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Résumé

Évaluation d'une intervention favorisant la perception personnelle chez les adultes souffrant d'un diabète de type 1 et d'hypoglycémie non perçue

Cheri Ann Hernandez, Margaret R. Hume et N. Wilson Rodger

L'objet de cette étude prospective avant-après était de déterminer les éventuels avantages psychosociaux et physiques d'une intervention favorisant la perception personnelle chez les adultes souffrant d'un diabète de type 1 et d'hypoglycémie non perçue (HU). Vingt-neuf adultes en tout ont participé aux 8 séances d'intervention, d'une durée de 3 heures chacune. Des mesures psychologiques (intégration, qualité de vie des personnes diabétiques) et physiques (nombre de signaux corporels, événements liés à la non perception de l'hypoglycémie, HbA1c) ont été faites au départ, puis 6, 12 et 18 mois après les séances. Après l'intervention, les participants détectaient davantage de signes d'euglycémie et d'hypoglycémie; leur intégration et leur contrôle métabolique (HbA1c) présentaient également une hausse significative. Le nombre d'événements liés à la non perception de l'hypoglycémie n'avait pas diminué et on notait des résultats instables en ce qui concerne la qualité de vie des personnes diabétiques. Une intervention favorisant la perception personnelle peut avoir des avantages physiques et psychosociaux, de même qu'elle a des implications pour l'éducation en matière de diabète. Cette intervention doit être testée dans une étude contrôlée, randomisée et multicentrique.

Mots-clés : signaux corporels, perception du diabète, hypoglycémie non perçue, intégration

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Evaluation of a Self-Awareness Intervention for Adults with Type 1 Diabetes and Hypoglycemia Unawareness

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The purpose of this prospective before-and-after study was to determine whether there are psychosocial and physical benefits of a self-awareness intervention for adults with type 1 diabetes and hypoglycemia unawareness (HU). A total of 29 adults participated in the self-awareness intervention of 8 sessions, each lasting 3 hours. Psychosocial (integration, diabetes quality of life) and physical (number of body cues, HU-related events, HbA1c) measures were taken at baseline and at 6, 12, and 18 months post-intervention. Post-intervention the participants detected more cues of euglycemia and hypoglycemia and experienced significant increases in integration and metabolic control (HbA1c). The number of HU-related events was not decreased and diabetes quality-of-life results were unstable. A self-awareness intervention can have physical and psychosocial benefits and has implications for diabetes education. This intervention needs to be tested in a multi-centre randomized control trial.

Keywords: body cues, collaborative alliance, diabetes self-awareness, glycemic control, hypoglycemia unawareness, integration

Introduction

Hypoglycemia is considered the main obstacle to achieving consistent glycemic control in type 1 diabetes. The risks and fears of hypoglycemia are compounded with the development of hypoglycemia unawareness (HU), which is manifested by decreased ability to perceive or discern the onset of hypoglycemia (Frier, 1993). HU is a serious clinical problem in the treatment of type 1 diabetes, occurring in up to 50% of long-term patients (Pinn & Gale, 1992).

Factors that cause alterations in the normal glucose counterregulatory system, such as frequent hypoglycemia (Cryer, Davis, & Shamoon 2003; Liu, McManus, & Ryan, 1996), longstanding diabetes (Pinn & Gale, 1992), and intensive insulin therapy (Liu et al., 1996), are associated with the development of HU. The main clinical concern with HU is greater risk of severe hypoglycemic episodes (Cryer, Fisher, & Shamoon, 1994;

Pinn & Gale, 1992), with its many concomitant risks such as accidents, loss of consciousness, seizures, and even death. HU may also have a detrimental impact on quality of life (Wredling, Theorell, Roll, Lins, & Adamson, 1992). The management of HU is multifaceted. It may include assisting individuals to become more aware of cues associated with varying glycemic levels. Inability to recognize glycemia-related cues precludes prompt treatment for abnormal blood glucose, thus preventing adequate self-management of diabetes. The present study entailed a self-awareness intervention (SAI) for adults with type 1 diabetes and HU.

