear description of included population
(Coster et al., 2000). Additionally, most of the studies used in this review were also analyzed by Welschen et al., (2005) and Sarol et al., (2005).

In summary, authors of these five reviews or meta-analyses (Coster et al., 2000; McAndrew et al., 2007; McGeoch et al., 2007; Sarol et al., 2005; Welschen et al., 2005) evaluated studies on the frequency and/or timing of performing SMBG and the effects on the HgA1C. While research to understand the effects of SMBG on the HgA1C value is important, results of these studies fail to explain how and why some individuals achieve blood glucose control with SMBG use and others do not. McAndrew et al., (2007) also found scant data in their systematic literature review for studies designed to explore mediators and moderators of SMBG. Understanding practice patterns and characteristics of those who engage in SMBG provides information about groups to target but, again this knowledge does not explain the reasons for the practice patterns or why some individuals engage in SMBG and others do not.

*SMBG Psychosocial Experiences Research*

The capacity for individuals with T2DM to know their real time blood glucose might lead to better DM self-management. The assumption of SMBG developers and clinicians who prescribe SMBG is that SMBG use could provide information to help individuals with T2DM change their behavior and better manage their disease. Changing unhealthy behavior and maintaining healthy behavior would lead to blood glucose control and the avoidance of microvascular and possible macrovascular complications of T2DM (The ACCORD Group, 2008; The ADVANCE Group, 2008; The DCCT Research Group, 1993; UKPDS Group, 1998). But, if change in behavior based on SMBG levels does not occur, then the significance of SMBG becomes unclear. Ultimately, the
means of healthcare experiences such as SMBG are unique to each individual and the individual will make self-management determinations and evaluate satisfaction with outcomes. Healthcare providers can influence interpretations and approaches to managing healthcare experiences but the individuals own conclusion and decisions will guide their behavior (Johnson, 1999).

Few researchers (Peel et al., 2004; Peel et al., 2007; Stewart et al., 2004) have examined the psychosocial experiences of adults who use SMBG and particularly for individuals with T2DM who are not using insulin. Information and education might increase knowledge and awareness but, this does not necessarily translate into engagement in self-management behaviors that would improve outcomes (Meetoo & Gopaul, 2005; Norris, Engelgau, & Narayan, 2001; Vallis, 1998; Whittemore, 2000).

The following studies had a focus on SMBG psychosocial experiences as a primary objective of the study or were one of many variables evaluated. The studies are divided into three categories (a) studies with a focus on quality of life, (b) studies with a focus on T2DM self-care/management in general, and (c) studies with a focus exclusively on SMBG psychosocial experiences.

Quality of Life

In only two studies, (Franciosi et al., 2001; O’Kane et al., 2008) quality of life and depression were measured as an outcome in relationship to SMBG. Franciosi and colleagues (2001) conducted a prospective cross sectional study in Italy with 2,855 participants with T2DM. The frequency of SMBG was compared to metabolic control (HgA1C) and quality of life. Participants were on oral medications and/or insulin and ranged in age from 50-73. A higher frequency of SMBG was associated with better
metabolic control but only for participants who adjusted their insulin doses ($\beta = -0.55, p = 0.015$). For non-insulin treated participants, the more frequent the SMBG was performed (>1/day) the higher the levels of distress ($n= 227, \beta = 8.17, p = 0.0001$), worries ($n= 227, \beta = 10.88, p = 0.0001$), and depressive symptoms ($n= 227, \beta = 2.27, p = 0.05$) (Franciosi, et al., 2001). Additionally, self-monitoring was not related to better metabolic control in the non-insulin treated participants.

O’Kane and colleagues (2008) assessed the effect of SMBG on blood glucose control, depression, and anxiety. The study was conducted in Northern Ireland and consisted of 184 participants who were newly diagnosed with T2DM and were not using insulin. The researchers found that SMBG had no effect on blood glucose control but was associated with higher scores on a depression subscale ($n=184, \beta = 6.05, p = 0.011$) and a trend towards increased anxiety ($n=184, \beta = 5.86, p = 0.07$).

Self-care/management

Researchers (Hall, Joseph & Schwartz-Barcott, 2003; Holmstrom & Rosenqvist, 2005; Price, 1993) explored the general concepts of self-care/management in DM. These researchers evaluated and discussed SMBG as part of self-care/management. The studies were examined to evaluate data obtained regarding SMBG comments only.

Price (1993) developed an experiential model of learning DM self-management. The model was developed from a qualitative study based on interview data from 18 adults with T1DM. Data analysis was conducted following grounded theory methodology. The four major categories that emerged were (a) Personal Consideration, (b) Monitoring, (c) Cognitive Skills, and (d) Control. The category of monitoring
predominantly referred to SMBG and as such only those findings are presented. Four types of monitoring were identified (a) Blood Glucose Testing, (b) Body Listening, (c) Secondary Monitoring by Others, and (d) Secondary Monitoring by Healthcare Professionals. SMBG changed in frequency over time. When initially diagnosed, participants determined their frequency based on recommendation. As time passed, frequency of testing was dependent on the need to gauge the effects of foods, activity, insulin and other variables. At a point where individuals said they had established a basic routine, SMBG was also used along with body listening to make self-management decisions. Body listening is defined as an internal, subjective awareness of how one feels. Participants used SMBG levels to evaluate blood glucose fluctuations and associated the levels with how they felt.

Hall and colleagues (2003) used a qualitative design to determine how 5 participants with T2DM overcame obstacles that interfered with maintaining behavior changes in diet, exercise, and SMBG. The participants were interviewed face-to-face. Three participants were men ages, 62, 65, and 82 and 2 participants were women ages 55 and 60. The participants were identified from a previous survey as maintaining behavior change related to diet, exercise, and SMBG for at least one year. The authors did not report the specific criteria for maintaining behavior change. Data were analyzed in-depth from a holistic perspective starting with an index case and looking for similarities and differences across the cases. Only findings pertaining to SMBG are presented. All 5 participants had incorporated SMBG as part of their daily routine and monitored between 1-4 times daily. When blood glucose levels were lower or higher than an individually determined range, the participants had to think about their previous behaviors to explain
the alteration. The specific behaviors the participants linked to the alteration were not reported.

Eighteen Swedish adults with T2DM who were on insulin, oral medications or diet therapy only were videotaped and asked to describe the misunderstandings they had about their illness and treatment (Holmstrom & Rosenqvist, 2005). The age range was 40-80 years (average 64.5). The data were analyzed thematically. The five themes that emerged were (a) T2DM is Not Real DM; (b) Complications- Horror Visions and Suppression; (c) Self-monitoring of Blood Glucose and Medication is a Routine, Not a Learning Tool; (d) Diet- The Important Thing to Reduce Fat; and (e) Physical Exercise is Good, They Tell Us. Almost all of the participants monitored their blood glucose at home and 14 did not know why they performed SMBG and what the benefits were (Holmstrom & Rosenqvist, 2005).

*SMBG Psychosocial Experiences*

Only five studies had a focus and/or an evaluation of the psychosocial experiences of SMBG in DM and how subjects used their SMBG levels (Bjorness, et al., 2003; Hjelm, et al., 2001; Peel et al., 2004; Peel et al., 2007; Stewart, et al., 2004). Bjorness and colleagues (2003) evaluated how often subjects checked their blood glucose levels, how many had a target, and how many acted on their target. The sample consisted of 815 participants with 61% (n=497) completing a telephone survey. All had DM but the type was not specified. Thirty-seven percent (n= 184) used insulin (27% insulin alone and 10% in combination with oral agents), 49% (n=243) used oral medications only, and 14% (n= 70) used no medication. Daily monitoring of SMBG was more prevalent in those using insulin (52%, n=97) followed by those taking oral medications (30%, n=73) and
those taking no medication (7%, n=5, \( p < .001 \)). Those using insulin were also more likely to have an SMBG target (88%) compared to those on oral medications only (70%) and those on no medications (42%, \( p < .001 \)). There were reports of taking some action such as adjusting medication and/or eating more/less when the levels were low among those taking insulin and who had a target in comparison to those without a target (90 vs. 71%, \( p = .02 \)). The same was found with those individuals on oral medications only (i.e. those with targets took action in response to lower than normal glucose levels) (63% vs. 46%, \( p = .03 \)). In both groups, those on insulin and those on oral medication only with a target value, no actions were taken when blood glucose levels were high.

In a study of 1677 adults with T2DM in Sweden, only 36.3% (n= 599) monitored their blood sugar (Hjelm et al., 2001). The participants were treated with diet only, oral agents, or insulin. The purpose of the study was to analyze the use of SMBG among adults. Of those 36.3%, only 20.5% (n = 123) monitored their blood glucose levels regularly, which was defined as several times/week, and 15.8% (n = 95) monitored a few times/month. Those who self-monitored regularly were diagnosed at a younger age (<30), were a younger age, and their duration of disease was longer (>10 years). Self-monitoring was also more common in those using insulin and with those with poorer blood glucose control (HgA1C > 7.4%). The strongest independent factors for self-adjustment of treatment (SAT) were awareness of illness (odds ratio 3.42 [ 95% CI 1.74 - 6.74 ] and duration of T2DM (> 10 years) (odds ratio 1.74 [1.28 - 2.38 ]). Awareness of illness was defined as the individuals’ adherence to the requirements of the health regimens during the previous 12 months. The authors did not define what is meant by a health regimen. Other variables such as living conditions, social position, or treatment
location were not related to SMBG or SAT. A limitation to this study was a lack of a definition or even a discussion of self-adjustment of treatment.

Stewart and colleagues (2004) described the self-monitoring practices and therapy decisions in a study of 181 participants with DM who were on insulin (n = 77, 42.5%) or oral therapy (n=103, 56.9%) and one participant with unknown therapy. A majority of respondents (n= 158, 87.3%) performed self-monitoring. There is no mention if the participants had T1DM or T2DM. The questionnaire used to collect data consisted of information regarding drug treatment, what type of monitoring was done (SMBG or urine testing) and how often SMBG or urine testing was done. Information was collected using open ended questions regarding target ranges and any adjustments to treatment based on SMBG results. Subjects using insulin (n = 64, 85.3%) were more likely to be monitoring than those on oral medications (n = 39, 50.6%) (χ², p < .001, d.f. = 1). Individuals who engaged in SMBG and were using insulin (n = 45, 61.6%) were more likely to adjust their treatment by altering their insulin dose if a reading was beyond their target range. A majority of subjects on oral medications and who self-monitored (n = 48, 68.6%) took no action at all.

Peel and colleagues (2004) interviewed 40 newly diagnosed (< 6 months) participants with T2DM to explore the pros and cons of glucose monitoring from their perspective. Researchers used a qualitative repeat-interview and grounded theory method. Results of the data demonstrated that monitoring can heighten awareness of the impact of lifestyle such as dietary choices effects on blood glucose levels. Blood glucose levels can signify success or failure about self-management. If blood glucose levels remain consistently high, anxiety and self-blame can occur. Counter-intuitive readings
can negatively affect self-management. Data analysis was not consistent with grounded theory methods. No categories or core variable were identified. Data were only categorized as cons or pros of monitoring.

Peel and colleagues (2007) undertook a follow-up study of one-half of the original cohort of 40 participants who were interviewed in their 2004 study. The purpose of the follow-up study was to gain a longitudinal perspective of the participants’ views and use of SMBG. All participants had T2DM and were being treated with diet only (n = 6); oral medications (n = 13) or insulin and tablets (n = 1). The mean age was 60.8 years with an age range of 40 - 80. Nine were women and 11 were men. The researchers used thematic analysis to analyze the data. The researchers found three main themes (a) The Role of Health Professionals, (b) Interpreting Readings and Managing High Values, and (c) The Ongoing Role of Blood Glucose Self-monitoring. The researchers concluded that participants rarely used self-monitoring to initiate change and/or maintain behavior. Healthcare professionals’ lack of attention to SMBG levels contributed to participants’ reduced engagement in SMBG. Participants said readings were indicative of “good” and “bad” behavior. Participants reported difficulties with interpreting readings and knowing how to deal with higher than normal readings. SMBG maintenance was guided by habit and a need for a reassurance of healthcare status.

Summary of Psychosocial Experience Research

Results of research about individuals with T2DM who do not use insulin is inconclusive in determining whether SMBG is effective (Coster et al., 2000; McAndrew et al., 2007; McGeoch et al., 2007; Sarol et al., 2005; Welschen et al., 2005). Researchers have focused on the outcome of SMBG with little focus on the process of
SMBG. There is a gap in knowledge about the psychosocial experiences of SMBG for adults with T2DM who are not using insulin. Of the scant research studies regarding the psychosocial experiences, SMBG is often one of many variables evaluated. Because the studies had different objectives, the summary will be divided into uses and difficulties with SMBG. The studies had many limitations and methodological flaws which are also summarized.

**SMBG Uses**

SMBG can heighten awareness and be used along with physiological symptoms to make management decisions and evaluate physiological symptoms (Peel et al., 2004; Peel et al., 2007; Price, 1993). Hall and colleagues (2003) and Price, (1993) found that participants sought reasons for alterations and planned behaviors based on the levels. Blood glucose levels can signify self-management success or failure (Peel et al., 2004; Peel et al., 2007).

Those who use insulin, whether they have T1DM or T2DM are more likely to have a target range (Bjorness et al., 2003) and more likely to take action when their blood glucose is beyond their target range (Stewart et al., 2004). Participants are also more concerned and take action more often for blood glucose levels that are lower than normal as opposed to higher than normal (Bjorness et al., 2003). Hjelm and colleagues (2001) found that those who adjusted their treatment (no definition provided in study) adhered more to their healthcare regimen and had T2DM for greater than 10 years.

**SMBG Difficulties**

Individuals who perform more frequent SMBG were found to have higher levels of distress, worries, and depressive symptoms (Franciosi et al., 2001; O’Kane et al.,
The levels obtained can signify success or failure (Peel et al., 2004; Peel et al., 2007). Consistently higher than normal blood glucose levels creates anxiety and self-blame (O’Kane et al., 2008; Peel et al., 2004; Peel et al, 2007).

Counter-intuitive readings, such as instances when an individual has been following a healthy diet or exercising and getting higher than normal blood glucose levels when they thought they should be normal, negatively affect self-management (Peel et al., 2004; Peel et al., 2007). Performing SMBG was considered routine but how SMBG was used and perceived changed over time (Hall et al., 2003; Holmstrom & Rosenqvist, 2005; Peel et al., 2007; Price, 1993). Holmstrom and Rosenqvist, (2005) and Peel and colleagues (2007) found that most participants did not perceive SMBG to be a learning tool and did not understand why they performed SMBG or what the benefits were.

Some individuals increase or decrease their monitoring frequency over time (Peel et al., 2007; Price, 1993). Price (1993) found that SMBG frequency determination was based on the need to evaluate physiological symptoms and the need to gauge the effects of food and activity and other events.

Methodological limitations

All of the studies with a primary objective to evaluate SMBG psychosocial experiences had many methodological flaws (Bjorness et al., 2003; Hjelm et al., 2001; Peel et al., 2004; Stewart et al., 2004). Other studies include only part of SMBG psychosocial experiences as one of many variables evaluated (Franciosi et al., 2001; Hall et al., 2003; Holmstrom & Rosenqvist, 2005; O’Kane et al., 2008; Price, 1993). A summary of the studies and limitations of these studies is discussed.
Seven of the 9 studies used to evaluate the psychosocial experiences of SMBG of adults with DM took place outside the United States: two in Sweden (Hjelm et al., 2001; Holmstrom & Rosenqvist, 2005), one in Italy (Franciosi et al., 2001), one in the United Kingdom (Stewart et al., 2004), two in Scotland (Peel et al., 2004; Peel et al., 2007), and one in Northern Ireland (O’Kane et al., 2008). All participants in the studies were adults with an average age between 40-80 years of age (Bjorness et al., 2003; Franciosi et al., 2001; Hall et al., 2003; Hjelm et al., 2001; Holmstrom & Rosenqvist, 2005; O’Kane et al., 2008; Peel et al., 2004; Peel et al., 2007; Stewart et al., 2004). The participants in the study by Price (1993) all had T1DM and subsequently were younger (range from 24-53 years).

Seven of the study samples included a relatively equal proportion of men and women in their samples (Bjorness et al., 2003; Franciosi et al., 2001; Hall et al., 2003; Hjelm et al., 2001; Holmstrom & Rosenqvist, 2005; O’Kane et al., 2008; Peel et al., 2004; Peel et al., 2007; Price, 1993). Stewart and colleagues (2004) did not mention the gender distribution of their samples.

Eight of the 9 study samples had individuals with T2DM only (Bjorness et al., 2003; Franciosi et al., 2001; Hall et al., 2003; Hjelm et al., 2001; Holmstrom & Rosenqvist, 2005; O’Kane et al., 2008; Peel et al., 2004; Peel et al., 2007). Price (1993) had a sample of only individuals with T1DM. The type of DM was not reported in one of the studies (Stewart et al., 2004).

In most of the studies, the mode of treatment included insulin only, insulin with an oral medication, an oral medication only or dietary therapy alone (Bjorness et al., 2003; Franciosi et al., 2001; Hjelm et al., 2001; Holmstrom & Rosenqvist, 2005; O’Kane et al., 2008).
et al., 2008; Peel et al., 2007). Stewart and colleagues (2004) excluded individuals on diet therapy only. Price (1993) only had participants with T1DM and consequently all were receiving insulin. Hall and colleagues (2003) did not describe whether the participants used insulin or oral medications or diet therapy only. Peel and colleagues (2004) were the only researchers who designed a study to describe individuals with T2DM not on insulin and who were diagnosed with T2DM within the past 6 months. In the other studies the duration of diagnosis of DM varied (Bjorness et al., 2003; Franciosi et al., 2001; Hall et al., 2003; Hjelm et al., 2001; Holmstrom & Rosenqvist, 2005; O’Kane et al., 2008; Peel et al., 2007; Price, 1993).

Peel and colleagues (2004) used open ended interviews and data were analyzed via thematic analysis informed by grounded theory. In this study, data analysis was not consistent with grounded theory methods. No categories or core variable were identified. In the four other studies questionnaires were developed that were either mailed or completed over the phone or in person (Bjorness et al., 2003; Hjelm et al., 2001; Stewart et al., 2004). In addition to questionnaires, one study included open ended questions (Stewart et al., 2004).

