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Barriers and enablers to self-titration of insulin in adults with type 2 diabetes: a qualitative study.

Running head: Barriers to insulin titration in diabetes.

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Structured Abstract

Aims

The aim of this study was to identify the barriers and enablers to effective insulin self-titration in type 2 diabetes.

Methods

A qualitative semi-structured interview approach was employed. Questions were structured according to the Theoretical Domains Framework, which outlines 14 domains that can act as barriers and enablers to changing behaviour. Interviews were audio-recorded and transcribed verbatim. The data were coded according to the 14 domains, belief statements were created within each domain and a frequency count of the most reported barriers and enablers were then calculated. Analyses were conducted by two researchers, and discrepancies agreed with a third researcher.

Results

Eighteen adults with type 2 diabetes took part in an interview. A majority were South Asian (n=8), men (n=12), on average age 61 years old. Average duration of diabetes was 16 years and time on insulin 9 years. Inter-rater reliability for each of the domains varied (29%-100%). The most frequently reported domains were Social Influence and Beliefs about Consequences; the least frequently reported were Optimism and Reinforcement. Participants reported receiving support to self-titrate from a range of sources. Self-titrating was perceived to have a range of both positive and negative consequences, as was not titrating.

Conclusions

The findings highlight that participants experienced a range of barriers and enablers when attempting to self-titrate. Improved education and training when initiating insulin treatment among adults with type 2 diabetes, and throughout their journey on insulin therapy could help people identify and address these barriers in order to optimise self-titration.

Novelty statement

• This study is the first to comprehensively explore the reasons people with insulin-treated type 2 diabetes struggle to self-titrate their insulin, using an established theoretical framework.

• Important factors in facilitating self-titration were support from healthcare professionals and family members, having a target blood glucose reading and strategies to achieve this.

• Barriers to self-titrating included difficulties experienced when at work or on holiday and concerns about the consequences of an increasing insulin dose. Holding strong but erroneous intentions to self-titrate, suggested a lack of knowledge about self-titration algorithms.

• Providing educational resources and training when initiating insulin treatment in type 2 diabetes and throughout treatment, in order to address these barriers and enhance these facilitators is vital.

Introduction

Whilst the first line treatment for type 2 diabetes mellitus is lifestyle management, given the progressive nature of the condition it is likely that most patients will ultimately need pharmacological intervention, [1] with approximately half prescribed insulin at some point in the course of their diabetes [2]. Whilst many people have their insulin dose titrated by their clinician, this is seen as resource intensive and not realistic to undertake in clinical practice [3]. As a result titration algorithms, in the form of individualised care plans, are now being offered to help people manage their own insulin regimens and these have been shown, under experimental conditions, to improve glycaemic control [4].

Despite the drive to empower patients to self-titrate, very few people with insulin-treated type 2 diabetes use their blood glucose readings to guide and maintain changes to their insulin dosage, behaviour or lifestyle [5]. There has however, been very little exploration of why this might be [6]. Although guidelines for the management of type 2 diabetes state that people with type 2 diabetes who are starting insulin must be taken through a structured education programme that teaches them how to titrate [7], there appears to be a lack of understanding on how to interpret and act on out-of-target blood glucose readings [5]. People with type 2 diabetes report lacking confidence about self-titration [8] and are concerned that increasing their dose could become addictive [9]. Those that are aware of their blood glucose target are more likely to report taking action compared to those who are not aware, but only if their current blood glucose reading is low [10]. Beyond this very little is known about what patients feel are the difficulties they face when self-titrating. This study therefore aims to explore the barriers and enablers to self-titration in people with insulin-treated type 2 diabetes, using an established framework for understanding the drivers of health-related behaviour.

Patients and Methods

Design

A qualitative study, using semi-structured one-to-one interviews.

Sample

People with insulin-treated type 2 diabetes, who had been advised to self-titrate, aged 18 years and over, attending the Diabetes Specialists Nurse Service in an inner London NHS Trust were eligible to participate. Those diagnosed with severe mental illness and those not able to speak sufficient English or Bengali to take part in the interview were excluded. Clinic lists were screened and those who met the inclusion/exclusion criteria were invited to participate. Interviews ceased when saturation of themes were achieved, defined as the emergence of no new themes in relation to the research question [11].