Background

A growing body of literature points to the need to help patients become more sensitive to their individual glucose-related cues and symptoms, particularly those indicating hypoglycemia (Cryer et al., 1994; Hernandez, Bradish, Rodger, & Rybansky, 1999; Hoffman et al., 1989). The ability to sense blood glucose fluctuations is an important aspect of self-management of type 1 diabetes (Cox et al., 1989). Patients frequently maintain blood glucose at high levels to offset fear of hypoglycemia, which puts them at increased risk for chronic complications such as retinopathy, neuropathy, and nephropathy (Diabetes Control and Complications Trial [DCCT] Research Group, 1993). Self-monitoring of blood glucose indicates the blood glucose level at the time tested, so hypoglycemia may go undetected even in those who are monitoring regularly. In addition, patients who have switched from fingertip to forearm testing may miss hypoglcyemic episodes due to the inaccuracy of forearm testing at hypoglycemic levels (Meguro, Hosokawa, Funae, & Atsumi, 2005).

The educational approach of teaching patients a core group of symptoms for hypo- and hyperglycemia can actually contribute to misdirected adjustment to the diabetes regimen, because these symptoms may not be the characteristic glycemia-related cues experienced by individual patients (Hernandez, Bradish, et al., 1999; Weinger, Jacobson, Draelos, Finkelstein, & Simonson, 1995). Some persons with HU have symptoms of hypoglycemia that they had not previously recognized and so might benefit from interventions to help them recognize those early warning signs (Clarke et al., 1995). Several studies have found that individuals can be taught to become sensitive to blood glucose levels (Cox et al., 1989, 1991; Cox, Gonder-Frederick, Julian, & Clarke, 1994; Hernandez, Laschinger, Rodger, Bradish, & Rybansky, 2004) and that sensitivity can be sustained over time (Cox et al., 1994). Sensitivity to blood glucose levels is enhanced through the identification of a greater number of symptoms for hypoglycemia (Cox, Cryer, Gonder-Frederick, Clarke, &

Antoun, 1993), with a combination of internal and external cues (Cox et al., 1989; Hernandez, Bradish, Laschinger, Rodger, & Rybansky, 1997), and through a variety of self-tests (Hernandez et al., 1997). Research has focused on improving awareness of blood glucose cues through Blood Glucose Awareness Training (Cox et al. 1989, 1991, 1994; Nurick & Johnson, 1991) and self-awareness education (Hernandez et al., 2004). To our knowledge, however, no intervention has specifically targeted only persons with HU. The present evaluation of a self-awareness intervention was designed to enhance self-awareness in type 1 adults with HU.

Conceptual Framework

This research was conducted within the theoretical framework of Hernandez's (1991) Theory of Integration, which was developed in and has been used in both type 1 and type 2 diabetes (Hernandez, 1995a, 1996; Hernandez, Antone, & Cornelius, 1999). Integration is described as a three-phase process of integration of the personal self (entity that existed prior to diagnosis) and the diabetic self (new entity that emerged upon diabetes diagnosis). By tuning into body cues and sensations, and using this body knowledge to make appropriate regimen adjustments, individuals with diabetes developed expertise in their own diabetes that allowed them to achieve glycemic control. Aspects of the theory of integration were used to design the SAI and to implement it employing the collaborative alliance education method (Hernandez, 1994).

The Study

Aims

This study was an evaluation of a new educational intervention to help participants become self-aware and detect important body cues for varying levels of glycemia. Its purpose was to evaluate the effectiveness of an SAI in (1) promoting increased awareness of body cues associated with various levels of glycemia, and (2) enhancing the well-being of type 1 diabetic adults with HU. Specifically, the study was designed to determine the effectiveness of the SAI in increasing the number of cues for varying levels of glycemia, reducing the number of HU-related incidents, promoting increased levels of integration and diabetes quality of life, and improving hemoglobin A1c levels. The research questions were: 1. *What is the effect of an SAI program on the number of body cues identified for different levels of glycemia?* 2. *What is the effect of an SAI program on the number of HU-related incidents?* 3. *What is the effect of an SAI program on perceptions of integration?* 4. *What is the effect of an SAI program on perceptions of diabetes quality of life?* 5. *What is the effect of an SAI program on metabolic control?*

Design

This was a prospective before-and-after study carried out in southwestern Ontario, Canada. A power analysis was not performed as this was a pilot study. The sample size was determined by the number of individuals who could be reasonably accommodated in a classroom situation, given the nature of the educational intervention and the amount of funding available. Data were collected at the first intervention session (baseline) and at 6, 12, and 18 months post-intervention.

