REVIEW

# The experiences of diabetics on self-monitoring of blood glucose: a qualitative metasynthesis

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**Aims and objectives.** To interpret, describe and analyse the results of various qualitative studies and comprehensively elucidate the self-monitoring of blood glucose experiences of diabetic patients, and to make recommendations based on these findings for clinical practices.

**Background.** Patients exhibited both positive and negative perceptions towards the self-monitoring of blood glucose. Numerous recent qualitative studies have explored the self-monitoring of blood glucose experiences of diabetic patients; however, no integrated results have been provided.

**Design.** Qualitative metasynthesis.

**Methods.** A systematic literature search of English and Chinese databases was undertaken, covering the period between January 2004 and April 2014. The following databases were searched: CINAHL, PubMed, MEDLINE, Cochrane Library, Airiti library and PsycInfo. Seven studies were assessed in the final analysis; the Joanna Briggs Institute Qualitative Assessment and Review Instrument was used to evaluate these studies.

**Results.** The self-monitoring experiences of patients with diabetes were divided into five themes: perceived disease severity, effects on daily life, lifestyle adjustments after becoming aware of blood glucose levels, determining the meaning of self-monitoring, and the differences between diabetic patients who use and do not use insulin. Individual differences in blood glucose self-monitoring vary widely among diabetic patients.

**Conclusions.** These differences result from personal cognition and feelings concerning blood glucose monitoring. Insights into and discussions regarding the self-monitoring of blood glucose experiences of diabetic patients enable health care professionals to understand the factors that influence the intentions of patients to perform self-monitoring of blood glucose and facilitate establishing customised self-monitoring of blood glucose treatment plans.

**Relevance to clinical practice.** Health care professionals must adopt flexible and individualised criteria to determine patient cognitive misconceptions, understand negative emotional reactions and provide individualised assistance.

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

- Patient cognitive misconceptions of SMBG may induce negative emotional reactions.
- Patient interpretations regarding the significance of self-monitoring may influence monitoring frequency and effect.
- Future studies should investigate the effects that SMBG have on patient mental health and quality of life.

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## Introduction

The self-monitoring of blood glucose (SMBG) is a method used to achieve favourable blood glucose control and is essential in self-managing diabetes (Farmer *et al.* 2012). Functioning as the cornerstone of diabetes care, SMBG effectively improves the blood glucose control of Type 1 diabetes (Saudek *et al.* 2006). However, concerns regarding to effectiveness of this method for controlling Type 2 diabetes remain. Diabetes experts and scholars have debated whether to use SMBG when treating Type 2 diabetic patients. Certain scholars have asserted that self-monitoring improves and controls blood glucose levels (Sarol *et al.* 2005, Aakre *et al.* 2012); however, several scholars have questioned the value of providing SMBG as a treatment option to patients with Type 2 diabetes who are not typically required to inject insulin (Ceriello 2012, Farmer *et al.* 2012).

Despite these concerns, SMBG is widely used among diabetic patients in clinical practice, regardless of whether the patients are undergoing insulin therapy (Barnard *et al.* 2010). Barnard *et al.* (2010) stressed that SMBG can be used to effectively prevent low blood glucose levels and adjust medicine, nutrition and physical activity levels. However, most patients who use SMBG monitor at a frequency lower than that suggested by health care providers (Karter *et al.* 2000, Abdelgadir *et al.* 2006).

International and domestic quantitative studies investigating the factors that influence SMBG have identified barriers to blood glucose monitoring such as pain, inconvenience, low self-efficacy, low self-esteem, lack of social support, a tendency to experience anxiety and depression, complicated treatment, and a lack of communication with medical staff members, education or health insurance (Bowker *et al.* 2004, Vincze *et al.* 2004, Fisher *et al.* 2011, Malanda *et al.* 2013). By contrast, qualitative studies have shown that patients exhibited both positive and negative perceptions towards SMBG. The negative perceptions included physical discomfort, lack of understanding regarding the relationship between blood glucose levels and self-care behaviours, and uncertainty concerning providing the appropriate responses to various blood glucose levels (Lawton *et al.* 2004, Peel *et al.* 2004, 2007, Farmer *et al.* 2009).

Nurses typically encourage patients to perform SMBG to enhance patient awareness of blood glucose levels and self-management. However, complex intrinsic and extrinsic factors associated with patients with Type 1 or Type 2 diabetes frequently vary during the process of SMBG. If nurses only teach patients with blood glucose-monitoring skills,

but do understand the meanings of the blood glucose data, they cannot probe patients' experiences in executing SMBG. Numerous recent qualitative studies have explored the SMBG experiences of diabetic patients; however, no integrated results have been provided. Thus, the current study attempted to combine, describe and analyse the results of various qualitative studies and comprehensively explore the SMBG experiences of patients with Type 1 or Type 2 diabetes. Qualitative metasynthesis was used to extract clinical evidence from these studies and the findings should serve as a valuable reference for enhancing nursing science and clinical practices.