Eight study reports (Bjorness et al., 2003; Franciosi et al., 2001; Hjelm et al., 2001; Holmstrom & Rosenqvist, 2005; O’Kane et al., 2008; Peel et al., 2004; Peel et al., 2007; Stewart et al., 2004) did not contain a theoretical framework. Hjelm and colleagues (2001) listed their primary objective as analyzing the use of SMBG but there is no discussion on how they define use. The participants in the study by Hall and colleagues (2003) were chosen because they were identified from a previous survey as maintaining behavior change for at least one year. The criteria for maintaining behavior
change were not reported. Sample sizes varied from 5 (Hall et al., 2003) to 2855 (Franciosi et al., 2001).

Summary

Considerable controversy exists regarding the efficacy of SMBG for individuals with non-insulin treated T2DM. Most of the research focus has been centered on individuals with T1DM who require lifelong insulin administration or with individuals with T2DM who use insulin (Welschen et al., 2005). Additionally, the focus of most of these quantitative studies has been the evaluation of the optimal frequency and timing of performing SMBG with most researchers using HgA1C as an outcome (Evans et al., 1999; Harris, 2001; Hoffman et al., 2002; Murata et al., 2003). While research to understand the effects of SMBG on the HgA1C value is important, results of these studies fail to lead to an explanation of how and why some individuals achieve blood glucose control with SMBG use and others do not (McAndrew et al., 2007).

Researchers (Bjorness et al., 2003; Hjelm et al., 2001; Karter et al., 2000; Price, 1992; Skelly et al., 2005; Stewart et al., 2004; Vincze, Barner & Lopez, 2004;) have also attempted to identify variables that influence SMBG practice patterns, characteristics of those who monitor and those who do not and barriers to engagement in SMBG. Discovery of practice patterns and characteristics of those who engage in SMBG provides directions about groups to target. Identification of barriers is important in understanding issues related to access, however, this information is inadequate to fully understand the role of SMBG in T2DM self-management (Peel et al., 2007).

Ultimately, if change in behavior based on SMBG levels does not occur, then the significance of SMBG becomes unclear to individuals and those recommending SMBG
in a T2DM management plan. Information and education might increase knowledge and awareness. Increased knowledge and awareness does not necessarily translate into engagement in self-management behaviors that would improve outcomes (Norris, Engelgau, & Narayan, 2001; Vallis, 1998; Whittemore, 2000). The meanings of healthcare experiences such as SMBG are unique to each individual and the individual will make self-management determinations and evaluate satisfaction with outcomes. Healthcare providers can influence interpretations and approaches to managing healthcare experiences but the individuals own conclusion and decisions will guide their behavior (Johnson, 1999).

Few researchers (Peel et al., 2004; Stewart et al., 2004) have examined the psychosocial experiences of adults who use SMBG and particularly for individuals with T2DM who are not on insulin. Of the qualitative psychosocial studies reviewed, none is adequate in describing the process and experiences of SMBG in adults with T2DM. The mixed populations of those with T2DM who are on insulin and/or oral medications limits the interpretation and understanding of the role of SMBG. The multiple methodological limitations and lack of theoretical framework severely limits the use of the data. A well-designed qualitative study was conducted to describe the process and experiences of SMBG. Price (1993) used grounded theory to develop an experiential model of learning DM self-management. Price found that SMBG perceptions changed over time and that SMBG is a dynamic process. A qualitative research method, such as grounded theory used in this study was the best way to collect and analyze data about phenomena that are dynamic processes rather than one time occurrences. Grounded theory is also a robust
method to collect and analyze data about complex phenomena such as feelings, thought processes, and experiences associated with SMBG.

Significance

T2DM is considered one of the top public health problems in the United States (CDC, 2002). Coupled with the rise in the co-morbidities of obesity, high blood pressure and high cholesterol, the T2DM epidemic is expected to continue to escalate (CDC, 2002; Narayan, Boyle, Geiss, Saaddine, & Thompson, 2006). As with other chronic illnesses, T2DM prevention and treatment are strongly linked to lifestyle behaviors (J. Davidson, 2005). Individual health behavior factors are considered prominent contributors to mortality and morbidity (CDC, 2002).

All groups, organizations and communities consist of individuals. While all these groups separately and collectively affect health behavior, the individual is the essential unit of health behavior. Self-care and shared decision making have been at the philosophical forefront of chronic disease management.

Successful strategies to facilitate self-care and shared decision making needs to include an understanding of health behavior. This knowledge of behavior then needs to be transformed into effective interventions. SMBG is advocated as an intervention to help individuals with T2DM make necessary lifestyle and/or pharmacologic changes to achieve blood glucose control. Achieving blood glucose control is fundamental in avoiding or decreasing the incidence of microvascular and possibly macrovascular complications of T2DM (Gerich, 2005; The ACCORD Group, 2008; The ADVANCE Group, 2008; The DCCT Research Group, 1993; UKPDS Group, 1998). Blood glucose control is also a marker of T2DM management success or failure. T2DM management
interventions are designed with the intent that blood glucose control will be achieved with implementation of the intervention. The efficacies of interventions are also measured by the effect or lack of on blood glucose control.

Despite 30 years of use, the effectiveness of SMBG in assisting individuals in achieving blood glucose control for individuals with T2DM who are not using insulin is unclear (Renard, 2005). Therefore, different approaches or a re-evaluation and improved implementation of existing strategies are needed to help individuals achieve blood glucose control.

Clinicians and researchers have assumed that if individuals have increased knowledge and information regarding their blood glucose levels then the awareness of this information and knowledge should lead to engagement in healthier lifestyles. The role of SMBG, however, for individuals who use insulin infrequently or take oral agents only or controlled by dietary means only continues to be unclear (ADA, 2009; Bergenstal & Gavin, 2005). Many clinical recommendations have been based on assumptions that increased awareness and knowledge leads to better outcomes and most clinical studies have not been theoretically based (ADA, 2009; Bergenstal & Gavin, 2005). Few researchers have investigated the psychosocial experiences of SMBG. SMBG use and effectiveness will continue to be elusive until there is a better understanding of the psychosocial experiences from an individual’s perspective.

The key to formulating an effective behavioral intervention first starts with regarding human values as the key to change (Glanz, Rimer & Lewis, 2002). Therefore, with a better understanding of SMBG, healthcare providers may be able to develop better
SMBG practice guidelines. Knowledge regarding SMBG psychosocial experiences can be incorporated into SMBG educational curriculums.

Ultimately, better practice guidelines and educational strategies will translate into more effective use of SMBG for individuals with T2DM. The more effective use of SMBG will lead to engagement in healthier lifestyle choices, improved blood glucose control, and better quality of life. Overall engagement in healthier lifestyle choices and improved blood glucose control will lead to a decreased financial burden of SMBG for individuals and the healthcare system in general.

From this research, a theory of self-monitoring was developed. This theory needs to be tested further. This theory could also be tested and used to further understand self-monitoring in other healthcare situations. The knowledge gained from self-monitoring theory can also be used to provide greater insight into the complex phenomenon of health behavior.

Assumptions

Individuals who engage in SMBG are doing so for some purpose and SMBG has some meaning (Burks, 2001; Locke, 1991). In order to effectively engage in SMBG, an individual needs cognitive capacities (J.Davidson, 2005). The individual performing SMBG requires information and education on how to use a device and/or how to interpret the data obtained (ADA, 2009; J.Davidson, 2005; Ipp et al., 2005; Renard, 2005).

Definitions

Type Two Diabetes Mellitus (T2DM)- Participants self report of diagnosis given by a healthcare provider.
**Self-monitoring of blood glucose (SMBG)** - use of a device by an individual diagnosed with T2DM to check blood sugar in a non-healthcare environment.
Design

Little is known about the experiences of SMBG of adults with T2DM who are not using insulin. There is sparse literature regarding what individuals with T2DM think or how they feel about SMBG and how they incorporate SMBG into their self-care management. Qualitative research methods are the best way to collect and analyze data about complex phenomena such as feelings, thought processes, and experiences. Because of the iterative process of persons adjusting to an illness, grounded theory was deemed the most appropriate type of qualitative method to explore the experiences of SMBG of adults with T2DM who are not using insulin.

Employing grounded theory is particularly useful when there is a need for a deeper understanding of specific characteristics of phenomena (Corbin & Strauss, 2008; Glaser, 1998). One of the strengths of grounded theory is that it “provides a way to transcend experience- to move it from a description of what is happening to understanding the process by which it happens” (Artinian, 1998, p. 5). Discovery is the focus in grounded theory rather than variable testing as in most quantitative methods. The research question in this study was “What are the experiences of SMBG usage of adults with T2DM who are not using insulin?” In grounded theory, the context and structure (why) and the process (how) of phenomena are analyzed (Corbin & Strauss, 2008). Structure and process are what comprise experiences and, therefore, this method in comparison to other qualitative methods was considered the most appropriate for analyzing experiences. Individuals with T2DM need to manage, integrate, and modify
multiple lifestyle and healthcare behaviors. The emphasis in grounded theory on analyzing structure and process was particularly useful in this study in capturing the dynamic, evolving and complex nature of the health behavior of SMBG.

In other qualitative methods such as phenomenology, the focus of the research is on the individuals’ lived experience and if used in SMBG and DM, participants may focus on a particular singular period regarding the phenomenon. In phenomenology, there is less emphasis during analysis on constant comparison between other participants and the literature (Speziale & Carpenter, 2007). Ethnography, another qualitative method, is a robust method when the focus of the research is the discovery and description of cultural patterns. The focus of this research is not cultural patterns. Additionally, ethnography involves collecting data by conducting fieldwork. Conducting fieldwork would have been impractical as there was only one investigator to observe the practice of SMBG in the lives of participants when they monitored on different days and at different times.

A grounded theory method is also particularly useful in areas where little or no research had been done (Corbin & Strauss, 2008; Stern, 1980). One of the purposes of grounded theory is to develop theory about psycho-social processes (Glaser, 1998). An a-priori theoretical framework, therefore, is not necessary when designing a study using grounded theory. There were no explicit theories of SMBG or self-monitoring in general health behavior. From this analysis a substantive theory of SMBG was developed.

The grounded theory method that was used in this study was modeled after Corbin and Strauss’ (2008) grounded theory description. Corbin and Strauss’ (2008)
description was developed from original works on grounded theory by Glaser and Strauss (1967) and other qualitative researchers. Corbin and Strauss’ grounded theory description in comparison to the original works of Glaser and Strauss (1967) are relatively similar on a surface level. The key distinctions lie in how the analytic processes are described and used (Walker & Myrick, 2006). The grounded theory method, as described by Corbin and Strauss (2008), was chosen over other grounded theory methods due to the detailed and clear articulation of these researchers on how to conduct grounded theory.

Sample

The study was implemented in South Florida using purposive and network sampling techniques. With purposive sampling, the researcher selected certain participants who were judged to be the best sources of the domain under study (Burns & Grove, 2001; Munhall, 2007). The domain under study was the experiences of SMBG of adults with T2DM so, the researcher selected participants who were actively performing SMBG as these participants were able to provide the best descriptions regarding SMBG.

These participants were self-identified Caucasian American adults over the age of 18 who had a diagnosis of T2DM for greater than 6 months (see Appendix A for demographic characteristics of participants). Only adults were chosen because, T2DM, while being diagnosed more frequently in youths is still considered rare in youths and is a disease predominantly affecting adults (CDC, 2008). Additionally, children and adolescents have different cognitive developmental framework than do adults (Glanz et al., 2002). The sample consisted of self-identified Caucasian Americans who spoke and understood English well enough to give informed consent and take part in the interview.
Caucasian Americans were chosen because they account for 14.9 million or 9.8% of all non-Hispanic whites aged 20 years or older who are diagnosed with DM, a substantial group (CDC, 2007).

All participants were on dietary therapy only or dietary therapy in combination with oral medications and/or a non-insulin injectable such as Byetta®. Those individuals with T2DM using insulin whether parenterally or inhaled were not included because the gap in the literature exists in non-insulin using populations (Blonde & Karter, 2005; Coster et al., 2000; Faas et al., 1997; Ipp et al., 2005; McAndrew et al., 2007; McGeoch et al., 2007; Sarol et al., 2005; Welschen et al., 2005).

In addition to the inclusion criteria and in order to ensure variability and to avoid premature sampling closure, the sample consisted of an adequate number of male and females of varying age groups who monitored with different frequencies within a week. In 2005, the rate of diagnosed T2DM was 5.7 per 100 individuals for men and 5.1 per 100 for women (CDC, 2007). The optimal frequency of performing SMBG was not known and the American Diabetes Association (2009) recommended that frequency be dictated by particular goals and needs of each individual. The researcher was seeking to document the experiences of SMBG and therefore, participants were monitoring their blood glucose an average of once a week. Once a week is the minimum number of times recommended to monitor for anyone with T2DM (Bergenstal & Gavin, 2005). The participants monitored their own blood glucose. Participants who had others regularly performing SMBG for them were excluded. The researcher was seeking to document the experiences of SMBG; therefore participants actively performing SMBG provided the best descriptions.
In grounded theory, a set number of study participants cannot be predetermined. Data were collected until saturation and adequate variability were reached in all emergent categories (Glaser, 1998). Redundancy and saturation were reached after 14 participants were interviewed and 5 additional participants were interviewed to assure that categories and patterns were stable.

In summary, inclusion criteria included (a) adults (≥18 years old), (b) T2DM for 6 month or longer, (c) English speaking, (d) self-identified Caucasian American, (e) T2DM managed with dietary therapy only or in combination with non-insulin pharmacotherapy and, (f) use of SMBG a minimum average of once a week. Any potential participants who did not meet the above criteria were not included in the study. To ensure variability and avoid premature sampling closure, the researcher sampled English speaking male and female adults with T2DM who did not use insulin and were of varying age groups. All participants performed their own SMBG with varying frequencies.

Setting

The participants were initially to be recruited from the Baptist Diabetes Care Center located at three different sites in south Florida. The center serves approximately 9,000 individuals with T1DM and T2DM. The center offers free blood pressure screenings, dietary education, and support counseling. The center also offers the services of exercise specialists, eating disorder counseling, and a foot care clinic. Flyers were posted at the main center with information regarding participation and the researcher’s contact number (see Appendix B). The flyers were posted in classroom bulletin boards and waiting rooms. The researcher also recruited participants by attending eight
educational sessions and identifying possible participants at the meeting. The researcher recruited one participant by attending the educational sessions and only one participant responded to the flyer and was recruited via this method.

Due to the low number of participants recruited from the main site, the researcher decided not to go to the two other sites and instead began recruiting using network sampling techniques. The researcher had personal and professional contacts (not from one center) who knew of qualified participants. Once eligibility was determined the potential participants were recruited for the study. Once participants were recruited the researcher asked the participants if they knew of anyone else that would be interested in participating in the study. If a participant knew of someone, the participant contacted the researcher with the potential new participant’s contact phone number. The researcher then evaluated whether they were eligible to participate.

Procedure

For individuals who called the researcher as a result of reading the flyer or through network sampling, the informed consent (see Appendix C) was discussed during the phone call. The researcher mailed two copies of the informed consent to the participant’s home. Upon receipt of the consent, the participants were instructed to review the consent, sign, and return one copy to the researcher in a supplied postage paid return envelope and retain the other copy for their records. Once the consent was returned and received, the researcher called the participants and a mutually convenient date and time to conduct the interview/s over the phone or face-to-face was set.

For individuals recruited in person at the classes or via network sampling, the informed consent was discussed in person at that time if mutually convenient. If the
individual agreed to participate, informed consent was obtained and a copy of the informed consent was given to the participant. A mutually convenient date and time to conduct the interview over the phone or face-to-face was set.

At the start of the telephone or face-to-face interview, the researcher discussed the issue of informed consent again. Participants were told that the interview would be audio-recorded and the recording would be transcribed verbatim by the interviewer. Participants were informed that any identifying information would be deleted from the transcription of the interview. Participants were reminded that they could choose not to answer any questions, and could ask to have the recorder turned off at any time during the interview. Demographic data were collected (see Appendix D).

Interviews then proceeded in a semi-structured manner incorporating open-ended questions. Open-ended interviews allowed participants the opportunity to fully explain their experiences with SMBG. The interviewer started by asking the broad question, “What are your experiences with self-monitoring of blood glucose?” The subsequent focus of the interview was guided by the participants’ responses. The original research question in grounded theory, usually just lends focus to the study. As data were generated and analyzed the original question/s and subsequent questions developed were frequently refined (Speziale & Carpenter, 2007). The study focus was refined through the use of the technique of the constant comparative method fundamental to grounded theory. The constant comparative method involves conducting an interview and analyzing the interview prior to proceeding with any further interviews. Findings from the interviews serve as a basis for guiding subsequent interviews.
The following were additional questions used for the interview (see below and Appendix E):

1- What were your SMBG experiences when you first started monitoring?

2- Have your experiences with monitoring changed over time? If so, how?

3- What are some things that negatively or positively influence your decision to monitor?

4- What thoughts do you have when you see your blood glucose value (from self-monitoring)?

5- What do you learn from self-monitoring?

6- How does the feedback from SMBG fit in with what you are doing for your T2DM?

The questions were developed using gaps in the literature existed regarding SMBG experiences. While refining the focus during constant comparison, Corbin and Strauss (2008) guide to questions that can be used during data collection and analysis was used. Corbin and Strauss (2008) developed four categories of questions. These four categories are (a) sensitizing questions, (b) theoretical questions, (c) practical questions and, (d) guiding questions. Use of sensitizing questions helps the researcher to focus on what the data might be indicating and involves the use of questions such as “What is happening here? What do situations mean to the participants? How are meanings different and the same for different participants?” Theoretical questions help the researcher see the process, variations, and help the researcher make connections between concepts. Questions that are of a theoretical nature may include “What is the relationship between concepts? How do events change over time?” Practical questions include questions that provide direction for theory development and may include “Which concepts are well developed and which are not? Is the development of my concepts and
theory logical? Why, why not?” Guiding questions help the researcher determine what literature needs to be gathered and how interviews and analysis should proceed. Guiding questions are generally open-ended at the beginning of a series of interviews. Subsequent guiding questions may include asking the participant if and how concepts revealed by other participants in prior interviews pertain to them.

The phone or face-to-face interviews lasted between 15 minutes and 21 seconds to 40 minutes and 56 seconds. The participant was told that he/she may be called back for a second and third interview if there was a need to clarify some of the answers or ask more questions. Only one participant was called back a second time because the researcher forgot to ask a demographic question. There were no other second calls.