Interview schedule

An interview topic guide was developed based on the Theoretical Domains Framework for behaviour change [12]. This framework proposes 14 theoretically distinct domains, each composed of psychological constructs that have been found to influence behaviour. For example: knowledge – a person's awareness of the need to self-titrate; beliefs about consequences – the perceived consequences of titrating or not. The interview schedule consisted of 26 questions (see additional online material). A Behavioural Scientist with extensive experience in the use of the Theoretical Domains Framework provided feedback on the wording of questions.

Procedures

An invitation and information sheet were sent to eligible patients. Interviews were undertaken either by HM or SB, depending on the preferred language of the interviewee. Both HM and SB undertook English speaking interviews and SB all Bengali interviews. Interviews took place at the Diabetes Unit and lasted between 17 and 79 minutes (mean=41minutes,

SD=18minutes). All interviews were digitally recorded, with the participants' permission, and transcribed verbatim by a professional transcription company for the English interviews and by SB for all Bengali interviews. The Bengali interviews were transcribed directly into English. Any identifiable data within the transcripts were anonymised.

Analyses

Analysis of the transcripts was performed using the Theoretical Domains Framework:

1.   Coding interview transcripts: Two researchers (HM and KM) independently coded all interview transcripts into the 14 domains, manually. The two coders then came together to compare results. Responses could be coded into more than one domain. Any differences between the two coders were then discussed until consensus were reached. If consensus could not be reached a third researcher (SB) was consulted. Using established methodology reliability was determined across the final four interviews (prior to consensus being reached) by calculating the percentage agreement/disagreement, to measure consistency in coding within and across the domains. Complete agreement was defined as the two coders identifying the same response and coding it into the same domain. Partial agreement was defined as the two coders identifying the same response, but coding it into different domains. This process was undertaken whilst the interviews were being conducted and informed the decision to cease recruiting further participants due to data saturation i.e. no new beliefs being generated.

2.   Generating specific beliefs: A final coded version of each transcript was uploaded into QSR NVivo 10. Specific belief statements were then generated by a third researcher (SB), within each domain. These statements represented the underlying beliefs held by participants, that either acted as an enabler or barrier to participants self-titrating. Quotes with similar underlying themes were grouped and coded under the same belief statement. Otherwise a new belief statement was created. Responses that were similar in their underlying belief, but were

polar opposites e.g. "I know how to self-titrate my insulin" and "I do not know how to self-titrate my insulin" were kept as individual belief statements in order to understand the frequency with which these opposing beliefs were reported. The belief statement was worded to convey a meaning that was common to multiple quotes, therefore the wording of the belief statements was an iterative process. This process was completed for two domains first, and the results discussed with HM and KM to ensure a true representation of the responses. Once agreement had been reached the remaining 12 domains were completed.

3.   Mapping domains onto beliefs: The belief statements were then coded back into the domains to ensure they were an accurate representation of the domain. Two coders (LR and FL), with experience of using the Theoretical Domains Framework and blinded to the domain in which the belief statement had been created, were asked to assign a domain to each belief statement. Level of agreement was summarised as the number of coders who agreed divided by the total number of coders.

4.   Frequency of beliefs and domains: A frequency count for each belief statement and domain, representing the number of participants who mentioned the belief or domain, was calculated.

5.   Relevant domains to self-titration were identified through consensus discussion between the two researchers (HM, SB) and confirmed by a third (KM). These decisions took into account three factors concurrently (i) frequency across interviews; (ii) presence of conflicting beliefs within a domain; and (iii) perceived strength of the domain impacting upon self-titration.

Ethical approval

The study was approved by an NHS research ethics committee and was conducted in accordance with the Declaration of Helsinki. All participants provided written informed consent.