## Aims

In this study, we interpreted, described and analysed the results of various qualitative studies to comprehensively elucidate the SMBG experiences of diabetic patients; based on the findings, we suggest nursing therapeutics relevant to nursing science and clinical practices.

## Methods

### Design

The metasynthesis method proposed by Sandelowski and Barroso (2007) was used to analyse qualitative SMBG research. The metasynthesis was conducted using the following steps: formulating the purpose and rationale, searching for and retrieving qualitative research reports, critical appraisal, classifying the findings, and data synthesis. Qualitative metasynthesis is a systematic method used to interpret and synthesise qualitative research results that involves considering the theory, methodology and analysis results of qualitative studies. A comprehensive understanding of these results enables novel interpretations of existing phenomena (Paterson *et al.* 2001). Sandelowski and Barroso (2007) defined qualitative metasynthesis as the theories, grand narratives, generalisations or interpretive translations produced by integrating or comparing the findings of qualitative studies. Using qualitative metasynthesis, to explore potential interpretations, transcends the results of the original studies; thus, conceptually, the effect of the whole surpasses that of the sum of the parts (Xu 2008).

### Search method

A review of the literature revealed that no prior metasyntheses of diabetes' experiences on SMBG had been conducted.

Two of the authors developed a search strategy using the key words 'diabetes OR Diabetic OR People with diabetes OR Diabetic patients' AND 'self-monitoring OR SMBG' AND 'qualitative study OR phenomenology OR grounded theory OR hermeneutics'. In collaboration with a librarian, the search strategy was modified to fit each database. Based on the study objectives, the inclusion criteria were established as follows: (1) research focusing on the opinions and experiences of diabetic patients regarding SMBG; (2) papers published by peer-reviewed journals; (3) research involving qualitative or mixed-method methodologies and (4) research written in English or Chinese. The exclusion criteria were (1) studies that conducted only quantitative research or (2) concerned only the perspectives of other parties, including nurses and physicians, rather than the personal experiences of patients. A literature review of studies conducted between 2004 and 2013 was performed. We limited the research period to 10 years to reduce the potential for over-interpretation (Sandelowski & Barroso 2007). The following databases were searched: CINAHL, PubMed, MEDLINE, Cochrane Library, Airiti library, PsycInfo.

## Search outcome

After conducting a manual search, we subsequently cross referenced any repeated articles and examined the titles, abstracts and contexts, removing articles that did not satisfy the inclusion criteria. The Joanna Briggs Institute Qualitative Assessment and Review Instrument (JBI-QARI) was used to evaluate the quality of the articles. Seven articles (Table 1, Fig. 1) were selected.

## Quality appraisal

In this study, we used the JBI-QARI to evaluate whether the objectives, questions, data collection and analytical methods of each study were consistent with the research