Protection of Human Subjects

Approval for the study was obtained from the University of Miami Institutional Review Board. Permission to recruit participants from the Baptist clinical research manager was obtained (see Appendix F). Prior to collecting data, informed consent was obtained from every participant. During the interview, the participants were encouraged to speak openly with the assurance that data that could identify them would be deleted from the transcripts. Participants were reminded before the interview that they could ask the researcher to turn off the recorder at any point during the interview. The participants were reminded that they did not need to answer any questions that made them feel uncomfortable. The voice recordings were downloaded into the Olympus Digital Speech Standard (DSS) player version 7.3.0 (2007). The recording was transcribed by the researcher. The electronic transcription and hard copy (paper) version of the transcription had a participant identification number assigned by the researcher. The
voice file and the electronic copy of the interview that had been transcribed from the recorder were stored on a password protected laptop hard drive. All data that could identify the participant on the voice, electronic, and paper copy were erased. The password protected laptop hard drive and paper copy of the transcriptions, and signed consent forms were kept in a locked file at the home of the researcher. The voice file recordings and transcribed electronic version of the interview will be erased at the end of the study. The transcribed paper copy of the recordings and the signed informed consent forms will be kept in a locked file cabinet for a period of 5 years and then will be destroyed.

Data Analysis

The method of data collection and analysis used in this study was modeled after Corbin and Strauss’ (2008) grounded theory description. Corbin and Strauss’ (2008) description has been developed from original works on grounded theory developed by Glaser and Strauss (1967) and other qualitative researchers.

Prior to discussing the grounded theory analytic techniques used in this study, there are three key points to be made regarding the use of grounded theory as a methodology. First, data collection and analysis were intricately linked and occurred simultaneously. Analysis began during initial data collection and these early analytic findings served as a guide for further data collection. Data analysis essentially drove data collection.

Second, there was a strong interplay between the researcher and the data. The researcher became immersed in the data and just as the researcher shaped the data, the data shaped the researcher (Corbin & Strauss, 2008). The third key point was that the
aim of the analysis, as consistent with grounded theory methodology, was discovery and
the researcher avoided using rigid preconceived concepts or a strict structured design as
these techniques would block discovery (Corbin & Strauss, 2008). An underlying
assumption while using a qualitative method such as grounded theory was that all of the
concepts that pertain to a given phenomenon were not yet discovered or were not fully or
well understood and further exploration was necessary to understand the phenomenon
(Corbin & Strauss, 2008). Because the analysis involved an intense interplay between
the researcher and the data, the researcher strived to possess certain characteristics.

These characteristics according to Strauss & Corbin (1998) included the ability to:

1. Step back and critically analyze situations.
2. Recognize the tendency toward bias.
3. Think abstractly.
4. Be flexible and open to helpful criticism.
5. Be sensitive to the words and actions of respondents.
6. Have a sense of absorption and devotion to the work process (p. 7).

The following is a description of the techniques and processes used in grounded
theory for this study. These processes were not necessarily sequential analytic steps but
were used throughout the whole analytic process.

After the first interview, the researcher downloaded the voice recording into the
Olympus DSS player software program version 7.3.0 (2007). With the DSS player
software program the voice files were archived and organized. The DSS player software
program where the voice recordings were stored was on a password protected laptop.
The voice recording was then transcribed verbatim into Microsoft Word©. Following
transcription, the voice recording was replayed and compared to the transcription to
ensure accuracy. The transcription was printed and this original paper transcript was
given a unique participant identification number and kept in a locked file accessible only
by the researcher. The electronic transcription was also assigned the same unique participant identification number as the paper copy of the transcriptions and the copy was backed up onto a password protected external hard drive. The electronic transcription was then transferred to the MAX qualitative data analysis software program (MAXQDA) (Kuckartz, 1988/2007).

The researcher used the MAXQDA (Kuckartz, 1988/2007) program to store, sort, and retrieve data from the interviews. Codes, memos and diagrams were developed and stored in the MAXQDA program (Kuckartz, 1988/2007). The MAXQDA program was chosen because in the current edition of Corbin and Strauss’ (2008) book on grounded theory, the program is featured along with details of how to use the program and sample analyses are provided using the program. The MAXQDA program is Windows based which is a very familiar format to the researcher.

The first interview was analyzed prior to proceeding with any further interviews. Findings from this interview served as the basis for guiding subsequent interviews. This process known as the constant comparative method was repeated with the second interview and so forth, with each interview transcribed and analyzed prior to the subsequent interview (Glaser & Strauss, 1967).

The focus in grounded theory analysis is the discovery of concepts and categories with the possible endpoint of the development of a substantive theory. During data analysis two coding techniques were used: open and axial coding (Corbin & Strauss, 2008). The focus during the use of each coding technique varied and most often occurred simultaneously rather than performing one technique first and then the other.
Throughout the use of all coding techniques and data analyses, any theoretical thoughts and notions that occurred were recorded as memos (Corbin & Strauss, 2008; Glaser, 1998). The researcher also wrote memos about any recognized personal bias or leading that did not allow the concepts to emerge from the data (Strauss & Corbin, 1998).

The first analytical coding technique was open coding with line-by-line analysis of data. Words, phrases, sentences, and passages in the transcriptions were the units of analysis. At this phase, concepts were identified. Codes were the names given to concepts derived through coding. Concepts were abstract representations of an object, event or an action that was deemed significant in the data. In quantitative methods, the “number” is the unit of analysis, in grounded theory the “concept” is the unit of analysis. Emerging concepts were labeled in the margins of the corresponding passage in the transcription. The aim at this stage of analysis was to identify as many concepts as possible and to identify properties and dimensions of codes (Corbin & Strauss, 2008). Properties are the characteristics of codes and dimension refers to variation of a property along a range.

In addition to identification of concepts, categories and subcategories were identified. During analysis, the researcher began to recognize that certain concepts could be grouped together and developed into categories. The large numbers of substantive codes were subsumed into emerging categories and subcategories. Categories developed were higher level concepts that were representative of lower level concepts and were linked according to shared properties (Corbin & Strauss, 2008). Subcategories clarified and specified a category. A subcategory described when, where, why, by whom, how
and with what consequences a category (phenomenon) was likely to occur (Corbin & Strauss, 2008).

Categories and subcategories were further analyzed during axial coding. Axial coding was the process of relating categories and subcategories through analysis of their properties and dimensions. When identifying and analyzing categories and subcategories, the researcher was focusing on understanding the structure (context) and process under which the phenomena were occurring. Context was the set of conditions under which problems and/or situations arise that lead to some form of action/interaction and emotion which then leads to consequences. Process was the ongoing action/interaction/emotion taken as a result of situations or problems with the purpose of reaching a goal. The researcher was guided by the following questions when analyzing the context and process of categories and subcategories: What were the conditions or circumstances under which a phenomenon was occurring? The word “when” in the data was an analytic cue that focused the researcher on what followed next. What were the actions, interactions and emotions expressed in the data? These were evident in responses made by the participants to a situation, problem, happening or event. What were the consequences of an action, interaction or emotion in response to an event or situation?

As categories and subcategories were compared and contrasted with each other, the number of identified categories was reduced and several categories were collapsed into a larger category. The focus during axial coding was to form more precise and complete descriptions of phenomena.
After coding, the processes of integrating and refining the theory took place. The goal in this phase was generation of a theory that was a generalizable and an internally integrated model. Category and pattern development continued and a central (core) category was identified (Corbin & Strauss, 2008; Glaser & Strauss, 1967). “The generation of theory occurs around a core category” (Glaser, 1978, p. 93). According to Glaser (1978), the core category must be central and related to as many other categories and properties as possible. The core category reoccurred frequently in the data and had a clear and grabbing implication for theory. The central category represented the main theme of the research. The central category represented a unification of other categories and therefore has explanatory power. Additionally the central category explained data variation and withstood contradictory or alternative cases (Strauss & Corbin, 1998).

The techniques used to integrate theory included sorting through memos to delineate a theoretical outline and reassembling the coded data conceptually and diagramming. The focus was on memos related to categories and properties that centered on the core variable. Data analysis continued until theoretical completeness had occurred. Theoretical completeness implied that the problem under study had been explained with as few concepts as possible, with the greatest scope and with as much variation for the behavior studied as possible. One possible goal of this study was to generate a theory of self-monitoring of blood glucose and this goal was accomplished.

Data collection and analysis continued until saturation was reached in all categories. Saturation occurred when (a) continued interviews did not yield any new or relevant data regarding a category, (b) properties and dimensions of categories were well developed and demonstrated variation, and (c) the categories’ relationships were
thorough, well established and validated (Strauss & Corbin 1998). Demographic data were analyzed. Frequencies, means, and ranges for demographic data were determined.

When conducting research studies, methodologic and analytic issues of validity, reliability and generalizability must be addressed. Internal validity refers to whether the researchers are measuring or observing what they set out to measure or observe. In qualitative inquiry, internal validity is also referred to as credibility. Findings need to make sense and be credible to the participants and readers. One of the strengths of grounded theory is that the data are credible because they are being obtained from those living the experience. Credibility existed because the data were obtained from the point of view of the participants first (Glaser & Strauss, 1967).

Generalizability, often referred to as external validity or transferability, refers to the extent to which findings and conclusions of a study can be applied in other contexts or populations than those studied. An adequate sample in terms of size and diversity and appropriate purposive or theoretical sampling enhanced external validity. In grounded theory, data are collected until saturation occurs. To ensure variability and avoid premature sampling closure, the researcher sampled English speaking male and female adults with T2DM who do not use insulin and are of varying age groups. All participants performed their own SMBG at least once a week but the sample was comprised of individuals who perform SMBG with varying frequencies. Interviewing participants who engaged in SMBG for varying lengths of time also allowed the researcher to explore the experiences of SMBG over time. Each interview served as a guide for further data collection, assuring that the phenomenon of SMBG was explored at an in-depth level.
Reliability refers to consistency over time. Internal reliability occurs when other researchers match the data with the same set of constructs as the original researcher. External reliability is defined as the ability of other researchers to discover the same phenomena or constructs in similar circumstances. Both these issues are directly tied in to the ability to replicate the study. The sequence of data collection and analysis were described in a step by step fashion. All data and analysis were kept in the MAXQDA qualitative analysis software program where all analytic steps can easily be retraced and retrieved. During data collection and analysis, the researcher consulted frequently with the dissertation chair regarding the integrity of the process and had the chair review the data for the accuracy of analysis. Additionally a third person who is an expert in qualitative methods was consulted to review the researcher’s knowledge and quality of grounded theory in this proposal. This third person reported that the researcher had a “strong” plan.

In order to reduce bias a researcher needs to be familiar with the method and qualitative inquiry methods in just the same fashion that the person reviewing statistical analysis needs to be familiar with the method. The dissertation chair was familiar with grounded theory and qualitative inquiry methods. The latter process also decreased the incidence of researcher bias. Researcher bias was also reduced by the researcher separating personal opinion memos during data analysis. The researcher documented in memos personal thoughts and feelings about participant responses especially as they related to pre-existing understandings the researcher had regarding SMBG in T2DM.

In grounded theory, researchers immerse themselves in the data which raises questions regarding the ability to maintain a balance between objectivity and sensitivity.
Objectivity is necessary to arrive at accurate interpretation and sensitivity is necessary to recognize nuances and meaning in data. These are not to be confused with subjectivity (bias) which is usually present in almost all forms of research (Strauss & Corbin, 1998). Therefore, objectivity and sensitivity are necessary while subjectivity (bias) should be minimized.

Methods to reduce bias but retain sensitivity included continuously validating ones interpretations against alternative explanations. Assumptions were validated with respondents against incoming data. Periodically, the researcher stopped analysis for a few days to be able to review the data anew and ask “What is going on here?” and “Does what I think I see fit the reality of the data?” (Strauss & Corbin, 1998, p. 45). All concepts, categories and subcategories were viewed with skepticism until further validated with subsequent interviews. To reduce bias and increase rigor, the researcher also used the technique of memo writing. The researcher wrote memos to keep track of personal biases regarding the topic being analyzed and reflected upon these memos to determine how these biases were influencing interpretation.

Summary

A grounded theory design was used to evaluate the experiences of SMBG of adults with T2DM who are not using insulin. Grounded theory is a particularly robust design when attempting to capture the structure (why) and process (how) of phenomena. The sample was recruited using purposive and network sampling techniques. All participants were adults (over the age of 18) who were self-identified Caucasian Americans who were diagnosed with T2DM for 6 months or longer. Participants were not using insulin and were performing SMBG a minimum average of once a week.
Informed consent was obtained and the participants were interviewed over the phone or face-to-face. Demographic data were collected and the interview proceeded in a semi-structured open ended manner. Interviews were transcribed verbatim and downloaded into the MAXQDA data analysis software program. Appendix G includes a brief sample of how data analysis was conducted.
Chapter 4

Results

The purpose of this study was to analyze the experiences of SMBG usage of adults with T2DM who were not on insulin. From the analyzed experiences, a substantive theory of SMBG was generated. The core category of “SMBG a Cue for T2DM Self-care” emerged. Four categories were identified (a) Engaging, (b) Checking, (c) Responding, and (d) Establishing a Pattern. An overview of the theory is discussed. A description of all categories and subcategories are presented.

Description of Sample

A total of 19 persons participated in the study. Appendix A is an illustration of the demographic characteristics of the participants. All were white, self-identified American adults with T2DM who were not taking insulin and who were monitoring their own blood glucose. Participants included 11 (58%) women and 8 (42%) men with an average age of 60.2 years (range 38 - 79 years of age). Eleven (58%) of the participants had attained a bachelor’s degree or higher. Annual household income levels were high, as 5 (26%) were between the $50,000 - $99,999 range and 10 (53%) were > $100,000. The remaining 4 (21%) were below $49,999. Only 1 (5%) participant paid for his own monitoring supplies. The remaining 18 (95%) had Medicare or private insurance with varying co-payments that covered the expenses for their monitoring supplies.

Five (26%) participants had been diagnosed with T2DM for > 10 years. Seven (37%) had T2DM between 5 - <10 years, 5 (26%) between 3 years - < 5 years, and
2 (11%) between 1 year - < 3 years. The length of time participants engaged in SMBG was similar to the length of time participants had been diagnosed with T2DM; however, 4 (22%) participants reported they had started monitoring after they were diagnosed with T2DM. Three of the 4 participants started monitoring 1 year after they had been diagnosed and the other started 4 years after being diagnosed. Two (11%) participants started monitoring before being diagnosed with T2DM because they were told by their physicians that their blood glucose levels were occasionally higher than normal.

Participants were asked to describe the main method they used to learn about SMBG. Most participants, 11(58%), stated they learned about SMBG on their own by reading informational pamphlets and instruction booklets. One (5%) learned via a group class; 5 (26%) learned with a healthcare professional during a one-to-one session and; 2 (11%) learned from their friends and/or family members.

Only 1 (5%) participant was on diet therapy alone. Fifteen (79%) were on diet therapy and oral pharmacotherapy for T2DM and 3 (16%) were on diet therapy, oral and non-insulin injectable (e.g. Byetta®) pharmacotherapy for T2DM. At the time of the interview, the average reported usage frequency of SMBG for the past 6 months was 8 (42%) performed SMBG 1 time a week, 5 (26%) performed SMBG 5-7 times a week (average once a day), and 6 (32%) performed SMBG 14 times a week (average twice a day).

**Participant Characteristics and Relation to Theory**

The participant characteristics were evaluated for their relevance and influence in the theory of SMBG. These characteristics included (a) gender, (b) age, (c) educational level, (d) income level, (e) method of payment for SMBG supplies, (f) duration of
diagnosis, (g) duration engaged in SMBG, (h) primary method of learning how to use SMBG, and (i) type of treatment (see Appendix A). The age and gender of the participants had no apparent influence on the responses participants made regarding SMBG experiences.

Most of the participants were well-educated with 58% having attained a bachelor’s degree or higher. Three who had an educational level of high school or less made similar comments as the participants with a post high school education. Participants’ income level had no apparent influence on their experiences with monitoring. The 4 participants who conveyed that SMBG monitoring strips were expensive had high co-payments and with 2 participants these expenses influenced how often they monitored.

The varying lengths of time participants had been diagnosed with T2DM and varying durations of time monitoring allowed the researcher to obtain a comprehensive view of the process of SMBG over time. The type of pharmacologic treatments participants were receiving had no apparent influence on the responses participants made regarding SMBG experiences. Participants described their recent average blood glucose readings and, if known, their most current HgA1C. Table 2 is a description of participants’ most recent self-reported HgA1C in relation to their monitoring frequency. Participants reported having their HgA1C performed from 1 month – 16 months prior to the interview. Some participants were unaware of their HgA1C value or did not recollect a specific number but were told by their healthcare providers that their HgA1C was “good” or “excellent”. Table 3 is a description of participants’ most recent self-
monitored blood glucose range in relation to their monitoring frequency. The lowest number in the self-reported range was used to place a participant in a specific category.

Table 2. Self-reported HgA1C and Monitoring Frequency of Persons with T2DM

<table>
<thead>
<tr>
<th>HgA1C mmol/L</th>
<th>Monitoring Frequency (N=19)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Once/week (n = 8)</td>
</tr>
<tr>
<td>5.9-6.9</td>
<td>1</td>
</tr>
<tr>
<td>7.0-7.9</td>
<td>1</td>
</tr>
<tr>
<td>8.0-8.9</td>
<td>1</td>
</tr>
<tr>
<td>9.0 &amp; &gt;</td>
<td>1</td>
</tr>
<tr>
<td>Unaware</td>
<td>3</td>
</tr>
<tr>
<td>Told by HCP*</td>
<td></td>
</tr>
<tr>
<td>Good/excellent</td>
<td>1</td>
</tr>
</tbody>
</table>

*HCP - healthcare provider
Table 3. Self-reported Blood Glucose Range and Monitoring Frequency of Persons with T2DM

<table>
<thead>
<tr>
<th>Monitoring Frequency (N= 19)*</th>
<th>Blood Glucose Range mg/dl</th>
<th>Once/week (n = 8)</th>
<th>Once/day (n = 5)</th>
<th>Twice/day (n = 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>80 - 100</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>101-120</td>
<td>-</td>
<td>1</td>
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<td></td>
<td>121-140</td>
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<td>2</td>
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<td>141-160</td>
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<tr>
<td></td>
<td>≥ 161</td>
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* lowest number in self-reported range used

Overview of Theory

The core category that emerged in this study is “SMBG: A Cue in T2DM Self-care”. The core category is a representation of the main theme of the research and is the category that links all other categories together (Corbin & Strauss, 2008). The experience of SMBG is composed of four sequential categories that each evolve over time. These categories are (a) Engaging, (b) Checking, (c) Responding, and (d) Establishing a Pattern. A schematic description of the theory is presented in Figure 1.
A cue is defined as anything that excites to action or serves as a suggestion or reminder (Miller, Felbaum, & Tengi, 2006; Pickett et al., 2000). Some synonyms of the word cue include prompt, urge, instigate, and impel. SMBG is a cue in T2DM self-care. Participants described SMBG serving as a cue at all phases during their monitoring experiences from Engaging, Checking, Responding, and Establishing a Pattern. Various descriptions of how SMBG served as a cue in T2DM self-care are discussed throughout each phase in each category description.