Results

Participant characteristics

A total of 18 interviews were undertaken, 2 of which were in Bengali. One English interview was removed from the analyses as the participant's partner was present and the patient was unable to contribute. A majority of the 17 participants were men (n=12, 71%), on average 60.6 years old (SD=11.0) and most were South Asian (n=8, Afro-Caribbean n=4, White n=2, other ethnicity n=3). The average duration of diabetes was 15.9 years (SD=7.4) and average time on insulin 8.9 years (SD=7.4). All of the sample had been prescribed a basal-bolus injection regimen. Only one participant reported attending a structured diabetes self-management programme.

Inter-rater reliability

The inter-rater agreement between the two coders ranged from 29% to 100% (Table 1). When blinded researchers were asked to map the belief statements onto a domain, for 70% of beliefs both researchers mapped the belief statement onto the intended domain, for 21 (25%) beliefs only one researcher mapped the belief statement onto the intended domain and for four (5%) belief statements there was zero agreement.

Domains

All domains were mentioned by at least three participants, the most frequently reported domain was Social Influence, followed by Beliefs about Consequences (Table 2). All domains were supported by at least three individual quotes, the domains with the most quotes were Social Influence and Behavioural Regulation.

Belief statements

71 belief statements were created across the 14 domains, between two and 11 per domain (median 5).

Relevant Domains

Social Influence

Participants identified a range of people who assisted them to self-titrate. Sixteen participants reported that they adjusted their dose of insulin based on information and advice they had received from their healthcare team.

"The doctor told me that if it was high I should inject more insulin and if it was low I should inject less"

Many described following these instructions independently, whilst others sought advice from their healthcare team prior to titrating. Family offered varying degrees of support; whilst for three participants their partners, children or grandchildren assisted them, three other participants felt that their family and friends did not play a role in whether or how they self-titrated.

"But now I've got the wife helping me [titrate] as well"

Beliefs about consequences

Participants expressed a range of beliefs about the potential consequences of self-titrating. Many identified that failure to titrate would lead to suboptimal glycaemic control, which could result in a number of serious complications, including kidney failure, sight loss, amputation and cardiac problems.

"I wasn't increasing my dose, I wasn't decreasing it, I just left it as it is. He says, now I've got kidney trouble, I've got, pancreas is collapsing"

Self-titrating was perceived to have both positive consequences, including preventing complications and improved glycaemic control, as well as negative consequences such as weight gain, an increased likelihood of experiencing a hypoglycaemic episode, greater pain and potential for addiction or dependency.

"But she said you can increase it but you'll get fat, if you go up on the insulin it will make you eat more, your appetite will increase so then you'll, she said, you will get fat. So you have to be careful so you don't get fat"

These negative consequences were primarily reported in relation to increasing the dose of insulin and motivated participants to titrate their insulin dose and manage their diabetes generally.

Intentions

14 of the 18 participants expressed an intention to self-titrate, however, not always in the desired direction. Many participants were accurate and intended to increase or decrease their dose, if their blood glucose levels were high or low, respectively.

"if [my blood sugar] is low then I need to inject less [insulin]"

However, many other participants held erroneous intentions to increase or decrease their dose when their blood levels were low or high, respectively i.e. the reverse of recommendations.

"Normally it happens in the afternoon or evening, so when I check, I check the diabetes and I see that [my blood sugar] is up then I have to reduce the insulin for two units"

There were also a group of participants who expressed intentions in both directions, i.e. contradictory beliefs to increase and decrease insulin when blood sugar levels were high.

Knowledge

In parallel, seven participants identified that their knowledge affected their ability to self-titrate, either because they did not know how to titrate, they were not clear on why they needed to titrate or were not aware of the consequences of not titrating.

"I know what to do and how to do it"

Skills

A majority of participants (n = 10) did not find adjusting their dose of insulin difficult to accomplish, in fact two participants felt that self-titrating did not require any special skills.

"I can do it, I can change the dose, the facility is in the pen to make it higher or lower. I don't need to do it but if I did, I could. It's very easy, changing it is very easy"

Many described developing the skills to titrate over time; by continually practicing participants became more experienced and as a result the task became easier (n = 7).

