

BMJ Open

Why do people with type 2 diabetes who are using insulin have poor glycemic control? A qualitative study.

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2014-006407
Article Type:	Research
Date Submitted by the Author:	19-Aug-2014
Complete List of Authors:	Tong, Wen Ting; University of Malaya, Department of Primary Care Medicine Vethakkan, Shireene Ratna Ng, Chirk Jenn; University of Malaya, Department of Primary Care Medicine
Primary Subject Heading:	Diabetes and endocrinology
Secondary Subject Heading:	Qualitative research
Keywords:	DIABETES & ENDOCRINOLOGY, QUALITATIVE RESEARCH, SOCIAL MEDICINE

SCHOLARONE™
Manuscripts

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Title: Why do people with type 2 diabetes who are using insulin have poor glycemic control? A qualitative study.

Corresponding author

Wen Ting Tong
Department of Primary Care Medicine, Faculty of Medicine, University of Malaya,
50603 Kuala Lumpur, Malaysia
e-mail: wentingtong@yahoo.com
Tel: 603-7949 2306
Fax: 603- 7957 7941

Shireene Ratna Vethakkan
Department of Medicine, Faculty of Medicine, University of Malaya, 50603 Kuala
Lumpur, Malaysia
e-mail: shireene@ummc.edu.my

Chirk Jenn Ng
Department of Primary Care Medicine, Faculty of Medicine, University of Malaya,
50603 Kuala Lumpur, Malaysia
e-mail: ngcj@um.edu.my

Abstract word count: 250
Main document word count: 3983
No of Table: 3
No of Figure: 1
No of references: 27

Keywords: Diabetes and endocrinology; qualitative research; social medicine

Abstract

Objective

This study aims to explore the factors influencing poor glycaemic control among people with type 2 diabetes using insulin.

Research design

This study used a qualitative methodology, comprising in-depth individual interviews. A semi-structured interview guide was used for the interviews, which were audio-recorded, transcribed verbatim and analyzed using a thematic approach.

Participants:

Seventeen people with type 2 diabetes using insulin with HbA1c $\geq 9\%$ for > 1 year participated in this study.

Setting

This study was conducted at the Primary Care Clinic and the Diabetes Clinic in the University of Malaya Medical Centre (UMMC), Malaysia.

Results

Data analysis revealed participants faced difficulties in integrating diabetes self-care tasks into their daily work-life schedule. They could not resist food cravings and health-limiting conditions hampered their performing exercise, both of which contributed to poor glycaemic control. Psychosocial and emotional problems caused participants to neglect their diabetes self-care. Some gave up when there were no improvements in their glycaemic control. Side effects of insulin use, such as fear of hypoglycaemia, needles and pain, and increased hunger caused participants to overeat and omit insulin. Lack of awareness of glycaemic levels and targets rendered participants unsure to what extent they should control their diet. Some were not confident in adjusting their insulin dosage for fear of negative consequences.

Conclusion

This study identified factors, which explained the poor glycaemic control in people with type 2 diabetes using insulin. Healthcare providers may use these findings to address patients' concerns during consultations and help to improve glycaemic control.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Strengths and limitations of this study

- This is the first few studies provided insights into factors for poor glycaemic control despite insulin use.
- Healthcare providers could use the findings and help patients with type 2 diabetes using insulin to address their concerns during consultations and improve glycaemic control.
- The recruitment of participants was conducted in a single hospital, hence healthcare systems as a factor in poor glycaemic control cannot be further explored.
- The interviews conducted in the hospital environment may influence the participants to give a socially desirable response. However, they were informed that their responses will not affect their medical care and will be kept confidential.

Introduction

Insulin has been identified as the most effective glucose lowering agent, however, studies has showed that many people with diabetes who are using insulin still fail to achieve glycaemic control.^{1, 2}

The challenges of achieving glycaemic control in people with diabetes using insulin were: the progression of the disease, the impact of hypoglycaemia and weight gain, the burden of poly-pharmacy, lack of resources in provision of diabetes self-care education and support of patients; and the inherent limitations of subcutaneous exogenous insulin administration.³ Other predictors of poor glycaemic control include younger age, shorter duration of diagnosis of diabetes, the interaction of age and duration of diabetes, lower body mass index and poor physical functioning.⁴

To date, research on identifying factors for poor glycaemic control among people with type 2 diabetes was largely by quantitative studies involving patients on various treatment modalities; including lifestyle adapters, OHAs (oral hypoglycaemic agents), OHAs + insulin and insulin only,⁵⁻⁷ while qualitative studies focused on barriers to diabetes self-care management in general.⁸⁻¹¹ Very few qualitative studies examined factors impacting poor glycaemic control from the patient's perspective, especially among people with type 2 diabetes using insulin with poor glycaemic control.

Since insulin is the most effective glucose-lowering agent, it is pertinent to understand from the patient's perspective why people with type 2 diabetes who are on insulin still fail to achieve glycaemic control. This study will help fill the gap in existing literature by exploring factors influencing poor glycaemic control in people with type 2

diabetes using insulin. An understanding of the barriers to achieving glycaemic control will help healthcare providers (HCPs) find ways to improve glycaemic control in this sub-population.

Research Design and Methods

This study used a qualitative methodology, comprising in-depth individual interviews to help understand patient experiences, as well as take into account the circumstances which led to poor glycaemic control among people with type 2 diabetes using insulin.

This study was conducted at the Primary Care Clinic and the Diabetes Clinic in the University of Malaya Medical Centre (UMMC). We purposively sampled patients who were diagnosed with type 2 diabetes, have been using insulin, either alone or in combination with OHAs and with poor control of diabetes ($HbA_{1c} \geq 9\%$) for at least one year. Participants were chosen from various socio-demographic backgrounds (age, ethnicity, education level) so that different perspectives on the reasons for poor glycaemic control can be explored.

We used a semi-structured interview guide (Table 1), which was developed based on the study's conceptual framework (Figure 1) drawn from literature review and experts' opinion. The interviews were carried out between January and August 2013 in consultation rooms in both clinics. Written informed consent and socio-demographic information was obtained from patients who agreed to participate. During the interviews, the participants were asked for the reasons why they think their blood sugar is not well controlled despite using insulin. When the participant could not give any more reasons that they could think of, the researcher would then probe

other areas contributing to poor glycaemic control, as developed in the interview guide. Data saturation was achieved upon the 17th interview, when no new factors influencing poor glycaemic control emerged from the interviews.

Audio-recordings of the interviews were transcribed verbatim and exported into NVivo qualitative software for data analysis using a thematic approach. Initially, the transcripts were read through for familiarization by the researchers and then codes were assigned to a particular phrase, sentence or paragraph that described the meaning of the text segment. Sentences that had a similar meaning were given the same code while texts with different meaning were given a new code. The whole transcript was analyzed until there were no new meanings from the texts to form new codes. Subsequently, all the codes were compared and related codes were clustered together under the same category. Irrelevant codes were omitted. The categories were later compared and further clustered under themes. The mapping of categories and themes resulted in the development of a coding frame. The coding frame was developed from the coding process on the first three transcripts by all the researchers (TWT, NCJ, SV). The coding frame was finalized when consensus was reached on the categories and themes. The finalized coding frame was used to code for the remaining transcripts by TWT. New emerging codes were added into the list of categories and themes that were created through constant discussion with other researchers to ensure the list of categories and themes produced the best representation of data that was obtained. Researchers constantly challenged one another's interpretation of the data to offset any potential biases when analyzing the data.

Results

Socio-demographic and diabetes profile of participants

There were 17 participants in this study. Their socio-demographic and diabetes profiles are listed in Table 2.

Emerging themes

Four themes, which corresponded to factors influencing poor glycaemic control despite insulin use, emerged from the data analysis (Table 3).

Lifestyle challenges in adhering to medical recommendations

Participants highlighted a range of lifestyle challenges in adhering to medical recommendations which contributed to their poor glycaemic control. These included difficulty in integrating diabetes medical recommendations into their work-life schedule, inability to control food cravings and eating habits, inappropriate diet recommendations by HCPs and health-limiting conditions affecting diabetes self-care.

Difficulty integrating diabetes medical recommendations into work-life schedule

Participants faced difficulties in integrating medical recommendations such as a medication regimen and meal times when they did not match with their daily activity schedule. When participants were too busy with their work-life, they tended to skip meals which caused them to become hungry and overeat later. Skipping meals also resulted in them missing or delaying their insulin injections.

“The way I eat and take the medications is not consistent. Sometimes I forget. Maybe I am too busy. Every time my insulin use would be

1
2
3 delayed. For example, usually we inject at 12 right, sometimes I will
4
5 inject at 2. Sometimes I did not inject at all” – 58 years old housewife
6
7
8
9

10 *Inability to control food cravings and eating habits*

11 Participants also reported that the temptation of eating something delicious would
12
13 lead them to lose control of their diet, causing them to overeat.
14
15

16
17 “My eating habit. Like I like to eat sweets, like kuihs [local dessert] and all
18
19 that. But I have to control. I know I am not controlling. I must put a full
20
21 stop to that.” - 60 years old woman housewife
22
23
24
25

26 It is also difficult to resist food when there is a variety of food available and coming
27
28 from a lifestyle and culture where food and eating are a way of living.
29
30
31

32
33 “Basically it is also Malaysia lifestyle whereby people like to eat.
34
35 You eat non-stop. Sugar is particularly everywhere in your diet so
36
37 that’s probably one of the main reasons why it is not controlled”. -
38
39 22 years old student
40
41
42
43

44 *Inappropriate diet recommendations by healthcare providers*

45
46 Participants felt that the diet recommended by HCPs provided insufficient energy for
47
48 them to carry out their work. Some also expressed frustrations with regards to the
49
50 monotony of eating the same type of food every day, such as bread and chapatti,
51
52 which were recommended by the HCPs. Hence, they often neglected the dietary
53
54 advice.
55
56
57
58
59
60

“Every time they [HCPs] ask me to eat bread. Can you eat bread everyday? For sure you will hate it. They will ask to eat vegetables every day. Cannot like that ” - 59 years old ex-lorry driver

Health conditions affecting exercise

Not being able to exercise optimally due to health conditions was another reason cited by many for poor glycaemic control.

“Another thing is exercise. Because of stroke, I have problem with walking. I have to exercise more”. - 61 years old engineer

Psychosocial issues and emotional hurdles

Psychosocial and emotional problems also affected the participants’ diabetes self-care; some lost motivation while others perceived poor glycaemic control as part of ageing. These, they believed, had led to their poor glycaemic control.

Psychosocial problems affecting diabetes self-care

Participants felt that their poor glycaemic control was attributed to personal problems which caused them to feel anxious, stressed and sad, which resulted in some adopting unhealthy eating habits and not taking their diabetes medications, including insulin.

“Actually when you have diabetes, you cannot be stressed. Previously when I was under stress [due to marital problems], my blood sugar level was very high because I did not eat and take my insulin. I was hoping to die.” – 50 years old taxi driver

Loss of motivation

Participants admitted that they were tired of adhering to diabetes medications after having taken them for such a long time that sometimes they would intentionally skip doses.

“Sometimes I purposely miss them because I am just so tired of injecting”. –

40 years old officer

Additionally, an absence of significant improvements in glycaemic control despite efforts made to improve glycaemic control led participants to ‘give up’ in controlling their blood sugar.

“There’s one time actually I did go to the gym and the exercise was okay but it didn’t really do anything to my weight. It does a little bit on my sugar but after a while I just give up. I think it would be as well [contributed to her poor glycaemic control] because the main thing is that, I think that if I actually lose weight, I would be able to control my sugar as well.” – *40 year old officer*

Perceived poor glycaemic control as part of ageing

Many older participants of this study held the view that whatever their attempts to control blood glucose levels, their glycaemic control would still fall short due to their advanced age.

“Maybe because I am getting old. As the days passed by, all my organs has deteriorated. Like engine, the more it is used, it will become spoilt.” - 69 years old retiree

Diabetes treatment-related factors

Diabetes treatment-related factors include side-effects of insulin and perception of appropriate dietary practices related to insulin.

Side-effects of insulin

Participants reported they would tend to overeat to prevent or counter the effects of insulin-induced hypoglycaemia. However, it is when participants overeat that their glycaemic control deteriorates.

“I had fit once (due to hypoglycaemia), that fear is always there. On and off, I used to eat more to make sure I don’t go into hypoglycaemia fit. It is extremely painful”. - 47 years old doctor

Participants also felt that insulin caused them to feel hungry, causing them to overeat, hence, raising their blood sugar levels.

“But if use insulin, it makes me eat. I feel that after using insulin, the blood sugar goes even higher”. – 37 years old clerk

Fear of needles and pain also caused participants to delay insulin initiation as well as intentionally skipping injections, thus contributing to poor glycaemic control.

“I don’t quite like insulin actually. I’m very afraid of needles and the pain that follows. In a week I would say at least 3 times [skipping insulin injections]. Although my blood sugar was already up about 6 to 7 years ago, but I’ve only started insulin not far back from now. So that’s the other reason [for poor glycaemic control].” – 40 years old officer

Perception of appropriate dietary practices related to insulin

One participant felt that his poor glycaemic control was attributed to the diet recommendations given by the HCP. He voiced that the meal pattern recommended was not right and would instead reduce the efficacy of the insulin.

“For example if you eat at 8pm, then you feel hungry and you eat again. So if I follow his [doctor] advice I will eat but this is wrong. The mistake is if lets say I eat at 7pm, then 8, 9, 10, 11, 12pm, for about 4 hours I will keep on eating. So the insulin cannot fight with my diabetes. Because I have experienced this so I know. The recommended cannot work. My diabetes reach 20, 30 something”. – 50 years old taxi driver

Lack of awareness and self-efficacy in diabetes self-care

Participants lacked awareness and self-efficacy in diabetes self-care. They did not know their glycaemic level and target and were not confident in adjusting the insulin dosage on their own.

Lack of awareness of glycaemic level and target

Lack of awareness of their glycaemic level and target was also cited as a reason for poor glycaemic control, as participants were not aware to what extent they should control their blood sugar. This lack of awareness was attributed to difficulties in performing SMBG due to financial reason, and some claimed that their HCPs did not inform them about their glycaemic levels and target.

“I check less because sometimes when the needles are finished, I have to wait for my salary to buy. I check once a week but if I need to see the doctor then only I will check 4 times a day. Actually it is not enough. When I don’t check, I cannot control my diet so that’s why my blood sugar is not good”. –
37 years old clerk

“I don’t know why he [doctor] wants to lower (blood sugar level) some more. No, because I don’t know what is the target. The doctor never mentioned. I am also not sure. So I also don’t know whether I am okay or not. If I know, I will control no matter what”. -*31 years old marketing coordinator*

Lack of self-efficacy in adjustment of insulin dosage

Despite receiving advice from the doctor that they could adjust their insulin dosage, some participants did not do so as they were afraid of making mistakes when

adjusting the insulin dose, which could lead to hypoglycaemia and other complications.

“I’m just reluctant [to adjust insulin dosage] because they [doctor] won’t be with me 24 hours. I didn’t increase or decrease any of the medication. I just stick to it. So maybe that is the reason”. - 36 years old personal bodyguard

Discussions

Our study revealed that people with type 2 diabetes using insulin attributed their sustained hyperglycemia to lifestyle challenges, psychosocial and emotional problems, treatment-related factors and lack of awareness of glycaemic levels and targets, as well as poor self-efficacy with regards to insulin dosage adjustment. Majority of the factors raised were not related to problems with insulin use per se, but were related to barriers in performing diabetes self-care tasks in general such as dietary control, adherence to exercise and medications including OHAs.

Our study participants faced difficulties in adhering to the recommended meal and insulin injection schedule due to work priorities and time constraints. In a multinational study involving 1530 people with type 1 diabetes (12.8%) and type 2 diabetes (88.2%) using insulin from eight countries, taking insulin at the prescribed time or with meals everyday was also reported to be difficult.¹² The lifestyle changes required for diabetes management in terms of diet and regular mealtimes were acknowledged to be hard to implement, even in people with type 2 diabetes using OHAs alone, who often report missed or delayed meals.¹³ This showed that adherence to regular meal and medication times is a universal and major barrier to diabetes

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

management among people with diabetes. It is crucial to overcome that, especially among people with type 2 diabetes using insulin, as insulin administration has to be synchronized with meals. When regular meal times cannot be followed, it often results in delayed or skipped insulin intake, as reported in our study, which explains poor glycaemic control.

Our participants raised the issue of dietary recommendations by HCPs, which did not meet their dietary needs. Other people with type 2 diabetes using insulin also reported that clinicians would simply assume that patients would comply to the medical recommendations given; without considering their individual needs and preferences.¹⁴ Additionally, it also appears that lack of understanding of the rationale behind dietary recommendations is common among type 2 diabetes patients. Our participants thought the meal pattern recommended by HCPs would thwart the efficacy of insulin, while type 2 diabetes patients on OHAs in another study perceived that frequent meals was a way to control their diabetes.¹⁵ In fact, the main purpose of regular meals is actually to counter the effects of hypoglycaemia, due to insulin and long acting sulfonylureas. These findings highlight the importance of HCPs in individualizing treatment management plans according to the patient's needs. It is also pertinent that HCPs explain to patients the rationale behind the treatment recommendation so that misconceptions would not cause the patient to neglect the medical advice or to practice other treatment approaches.

The issue of psychosocial factors and lack of motivation is crucial, as it affects all aspects of diabetes self-care including adherence to insulin, as evidenced from our study. Diabetes self-care is a complex task that demands behavioral change in the

1
2
3 patient on a daily basis; the influences of social, cultural, familial and professional
4 contexts further complicate management of the disease in diabetes patients as shown
5 in other studies.¹⁶⁻¹⁸ Furthermore, our participants also showed that when a patient's
6 diabetes condition remains unimproved despite efforts to control it, this leads to
7 'diabetes burn-out' stemming from frustration and loss of motivation; eventually
8 resulting in neglect of diabetes self-care. Perhaps explaining the disease progression
9 in type 2 diabetes and that the progressive loss of β -cell function is common, will lift
10 the feeling of frustration and loss of motivation in them.

21
22 Older participants of our study perceived that they would never be able to achieve
23 glycaemic control due to their old age even with insulin use. Such misconceptions are
24 alarming as they may decrease older people's perceived importance of glycaemic
25 control. They may lower their expected treatment target in order to cope with the
26 challenges in managing diabetes at such an age.¹⁹ There is a need to inform elderly
27 people with type 2 diabetes that insulin has no upper limit dosage and they will still
28 be able to control their glycaemic levels even with increasing age.

39
40 It is not surprising that our participants reported fear of hypoglycaemia, needles and
41 pain as reasons for poor glycaemic control. These factors have been well established
42 as factors for intentional insulin omission²⁰ and overeating to prevent insulin-induced
43 hypoglycaemia.^{14,21} The UMMC has an established specialized diabetes clinic with
44 trained diabetes nurses to provide education and skills training in diabetes self-care to
45 patients. Therefore the patients would have been educated and trained on techniques
46 of insulin administration and ways to prevent and manage hypoglycaemia.

56 Furthermore, they have been using insulin for some time and were using insulin pens,

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

so the needle used is relatively thin which causes little or no injection pain. In addition to providing diabetes education and skills training to people with type 2 diabetes using insulin, provision of counselling to address these fears is warranted.

Lack of awareness of glycaemic level and targets was also a reason for poor glycaemic control in our participants. They were unsure to what extent they should control their glucose levels. The issue of lack of awareness of glycaemic levels and targets in our study stemmed from lack of SMBG and perceived minimal feedback from HCPs. Our participants reported financial constraints in carrying out effective SMBG, as costs for SMBG supplies are not subsidized by the Malaysian government. The impact of economic factors on SMBG adherence is well established²² as an issue that limits glycaemic control.²³ Other diabetes patients reported that they were not informed by their doctor of their target blood glucose levels and perceived that as a barrier to diabetes self-management.²⁴ HCPs have a crucial role to play in discussing glycemia results with their patients and formulating mutually agreed glycaemic targets. Awareness of HbA1c had a positive impact on maintaining better glycaemic control.²⁵

Self-adjustment of insulin dosage is a technically complex regimen²⁶ and people with diabetes spend most of their time managing their diabetes away from healthcare professionals. It is thus not surprising that our participants were still apprehensive about self-adjustment of their insulin dose; for fear of hypoglycaemia. Dependent and deferential attitudes towards health professionals were cited as the reasons why type 1 diabetes patients do not adjust their insulin dosage²⁶ and this may also be the reason for failure to adjust insulin dosing among our participants.