Participants

A convenience sample of 29 type 1 diabetics with HU was recruited through endocrinologists' offices. Selection criteria were: over 21 years of age, type 1 diabetes for at least 5 years, diagnosed with HU, and currently self-monitoring blood glucose with a glucose meter. HU had been diagnosed previously by endocrinologists but the diagnosis was verified using an eight-item hypoglycemic awareness survey (Clarke et al., 1995). Patients self-selected to participate in either a morning group or an evening group.

Self-Awareness Intervention (SAI)

The SAI was delivered using the collaborative alliance education method (Hernandez, 1994). Collaborative alliance has been described as a relationship between the client and the educator that is characterized by mutual trust and respect and reciprocity in the areas of participation, power, and acknowledgment of expertise (Hernandez, 1991). In the collaborative alliance education method, the client is acknowledged as being an active participant and a self-determining expert in his or her own diabetes. Therefore, the participants in the present study took part in choosing education content, methods, sequencing, and strategies, and in delivering the education program.

The SAI consisted of eight 3-hour sessions held biweekly. The major topic areas and research activities are presented in Table 1. At the first session, the participants were given an SAI manual and introduced to the concept of self-awareness through a video that had been developed during previous SAI research (Hernandez et al., 2004). Both the manual and the video described self-awareness as (1) being constantly sensitive to body cues and sensations and listening to your body; (2) knowing your body's particular cues and signals that result from low, normal, and high blood glucose; (3) knowing what circumstances might precipitate these cues; and (4) knowing your body's norms for different times of the day, days of the month, and perhaps even seasons of the year. The manual provided diabetes information related to self-awareness and the development of

collaborative alliances. It included possible homework and classroom activities as well as forms for documenting individual progress. At the beginning of each session, general topics (e.g., hypoglycemia) were identified as themes for the session. However, consistent with the collaborative alliance teaching method, the activities within each topic, their sequencing, and the time spent on them were co-determined by the participants, based on their needs and preferences, and homework assignments, though strongly encouraged, were voluntary. Self-monitoring of blood glucose, as a means of objectively validating blood glucose levels and the detection of relevant body cues, was an important aspect of both classroom and homework activities.

Data Collection

The study questionnaire included demographic data and published instruments with known validity and reliability to measure integration and diabetes quality of life.

Integration. Integration was measured by the total score on the *The Diabetes Questionnaire* (TDQ), a 15-item instrument with a six-point Likert format (1 = *strongly disagree;* 6 = *strongly agree*). The questionnaire was pilot tested with 224 patients with type 1 or type 2 diabetes and proved to have both content and construct validity. Reliability has also been demonstrated: Pearson's r = .75 for test-retest reliability and Cronbach's alpha .84 for internal consistency of the total scale, and .77 and .80, respectively, for the Psychoemotional Adjustment and Somatic Sensitivity subscales (Hernandez, 1995b). Internal consistency results for the TDQ in this study were .80, .85, .87, and .85 at baseline, 6 months, 12 months, and 18 months, respectively.

Diabetes quality of life. Diabetes quality of life was measured by the total score on the *Diabetes Quality-of-Life* (DQOL) scale, a 46-item instrument with a five-point Likert format and four subscales: satisfaction (1 = *very satisfied;* 5 = *very dissatisfied*); impact (1 = *no impact;* 5 = *always impacted*); diabetes worry (1 = *never worried;* 5 = *always worried*); and social/vocational worry (1 = *never worried;* 5 = *always worried*). This instrument was pilot tested with 192 adults and adolescents with diabetes and was shown to be valid (content and concurrent validity), stable (Pearson's r = .92), and internally consistent (Cronbach's alpha = .92) (DCCT Research Group, 1988). Internal consistency for the DQOL was .89, 83, .88, and .82 for baseline, 6 months, 12 months, and 18 months, respectively.