**Table 1** Summary of participants, design and findings of the synthesised articles

| Study | Participants | Design/Methodology | Findings |
|---|---|---|---|
| Lawton *et al.* (2004) | 40 patients newly diagnosed (<6 months) with noninsulin-treated type 2 diabetes | Three semi-structured interviews at 6-month intervals; grounded theory | Patients reported strongly negative views of urine testing, preferring blood glucose monitoring. Most assumed blood glucose monitors were only offered to 'more serious' cases |
| Peel *et al.* (2004) | 40 patients newly diagnosed (<6 months) with noninsulin-treated type 2 diabetes | Three in-depth interviews; article focuses on first interview and perspectives on information needs at time of diagnosis; thematic analysis informed by grounded theory | Blood glucose monitoring can enhance patient awareness of the impact of lifestyle. However, monitoring can affect self-management when readings are counterintuitive |
| Peel *et al.* (2007) | 18 patients with type 2 diabetes with patients over four years after clinical diagnosis | Four repeat in-depth interviews; Longitudinal, qualitative study | Analysis revealed three main themes – the role of health professionals, interpreting readings and managing high values, and the ongoing role of blood glucose self-monitoring |
| Farmer *et al.* (2009) | 40 patients with noninsulin-treated type 2 diabetes | Semi-structured interviews; thematic analysis informed by grounded theory | Interviewees' perspectives of self-monitoring of blood glucose (SMBG) focused around three main themes: awareness, influence on health behaviour and empowerment |
| Hortensius *et al.* (2012) | 28 patients with type 1 or insulin-treated type 2 diabetes and over the age of 18 | In-depth interviews; All interviews were transcribed verbatim and analysed using the grounded theory approach | Perceptions, goals of SMBG and personal and contextual factors were identified, influencing the respondents' perspective of SMBG, and leading to this variety |
| Gucciardi *et al.* (2013) | 12 patients with type 2 DM and were not using insulin and over 18 years old | Semi-structured interviews; thematic network analysis | SMBG can facilitate a better understanding and maintenance of self-care behaviours. However, it can trigger both positive and negative emotional responses |
| Ong *et al.* (2014) | 12 patients with type 2 diabetes using insulin who had practiced SMBG | Semi-structured interviews; thematic analysis | The emotions associated with SMBG, and the complexity, pain and cost related to SMBG as well as personal and family motivation are the key factors |
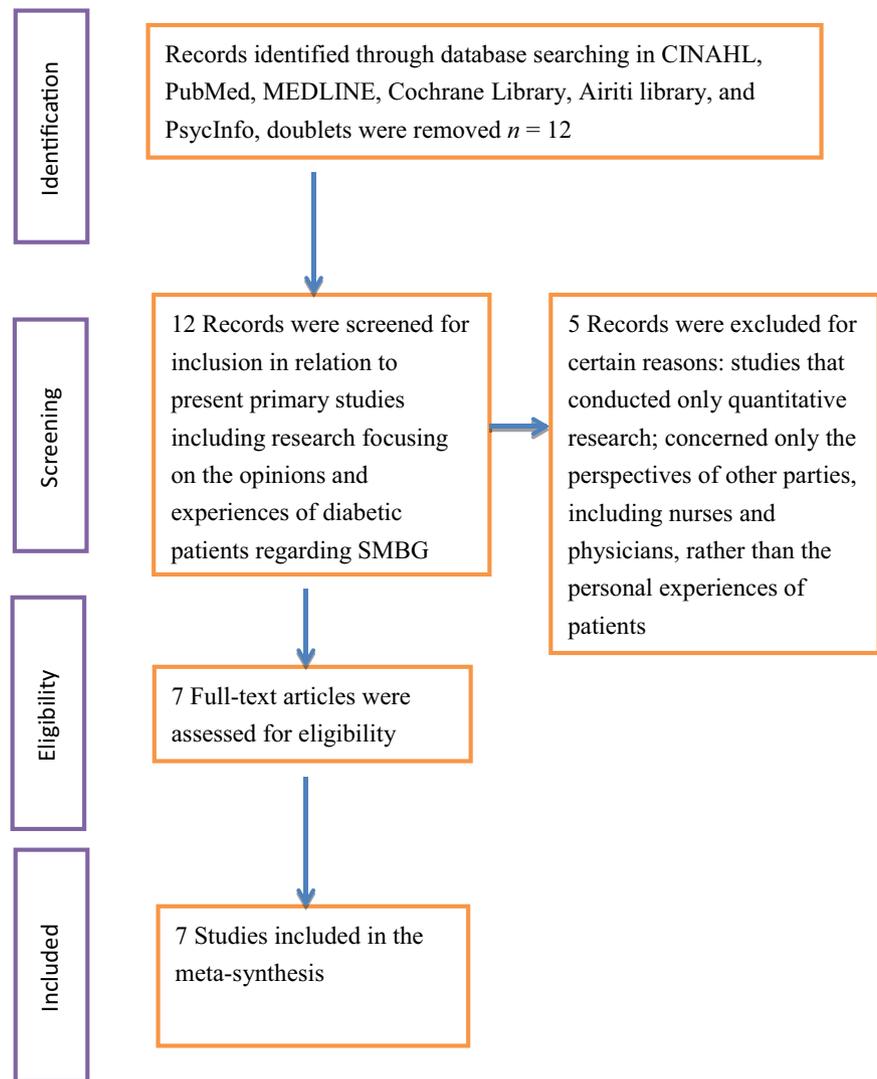
**Figure 1** Flow chart of literature search process.

methodology (Joanna Briggs Institute 2011). We screened the studies' titles and abstracts and individually appraised relevant studies following the tool facilitates the management, evaluation, analysis and integration of study data, and the provision of key assessment criteria (Joanna Briggs Institute 2011). The effectiveness of the methodologies adopted in the studies was strictly evaluated and reviewed by two independent reviewers. When the reviewers expressed differing opinions, a third reviewer determined the results. Subsequently, the selected articles were classified to facilitate identifying themes in the research results and understanding the raw data that comprised these themes. Evaluation and result classification was not performed to examine deficits in the articles; instead, we critically evaluated and classified the studies to mitigate differences generated during the qualitative metasynthesis process.

### Data abstraction and synthesis

Sandelowski and Barroso (2007) indicated that qualitative research metaanalysis involves qualitative metasummaries and qualitative metasynthesis. Qualitative metasummary refers to the quantitative summation of qualitative research results; by contrast, qualitative metasynthesis involves integrating the qualitative result interpretations of original studies, and enables synthesising interpretative data that document conceptual or thematic descriptions or interpretative explanations.

First, we carefully read all the articles. Second, researchers interpreted the results of the studies and compared, translated and analysed the scope of phenomena constructed and meanings extracted. Third and according to Graneheim and Lundman's (2004) content analysis, we grouped findings and created meaning units. Subsequently, each theme, sub-

theme and phenomenon was compared and contrasted before further examining the overall summarised structure of the article. The content and meanings of these key concepts were then analysed and described. In addition, the theoretical frameworks used in each article were identified.

In the next step, we carefully reread each article and highlighted the patient SMBG experiences, which were then combined and compared. Finally, these contents and meanings were compiled and assigned new structural implications and names, thereby establishing novel themes, each of which represented an interpretative rendering of all studies that remained faithful to the original research results. Table 2 shows the examples of the theme that was derived. The resulting synthesis produces a whole that is more than the parts alone represent.