Participant data revealed many comments on the temporal quality of the experiences of SMBG. While certain comments were in response to the temporal nature of the interviewer’s questions such as “Tell me what it was like when you first started monitoring”, the participants offered other statements referring to past and present (now) perceptions and the evolving character of the process.

All participants had varying levels of understanding regarding SMBG when they first began monitoring. These perceptions of SMBG changed over time as evidenced in statements that began with “at the beginning” or “when I first started.” These statements were followed by statements reflecting present perceptions such as “finally, now after so many years” or “I have finally gotten it down, after all this time” (referring to SMBG in general not specifically the level).

Participants referred back and forth between earlier and current experiences in developing an expanding repertoire of SMBG. When describing their beginning experiences with monitoring, participants made comments such as “I didn’t know” or “I wanted to check to see.” One participant described his initial monitoring experiences as the “educational phase.” SMBG was used in the beginning as a “learning tool.” With
continuing experience with monitoring, participants comments changed more to “I now know” or “now, I’m pretty knowledgeable.” They described SMBG as more of a “guide” rather than a learning tool.

Despite descriptions of past and present perceptions, participants’ statements demonstrated that their experiences with SMBG often evolved. The evolving nature of the process was evident in each category ranging from why they checked, to how they interpreted their values, to the emotions felt and actions taken, to the determination of how often and when they were going to monitor. This back and forth exchange is evident in the following statement by a participant describing how he was trying to gain a greater understanding of his dietary habits and the effects on his blood glucose, “…but you start getting a little more, try getting a little bit more sophisticated on knowing what things, if some things, you know, you just don’t instinctively know.” Another participant stated, “I didn’t know anything in the beginning, now it’s different.”

Engaging

The decision to engage in SMBG marks the beginning of the participants’ experiences with monitoring. Eighteen (95%) of 19 participants initiated SMBG at the recommendation of their physician. Thirteen of these 18 participants began monitoring upon being diagnosed with T2DM. Two participants began within 1 year of being diagnosed and 1 participant began 4 years after being diagnosed. Two (11%) participants began monitoring before being diagnosed with T2DM. One (5%) began before being diagnosed because she had impaired levels of fasting blood glucose. One (5%) participant initiated SMBG approximately 1 year after being diagnosed. The participant initiated monitoring because a nurse employed at the participant’s insurance company
called every 2-3 months to ask if the participant was performing SMBG and these frequent inquiries prompted the participant to start SMBG.

During this stage, participants had to learn how to use the equipment. Most participants (58%) learned how to use the monitor by independently reading the monitor’s instruction manual or other written sources of information. Five (26%) participants learned to use the monitor during visits with a healthcare provider (physician or nurse). Two (11%) learned from a family member and 1 (5%) learned to use the monitor by attending a group DM education class. Participants commented that the technique was easy to learn and do even though, at times, getting an adequate amount of blood on the strip was sometimes an issue. One participant described feeling “clumsy” in the beginning and another described incidences of getting blood on his clothes when initially learning how to “stick” his fingers.

Participants discussed that during the stage of Engaging, monitoring frequency was based on the recommendation of their physician or based on the recommendation contained in the SMBG instruction booklet. Participants stated that after initiating monitoring they checked their blood glucose levels from 2-6 times per day. Participants described being “very organized” and “religious” about SMBG in the beginning and 1 participant stated, “I just did what I was told.” While some participants continued to monitor twice a day from the time they initiated monitoring until the time of the interview, most reduced their monitoring frequency over time. The period of time between the increased intensity usage to the decreased frequency usage lasted between 1 – 6 months.
The participants stated that the enhanced frequency during the initial stages of monitoring was done to be able to report patterns back to their physicians. Participants, at times, brought in logbooks of the values recorded to review with their physician. SMBG was also done because it was a “novelty” or to satisfy a “curiosity” about what was happening with their blood glucose. One participant stated, “I had just been diagnosed and it was a new routine, it was something that I had to add into my life.”

As early as three days after the initiation of SMBG, participants discussed a dislike of monitoring because of the pain from having to prick their fingers. All but one participant discussed the finger pain or numbness associated with monitoring. One participant, who had monitored for 20 years, remembered when the lancets had bigger needles which were more painful. Another participant stated that “no matter how fine the needle is, it still hurts.”

In summary, Engaging is the initial process of participant monitoring. Most participants began SMBG on the recommendation of their physician. Most participants described learning to use the monitor independently and said the technique was easy to learn. Participants stated they followed a monitoring frequency schedule that was usually prescribed by a physician or developed by the participants from reading SMBG informational material. The initial monitoring frequency ranged between 2-6 times per day. The initial increased monitoring frequency lasted between 1-6 months, at which point most participants reduced their monitoring frequency. Some participants, however, kept their initial monitoring frequency. During the early stages of initiating SMBG, participants disliked SMBG due to the pain from having to prick their fingers. Participants stated they monitored to be able to discuss their results with their physicians.
and because SMBG was a novelty. The participants also described being curious about their blood glucose levels.

**Checking**

Checking is the second category in the theory of SMBG. Checking is a conscious, purposeful, act which occurs at the time the blood glucose is actually obtained. Two subcategories emerged within the category of Checking: Evaluating and Validating. When participants checked their blood glucose, they were either Evaluating or Validating their blood glucose level.

Evaluating is a process of discovering the meaning of blood glucose levels. Participants described getting a level and trying to interpret and place their blood glucose level into context. When participants were Evaluating they usually had no preconceived ideas or were not sure of what their blood glucose might be in relation to an event or what it meant. One participant, when describing a time when he was getting higher than normal blood glucose levels, stated, “Whoa! - What does that mean? I need to put that in context or something.” Evaluating is the process that involves determining the significance of an obtained level.

All participants evaluated their blood glucose levels throughout the entire time they monitored. Participants occupied most of their time in the beginning stages of monitoring Evaluating the meaning of the level they had obtained. Participants made comments such as “in the beginning I didn’t know.” One participant stated:

I was trying to figure what that meant and I found out things like if I would go through a McDonald’s drive thru and buy a McDonald’s breakfast I’d get a big spike which told me boy that was a lot of sugar in it.
Another participant, referring to when he first started monitoring, stated, “I had absolutely no idea what they meant (referring to blood glucose levels) or why I got to that or what I did wrong.” Participants monitored regularly and frequently (approx. 1-6 times/day). One participant described the early stage of Evaluating as “the educational phase.” The length of time spent monitoring at the increased frequency varied from 1 - 6 months.

The second subcategory of Checking is Validating. Validating is a process of confirming. When Validating, participants had preconceived ideas regarding what their blood glucose level might have been and checked to confirm their suspicions. All participants, to a certain extent, entered into SMBG with preconceived ideas about the effects of certain foods on their blood glucose levels. In general, however, the process of Validating occurred after a more intense period of Evaluating. Participants made comments such as “Now I know” or “I figured this out with time.” One participant, referring to the effects of eating dessert on his blood glucose levels, commented, “Like you know you don’t eat birthday cake, that’s a no-brainer”. This same participant also commented that although he knew about certain foods, he wanted to learn more about diet and the effects on blood glucose levels because he was not always sure of the connection. Another participant commented,

I know why I got them (referring to high numbers). I know it’s not like I don't expect it. I know it is coming and I just sit there and I say okay (participant name), you've got to cut back, you've had your little bit of fun and you've got to knock it back down again.

At any given moment during Checking, a participant may have been in the process of Evaluating and/or Validating within a short time span. While participants may have checked their blood glucose with the intent of Validating when a level was obtained,
they may quickly have to switch to Evaluating. Logic and intuition were used by
participants when Evaluating and/or Validating their blood glucose levels to develop a
repertoire of experiences with SMBG. This repertoire of understanding blood glucose
levels was developed from theoretical and experiential knowledge. Participants described
learning about dietary issues from various sources of information such as the web, written
literature, and from others with T2DM. The participants also described learning about
dietary issues by performing SMBG.

The five items participants attempted to evaluate or validate in relation to either a
higher or lower than normal blood glucose level were the effects of (a) food/beverages;
(b) events such as stress, weight changes, activity level, medications; (c) physical
symptoms; (d) general blood glucose status; and (e) actions taken. Food/beverages were
the most frequent items that participants connected to alterations in their blood glucose
levels.

All participants experienced episodes of higher than normal blood glucose levels
and 13 (68%) experienced lower than normal levels. The incidence of lower than normal
blood glucose levels was not as common as higher levels; although 1 participant reported
being concerned about getting lower than normal blood glucose levels every morning.
She described having higher than normal blood glucose levels in the evening before
going to bed (usually in the 170s) and then waking up in the morning with numbers
sometimes in the 60s. Lower than normal blood glucose levels were always accompanied
by a spectrum of physical symptoms. The symptoms felt included sweating, shakiness,
weakness or dizziness. One woman described feeling as if she had a white lace over her
eyes when her blood glucose levels were lower than normal. Participants felt these symptoms when their blood glucose levels dropped within the 50-60 mg/dl range.

Participants who experienced lower than normal blood glucose levels initially checked their blood glucose levels to evaluate whether the symptoms they felt were related to their blood glucose level. With continued monitoring experience, participants began to quickly recognize the symptoms of lower than normal blood glucose levels and sometimes did not even validate but proceeded immediately to take action. One participant commented, “There were times like if it is low, you can physically feel it. You don’t have to always test to know. I know what it feels like when your blood sugar gets low”. Those participants who experienced lower than normal blood glucose levels quickly recognized that their blood glucose levels were lower than normal because they had skipped meals or had taken their medication/s and not eaten enough. One participant commented,

…the only time I have, and it’s not like a real medical emergency low but I might be in the 50s, is if I don’t eat at all and I’ve taken all my medicines and then I, you know, get sidetracked or something and don’t eat.

Consequently, the action taken when participants experienced a lower than normal blood glucose level always involved eating something quickly that was usually high in glucose such as glucose tablets/gel or fruit juice. One participant, who experienced lower than normal blood glucose levels frequently in the morning, had not figured out why her blood glucose level dropped down so often and had not consulted with her healthcare provider.

When blood glucose levels were higher than normal, participants attributed the effect of different types of foods/beverages and quantities of foods/beverages consumed
on their blood glucose levels. During the initial stages of monitoring, many participants described monitoring similarly to 1 participant who said, “It was kind of novel in the beginning to see how different foods would affect my blood sugar.” One participant even qualified what type of beverage was worse for him and how much of an effect it would have as evidenced in this comment “… the worst for me to [sic] sugar go up very fast is the beer. If I take a beer it’ll go 175 about and if I take two it goes over 200, so it goes fast, awful [sic] fast up. So, I drop the beer completely now I don’t take no [sic] more beer and I feel good.” Another participant stated, “I wasn’t really experimenting with all types of food but it showed me where my diet had a lot of sugars in it or didn’t.”

Participants generally reflected on foods/beverages that were eaten within the last few hours or within the past day as reflected in these statements: “… if I’ve had a sweet, dessert the day before, the numbers will be higher” or “I think back on what caused it, the night before. Did I either go out or have a, you know, was I out on the town and have drinks or something?” Another participant commented,

This morning it was especially high and again it was because we ate last night and I probably had more than I should have eaten and I ate the things that I should not have eaten and this morning when I woke up it was 205.

As time passed, engagement in SMBG led to the development of a broader base of experiences with food/beverages and rather than Evaluating for the effects of food/beverages, the participants described more instances of Checking their blood glucose level to validate a preconceived idea they had about a certain food or beverage. One participant, when referring to times when she gets higher than normal blood glucose levels, stated, “Every time I eat a French fry or a potato, but it has to be fried, potatoes put me over the moon. Bread puts me over the moon, rice, some fruit also.” Despite
“knowing” and Validating whether their blood glucose levels would be higher than
normal after eating or drinking certain foods, some participants, however, described not
necessarily being sure how high their blood glucose levels would rise and then checked to
evaluate. One participant stated, “Like if I’ve had a margarita or something like that,
that’s really high in sugar, you know, I would double check to make sure that it was
okay.”

While food was the predominant factor associated with changes in blood glucose
levels, 10 (53%) participants connected various life events such as stress or weight gain
or activity level to their blood glucose levels. These participants noted that when they
gained weight or were feeling stressed their blood glucose levels were higher than
normal. These participants also noted that exercise brought down their blood glucose
levels. One participant even remarked, “I don’t know if it’s fact or whatever, but I think
exercise is one of the biggest factors to bringing it down (referring to his blood glucose
level).” One participant also attributed having lower blood glucose levels in the
afternoon after work (as opposed to the morning) because of all the activity he engaged in
during the day at work.

When blood glucose levels were higher than normal, 5 (26%), described
reflecting on whether the alteration was due to skipping or improperly taking their
medications. Participants also questioned whether the medication they were taking was
effective. One participant, who would occasionally get a “really high spike”, commented,
“I always had this feeling that maybe the medication wasn’t working.”

The third item participants would attempt to Evaluate or Validate was the
connection between blood glucose levels and physical symptoms. Participants evaluated
or validated their blood glucose level when they felt physical symptoms or when they got sick. Participants stated when their blood glucose level was higher than normal they sometimes had urinary frequency, increased thirst, sleepiness, dizziness, weakness, developed a headache, or felt their skin was tight. Most of the time, however, participants did not experience any symptoms when their blood glucose levels were higher than normal. When physical symptoms of high blood glucose levels were present, participants stated that they checked to evaluate if their blood glucose level was actually higher than normal. Participants stated that they checked their blood glucose level because the symptoms of higher blood glucose levels were not as discrete as when they experienced lower blood glucose levels. Participants stated that a reason to monitor was not having symptoms when their blood glucose levels were higher than normal. One participant commented,

> When it is low I feel it and when it goes up high I don't notice it. So, if I am staying 150, 140 whatever, I would never know, so that is one of the reasons that I do test to know approximately where I am at.

Eight (42%) of the participants also noted that their blood glucose level was higher than normal during periods of illness such as the flu, a cold, allergies, or a urinary tract infection. One participant described that when she had pneumonia her blood glucose level “went all astray.” Another stated she had allergies and “if they start kicking up (referring to her allergies) my sugar will rise and when I get to feeling better it will drop back down again.” One participant stated that she did not even bother to check her blood glucose levels more often during a sickness because she already knew her blood glucose levels were usually higher than normal during a sickness.
Seven participants (37%) reported getting blood glucose levels that they were not able to interpret. They still attempted to interpret the levels but often concluded that they did not know the reason for the alteration. The participants conveyed that this inability to interpret their levels was not a common occurrence. One participant, when describing a morning when she had a higher than normal blood glucose level, stated, “Sometimes we don’t know why it’s too high. Maybe it’s from two or three days ago, I don’t know.” Sometimes these blood glucose level elevations were a onetime higher than normal level but at times the elevations persisted over a period of time. One participant commented that he did not “understand why but it (blood glucose level) stayed high for a couple of months.” Two participants even described getting blood glucose levels that did not correspond to what they were eating. One participant stated, “Sometimes you can actually cheat and it’s (blood glucose level) fine, you know, and times you’ve been so good you know it (blood glucose level) goes haywire.” Although not a common occurrence, all participants, except for one, had experienced difficulties interpreting higher than normal blood glucose levels. One participant, however, stated she did not understand why she frequently received so many lower than normal levels in the morning.

The fourth item participants attempted to check was their general blood glucose status. All participants described many instances of checking to “get an idea of what’s going on”, “to be sure everything was alright”, and “to gauge how healthy I am at that moment.” SMBG levels were used to evaluate and validate immediate and overall health status. Participants either focused on general patterns of blood glucose levels or individual blood glucose levels to make judgments about their health status. Participants
described that Checking blood glucose levels, for this purpose, reinforced that they were doing “okay.” Obtaining higher than normal blood glucose levels also served as a reminder that they needed to take action. Participants said SMBG reminded them they had T2DM. One participant stated, “it (referring to T2DM) is the one thing I think about all day long” and the numbers keep you “aware of it.” Another participant described the numbers as bringing T2DM “… in your face, I mean it is right there.”

While all participants conveyed that they checked to be reminded, there were times when they preferred not to know. One participant stated, “

So whenever I get something that reminds me that I do have that thing (T2DM) then I start thinking about, ahh, I should go to the doctor and then I ignore it and then sometimes you say let me check (blood glucose level) what it is.

One participant summarily stated,

It (SMBG) reminds me of the situation (having T2DM) and out of sight, out of mind. If you just don’t test for a long time, you just pretend it’s, there’s no problem. You know it’s very easy to, for me to say I have no problem. I don’t know it, so it can’t be there because I don’t know about it.

Closely linked to Evaluating and Validating their general blood glucose levels, participants described instances of using blood glucose levels to determine whether specific actions taken were effective. Participants described a self-tailored action plan centered mostly on food/beverage choices. These choices generally involved avoiding or reducing the consumption of certain foods. This interplay of taking an action and Evaluating or Validating the action was evident in this participant’s comment, “I also found out that the more I stay away from sugar and the more I exercise the better my sugar levels are.” Another participant commented,
A couple of times I had it down like to 88, 95 so and I knew, I knew why. I was exercising, eating right, taking my medicines. I was trying as hard as I could at that time to do the right thing.

In summary, Checking is a process that involves Evaluating and Validating. Evaluating involves discovering and determining the meaning of blood glucose levels in circumstances where participants have minimal or no preconceived idea of what the level might be. Validating involves confirming what a blood glucose level might be based on a preconceived idea. Participants were constantly Evaluating and Validating. The five items participants attempted to evaluate or validate in relation to blood glucose levels are the effects of (a) food/beverages; (b) events such as stress, weight changes, activity level, medications; (c) physical symptoms; (d) general blood glucose status; and; (e) actions taken.

Responding

All participants were Responding to their blood glucose levels. Responding is the process of reacting to SMBG. The reaction was to monitoring in general or to specific blood glucose levels. The types of responses can be described in two subcategories: Taking Action and Experiencing an Emotion. All participants responded to SMBG and the type of response varied based on whether the blood glucose levels were either normal, or lower or higher than normal.

Participants often described that they needed to “behave” or “be good” in general when referring to actions they thought they needed to take. When participants engaged in behavior that they thought might raise their blood glucose levels they would say they were “cheating” or they described that they were “not behaving good” or “being bad.”
One participant described having a conversation with herself saying, “I know, you know, I know this. I need to be doing this” during times when she said she wasn’t “behaving.”