Metabolic control. Metabolic control was assessed through the hemoglobin A1c (HbA1c) and the number of HU-related incidents (meter glucose readings below 3.5 mmol/L without prior warning signs, driving infractions/accidents, hypoglycemic episodes requiring treatment assis-

Table 1 *Self-Awareness Intervention (SAI)*

Session	General Content	SAI Classroom Activities	Homework	Research Activities
Class 1	Introduction to Self-Awareness (SA) and Collaborative Alliance Method	SA video, SA manual and discussion SA assessment and exercises Blood glucose monitoring (BGM) in conjunction with exercises	SA exercises Interview with family members	Completion of questionnaires Random blood glucose and Hb A_{1c} Simultaneous meter checks with lab
Classes 2–4	Hyppoglycemia, HU, SA strategies	Small and large group discussion of homework findings Discussion of hypoglycemia cues SA exercises	SA exercises BGM Family member interview Denial exercise	Repeat meter checks until accuracy demonstrated Clinical consultant review of meter care and operation
Classes 5–6	Hyperglycemia SA strategies Review and summary	Small and large group discussion of homework findings Discussion of hypoglycemia cues SA exercises	SA exercises BGM Hyperglycemia diary SA learning from others	
Class 7	Euglycemia SA strategies	Large group discussion of learning from homework exercises Discussion of euglycemia cues SA exercises	SA exercises BGM	

Class 8	Personal SA strategies Focus on HU strategies How to develop collaborative alliance relationships	Individual and/or group feedback on homework findings Discussion of personal SA strategies Collaborative alliance role play	SA exercises BGM	Learning assessment and program evaluation, part 1, by external consultant
6 months post-test				Completion of questionnaires Blood drawn for HbA1c Simultaneous meter checks with lab Learning assessment and program evaluation, part 2, by external consultant
12 months post-test				Completion of questionnaires Blood drawn for HbA1c Simultaneous meter checks with lab
18 months post-test				Completion of questionnaires Blood drawn for HbA1c

tance, visits to the emergency room or hospitalization). The analysis method of HbA1c used for all but the 18-month time point was high-pressure liquid chromatography, a method that is the acknowledged gold standard for glycated hemoglobin determination (Daneman & Ellis, 1996). At the final time point the laboratory had converted to an automated chemistry analyzer method. The normal reference range for HbA1c was 0.43 to 0.61 for both methods.

For the purpose of ensuring accuracy of the participants' blood glucose meters, laboratory determinations were compared with participants' meter readings at the first SAI session and at the 6- and 12-month post-intervention sessions. Meter readings were required to be within 15% of the laboratory values.

Other measures. A learning assessment and program evaluation were completed by an external consultant at the end of the final (eighth) SAI session and 6 months post-intervention. The results of this two-part evaluation are published elsewhere (Hernandez, Hume, & Rodger, 2003).

Ethical Considerations

Ethical clearance for the study was obtained from the university's Research Ethics Board. The research nurse obtained informed consent at the beginning of the first SAI session. Confidentiality was ensured throughout the study.

Data Analysis

Statistical analyses were performed using SPSS version 8. The data from the two groups were combined for the analysis after unpaired *t* tests revealed no pre-intervention differences in demographic characteristics. Repeated measures analysis of variance (RM-ANOVA) was used to test the study questions to identify any pre- and post-intervention differences in numbers of symptoms/cues detected for high, low, and normal blood glucose; number of HU-related incidents; and levels of integration, diabetes quality of life, and glycemic control. The 0.05 level of significance was used for all tests.

Results

Results are presented for all post-intervention time points, but the focus of the present analysis is the 12-month and 18-month findings, since the 6-month findings are published elsewhere (Hernandez et al., 2003). Results of the study outcome measures are summarized in Table 2.

Participants

Data were collected from 23 participants at all four time points and are included in the analyses reported here. The sample comprised 12 men

and 11 women ranging in age from 29 to 75 years with a median age of 54 (*mean age* = 50.52). Duration of diabetes ranged from 10 to 47 years with a mean duration of 26.5 years. All participants were Caucasian. The majority reported "English Canadian" as their ethnic background, 57% were married, 64% reported having a college or university education, and 53% reported an annual household income greater than $40,000. Those who dropped out of the study did so due to illness of self or family member or lack of transport to all SAI sessions; one participant explained that she dropped out because she had learned enough to help her detect her "lows" and therefore did not need to continue with the study.

Physical Outcome Measures

The number of symptoms of glycemia (i.e., the number of cues recognized for low, normal, and high levels of glycemia) was the first physical outcome variable (study question 1). RM-ANOVA showed a significant change in number of symptoms for *low* over time (F [3, 19] = 4.44, $p <$ .05). Post hoc paired t tests showed that participants identified more symptoms for *low* at 18-month follow-up than at 12-month follow-up (t [21] = - 2.73, $p < .05$), but there were no significant differences between 18-month follow-up and either baseline or 6-month follow-up for this variable. Symptoms for *normal* also showed significant change over the four time points (F [3, 19] = 3.33, $p < .05$). Post hoc paired t tests showed no significant effects for the 18-month time point. Significantly more symptoms were reported at 12 months than at baseline (t [21] = -2.57, $p <$ 05). No significant differences over time were shown for symptoms for *high* or for total number of symptoms.