Some factors for poor glycaemic control as highlighted in the conceptual framework did not emerge in our study findings. The issue of social stigma was not raised by our participants as a reason for poor glycaemic control. We assumed that our participants had overcome this barrier upon initiation of insulin since they have been on insulin for at least one year; as they also reported of performing adaptive strategies such as injecting insulin in private in public places, for example in the toilet or in their car. Our participants did not blame their family, friends, employers, the healthcare system or HCPs for their poor glycaemic control. They however expressed dismay at the short consultation times and not being able to see the same doctor for their diabetes. Our participants expressed that diabetes control is a personal responsibility, therefore they tended to focus on their personal inadequacies when it came to poor glycaemic control. This may be due to diabetes self-care playing a huge role in disease control, hence people with type 2 diabetes may have felt greater responsibility for self-care. Thus, when glycaemic control cannot be achieved, this resulted in self-blame.²⁷

Strengths and limitations of the study

The study provided insights into factors for poor glycaemic control despite insulin use, a topic that is surprisingly understudied. Furthermore, the reasons behind poor glycaemic control were uncovered from the perspectives of people with type 2 diabetes with sustained hyperglycaemia for more than one year despite insulin use. This provided reasons for poor glycaemic control from current real patient experiences. However, they were informed that their responses will not affect their medical care and will be kept confidential.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

This study has a few limitations. The recruitment of participants in this study was only conducted in a single hospital, hence healthcare systems as a factor in poor glycaemic control cannot be further explored. The interviews were conducted in the hospital where the participants were recruited, hence the environment may influence them to give a socially desirable response.

Clinical and future research recommendations

HCPs should create individualized plans with people with type 2 diabetes using insulin, to ensure a routine that allows for proper meal times and exercise, which would enable them to take their diabetes medication, including insulin, in a timely manner. Patients reported they face problems with treatment recommendations, hence HCPs should continuously assess the efficacy and feasibility of treatment provided to their patients and clarify patient misconceptions. It is also pertinent for HCPs to recognise the psychological and emotional problems that impact on their patients’ diabetes self-care and provide affective support to them. Lastly, HCPs should discuss glycaemic readings and adjustment of insulin dosage, as well as formulate a mutually agreed target with patients to facilitate improvement of glycaemic control.

More research is needed pertaining to this topic to uncover other factors that could influence poor glycaemic control despite insulin use. In addition, exploring views from HCPs and caretakers of the patients would provide a more holistic understanding of factors for poor glycaemic control despite insulin use. Accurate assessment of patient’s knowledge, actual self-care practices, and, clinical characteristics could also be conducted. This would allow triangulation of multiple sources of data which would then provide more comprehensive understanding and

1
2
3 better identification of reasons for poor glycaemic control. Ultimately, the factors
4 identified may help to develop a tool to be used by HCPs, as a checklist to address the
5 barriers faced by people with type 2 diabetes using insulin in achieving glycaemic
6 control.
7
8
9
10

11 12 13 14 **Conclusions**

15 Our findings revealed lifestyle challenges, psychosocial and emotional problems,
16 treatment-related factors and lack of awareness of glycaemic levels and targets, and
17 poor self-efficacy with regards to insulin dosage adjustment as factors for poor
18 glycaemic control despite insulin use. Healthcare providers could look into these
19 factors and help patients with type 2 diabetes using insulin to address their concerns
20 during consultations and thus improve glycaemic control.
21
22
23
24
25
26
27
28
29
30
31

32 **Contributorship statement**

33 All authors (WTT, SV, CJN) of this study conceived and designed the study,
34 researched and analyzed the data, contributed to discussion, wrote, edited and
35 reviewed the manuscript.
36
37
38
39
40
41
42

43 **Competing interests**

44 None.
45
46
47
48
49

50 **Funding**

51 We would like to thank the University of Malaya, Malaysia for funding this project
52 (reference: PV109-2012A).
53
54
55
56
57
58
59
60

Ethics approval

This study received ethical approval from the University of Malaya Medical Centre Medical Ethics Committee (926.18).

Data sharing

No additional data are available.

References

- 1.Cramer JA, Pugh MJ. The influence of insulin use on glycaemic control. *Diabetes Care* 2005;28(1):78-83.
2. Harris SB, Kapor J, Lank CN, et al. Clinical inertia in patients with T2DM requiring insulin in family practice. *Canadian family physician Medecin de famille canadien* 2010;56(12):e418-24.
- 3.Davies M. The reality of glycaemic control in insulin treated diabetes: defining the clinical challenges. *Int J Obes Relat Metab Disord* 2004;28(S2):S14-S22.
- 4.Nichols GA, Hillier TA, Javor K, et al. Predictors of glycaemic control in insulin-using adults with type 2 diabetes. *Diabetes Care* 2000;23(3):273-7.
- 5.Sanal TS, Nair NS, Adhikari P. Factors associated with poor control of type 2 diabetes mellitus: A systematic review and Meta-analysis. *Journal of Diabetology* 2011;3(1):1-10.
- 6.Khattab M, Khader YS, Al-Khawaldeh A, et al. Factors associated with poor glycaemic control among patients with Type 2 diabetes. *Journal of Diabetes and its Complications* 2010;24(2):84-9.
- 7.Sasi ST, Kodali M, Burra KC, et al. Self Care Activities, Diabetic Distress and other Factors which Affected the Glycaemic Control in a Tertiary Care Teaching Hospital in South India. *Journal of clinical and diagnostic research : JCDR* 2013;7(5):857-60.
- 8.Chlebowy DO, Hood S, LaJoie AS. Facilitators and barriers to self-management of type 2 diabetes among urban African American adults: focus group findings. *Diabetes Educ* 2010;36(6):897-905.
- 9.Shakibazadeh E, Larijani B, Shojaeezadeh D, et al. Patients' Perspectives on Factors that Influence Diabetes Self-Care. *Iranian journal of public health* 2011;40(4):146-58.
- 10.Singh H, Cinnirella M, Bradley C. Support systems for and barriers to diabetes management in South Asians and Whites in the UK: qualitative study of patients' perspectives. *BMJ open* 2012;2(6).
- 11.Hu J, Amirehsani K, Wallace DC, et al. Perceptions of barriers in managing diabetes: perspectives of Hispanic immigrant patients and family members. *Diabetes Educ* 2013;39(4):494-503.

12. Peyrot M, Barnett AH, Meneghini LF, et al. Insulin adherence behaviours and barriers in the multinational Global Attitudes of Patients and Physicians in Insulin Therapy study. *Diabet Med* 2012;29(5):682-9.
13. Frandsen KB, Smedegaard KJ. Compliance with, and understanding of, mealtime advice in patients with Type 2 Diabetes. *Diabetes* 2000;49(Suppl 1):a176.
14. Janes R, Titchener J, Pere J, et al. Understanding barriers to glycaemic control from the patient's perspective. *Journal of primary health care* 2013;5(2):114-22.
15. Frandsen KB, Kristensen JS. Diet and lifestyle in type 2 diabetes: the patient's perspective. *Practical Diabetes International* 2002;19(3):77-80.
16. Samuel-Hodge CD, Headen SW, Skelly AH, et al. Influences on day-to-day self-management of type 2 diabetes among African-American women: spirituality, the multi-caregiver role, and other social context factors. *Diabetes Care* 2000;23(7):928-33.
17. Shacter HE, Shea JA, Akhabue E, et al. A qualitative evaluation of racial disparities in glucose control. *Ethnicity & disease* 2009;19(2):121-7.
18. Peyrot M, Rubin RR, Lauritzen T, et al. Psychosocial problems and barriers to improved diabetes management: results of the Cross-National Diabetes Attitudes, Wishes and Needs (DAWN) Study. *Diabet Med* 2005;22(10):1379-85.
19. Paul C, Ayis S, Ebrahim S. Disability and psychosocial outcomes in old age. *J Aging Health* 2007;19(5):723-41.
20. Peyrot M, Rubin RR, Kruger DF, et al. Correlates of insulin injection omission. *Diabetes Care* 2010;33(2):240-5.
21. Perlmuter LC. Glycaemic Control and Hypoglycaemia. Is the loser the winner? *Diabetes Care* 2008;31(10):2072-6.
22. Ong WM, Chua SS, Ng CJ. Barriers and facilitators to self-monitoring of blood glucose in people with type 2 diabetes using insulin: a qualitative study. *Patient Preference and Adherence* 2014;8:237-46.
23. Yuan L, Guo X, Xiong Z, et al. Self-monitoring of blood glucose in type 2 diabetic patients in China: current status and influential factors. *Chinese medical journal* 2014;127(2):201-7.
24. Onwudiwe NC, Mullins CD, Winston RA, et al. Barriers to self-management of diabetes: a qualitative study among low-income minority diabetics. *Ethnicity & disease* 2011;21(1):27-32.
25. Kumpatla S, Medempudi S, Manoharan D, et al. Knowledge and Outcome Measure of HbA1c Testing in Asian Indian Patients with Type 2 Diabetes from a Tertiary Care Center. *Indian journal of community medicine : official publication of Indian Association of Preventive & Social Medicine* 2010;35(2):290-3.
26. Lawton J, Rankin D, Cooke D, et al. Patients' experiences of adjusting insulin doses when implementing flexible intensive insulin therapy: a longitudinal, qualitative investigation. *Diabetes Res Clin Pract* 2012;98(2):236-42.
27. Beverly EA, Ritholz MD, Brooks KM, et al. A qualitative study of perceived responsibility and self-blame in type 2 diabetes: reflections of physicians and patients. *Journal of general internal medicine* 2012;27(9):1180-7.

Table 1 Summary of interview guide topic on factors influencing poor glycaemic control despite using insulin

PREAMBLE: Actually you have had diabetes for a long time and are now using insulin to control your blood sugar. Since you are using insulin to control your blood sugar, but your blood sugar is still not well controlled.
<ul style="list-style-type: none">Can you share with me what do you think are the reasons why your blood sugar is still not well controlled?
Focussing on areas influencing poor glycaemic control
<ul style="list-style-type: none">Do you face any problems in adjusting lifestyle for your diabetes care? (Probe: diet, exercise, medications). How?
<ul style="list-style-type: none">What barriers do you face when using insulin? (Probe: injecting insulin in the public, negative beliefs about insulin, fear of needle, pain, blood, body injury, marks and scars, weight gain, hypoglycaemia, knowledge and skills in administrating insulin)
<ul style="list-style-type: none">Does your family, friends, or employer takes part in managing your diabetes? Do you think they affect you in your blood sugar control? How?
<ul style="list-style-type: none">Do you face any health problems that makes it difficult for you to manage your diabetes? (Probe: vision problems, dexterity, mobility, poly-pharmacy, exercise)
<ul style="list-style-type: none">There are some people with diabetes who are depressed and stressed and that affect their sugar control. Do you face this problem? How does it affect you in controlling your blood sugar?
<ul style="list-style-type: none">Do you perform self-blood glucose monitoring? If no, why not? Does it affect your blood sugar control? If yes, how?
<ul style="list-style-type: none">What barriers do you face when consulting the doctor/nurse for your diabetes? (Probe: language, communication, and interaction). Does it affect your blood sugar control?
<ul style="list-style-type: none">What do you think of the hospitals and clinics that you go for your diabetes? (Probe: resources, complexity of system, accessibility, long waiting time, short consultation time) Does it affect your blood sugar control?
<ul style="list-style-type: none">Do you face any financial difficulties to care for your diabetes? (Probe: Medication cost, transportation to hospitals, SMBG)

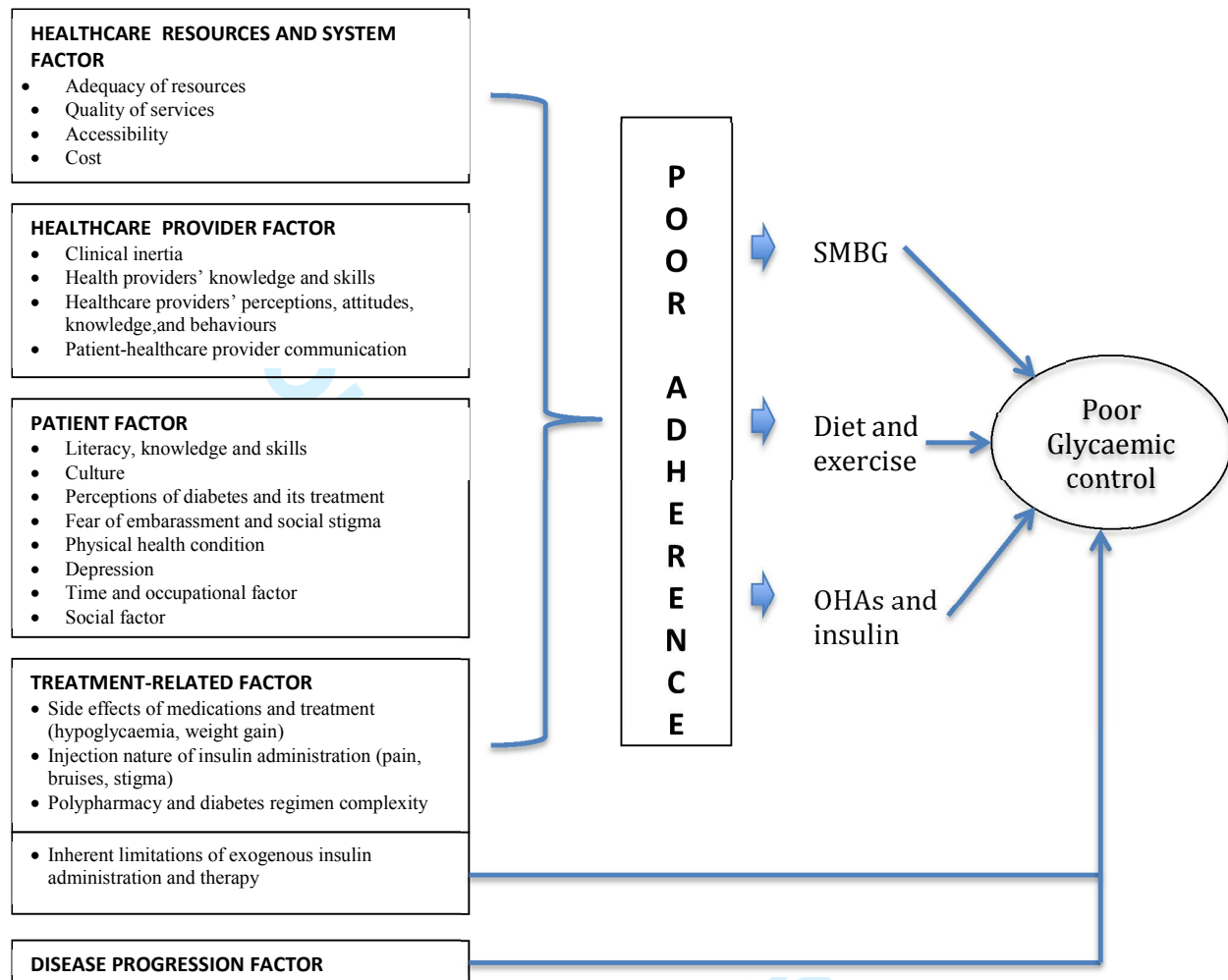
Table 2: Socio-demographic background and diabetes profile of participants

Characteristic	Participants (n=17)
Age (range)	22- 69 years
Sex	
Female	10
Male	7
Race	
Malays	8
Chinese	4
Indians	4
Nepalese	1
Education	
Secondary	9
Tertiary	5
Primary	2
No formal education	1
Years living with diabetes (range)	2-30
Years using insulin (range)	1-14

Table 3 Factors influencing poor glycaemic control in people with type 2 diabetes using insulin

Theme		Category
1	Lifestyle challenges in adhering to medical recommendations	1. Difficulty integrating diabetes medical recommendations into work-life schedule
		2. Inability to control food cravings and eating habits
		3. Inappropriate diet recommendations by HCPs
		4. Health-limiting conditions affecting exercise
2	Psychosocial issues and emotional hurdles	1. Psychosocial-problems affecting diabetes self-care management
		2. Loss of motivation
		3. Perceived poor glycaemic control as part of ageing
3	Diabetes treatment-related factors	1. Side-effects of insulin
		2. Perception of appropriate dietary practices related to insulin
4	Lack of awareness and self-efficacy in diabetes self-care	1. Lack of awareness of glycaemic level and target
		2. Lack of self-efficacy in adjustment of insulin dosage

Figure 1 Conceptual framework of study



BMJ Open

Why do people with type 2 diabetes who are using insulin have poor glycemic control? A qualitative study.

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2014-006407.R1
Article Type:	Research
Date Submitted by the Author:	02-Oct-2014
Complete List of Authors:	Tong, Wen Ting; University of Malaya, Department of Primary Care Medicine Vethakkan, Shireene Ratna; University of Malaya, Department of Medicine Ng, Chirk Jenn; University of Malaya, Department of Primary Care Medicine
Primary Subject Heading:	Diabetes and endocrinology
Secondary Subject Heading:	Qualitative research
Keywords:	PRIMARY CARE, SOCIAL MEDICINE, PUBLIC HEALTH, PREVENTIVE MEDICINE

SCHOLARONE™
Manuscripts

Title: Why do people with type 2 diabetes who are using insulin have poor glycemic control? A qualitative study.

Corresponding author
Wen Ting Tong
Department of Primary Care Medicine, Faculty of Medicine, University of Malaya,
50603 Kuala Lumpur, Malaysia
e-mail: wentingtong@yahoo.com
Tel: 603-7949 2306
Fax: 603- 7957 7941

Shireene Ratna Vethakkan
Department of Medicine, Faculty of Medicine, University of Malaya, 50603 Kuala
Lumpur, Malaysia
e-mail: shireene@ummc.edu.my

Chirk Jenn Ng
Department of Primary Care Medicine, Faculty of Medicine, University of Malaya,
50603 Kuala Lumpur, Malaysia
e-mail: ngcj@um.edu.my

Keywords: Diabetes and endocrinology; qualitative research; social medicine

Abstract

Objective

This study aims to explore the factors influencing poor glycemic control among people with type 2 diabetes using insulin.

Research design

This study used a qualitative methodology, comprising in-depth individual interviews. A semi-structured interview guide was used. The interviews were audio-recorded, transcribed verbatim and analysed using a thematic approach.

Participants:

Seventeen people with type 2 diabetes using insulin with HbA1c $\geq 9\%$ for > 1 year participated in this study.

Setting

This study was conducted at the Primary Care Clinic and the Diabetes Clinic in the University of Malaya Medical Centre (UMMC), Malaysia.

Results

Data analysis uncovered four themes. They were lifestyle challenges in adhering to medical recommendations, psychosocial and emotional hurdles, diabetes treatment related factors and, lack of knowledge and self-efficacy in diabetes self-care.

Conclusion

This study identified factors, which explained the poor glycaemic control in people with type 2 diabetes using insulin. Healthcare providers may use these findings to address patients' concerns during consultations and help to improve glycaemic control.