## Results

### Metasummaries

In this study, we compiled the results of seven studies relevant to the SMBG experiences of diabetic patients (Table 1); these experiences were categorised into the following themes: perceived disease severity, effects on daily life, lifestyle adjustments after becoming aware of blood glucose levels, determining the meaning of self-monitoring, and differences between diabetic patients who use and do not use insulin.

Qualitative metasummaries consider the size of the frequency effect and intensity effect (Table 3). The frequency effect size refers to the number of original studies containing the subtheme of interest, divided by the number of all study reports. In other words, when the frequency effect was 100%, seven original studies contained the subtheme, and the value is divided by seven (number of all articles). The intensity effect size represents the contribution that the original studies have to each theme. An 80% intensity effect indicated that the original study contained four themes summarised in our study; the number three was then divided by the number of all themes in the study (i.e. five). The use of effect sizes provides more complex levels of understanding of the meaning of SMBG for people with diabetes.

### Metasynthesis

This study provides a comprehensive understanding of the SMBG experiences of diabetic patients, yielding five themes. These themes and the related subthemes are detailed as follows.

### Perceived disease severity

Self-monitoring of blood glucose enables patients to immediately determine their blood glucose levels. During the SMBG process, patients internalise self-perceptions regarding their disease and state of health by deciding whether to monitor changes in their blood glucose levels and act according to the results. This theme involves two subthemes: 'those who test their blood glucose have a more severe disease compared with those who test their urine glucose' and 'the association between monitoring results and state of health.'

*Those who test their blood glucose have a more severe disease compared with those who test their urine glucose.* Patients expressed various experiences and perceptions regarding the necessity of conducting blood or urine glucose monitoring. Most patients believed that blood glucose-monitoring devices are designed for those with severe diabetes. Consequently, respondents with this perception who typically performed urine tests assumed that patients who required blood glucose monitoring must have more severe diabetes compared with their own (Lawton *et al.* 2004, p. 1047). In addition, patients believed that blood glucose-monitoring devices are a more advanced technology compared with urine test devices. Thus, these patients believed that urine monitoring was inaccurate as it could not provide all necessary data (Lawton *et al.* 2004, Farmer *et al.* 2009). Certain patients worried about diabetes and its threat to their health, but were not informed that their blood glucose levels required monitoring; thus, they perceived that the medical staff members had failed to provide appropriate care (Lawton *et al.* 2004).

*Association between monitoring results and health status.* From the perspectives of several patients, blood glucose monitoring confirmed their diagnosis of diabetes. Because diabetic symptoms are not always obvious, blood glucose levels are used to observe the status of the disease (Peel *et al.* 2004, Farmer *et al.* 2009, Hortensius *et al.* 2012, Gucciardi *et al.* 2013). 'It lets me have an understanding… But then when you do get a higher reading, you realize, well if your sugar levels can go to that, then there is something wrong' (Peel *et al.* 2004, p. 185). Therefore, SMBG improves the awareness of patients with diabetes and assists in confirming abnormalities, enabling patients to understand changes in their blood glucose levels (Farmer *et al.* 2009) and estimate the severity of their illness: 'It's just sort of comforting to know that it's not going high and it's at the level where it won't cause any complications… that's the biggest thing, I think …' (Peel *et al.* 2004, p. 185). Overall, SMBG provides concrete and visible

**Table 2** Examples of the theme was derived

| Example themes from subthemes extraction | Quotes from papers | Translated subthemes | Translated themes |
|---|---|---|---|
| Patient felt they had to carry a lot of things with them whenever they would go out to be able to measure their glucose concentration (Hortensius *et al.* 2012) | 'Always having to think: did I remember this? Did I remember that? My pockets are always stuffed full of all kinds of things. It's annoying. My purse is like a moving van. I can't ever go out with a small neat purse. Not even when I go to the opera house'. *(Hortensius et al. 2012)* | Interference in daily lives | Effects on daily life Self-monitoring of blood glucose (SMBG)-related problems are not limited to the pain resulting from pricking fingers to obtain blood, and its requirements cause various inconveniences in daily life. These monitoring inconveniences cause diverse and individualised emotional distress |
| Patients complained that testing did not fit into their lifestyle or work patterns, or that they encountered problems in using the monitor (Peel *et al.* 2004) | 'I struggle to … work that darned thing, that machine'. (Peel *et al.* 2004) | | |
| Felt 'the fiddly bits' (Lawton *et al.* 2004) | 'I don't think it's a good thing for people to mess about like that,….. I don't mess about with those sort of things on my own'. (Farmer *et al.* 2009) | | |
| The finger prick can be painful and can lead to callous and hard spots (Hortensius *et al.* 2012, Gucciardi *et al.* 2013, Ong *et al.* 2014) | 'I have only five fingers and they're all sort of pricked useless'. (Peel *et al.* 2004). 'It is not easy to get a drop of blood. I have got hard black marks on his hand'. (Hortensius *et al.* 2012) | | |
| According to these participants SMBG required a lot of organisational effort and interruption of their regular activities (Hortensius *et al.* (2012) | | | |
| This association between self-monitoring and individual behaviour was particularly marked and was closely aligned with a language of self-chastisement (Peel *et al.* 2007) | 'It's telling me I'm being bad maybe or not keeping—not being strict enough—and I think that's why I don't use it'. (Peel *et al.* 2007) | Emotional distress | |
| Many participants viewed and interpreted readings as a proxy measure of short term good or bad behaviour (Peel *et al.* 2007). | 'I'm angry at myself for being so weak and pathetic. I'm inclined to worry that, I'm failing to do something as a sense of responsibility and that just hangs round me like an albatross really'. (Peel *et al.* 2004) | | |
| Readings outside the specified parameters were associated with feelings of failure. These participants described making efforts to adhere to dietary and physical activity recommendations as part of their diabetes control strategies, and abnormally high readings may have been considered a failure of these efforts (Farmer *et al.* 2009, Ong *et al.* 2014) | 'I feel guilty and, and a bit of a failure and I don't know why'. (Farmer *et al.* 2009). 'But, but, even if I, even if I do everything they say, for a couple of days, I still don't get good readings, so you know there's nothing there to encourage me'. (Farmer *et al.* 2009) | | |