Participants varied in their convictions to take action for higher than normal blood glucose levels. The spectrum of responses ranged from being able to take action consistently to responses conveying struggles with Taking Action on a consistent basis. One participant described these difficulties with following a dietary plan in this statement, “I’ll be good sometimes and other times I won’t be so good”. Another participant stated,

I guess I’m pretty thick headed. I keep thinking, well, next time just like everybody who tries to start dieting and you know they keep failing over and over again and except this isn’t a diet. It’s diabetes and you know I keep thinking I’m going to do better next time. I’m going to do better next time.

Eight (42%) of these participants seemed to struggle more with enacting and maintaining an action plan. These participants also made more comments such as “I know I need to” or “I plan to”, which reflected a future versus now orientation toward Taking Action. These same participants had a sporadic, infrequent (1/week) to regular (1/day) current monitoring pattern.

Ten participants, who used their blood glucose levels to take action more consistently, made similar comments that described their persistence such as “I just keep going like this, watch myself, watch my food.” These 10 (56%) participants were monitoring more frequently (1-2/day) and regularly and described instances of using monitoring as a guide to action more often. One participant said SMBG keeps him “honest” about his choices. The participants also described already understanding what they could and could not eat and more frequently described having made changes to their
diet. Participants made comments such as “After years I know what I can’t eat and should avoid” or “I cut the foods that are bad for me.”

Those participants with a regular, frequent monitoring pattern spoke more in the present tense while those participants with infrequent, sporadic patterns spoke more in the future tense in regards to actions. Participants who spoke about Taking Action in the present made comments such as, “I got [sic] to really watch out more today because my sugar’s a little high in the morning” or “I’m mad (referring to high levels) but I have to be careful and my number has to be better the next day.” Participants who struggled spoke of future plans as evidenced in these statements, “So, I know, I am at this point now, where I need to monitor because I have to figure out what to do” or “I’m going to try to start everything again (referring to SMBG, exercise, watching food intake).” One participant, however, who engaged in SMBG infrequently and sporadically, had just decided to eat no foods that contained over a predefined number of carbohydrates and he stated his blood glucose levels were “stable” all the time. Another participant, who had been monitoring for 15 years, stated that she monitored 3 times a day for 5 years and because she always obtained numbers within a normal range she started monitoring once a week and continued to obtain levels within a normal range.

All participants were aware that when they got higher than normal blood glucose levels they should do something such as avoid or reduce the consumption of certain food categories, exercise more, and lose weight. Just as participants interpreted their blood glucose level alterations to food/beverages, the actions taken predominantly involved changing the type or the amount of food they were going to eat. The food category they were going to change was carbohydrates, as participants made comments such as, “I cut
[sic] the pie, cut [sic] the ice cream, cut [sic] the cake” or “I just watch my carbs the next day.”

Participants also described using SMBG levels as a guide to their food choices for the day. They checked in the morning to determine what kind of breakfast they could have. One participant stated:

The machine (monitor) help me in the morning because she (monitor) tell me what, [sic] if I’m too high or too low. If I’m too low well then I eat a little bit sugar in the morning, if I’m too high I cut the sugar in the morning and that mean [sic] all kind of way to help me. Just by myself it’s hard but with the machine it’s nice.

Participants described using food as a reward for getting a “normal number” and eating a treat such as chocolate. One participant described using SMBG levels to see how he was going to eat at a party and stated, “I have to see if I can go ahead and splurge (at a party) because my numbers are low or if my numbers are too high and I have to really just control myself and look away.” When getting a “normal number” participants described becoming lax with their diet. One participant described having a pastry for breakfast instead of a Glucerna® bar. Other participants stated they may eat cereal with a higher “sugar” content. Participants who experienced lower than normal blood glucose levels, which were usually defined as in the 50s and 60s, immediately ate something or ingested glucose tablets or glucose gel.

Two (11%) participants discussed that higher than normal blood glucose levels were a reminder to take their medications. Four (21%) participants manipulated their medications based on their levels. One participant took an extra pill if blood glucose levels were higher than normal while 2 others skipped or took half their pills if their blood glucose levels were lower than normal. One participant was regularly taking half
her prescribed doses of medications because she was concerned about frequent lower than normal levels in the morning. These participants manipulated their medications without consulting their healthcare provider.

Four (21%) participants contacted their physician when blood glucose levels were consistently higher than normal. Most of the participants who contacted their physicians did so because they said their medications needed adjustments, whether it was because of side effects or a need to increase, reduce, or change a medication.

Six (32%) participants planned to try to lose weight or exercise more when they obtained higher than normal blood glucose levels but a majority made food modifications based on their results. While participants recognized that exercise lowered their blood glucose levels, only one participant stated she would take a walk to try to bring down a higher than normal blood glucose level.

The second subcategory of Responding is “Feeling Emotions”. All of the participants conveyed a variety of emotions that were triggered when obtaining specific levels or by the act of monitoring in general. Sixteen (84%) participants experienced distressing emotions when getting higher than normal blood glucose levels. These emotions included (a) blame, (b) guilt, (c) anger, (d) frustration, and (e) fear. Other emotions included (a) pain, (b) annoyance, and (c) happiness. These distressing emotions occurred in the initial or later stages of monitoring and remained relatively constant throughout the time participants monitored. Six (32%) participants discussed distressing emotions more often throughout the interview. The other 10 (55%) participants expressed the distressing emotion and then made comments about “moving on” and not dwelling on these distressing emotions. One participant stated, “It’s no use to get mad
because I don’t help myself.” Normal levels, or levels in a range they thought were good or adequate, triggered feelings of happiness and confidence. One participant stated, “Well I’m always happy when it’s a good number.” Another participant stated he has been monitoring for so long that he does not get “too excited” about the numbers anymore but he does feel “confident” when the levels are normal.

A common emotion expressed by all but one of the participants was a dislike of monitoring because of the pain or numbness that occurred from having to prick their fingers. The pain began as soon as three days after initiating monitoring and continued regardless of how long they had been monitoring. One participant, who had monitored for 20 years, remembered when the lancets had bigger needles which were more painful. Instead of pain, 2 participants said they experienced finger numbness. Participants described the process of sticking their finger as “unpleasant” and “not normal”. One participant even described SMBG as “self-mutilation.” Pain and finger insensitivity were factors that led to a decreased monitoring frequency for some participants. Only three (16%) participants discussed using their forearm as an alternate site to pricking than their fingertips. Of these 3, one stated that she could not perform alternate site testing due to the limitations of her monitor. The 2 other participants stated that pricking themselves on the forearm probably caused just as much pain as the fingertips and they have chosen not to try this alternate testing site.

One participant found monitoring to be inconvenient because she had to carry her “machine” around. Two others stated they did not bother to bring the monitoring device with them on vacation because they did not want to travel with it. While all participants, except for 1, had insurance or Medicare that compensated for their strips, 4 (21%)
participants expressed that the deductibles for the strips still made monitoring costly. Participants did not like monitors they had “to code” or those that took “too much blood” or “took too long to get results”. One participant described being annoyed when unable to get a sufficient specimen as follows,

Sometimes you get a little bleed, you stick yourself and nothing happens. You have to stick yourself two, three times before. It’s real slow you know. It’s, it’s kind of a, it’s no fun you know, it’s kind of an annoyance.

All found a monitor that they eventually liked, although one participant stated the monitor he preferred was not compensated by his insurance and therefore he had one he did not like as much. Nine (47%) participants said that monitoring was “easy to do”.

Fourteen (74%) participants blamed and chastised themselves when they obtained higher than normal blood glucose levels. The participants said they should have “behaved better” and stated they did something “bad”. Participants attributed eating certain foods or certain amounts of food as the most common reason for their higher than normal blood glucose levels. Participants expressed that SMBG levels represented a gauge of how “good” or how “bad” one was doing. Some expressed a sense of failure and disappointment at not being able to follow a regimen. Examples of regimens discussed by participants included following a specific diet, exercising, losing weight, and/or taking prescribed medications. One participant, after 4 years continued to struggle with being diagnosed with T2DM. He said he was “embarrassed” at his failure to “not follow the right number.” This participant reported that he had never obtained blood glucose levels less than 130 mg/dl. The same participant stated he usually obtained blood glucose levels between 170-200 mg/dl, and these blood glucose levels always made him feel as if he was “deteriorating” and a “failure.”
Participants with higher than normal blood glucose levels stated that they felt they were intentionally neglecting their health and these emotions triggered a sense of guilt. One participant stated,

Well I felt like, I was, I knew the stuff I shouldn’t be eating but I was eating it anyway. So, I kind of felt like I was neglecting my personal health but having the conversation and not doing anything about it.

This sense of frustration was echoed in other participant statements, “… frustrated, you know, mad at myself for not being a better person about doing it (SMBG)” and “I guess I just beat myself up and I need to exercise more, I need to cut down my carbs and I wasn’t doing it.” Two participants stated they wished they had “willpower.”

When participants indulged in eating a food they knew might increase their blood glucose levels they stated that they knew they might “pay the price.” Participants described eating certain foods/beverages as cheating. One participant stated, “Maybe once in a great while if I go out to eat I’d cheat and have a regular coke.” Some of these indulgences caused guilt but also triggered the thought that they knew they had to get back “on track” and could not afford to indulge often. One participant summed it up in the following statement,

My weakness in life really isn’t sweets, it’s uhh Italian food. So, I go out and have uhh and everyone once in a while I go out and have dinner and I can expect that I’m going to have high blood sugar the next day or two. But I say well, it’s worth it I’m not dead yet. So, well I just, you know, just eat something that I really know I shouldn’t but geeze that was really good so I’ll have it. I know I’m going to pay a price for that, I’m going to have to, you know, blood sugars going to be up the next day I got to make sure I don’t do that continuously. I do that as a one shot deal and again in my mind, okay, I’m going to have adventures but I got to make sure I’m not going to make them continuous adventures.
Anger was another emotion expressed by more than half of the participants. One participant said a higher than normal blood glucose level angered him because he had to give up some of his favorite foods: “I was mad because then I knew I would have to stop eating this [sic] lots of sugar, have to be careful and I couldn’t eat what I want. So, that’s why it makes me mad.” The difficulty of lowering blood glucose levels and the complexity of interpreting blood glucose levels was expressed as frustration. Frustration occurred when participants described being unable to lower their levels even though they thought they were “doing all the right things.” One participant commented, “It bothers me sometimes when it is very high, especially when I think that I have done things right. That is when I get a little … frustrated.” Frustrations also occurred when they had difficulties keeping up with doing the “right” things and following a prescribed diet and exercise plan. Participants described how challenging it was to be around food they enjoyed and use to indulge in. One participant, who enjoyed rice, commented that his son wanted to eat rice every day. Seeing the rice on the dinner table everyday and not being able to eat as much as he wanted was difficult for the participant. One participant described the frustration in the following statement,

… you miss the things. You see your family around you. You are making homemade ice cream at a family reunion and you want a bowl and I said well I want to have a bowl, you know. At first, when I would have a high one I would be a little angry. But, like I said, I've had it 10 years and I have learned that it is something that I have to live with and I am not going to get angry over it if it is a little high.

Higher than normal blood glucose levels also reminded participants they had T2DM. Thoughts of their illness sparked fears of the long term consequences of
uncontrolled T2DM such as the potential loss of vision, loss of limbs, and premature death. Participants made comments such as

The fear is the long range effect of the diabetes, because I know for a fact I’m not afraid that I’m going to any kind of diabetic coma or anything like that but I know that it’s the long range things that will, will eventually kill you.

One participant, when asked why she monitored, stated, “I don’t want to die. I don’t want to get some of the uhh, they say all of the things a diabetic gets are actually preventative if you can keep your blood sugars good.” The higher than normal blood glucose levels reminded participants of relatives who had T2DM and the complications their relatives faced. Five (26%) participants did not want to have to start insulin injections which they thought was a probability if they did not keep their blood glucose levels within a normal range. One participant stated, “I don’t want to have to take insulin and I know that after years and years of this that might happen but I’m trying so hard to not have that happen.”

In summary, all participants responded to the blood glucose levels they obtained. Their responses fell into one of two categories: Taking Action or Feeling Emotions. Participants described taking action or planning to take action. Conflicts arose when participants knew they needed to take action but did not follow through. When participants engaged in behavior they felt was not appropriate they described themselves as “not behaving” and “being bad.” Most actions involved changing the type or quantity of food/beverages the participants consumed. Although not as common, participants also described taking actions that involved altering medications, exercising, and losing weight. Participants who monitored regularly and/or more frequently often described
the ability to follow through with an action plan while those who struggled with following an action plan had varying monitoring frequencies.

Participants responded to the blood glucose levels obtained with various emotions. The emotions expressed by participants included (a) blame, (b) guilt, (c) anger, (d) fear, (e) frustration, (f) annoyance, and (g) pain. These distressing emotions were experienced when blood glucose levels were higher than normal. Participants described feeling happy and confident when they obtained normal levels. While all participants responded to their blood glucose levels with various emotions, some participants discussed these distressing emotions often during the interview.

Establishing a Pattern

The final phase of the theory of SMBG occurs when participants decide on a pattern of SMBG. Two subcategories emerged within this category of Establishing a Pattern: Using Regularly and Using Sporadically. Participants were either using monitoring regularly and usually frequently (e.g. once or twice a day) or Using Sporadically and less frequently (e.g. once a week). When Establishing a Pattern, participants described tailoring how often and when they were going to monitor. After the initial period of a usually increased monitoring frequency, participants either maintained or decreased this frequency. Seventeen (95%) participants described a point of feeling “stable” in terms of their blood glucose levels and/or their health in general. One (5%) participant reported that his levels continued to be “high” after 2 years of monitoring but he had continued to maintain a twice a day monitoring frequency. This point of stability was a determinant in when and how often participants stated they were going to monitor.
Stability did not imply that participants were necessarily satisfied with their levels or that they did not have to continue to be active in their care. Stability meant that the participants had reached a point where they stated they felt “okay” about their numbers and/or they did not feel physically ill. When Establishing a Pattern, participants stated that the frequency they chose was “enough” for them. Some participants described that they no longer felt the need to monitor as often or did not see as much benefit as when they first started so they abandoned or sporadically monitored.

Fifteen (79%) participants stated that they felt they had “stable” or “normal” blood glucose levels when they were Establishing a Pattern. Participants stated that their blood glucose levels were within the 80 to 130 mg/dl range when they checked every day. Participants also reported that they determined their levels were stable because their blood glucose levels remained consistent and were “stable” or “normal” over time. Participants made statements such as “I’ve got it down to a pretty good pattern now” and “I’m kind of not on top of my sugars because I don’t have to….My sugar is always good.” Despite achieving “normal” or “stable” numbers, 4 (21%) participants conveyed that they wanted their numbers to be like someone without T2DM. Participants also said that if their numbers were “low” enough they would no longer have T2DM. Three (16%) participants said they would like to be completely free of all medications.

Some participants, in the beginning stages of monitoring, had more frequent visits with their physicians. Two (11%) participants said their physicians told them they could decrease their monitoring frequency because their HgA1C was “good”. Three (16%) other participants stated their physicians did not emphasize the importance of monitoring in the beginning. The time frame to get from the initial increased frequency of
monitoring to Establishing a Pattern ranged from 1 – 6 months. Of the 15 participants who said their numbers were stable, 11 (73%) continued monitoring at the same frequency as when they started, which was usually about once a day. The other 4 (27%) participants decreased their frequency to either once a day or sporadically.

Two (11%) participants never achieved normal levels. These two participants used how they felt rather than what numbers they obtained as a gauge of stability. Both these participants reported having higher than normal blood glucose levels and/or HgA1C. One of these participants said he “never took the numbers seriously” and because he felt good, he decreased his monitoring frequency. The other participant stated,

I would say a few months, a few months I was kind of religious about it. Uhh but uhh with no success … in lowering my level and I would get consistently like uhh over 160 and then you say well why the hell am I hurting myself if I’m kind of constantly at 190.

This participant also mentioned that he said he was not getting worse (levels were not going higher than what he usually obtained e.g. 160s). These last two participants described sporadic monitoring patterns. They have varied their monitoring frequency from once a day, to once a month, to stopping altogether for months at a time.

In addition to their numbers stabilizing, participants described additional reasons for Establishing a Pattern. One participant stated she was initially monitoring 4 times a day because she was regulating her T2DM with diet only and would use SMBG to gauge how to eat. When her physician placed her on medications, she said it was not necessary to monitor as much because she thought the medication would bring her blood glucose level down and she no longer used SMBG as a guide to eat. Another participant also stated she did not initially monitor as often because she did not focus on what she ate but
was using SMBG to evaluate the effect of her medication on her blood glucose levels. Participants also stated that pain or fingertip insensitivity spurred them to monitor less after an initial increased frequency.

In summary, participants established a regular, usually more frequent, monitoring pattern or a sporadic, usually less frequent, monitoring pattern. The participants described developing their pattern based on how “stable” or “normal” their blood glucose patterns were. A few participants, however, never attained normal levels and based their frequency on the absence of ill symptoms from T2DM. Participants also described that healthcare providers did not emphasize the importance of monitoring. Some participants were told they could decrease the frequency because of “good” HgA1C levels. Fingertip pain and insensitivity also contributed to a decreased monitoring frequency.

Cyclical/Iterative Characteristic of Process

The experience of SMBG is dynamic and iterative. The characteristics of the experience of SMBG correspond with the complexity of human behavior and the cyclical nature of blood glucose patterns and variations that exist for individuals with T2DM. All participants began by Engaging in SMBG, and then proceeded to Checking, Responding, and Establishing a Pattern. Participants, however, also described frequent cyclical, iterative episodes of Checking, Responding and varying their established patterns throughout their experiences with monitoring. The iterative, cyclical nature of the SMBG experience is most evident when participants described changing their monitoring pattern.

Half of the participants established a pattern but then described periods of increasing and decreasing monitoring frequency along with periods of not monitoring at
all. The participants’ reasons for increasing, decreasing, and stopping varied. The decreased frequency occurred due to the perception that the numbers were always “normal” and they stated that they did not feel the need to check at all or so often. One participant stated, “Once I always was normal, I would, I stopped monitoring because I was normal.”

One participant monitored 4 times a day when he first started and then decreased to 1 time a day once his blood glucose levels became normal. This same participant kept this daily pattern for 2 years. Because he always had “good” numbers, he started a pattern of random “spot” checking an average of once a week. He had maintained this random, sporadic pattern for the past 5 years. This participant had made the decision in collaboration with his physician as noted in the following statement,

After I went to a more reasonable regime of just for a while checking once a day and I’d say within the second year, I was just told it’s been stable for so long and my quarterly checkup it was always stable. Umm, I just asked to periodically to just spot check and if there’s a problem contact the physician.”