Environmental context and resources

Seven participants reported that environmental factors affected their ability to self-titrate. Four participants reported that either being on holiday or at work made it difficult. This was either because the journey itself, the change in time or the weather impacted on their regimen, or because work patterns and responsibilities made it difficult to find the time to self-titrate.

"I think one aspect is on holidays. Again that's a big problem because if you are flying, and the time difference from one country to another country, that can throw your whole regime of insulin"

Behavioural regulation

Many participants reported using specific strategies to enable them to titrate. A majority of participants self-titrated on consideration of the food they had consumed or planned to consume, or the amount of exercise they had done or planned to do.

"You equate different factors, one is exercise, the other one is what you're going to eat and then between that lot you sort of decide how much insulin"

Six participants took a watch and wait approach before adjusting their dose, these participants described waiting to see if their blood glucose returned to within a normal range before they made any alterations.

"Like I said, if [my blood sugar] abnormal, I don't adjust [my insulin] for two days, because I can get [my blood sugar] levelling off again. I give it two days before I start adjusting [my insulin]. If [my blood sugar] doesn't level off, then I will adjust [my insulin] myself. Either add two or take two."

Goals

Although participants recognised the importance of titrating, some would rather make adjustments to their diet than adjust their dose of insulin.

"I have been trying, but if it is up I just leave it like that and I manage the food that I take, and it will come down later. Yeah, it will come down later"

Participants also had different targets when self-titrating, for some this was an optimal blood glucose reading, for others it was avoidance of a hypoglycaemic event or aiming to administer the lowest dose of insulin possible by balancing dose with dietary intake.

"The first objective is to make sure that I don't take too much insulin, so that I may go into hypo."

Emotion

Although many participants were happy and unconcerned about adjusting their insulin dose, some were worried about self-titrating and others were fearful of having a hypoglycaemic event.

"Yeah, yeah, yeah, when I, that's why I'm scared about the hypo, sometimes the morning, early morning I went to the work, it's, I think it's five o'clock, morning, early morning, when I was climbing I got a hypo, it's very difficult. That's why I'm scared about that."

Beliefs about capabilities

Seven participants explicitly stated that they felt confident or very confident about their ability to self-titrate; only one participant felt that they lacked confidence.

"Now I am confident, now I am confident I can change my, the way I feel like if I'm too high I can change [my insulin] to one or two"

Domains deemed not relevant to self-titration

Four domains appeared to be less relevant to self-titration: Social Professional Role and Identity, Memory Attention and Decision Processes, Reinforcement and Optimism. The majority of patients acknowledged that it was their responsibility to titrate (Social,

Professional Role and Identity). No participants reported forgetting when to titrate, in fact some stated that they were very careful about their insulin and never forgot, however, this often took a lot of thought and attention (Memory Attention and Decision Processes). Reinforcement and Optimism were endorsed by very few participants. Being able to see the benefits of titrating, such as experiencing hypoglycaemia at a lower blood glucose level (Reinforcement), encouraged two participants to titrate. Three participants felt hopeful that they would be able to titrate in the future (Optimism).

Discussion

This study aimed to identify the beliefs that people with type 2 diabetes hold that either prevent or enable them to self-titrate their insulin. The most frequently reported influences were found to be within a patient's social environment and the beliefs they hold about the potential positive and negative consequences of titrating or not.

Social support has been linked to performance of health-promoting diabetes behaviours, particularly for people from minority ethnic groups [13]. Although participants followed the advice they had received from their healthcare team the influence of the family was mixed. Whilst for some the family offered little support or advice, others identified specific people, primarily spouses, who assisted them. Harnessing the positive features of these social relationships would therefore be an important part of any intervention attempting to improve self-titration.

Not self-titrating was associated with increased blood glucose levels and ultimately serious, potentially life changing complications, which encouraged participants to titrate. As found in type 1 diabetes, however, increasing the dose of insulin was linked to weight gain [14] and an increased likelihood of experiencing a hypoglycaemic episode [15], as well as developing a

habit or addiction, as reported by others with type 2 diabetes [9]. As a consequence, some participants prioritised avoiding these outcomes rather than increase their dose. Providing evidence-based education about the likelihood of these outcomes occurring may provide people with a better understanding of the consequences of self-titrating and hence improve behaviour.