**Table 2** (Continued)

| Example themes from subthemes extraction | Quotes from papers | Translated subthemes | Translated themes |
|---|---|---|---|
| When the readings were not in accordance with the expectations, especially unexpected 'poor' readings, respondents reported feeling frustrated, anxious, ashamed or helpless (Hortensius *et al.* 2012, Gucciardi *et al.*(2013) | 'If my blood sugars are high and I think they shouldn't be I really get fed up'. (Peel *et al.* 2004). 'I've not had a bit of sugar today or yesterday and it's so high. I've not had a bit [of] fruit. I've had nothing, to my knowledge with sugar in it and it still reads so high'. (Peel *et al.* 2004) | | |
| Some respondents reported having been worried or depressed (Farmer *et al.* 2009, Hortensius *et al.* 2012) | 'In that period of depression I was just happy when I felt good and that things were moving again, and that I could do my job again and things like that, and for me that was enough' (Hortensius *et al.* 2012). 'I feel I get it done often enough so that quite suits me. I think very often, you could get worried if you keep doing it…'. (Farmer *et al.* 2009) | | |

results that can compel patients to accept their diabetes diagnosis (Hortensius *et al.* 2012).

*Effects on daily life*
Self-monitoring of blood glucose-related problems is not limited to the pain resulting from pricking fingers to obtain blood, and its requirements cause various inconveniences in daily life. These monitoring inconveniences cause diverse and individualised emotional distress. This theme involves two subthemes: 'The interference in daily life' and 'emotional distress.'

*Interference in daily life.* Some patients expressed that when they initially used the blood glucose-monitoring device, they experienced problems operating the device. Furthermore, they complained that blood glucose monitoring could not be integrated into their daily lives or work. Thus, they felt that they could never be truly unconstrained from the effects of having this disease because they had no option other than allowing diabetes to dominate their lives (Lawton *et al.* 2004, Peel *et al.* 2004, Hortensius *et al.* 2012). In addition, the patients realised that testing caused discomfort, such as pain, skin numbness or stiffness, after continual pricking of the fingers (Lawton *et al.* 2004, Hortensius *et al.* 2012, Gucciardi *et al.* 2013, Ong *et al.* 2014). Most patients believed that SMBG would require assistance from numerous people and interrupt their daily activities. In particular, they felt that wherever they went they would be required to carry a large kit of equipment to measure their blood glucose levels (Hortensius *et al.* 2012). 'My pockets are always stuffed full of all kinds of things. It's annoying. My purse is like a moving van. I can't ever go out with a small neat purse.' (Hortensius *et al.* 2012, p. 5).

*Emotional distress.* When holding the blood glucose-monitoring device, patients felt that they developed a persistently negative attitude towards the data (Peel *et al.* 2004, 2007). Frequently, an increase in the blood glucose level induced feelings of self-reproach and negative emotional reactions (Peel *et al.* 2004, Gucciardi *et al.* 2013), particularly when the blood glucose level exceeded the specific reference level, the patients frequently felt a sense of failure (Farmer *et al.* 2009, Ong *et al.* 2014). The patients indicated that they strived to attain control of their diabetes by abiding to prescribed dietary requirements and physical activities. However, when high blood glucose levels were observed, these patients not only regarded their efforts as a failure (Farmer *et al.* 2009) but also felt a sense of self-punishment, confusion and anxiety (Peel *et al.* 2007). Moreover, when the measurement results did not meet expectations or exhibited unexpected and undesirable values, the patients felt depressed, anxious, ashamed, powerless or helpless (Peel *et al.* 2004, Hortensius *et al.* 2012, Gucciardi *et al.* 2013, Ong *et al.* 2014). The sense of agitation and frustration differed when patients did not expect a blood glucose level vs. when the patient understood the reasons for their high blood glucose level (Peel *et al.* 2004, Farmer *et al.* 2009). 'Sometimes if you get, not depressed, but when you're saying, I've not had a bit of sugar today