Word count: 163/250

57 Strengths and limitations of this study

- 58
- 59 • The major strength of this study lies in the fact that the reasons behind poor
60 glycaemic control were uncovered from the perspectives of people with type 2
61 diabetes with sustained hyperglycaemia for more than one year despite insulin
62 use, through in-depth interviews.
 - 63 • This study found that issues such as adherence to regular meal and medication
64 times, fear of hypoglycaemia, needles and pain and lack of knowledge and
65 self-efficacy in diabetes care remain as barriers for poor glycaemic control
66 among people with type 2 diabetes using insulin.
 - 67 • Issues such as social stigma, ethnicity, socio-economic factors, family, friends,
68 healthcare system and HCPs did not emerge as reasons for poor glycaemic
69 control despite insulin use.
 - 70 • The recruitment of participants was conducted in a single hospital, hence
71 healthcare systems as a factor in poor glycaemic control cannot be further
72 explored.
 - 73 • The interviews conducted in the hospital environment may influence the
74 participants to give a socially desirable response. However, they were
75 informed that their responses would not affect their medical care and would be
76 kept confidential.
- 77
78
79
80
81

Introduction

Insulin has been identified as the most effective glucose lowering agent, however, studies has showed that many people with diabetes who are using insulin still fail to achieve glycemic control [1,2].

The challenges of achieving glycemic control in people with diabetes using insulin were: the progression of the disease, the impact of hypoglycemia and weight gain, the burden of poly-pharmacy, lack of resources in provision of diabetes self-care education and support of patients; and the inherent limitations of subcutaneous exogenous insulin administration [3]. Other predictors of poor glycemic control among people with type 2 diabetes using insulin include younger age, shorter duration of diagnosis of diabetes, lower body mass index and poor physical functioning [4].

Barriers to glycaemic control highlighted in a qualitative study among people with T2DM using insulin were fear about illness, guilt or self-blame, shame, ideas or beliefs about causation of diabetes, personal or cultural beliefs difficulty finding common grounds with clinicians on diabetes management [5].

To date, many studies have been conducted on barriers to insulin initiation [6-8], whereas, research on identifying factors for poor glycemic control among people with type 2 diabetes was largely by quantitative studies involving patients on various treatment modalities; including lifestyle adapters, OHAs (oral hypoglycemic agents), OHAs + insulin and insulin only [9-11], while qualitative studies focused on barriers to diabetes self-care management in general [12-15]. Very few qualitative studies examined factors impacting poor glycemic control from the patient's perspective,

107 especially among people with type 2 diabetes using insulin with poor glycemic
108 control.

109
110 Since insulin is the most effective glucose-lowering agent, it is pertinent to understand
111 from the patient's perspective why people with type 2 diabetes who are on insulin still
112 fail to achieve glycemic control. This study will help fill the gap in existing literature
113 by exploring factors influencing poor glycemic control in people with type 2 diabetes
114 using insulin. An understanding of the barriers to achieving glycemic control will help
115 healthcare providers (HCPs) find ways to improve glycemic control in this sub-
116 population.

118 **Research Design and Methods**

119 This study used a qualitative methodology, comprising in-depth individual interviews
120 to help understand patient experiences, as well as take into account the circumstances
121 which led to poor glycemic control among people with type 2 diabetes using insulin.

122
123 This study was conducted at the Primary Care Clinic and the Diabetes Clinic in the
124 University of Malaya Medical Centre (UMMC). We purposively sampled patients
125 who were diagnosed with type 2 diabetes, have been using insulin, either alone or in
126 combination with OHAs and with poor control of diabetes ($HbA_{1c} \geq 9\%$) for at least
127 one year. Participants were chosen from various socio-demographic backgrounds
128 (age, ethnicity, education level) so that different perspectives on the reasons for poor
129 glycemic control can be explored.

130

1
2
3 131 We used a semi-structured interview guide (Table 1), which was developed based on
4
5 132 the study's conceptual framework (Figure 1) drawn from literature review and
6
7 133 experts' opinion. We reviewed the literature to identify possible factors, concepts and
8
9
10 134 variables [16] that have been shown to influence glycaemic control among people
11
12 135 with diabetes. A preliminary conceptual framework was developed based on these
13
14 136 factors. Later, the conceptual framework was given to two researchers (NCJ and
15
16 137 SRV) (one is a family medicine specialist and another is an endocrinologist) to
17
18 138 provide feedback and strengthen the conceptual framework based on their clinical
19
20 139 experience and expertise. Subsequently, the interview guide was constructed based on
21
22 140 the revised conceptual framework.
23
24
25
26
27

28 142 The interviews were carried out between January and August 2013 in consultation
29
30 143 rooms in both clinics. Written informed consent and socio-demographic information
31
32 144 was obtained from patients who agreed to participate. During the interviews, the
33
34 145 participants were asked for the reasons why they think their blood sugar is not well
35
36 146 controlled despite using insulin. When the participant could not give any more
37
38 147 reasons that they could think of, the researcher would then probe other areas
39
40 148 contributing to poor glycemic control, as developed in the interview guide. Data
41
42 149 saturation was achieved upon the 17th interview, when no new factors influencing
43
44 150 poor glycemic control emerged from the interviews.
45
46
47

48 151
49
50 152 It is important to note that the participants of this study were recruited from the clinics
51
52 153 where SRV and NCJ conduct their clinical practice. Thus, in order to offset the
53
54 154 influence of power disparities between doctor and patient, all the interviews were
55
56 155 conducted by WTT. WTT was competent in English, Malay and Cantonese, hence the
57
58
59
60

156 interviews were conducted in three languages. Out of the 17 interviews, there were
157 two interviews that were conducted in Cantonese and seven in Malay. Given that the
158 Cantonese language has many colloquialisms, the recordings were translated directly
159 into English by WTT so the meaning would not be lost. Other interviews that were
160 conducted in English and Malay were given to experienced transcribers for verbatim
161 transcription. All the transcripts were checked for accuracy and quality by WTT by
162 listening to the audio recording and checked against the transcript, before exported
163 into NVivo qualitative software for data analysis using a thematic approach. Malay
164 transcripts were analysed in the said language and the selected quotes were later
165 translated to English. The translated quotes were checked with other researchers to
166 ensure the meaning were not lost or distorted.

167
168 Initially, the transcripts were read through for familiarization by the researchers and
169 then codes were assigned to a particular phrase, sentence or paragraph that described
170 the meaning of the text segment. Sentences that had a similar meaning were given the
171 same code while texts with different meaning were given a new code. The whole
172 transcript was analyzed until there were no new meanings from the texts to form new
173 codes. Subsequently, all the codes were compared and related codes were clustered
174 together under the same category. Irrelevant codes were omitted. The categories were
175 later compared and further clustered under themes. The mapping of categories and
176 themes resulted in the development of a coding frame. The coding frame was
177 developed from the coding process on the first three transcripts by all the researchers
178 (WTT, NCJ, SRV). The coding frame was finalized when consensus was reached on
179 the categories and themes. The finalized coding frame was used to code for the
180 remaining transcripts by WTT. New emerging codes were added into the list of

181 categories and themes that were created through constant discussion with other
182 researchers to ensure the list of categories and themes produced the best
183 representation of data that was obtained. Researchers constantly challenged one
184 another's interpretation of the data to offset any potential biases when analyzing the
185 data.

186 187 188 **Results**

189 Socio-demographic and diabetes profile of participants

190 There were 17 participants in this study. Their socio-demographic and diabetes
191 profiles are listed in Table 2.

192 193 Emerging themes

194 Four themes, which corresponded to factors influencing poor glycemic control despite
195 insulin use, emerged from the data analysis (Table 3).

196 197 198 **Lifestyle challenges in adhering to medical recommendations**

199 Under this theme there are five subthemes identified.

200 201 *Difficulty integrating diabetes medical recommendations into work-life schedule*

202 Participants faced difficulties in integrating medical recommendations such as a
203 medication regimen and meal times when they did not match with their daily activity
204 schedule. When participants were too busy with their work-life, they tended to skip
205 meals which caused them to become hungry and overeat later. Skipping meals also
206 resulted in them missing or delaying their insulin injections.

207

208 *“The way I eat and take the medications is not consistent. Sometimes I*
209 *forget. Maybe I am too busy. Every time my insulin use would be*
210 *delayed. For example, usually we inject at 12 right, sometimes I will*
211 *inject at 2. Sometimes I did not inject at all” – 58 years old housewife*

212
213 One participant described how the nature of his occupation made it difficult for him to
214 adhere to healthy diet and insulin treatment.

215
216 *“We are going around okay. So we can’t just go and get what we want*
217 *to eat. We can’t go and pack something or bring the food from house.*
218 *Furthermore, like now I’m taking the short-acting insulin, so every*
219 *mealtime you have to inject. You just can’t go and take insulin, you*
220 *see. I’m working as a bodyguard you see, you have to follow the boss*
221 *closely. I think so that is the reason [for poor blood sugar]”. –*
222 *Thomas 36 years old personal bodyguard*

223
224
225 *Inability to control food cravings and eating habits*

226 Participants also reported that the temptation of eating something delicious would
227 lead them to lose control of their diet, causing them to overeat.

228
229 *“My eating habit. Like I like to eat sweets, like kuihs [local dessert] and*
230 *all that. But I have to control. I know I am not controlling. I must put a full*
231 *stop to that.” - 60 years old woman housewife*

232
233 It is also difficult to resist food when there is a variety of food available and coming
234 from a lifestyle and culture where food and eating are a way of living.

235

236 *“Basically it is also Malaysia lifestyle whereby people like to eat.*

237 *You eat non-stop. Sugar is particularly everywhere in your diet so*

238 *that’s probably one of the main reasons why it is not controlled”. -*

239 *22 years old student*

240

241 *Inappropriate diet recommendations by healthcare providers*

242 Participants felt that the diet recommended by HCPs provided insufficient energy for

243 them to carry out their work. Some also expressed frustrations with regards to the

244 monotony of eating the same type of food every day, such as bread and chapatti,

245 which were recommended by the HCPs. Hence, they often neglected the dietary

246 advice.

247 *“Every time they [HCPs] ask me to eat bread. Can you eat bread*

248 *everyday? For sure you will hate it. They will ask to eat vegetables every*

249 *day. Cannot like that ” - 59 years old ex-lorry driver*

250

251 *Health conditions affecting exercise*

252 Not being able to exercise optimally due to health conditions was another reason cited

253 by many for poor glycemic control.

254 *“Another thing is exercise. Because of stroke, I have problem with walking. I*

255 *have to exercise more”. - 61 years old engineer*

256

257

258

259

260 **Psychosocial issues and emotional hurdles**

261 Three subthemes emerged under this theme.

262

263 *Psychosocial problems affecting diabetes self-care*

264 Participants felt that their poor glycemic control was attributed to personal problems
265 which caused them to feel anxious, stressed and sad, which resulted in some adopting
266 unhealthy eating habits and not taking their diabetes medications, including insulin.

267

268 *“Actually when you have diabetes, you cannot be stressed. Previously when I*
269 *was under stress [due to marital problems], my blood sugar level was very*
270 *high because I did not eat and take my insulin. I was hoping to die.” – 50*
271 *years old taxi driver*

272

273 *Loss of motivation*

274 Participants admitted that they were tired of adhering to diabetes medications after
275 having taken them for such a long time that sometimes they would intentionally skip
276 doses.

277 *“Sometimes I purposely miss them because I am just so tired of injecting”. –*
278 *40 years old officer*

279

280 Additionally, an absence of significant improvements in glycemic control despite
281 efforts made to improve glycemic control led participants to ‘give up’ in controlling
282 their blood sugar.

283

284 *“There’s one time actually I did go to the gym and the exercise was okay but*
285 *it didn’t really do anything to my weight. It does a little bit on my sugar but*
286 *after a while I just give up. I think it would be as well [contributed to her*
287 *poor glycemic control] because the main thing is that, I think that if I*
288 *actually lose weight, I would be able to control my sugar as well.” – 40 year*
289 *old officer*

292 *Perceived poor glycemic control as part of ageing*

293 Many older participants of this study held the view that whatever their attempts to
294 control blood glucose levels, their glycemic control would still fall short due to their
295 advanced age.

297 *“Maybe because I am getting old. As the days passed by, all my organs has*
298 *deteriorated. Like engine, the more it is used, it will become spoilt.” - 69*
299 *years old retiree*

303 **Diabetes treatment-related factors**

304 There are two subthemes under this theme.

305

306 *Side-effects of insulin*

307 Participants reported they would tend to overeat to prevent or counter the effects of
308 insulin-induced hypoglycaemia. However, it is when participants overeat that their
309 glycemic control deteriorates.

310 *“I had fit once (due to hypoglycaemia), that fear is always there. On*
311 *and off, I used to eat more to make sure I don’t go into*
312 *hypoglycaemia fit. It is extremely painful”. - 47 years old doctor*

313

314 Participants also felt that insulin caused them to feel hungry, causing them to overeat,
315 hence, raising their blood sugar levels.

316

317 *“But if use insulin, it makes me eat. I feel that after using insulin, the blood*
318 *sugar goes even higher”. – 37 years old clerk*

319

320 Fear of needles and pain also caused participants to delay insulin initiation as well as
321 intentionally skipping injections, thus contributing to poor glycemic control.

322

323 *“I don’t quite like insulin actually. I’m very afraid of needles and the pain*
324 *that follows. In a week I would say at least 3 times [skipping insulin*
325 *injections]. Although my blood sugar was already up about 6 to 7 years ago,*
326 *but I’ve only started insulin not far back from now. So that’s the other reason*
327 *[for poor glycemic control].” – 40 years old officer*

328 *Perception of appropriate dietary practices related to insulin*

329 One participant felt that his poor glycemic control was attributed to the diet
330 recommendations given by the HCP. He voiced that the meal pattern recommended
331 was not right and would instead reduce the efficacy of the insulin.

332

333 *“For example if you eat at 8pm, then you feel hungry and you eat again. So*
334 *if I follow his [doctor] advice I will eat but this is wrong. The mistake is if*
335 *lets say I eat at 7pm, then 8, 9, 10, 11, 12pm, for about 4 hours I will keep on*
336 *eating. So the insulin cannot fight with my diabetes. Because I have*
337 *experienced this so I know. The recommended cannot work. My diabetes*
338 *reach 20, 30 something”.* – 50 years old taxi driver

339

340

341 **Lack of knowledge and self-efficacy in diabetes self-care**

342 Two subthemes were identified under this theme.

343

344 *Lack of knowledge of glycemic level and target*

345 Lack of knowledge of their glycemic level and target was also cited as a reason for
346 poor glycemic control, as participants were not aware to what extent they should
347 control their blood sugar. This lack of knowledge was attributed to difficulties in
348 performing SMBG due to financial reason, and some claimed that their HCPs did not
349 inform them about their glycemic levels and target.

350

351 *“I check less because sometimes when the needles are finished, I have to*
352 *wait for my salary to buy. I check once a week but if I need to see the doctor*

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

353 *then only I will check 4 times a day. Actually it is not enough. When I don't*
354 *check, I cannot control my diet so that's why my blood sugar is not good". –*
355 *37 years old clerk*
356
357 *"I don't know why he [doctor] wants to lower (blood sugar level) some*
358 *more. No, because I don't know what is the target. The doctor never*
359 *mentioned. I am also not sure. So I also don't know whether I am okay or*
360 *not. If I know, I will control no matter what". -31 years old marketing*
361 *coordinator*
362
363 *Lack of self-efficacy in adjustment of insulin dosage*
364 *Despite receiving advice from the doctor that they could adjust their insulin dosage,*
365 *some participants did not do so as they were afraid of making mistakes when*
366 *adjusting the insulin dose, which could lead to hypoglycaemia and other*
367 *complications.*
368
369 *"I'm just reluctant [to adjust insulin dosage] because they [doctor] won't be*
370 *with me 24 hours. I didn't increase or decrease any of the medication. I just*
371 *stick to it. So maybe that is the reason". - 36 years old personal bodyguard*
372
373
374

Discussions

Our study revealed that people with type 2 diabetes using insulin attributed their sustained hyperglycemia to lifestyle challenges, psychosocial and emotional problems, treatment-related factors and lack of knowledge of glycemic levels and targets, as well as poor self-efficacy with regards to insulin dosage adjustment. Majority of the factors raised were not related to problems with insulin use per se, but were related to barriers in performing diabetes self-care tasks in general such as dietary control, adherence to exercise and medications including OHAs.

Our study participants faced difficulties in adhering to the recommended meal and insulin injection schedule due to work priorities and time constraints. In a multinational study involving 1530 people with type 1 diabetes (12.8%) and type 2 diabetes (88.2%) using insulin from eight countries, taking insulin at the prescribed time or with meals everyday was also reported to be difficult [17]. The lifestyle changes required for diabetes management in terms of diet and regular mealtimes were acknowledged to be hard to implement, even in people with type 2 diabetes using OHAs alone, who often report missed or delayed meals [18]. This showed that adherence to regular meal and medication times is a universal and major barrier to diabetes management among people with diabetes. It is crucial to overcome that, especially among people with type 2 diabetes using insulin, as insulin administration has to be synchronized with meals. When regular meal times cannot be followed, it often results in delayed or skipped insulin intake, as reported in our study, which explains poor glycemic control.

399 Our participants raised the issue of dietary recommendations by HCPs, which did not
400 meet their dietary needs; the issues of the monotony of eating the same type of food
401 every day and the recommended diet could not provide sufficient energy. Other
402 people with type 2 diabetes using insulin have reported that clinicians would simply
403 assume that patients would comply to the medical recommendations given; without
404 considering their individual needs and preferences [5]. Additionally, it also appears
405 that lack of understanding of the rationale behind dietary recommendations is
406 common among type 2 diabetes patients. One participant of our study thought the
407 meal pattern recommended by HCPs would thwart the efficacy of insulin, while type
408 2 diabetes patients on OHAs in another study perceived that frequent meals was a
409 way to control their diabetes [19]. In fact, the main purpose of regular meals is
410 actually to counter the effects of hypoglycemia, due to insulin and long acting
411 sulfonylureas. HCPs may be a contributing factor to these barriers in adhering to
412 dietary recommendations. In a collaborative study conducted in Austria, Canada,
413 Germany and United Kingdom, it was found that general practitioners lack the
414 knowledge and skills to educate, support and motivate patients on healthy lifestyle
415 changes [20].
416
417 The issue of psychosocial factors and lack of motivation is crucial, as it affects all
418 aspects of diabetes self-care including adherence to insulin, as evidenced from our
419 study. Diabetes self-care is a complex task that demands behavioral change in the
420 patient on a daily basis; the influences of social, cultural, familial and professional
421 contexts further complicate management of the disease in diabetes patients as shown
422 in other studies [21-23]. Furthermore, our participants also showed that when a
423 patient's diabetes condition remains unimproved despite efforts to control it, this

1
2
3 424 leads to ‘diabetes burn-out’ stemming from frustration and loss of motivation;
4
5 425 eventually resulting in neglect of diabetes self-care. Perhaps explaining the disease
6
7 426 progression in type 2 diabetes and that the progressive loss of β -cell function is
8
9 427 common, will lift the feeling of frustration and loss of motivation in them.
10
11 428
12
13 429 Older participants of our study perceived that they would never be able to achieve
14
15 430 glycemic control due to their old age even with insulin use. Such misconceptions are
16
17 431 alarming as they may decrease older people’s perceived importance of glycemic
18
19 432 control. They may lower their expected treatment target in order to cope with the
20
21 433 challenges in managing diabetes at such an age [24]. There is a need to inform elderly
22
23 434 people with type 2 diabetes that insulin has no upper limit dosage and they will still
24
25 435 be able to control their glycemic levels even with increasing age.
26
27 436
28
29 437 Issues such as fear of hypoglycaemia and needles and pain have been well established
30
31 438 as barriers to insulin initiation [6,7] and it is interesting to know that such problems
32
33 439 still prevails even after participant initiate insulin use, as found in participants of our
34
35 440 study. Moreover, these factors have been well established as factors for intentional
36
37 441 insulin omission [25] and overeating to prevent insulin-induced hypoglycemia [5,26].
38
39 442 The UMMC has an established specialized diabetes clinic with trained diabetes nurses
40
41 443 to provide education and skills training in diabetes self-care to patients. Therefore, our
42
43 444 study participants would have been educated and trained on techniques of insulin
44
45 445 administration and ways to prevent and manage hypoglycemia. In addition to
46
47 446 providing diabetes education and skills training to people with type 2 diabetes using
48
49 447 insulin, provision of counselling to address these fears is warranted.
50
51 448
52
53
54
55
56
57
58
59
60

449 Lack of knowledge of glycemic level and targets was also a reason for poor glycemic
450 control in our participants. They were unsure to what extent they should control their
451 glucose levels. The issue of lack of knowledge of glycemic levels and targets in our
452 study stemmed from lack of SMBG and perceived minimal feedback from HCPs. Our
453 participants reported financial constraints in carrying out effective SMBG, as costs for
454 SMBG supplies are not subsidized by the Malaysian government. The impact of
455 economic factors on SMBG adherence have been reported as an issue that limits
456 glycemic control in other studies [27,28]. In a study by Onwudine et al., (2011), the
457 study participants reported that they were not informed by their doctor of their target
458 blood glucose levels and perceived that as a barrier to diabetes self-management [29].
459 HCPs have a crucial role to play in discussing glycemia results with their patients and
460 formulating mutually agreed glycemic targets. A study has shown that knowledge of
461 HbA1c and target goal had a positive impact on maintaining better glycemic control
462 among people with type 2 diabetes [30].
463
464 Self-adjustment of insulin dosage have been shown to be a technically complex
465 regimen for people with type 1 diabetes [31] and people with diabetes spend most of
466 their time managing their diabetes away from healthcare professionals. It is thus not
467 surprising that our participants were still apprehensive about self-adjustment of their
468 insulin dose; for fear of hypoglycemia. Dependent and deferential attitudes towards
469 health professionals were cited as the reasons why type 1 diabetes patients do not
470 adjust their insulin dosage [31] and this may also be the reason for failure to adjust
471 insulin dosing among our participants. Furthermore, the lack of skills to educate
472 patients on how to monitor their glycaemic levels and adjustment of insulin has also
473 been found to be a common challenge faced by general practitioners [20].