The HU-related events included low blood glucose episodes requiring treatment, hospitalization for low blood glucose, driving incidents (accidents, near accidents, and receiving tickets or warnings for poor driving), and blood glucose readings below 3.5 mmol/L without warning cues. RM-ANOVA showed no significant differences by time point on any of these variables (question 2).

RM-ANOVA showed a significant change in HbA1c over time (F [3, 19] = 7.54, $p < .01$) (question 5). Post hoc paired t tests revealed that the levels at 18 months differed significantly from those at baseline (t [22] = 3.99, $p < .01$) and at 6 months (t [21] = 3.98, $p < .01$).

Psychosocial Measures

Changes in integration over time points were analyzed using RM-ANOVA. There was a significant change in integration over time (question 3) in that TDQ scores showed appreciable change across the time points (F [3, 20] = 4.35, $p < .05$). Post hoc paired t tests revealed that TDQ scores were much higher at 18 months than at baseline (t [22] =

Table 2 ***Study Outcome Measures***

Measure	*Range*	*Mean*	*SD*	*F*	*Sig.*
Psychosocial Measures					
TDQ					
Baseline	55–87	75.30	7.81	4.35	.016
6 months	53–88	76.46	8.65		
12 months	65–90	79.30	7.67		
18 months	65–90	79.68	6.99		
DQOL⋆					
Baseline	61–144	93.31	18.70	18.51	.000
6 months	55–172	126.17	26.77		
12 months	48–122	88.05	17.37		
18 months	73–156	120.93	22.25		
Symptoms of Glycemia					
Symptoms for low					
Baseline	0–7	3.41	1.94	4.44	.016
6 months	0–10	3.36	1.99		
12 months	0–11	2.68	2.26		
18 months	1–13	3.32	2.63		
Symptoms for high					
Baseline	0–5	1.83	1.59	0.57	.640
6 months	0–6	1.91	1.76		
12 months	0–9	2.17	1.99		
18 months	0–12	2.26	2.60		
Symptoms for normal					
Baseline	0–0	0.00	0.00	3.33	.041
6 months	0–4	0.54	0.96		
12 months	0–3	0.50	0.91		
18 months	0–3	0.41	0.96		
Total symptoms					
Baseline	1–10	4.80	2.93	1.84	.179
6 months	0–20	5.75	4.10		
12 months	1–22	4.70	3.01		
18 months	1–25	5.35	3.25		

Measure	*Range*	*Mean*	*SD*	*F*	*Sig.*
Hypoglycemia Unawareness Events					
Required assistance					
Baseline	0–52	13.33	17.40	0.86	.478
6 months	0–52	9.43	14.78		
12 months	0–26	6.86	11.01		
18 months	0–39	7.10	11.59		
Hospitalization					
Baseline	0–10	0.76	2.19	1.11	.370
6 months	0–1	0.14	0.36		
12 months	0–2	0.14	0.48		
18 months	0–1	0.19	0.40		
Driving incidents					
Baseline	0–2	0.29	0.72	1.00	.410
6 months	0–1	0.10	0.30		
12 months	0–4	0.26	0.80		
18 months	0–2	0.14	0.48		
Blood glucose < 3.5					
Baseline	0–50	16.55	15.99	2.23	.121
6 months	0–50	7.55	10.40		
12 months	0–45	9.72	10.96		
18 months	0–104	19.85	31.69		
Total HU events					
Baseline	3–77	30.35	23.83	2.11	.137
6 months	0–76	15.95	20.87		
12 months	0–61	15.82	18.14		
18 months	0–111	27.65	36.42		
Metabolic Control: HbA1c					
Baseline	.067–.125	0.088	.015	7.54	.002
6 months	.064–.122	0.085	.014		
12 months	.062–.135	0.084	.017		
18 months	.058–.124	0.080	.015		

⋆ Unless otherwise indicated, data are presented with median and range.