Most participants, however, decided on their own to change their monitoring frequency. Participants increased, decreased, and had periods of abandoning SMBG because participants described that they were tired of having sore fingers and/or they just “got lazy”. Two participants stated they felt good so they did not feel the need to monitor as evidenced in this statement: “…it’s just over time either through laziness or whatever you want to say where again I feel, I feel good enough it’s like, you know, I don’t have, feel the need to take it.” Another participant, when asked the reasons for decreasing monitoring frequency, also described feeling lazy and described laziness as follows, “Just too lazy to do it. Didn’t want to be bothered and again the sore fingers.” Sore fingers or fingertip insensitivity was a common feeling expressed amongst many participants. For 3
(17%) participants the soreness was the overriding reason for decreasing monitoring frequency.

The participants who decreased or stopped monitoring also described times when they increased the frequency or returned to monitoring again. A common reason to increase the frequency was that their levels remained consistently higher than normal. One participant stated,

When I first started out, after I finally was losing some weight and monitoring, I got down to where I was normal and stayed normal for quite a while. And then I quit monitoring and then I discovered chocolate chip cookies again and umm, and, and kind of went back to where I was eating wrong. But, I wasn’t monitoring at that point for a while and had to get back onto a routine.

Three (16%) participants, however, described a cycle of starting and stopping not based on attaining normal levels but based on being frightened by their physicians into monitoring again. The participants conveyed that their physicians had given them “a lecture” frightening them about the complications of T2DM and encouraged them to monitor. As a result, many resumed or increased the frequency of monitoring. One participant stated, “My doctor up here, yeah he has me more motivated umm in a way because he’s on me about it and they check my blood glucose at his office (referring to a fingerstick, in addition to drawing labs).” Another participant commented,

Usually you go to the doctor, I’ve gained weight, umm you know, he gives me the lecture for the third or fourth time about how serious it is and that, you know, bad things are going to happen if I don’t take it more seriously.

Two participants even voiced that they avoided going to the doctor because they did not want to hear about the complications of T2DM. One participant stated,

Yeah the doctor will scare me to death so I, I, if, if I go to the doctor I won’t go there. I know he’ll scare me to death and then I’ll do something about my condition but it now, now avoiding [sic] to go to the doctor because now I don’t
want to get scared anymore. I know what is happening, it’s clear so uhh why should I bother with that.

Another participant, who checked his blood glucose levels once a week in the morning fasting, stated he obtained numbers in the 80-90 mg/dl range but he had also noted that his last HgA1C was higher than normal (8.0mmol/L). This participant was aware of the discrepancy between the “normal” sporadic SMBG level he was getting and the higher average (HgA1C) but stated he did not want to go to his healthcare provider to discuss the discrepancy. Only one of these participants who stated that he had started and stopped monitoring about 10 times, was trying to monitor again because of the development of peripheral neuropathy. He stated, “I’m trying to watch the numbers more seriously now because the numbness in my hands is pretty much a daily thing now.”

While half of the participants’ monitoring patterns fluctuated for varying periods of time and a varying number of times throughout their experiences with monitoring, the other half rarely fluctuated from the time they made a decision on how often and when they were going to monitor. These participants monitored an average of once to twice a day. These participants described increasing their frequency for short periods (1-2 days) when feeling sick or temporarily reducing the frequency when on vacation or when they were very busy. One participant stated, “There’s [sic] time when I haven’t done it at all, you know, I feel fine and I, I just I’m so busy or something I forget about it and I don’t do it but generally I do it twice a day.” Another participant stated, “If I’m out of the country I’m not going to schlep it along with me because I’m not going to change anything while I’m gone.”
Summary

The purpose of this study was to describe the experiences of SMBG of adults with T2DM who are not using insulin. A substantive theory of SMBG was developed. “SMBG: A Cue in T2DM Self-care” emerged as the core category. Supporting the core category are the four categories of (a) Engaging, (b) Checking, (c) Responding, and (d) Establishing a Pattern. The theory of SMBG has a temporal quality and participants described the cyclical, iterative nature of SMBG.
Chapter 5

Discussion

Summary of Results

Data from this study revealed that participants develop their own conclusions on when and how they are going to use SMBG in their T2DM self-care regime. These conclusions are based on practical knowledge gained from actually living with T2DM and performing SMBG. Data also revealed that participants’ perceptions and understanding of SMBG evolve over time. Participants often made statements about when they first started monitoring and how things changed over time and how they felt at the present time about SMBG.

The main theme revealed from the study data is that SMBG serves as a Cue in T2DM Self-care. SMBG as a Cue in T2DM Self-care links the four categories that were developed to describe the experiences of SMBG. These four categories are (a) Engaging, (b) Checking, (c) Responding, and (d) Establishing a Pattern.

The Engaging phase begins when participants decide to start monitoring. Most participants initiated monitoring at the recommendation of their physician. During this phase, SMBG frequency was based on an initial prescription suggested by the physician or based on information obtained from instruction manuals on when and how often to monitor. Monitoring frequency ranged between 1-6 times a day. Participants described SMBG as a novelty and described being curious about what their levels were. Fingertip pain from pricking their fingers began as early as three days after the initiation of monitoring.
Checking is the second category and phase in the theory of SMBG. Checking is a purposeful, conscious act and participants described Checking for two main purposes: Evaluating and Validating. Both of these processes involve interpreting blood glucose levels obtained. Evaluating involves discovery and exploration. When Evaluating, participants sought an explanation of their blood glucose level and usually had no preconceived notions of what it might be. In contrast, Validating involves performing their blood glucose levels to confirm some pre-existing thought of what their blood glucose level might be.

The third category and phase in the theory of SMBG is “Responding”. Participants responded to the blood glucose levels they obtained by Taking Action and/or Feeling Emotions. The responses were dependent on whether the blood glucose levels obtained were normal, lower, or higher than normal. All participants described actions involving food or beverages. Participants were Responding to SMBG by Feeling Emotions. Obtaining higher than normal blood glucose levels elicited emotions of a distressing nature. These emotions included (a) blame, (b) guilt, (c) anger, (d) frustration, (e) fear, (f) annoyance, and (g) pain. Obtaining levels that were within a normal range created feelings of self-confidence and happiness.

The final phase of the theory of SMBG is Establishing a Pattern. The establishment of a monitoring pattern begins when participants decide on how often and when they are going to monitor. Participants described basing their decisions on how “stable” or “normal” their numbers were and/or on how they felt. Two monitoring pattern categories emerged from the data: Using Regularly and Using Sporadically. Participants either kept the same monitoring frequency that they had started with or
reduced the frequency of monitoring over time. Those participants who reduced the frequency developed either a regular pattern or sporadic pattern and monitored randomly. In addition to feeling like the levels were consistently normal and/or feeling no symptoms from T2DM, some participants decreased the frequency because of fingertip pain or insensitivity.

While participants’ experiences with SMBG evolved over time, participants also described cyclical, iterative episodes of Checking, Responding, and Establishing a Pattern. Frequency of monitoring fluctuated and varied based on the levels obtained and how they felt. Some participants’ frequency rarely fluctuated while some participants’ frequency increased, decreased, or stopped altogether for varying lengths of time.

**Interpretation**

SMBG was originally introduced as a tool to allow individuals, as opposed to healthcare professionals only, to assess blood glucose status (Sonksen et al., 1978; Walford et al., 1978). Early studies of SMBG were conducted in individuals with DM who were using insulin. Sonksen and colleagues (1978) evaluated 64 men and women with DM who were using insulin. These researchers concluded that a majority of the 53 participants (83%) were able to maintain “good” glucose control while monitoring. Good glucose control was defined as the achievement of blood glucose levels of equal to or less than 10 mmol/l (180 mg/dl). Hypoglycemic episodes were infrequent and 70% of the participants preferred blood testing over urine testing. Walford and colleagues (1978) evaluated SMBG in 69 participants with DM who were using insulin. These researchers concluded that patients with limited education could use the technique accurately and that SMBG was useful in identifying hypoglycemic episodes. SMBG levels are considered
more informative than urine and HgA1C levels. Participants when engaging in SMBG were more actively involved in the management of their disease, were more motivated and had a greater understanding of DM and this resulted in a sustained improvement in blood glucose control. These early studies served as a base from which assumptions regarding SMBG developed and future studies were conducted.

These assumptions are that SMBG increases awareness and provides feedback. With this feedback an individual with DM can decide whether action is necessary or not (Bergenstal & Gavin, 2005; Ipp et al., 2005; Renard, 2005). SMBG is also considered a motivational tool to initiate behavioral change (Bergenstal & Gavin, 2005; J.Davidson, 2005; Renard, 2005). One of the consequences of SMBG may be empowerment. The findings of this study will be discussed as they pertain to these assumptions.

The theory of SMBG developed from these study data supports many of the assumptions that have evolved regarding SMBG and provides insight into the success and struggles encountered with SMBG. The first assumption is that SMBG provides individuals with information that increases awareness (Bergenstal & Gavin, 2005; Davidson, 2005; Sonksken et al., 1978; Walford et al., 1978). Participants in this study revealed that SMBG did increase awareness. Participants wanted to be aware and kept abreast of their numbers. During the stage of Engaging, this need to know was based on a prescription provided by a physician. During Engaging, participants were curious and found SMBG to be novel. Over time, for some, SMBG became routine and SMBG was used as a guide to their general health and gauge as to how they were doing with an action plan.
Other researchers (Hall et al., 2003; Peel et al., 2004; Peel et al., 2007; Price, 1993) confirmed that SMBG increases awareness. Price (1993) described participants also initially based their frequency of monitoring on physician recommendation. As time passed, frequency of testing was dependent on the need to gauge the effects of foods, activity, insulin and other variables. Other researchers (Hall et al., 2003; Holmstrom & Rosenqvist, 2005; Peel et al., 2007; Price, 1993) reported that performing SMBG was considered a routine but how SMBG was used and perceived changed over time.

The increased awareness from SMBG was not always welcomed. Participants described times when they did not want to know their blood glucose levels. Knowing the blood glucose level served as a reminder that they had T2DM. In T2DM and other chronic illnesses such as rheumatoid arthritis, the state of constant awareness can lead to feelings of a loss of self, loss of autonomy, and loss of self-esteem (Belgrave, 1990; Schoenberg, Drew, Stoller & Kart, 2005). In a qualitative study of women living with T2DM, Alcozer (1998) found that T2DM begins to take over a person’s life. The treatment regimen in T2DM, including SMBG, can be more intrusive than having the disease itself. Lowton and Gabe (2003), interviewed adults with cystic fibrosis and participants reported that having to constantly think about their health affected what they could do in their everyday lives. The adults with cystic fibrosis, in order to maintain an image of normalcy, kept treatments separate from daily life and kept acute symptoms hidden from others.

Franciosi and colleagues (2001) reported that for non-insulin treated participants, the more frequent the SMBG was performed (>1/day) the higher the levels of distress (n = 227, β 8.17, p .0001), worries (n = 227, β 10.88, p .001), and depressive symptoms
O’Kane and colleagues (2008) assessed the effect of SMBG on blood glucose control, depression, and anxiety. The study included 184 participants who were newly diagnosed with T2DM and were not using insulin. SMBG was associated with higher scores on a depression subscale ($n = 184, \beta 6.05, p .011$) and a trend towards increased anxiety ($n = 184, \beta 5.866, p .07$). Does the awareness of SMBG levels cause these feelings of worry and anxiety? Further investigation is needed into the relationship found between SMBG frequency and distress, worry, depressive symptoms and anxiety.

The significance of the findings in this study are that while SMBG does increase awareness and participants monitored to be aware, participants also struggled with being aware. Despite achieving “normal” or “stable” numbers, participants conveyed they wanted their levels to be like someone without T2DM. Participants also said that if their levels were “low” enough they would no longer have T2DM. The struggle between wanting and not wanting to be aware of their blood glucose level parallels the perspective that people living with a chronic illness live in the worlds of both the well and the sick (Donnelly, 1993). Paterson (2001) developed “The Shifting Perspectives Model of Chronic Illness” from a metasynthesis of 292 qualitative research reports that were focused on the experiences of adults with chronic physical illness. Paterson (2001) revealed through her model that people with chronic illness are continually shifting their focus and placing their “illness-in-the-foreground” or “wellness-in-the-foreground”. When individuals have a perspective of living with “wellness-in-the-foreground”, their chronic illness is placed in the distance but their management must be foremost in order to keep the illness in the distance (i.e. stay well). Conversely, with an “illness-in-the-
foreground” individuals perceive a threat to control. Examples of threats to control include disease progression and a lack of an ability to manage the disease.

The implications of this continual shifting between wellness and illness is that people with chronic illness will vary their attention to symptoms over time even if sometimes in ways that are not appropriate or even harmful. Participants in this study described many instances of the shifts and struggles associated with wanting to be aware of their blood glucose levels (as a marker of their DM health state) and at times not wanting to be aware. Participants commented that T2DM was the one thing they thought about “all day long” and the levels keep you “aware of it”. Another participant described the levels as bringing T2DM “… in your face, I mean it is right there.” Other participants commented that at times they preferred not to know their blood glucose levels while simultaneously stating that they needed to know their blood glucose levels as a guide in their self-care. Participants described periods of starting and stopping SMBG and placing varying attention on their blood glucose level. These findings reveal the struggles participants face in maintaining an intervention strategy that is of value to their health but that simultaneously creates distress.

The second assumption regarding SMBG is that the blood glucose levels provide feedback. For the feedback to be meaningful, the levels need to be accurately interpreted. Interpretation of levels and how to use the levels to implement and adjust lifestyle and other therapeutic changes are critical to the successful implementation of SMBG use (Blonde & Karter, 2005; Peel et al., 2007; Renard, 2005). The data from this study support the assumption that individuals who engage in SMBG receive feedback. All participants engaged in the process of Checking their SMBG to evaluate and validate
their blood glucose levels. Evaluating and Validating are the two subcategories of Checking and these processes involve interpretation.

Participants sought out reasons for their alterations. Other researchers’ (Hall et al., 2003; Peel et al., 2007; Price, 1993) findings support that participants seek out explanations for their altered blood glucose levels. The researchers in these studies did not describe the types of items participants attributed to their blood glucose level alterations. In this study, most alterations were attributed to the consumption of certain foods/beverages. While not as common, participants also evaluated and validated whether stress, weight gain, activity levels, or their medications were the source of their blood glucose alterations. Diet, medication, exercise, stress, illness, and T2DM disease status are all factors that influence blood glucose status (Linek in, 2002; Renard, 2005).

The one factor that none of the participants connected to alterations in their blood glucose levels was their disease progression. Causes and progression of T2DM as a disease are complex and involve an interaction of genetic, metabolic, behavioral, and ecological factors (NIDDK, 2002). The participants frequently blamed higher than normal blood glucose levels on behaviors they engaged in or behaviors they failed to engage in. The importance of the ability for persons with T2DM to interpret and understand their blood glucose levels is evidenced in two studies (Holmstrom & Rosenqvist, 2005; Peel et al., 2007) where researchers found participants had difficulty interpreting their levels and consequently did not understand the purpose of SMBG. The significance of the findings in these studies in regards to SMBG feedback and interpretation is that in order for SMBG to become a value for self-care, individuals need
to be able to understand the obtained blood glucose levels. These meanings need to be logical and placed in a context for those performing SMBG.

Participants in this study often interpreted their blood glucose levels as a measure of how “good” or “bad” they were behaving. When participants behaved in a manner they thought might raise their blood glucose level they often commented that they were “being bad,” “cheating” or “being lax.” These comments were made by participants who had normal or higher than normal blood glucose levels and/or HgA1C’s. Participants in a study by Peel and colleagues (2007) also described their behavior as “good” or “bad” depending on the blood glucose level they obtained. What can be deduced from these findings is that the numbers become a symbol of how an individual is behaving (i.e. “good” or “bad”) and individuals place their actions into one of these categories. Since food alterations were the most common action participants attempted to change, the necessary and frequent task of eating now becomes something they are doing “right” or “wrong”. Participants with T2DM have altered their perceptions of a usually social and pleasurable event such as eating into a task that might be bad, full of temptations, and/or a burden. Emotions can influence cognitions concerning health and can affect perceptions and beliefs regarding illness and behavioral responses and/or coping (Mayne & Bonnano, 2001; Richman et al., 2005).

SMBG, as opposed to other treatment options for individuals with T2DM such as dietary therapy and medications, does not directly alter blood glucose levels. The information only provides documentation and not necessarily a change in condition (Ipp et al., 2005). There is no doubt that without engaging in healthy lifestyle choices, individuals with T2DM will most likely not achieve blood glucose control. What has not
been clear in the literature is whether individuals with T2DM who are not using insulin actually take action based on their blood glucose levels. All participants in this study were Responding to their blood glucose values. The types of responses can be described in two subcategories: Taking Action and Experiencing an Emotion.

All participants described knowing that when their blood glucose level was lower than normal they quickly ingested a high glucose item. When obtaining higher than normal blood glucose levels all participants in this study described knowing they needed to take action. Participants made statements such as “I am going to” versus “I know I have to” take action relatively soon (at the next meal) or some time later (a few days). The distinction between these statements provides evidence of instances where following through with an action seemed more likely (“I am going to”) versus actions that are still being contemplated (“I know I have to”). These statements are evidence that participants in this study struggled with following through with action for high levels although they knew what they had to do. Participants in this study also varied in their convictions to take action.

Peel and colleagues (2007) found that participants rarely used self-monitoring to initiate change and/or maintain behavior. Peel and colleagues (2007), however, reported their participants had difficulties with interpreting readings and knowing how to act on high readings. Participants in this current study were able to interpret readings appropriately and knew how to act when obtaining higher than normal readings. The findings in these two studies, while yielding contradictory findings, actually elucidate a key point regarding SMBG for participants with T2DM. The key point is that participants in both studies may ultimately not achieve blood glucose control but for
different reasons. In the Peel and colleagues (2007) cohort the lack of an ability to interpret and understand what healthy behaviors to engage in renders SMBG ineffective. Most participants (84%) in this study were highly educated (some college and higher) which may have influenced their understanding and knowledge levels regarding SMBG interpretation. Despite most participants in this study being highly educated, an ability to interpret and understand what behaviors to engage in but not following through on enacting these behaviors will render SMBG ineffective. Understanding levels and knowing how to act on these levels, therefore, is insufficient in effectively using SMBG as a means to achieve blood glucose control. In other words, knowledge alone is an insufficient antecedent to action (Meetoo & Gopaul, 2005). There are other mediators such as mood, anxiety, stress and so forth that also mediate proceeding to action (Peyrot et al., 2005; Simmons, Lillis, Swan & Haar, 2007).