Some factors for poor glycemic control as highlighted in the conceptual framework did not emerge in our study findings even when the participants were probed. The issue of social stigma was not raised by our participants as a reason for poor glycemic control. We assumed that our participants had overcome this barrier upon initiation of insulin since they have been on insulin for at least one year; as they also reported of performing adaptive strategies such as injecting insulin in private in public places, for example in the toilet or in their car. Ethnicity was also not raised as a factor for poor glycaemic control in this study. Instead, the participants described eating culture as a way of living for Malaysians in general. Therefore, participants of this study might have adapted to the 'Malaysian' culture whereby they share and practise culture of others. Even if the recommended diet by HCPs may not be the types of food familiar with the specific ethnic group or culture, nevertheless, they could still follow the recommended diet. No specific ethnicity barrier was also reported for diabetes treatment aspects. Socio-economic was not a factor for participants in this study to seek healthcare treatment as the company where they or their spouses are working subsidized the medical costs. It should also be noted that the Malaysian government provides relatively cheap health care for the people and the cost for insulin is subsidized. However, this is not the case for SMBG where patients have to pay out-of-pocket for glucometer and test strips. This is the reason why the lack of knowledge of glycaemic status due to low performance of SMBG was raised as a reason for poor glycaemic control. Our participants did not blame their family, friends, healthcare system or HCPs for their poor glycemic control. They however expressed dismay at the short consultation times and not being able to see the same doctor for their diabetes. Our participants expressed that diabetes control is a personal responsibility, therefore they tended to focus on their personal inadequacies when it came to poor

glycemic control. This may be due to diabetes self-care playing a huge role in disease control, hence people with type 2 diabetes may have felt greater responsibility for self-care. Thus, when glycemic control cannot be achieved, this resulted in self-blame [32].

503

504 **The strengths and limitations of the study**

505 The major strength of this study lies in the fact that the reasons behind poor glycaemic control were gained from the insights of people with T2DM with sustained hyperglycaemia for more than one year despite insulin use, through in-depth interviews to explain why their diabetes remains poorly controlled despite being on insulin. To researchers' knowledge, such findings has never been reported before. This study found that issues such as adherence to regular meal and medication times, fear of hypoglycaemia, needles and pain and lack of knowledge and self-efficacy in diabetes care remain as barriers for poor glycaemic control among people with type 2 diabetes using insulin, whereas, issues such as social stigma, ethnicity, socio-economic factors, family, friends, healthcare system factors and HCPs were found not to be reasons for poor glycaemic control despite insulin use.

516

517 This study has a few limitations. The recruitment of participants in this study was only conducted in a single hospital, hence healthcare systems as a factor in poor glycemic control cannot be further explored. The interviews were conducted in the hospital where the participants were recruited, hence the environment may influence them to give a socially desirable response. However, they were informed that their responses would not affect their medical care and would be kept confidential.

523

524 Clinical recommendations

525 HCPs should create individualized plans with people with type 2 diabetes using
526 insulin, to ensure a routine that allows for proper meal times and exercise, which
527 would enable them to take their diabetes medication, including insulin, in a timely
528 manner. Patients reported they face problems with treatment recommendations, hence
529 HCPs should continuously assess the efficacy and feasibility of treatment provided to
530 their patients and clarify patient misconceptions. It is also pertinent for HCPs to
531 recognise the psychological and emotional problems that impact on their patients'
532 diabetes self-care and provide affective support to them. Lastly, HCPs should discuss
533 glycemic readings and adjustment of insulin dosage, as well as formulate a mutually
534 agreed target with patients to facilitate improvement of glycemic control.

535
536 Murray et al., (2011) has identified the common challenges faced by general
537 practitioners when caring for people with type 2 diabetes across international and
538 health system borders and they were related to knowledge, skills, attitudes,
539 behaviours and context [20]. Some of the challenges faced by HCPs may explain the
540 reasons for poor glycaemic control as faced by participants of this study such as the
541 lack of knowledge and skills to: give clear explanations to the patients, actively
542 engage their patients in their health management, educate patients on how to monitor
543 their glycaemic levels, engage in shared decision making with patients and provide
544 support and motivation to patients in their efforts towards lifestyle changes for better
545 glycaemic control. Therefore, it is pertinent that HCPs are equipped with accurate and
546 latest knowledge and skills about diabetes and its treatment and be able to impart
547 them to their patients to empower them to perform effective diabetes self-care tasks.

548

549 **Future research recommendations**

550 More research is needed pertaining to this topic to uncover other factors that could
551 influence poor glycemic control despite insulin use. In addition, exploring views from
552 HCPs and caretakers of the patients would provide a more holistic understanding of
553 factors for poor glycemic control despite insulin use. Accurate assessment of patient's
554 knowledge, actual self-care practices, and, clinical characteristics could also be
555 conducted. This would allow triangulation of multiple sources of data which would
556 then provide more comprehensive understanding and better identification of reasons
557 for poor glycemic control. Ultimately, the factors identified may help to develop a
558 tool to be used by HCPs, as a checklist to address the barriers faced by people with
559 type 2 diabetes using insulin in achieving glycemic control. In addition, future study
560 should look into the motivators of better glycaemic control among people with type 2
561 diabetes using insulin who is succesful in gaining glycaemic control. Understanding
562 both the barriers and the motivators would help to improve glycaemic control among
563 this subpopulation.

565 **Conclusions**

566 Our findings revealed lifestyle challenges, psychosocial and emotional problems,
567 treatment-related factors and lack of knowledge of glycemic levels and targets, and
568 poor self-efficacy with regards to insulin dosage adjustment as factors for poor
569 glycemic control despite insulin use. Healthcare providers could look into these
570 factors and help patients with type 2 diabetes using insulin to address their concerns
571 during consultations and thus improve glycemic control.

Contributorship statement

All authors (WTT, SRV, CJN) of this study conceived and designed the study, researched and analysed the data, contributed to discussion, wrote, edited, reviewed and approved the final version of the manuscript.

Competing interests

None.

Funding

We would like to thank the University of Malaya, Malaysia for funding this project (reference: PV109-2012A).

Ethics approval

This study received ethical approval from the University of Malaya Medical Centre Medical Ethics Committee (926.18).

Data sharing

No additional data are available.

References

1. Cramer JA, Pugh MJ (2005) The influence of insulin use on glycemic control. *Diabetes Care* 28: 78-83.
2. Harris SB, Kapor J, Lank CN, Willan AR, Houston T (2010) Clinical inertia in patients with T2DM requiring insulin in family practice. *Can Fam Physician* 56: e418-424.
3. Davies M (2004) The reality of glycaemic control in insulin treated diabetes: defining the clinical challenges. *Int J Obes Relat Metab Disord* 28: S14-S22.

4. Nichols GA, Hillier TA, Javor K, Brown JB (2000) Predictors of glycemic control in insulin-using adults with type 2 diabetes. *Diabetes Care* 23: 273-277.

5. Janes R, Titchener J, Pere J, Pere R, Senior J (2013) Understanding barriers to glycaemic control from the patient's perspective. *J Prim Health Care* 5: 114-122.

6. Abu Hassan H, Tohid H, Mohd Amin R, Long Bidin MB, Muthupalaniappen L, et al. (2013) Factors influencing insulin acceptance among type 2 diabetes mellitus patients in a primary care clinic: a qualitative exploration. *BMC Fam Pract* 14: 164.

7. Chen KW, Tseng HM, Huang YY, Chuang YJ (2012) The Barriers to Initiating Insulin Therapy among People with Type 2 Diabetes in Taiwan - A Qualitative Study. *J Diabetes Metab Disord* 3: 194.

8. Lee YK, Lee PY, Ng CJ (2012) A qualitative study on healthcare professionals' perceived barriers to insulin initiation in a multi-ethnic population. *BMC Fam Pract* 13: 28.

9. Sanal TS, Nair NS, Adhikari P (2011) Factors associated with poor control of type 2 diabetes mellitus: A systematic review and Meta-analysis. *Journal of Diabetology* 3: 1-10.

10. Khattab M, Khader YS, Al-Khawaldeh A, Ajlouni K (2010) Factors associated with poor glycemic control among patients with Type 2 diabetes. *Journal of Diabetes and its Complications* 24: 84-89.

11. Sasi ST, Kodali M, Burra KC, Muppala BS, Gutta P, et al. (2013) Self Care Activities, Diabetic Distress and other Factors which Affected the Glycaemic Control in a Tertiary Care Teaching Hospital in South India. *J Clin Diagn Res* 7: 857-860.

12. Chlebowy DO, Hood S, LaJoie AS (2010) Facilitators and barriers to self-management of type 2 diabetes among urban African American adults: focus group findings. *Diabetes Educ* 36: 897-905.

13. Shakibazadeh E, Larijani B, Shojaezadeh D, Rashidian A, Forouzanfar M, et al. (2011) Patients' Perspectives on Factors that Influence Diabetes Self-Care. *Iran J Public Health* 40: 146-158.

14. Singh H, Cinnirella M, Bradley C (2012) Support systems for and barriers to diabetes management in South Asians and Whites in the UK: qualitative study of patients' perspectives. *BMJ Open* 2.

15. Hu J, Amirehsani K, Wallace DC, Letvak S (2013) Perceptions of barriers in managing diabetes: perspectives of Hispanic immigrant patients and family members. *Diabetes Educ* 39: 494-503.

16. Matthew BM, Huberman AM (1994) *Qualitative Data Analysis: An Expanded Sourcebook*: SAGE Publications.

17. Peyrot M, Barnett AH, Meneghini LF, Schumm-Draeger PM (2012) Insulin adherence behaviours and barriers in the multinational Global Attitudes of Patients and Physicians in Insulin Therapy study. *Diabet Med* 29: 682-689.

18. Frandsen KB, Smedegaard KJ (2000) Compliance with, and understanding of, mealtime advice in patients with Type 2 Diabetes. *Diabetes* 49: a176.

19. Frandsen KB, Kristensen JS (2002) Diet and lifestyle in type 2 diabetes: the patient's perspective. *Practical Diabetes International* 19: 77-80.

20. Murray S, Lazure P, Schroter S, Leuschner PJ, Posel P, et al. (2011) International challenges without borders: a descriptive study of family physicians' educational needs in the field of diabetes. *BMC Fam Pract* 12: 27.

21. Samuel-Hodge CD, Headen SW, Skelly AH, Ingram AF, Keyserling TC, et al. (2000) Influences on day-to-day self-management of type 2 diabetes among African-American women: spirituality, the multi-caregiver role, and other social context factors. *Diabetes Care* 23: 928-933.
22. Shacter HE, Shea JA, Akhabue E, Sablani N, Long JA (2009) A qualitative evaluation of racial disparities in glucose control. *Ethn Dis* 19: 121-127.
23. Peyrot M, Rubin RR, Lauritzen T, Snoek FJ, Matthews DR, et al. (2005) Psychosocial problems and barriers to improved diabetes management: results of the Cross-National Diabetes Attitudes, Wishes and Needs (DAWN) Study. *Diabet Med* 22: 1379-1385.
24. Paul C, Ayis S, Ebrahim S (2007) Disability and psychosocial outcomes in old age. *J Aging Health* 19: 723-741.
25. Peyrot M, Rubin RR, Kruger DF, Travis LB (2010) Correlates of insulin injection omission. *Diabetes Care* 33: 240-245.
26. Perlmutter LC (2008) Glycemic Control and Hypoglycemia. Is the loser the winner? *Diabetes Care* 31: 2072-2076.
27. Ong WM, Chua SS, Ng CJ (2014) Barriers and facilitators to self-monitoring of blood glucose in people with type 2 diabetes using insulin: a qualitative study. *Patient Preference and Adherence* 8: 237-246.
28. Yuan L, Guo X, Xiong Z, Lou Q, Shen L, et al. (2014) Self-monitoring of blood glucose in type 2 diabetic patients in China: current status and influential factors. *Chin Med J (Engl)* 127: 201-207.
29. Onwudiwe NC, Mullins CD, Winston RA, Shaya FT, Pradel FG, et al. (2011) Barriers to self-management of diabetes: a qualitative study among low-income minority diabetics. *Ethn Dis* 21: 27-32.
30. Kumpatla S, Medempudi S, Manoharan D, Viswanathan V (2010) Knowledge and Outcome Measure of HbA1c Testing in Asian Indian Patients with Type 2 Diabetes from a Tertiary Care Center. *Indian J Community Med* 35: 290-293.
31. Lawton J, Rankin D, Cooke D, Elliott J, Amiel S, et al. (2012) Patients' experiences of adjusting insulin doses when implementing flexible intensive insulin therapy: a longitudinal, qualitative investigation. *Diabetes Res Clin Pract* 98: 236-242.
32. Beverly EA, Ritholz MD, Brooks KM, Hultgren BA, Lee Y, et al. (2012) A qualitative study of perceived responsibility and self-blame in type 2 diabetes: reflections of physicians and patients. *J Gen Intern Med* 27: 1180-1187.

Title: Why do people with type 2 diabetes who are using insulin have poor glycemic control? A qualitative study.

Corresponding author

Wen Ting Tong
Department of Primary Care Medicine, Faculty of Medicine, University of Malaya,
50603 Kuala Lumpur, Malaysia
e-mail: wentingtong@yahoo.com
Tel: 603-7949 2306
Fax: 603- 7957 7941

Shireene Ratna Vethakkan
Department of Medicine, Faculty of Medicine, University of Malaya, 50603 Kuala
Lumpur, Malaysia
e-mail: shireene@ummc.edu.my

Chirk Jenn Ng
Department of Primary Care Medicine, Faculty of Medicine, University of Malaya,
50603 Kuala Lumpur, Malaysia
e-mail: ngcj@um.edu.my

Keywords: Diabetes and endocrinology; qualitative research; social medicine

Abstract

Objective

This study aims to explore the factors influencing poor glycaemic control among people with type 2 diabetes using insulin.

Research design

This study used a qualitative methodology, comprising in-depth individual interviews. A semi-structured interview guide was used. ~~for the interviews, which~~ were audio-recorded, transcribed verbatim and analysed using a thematic approach.

Participants:

Seventeen people with type 2 diabetes using insulin with HbA1c $\geq 9\%$ for > 1 year participated in this study.

Setting

This study was conducted at the Primary Care Clinic and the Diabetes Clinic in the University of Malaya Medical Centre (UMMC), Malaysia.

Results

Data analysis uncovered four themes. They were lifestyle challenges in adhering to medical recommendations, psychosocial and emotional hurdles, diabetes treatment related factors and, lack of knowledge and self-efficacy in diabetes self-care. ~~revealed participants faced difficulties in integrating diabetes self care tasks into their daily work-life schedule. They could not resist food cravings and health-limiting conditions hampered their performing exercise, both of which contributed to poor glycaemic control. Psychosocial and emotional problems caused participants to neglect their diabetes self care. Some gave up when there were no improvements in their glycaemic control. Side effects of insulin use, such as fear of hypoglycaemia, needles and pain, and increased hunger caused participants to overeat and omit insulin. Lack of awareness of glycaemic levels and targets rendered participants unsure to what extent they should control their diet. Some were not confident in adjusting their insulin dosage for fear of negative consequences.~~

Conclusion

This study identified factors, which explained the poor glycaemic control in people with type 2 diabetes using insulin. Healthcare providers may use these findings to address patients' concerns during consultations and help to improve glycaemic control.

Word count: 163250/250

Strengths and limitations of this study

- The major strength of this study lies in the fact that the reasons behind poor glycaemic control were uncovered from the perspectives of people with type 2 diabetes with sustained hyperglycaemia for more than one year despite insulin use, through in-depth interviews.
- This study found that issues such as adherence to regular meal and medication times, fear of hypoglycaemia, needles and pain and lack of knowledge and self-efficacy in diabetes care remain as barriers for poor glycaemic control among people with type 2 diabetes using insulin.
- Issues such as social stigma, ethnicity, socio-economic factors, family, friends, healthcare system and HCPs did not emerge as reasons for poor glycaemic control despite insulin use.
- This is the first few studies provided insights into factors for poor glycaemic control despite insulin use.
- Healthcare providers could use the findings and help patients with type 2 diabetes using insulin to address their concerns during consultations and improve glycaemic control.
- The recruitment of participants was conducted in a single hospital, hence healthcare systems as a factor in poor glycaemic control cannot be further explored.
- The interviews conducted in the hospital environment may influence the participants to give a socially desirable response. However, they were informed that their responses ~~will~~would not affect their medical care and ~~will~~would be kept confidential.

Introduction

Insulin has been identified as the most effective glucose lowering agent, however, studies has showed that many people with diabetes who are using insulin still fail to achieve glycemic control [1,2].

The challenges of achieving glycemic control in people with diabetes using insulin were: the progression of the disease, the impact of hypoglycemia and weight gain, the burden of poly-pharmacy, lack of resources in provision of diabetes self-care education and support of patients; and the inherent limitations of subcutaneous exogenous insulin administration [3]. Other predictors of poor glycemic control among people with type 2 diabetes using insulin include younger age, shorter duration of diagnosis of diabetes, ~~the interaction of age and duration of diabetes~~, lower body mass index and poor physical functioning [4]. Barriers to glycaemic control highlighted in a qualitative study among people with T2DM using insulin were fear about illness, guilt or self-blame, shame, ideas or beliefs about causation of diabetes, personal or cultural beliefs difficulty finding common grounds with clinicians on diabetes management [5].