**Table 3** Intrastudy intensity effect sizes and interstudy frequency effect sizes of themes pertaining to patients' experiences of self-monitoring of blood glucose (SMBG)

| Theme | Perceived disease severity | | Effects on daily life | | Lifestyle adjustments after becoming aware of the blood glucose levels | | Determining the meaning of self-monitoring | | Difference between diabetic patients who use and do not use insulin | | Intrastudy intensity effect sizes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Subthemes | Those who test their blood glucose have a more severe disease compared with those who test their urine glucose | Association between monitoring results and health status | Interference in daily lives | Emotional distress | Assessing the influence of lifestyle on blood glucose levels | Adopting actions and adjustment | Passively performing SMBG for others | Actively deciding to perform SMBG | Differing behaviours towards the monitoring results | Health care professionals presenting varying attitudes towards the necessity of SMBG | Individual studies' contribution to themes |
| **Authors** | | | | | | | | | | | |
| Lawton et al. (2004) | × | × | × | | | | | | | | 40% (2 out of 5) |
| Peel et al. (2004) | | × | × | × | × | × | × | | × | | 100% (5 out of 5) |
| Peel et al. (2007) | | | | × | | × | × | × | | × | 80% (4 out of 5) |
| Farmer et al. (2009) | × | × | | × | × | × | × | × | | | 80% (4 out of 5) |
| Hortensius et al. (2012) | | | × | × | | × | × | × | × | × | 80% (4 out of 5) |
| Gucciardi et al. (2013) | | × | × | × | × | × | × | | | | 80% (4 out of 5) |
| Ong et al. (2014) | | | × | × | × | | × | | × | | 80% (4 out of 5) |
| **Inter study frequency effect sizes** | | | | | | | | | | | |
| Representation of subthemes in individual studies | 29% (2 out of 7) | 57% (4 out of 7) | 71% (5 out of 7) | 86% (6 out of 7) | 57% (4 out of 7) | 71% (5 out of 7) | 86% (6 out of 7) | 43% (3 out of 7) | 43% (3 out of 7) | 29% (2 out of 7) | |

or yesterday and it's so high. I've not had a bit [of] fruit. I've had nothing, to my knowledge with sugar in it and it still reads so high' (Peel *et al.* 2004, p. 186).

### Lifestyle adjustments after becoming aware of the blood glucose levels

The patients used self-monitoring results to evaluate how their lifestyles influenced their blood glucose levels. In addition, self-monitoring prompted patients to adhere to healthy lifestyles. Patient interpretations of various values influenced their subsequent actions. This theme involved two subthemes: 'assessing the influence of lifestyle on blood glucose levels' and 'adopting actions and adjustments.'

*Assessing the influence of lifestyle on blood glucose levels.* Based on the self-monitoring values, the patients understood how food, exercise or other living habits influenced their blood glucose levels and learnt to judge what they could do vs. which foods and actions were prohibited. The patients could evaluate the effects of their daily life and connect their lifestyle with their blood glucose levels (Peel *et al.* 2004, Farmer *et al.* 2009, Gucciardi *et al.* 2013, Ong *et al.* 2014). SMBG plays a positive role in patient management of diabetes (Peel *et al.* 2004). Patients indicated that they used their self-monitoring results to evaluate how their daily behaviours influenced their blood glucose levels: '….you can certainly tell whether you've eaten the wrong things. Or whether you've overdone it and then you obviously need to go and correct that by doing exercise or being extremely good, you know' (Farmer *et al.* 2009, p. 32).

*Adopting actions and adjustment.* Patient interpretations of various values influenced their subsequent actions and evaluations of the results of their actions. When the monitoring result value was high or low, the patients changed their behaviours or appropriately adjust their self-management (Peel *et al.* 2004, Farmer *et al.* 2009, Gucciardi *et al.* 2013). 'If I think it is high I can maybe cut back on something' (Peel *et al.* 2004, p. 186). 'There was a few times for about a fortnight it was away up in the twenties. Then I thought "Right" so I stopped drinking' (Peel *et al.* 2004, p. 186). Some patients also adopted wait-and-see policy (Hortensius *et al.* 2012). 'My weight was good, I didn't have too much belly fat, … so I figured that things were going all right. So I just waited to see what the next month's results would bring' (Hortensius *et al.* 2012, p. 4).

### Determining the meaning of self-monitoring

When the patients integrated self-monitoring interpretations and treatment into their daily routines, they continuously contemplated and considered what blood glucose monitoring meant to them. This theme involves two subthemes: 'passively performing SMBG for others' and 'actively deciding to perform SMBG for oneself.'