Engaging in healthy self-care behaviors and sustaining behavior changes are challenges faced by individuals with chronic illness. DM self-care behaviors include dietary modifications, exercise, and medication administration. These behaviors must be incorporated into daily activities. Barriers to engagement and maintenance of a DM self-management plan were not explored in this study except from the context of the role SMBG levels played in their self-management plan. The increased awareness and feedback obtained from SMBG is supposed to lead to engagement in healthier lifestyle behaviors and participants performed SMBG to be able to make choices about behaviors. The struggles participants described regarding following through with action/s in this study are well documented in the DM literature (Hall et al., 2003; Nagelkerk, Reick & Meengs, 2006; Peyrot et al., 2005; Simmons et al., 2007; Vijan at al., 2004). Various
factors have been identified and implicated as barriers to engagement in self-care. Some of these barriers include psychosocial problems (depression, anxiety, stress, motivation, and burnout) (Peyrot et al., 2005; Simmons et al, 2007), lack of knowledge regarding diet plan and general plan of care, helplessness, and frustration (Nagelkerk et al., 2006). Hall and colleagues (2003) found that barriers to maintaining a dietary plan were hunger, planned and unplanned meal events and a desire for new foods. Obstacles to maintaining an exercise plan included physical illness such as hip surgery and unexpected life events. Vijan and colleagues (2004) identified dietary adherence concerns in participants with DM. The top five concerns included (a) food expense, (b) portion size restrictions, (c) support/family, (d) quality of life/lifestyle and, (e) confusion.

While participants performed SMBG to determine if they need to take action, the findings in this study reveal that blood glucose levels the participants obtain also become a symbol of their health status and how well they are doing in implementing a self-management plan. Participants revealed different meanings they attributed to the levels they obtained and these meanings were different for participants at any given point in time and that the meanings evolved over time. Some participants revealed that if they were not doing well with their self-management plan, they did not bother to check their blood glucose because they knew the level would be high. Other participants checked their blood glucose levels even when they knew they were not following through with their management plan because they wanted to be reminded to “get back on track.” These findings again confirm that SMBG increases awareness and provides feedback. The variable that changes is how the individual is Responding.
Participants in this study not only described taking action in response to blood glucose levels and struggling to take action but all participants responded to SMBG levels with varied emotions. As with other studies (Franciosi et al., 2001; O’Kane et al., 2008) many of the emotions participants described were distressing. Distressing emotions such as (a) blame, (b) guilt, (c) anger, (d) frustration, (e) fear, and (f) annoyance occurred when participants obtained higher than normal blood glucose levels. Peel and colleagues (2007) reported that anxiety and self-blame existed for some participants when obtaining higher than normal blood glucose levels. Participants in this study discussed channeling these distressing emotions by Taking Action and/or trying not to focus on these distressing emotions. Fear of T2DM complications and starting insulin was a common emotion expressed by participants. This fear for some served as a motivator to continue SMBG and engage in healthy behaviors but others described not wanting to know because of the resulting distress of knowing their numbers were high. Participants in this study also reported feeling happy and self-confident when they achieved normal blood glucose levels. The numbers, therefore, in addition to being a gauge for whether a behavior is classified as good or bad, became a gauge of whether actions enacted were successful. Peel and colleagues (2004, 2007) found that blood glucose levels can signify success or failure in a DM self-management plan.

Fingertip pain and insensitivity developed shortly after the initiation of SMBG. Fingertip pain or insensitivity from monitoring is common and is a frequent reason for individuals to decrease monitoring frequency or abandon monitoring (Craddock & Hawthorn, 2002; Hall et al., 2003; Peel et al., 2007; Reed et al., 2003). The fingertip pain/insensitivity impacted their ability to work and perform simple tasks in the home.
such as turning on a video cassette recorder (VCR). While alternate (forearm) site testing could alleviate some of the fingertip pain, only 3 participants discussed forearm testing. Participants stated that forearm testing was just diverting the pain to another area of the body and 1 participant stated she did not attempt forearm testing because her monitor did not have the feature.

The question remains does SMBG motivate or empower individuals with T2DM to engage in healthier lifestyles and if so, how? The phenomena of empowerment and motivation in relationship to SMBG have never been explored. These study findings revealed that SMBG did motivate and/or empower individuals with T2DM to engage in healthy lifestyle behaviors. How SMBG motivates and/or empowers lies in how participants choose to view SMBG as fitting into their self-care regimen. Participants described instances where SMBG served as a guide to let them know their health was “okay” and they were doing “okay” in terms of their management plan. Peel and colleagues (2007) reported that reassurance of health status was a key reason for continuing self-monitoring. Participants described SMBG as an important part of their self-care because without knowing the numbers they would not be able to control their T2DM well. When participants stopped SMBG and began having higher than normal blood glucose levels, they discussed using SMBG to get back “on track.” An awareness of their levels, although at times intrusive and burdensome, also kept individuals focused on their health status and aware of when corrective action needed to be taken.

Intervention strategies that enable and foster decision making about goals, therapeutic options and allow for independence in daily DM care are usually empowering and more effective than prescriptive styles of interventions (Funnell & Anderson, 2004).
Empowerment is a person centered collaborative approach where the people have an active role in their care. Using empowering principles involves helping people discover and develop the capacity to be responsible for self (Funnell & Anderson, 2004). SMBG as an intervention fits the criteria of being an intervention that empowers. The data in this study reveal that Engaging in SMBG and Checking and Responding to levels did motivate and/or empower individuals with T2DM. This empowerment came from SMBG serving as a cue. SMBG was a cue because it prompted individuals to know when things were wrong, when things were right, and when action was needed. SMBG served as a cue by reminding individuals of their T2DM and the potential consequences of poorly controlled blood glucose levels and this fear, in some instances, served as a motivator. SMBG levels served as a reminder of their T2DM status. An important finding in this study was that some participants found that being reminded was burdensome. Participants described the intrusiveness of SMBG in their lives. Some participants adjusted to the intrusiveness and the burdens while other participants were struggling. Other participants yet described periods of adjustment followed by struggles and then adjustment again.

Eventually, all participants established a pattern of monitoring and determined how often and when they were going to monitor. Participants described getting consistent, stable or normal levels and/or how they felt as a basis for determining how often and when they were going to monitor. Participants usually maintained or decreased their frequency from when they first started monitoring. Price (1993) reported that once individuals with T1DM established a basic SMBG routine; SMBG was also used along with body listening to make self-management decisions. Body listening is defined as an
internal, subjective awareness of how one feels. Peel and colleagues (2007) also found that individuals with T2DM determined how often they were going to monitor. Although, in this study, some participants discussed their plans with their physicians, they still conveyed that they determined how often and when they were going to monitor. This finding supports the notion that healthcare providers can influence interpretations and approaches to managing healthcare experiences but individuals own conclusions and decisions will guide their behavior (Johnson, 1999).

Most participants (79%) in this study fell into a higher income bracket (> $50,000 annual household income) and all but one participant had Medicare or private insurance with varying co-payments that covered the expenses for their monitoring supplies. Access to supplies, which is identified as a barrier to performing SMBG in other studies, was not an issue in this sample. Only a few participants stated that their co-payments for supplies were high. Findings regarding Establishing a Pattern might be different for people from lower income because they may have more difficulty affording supplies.

An important finding in this study was the revelation of the cyclical, iterative process of SMBG. Most participants described episodes of Checking, Responding, and varying their established patterns. Participants’ experiences with SMBG were in flux just as their blood glucose levels were. Participants described developing a routine based on their needs. Participants who had achieved blood glucose control and those who had not described instances of Checking frequently then decreasing the frequency, then increasing again based on the consistency of the numbers they obtained or how they felt. Participants described also varying their patterns because of the fingertip pain and
insensitivity and just “got tired” of monitoring. Monitoring fatigue is a phenomenon that was also reported by Peel and colleagues (2007).

In summary, the findings from this in-depth study of the experiences of SMBG elucidate the process of SMBG in a T2DM self-care regimen. The findings in this study also support many assumptions that exist regarding SMBG but had never been scientifically evaluated. When performing SMBG, individuals obtained feedback and became more aware of their health status and their action plan. Ideally, individuals should be able to interpret and know what to do with the information they obtain from SMBG in order to value SMBG. Knowledge alone, however, is insufficient in the effective use of SMBG as a cue to achieving blood glucose control. Despite the knowledge and increased awareness from knowing blood glucose levels, participants described struggles following through with an action plan. The actual engagement in healthy behaviors should lead to blood glucose control. Increased awareness became intrusive and burdensome for participants in their everyday living with T2DM. The increased awareness also kept individuals focused on what actions they had to take to keep their blood glucose levels under control and remain healthy. The levels obtained from SMBG became a symbol of how good or how bad one was behaving. The numbers also signified success or failure in self-care. These distressing emotions and thoughts were factors in participants determining how often and how SMBG was used in their T2DM self-care regimen. Fingertip pain and monitoring fatigue also influenced monitoring frequency. Ultimately, individuals came to their own conclusions on how SMBG fit into their everyday living with T2DM and developed their own ideas on how they were going to use SMBG and how often and when they were going to monitor.
Implications

Education & Practice

T2DM is a common primary and co-morbid clinical condition. With 17.9 million individuals in the United States already diagnosed with DM and another 5.7 million individuals who probably have DM but are not yet diagnosed, there is a high likelihood that healthcare providers will at some point in time provide care and/or counseling to someone with T2DM (CDC, 2008). This care and counseling will likely include discussions regarding SMBG in a T2DM self-care regimen.

The findings in this study revealed that the experiences of SMBG evolved over time. Understanding and perceptions, including reasons for performing SMBG, change over time. The use of the theory of SMBG developed from this study does not lie in attempting to plot what stage a person with T2DM may be in but rather healthcare providers can use the theory to understand the iterative, cyclical nature of the process that occurs with SMBG. Participants also come to their own conclusions regarding how often and when they are going to monitor. Healthcare providers need to take these factors into account when discussing SMBG in a T2DM self-care regimen.

An assumption of this study was that all individuals performing SMBG require information and education on how to use a device and/or how to interpret the data obtained (J. Davidson, 2005; Ipp et al., 2005; Renard, 2005). Most of this information and education was obtained at the beginning stage of monitoring whether in a class, one-on-one, or as revealed in this study, predominantly from self-study. Participants conveyed learning about SMBG during the beginning stages. Additionally, over time,
participants perceived a disinterest from healthcare professionals in discussing their results at subsequent visits.

A few key points need to be made regarding these findings and the implications for practice. First, if healthcare professionals who recommend SMBG display a disinterest in SMBG, then individuals with T2DM who are told that they should monitor may become confused. Participants also conveyed that encouragement from their healthcare providers motivated them to engage in SMBG. The first practice recommendation is that healthcare providers discuss SMBG each time the T2DM regimen is discussed and develop a mutual plan on how SMBG fits into a T2DM self-care regimen.

The second practice recommendation is that the nature of discussions regarding SMBG change with each healthcare provider encounter because understanding and perceptions change over time. In the beginning, participants described SMBG as being novel and interesting to learn but over time this novelty faded. Over time participants described an ability to interpret their numbers and knew what they had to do when alterations occurred but voiced that they were not always able to follow through with their planned actions. Participants experienced distressing emotions with higher than normal blood glucose levels. Participants said they felt frustrated and blamed themselves when their blood glucose levels were higher than normal. Healthcare providers who are cognizant of these struggles and distressing emotions individuals experience when performing SMBG may be more effective during interactions with patients.
Healthcare provider encounters that center on reflective questioning and discussing experiences rather than merely physiological facts regarding T2DM and SMBG can be quite beneficial. These encounters could include an exploration of perceptions and beliefs held regarding SMBG and the purpose of monitoring. Individuals could then be encouraged to actively participate in developing a monitoring plan.

Individuals could also be encouraged to attend educational and/or support sessions. Educational and/or support sessions for those who have been monitoring for a while could be different from those persons who are just beginning to monitor. These sessions, whether they are in a group or one-on-one, could have a focus on updating individuals on current issues regarding SMBG and blood glucose control. The focus of the sessions could be centered on helping individuals identify strategies to engage in healthy lifestyle choices based on the levels they obtain. Educational strategies could be combined with behavioral strategies especially as individuals gain experience with SMBG. Long term support and education could also be provided via alternative formats such as tele-health or web-based mechanisms.

Healthcare provider education is important in improving DM care quality. Healthcare provider educational curriculums often include updates on the pathophysiology and pharmocotherapeutic approach to managing DM with little attention to managing the psychosocial impacts of DM. The findings from this study reveal that more education could be done to assist individuals with using SMBG as an intervention. Healthcare provider curriculums at the pre-degree level and in continuing education formats could incorporate educational objectives that include an understanding in the effective use of behavioral strategies in DM care. Curriculums could also include
increased content on awareness and development of effective communication strategies between healthcare providers and recipients of care.

Research

The following recommendations for further research are made as a result of the findings of this study:

1. Replicate the study in a different population (different culture) to compare and contrast with results of this study.

2. Further explore the subtleties of SMBG use, personality traits and T2DM management style looking for characteristics that lead to maintenance versus abandonment or difficulties with sustaining a plan.

3. Develop and test an instrument from these data to be used to identify correlates of successful SMBG use. The instrument could then be used in a study to correlate successful SMBG use with blood glucose control (HgA1C).

4. Explore the relationship between SMBG and motivation and/or empowerment and self-management plan adherence.

5. Further test the theory developed from this study with other self-monitoring healthcare technologies (e.g. home blood pressure monitoring and efficacy in control of hypertension; regular weighing and effect on weight loss etc.)

6. Explore healthcare professionals’ attitudes and guidance provided regarding SMBG.

7. Quantitatively explore factors such as age, duration of diagnoses of T2DM, duration of engagement in SMBG, and the effects on effective use of SMBG and/or engagement in an effective T2DM management plan.
8. Develop an intervention study to evaluate the effect of various educational behavioral strategies in conjunction with SMBG and the effect on blood glucose control.

**Limitations**

Participants for this study were initially to be recruited from the Baptist Diabetes Care Center. Recruitment flyers were posted and the researcher attended educational sessions in an attempt to recruit participants. After attending approximately eight sessions, the researcher only recruited one participant from these sessions and one participant responded to the flyer. The researcher recruited participants predominantly via snowball sampling. The researcher knew of a relative with T2DM and this relative knew of acquaintances with T2DM and so forth. The researcher noticed that the participants seemed to possess similar characteristics (e.g. age, attendance at the same church) and these initial 2-3 participants seemed to describe their experiences with monitoring in a similar manner. The researcher then purposely sought out different contacts to seek participants who would had different characteristics and provide a variety of descriptions with their monitoring. In retrospect, the similar experiences described by these early participants were coincidental and most likely not a reflection of their familiarity with each other. These early participants’ descriptions ended up being similar to descriptions of other participants who did not know each other and were interviewed months later.

Some of the strengths of the methodology used in this study can be also deemed as limitations. Grounded theory is a robust method to explore complex phenomena such as feelings, thought processes, and experiences but there is a reliance on recall and self-report of all information shared. Most participants (89%) in this study had been
diagnosed with T2DM and performing SMBG for greater than 3 years; therefore time frames, blood glucose levels, and other experiences might have been difficult to recall. When being interviewed, some participants made statements such as “that was quite a while ago.” The argument could be made, however, that preciseness in recollections is not necessary but rather it is these summative reflections that were the key parts of their prior experiences and continue to be part of their current SMBG experience.

Most participants were over the age of 50, were highly educated (some college and higher), and fell into the higher income bracket (> $ 50,000 per year). Therefore findings of this study are probably peculiar to this group. The intent of this study was to describe the experiences of SMBG of participants who are performing SMBG at least once a week. Access to supplies, which is identified as a barrier to performing SMBG in other studies, was not an issue in this sample. Only a few participants stated that their co-payments for supplies were high. Findings might be different in groups from lower income and, consequently, may have more difficulty in accessing supplies.

Summary

The results of this study reveal that SMBG in adults with T2DM who are not using insulin can serve as a valuable tool in a T2DM self-care regimen. SMBG serves as “A Cue in T2DM Self-care.” The information on blood glucose status obtained from performing SMBG increases awareness and provides feedback of a health state and behavioral actions implemented. The blood glucose level information obtained from SMBG can be used to guide decisions regarding healthier lifestyle choices that are important in the achievement of blood glucose control. Blood glucose control, in turn, is
associated with improved health status and reduction of morbidity and mortality associated with T2DM.

While participants discussed the benefits of SMBG in this study, many struggles with SMBG were also revealed. The frequent awareness and reminder SMBG levels represent regarding their T2DM can be distressing. Fingertip pain and insensitivity is common. Self-blame and feelings of guilt were frequently described by participants when obtaining higher than normal blood glucose levels. Participants described frustrations when they did not follow through with planned actions they knew would be beneficial to their health. Participants described struggling with enacting an action plan.