To date, many studies have been conducted on barriers to insulin initiation [6-8], whereas, research on identifying factors for poor glycemic control among people with type 2 diabetes was largely by quantitative studies involving patients on various treatment modalities; including lifestyle adapters, OHAs (oral hypoglycemic agents), OHAs + insulin and insulin only [9-11], while qualitative studies focused on barriers to diabetes self-care management in general [12-15]. Very few qualitative studies examined factors impacting poor glycemic control from the patient's perspective,

1
2
3
4
5
6 123 especially among people with type 2 diabetes using insulin with poor glycemic
7
8 124 control.
9
10 125
11
12 126 Since insulin is the most effective glucose-lowering agent, it is pertinent to understand
13
14 127 from the patient's perspective why people with type 2 diabetes who are on insulin still
15
16 128 fail to achieve glycemic control. This study will help fill the gap in existing literature
17
18 129 by exploring factors influencing poor glycemic control in people with type 2 diabetes
19
20 130 using insulin. An understanding of the barriers to achieving glycemic control will help
21
22 131 healthcare providers (HCPs) find ways to improve glycemic control in this sub-
23
24 132 population.
25
26 133
27
28 134 **Research Design and Methods**
29
30 135 This study used a qualitative methodology, comprising in-depth individual interviews
31
32 136 to help understand patient experiences, as well as take into account the circumstances
33
34 137 which led to poor glycemic control among people with type 2 diabetes using insulin.
35
36 138
37
38 139 This study was conducted at the Primary Care Clinic and the Diabetes Clinic in the
39
40 140 University of Malaya Medical Centre (UMMC). We purposively sampled patients
41
42 141 who were diagnosed with type 2 diabetes, have been using insulin, either alone or in
43
44 142 combination with OHAs and with poor control of diabetes (HbA1c \geq 9%) for at least
45
46 143 one year. Participants were chosen from various socio-demographic backgrounds
47
48 144 (age, ethnicity, education level) so that different perspectives on the reasons for poor
49
50 145 glycemic control can be explored.
51
52 146
53
54
55
56
57
58
59
60

We used a semi-structured interview guide (Table 1), which was developed based on the study's conceptual framework (Figure 1) drawn from literature review and experts' opinion. We reviewed the literature to identify possible factors, concepts and variables [16] that have been shown to influence glycaemic control among people with diabetes. A preliminary conceptual framework was developed based on these factors. Later, the conceptual framework was given to two researchers (NCJ and SRV) (one is a family medicine specialist and another is an endocrinologist) to provide feedback and strengthen the conceptual framework based on their clinical experience and expertise. Subsequently, the interview guide was constructed based on the revised conceptual framework.

The interviews were carried out between January and August 2013 in consultation rooms in both clinics. Written informed consent and socio-demographic information was obtained from patients who agreed to participate. During the interviews, the participants were asked for the reasons why they think their blood sugar is not well controlled despite using insulin. When the participant could not give any more reasons that they could think of, the researcher would then probe other areas contributing to poor glycemic control, as developed in the interview guide. Data saturation was achieved upon the 17th interview, when no new factors influencing poor glycemic control emerged from the interviews.

It is important to note that the participants of this study were recruited from the clinics where SRV and NCJ conduct their clinical practice. Thus, in order to offset the influence of power disparities between doctor and patient, all the interviews were conducted by WTT. WTT was competent in English, Malay and Cantonese, hence the

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

interviews were conducted in three languages. Out of the 17 interviews, there were
two interviews that were conducted in Cantonese and seven in Malay. Given that the
Cantonese language has many colloquialisms, the recordings were translated directly
into English by WTT so the meaning would not be lost. Other interviews that were
conducted in English and Malay were given to experienced transcribers for verbatim
transcription. All the transcripts were checked for accuracy and quality by WTT by
listening to the audio recording and checked against the transcript, before exported
into NVivo qualitative software for data analysis using a thematic approach. Malay
transcripts were analysed in the said language and the selected quotes were later
translated to English. The translated quotes were checked with other researchers to
ensure the meaning were not lost or distorted.

Initially, the transcripts were read through for familiarization by the researchers and then codes were assigned to a particular phrase, sentence or paragraph that described the meaning of the text segment. Sentences that had a similar meaning were given the same code while texts with different meaning were given a new code. The whole transcript was analyzed until there were no new meanings from the texts to form new codes. Subsequently, all the codes were compared and related codes were clustered together under the same category. Irrelevant codes were omitted. The categories were later compared and further clustered under themes. The mapping of categories and themes resulted in the development of a coding frame. The coding frame was developed from the coding process on the first three transcripts by all the researchers (WTT, NCJ, SRV). The coding frame was finalized when consensus was reached on the categories and themes. The finalized coding frame was used to code for the remaining transcripts by FWTT. New emerging codes were added into the list of

197 categories and themes that were created through constant discussion with other
198 researchers to ensure the list of categories and themes produced the best
199 representation of data that was obtained. Researchers constantly challenged one
200 another's interpretation of the data to offset any potential biases when analyzing the
201 data.

202 203 204 **Results**

205 Socio-demographic and diabetes profile of participants

206 There were 17 participants in this study. Their socio-demographic and diabetes
207 profiles are listed in Table 2.

208 209 Emerging themes

210 Four themes, which corresponded to factors influencing poor glycemic control despite
211 insulin use, emerged from the data analysis (Table 3).

212 213 214 **Lifestyle challenges in adhering to medical recommendations**

215 Under this theme there are five subthemes identified.

216 ~~Participants highlighted a range of lifestyle challenges in adhering to medical~~
217 ~~recommendations which contributed to their poor glycemic control. These included~~
218 ~~difficulty in integrating diabetes medical recommendations into their work-life~~
219 ~~schedule, inability to control food cravings and eating habits, inappropriate diet~~
220 ~~recommendations by HCPs and health-limiting conditions affecting diabetes self-care.~~

221
222
223 *Difficulty integrating diabetes medical recommendations into work-life schedule*

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

224 Participants faced difficulties in integrating medical recommendations such as a
225 medication regimen and meal times when they did not match with their daily activity
226 schedule. When participants were too busy with their work-life, they tended to skip
227 meals which caused them to become hungry and overeat later. Skipping meals also
228 resulted in them missing or delaying their insulin injections.

230 *“The way I eat and take the medications is not consistent. Sometimes I*
231 *forget. Maybe I am too busy. Every time my insulin use would be*
232 *delayed. For example, usually we inject at 12 right, sometimes I will*
233 *inject at 2. Sometimes I did not inject at all” – 58 years old housewife*
234
235 One participant described how the nature of his occupation made it difficult for him to
236 adhere to healthy diet and insulin treatment.

238 *“We are going around okay. So we can’t just go and get what we want*
239 *to eat. We can’t go and pack something or bring the food from house.*
240 *Furthermore, like now I’m taking the short-acting insulin, so every*
241 *mealtime you have to inject. You just can’t go and take insulin, you*
242 *see. I’m working as a bodyguard you see, you have to follow the boss*
243 *closely. I think so that is the reason [for poor blood sugar]”.*
244 *Thomas 36 years old personal bodyguard*

245
246
247 *Inability to control food cravings and eating habits*
248 Participants also reported that the temptation of eating something delicious would
249 lead them to lose control of their diet, causing them to overeat.

Formatted: Font: Italic

251 *"My eating habit. Like I like to eat sweets, like kuihs [local dessert] and*
252 *all that. But I have to control. I know I am not controlling. I must put a full*
253 *stop to that." - 60 years old woman housewife*

Formatted: Font: Italic

255 It is also difficult to resist food when there is a variety of food available and coming
256 from a lifestyle and culture where food and eating are a way of living.

258 *"Basically it is also Malaysia lifestyle whereby people like to eat.*
259 *You eat non-stop. Sugar is particularly everywhere in your diet so*
260 *that's probably one of the main reasons why it is not controlled". -*
261 *22 years old student*

Formatted: Font: Italic

263 *Inappropriate diet recommendations by healthcare providers*

264 Participants felt that the diet recommended by HCPs provided insufficient energy for
265 them to carry out their work. Some also expressed frustrations with regards to the
266 monotony of eating the same type of food every day, such as bread and chapatti,
267 which were recommended by the HCPs. Hence, they often neglected the dietary
268 advice.

269 *"Every time they [HCPs] ask me to eat bread. Can you eat bread*
270 *everyday? For sure you will hate it. They will ask to eat vegetables every*
271 *day. Cannot like that " - 59 years old ex-lorry driver*

Formatted: Font: Italic

273 *Health conditions affecting exercise*

274 Not being able to exercise optimally due to health conditions was another reason cited
275 by many for poor glycaemic control.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

276 *"Another thing is exercise. Because of stroke, I have problem with walking. I*
277 *have to exercise more". - 61 years old engineer*

Formatted: Font: Italic

282 **Psychosocial issues and emotional hurdles**

283 ~~Psychosocial and emotional problems also affected the participants' diabetes self-~~
284 ~~care; some lost motivation while others perceived poor glyceemic control as part of~~
285 ~~ageing. These, they believed, had led to their poor glyceemic control. Three subthemes~~
286 ~~emerged under this theme.~~

288 *Psychosocial problems affecting diabetes self-care*
289 Participants felt that their poor glyceemic control was attributed to personal problems
290 which caused them to feel anxious, stressed and sad, which resulted in some adopting
291 unhealthy eating habits and not taking their diabetes medications, including insulin.

293 *"Actually when you have diabetes, you cannot be stressed. Previously when I*
294 *was under stress [due to marital problems], my blood sugar level was very*
295 *high because I did not eat and take my insulin. I was hoping to die." – 50*
296 *years old taxi driver*

Formatted: Font: Italic

Formatted: Font: Italic

298 *Loss of motivation*

299 Participants admitted that they were tired of adhering to diabetes medications after
300 having taken them for such a long time that sometimes they would intentionally skip
301 doses.

302 *"Sometimes I purposely miss them because I am just so tired of injecting". –*
303 *40 years old officer*

Formatted: Font: Italic

305 Additionally, an absence of significant improvements in glycemic control despite
306 efforts made to improve glycemic control led participants to 'give up' in controlling
307 their blood sugar.

309 *"There's one time actually I did go to the gym and the exercise was okay but*
310 *it didn't really do anything to my weight. It does a little bit on my sugar but*
311 *after a while I just give up. I think it would be as well [contributed to her*
312 *poor glycemic control] because the main thing is that, I think that if I*
313 *actually lose weight, I would be able to control my sugar as well." – 40 year*
314 *old officer*

Formatted: Font: Italic

317 *Perceived poor glycemic control as part of ageing*

318 Many older participants of this study held the view that whatever their attempts to
319 control blood glucose levels, their glycemic control would still fall short due to their
320 advanced age.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

322
323
324
325
326
327

*“Maybe because I am getting old. As the days passed by, all my organs has
deteriorated. Like engine, the more it is used, it will become spoilt.” - 69
years old retiree*

Formatted: Font: Italic

For peer review only

Diabetes treatment-related factors

~~Diabetes treatment-related factors include side effects of insulin and perception of appropriate dietary practices related to insulin. There are two subthemes under this theme.~~

Side-effects of insulin

Participants reported they would tend to overeat to prevent or counter the effects of insulin-induced hypoglycaemia. However, it is when participants overeat that their glycemic control deteriorates.

"I had fit once (due to hypoglycaemia), that fear is always there. On and off, I used to eat more to make sure I don't go into hypoglycaemia fit. It is extremely painful". - 47 years old doctor

Participants also felt that insulin caused them to feel hungry, causing them to overeat, hence, raising their blood sugar levels.

"But if use insulin, it makes me eat. I feel that after using insulin, the blood sugar goes even higher". - 37 years old clerk

Fear of needles and pain also caused participants to delay insulin initiation as well as intentionally skipping injections, thus contributing to poor glycemic control.

"I don't quite like insulin actually. I'm very afraid of needles and the pain that follows. In a week I would say at least 3 times [skipping insulin injections]. Although my blood sugar was already up about 6 to 7 years ago,

Formatted: Font: Italic

Formatted: Font: Italic

Formatted: Font: Italic

Formatted: Font: Italic

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

353 *but I've only started insulin not far back from now. So that's the other reason*
354 *[for poor glycemic control].” – 40 years old officer*

357 *Perception of appropriate dietary practices related to insulin*

358 One participant felt that his poor glycemic control was attributed to the diet
359 recommendations given by the HCP. He voiced that the meal pattern recommended
360 was not right and would instead reduce the efficacy of the insulin.

362 *“For example if you eat at 8pm, then you feel hungry and you eat again. So*
363 *if I follow his [doctor] advice I will eat but this is wrong. The mistake is if*
364 *lets say I eat at 7pm, then 8, 9, 10, 11, 12pm, for about 4 hours I will keep on*
365 *eating. So the insulin cannot fight with my diabetes. Because I have*
366 *experienced this so I know. The recommended cannot work. My diabetes*
367 *reach 20, 30 something”. – 50 years old taxi driver*

Formatted: Font: Italic

Formatted: Font: Italic

371 **Lack of awareness-knowledge and self-efficacy in diabetes self-care**

372 Two subthemes were identified under this theme.

373 ~~Participants lacked awareness and self-efficacy in diabetes self-care. They did not~~
374 ~~know their glycemic level and target and were not confident in adjusting the insulin~~
375 ~~dosage on their own.~~

377 *Lack of awareness-knowledge of glycemic level and target*

378 Lack of awareness-knowledge of their glycemic level and target was also cited as a
 379 reason for poor glycemic control, as participants were not aware to what extent they
 380 should control their blood sugar. This lack of awareness-knowledge was attributed to
 381 difficulties in performing SMBG due to financial reason, and some claimed that their
 382 HCPs did not inform them about their glycemic levels and target.

384 *"I check less because sometimes when the needles are finished, I have to*
 385 *wait for my salary to buy. I check once a week but if I need to see the doctor*
 386 *then only I will check 4 times a day. Actually it is not enough. When I don't*
 387 *check, I cannot control my diet so that's why my blood sugar is not good". –*
 388 *37 years old clerk*

Formatted: Font: Italic

Formatted: Font: Italic

390 *"I don't know why he [doctor] wants to lower (blood sugar level) some*
 391 *more. No, because I don't know what is the target. The doctor never*
 392 *mentioned. I am also not sure. So I also don't know whether I am okay or*
 393 *not. If I know, I will control no matter what". -31 years old marketing*
 394 *coordinator*

Formatted: Font: Italic

397 *Lack of self-efficacy in adjustment of insulin dosage*
 398 Despite receiving advice from the doctor that they could adjust their insulin dosage,
 399 some participants did not do so as they were afraid of making mistakes when
 400 adjusting the insulin dose, which could lead to hypoglycaemia and other
 401 complications.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

403
404
405
406
407
408

“I’m just reluctant [to adjust insulin dosage] because they [doctor] won’t be with me 24 hours. I didn’t increase or decrease any of the medication. I just stick to it. So maybe that is the reason”. - 36 years old personal bodyguard

Formatted: Font: Italic

For peer review only

Discussions

Our study revealed that people with type 2 diabetes using insulin attributed their sustained hyperglycemia to lifestyle challenges, psychosocial and emotional problems, treatment-related factors and lack of awareness-knowledge of glycemic levels and targets, as well as poor self-efficacy with regards to insulin dosage adjustment. Majority of the factors raised were not related to problems with insulin use per se, but were related to barriers in performing diabetes self-care tasks in general such as dietary control, adherence to exercise and medications including OHAs.

Our study participants faced difficulties in adhering to the recommended meal and insulin injection schedule due to work priorities and time constraints. In a multinational study involving 1530 people with type 1 diabetes (12.8%) and type 2 diabetes (88.2%) using insulin from eight countries, taking insulin at the prescribed time or with meals everyday was also reported to be difficult [17]. The lifestyle changes required for diabetes management in terms of diet and regular mealtimes were acknowledged to be hard to implement, even in people with type 2 diabetes using OHAs alone, who often report missed or delayed meals [18]. This showed that adherence to regular meal and medication times is a universal and major barrier to diabetes management among people with diabetes. It is crucial to overcome that, especially among people with type 2 diabetes using insulin, as insulin administration has to be synchronized with meals. When regular meal times cannot be followed, it often results in delayed or skipped insulin intake, as reported in our study, which explains poor glycemic control.

1
2
3
4
5
6 434 Our participants raised the issue of dietary recommendations by HCPs, which did not
7
8 435 meet their dietary needs; the issues of the monotony of eating the same type of food
9
10 436 every day and the recommended diet could not provide sufficient energy. Other
11
12 437 people with type 2 diabetes using insulin ~~also have~~ reported that clinicians would
13
14 438 simply assume that patients would comply to the medical recommendations given;
15
16 439 without considering their individual needs and preferences [5]. Additionally, it also
17
18 440 appears that lack of understanding of the rationale behind dietary recommendations is
19
20 441 common among type 2 diabetes patients. ~~One~~ participant of our study thought the
21
22 442 meal pattern recommended by HCPs would thwart the efficacy of insulin, while type
23
24 443 2 diabetes patients on OHAs in another study perceived that frequent meals was a
25
26 444 way to control their diabetes [19]. In fact, the main purpose of regular meals is
27
28 445 actually to counter the effects of hypoglycemia, due to insulin and long acting
29
30 446 sulfonylureas. HCPs may be a contributing factor to these barriers in adhering to
31
32 447 dietary recommendations. In a collaborative study conducted in Austria, Canada,
33
34 448 Germany and United Kingdom, it was found that general practitioners lack the
35
36 449 knowledge and skills to educate, support and motivate patients on healthy lifestyle
37
38 450 changes [20]. These findings highlight the importance of HCPs in individualizing
39
40 451 treatment management plans according to the patient's needs. It is also pertinent that
41
42 452 HCPs explain to patients the rationale behind the treatment recommendation so that
43
44 453 misconceptions would not cause the patient to neglect the medical advice or to
45
46 454 practice other treatment approaches.
47
48 455
49
50 456 The issue of psychosocial factors and lack of motivation is crucial, as it affects all
51
52 457 aspects of diabetes self-care including adherence to insulin, as evidenced from our
53
54 458 study. Diabetes self-care is a complex task that demands behavioral change in the
55
56
57
58
59
60

1
2
3
4
5
6 459 patient on a daily basis; the influences of social, cultural, familial and professional
7
8 460 contexts further complicate management of the disease in diabetes patients as shown
9
10 461 in other studies [21-23]. Furthermore, our participants also showed that when a
11
12 462 patient's diabetes condition remains unimproved despite efforts to control it, this
13
14 463 leads to 'diabetes burn-out' stemming from frustration and loss of motivation;
15
16 464 eventually resulting in neglect of diabetes self-care. Perhaps explaining the disease
17
18 465 progression in type 2 diabetes and that the progressive loss of β -cell function is
19
20 466 common, will lift the feeling of frustration and loss of motivation in them.
21
22 467
23
24 468 Older participants of our study perceived that they would never be able to achieve
25
26 469 glycemic control due to their old age even with insulin use. Such misconceptions are
27
28 470 alarming as they may decrease older people's perceived importance of glycemic
29
30 471 control. They may lower their expected treatment target in order to cope with the
31
32 472 challenges in managing diabetes at such an age [24]. There is a need to inform elderly
33
34 473 people with type 2 diabetes that insulin has no upper limit dosage and they will still
35
36 474 be able to control their glycemic levels even with increasing age.
37
38 475
39 476 Issues such as fear of hypoglycaemia and needles and pain have been well established
40
41 as barriers to insulin initiation [6,7] and it is interesting to know that such problems
42
43 still prevails even after participant initiate insulin use, as found in participants of our
44
45 study. Moreover,
46
47 It is not surprising that our participants reported fear of hypoglycemia, needles and
48
49 pain as reasons for poor glycemic control. These factors have been well established
50
51 as factors for intentional insulin omission [25] and overeating to prevent insulin-
52
53 induced hypoglycemia [5,26]. [6] The UMMC has an established specialized
54
55
56
57
58
59
60