-2.87, $p < .01$) and at 6 months (t [22] = - 2.83, $p = .01$). The difference between the 12-month and 18-month DQOL scores was non-significant.

RM-ANOVA also showed significant changes in DQOL scores over time (F [3, 20] = 18.51, $p < .05$). Post hoc paired t tests showed that DQOL scores were significantly higher at 18 months than at 12 months on this measure (t [22] = - 6.62, $p < .001$) and significantly higher than at baseline (t [22] = - 5.74, $p < .001$). There was no significant difference between 18 months and 6 months for the DQOL scores. A high score on the DQOL reflects lower perceived quality of life; therefore, diabetes quality of life was reported to be highest at 12-month follow-up and significantly lower at 18-month follow-up (question 4).

Discussion

This is the first study to demonstrate that a self-awareness intervention designed specifically for type 1 diabetics with HU can have both physical (more body cues for low and normal blood glucose, improved HbA1c) and psychological (integration) outcomes. This is also the first study to demonstrate that some individuals with HU recognize body cues for normal blood glucose, although previous studies documented this phenomenon in persons without HU (Hernandez et al., 2004; Hernandez, Bradish, et al., 1999). Ability to detect cues associated with normal blood glucose may be an important factor in maintaining blood glucose within the normal range. Recognition that cues for normal are absent may alert individuals to check for cues of abnormal blood glucose, to check blood glucose values, and to respond appropriately. Further research is needed to assess this assertion.

Cox and associates have found that Blood Glucose Awareness Training for individuals with type 1 diabetes can enhance accuracy in detecting both hypo- and hyperglycemia (Cox et al., 1989, 1991) and improve glycemic control (Cox et al., 1989) and that these benefits could be sustained over time, with accuracy increasing in those with booster training (Cox et al., 1994). In future research with a self-awareness intervention, the addition of a booster training intervention group should be considered. The present results show that individuals diagnosed with HU can learn to detect hypoglycemia cues, although these will be different from cues originally experienced; this is essential information for diabetes education.

An important aspect of this self-awareness intervention was teaching participants to tune in to their own body cues and identify those that signal various levels of glycemia, rather than giving them a standard list of cues to look for, as is currently the case in education programs and in

some research (Weinger et al., 1995). Researchers have found that individuals with type 1 diabetes frequently exhibit glycemia-related symptoms that are not reported in the literature nor taught in diabetes classes (Hernandez, Bradish, et al., 1999; Hernandez & Williamson, 2004) and that these symptoms differ from patient to patient (Nurick & Johnson, 1991). This finding was verified in the present study. It has been observed that patients lose their cues for detecting low blood glucose after many years with diabetes (Pinn & Gale, 1992), but a study with adolescents and young adults found that cues for both hypo- and hyperglycemia could change over the span of 1 year (Hernandez & Williamson, 2004). This finding was verified in the present study with adults — that is, changes in body cues (some dropped, some added) for both hypo- and hyperglycemia occur within a short time frame. Given the above findings, and given the fact that no detriments to health or well-being were found by researchers investigating the impact of Blood Glucose Awareness Training or self-awareness training, it is imperative that persons with diabetes be taught to tune in to individual symptoms of varying levels of glycemia as a strategy for enhancing their diabetes self-management.

An important consideration for future research is the use of total number of cues as a self-awareness measure. Many participants lost particular cues for hypo- or hyperglycemia over the study period. However, the ability to recognize that such cues are no longer indicative of a particular glycemic level is an important advance in self-awareness, one that could improve blood glucose estimation and perhaps even prevent poor treatment decisions. It may be that the detection of *particular* body cues is more important than the *number* of cues in signifying the actual glycemic state. Cox et al. (1995) found that improved detection of low blood glucose was unrelated to an increase in the number of symptoms and that Blood Glucose Awareness Training helped participants to use their available body cues more effectively. Another suggestion is to look at the *intensity* of the hypoglycemia symptoms experienced (Frier, 1993). Future research should incorporate more than number of glycemia cues as the measure of self-awareness.

Researchers have affirmed that patients evaluate glycemic control through a combination of measures, both objective (glucose tests) and subjective (feelings, functioning), and have recommended that health professionals teach patients to adapt guidelines for self-care through informed decision-making (Hunt, Pugh, & Valenzuela, 1998; Thorne & Paterson, 2001). The present study took these recommendations one step further by teaching individuals to detect and respond to reliable and relevant body cues within an environment in which the participants and the intervention facilitator were collaborators in the experience. This collaborative environment likely promoted the ability to self-assess and

respond appropriately, because partnership supports self-care management (Thorne & Paterson, 2001) whereas situations of power imbalance between health professionals and clients do not (Glasgow, Davis, Funnell, & Beck, 2003).