Participants revealed that their experiences with SMBG evolve over time and simultaneously were iterative. Initially, SMBG levels were novel and participants described a period of increased frequency and discovery. Over time, participants described becoming more knowledgeable and understanding of how to place their blood glucose levels into context. Participants’ SMBG repertoire became a blend of theoretical and experiential knowledge. Participants also described initially monitoring based on the recommendations of a physician. Over time the participants developed their own conclusions regarding when and how often they were going to monitor. Participants’ conclusions regarding SMBG, however, were not finite or a static entity. Participants described periods of shifting back and forth between monitoring frequencies. Participants described changing uses of SMBG levels in their self-care and varied the degree of attention to blood glucose levels. Participants also described challenges with an ability to engage and maintain an action plan.
The utility of the theory of SMBG lies in the revelation and understanding of evolving, cyclical, and iterative nature of SMBG in T2DM. What is pertinent to a person with T2DM regarding SMBG changes over time. Long-term support is needed in assisting individuals with T2DM engage in healthy behaviors but the type of support to be provided would be most beneficial if directed by those living with T2DM.
Appendices

Appendix A

Demographic Characteristics of Participants

<table>
<thead>
<tr>
<th>Category</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>58%</td>
</tr>
<tr>
<td>Male</td>
<td>8</td>
<td>42%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 – 39</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>40 – 49</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>50 – 59</td>
<td>5</td>
<td>26%</td>
</tr>
<tr>
<td>60 – 69</td>
<td>7</td>
<td>37%</td>
</tr>
<tr>
<td>70 – 79</td>
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<td>21%</td>
</tr>
<tr>
<td>Highest Level of Education</td>
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<td></td>
</tr>
<tr>
<td>Less Than High School</td>
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<td>5%</td>
</tr>
<tr>
<td>High School</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>Some College</td>
<td>5</td>
<td>26%</td>
</tr>
<tr>
<td>Bachelors Degree</td>
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<td>11%</td>
</tr>
<tr>
<td>Postgraduate Degree</td>
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<td>47%</td>
</tr>
<tr>
<td>Annual Household Income</td>
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<td></td>
</tr>
<tr>
<td>&lt; $25,000</td>
<td>3</td>
<td>16%</td>
</tr>
<tr>
<td>$25,000 - $49,999</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>$50,000 - $99,999</td>
<td>5</td>
<td>26%</td>
</tr>
<tr>
<td>&gt; $100,000</td>
<td>10</td>
<td>53%</td>
</tr>
<tr>
<td>How Monitoring Supplies Paid For</td>
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</tr>
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<td>Medicare/Medicaid</td>
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<td>Self Pay</td>
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</tr>
<tr>
<td>Duration of Diagnosis</td>
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<td></td>
</tr>
<tr>
<td>6 month - &lt; 1 year</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1 year - &lt; 3 years</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>3 years - &lt; 5 years</td>
<td>5</td>
<td>26%</td>
</tr>
<tr>
<td>5 years - &lt; 10 years</td>
<td>7</td>
<td>37%</td>
</tr>
<tr>
<td>10 years &amp; greater</td>
<td>5</td>
<td>26%</td>
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Demographic Characteristics of Participants\textsuperscript{a}

<table>
<thead>
<tr>
<th>Duration Engaged in SMBG</th>
<th>N</th>
<th>%</th>
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<tbody>
<tr>
<td>&lt; 1 year</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1 year - &lt; 3 years</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>3 years - &lt; 5 years</td>
<td>5</td>
<td>26</td>
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<td>5 years - &lt; 10 years</td>
<td>6</td>
<td>32</td>
</tr>
<tr>
<td>&gt; 10 years</td>
<td>5</td>
<td>26</td>
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</table>

<table>
<thead>
<tr>
<th>Primary Method Used to Learn About SMBG</th>
<th>N</th>
<th>%</th>
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<td>Self</td>
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<td>58</td>
</tr>
<tr>
<td>Diabetes education class (group)</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Healthcare personnel (individual)</td>
<td>5</td>
<td>26</td>
</tr>
<tr>
<td>Friend/family</td>
<td>2</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of Treatment</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet Only</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Diet &amp; Pills</td>
<td>15</td>
<td>79</td>
</tr>
<tr>
<td>Diet, Pills &amp; Non-Insulin Injection</td>
<td>3</td>
<td>16</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Frequency of Current SMBG Usage</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once a Week (average in 1 month)</td>
<td>8</td>
<td>42</td>
</tr>
<tr>
<td>5-7/Week (average 1/day)</td>
<td>5</td>
<td>26</td>
</tr>
<tr>
<td>14/Week (average 2/day)</td>
<td>6</td>
<td>32</td>
</tr>
</tbody>
</table>

\textsuperscript{a}n = 19 in each group.
Appendix B

*University of Miami*

Experiences of Self-monitoring of Blood Glucose Usage of Adults with Type 2 Diabetes Mellitus who are Not Using Insulin

**Participants Wanted for a Research Study**

The purpose of this research study is to understand your experiences with monitoring your blood sugar (glucose). There will be approximately 1-3 interviews each lasting 30-45 minutes. The interviews with a researcher will be confidential and conducted over the phone or in person.

You can participate if:

1- You are over the age of 18 & speak English
2- Caucasian, American
3- Have type 2 diabetes mellitus for more than 6 months
4- DO NOT take insulin by injection or inhalation
5- Check your own blood sugar at least once a week

To learn more about this research, call **305-348-0367**

This research is conducted under the direction of Dr. Doris Ugarriza, associate professor of nursing at the University of Miami and Lois Exelbert, director of the Baptist-South Miami Diabetes Care Center.
Appendix C

*University of Miami*

**CONSENT TO PARTICIPATE IN A RESEARCH STUDY**

*The Experiences of Self-monitoring of Blood Glucose of Adults with Type 2 DM Who Are Not on Insulin*

The following information describes the research study in which you are being asked to participate. Please read the information carefully. At the end, you will be asked to sign if you agree to participate.

**PURPOSE OF STUDY:**

You are being asked to participate in a research study. The purpose of this study is to understand your experiences checking your blood sugar. You are being asked to be in the study because you have type 2 DM and are currently checking your blood sugar.

**PROCEDURES:**

If you agree to participate in this study, you will have a tape-recorded interview via telephone or in person with the principal investigator, Lucie Dlugasch, ARNP-BC, MSN, a doctoral student from the University of Miami School of Nursing and Health Studies. The interview will be at a date and time that are convenient for you. During the interview, you will be asked questions about your experiences checking your blood sugar. Some questions may include what are your thoughts when you see your blood sugar values and how have your experiences with monitoring your blood sugar changed over time. You are encouraged to speak freely during the interview. You may take as long as you like to answer the questions and relate your experiences. You do not have to answer any questions you do not want to, and you may request that the tape recorder be turned off at any time during the interview.

The interview will last approximately 45 minutes. The tape-recordings of the interviews will be copied onto paper word for word. You may be called back for a second and third interview if there is a need to clarify some of your answers or asked more questions. These possible second and third interviews should not last more than 30 minutes.

**RISKS:**

We do not anticipate any risks. During the interview, you may skip any questions you do not wish to answer and you may request that the tape recorder be turned off at any time during the interview.

**BENEFITS:**

No benefit can be promised to you from your participation in this study.

**ALTERNATIVES:**

You have the alternative not to participate in this study.
CONFIDENTIALITY:

The tape recording will have a number assigned by the investigator. The written copy of the recording will also only have a number that corresponds to the tape. All data that could identify you from the written copy will be erased. The tape, written copy, and signed consent forms will all be kept in locked file at the home of the investigator. The tape recordings will be erased at the end of the study. The written copy of the recording and signed consent form will be kept in a locked file cabinet for a period of 5 years and then will be destroyed.

When the results of this study are published, excerpts from interviews may be used to illustrate the findings of the study. No names or other identifying information will be used in any publication related to the findings of this study. The investigator will consider your records confidential to the extent permitted by law. The U.S. Department of Health and Human Services (DHHS) may request to review and obtain copies of your records. Your records may also be reviewed for audit purposes by authorized University employees or other agents who will be bound by the same provisions of confidentiality.

COSTS:

There are no costs associated with your participation in this study.

COMPENSATION:

You will not be paid for the time spent in completing the interview.

RIGHT TO DECLINE OR WITHDRAW:

Your participation this study is voluntary. You are free to refuse to participate in the study or withdraw your informed consent at any time during the study. The investigator reserves the right to remove you without your consent at such time that she feels it is in the best interest for you.

CONTACT INFORMATION:

Lucie Dlugasch may be contacted at 305-348-0367 and she will gladly answer any questions you may have concerning the purpose, procedures, and outcome of this project. If you have questions about your rights as a research subject you may contact Human Subjects Research Office at the University of Miami at (305) 243-3195.

PARTICIPANT AGREEMENT:

I have read the information in this consent form and agree to participate in this study. I have had the chance to ask any questions I have about this study, and they have been answered for me. I am entitled to a copy of this form after it has been read and signed.
Signature of Participant _______________ Date _______________

Signature of person obtaining consent _______________ Date _______________

AUDIO TAPING:
( ) Please check here if you do not want the interview audio taped.

By signing this section you give consent to be audio taped during the interview.

Signature of Participant _______________ Date _______________

Signature of person obtaining consent _______________ Date _______________
Appendix D

Demographics data collection form

Participant ID #______________________ DOB ___________________

INSTRUCTIONS: Check one item from each category.

1- Gender:  Male _____ Female ___

2- Self Identified Ethnicity
   _____ White Non-Hispanic/Non-Latino
   _____ White Hispanic or Latino
   _____ Black or African American
   _____ American Indian or Alaska Native
   _____ Asian
   _____ Native Hawaiian or Pacific Islander
   _____ Other, Please Specify ______________

3- What is your highest level of education?
   _____ Less than high school
   _____ High School
   _____ Some college
   _____ Bachelors Degree
   _____ Postgraduate Degree
4- How long have you had type 2 DM?

______ 0-6 months

______ >6 months- 1 year

______ > 1 year - 3 years

______ > 3 years - 5 years

______ > 5 years – 10 years

______ > 10 years

5- What pharmacologic treatment are you on for your diabetes?

______ Diet only

______ Diet and pills

______ Diet, injectable Byetta

______ Diet, injectable Byetta, pills

______ Diet, Pills and Insulin

6- Who performs your own blood sugar monitoring?

______ Self

______ Family

______ Friend

______ Healthcare personnel
7- How long have you been checking your blood sugar?

_______ Less than 1 year
_______ > 1 year - 3 year
_______ > 3 years - 5 years
_______ > 5 years – 10 years
_______ > 10 years

8- How did you learn how to check your blood sugar?

_______ Self
_______ Diabetes education Class
_______ Healthcare personnel (one to one; example nurse, dietitian, physician etc)
_______ Friend/family

9- How long ago did you learn to check your blood sugar?

_______ Less than 1 year
_______ > 1 year - 3 year
_______ > 3 years - 5 years
_______ > 5 years – 10 years
_______ > 10 years ___

10- How often in one week do you check your blood sugar?

_______ 1-5 times a week
_______ 6-10 times a week
_______ 10-15 times a week
_______ >16 times a week
Appendix E

**Interview Questions**

**Opening Broad Question:**

What are your experiences with self-monitoring of blood glucose?

**Subsequent additional questions:**

1- What were your SMBG experiences when you first started monitoring?

2- Have your experiences with monitoring changed over time? If so, how?

3- What are some things that negatively or positively influence your decision to monitor?

4- What thoughts do you have when you see your blood glucose value (from self-monitoring)?

5- What do you learn from self-monitoring?

6- How does the feedback from SMBG fit in with what you are doing for your DM?
December 11, 2007

To Whom It May Concern:

This letter is written to confirm that Ms. Lucie Dlugasch will be recruiting patients from the Diabetes Education Center at Baptist Hospital of Miami for her research proposal. Patients will be provided with information about the study. Baptist Hospital of Miami has agreed to facilitate with the recruitment.

If you have any questions, please contact me at (786) 596-8680.

Sincerely,

Maria J. Arnold, CRP
Clinical Research Manager
Baptist Health South Florida
Institutional Review Board
Appendix G

A description of data collection analysis is detailed below with examples from the MAXQDA data management software program. The MAXQDA program is a very powerful, sophisticated data management system. The researcher was able to code all transcripts in the margins of the text and create memos. The codes were assigned colors created by the researcher. Memos could be labeled by the researcher for ease of retrieval (e.g. a memo could be labeled as a theoretical thought- symbolized by T). While these are things that can be accomplished with pen and paper, the distinctions lie in the ability to retrieve data in an expedient, efficient manner. Codes and memos for all data can be retrieved in a table format that illustrates the date the codes/memos were created, what text are the codes and memos related to, what participant are the codes/memos related to and so forth. As data analysis continues codes can be easily shifted in a hierarchical format. The researcher can easily retrieve a code and all associated texts. The data can also be retrieved in a discriminatory manner, pulling up only information that pertains to men or women etc. The researcher can retrieve tally tables demonstrating how often codes occur. Many of the documents that were created can only be viewed on the actual software program making it difficult to provide concrete examples. Therefore, this a brief, limited sampling of data collection and analysis methods used. For clarity the description is numbered and discussed in linear format recognizing that grounded theory methods require a constant back and forth interplay with the data.

1- The first interview was transcribed and downloaded to the MAXDA. The researcher began reading the transcript and engaged in open coding with line-by-line analysis of data.
A List of codes and memos developed after first interview:

The codes & memos from the first interview included:
1-Negative view
2-Disbelief
3-Confirm
4-Purpose
5-Goal- I have two codes goal & purpose but at this stage do not have a clear distinction between the two. I am using goal at this point as a more concrete,
tangible outcome, as opposed to purpose I am in my mind thinking more of an overall outcome rather than the specific why.

6-Action Taken- He in some instances doesn’t seem to have to check the blood sugar but follows symptoms. In the past did he always his blood sugar when he had symptoms, were they contradictory?

7-Consequence of Action
8-Searching
9-Learning
10-Confidence- I want to use the word empowerment but I think I do because that is the word used in the literature to describe as an outcome of SMBG. For now I’ll stick with confidence but empowerment may be part of this or I may replace later

11-Learned behavior- He already seems to know probably from past checking the blood sugar when he most likely might be low

12-Dictates mood/outlook
13-Adapt
14-Uncertainty
15-Others influence
16-Routine
17-Maintenance
18-Following orders
19-Persistence
20-Conditions
21-Monitor not used for
22-Change over time
23-Conflicting
24-Taking self control
25-Facilitates self management
26-Control

2- Before proceeding with the second interview, the researcher continued to use the same questions (See Appendix E) but additional thoughts and potential questions were added to ask the second participant:

These questions additional questions were developed from codes and memos written in the first interview.

This participant referred how he used and felt about SMBG when he started up to the present time. So, I knew with the next participant I wanted to capture the process of SMBG over time. I made sure I worded future questions to include references to time. I
included questions such as “Tell me what it was like when you first started monitoring” and “Tell me how your thoughts about monitoring have changed over time.”

The first participant talked a lot about control and I wanted to get a better understanding of what is meant by control. Did control refer to obtaining a specific value (SMBG glucose value or HgA1C or does it mean feeling good? So, I decided I was going to ask all participants about their HgA1C levels and there average SMBG values. I decided to ask about HgA1C values also because this is the outcome variable in most studies pertaining to SMBG. (Tables located under chapter 4 findings)

3- The processes described in step 1 & 2 were repeated for each interview. Developed codes were used and new ones were created.

4- I sent every 4th transcript to my dissertation chair. She reviewed the transcripts and offered suggestions regarding the interview process. We discussed codes that were emerging.

5- After the 8th interview, I met with my dissertation chair and we reviewed codes, categories and subcategories that were emerging from the data at length. Crude, preliminary models were being developed. This is a sample of one.

6- At the 12th interview, the researcher was beginning to notice redundancy in the interviews. New models were created (see sample below) and the researcher began to write the findings in story format. See sample below. Writing the “storyline” is a technique suggested by Corbin and Strauss (2008) to aid in theoretical integration. My dissertation chair also created a model which was very similar to the ones I was developing.
Story format analysis Draft Style

These are the categories:

1- Connecting

2- Experience Emotion

3- Cue to Action/status

4- Integration/Sporadic

1- Connections-
   Subcategories
   1- With food (types & amounts)
   2- With how they feel (physically) & ? emotionally??- feel better

   3- Confirmed they had DM (NOT SURE IF THIS IS A SUB)

   Connections is something that is done quite extensively in the initial stages of monitoring. Although it continues throughout the whole process of monitoring.

   Connections refers to the participants evaluating the effects of various things on their blood sugar on their blood sugar. Participants evaluated the effect of different types of foods and quantities of foods on their blood sugar. At times the participants had preconceived ideas of a type of food and what the effect would be on their blood sugar (usually raise) & at times they did not know the effect beforehand.
Participants also made connections with physical symptoms they felt. Most felt clear, specific symptoms of when there sugar was too low. Some felt symptoms when they were high. The participants tried to connect their symptoms to a blood sugar value or just validate if their symptoms were related to changes in their blood sugar.

Participants also attempted to connect various life events such as stress to their blood sugars. Additionally, although not very common people noted changes in their blood glucose with weight changes or changes in activity level.

2- Cue to Action/status
   Subcategories
   1- Cue to action- current or future
   2- Check status of how they are doing
   3- Evaluate actions taken

The information gained while developing connections laid the groundwork for how the participants were going to use the values they obtained while monitoring. The participants evaluate the blood sugar and determine what actions they must take if they are altered. The actions taken predominantly involved changing what they were going to eat relatively soon or in the near future. The changing what they were going to eat involved an attempt to avoid certain food categories or change the amount of a food category.

They also planned to exercise more (NOT stated too often)

It also reminded them to take their medication (but none of them changed what they took, unless there were concerns about their blood sugar dropping too much-they may cut back)

The participants also used to evaluate their status; if they’ve done good or bad

The purpose of people engaging in SMBG remained relatively constant throughout the time they have monitored, however, the participants reduced the reliance on the SMBG value to make food choices and more often used SMBG to
evaluate the relationship between their blood sugar & how they were feeling or to check the general status of their diabetes.

3- Experiencing emotion

All participants conveyed a variety of emotions that monitoring in general and then seeing specific values triggered.

The emotions triggered were predominantly negative in quality when high & positive when normal or in a range they were happy with.

4- Integration/Sporadic

After an initial phase of varying lengths of time where participants connected, developed cue to action & experienced varying emotions, participants developed their own monitoring pattern and redefined how they were going to use SMBG.

At this point, the participants separated into two groups. One group felt liked the numbers they were getting on a relatively consistent basis (numbers were normal or just slightly over normal limit), while the other never achieved a state of satisfaction (they remained high).

Some participants dwelled more on the negative emotions & inconveniences of monitoring and did not value (NOT RIGHT word) SMBG as much.

When a state of satisfaction is achieved Integration of SMBG into DM self care occurs and the monitoring pattern remains relatively constant; Satisfaction is dependent of how they feel physically; Focus is on goal maintenance. This study asked A1C values but all not participants knew what they were. But, the ones that new had low A1C’s and the ones that didn’t reported low blood glucose patterns.

Connections are fairly well-established and just being refined; various emotions occur but are not a focus; serves as a regular cue to action

At this stage participants might change their monitoring frequency or maintain the one from the start.
This can result in regular use or infrequent use

When satisfaction is not attained then SMBG in DM self care is sporadic and the participants begin cycles of connecting etc
This usually results in infrequent use

7- Saturation was achieved by the 14th interview. I met again with my dissertation chair to discuss the model and review categories and subcategories that were being developed. Further interviews were conducted to ensure for category and subcategory stability.
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VITA

Lucie Bouffard Dlugasch was born in Miami Beach, Florida. Her parents are Laureane Pomerleau Cyr and Alfred Bouffard. She received her secondary education at Miami Senior High School. In 1983, she graduated Cum Laude from Florida State University with a Bachelor of Science in Nursing. In 1992, she graduated Summa Cum Laude from the University of Miami with a Master of Science in Nursing with a specialization as a Critical Care Clinical Nurse Specialist. She received the Teresa Gaete clinical excellence award upon graduation. In 1995, she earned a Post-Masters certificate as an Adult Nurse Practitioner from the University of Miami. In 2002, she was again admitted to the Graduate School of the University of Miami. She was granted the degree of Doctor of Philosophy in Nursing in June 2009.