1
2
3
4
5
6 484 diabetes clinic with trained diabetes nurses to provide education and skills training in
7
8 485 diabetes self-care to patients. Therefore, ~~our study participants~~ ~~the patients~~ would
9
10 486 have been educated and trained on techniques of insulin administration and ways to
11
12 487 prevent and manage hypoglycemia. ~~Furthermore, they have been using insulin for~~
13
14 488 ~~some time and were using insulin pens, so the needle used is relatively thin which~~
15
16 489 ~~causes little or no injection pain. In addition to~~ In addition to providing diabetes
17
18 490 education and skills training to people with type 2 diabetes using insulin, provision of
19
20 491 counselling to address these fears is warranted.
21
22 492
23
24 493 Lack of ~~awareness~~ knowledge of glycemic level and targets was also a reason for
25
26 494 poor glycemic control in our participants. They were unsure to what extent they
27
28 495 should control their glucose levels. The issue of lack of ~~awareness~~ knowledge of
29
30 496 glycemic levels and targets in our study stemmed from lack of SMBG and perceived
31
32 497 minimal feedback from HCPs. Our participants reported financial constraints in
33
34 498 carrying out effective SMBG, as costs for SMBG supplies are not subsidized by the
35
36 499 Malaysian government. The impact of economic factors on SMBG adherence have
37
38 500 ~~been reported is well established~~ [27] as an issue that limits glycemic control in other
39
40 501 studies [27,28]. In a study by Onwudine et al., (2011), the study participants ~~Other~~
41
42 502 ~~diabetes patients~~ reported that they were not informed by their doctor of their target
43
44 503 blood glucose levels and perceived that as a barrier to diabetes self-management [29].
45
46 504 [20]HCPs have a crucial role to play in discussing glycemia results with their patients
47
48 505 and formulating mutually agreed glycemic targets. A study has shown that Awareness
49
50 506 knowledge of HbA1c and target goal had a positive impact on maintaining better
51
52 507 glycemic control among people with type 2 diabetes [30].
53
54 508

509 Self-adjustment of insulin dosage is have been shown to be a technically complex
 510 regimen for people with type 1 diabetes [31] and people with diabetes spend most of
 511 their time managing their diabetes away from healthcare professionals. It is thus not
 512 surprising that our participants were still apprehensive about self-adjustment of their
 513 insulin dose; for fear of hypoglycemia. Dependent and deferential attitudes towards
 514 health professionals were cited as the reasons why type 1 diabetes patients do not
 515 adjust their insulin dosage [31] and this may also be the reason for failure to adjust
 516 insulin dosing among our participants. Furthermore, the lack of skills to educate
 517 patients on how to monitor their glycaemic levels and adjustment of insulin has also
 518 been found to be a common challenge faced by general practitioners [20].
 519 Some factors for poor glycemic control as highlighted in the conceptual framework
 520 did not emerge in our study findings even when the participants were probed. The
 521 issue of social stigma was not raised by our participants as a reason for poor glycemic
 522 control. We assumed that our participants had overcome this barrier upon initiation of
 523 insulin since they have been on insulin for at least one year; as they also reported of
 524 performing adaptive strategies such as injecting insulin in private in public places, for
 525 example in the toilet or in their car. Ethnicity was also not raised as a factor for poor
 526 glycaemic control in this study. Instead, the participants described eating culture as a
 527 way of living for Malaysians in general. Therefore, participants of this study might
 528 have adapted to the 'Malaysian' culture whereby they share and practise culture of
 529 others. Even if the recommended diet by HCPs may not be the types of food familiar
 530 with the specific ethnic group or culture, nevertheless, they could still follow the
 531 recommended diet. No specific ethnicity barrier was also reported for diabetes
 532 treatment aspects. Socio-economic was not a factor for participants in this study to
 533 seek healthcare treatment as the company where they or their spouses are working

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

534 subsidized the medical costs. It should also be noted that the Malaysian government
535 provides relatively cheap health care for the people and the cost for insulin is
536 subsidized. However, this is not the case for SMBG where patients have to pay out-
537 of-pocket for glucometer and test strips. This is the reason why the lack of knowledge
538 of glycaemic status due to low performance of SMBG was raised as a reason for poor
539 glycaemic control. Our participants did not blame their family, friends, healthcare
540 system or HCPs for their poor glycaemic control. They however expressed dismay at
541 the short consultation times and not being able to see the same doctor for their
542 diabetes. Our participants expressed that diabetes control is a personal responsibility,
543 therefore they tended to focus on their personal inadequacies when it came to poor
544 glycaemic control. This may be due to diabetes self-care playing a huge role in disease
545 control, hence people with type 2 diabetes may have felt greater responsibility for
546 self-care. Thus, when glycaemic control cannot be achieved, this resulted in self-blame
547 [32].
548
549 The strengths and limitations of the study
550 The major strength of this study lies in the fact that the reasons behind poor glycaemic
551 control were gained from the insights of people with T2DM with sustained
552 hyperglycaemia for more than one year despite insulin use, through in-depth
553 interviews to explain why their diabetes remains poorly controlled despite being on
554 insulin. To researchers' knowledge, such findings has never been reported before.
555 This study found that issues such as adherence to regular meal and medication times,
556 fear of hypoglycaemia, needles and pain and lack of knowledge and self-efficacy in
557 diabetes care remain as barriers for poor glycaemic control among people with type 2
558 diabetes using insulin, whereas, issues such as social stigma, ethnicity, socio-

economic factors, family, friends, healthcare system factors and HCPs were found not to be reasons for poor glycaemic control despite insulin use.

Formatted: English (Malaysia)

This study has a few limitations. The recruitment of participants in this study was only conducted in a single hospital, hence healthcare systems as a factor in poor glycemic control cannot be further explored. The interviews were conducted in the hospital where the participants were recruited, hence the environment may influence them to give a socially desirable response. However, they were informed that their responses would not affect their medical care and would be kept confidential.

Clinical recommendations

HCPs should create individualized plans with people with type 2 diabetes using insulin, to ensure a routine that allows for proper meal times and exercise, which would enable them to take their diabetes medication, including insulin, in a timely manner. Patients reported they face problems with treatment recommendations, hence HCPs should continuously assess the efficacy and feasibility of treatment provided to their patients and clarify patient misconceptions. It is also pertinent for HCPs to recognise the psychological and emotional problems that impact on their patients' diabetes self-care and provide affective support to them. Lastly, HCPs should discuss glycemic readings and adjustment of insulin dosage, as well as formulate a mutually agreed target with patients to facilitate improvement of glycemic control.

Murray et al., (2011) has identified the common challenges faced by general practitioners when caring for people with type 2 diabetes across international and health system borders and they were related to knowledge, skills, attitudes.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

behaviours and context [20]. Some of the challenges faced by HCPs may explain the reasons for poor glycaemic control as faced by participants of this study such as the lack of knowledge and skills to: give clear explanations to the patients, actively engage their patients in their health management, educate patients on how to monitor their glycaemic levels, engage in shared decision making with patients and provide support and motivation to patients in their efforts towards lifestyle changes for better glycaemic control. Therefore, it is pertinent that HCPs are equipped with accurate and latest knowledge and skills about diabetes and its treatment and be able to impart them to their patients to empower them to perform effective diabetes self-care tasks.

Future research recommendations

More research is needed pertaining to this topic to uncover other factors that could influence poor glycemic control despite insulin use. In addition, exploring views from HCPs and caretakers of the patients would provide a more holistic understanding of factors for poor glycemic control despite insulin use. Accurate assessment of patient's knowledge, actual self-care practices, and, clinical characteristics could also be conducted. This would allow triangulation of multiple sources of data which would then provide more comprehensive understanding and better identification of reasons for poor glycemic control. Ultimately, the factors identified may help to develop a tool to be used by HCPs, as a checklist to address the barriers faced by people with type 2 diabetes using insulin in achieving glycemic control. In addition, future study should look into the motivators of better glycaemic control among people with type 2 diabetes using insulin who is successful in gaining glycaemic control. Understanding both the barriers and the motivators would help to improve glycaemic control among this subpopulation.

609

610 Conclusions

611 Our findings revealed lifestyle challenges, psychosocial and emotional problems,
612 treatment-related factors and lack of awareness-knowledge of glycemic levels and
613 targets, and poor self-efficacy with regards to insulin dosage adjustment as factors for
614 poor glycemic control despite insulin use. Healthcare providers could look into these
615 factors and help patients with type 2 diabetes using insulin to address their concerns
616 during consultations and thus improve glycemic control.

619 Contributorship statement

620 All authors (WTT, SRV, CJNI) of this study conceived and designed the study,
621 researched and analysed the data, contributed to discussion, wrote, edited, reviewed
622 and approved the final version of the manuscript.

624 Competing interests

625 None.

627 Funding

628 We would like to thank the University of Malaya, Malaysia for funding this project
629 (reference: PV109-2012A).

631 Ethics approval

632 This study received ethical approval from the University of Malaya Medical Centre
633 Medical Ethics Committee (926.18).

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Data sharing

No additional data are available.

References

1. Cramer JA, Pugh MJ (2005) The influence of insulin use on glycemic control. *Diabetes Care* 28: 78-83.

2. Harris SB, Kapor J, Lank CN, Willan AR, Houston T (2010) Clinical inertia in patients with T2DM requiring insulin in family practice. *Can Fam Physician* 56: e418-424.

3. Davies M (2004) The reality of glycaemic control in insulin treated diabetes: defining the clinical challenges. *Int J Obes Relat Metab Disord* 28: S14-S22.

4. Nichols GA, Hillier TA, Javor K, Brown JB (2000) Predictors of glycemic control in insulin-using adults with type 2 diabetes. *Diabetes Care* 23: 273-277.

5. Janes R, Titchener J, Pere J, Pere R, Senior J (2013) Understanding barriers to glycaemic control from the patient's perspective. *J Prim Health Care* 5: 114-122.

6. Abu Hassan H, Tohid H, Mohd Amin R, Long Bidin MB, Muthupalaniappen L, et al. (2013) Factors influencing insulin acceptance among type 2 diabetes mellitus patients in a primary care clinic: a qualitative exploration. *BMC Fam Pract* 14: 164.

7. Chen KW, Tseng HM, Huang YY, Chuang YJ (2012) The Barriers to Initiating Insulin Therapy among People with Type 2 Diabetes in Taiwan - A Qualitative Study. *J Diabetes Metab Disord* 3: 194.

8. Lee YK, Lee PY, Ng CJ (2012) A qualitative study on healthcare professionals' perceived barriers to insulin initiation in a multi-ethnic population. *BMC Fam Pract* 13: 28.

9. Sanal TS, Nair NS, Adhikari P (2011) Factors associated with poor control of type 2 diabetes mellitus: A systematic review and Meta-analysis. *Journal of Diabetology* 3: 1-10.

10. Khattab M, Khader YS, Al-Khawaldeh A, Ajlouni K (2010) Factors associated with poor glycemic control among patients with Type 2 diabetes. *Journal of Diabetes and its Complications* 24: 84-89.

11. Sasi ST, Kodali M, Burra KC, Muppala BS, Gutta P, et al. (2013) Self Care Activities, Diabetic Distress and other Factors which Affected the Glycaemic Control in a Tertiary Care Teaching Hospital in South India. *J Clin Diagn Res* 7: 857-860.

12. Chlebowy DO, Hood S, LaJoie AS (2010) Facilitators and barriers to self-management of type 2 diabetes among urban African American adults: focus group findings. *Diabetes Educ* 36: 897-905.

13. Shakibazadeh E, Larijani B, Shojaezadeh D, Rashidian A, Forouzanfar M, et al. (2011) Patients' Perspectives on Factors that Influence Diabetes Self-Care. *Iran J Public Health* 40: 146-158.

Formatted: Font: (Default) Times New Roman

14. Singh H, Cinnirella M, Bradley C (2012) Support systems for and barriers to diabetes management in South Asians and Whites in the UK: qualitative study of patients' perspectives. *BMJ Open* 2.
15. Hu J, Amirehsani K, Wallace DC, Letvak S (2013) Perceptions of barriers in managing diabetes: perspectives of Hispanic immigrant patients and family members. *Diabetes Educ* 39: 494-503.
16. Matthew BM, Huberman AM (1994) *Qualitative Data Analysis: An Expanded Sourcebook*: SAGE Publications.
17. Peyrot M, Barnett AH, Meneghini LF, Schumm-Draeger PM (2012) Insulin adherence behaviours and barriers in the multinational Global Attitudes of Patients and Physicians in Insulin Therapy study. *Diabet Med* 29: 682-689.
18. Frandsen KB, Smedegaard KJ (2000) Compliance with, and understanding of, mealtime advice in patients with Type 2 Diabetes. *Diabetes* 49: a176.
19. Frandsen KB, Kristensen JS (2002) Diet and lifestyle in type 2 diabetes: the patient's perspective. *Practical Diabetes International* 19: 77-80.
20. Murray S, Lazure P, Schroter S, Leuschner PJ, Posel P, et al. (2011) International challenges without borders: a descriptive study of family physicians' educational needs in the field of diabetes. *BMC Fam Pract* 12: 27.
21. Samuel-Hodge CD, Headen SW, Skelly AH, Ingram AF, Keyserling TC, et al. (2000) Influences on day-to-day self-management of type 2 diabetes among African-American women: spirituality, the multi-caregiver role, and other social context factors. *Diabetes Care* 23: 928-933.
22. Shacter HE, Shea JA, Akhabue E, Sablani N, Long JA (2009) A qualitative evaluation of racial disparities in glucose control. *Ethn Dis* 19: 121-127.
23. Peyrot M, Rubin RR, Lauritzen T, Snoek FJ, Matthews DR, et al. (2005) Psychosocial problems and barriers to improved diabetes management: results of the Cross-National Diabetes Attitudes, Wishes and Needs (DAWN) Study. *Diabet Med* 22: 1379-1385.
24. Paul C, Ayis S, Ebrahim S (2007) Disability and psychosocial outcomes in old age. *J Aging Health* 19: 723-741.
25. Peyrot M, Rubin RR, Kruger DF, Travis LB (2010) Correlates of insulin injection omission. *Diabetes Care* 33: 240-245.
26. Perlmuter LC (2008) Glycemic Control and Hypoglycemia. Is the loser the winner? *Diabetes Care* 31: 2072-2076.
27. Ong WM, Chua SS, Ng CJ (2014) Barriers and facilitators to self-monitoring of blood glucose in people with type 2 diabetes using insulin: a qualitative study. *Patient Preference and Adherence* 8: 237-246.
28. Yuan L, Guo X, Xiong Z, Lou Q, Shen L, et al. (2014) Self-monitoring of blood glucose in type 2 diabetic patients in China: current status and influential factors. *Chin Med J (Engl)* 127: 201-207.
29. Onwudiwe NC, Mullins CD, Winston RA, Shaya FT, Pradel FG, et al. (2011) Barriers to self-management of diabetes: a qualitative study among low-income minority diabetics. *Ethn Dis* 21: 27-32.
30. Kumpatla S, Medempudi S, Manoharan D, Viswanathan V (2010) Knowledge and Outcome Measure of HbA1c Testing in Asian Indian Patients with Type 2 Diabetes from a Tertiary Care Center. *Indian J Community Med* 35: 290-293.
31. Lawton J, Rankin D, Cooke D, Elliott J, Amiel S, et al. (2012) Patients' experiences of adjusting insulin doses when implementing flexible intensive insulin therapy: a longitudinal, qualitative investigation. *Diabetes Res Clin Pract* 98: 236-242.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

728 | 32. Beverly EA, Ritholz MD, Brooks KM, Hultgren BA, Lee Y, et al. (2012) A
729 | qualitative study of perceived responsibility and self-blame in type 2 diabetes:
730 | reflections of physicians and patients. J Gen Intern Med 27: 1180-1187.
731 |
732 |

For peer review only

Table 1 Summary of interview guide topic on factors influencing poor glycemic control despite using insulin

PREAMBLE: Actually you have had diabetes for a long time and are now using insulin to control your blood sugar. Since you are using insulin to control your blood sugar, but your blood sugar is still not well controlled.
<ul style="list-style-type: none"> Can you share with me what do you think are the reasons why your blood sugar is still not well controlled?
Focussing on areas influencing poor glycemic control
<ul style="list-style-type: none"> Do you face any problems in adjusting lifestyle for your diabetes care? (Probe: diet, exercise, medications). How?
<ul style="list-style-type: none"> What barriers do you face when using insulin? (Probe: injecting insulin in the public, negative beliefs about insulin, fear of needle, pain, blood, body injury, marks and scars, weight gain, hypoglycaemia, knowledge and skills in administering insulin)
<ul style="list-style-type: none"> Does your family, friends, or employer takes part in managing your diabetes? Do you think they affect you in your blood sugar control? How?
<ul style="list-style-type: none"> Do you face any health problems that makes it difficult for you to manage your diabetes? (Probe: vision problems, dexterity, mobility, poly-pharmacy, exercise)
<ul style="list-style-type: none"> There are some people with diabetes who are depressed and stressed and that affect their sugar control. Do you face this problem? How does it affect you in controlling your blood sugar?
<ul style="list-style-type: none"> Do you perform self-blood glucose monitoring? If no, why not? Does it affect your blood sugar control? If yes, how?
<ul style="list-style-type: none"> What barriers do you face when consulting the doctor/nurse for your diabetes? (Probe: language, communication, and interaction). Does it affect your blood sugar control?
<ul style="list-style-type: none"> What do you think of the hospitals and clinics that you go for your diabetes? (Probe: resources, complexity of system, accessibility, long waiting time, short consultation time) Does it affect your blood sugar control?
<ul style="list-style-type: none"> Do you face any financial difficulties to care for your diabetes? (Probe: Medication cost, transportation to hospitals, SMBG)

Table 2: Socio-demographic background and diabetes profile of participants

Characteristic	Participants (n=17)
Age (range)	22- 69 years
Sex	
Female	10
Male	7
Race	
Malays	8
Chinese	4
Indians	4
Nepalese	1
Education	
Secondary	9
Tertiary	5
Primary	2
No formal education	1
Years living with diabetes (range)	2-30
Years using insulin (range)	1-14

Table 3 Factors influencing poor glycemic control in people with type 2 diabetes using insulin

	Theme	Category
1	Lifestyle challenges in adhering to medical recommendations	1. Difficulty integrating diabetes medical recommendations into work-life schedule 2. Inability to control food cravings and eating habits 3. Inappropriate diet recommendations by HCPs 4. Health-limiting conditions affecting exercise
2	Psychosocial issues and emotional hurdles	1. Psychosocial-problems affecting diabetes self-care management 2. Loss of motivation 3. Perceived poor glycemic control as part of ageing
3	Diabetes treatment-related factors	1. Side-effects of insulin 2. Perception of appropriate dietary practices related to insulin
4	Lack of awareness-knowledge and self-efficacy in diabetes self-care	1. Lack of awareness-knowledge of glycemic level and target 2. Lack of self-efficacy in adjustment of insulin dosage

Figure 1 Conceptual framework of study

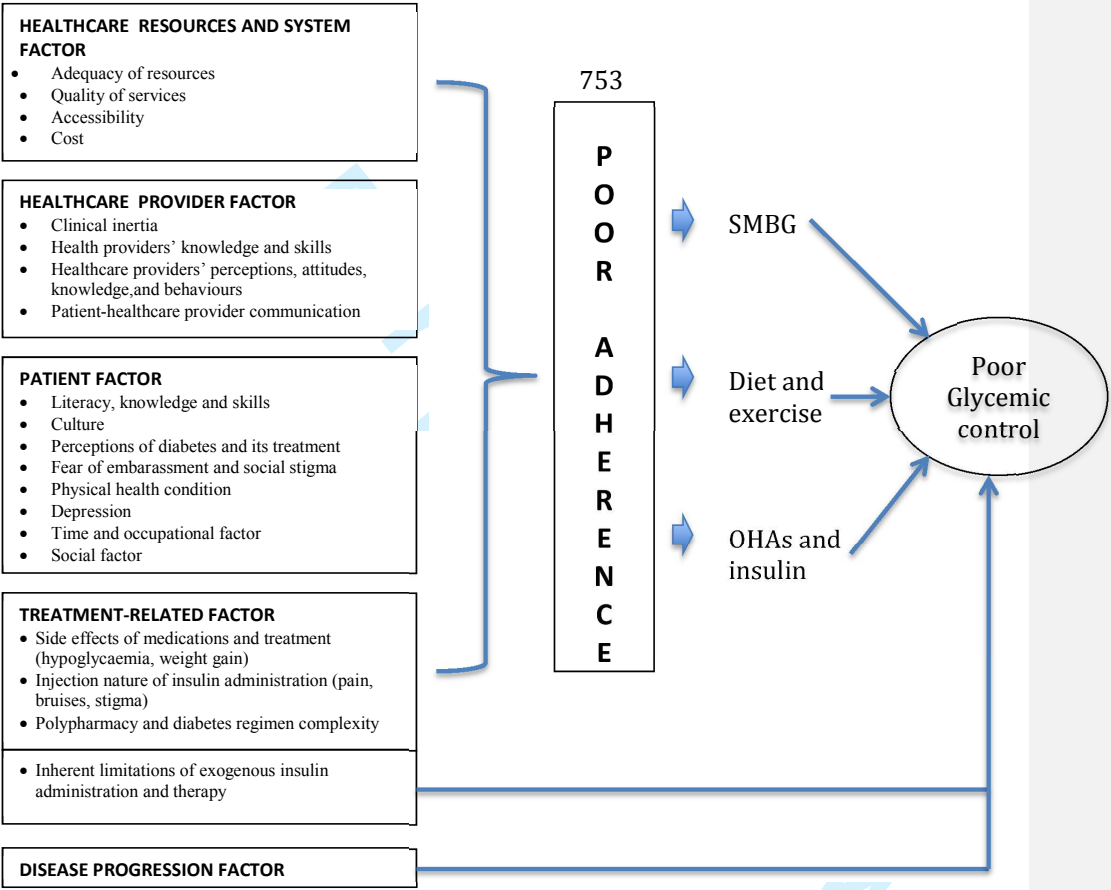


Table 1 Summary of interview guide topic on factors influencing poor glycemic control despite using insulin