*Passively performing SMBG for others.* Self-monitoring can empower patients; however, certain patients performed SMBG for their physicians, rather than for themselves (Peel *et al.* 2004, 2007, Ong *et al.* 2014). Initially, these patients refused to monitor their blood glucose (Peel *et al.* 2004) because they felt it was unnecessary (Hortensius *et al.* 2012) or burdensome (Farmer *et al.* 2009). Nevertheless, after their physicians convinced these patients that blood glucose testing was necessary, the patients were willing to perform the tests (Gucciardi *et al.* 2013). 'I don't think it's a good thing for people to mess about like that, unless the doctor suggests that I get something of that nature, then I would. But I would only do it under his instruction or if he told me or showed me how to do it, or the nurse. I don't mess about with those sorts of things on my own' (Farmer *et al.* 2009, p. 35). Several patients believed that if clinicians were uninterested in their daily measured values, then SMBG would be a 'waste of time' (Peel *et al.* 2004). This was another reason that patients failed to continue SMBG (Peel *et al.* 2007). When physicians were uninterested in the daily data that patients carefully recorded, the patients felt disappointed: '[The doctors were]… not the least bit interested in it, and I feel like asking them why the hang did they give me it in the first place' (Peel *et al.* 2004, p. 187).

*Actively deciding to perform SMBG.* These patients believed that they must be responsible for their health, take proactive care of their diabetes, and perform SMBG (Hortensius *et al.* 2012). They primarily used their SMBG results to understand how their behaviour affected their health (Peel *et al.* 2007, Farmer *et al.* 2009). Several of these patients considered the information vital and actively communicated the changes in their blood glucose levels to medical staff members (Farmer *et al.* 2009) rather than passively waiting for their physicians to act. '… any trend that comes up…I don't have to wait for a doctor to tell me the answer. I mean if I have any problems, if I find my blood sugar low, low, low, I can go straight into the doctor and say 'Look what's happening.' If I have to wait for somebody else then I could be done by then' (Farmer *et al.* 2009, p. 34).

### Differences between diabetic patients who use and do not use insulin

Although diabetic patients who require and do not require insulin share similarities, their individual factors and atti-

tudes vary. This theme involves two subthemes: 'differing behaviours towards the monitoring results' and 'medical staff members presenting varying attitudes towards the necessity of patient self-monitoring.'

*Differing behaviours towards the monitoring results.* Although diabetic patients who use and do not use insulin share similarities, their individual focuses differ. Diabetic patients who did not use insulin focused on regulating their daily food intake and lifestyle, including exercise, when responding to the monitoring results (Peel *et al.* 2004). In addition, their blood glucose-monitoring methods demonstrated variations in the time and frequency of testing, because they hoped to enjoy their lives rather than continually focusing on their diabetic condition. By contrast, diabetic patients who used insulin focused on insulin dosage amounts. Because certain patients had sustained autonomic nerve damage and were no longer aware of hypo- and hyperglycaemic symptoms, SMBG was considered helpful in prevention and detection (Hortensius *et al.* 2012, Ong *et al.* 2014). Therefore, diabetic patients who used insulin considered that SMBG enabled them to understand their current blood glucose levels, and SMBG became a habit (Hortensius *et al.* 2012).

*Health care professionals presenting varying attitudes towards the necessity of SMBG.* Clinically, medical staff members exhibited consistent attitudes towards the necessity of SMBG among patients using insulin. However, varying approaches existed towards patients who did not use insulin. Patients could perform tests once per day, twice per week or once every 2 to 3 months (Peel *et al.* 2007). Thus, medical staff members did not strictly regulate the monitoring frequency of diabetic patients who did not use insulin. Regardless of their insulin requirements, patients with diabetes felt that their goals and perceptions regarding SMBG were disparate to those of medical staff members. The staff members emphasised strict control of blood glucose, whereas the patients emphasised creating a balance between quality of life and blood glucose control (Hortensius *et al.* 2012). These patients felt supported when the medical staff members customised individual blood glucose control plans based on their unique conditions (Hortensius *et al.* 2012).

## Discussions

By using the qualitative synthesis method, we established an integrated perspective on the SMBG experiences of dia-betic patients. The results indicated that SMBG is a useful strategy for controlling patient blood glucose levels (Farmer *et al.* 2009), when patients reasonably and appropriately respond to the measured data (Ceriello 2012, Polonsky & Fisher 2013). Blood glucose levels enable patients to monitor changes in their blood glucose levels (Peel *et al.* 2004) and illness statuses, or identify whether their self-care behaviours require modification (Peel *et al.* 2004, Farmer *et al.* 2009). However, when patients or medical staff members do not react to the measurement results (e.g. regulating patient diet, and medication or exercise frequencies), believe that interpreting or responding to the data is difficult, or do not know the appropriate reaction, this decreases the efficacy of SMBG and patient willingness to continually monitor blood glucose levels (Peel *et al.* 2007, Song & Lipman 2008, Hortensius *et al.* 2012, McAndrew *et al.* 2012).