A majority of participants expressed a strong intention to self-titrate however, the nature of these intentions did not always correspond with recommendations. It was unclear however, to what degree these intentions were enacted. Knowledge is an important factor in determining the nature of an intention and whether an intention is translated into action [16]. Participants rarely mentioned knowledge as a barrier, but when they did participants felt they lacked an awareness of how to titrate. Although knowledge is necessary, but not sufficient to improve glycaemic control [17] the success of self-titration algorithms has in part been attributed to programmes that have a strong educational component [4]. Despite guidelines for the management of type 2 diabetes recommending structured education programmes that teach patients how to self-titrate [18] [19], the findings of this study support previous indications [5] that in practice either structured education is not being offered or is not sufficient to meet the needs of patients. Programmes do exist, for example the Injectable Therapies Toolkit offered by DESMOND in the UK [20], however their reach, effectiveness, techniques used to change behaviour and theoretical underpinnings are as yet unknown. The fact that participants described acquiring the skills needed to self-titrate over time, with practice, may suggest that educational programmes also need to incorporate behavioural practice and rehearsal, delivered on an ongoing basis. The findings of this study suggest that lack of diabetes education is a major barrier to self-titration.

The importance of self-titrating was signified in the reporting of target blood glucose readings, which has been associated with an increased likelihood of taking action [10]. To achieve this target participants often had strategies in place to aid or guide them, such as dosing according to carbohydrate consumption and exercise, watching and waiting and self-monitoring of dose and blood glucose readings - all techniques advocated by the Dose Adjustment for Normal Eating (DAFNE) programme in type 1 diabetes [21] and that could be adopted when educating patients about self-titrating in type 2 diabetes. Although self-monitoring of blood glucose is an established and recommended element of managing type 2 diabetes [18]; self-monitoring of insulin dose is not part of standard practice, but appears to aid some people when self-titrating.

A majority of the sample were from black and minority ethnic (BAME) populations and other research has found that cultural influences play an important role in diabetes self-management [22-24]. However, to the best of our knowledge this research has not examined cultural influences on insulin self-titration in type 2 diabetes. In the current study, participants did speak about how their culture and ethnicity impacted on their broader diabetes self-management, particularly in relation to diet, but the impact of culture and ethnicity specifically on titration behaviour was evident in only one theoretical domain Environmental Context and Resources. Holidays and the work environment often made it difficult for participants to self-titrate. Travel was particularly pertinent for our sample, which consisted of primarily first and second generation South Asians, as it is common for this group to travel to the east especially during the UK winter months [25]. Seasonal variations in glycaemic control have been reported in the literature [26], are related to changes in weather [27] and made self-titration challenging for participants. Recommendations have been developed to guide patients in self-titrating when travelling both east and west [28]. Although their

widespread use and effectiveness are yet to be evaluated, integration of these guidelines may be a useful addition to education programmes that are delivered in the South Asian community to people with insulin-treated type 2 diabetes.

Given that diabetes self-care takes up an estimated 2 extra hours daily,[29] creating time to titrate within a working day was a problem for participants and led to them injecting the same dose of insulin on every occasion, irrespective of blood glucose readings. Integrating diabetes self-management into the work environment has been identified as an issue in other qualitative work [30] and highlights the need to explore how diabetes is managed in the workplace.

In contrast with previous qualitative research [8], participants reported feeling confident about their ability to self-titrate. Those who were confident also found the complexities of self-titrating easier to achieve and reported intentions that corresponded with recommendations. The individual who reported a lack of confidence however, reported that they would both increase and decrease their dose of insulin if their blood glucose reading was high in different parts of the interview. This highlights the potentially important link between skills, beliefs about capabilities and intentions. Evidence from the literature supports the mediating role of self-efficacy in the gap between intending to and actually performing a behaviour [31]. The successful accomplishment of a behaviour is also integral to the development of self-efficacy. This highlights the need for interventions that involve continual practice to enable effective attempts at the behaviour, thereby increasing self-efficacy and bridging the gap between intention and behaviour.