PREAMBLE: Actually you have had diabetes for a long time and are now using insulin to control your blood sugar. Since you are using insulin to control your blood sugar, but your blood sugar is still not well controlled.
<ul style="list-style-type: none"> Can you share with me what do you think are the reasons why your blood sugar is still not well controlled?
Focussing on areas influencing poor glycemic control
<ul style="list-style-type: none"> Do you face any problems in adjusting lifestyle for your diabetes care? (Probe: diet, exercise, medications). How?
<ul style="list-style-type: none"> What barriers do you face when using insulin? (Probe: injecting insulin in the public, negative beliefs about insulin, fear of needle, pain, blood, body injury, marks and scars, weight gain, hypoglycaemia, knowledge and skills in administrating insulin)
<ul style="list-style-type: none"> Does your family, friends, or employer takes part in managing your diabetes? Do you think they affect you in your blood sugar control? How?
<ul style="list-style-type: none"> Do you face any health problems that makes it difficult for you to manage your diabetes? (Probe: vision problems, dexterity, mobility, poly-pharmacy, exercise)
<ul style="list-style-type: none"> There are some people with diabetes who are depressed and stressed and that affect their sugar control. Do you face this problem? How does it affect you in controlling your blood sugar?
<ul style="list-style-type: none"> Do you perform self-blood glucose monitoring? If no, why not? Does it affect your blood sugar control? If yes, how?
<ul style="list-style-type: none"> What barriers do you face when consulting the doctor/nurse for your diabetes? (Probe: language, communication, and interaction). Does it affect your blood sugar control?
<ul style="list-style-type: none"> What do you think of the hospitals and clinics that you go for your diabetes? (Probe: resources, complexity of system, accessibility, long waiting time, short consultation time) Does it affect your blood sugar control?
<ul style="list-style-type: none"> Do you face any financial difficulties to care for your diabetes? (Probe: Medication cost, transportation to hospitals, SMBG)

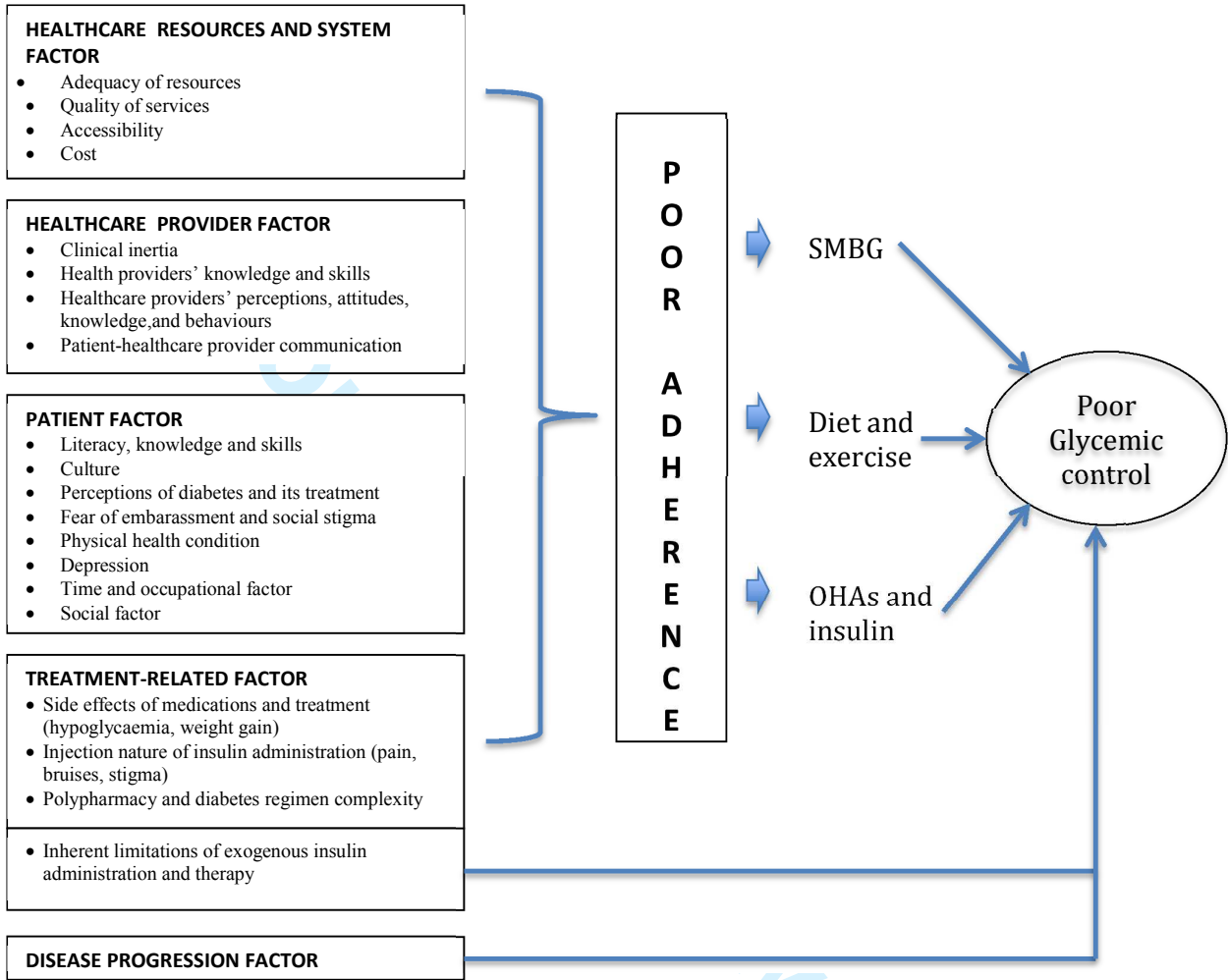
Table 2: Socio-demographic background and diabetes profile of participants

Characteristic	Participants (n=17)
Age (range)	22- 69 years
Sex	
Female	10
Male	7
Race	
Malays	8
Chinese	4
Indians	4
Nepalese	1
Education	
Secondary	9
Tertiary	5
Primary	2
No formal education	1
Years living with diabetes (range)	2-30
Years using insulin (range)	1-14

Table 3 Factors influencing poor glycemic control in people with type 2 diabetes using insulin

	Theme	Category
1	Lifestyle challenges in adhering to medical recommendations	<ol style="list-style-type: none"> 1. Difficulty integrating diabetes medical recommendations into work-life schedule 2. Inability to control food cravings and eating habits 3. Inappropriate diet recommendations by HCPs 4. Health-limiting conditions affecting exercise
2	Psychosocial issues and emotional hurdles	<ol style="list-style-type: none"> 1. Psychosocial-problems affecting diabetes self-care management 2. Loss of motivation 3. Perceived poor glycemic control as part of ageing
3	Diabetes treatment-related factors	<ol style="list-style-type: none"> 1. Side-effects of insulin 2. Perception of appropriate dietary practices related to insulin
4	Lack of knowledge and self-efficacy in diabetes self-care	<ol style="list-style-type: none"> 1. Lack of knowledge of glycemic level and target 2. Lack of self-efficacy in adjustment of insulin dosage

Figure 1 Conceptual framework of study



BMJ Open

Why do people with type 2 diabetes who are using insulin have poor glycemic control? A qualitative study.

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2014-006407.R2
Article Type:	Research
Date Submitted by the Author:	14-Oct-2014
Complete List of Authors:	Tong, Wen Ting; University of Malaya, Department of Primary Care Medicine Vethakkan, Shireene Ratna; University of Malaya, Department of Medicine Ng, Chirk Jenn; University of Malaya, Department of Primary Care Medicine
Primary Subject Heading:	Diabetes and endocrinology
Secondary Subject Heading:	Qualitative research
Keywords:	PRIMARY CARE, SOCIAL MEDICINE, PUBLIC HEALTH, PREVENTIVE MEDICINE

SCHOLARONE™
Manuscripts

Title: Why do people with type 2 diabetes who are using insulin have poor glycemic control? A qualitative study.

Corresponding author

Wen Ting Tong
Department of Primary Care Medicine, Faculty of Medicine, University of Malaya,
50603 Kuala Lumpur, Malaysia
e-mail: wentingtong@yahoo.com
Tel: 603-7949 2306
Fax: 603- 7957 7941

Shireene Ratna Vethakkan
Department of Medicine, Faculty of Medicine, University of Malaya, 50603 Kuala
Lumpur, Malaysia
e-mail: shireene@ummc.edu.my

Chirk Jenn Ng
Department of Primary Care Medicine, Faculty of Medicine, University of Malaya,
50603 Kuala Lumpur, Malaysia
e-mail: ngcj@um.edu.my

Keywords: Diabetes and endocrinology; qualitative research; social medicine

Abstract

Objective

This study aims to explore the factors influencing poor glycemic control among people with type 2 diabetes using insulin.

Research design

This study used a qualitative methodology, comprising in-depth individual interviews. A semi-structured interview guide was used. The interviews were audio-recorded, transcribed verbatim and analysed using a thematic approach.

Participants:

Seventeen people with type 2 diabetes using insulin with HbA1c $\geq 9\%$ for > 1 year participated in this study.

Setting

This study was conducted at the Primary Care Clinic and the Diabetes Clinic in the University of Malaya Medical Centre (UMMC), Malaysia.

Results

Data analysis uncovered four themes. They were lifestyle challenges in adhering to medical recommendations, psychosocial and emotional hurdles, diabetes treatment related factors and, lack of knowledge and self-efficacy in diabetes self-care.

Conclusion

This study identified factors, which explained the poor glycaemic control in people with type 2 diabetes using insulin. Healthcare providers may use these findings to address patients' concerns during consultations and help to improve glycaemic control.

Word count: 163/250

57 Strengths and limitations of this study

- 58
- 59 • The major strength of this study lies in the fact that the reasons behind poor
60 glycaemic control were uncovered from the perspectives of people with type 2
61 diabetes with sustained hyperglycaemia for more than one year despite insulin
62 use, through in-depth interviews.
 - 63 • This study found that issues such as adherence to regular meal and medication
64 times, fear of hypoglycaemia, needles and pain and lack of knowledge and
65 self-efficacy in diabetes care remain as barriers for poor glycaemic control
66 among people with type 2 diabetes using insulin.
 - 67 • Issues such as social stigma, ethnicity, socio-economic factors, family, friends,
68 healthcare system and HCPs did not emerge as reasons for poor glycaemic
69 control despite insulin use.
 - 70 • The recruitment of participants was conducted in a single hospital, hence
71 healthcare systems as a factor in poor glycaemic control cannot be further
72 explored.
 - 73 • The interviews conducted in the hospital environment may influence the
74 participants to give a socially desirable response. However, they were
75 informed that their responses would not affect their medical care and would be
76 kept confidential.
- 77
78
79
80
81

Introduction

Insulin has been identified as the most effective glucose lowering agent, however, studies has showed that many people with diabetes who are using insulin still fail to achieve glycemic control [1,2].

The challenges of achieving glycemic control in people with diabetes using insulin were: the progression of the disease, the impact of hypoglycemia and weight gain, the burden of poly-pharmacy, lack of resources in provision of diabetes self-care education and support of patients; and the inherent limitations of subcutaneous exogenous insulin administration [3]. Other predictors of poor glycemic control among people with type 2 diabetes using insulin include younger age, shorter duration of diagnosis of diabetes, lower body mass index and poor physical functioning [4].

Barriers to glycaemic control highlighted in a qualitative study among people with T2DM using insulin were fear about illness, guilt or self-blame, shame, ideas or beliefs about causation of diabetes, personal or cultural beliefs, and difficulty finding common grounds with clinicians on diabetes management [5].

To date, many studies have been conducted on barriers to insulin initiation [6-8]. Research on factors associated with poor glycemic control in people with type 2 diabetes was largely quantitative and tend to focus on specific treatment modalities such as lifestyle modifications, OHAs (oral hypoglycemic agents), OHAs + insulin and insulin only [9-11]. In terms of qualitative studies, many focused on barriers to diabetes self-care management in general [12-15] rather than reasons for poor glycaemic control. Very few qualitative studies examined factors impacting poor

107 glycemic control from the patient's perspective, especially among people with type 2
108 diabetes using insulin with poor glycemic control.

109
110 Since insulin is the most effective glucose-lowering agent, it is pertinent to understand
111 from the patient's perspective why people with type 2 diabetes who are on insulin still
112 fail to achieve glycemic control. This study will help fill the gap in existing literature
113 by exploring factors influencing poor glycemic control in people with type 2 diabetes
114 using insulin. An understanding of the barriers to achieving glycemic control will help
115 healthcare providers (HCPs) find ways to improve glycemic control in this sub-
116 population.

117
118 **Research Design and Methods**

119 This study used a qualitative methodology, comprising in-depth individual interviews
120 to help understand patient experiences, as well as take into account the circumstances
121 which led to poor glycemic control among people with type 2 diabetes using insulin.

122
123 This study was conducted at the Primary Care Clinic and the Diabetes Clinic in the
124 University of Malaya Medical Centre (UMMC). We purposively sampled patients
125 who were diagnosed with type 2 diabetes, have been using insulin, either alone or in
126 combination with OHAs and with poor control of diabetes ($HbA_{1c} \geq 9\%$) for at least
127 one year. Participants were chosen from various socio-demographic backgrounds
128 (age, ethnicity, education level) so that different perspectives on the reasons for poor
129 glycemic control can be explored.

130

1
2
3 131 We used a semi-structured interview guide (Table 1), which was developed based on
4
5 132 the study's conceptual framework (Figure 1) drawn from literature review and
6
7 133 experts' opinion. We reviewed the literature to identify possible factors, concepts and
8
9
10 134 variables [16] that have been shown to influence glycaemic control among people
11
12 135 with diabetes. A preliminary conceptual framework was developed based on these
13
14 136 factors. Later, the conceptual framework was given to two researchers (NCJ and
15
16 137 SRV) (one is a family medicine specialist and another is an endocrinologist) to
17
18 138 provide feedback and strengthen the conceptual framework based on their clinical
19
20 139 experience and expertise. Subsequently, the interview guide was constructed based on
21
22 140 the revised conceptual framework.
23
24
25
26
27

28 142 The interviews were carried out between January and August 2013 in consultation
29
30 143 rooms in both clinics. Written informed consent and socio-demographic information
31
32 144 was obtained from patients who agreed to participate. During the interviews, the
33
34 145 participants were asked for the reasons why they think their blood sugar is not well
35
36 146 controlled despite using insulin. When the participant could not give any more
37
38 147 reasons that they could think of, the researcher would then probe other areas
39
40 148 contributing to poor glycemic control, as developed in the interview guide. Data
41
42 149 saturation was achieved upon the 17th interview, when no new factors influencing
43
44 150 poor glycemic control emerged from the interviews.
45
46
47

48 151
49
50 152 It is important to note that the participants of this study were recruited from the clinics
51
52 153 where SRV and NCJ conduct their clinical practice. Thus, in order to offset the
53
54 154 influence of power disparities between doctor and patient, all the interviews were
55
56 155 conducted by WTT. WTT was competent in English, Malay and Cantonese, hence the
57
58
59
60

156 interviews were conducted in three languages. Out of the 17 interviews, there were
157 two interviews that were conducted in Cantonese and seven in Malay. Given that the
158 Cantonese language has many colloquialisms, the recordings were translated directly
159 into English by WTT so the meaning would not be lost. Other interviews that were
160 conducted in English and Malay were given to experienced transcribers for verbatim
161 transcription. All the transcripts were checked for accuracy and quality by WTT by
162 listening to the audio recording and checked against the transcript, before exported
163 into NVivo qualitative software for data analysis using a thematic approach. Malay
164 transcripts were analysed in the said language and the selected quotes were later
165 translated to English. The translated quotes were checked with other researchers to
166 ensure the meaning were not lost or distorted.
167
168 Initially, the transcripts were read through for familiarization by the researchers and
169 then codes were assigned to a particular phrase, sentence or paragraph that described
170 the meaning of the text segment. Sentences that had a similar meaning were given the
171 same code while texts with different meaning were given a new code. The whole
172 transcript was analyzed until there were no new meanings from the texts to form new
173 codes. Subsequently, all the codes were compared and related codes were clustered
174 together under the same category. Irrelevant codes were omitted. The categories were
175 later compared and further clustered under themes. The mapping of categories and
176 themes resulted in the development of a coding frame. The coding frame was
177 developed from the coding process on the first three transcripts by all the researchers
178 (WTT, NCJ, SRV). The coding frame was finalized when consensus was reached on
179 the categories and themes. The finalized coding frame was used to code for the
180 remaining transcripts by WTT. New emerging codes were added into the list of

181 categories and themes that were created through constant discussion with other
182 researchers to ensure the list of categories and themes produced the best
183 representation of data that was obtained. Researchers constantly challenged one
184 another's interpretation of the data to offset any potential biases when analyzing the
185 data.

186 187 188 **Results**

189 Socio-demographic and diabetes profile of participants

190 There were 17 participants in this study. Their socio-demographic and diabetes
191 profiles are listed in Table 2.

192 193 Emerging themes

194 Four themes, which corresponded to factors influencing poor glycemic control despite
195 insulin use, emerged from the data analysis (Table 3).

196 197 198 **Lifestyle challenges in adhering to medical recommendations**

199 Under this theme there are five subthemes identified.

200 201 *Difficulty integrating diabetes medical recommendations into work-life schedule*

202 Participants faced difficulties in integrating medical recommendations such as a
203 medication regimen and meal times when they did not match with their daily activity
204 schedule. When participants were too busy with their work-life, they tended to skip
205 meals which caused them to become hungry and overeat later. Skipping meals also
206 resulted in them missing or delaying their insulin injections.

207

208 *“The way I eat and take the medications is not consistent. Sometimes I*
209 *forget. Maybe I am too busy. Every time my insulin use would be*
210 *delayed. For example, usually we inject at 12 right, sometimes I will*
211 *inject at 2. Sometimes I did not inject at all” – 58 years old housewife*

212
213 One participant described how the nature of his occupation made it difficult for him to
214 adhere to healthy diet and insulin treatment.