The SAI reflected the recommended ongoing collaboration between health professionals and individuals with complex chronic illness, with a particular emphasis on "collaborative exploration of patient-identified problems and the development of individualized treatment plans" (Bayliss et al., 2007, p. 171). A movement of lay-led self-management intervention for chronic illness spearheaded by Kate Lorig, head of the Chronic Disease Self Management Program in California, has spread to the United Kingdom and other countries (Newbould, Taylor, & Bury, 2006). Newbould et al. (2006), in their review of the literature on lay-led programs, find many short-term benefits of these programs but conclude that a pluralistic approach to chronic illness is necessary — including both professional-led and lay-led interventions to support self-management. The SAI represents a variation of this recommendation, because lay participants and a nurse facilitator interacted as equals in terms of participation, power, and acknowledgement of expertise (Hernandez, 1994), with all participants having an opportunity to provide input and advice to their fellow participants. Redman (2007) asserts that patient self-management, defined as the "ability to detect and manage symptoms, treatments and their consequences" (p. 88), results in improved outcomes. Redman describes self-management at its best as allowing "expression of individual choices and priorities through skilled practice, so that the chronic condition recedes into the background of a life constructed to one's satisfaction" (p. 90). This description is consistent with the focus on "living with diabetes" that characterizes individuals in the last phase of integration (Hernandez, 1991, 1996; Hernandez, Antone, et al., 1999), and greater integration was one of the outcome measures promoted by the SAI.

Limitations

As this pilot study was an uncontrolled trial, the findings should be treated with caution. The participants were Caucasian and well-educated, characteristics that are not completely representative of the type 1 diabetic population with HU. Other limitations include the absence of a control group, instability of the DQOL instrument, and problems with loss of ancillary forms used by participants for logging data on incidents related to hypoglycemia awareness. It is unknown why the scores on the DQOL instrument vacillated over time, so that diabetes quality of life was significantly decreased at 6 and 18 months but significantly increased

at 12 months post-intervention. However, there is evidence that quality of life did improve over the study period. Self-report of diabetes life satisfaction, measured on a visual analogue scale, increased significantly between baseline and the 6- and 18-month follow-up time points. In addition, the external consultant found that participants reported high levels of confidence and satisfaction with the SAI activities at 6-month follow-up (Hernandez et al., 2003). The DQOL may not have been an appropriate measure for this sample as it was developed and tested on younger patients (< 40 years of age) who had minimal or no complications (DCCT Research Group, 1988), whereas the present sample had a median age of 54 and did have complications. In future research, multiple quality-of-life measures will be incorporated, both generic (e.g., the SF-36 [Ware & Sherbourne, 1992]) and diabetes-specific (e.g., DSQOLS [Bott, Overmann, Muhlhauser, & Berger, 1998]), once the English-language version of the DSQOLS has been validated.

Conclusion

The findings demonstrate that a self-awareness intervention operationalized through the collaborative alliance education method can have positive physical and psychosocial outcomes for adults with type 1 diabetes and HU. Participants experienced increased integration and better glycemic control, as measured by HbA1c, and were able to detect more body cues for hypoglycemia and euglycemia.

The findings support postulations in Hernandez's (1991) theory of integration, related to the impact of self-awareness and the effectiveness of the collaborative alliance education method to improve this self-awareness skill, a skill that enhances diabetes self-management ability. Specifically, as self-awareness improved, so did self-reported integration and HbA1c levels. These findings support the value of having a conceptual framework to guide research in type 1 diabetes. Another support for the theory of integration was the effectiveness of the collaborative alliance education method in promoting self-awareness. The utility of this method should be tested for use in other diabetes practice environments and with other chronic illnesses.

The management of HU is complex, requiring a multifaceted approach. Education aimed at increasing sensitivity to varying glycemic levels can be a valuable aspect of that approach. In spite of the study's limitations, the results demonstrate that important benefits can be realized through self-awareness education using a collaborative alliance education method. Further multi-site research is warranted, with a larger number of participants, using a control group for comparison, and of longer study duration.

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