There are several limitations to our study. The sample was recruited from a specialist diabetes clinic for people experiencing suboptimal glycaemic control, and consisted of predominantly first and second generation South Asian and Afro-Caribbean men. Although the prevalence of diabetes is higher in men than women [32] and the ethnic mix mirrors that of the local population, the representativeness of the sample makes generalisability to the broader type 2 diabetes population problematic. Furthermore, the interviews conducted in Bengali were transcribed in to English by the interviewer. This may have introduced issues around concept validity, which refers to a complex situation in which it is not possible to express a concept found in Bengali in English with precise equivalence. This could have been further complicated by the interviewer being British South Asian, educated in Western tradition and therefore potentially culturally distant from the participants [33]. Bilingual researchers who act as their own translator can however, provide an in-depth more meaningful interpretation of the data contributing to the ethical sensitivity and quality of research [33]. Due to financial constraints, it was not possible to have a second transcriber either back translate or reliability check the English transcription, which could have overcome some of these limitations. Finally, there was significant variation in the inter-rater reliability between coders. Although use of the Theoretical Domains Framework provides significant advantages including its theoretical underpinnings, synthesis of concepts from a range of behaviour change theories and systematic approach to identifying a broad range of barriers and enabler [34] it comes with challenges. A lack of clear operational definitions for each of the domains [34] can make coding of the transcripts difficult, despite the team having a background in psychology. This is likely to explain the variation in inter-rater reliability found within the study.

In conclusion, this study reveals that adults with type 2 diabetes experience a range of barriers when attempting to self-titrate. Many of these factors are potentially amenable to

change and could be explored and addressed as part of the process of initiating patients onto insulin. There is a clear need for more structured evidence-based educational approaches to insulin therapy in type 2 diabetes that are more focused on self-titration. Through continued education that addresses the specific barriers patients report in relation to titration, these interventions could provide a useful avenue via which self-titration could be improved.

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Table 1. Percent agreement calculated across interviews and within domains[†]

Domains	Complete agreement[1]	Partial agreement[2]
Behavioural regulation	43%	57%
Beliefs about capabilities	85%	15%
Beliefs about consequences	88%	12%
Emotion	60%	40%
Environmental context & resources	46%	54%
Goals	50%	50%
Intentions	42%	58%
Knowledge	31%	69%
Memory, attention & decision processes	29%	71%
Optimism	67%	33%
Reinforcement	100%	0%
Skills	57%	43%
Social, professional role & identity	44%	56%
Social influences	76%	24%
Average	**58%**	**42%**

[†] Based on the final four interviews
[1]Complete agreement: Two coders identified the same quote and coded it into the same domain
[2]Partial agreement: Two coders identified the same quote but coded it into different domains

Table 2. Belief statements and sample quotes for each domain

Domain (total no. of belief statements)	Specific belief	No. of participants	Total no. of quotes
Behavioural Regulation (14)	I adjust my dose of insulin, based on what I eat and exercise.	11	41
	Before I adjust my insulin, I check my blood sugar levels.	8	12
	I do not adjust my dose of insulin immediately, I often watch and wait to see if it will go down by itself.	6	16
	I record what dose of insulin I take.	2	2
	The amount of insulin I need is dependent on where I inject it.	1	1
	On special occasions (e.g. eating out, weddings, parties, when I travel or on holiday), I have a plan of how I will adjust my dose of insulin.	1	4
	I don't record my dose of insulin.	1	2
Beliefs about Capabilities (8)	I am confident about adjusting my dose of insulin	7	7
	I am not confident about adjusting my dose of insulin	1	1
Beliefs about Consequences (15)	Not adjusting my insulin dose can lead to complications.	11	14
	If I don't adjust my dose of insulin my blood sugar levels will be high.	9	10
	Increasing my dose of insulin brings my blood sugar levels down.	6	7
	Not adjusting my insulin may lead to a hypoglycaemic attack.	4	5
	The more insulin I take the more weight I gain.	3	6
	Injecting a higher dose of insulin is more painful.	1	2
	Injecting more and more insulin may lead to a habit or addiction.	1	2