Scholars have determined that SMBG can encourage patient adherence to dietary and medication treatment plans (Peel *et al.* 2004, Farmer *et al.* 2009, McAndrew *et al.* 2012, Virdi *et al.* 2012, Ong *et al.* 2014). Blood glucose monitoring provides physical data, which can be used as basis for changing dietary plans (McAndrew *et al.* 2011, 2012, Gucciardi *et al.* 2013). This assertion supports the common-sense model of self-regulation proposed by Leventhal *et al.* (2008). However, in this qualitative metasynthesis, numerous findings differed from those based on the common-sense model. Certain patients performed SMBG to placate others and refused to assume an active role in their care (Peel *et al.* 2004, 2007, Farmer *et al.* 2009). Conversely, other patients were willing to actively assume responsibility and integrated SMBG into their lives (Peel *et al.* 2007, Farmer *et al.* 2009, Hortensius *et al.* 2012). Therefore, not all patients are active problem solvers (Thorne & Paterson 1998).

Patient responses to SMBG results were diverse and personal. Certain patients experienced few difficulties, whereas others felt that SMBG strongly affected their lives and caused anxiety and numerous internal and external psychological conflicts (Peel *et al.* 2004, 2007, Farmer *et al.* 2009, Hortensius *et al.* 2012, Gucciardi *et al.* 2013, Ong *et al.* 2014). Research has confirmed that emotional fluctuations influence the effectiveness of health care for diabetes (Roglic *et al.* 2002, Skovlund & Peyrot 2005). However, whether emotional fluctuations reduce patient willingness to perform SMBG, or whether SMBG affects emotional stability and quality of life remains unknown, necessitating further research.

In addition, based on the synthesised data, emotional problems were occasionally caused by misconceptions

regarding the disease. Confronted with an ineradicable disease, patients with diabetes experience diverse cognitive processes that are influenced by personal life experiences and cultural context. Patients construct cognitions and meanings about their disease using distinct approaches, and they might not realise the conflicts between various cognitions. Some patients adopt wrong combinational logic that might influence their decision-making behaviour and emotions. From the perspective of clinical application, coping behaviours might not be the necessary approach to solve emotional problems. Clarifying this misconception in cognition can at least partially reduce the worries of patients. Leventhal *et al.* (2008) asserted that emotion-focused coping was a crucial factor affecting patient adjustment. However, patients' cognitive representations of their disease determine how they manage the disease and reduce the level of threat. The extended action plans created according to patients' cognitive representations in terms of cognitive processing are key to facilitating patient devotion to and maintenance of coping behaviours.

Instead of infusing patients with new knowledge, health care professionals should search for patients' misconceptions about diseases and adopt concepts and terminologies that patients can accept to clarify patient misconceptions. Thus, the communication between patients and health care professionals would be much more efficient. In addition, health care professionals should spend more time caring for and counselling patients who face their diseases with negative emotions, enabling patients to face their diseases with a positive attitude.

## Conclusions

Insights into and discussions regarding the SMBG experiences of diabetic patients enable health care professionals to understand the factors that influence the intentions of patients to perform SMBG and facilitate establishing customised SMBG treatment plans. Our interpretations of the qualitative results and synthesised themes indicated that patients continually and closely monitored themselves and interacted with others and the environment during the SMBG process. This behaviour is related to personal cognition, emotional perceptions, learning and adjustment. Therefore, flexibility and individualisation should be emphasised when educating patients regarding SMBG. Moreover, patients and health care professionals must provide each other with feedback concerning the SMBG results and make therapeutic decisions together. Patients must be able to perform self-care by reacting to the SMBG results,

appropriately controlling their blood glucose levels, and adjusting their lifestyles to prevent or reduce the risks of fluctuating blood glucose levels (Belsey *et al.* 2009). In addition, health care professionals must incorporate SMBG data into individualised treatment plans (Klonoff *et al.* 2008).

In metasynthesis, meta implied overall, and synthesis indicated making a whole; therefore, it provided empirical data regarding the overall connotation of a life experience (Castro *et al.* 2010). Determining the entirety and spatio-temporal context framework of patients with diabetes when they performed SMBG and explaining the meaning of their behaviour by using qualitative metasynthesis enabled providing crucial information about empirical applications.

## Relevance to clinical practice

Health care professionals must adopt flexible and individualised criteria to determine patient cognitive misconceptions, understand negative emotional reactions and provide individualised assistance.

Based on the results, we suggest the followings:

1 During medical in-service education, training should focus on listening to patients to enable health care professionals to understand the behaviours of patients and common predicaments encountered during SMBG.
2 Health care professionals should be aware of the negative emotional reactions that result from blood glucose monitoring and counselling should be provided to assist patients in managing their problems and emotions.
3 Health care professionals should determine and actively clarify the primary misconceptions of patients regarding SMBG.
4 Health care professionals should understand patient SMBG behaviours and provide customised assistance by incorporating flexible and individualised principles.
5 Future studies should analyse how SMBG affects mental health and quality of life.

## Disclosure

The authors have confirmed that all authors meet the IC-MJE criteria for authorship credit (www.icmje.org/ethical_1author.html), as follows: (1) substantial contributions to conception and design of, or acquisition of data or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, and (3) final approval of the version to be published.

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## Conflict of interest

The authors have no conflicts of interest.

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