Domain (total no. of belief statements)	Specific belief	No. of participants	Total no. of quotes
	Adjusting my insulin may lead to a hypoglycaemic attack.	1	2
	Injecting less insulin will help me lose weight.	1	1
	The effects of the insulin don't last for long.	1	1
Emotion (12)	I do not worry about adjusting my dose of insulin.	8	11
	I worry about adjusting my dose of insulin myself.	2	2
	I am scared about having a hypoglycaemic attack.	3	3
	I am happy about adjusting my dose of insulin myself.	2	2
	When I am stressed I need more insulin.	1	1
Environmental Context & Resources (7)	When I am away from home, I find it difficult to adjust my dose of insulin.	2	3
	When I am at work, I need a different amount of insulin.	2	2
	When I am at work, I find it difficult to adjust my dose of insulin.	2	2
	In the winter, I need more insulin.	1	1
	I adjust my dose of insulin wherever I am.	1	1
Goals (14)	I have a target blood sugar level that I aim for.	7	13
	Adjusting my dose of insulin is important.	6	8
	I change my diet rather than adjust my dose of insulin.	4	4
	When I am adjusting my dose of insulin, I aim to avoid having a hypoglycaemic attack.	2	3
	I do not want to take insulin.	1	2

Domain (total no. of belief statements)	Specific belief	No. of participants	Total no. of quotes
	I aim to take the lowest dose of insulin as possible.	1	3
	My other health conditions are more important than my diabetes.	1	2
	I want to get my diabetes under control.	1	1
Intentions (14)	If my blood sugar level is high, I will increase my dose of insulin.	10	18
	If my blood sugar level is high, I will adjust my dose of insulin.	7	13
	If my blood sugar level is low, I will increase my dose of insulin.	5	9
	If my blood sugar level is low, I will decrease my dose of insulin.	4	11
	If my blood sugar level is normal, I do not adjust my dose of insulin.	4	4
	If my blood sugar level is high, I will decrease my dose of insulin.	3	3
	I never adjust my dose of insulin.	2	2
	If my blood sugar level is normal, I will decrease my dose of insulin.	1	1
	If my blood sugar level is low, I do not adjust my dose of insulin.	1	1
	If I need to adjust my insulin I will.	1	1
Knowledge (7)	I know how to adjust my dose of insulin	2	3
	I don't know why I need to adjust my insulin dose	3	4
	I don't know what would happen if I didn't change my insulin dose	1	1
	I don't know how to adjust my dose of insulin.	3	3
Memory, Attention	I do not forget to adjust my dose of insulin.	7	7

Domain (total no. of belief statements)	Specific belief	No. of participants	Total no. of quotes
& Decision Processes (9)	Adjusting my dose of insulin takes a lot of thought.	3	3
Optimism (3)	I am hopeful that I will be able to adjust my dose of insulin in the future.	3	4
	I am not optimistic that I will be able to adjust my dose of insulin in the future.	1	1
Reinforcement (3)	Seeing the benefits of managing my diabetes encourages me to adjust my dose of insulin myself	2	2
	I receive encouragement from my healthcare team when I adjust my insulin	1	2
Skills (12)	I do not find it difficult to adjust my dose of insulin.	10	24
	I have developed the skills to adjust my dose of insulin over time.	7	10
	Adjusting my dose of insulin does not require any specific skills.	2	2
Social influences (17)	I adjust my dose of insulin based on advice from my healthcare team.	16	70
	My friends and family help me adjust my dose of insulin.	3	4
	Other people with diabetes don't adjust their dose of insulin.	3	3
	My friends and family do not impact on me adjusting my insulin.	3	3
	I don't want my diabetes to make me different from other people.	1	1
Social Professional Role & Identity (13)	It is my responsibility to adjust my dose of insulin.	12	26
	It is the responsibility of my healthcare team to adjust my dose of insulin.	4	7