215
216 *“We are going around okay. So we can’t just go and get what we want*
217 *to eat. We can’t go and pack something or bring the food from house.*
218 *Furthermore, like now I’m taking the short-acting insulin, so every*
219 *mealtime you have to inject. You just can’t go and take insulin, you*
220 *see. I’m working as a bodyguard you see, you have to follow the boss*
221 *closely. I think so that is the reason [for poor blood sugar]”. –36*
222 *years old personal bodyguard*

223
224
225 *Inability to control food cravings and eating habits*

226 Participants also reported that the temptation of eating something delicious would
227 lead them to lose control of their diet, causing them to overeat.

228
229 *“My eating habit. Like I like to eat sweets, like kuihs [local dessert] and*
230 *all that. But I have to control. I know I am not controlling. I must put a full*
231 *stop to that.” - 60 years old woman housewife*

232
233 It is also difficult to resist food when there is a variety of food available and coming
234 from a lifestyle and culture where food and eating are a way of living.

235

236 *“Basically it is also Malaysia lifestyle whereby people like to eat.*

237 *You eat non-stop. Sugar is particularly everywhere in your diet so*

238 *that’s probably one of the main reasons why it is not controlled”. -*

239 *22 years old student*

240

241 *Inappropriate diet recommendations by healthcare providers*

242 Participants felt that the diet recommended by HCPs provided insufficient energy for

243 them to carry out their work. Some also expressed frustrations with regards to the

244 monotony of eating the same type of food every day, such as bread and chapatti,

245 which were recommended by the HCPs. Hence, they often neglected the dietary

246 advice.

247 *“Every time they [HCPs] ask me to eat bread. Can you eat bread*

248 *everyday? For sure you will hate it. They will ask to eat vegetables every*

249 *day. Cannot like that ” - 59 years old ex-lorry driver*

250

251 *Health conditions affecting exercise*

252 Not being able to exercise optimally due to health conditions was another reason cited

253 by many for poor glycemic control.

254 *“Another thing is exercise. Because of stroke, I have problem with walking. I*

255 *have to exercise more”. - 61 years old engineer*

256

257

258

259

260 **Psychosocial issues and emotional hurdles**

261 Three subthemes emerged under this theme.

262

263 *Psychosocial problems affecting diabetes self-care*

264 Participants felt that their poor glycemic control was attributed to personal problems
265 which caused them to feel anxious, stressed and sad, which resulted in some adopting
266 unhealthy eating habits and not taking their diabetes medications, including insulin.

267

268 *“Actually when you have diabetes, you cannot be stressed. Previously when I*
269 *was under stress [due to marital problems], my blood sugar level was very*
270 *high because I did not eat and take my insulin. I was hoping to die.” – 50*
271 *years old taxi driver*

272

273 *Loss of motivation*

274 Participants admitted that they were tired of adhering to diabetes medications after
275 having taken them for such a long time that sometimes they would intentionally skip
276 doses.

277 *“Sometimes I purposely miss them because I am just so tired of injecting”. –*
278 *40 years old officer*

279

280 Additionally, an absence of significant improvements in glycemic control despite
281 efforts made to improve glycemic control led participants to ‘give up’ in controlling
282 their blood sugar.

283

284 *“There’s one time actually I did go to the gym and the exercise was okay but*
285 *it didn’t really do anything to my weight. It does a little bit on my sugar but*
286 *after a while I just give up. I think it would be as well [contributed to her*
287 *poor glycemic control] because the main thing is that, I think that if I*
288 *actually lose weight, I would be able to control my sugar as well.” – 40 year*
289 *old officer*

292 *Perceived poor glycemic control as part of ageing*

293 Many older participants of this study held the view that whatever their attempts to
294 control blood glucose levels, their glycemic control would still fall short due to their
295 advanced age.

297 *“Maybe because I am getting old. As the days passed by, all my organs has*
298 *deteriorated. Like engine, the more it is used, it will become spoilt.” - 69*
299 *years old retiree*

300

301

302

303 **Diabetes treatment-related factors**

304 There are two subthemes under this theme.

305

306 *Side-effects of insulin*

307 Participants reported they would tend to overeat to prevent or counter the effects of

308 insulin-induced hypoglycaemia. However, it is when participants overeat that their

309 glycemic control deteriorates.

310 *“I had fit once (due to hypoglycaemia), that fear is always there. On*

311 *and off, I used to eat more to make sure I don’t go into*

312 *hypoglycaemia fit. It is extremely painful”. - 47 years old doctor*

313

314 Participants also felt that insulin caused them to feel hungry, causing them to overeat,

315 hence, raising their blood sugar levels.

316

317 *“But if use insulin, it makes me eat. I feel that after using insulin, the blood*

318 *sugar goes even higher”. – 37 years old clerk*

319

320 Fear of needles and pain also caused participants to delay insulin initiation as well as

321 intentionally skipping injections, thus contributing to poor glycemic control.

322

323 *“I don’t quite like insulin actually. I’m very afraid of needles and the pain*

324 *that follows. In a week I would say at least 3 times [skipping insulin*

325 *injections]. Although my blood sugar was already up about 6 to 7 years ago,*

326 *but I’ve only started insulin not far back from now. So that’s the other reason*

327 *[for poor glycemic control].” – 40 years old officer*

328 *Perception of appropriate dietary practices related to insulin*

329 One participant felt that his poor glycemic control was attributed to the diet
330 recommendations given by the HCP. He voiced that the meal pattern recommended
331 was not right and would instead reduce the efficacy of the insulin.

332

333 *“For example if you eat at 8pm, then you feel hungry and you eat again. So*
334 *if I follow his [doctor] advice I will eat but this is wrong. The mistake is if*
335 *lets say I eat at 7pm, then 8, 9, 10, 11, 12pm, for about 4 hours I will keep on*
336 *eating. So the insulin cannot fight with my diabetes. Because I have*
337 *experienced this so I know. The recommended cannot work. My diabetes*
338 *reach 20, 30 something”.* – 50 years old taxi driver

339

340

341 **Lack of knowledge and self-efficacy in diabetes self-care**

342 Two subthemes were identified under this theme.

343

344 *Lack of knowledge of glycemic level and target*

345 Lack of knowledge of their glycemic level and target was also cited as a reason for
346 poor glycemic control, as participants were not aware to what extent they should
347 control their blood sugar. This lack of knowledge was attributed to difficulties in
348 performing SMBG due to financial reason, and some claimed that their HCPs did not
349 inform them about their glycemic levels and target.

350

351 *“I check less because sometimes when the needles are finished, I have to*
352 *wait for my salary to buy. I check once a week but if I need to see the doctor*

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

353 *then only I will check 4 times a day. Actually it is not enough. When I don't*
354 *check, I cannot control my diet so that's why my blood sugar is not good". –*
355 *37 years old clerk*
356
357 *"I don't know why he [doctor] wants to lower (blood sugar level) some*
358 *more. No, because I don't know what is the target. The doctor never*
359 *mentioned. I am also not sure. So I also don't know whether I am okay or*
360 *not. If I know, I will control no matter what". -31 years old marketing*
361 *coordinator*
362
363 *Lack of self-efficacy in adjustment of insulin dosage*
364 *Despite receiving advice from the doctor that they could adjust their insulin dosage,*
365 *some participants did not do so as they were afraid of making mistakes when*
366 *adjusting the insulin dose, which could lead to hypoglycaemia and other*
367 *complications.*
368
369 *"I'm just reluctant [to adjust insulin dosage] because they [doctor] won't be*
370 *with me 24 hours. I didn't increase or decrease any of the medication. I just*
371 *stick to it. So maybe that is the reason". - 36 years old personal bodyguard*
372
373
374

Discussions

Our study revealed that people with type 2 diabetes using insulin attributed their sustained hyperglycemia to lifestyle challenges, psychosocial and emotional problems, treatment-related factors and lack of knowledge of glycemic levels and targets, as well as poor self-efficacy with regards to insulin dosage adjustment. Majority of the factors raised were not related to problems with insulin use per se, but were related to barriers in performing diabetes self-care tasks in general such as dietary control, adherence to exercise and medications including OHAs.

Our study participants faced difficulties in adhering to the recommended meal and insulin injection schedule due to work priorities and time constraints. In a multinational study involving 1530 people with type 1 diabetes (12.8%) and type 2 diabetes (88.2%) using insulin from eight countries, taking insulin at the prescribed time or with meals everyday was also reported to be difficult [17]. The lifestyle changes required for diabetes management in terms of diet and regular mealtimes were acknowledged to be hard to implement, even in people with type 2 diabetes using OHAs alone, who often report missed or delayed meals [18]. This showed that adherence to regular meal and medication times is a universal and major barrier to diabetes management among people with diabetes. It is crucial to overcome that, especially among people with type 2 diabetes using insulin, as insulin administration has to be synchronized with meals. When regular meal times cannot be followed, it often results in delayed or skipped insulin intake, as reported in our study, which explains poor glycemic control.

399 Our participants raised the issue of dietary recommendations by HCPs, which did not
400 meet their dietary needs; the issues of the monotony of eating the same type of food
401 every day and the recommended diet could not provide sufficient energy. Other
402 people with type 2 diabetes using insulin have reported that clinicians would simply
403 assume that patients would comply to the medical recommendations given; without
404 considering their individual needs and preferences [5]. Additionally, it also appears
405 that lack of understanding of the rationale behind dietary recommendations is
406 common among type 2 diabetes patients. One participant of our study thought the
407 meal pattern recommended by HCPs would thwart the efficacy of insulin, while type
408 2 diabetes patients on OHAs in another study perceived that frequent meals was a
409 way to control their diabetes [19]. In fact, the main purpose of regular meals is
410 actually to counter the effects of hypoglycemia, due to insulin and long acting
411 sulfonylureas. HCPs may be a contributing factor to these barriers in adhering to
412 dietary recommendations. In a collaborative study conducted in Austria, Canada,
413 Germany and United Kingdom, it was found that general practitioners lack the
414 knowledge and skills to educate, support and motivate patients on healthy lifestyle
415 changes [20].
416
417 The issue of psychosocial factors and lack of motivation is crucial, as it affects all
418 aspects of diabetes self-care including adherence to insulin, as evidenced from our
419 study. Diabetes self-care is a complex task that demands behavioral change in the
420 patient on a daily basis; the influences of social, cultural, familial and professional
421 contexts further complicate management of the disease in diabetes patients as shown
422 in other studies [21-23]. Furthermore, our participants also showed that when a
423 patient's diabetes condition remains unimproved despite efforts to control it, this

1
2
3 424 leads to ‘diabetes burn-out’ stemming from frustration and loss of motivation;
4
5 425 eventually resulting in neglect of diabetes self-care. Perhaps explaining the disease
6
7 426 progression in type 2 diabetes and that the progressive loss of β -cell function is
8
9 427 common, will lift the feeling of frustration and loss of motivation in them.
10
11 428
12
13 429 Older participants of our study perceived that they would never be able to achieve
14
15 430 glycemic control due to their old age even with insulin use. Such misconceptions are
16
17 431 alarming as they may decrease older people’s perceived importance of glycemic
18
19 432 control. They may lower their expected treatment target in order to cope with the
20
21 433 challenges in managing diabetes at such an age [24]. There is a need to inform elderly
22
23 434 people with type 2 diabetes that insulin has no upper limit dosage and they will still
24
25 435 be able to control their glycemic levels even with increasing age.
26
27 436
28
29 437 Issues such as fear of hypoglycaemia and needles and pain have been well established
30
31 438 as barriers to insulin initiation [6,7] and it is interesting to know that such problems
32
33 439 still prevails even after participant initiate insulin use, as found in participants of our
34
35 440 study. Moreover, these factors have been well established as factors for intentional
36
37 441 insulin omission [25] and overeating to prevent insulin-induced hypoglycemia [5,26].
38
39 442 The UMMC has an established specialized diabetes clinic with trained diabetes nurses
40
41 443 to provide education and skills training in diabetes self-care to patients. Therefore, our
42
43 444 study participants would have been educated and trained on techniques of insulin
44
45 445 administration and ways to prevent and manage hypoglycemia. In addition to
46
47 446 providing diabetes education and skills training to people with type 2 diabetes using
48
49 447 insulin, provision of counselling to address these fears is warranted.
50
51 448
52
53
54
55
56
57
58
59
60

449 Lack of knowledge of glycemic level and targets was also a reason for poor glycemic
450 control in our participants. They were unsure to what extent they should control their
451 glucose levels. The issue of lack of knowledge of glycemic levels and targets in our
452 study stemmed from lack of SMBG and perceived minimal feedback from HCPs. Our
453 participants reported financial constraints in carrying out effective SMBG, as costs for
454 SMBG supplies are not subsidized by the Malaysian government. The impact of
455 economic factors on SMBG adherence have been reported as an issue that limits
456 glycemic control in other studies [27,28]. In a study by Onwudine et al., (2011), the
457 study participants reported that they were not informed by their doctor of their target
458 blood glucose levels and perceived that as a barrier to diabetes self-management [29].
459 HCPs have a crucial role to play in discussing glycemia results with their patients and
460 formulating mutually agreed glycemic targets. A study has shown that knowledge of
461 HbA1c and target goal had a positive impact on maintaining better glycemic control
462 among people with type 2 diabetes [30].
463
464 Self-adjustment of insulin dosage have been shown to be a technically complex
465 regimen for people with type 1 diabetes [31] and people with diabetes spend most of
466 their time managing their diabetes away from healthcare professionals. It is thus not
467 surprising that our participants were still apprehensive about self-adjustment of their
468 insulin dose; for fear of hypoglycemia. Dependent and deferential attitudes towards
469 health professionals were cited as the reasons why type 1 diabetes patients do not
470 adjust their insulin dosage [31] and this may also be the reason for failure to adjust
471 insulin dosing among our participants. Furthermore, the lack of skills to educate
472 patients on how to monitor their glycaemic levels and adjustment of insulin has also
473 been found to be a common challenge faced by general practitioners [20].

Some factors for poor glycemic control as highlighted in the conceptual framework did not emerge in our study findings even when the participants were probed. The issue of social stigma was not raised by our participants as a reason for poor glycemic control. We assumed that our participants had overcome this barrier upon initiation of insulin since they have been on insulin for at least one year; as they also reported of performing adaptive strategies such as injecting insulin in private in public places, for example in the toilet or in their car. Ethnicity was also not raised as a factor for poor glycaemic control in this study. Instead, the participants described eating culture as a way of living for Malaysians in general. Therefore, participants of this study might have adapted to the 'Malaysian' culture whereby they share and practise culture of others. Even if the recommended diet by HCPs may not be the types of food familiar with the specific ethnic group or culture, nevertheless, they could still follow the recommended diet. No specific ethnicity barrier was also reported for diabetes treatment aspects. Socio-economic was not a factor for participants in this study to seek healthcare treatment as the company where they or their spouses are working subsidized the medical costs. It should also be noted that the Malaysian government provides relatively cheap health care for the people and the cost for insulin is subsidized. However, this is not the case for SMBG where patients have to pay out-of-pocket for glucometer and test strips. This is the reason why the lack of knowledge of glycaemic status due to low performance of SMBG was raised as a reason for poor glycaemic control. Our participants did not blame their family, friends, healthcare system or HCPs for their poor glycemic control. They however expressed dismay at the short consultation times and not being able to see the same doctor for their diabetes. Our participants expressed that diabetes control is a personal responsibility, therefore they tended to focus on their personal inadequacies when it came to poor

glycemic control. This may be due to diabetes self-care playing a huge role in disease control, hence people with type 2 diabetes may have felt greater responsibility for self-care. Thus, when glycemic control cannot be achieved, this resulted in self-blame [32].

The strengths and limitations of the study

The major strength of this study lies in the fact that the reasons behind poor glycaemic control were gained from the insights of people with T2DM with sustained hyperglycaemia for more than one year despite insulin use, through in-depth interviews to explain why their diabetes remains poorly controlled despite being on insulin. To researchers' knowledge, such findings has never been reported before. This study found that issues such as adherence to regular meal and medication times, fear of hypoglycaemia, needles and pain and lack of knowledge and self-efficacy in diabetes care remain as barriers for poor glycaemic control among people with type 2 diabetes using insulin, whereas, issues such as social stigma, ethnicity, socio-economic factors, family, friends, healthcare system factors and HCPs were found not to be reasons for poor glycaemic control despite insulin use.

This study has a few limitations. The recruitment of participants in this study was only conducted in a single hospital, hence healthcare systems as a factor in poor glycemic control cannot be further explored. The interviews were conducted in the hospital where the participants were recruited, hence the environment may influence them to give a socially desirable response. However, they were informed that their responses would not affect their medical care and would be kept confidential.

524 Clinical recommendations

525 HCPs should create individualized plans with people with type 2 diabetes using
526 insulin, to ensure a routine that allows for proper meal times and exercise, which
527 would enable them to take their diabetes medication, including insulin, in a timely
528 manner. Patients reported they face problems with treatment recommendations, hence
529 HCPs should continuously assess the efficacy and feasibility of treatment provided to
530 their patients and clarify patient misconceptions. It is also pertinent for HCPs to
531 recognise the psychological and emotional problems that impact on their patients'
532 diabetes self-care and provide affective support to them. Lastly, HCPs should discuss
533 glycemic readings and adjustment of insulin dosage, as well as formulate a mutually
534 agreed target with patients to facilitate improvement of glycemic control.

535
536 Murray et al., (2011) has identified the common challenges faced by general
537 practitioners when caring for people with type 2 diabetes across international and
538 health system borders and they were related to knowledge, skills, attitudes,
539 behaviours and context [20]. Some of the challenges faced by HCPs may explain the
540 reasons for poor glycaemic control as faced by participants of this study such as the
541 lack of knowledge and skills to: give clear explanations to the patients, actively
542 engage their patients in their health management, educate patients on how to monitor
543 their glycaemic levels, engage in shared decision making with patients and provide
544 support and motivation to patients in their efforts towards lifestyle changes for better
545 glycaemic control. Therefore, it is pertinent that HCPs are equipped with accurate and
546 latest knowledge and skills about diabetes and its treatment and be able to impart
547 them to their patients to empower them to perform effective diabetes self-care tasks.

548

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

549 **Future research recommendations**

550 More research is needed pertaining to this topic to uncover other factors that could
551 influence poor glycemic control despite insulin use. In addition, exploring views from
552 HCPs and caretakers of the patients would provide a more holistic understanding of
553 factors for poor glycemic control despite insulin use. Accurate assessment of patient's
554 knowledge, actual self-care practices, and, clinical characteristics could also be
555 conducted. This would allow triangulation of multiple sources of data which would
556 then provide more comprehensive understanding and better identification of reasons
557 for poor glycemic control. Ultimately, the factors identified may help to develop a
558 tool to be used by HCPs, as a checklist to address the barriers faced by people with
559 type 2 diabetes using insulin in achieving glycemic control. In addition, future study
560 should look into the motivators of better glycaemic control among people with type 2
561 diabetes using insulin who is succesful in gaining glycaemic control. Understanding
562 both the barriers and the motivators would help to improve glycaemic control among
563 this subpopulation.

565 **Conclusions**

566 Our findings revealed lifestyle challenges, psychosocial and emotional problems,
567 treatment-related factors and lack of knowledge of glycemic levels and targets, and
568 poor self-efficacy with regards to insulin dosage adjustment as factors for poor
569 glycemic control despite insulin use. Healthcare providers could look into these
570 factors and help patients with type 2 diabetes using insulin to address their concerns
571 during consultations and thus improve glycemic control.

572

573

Contributorship statement

All authors (WTT, SRV, CJN) of this study conceived and designed the study, researched and analysed the data, contributed to discussion, wrote, edited, reviewed and approved the final version of the manuscript.

Competing interests

None declared.

Funding

We would like to thank the University of Malaya, Malaysia for funding this project (reference: PV109-2012A).

Ethics approval

This study received ethical approval from the University of Malaya Medical Centre Medical Ethics Committee (926.18).

Data sharing

No additional data are available.

Figure 1 Conceptual framework of study

600 **References**

601 1. Cramer JA, Pugh MJ (2005) The influence of insulin use on glycemic control.
602 Diabetes Care 28: 78-83.

603 2. Harris SB, Kapor J, Lank CN, Willan AR, Houston T (2010) Clinical inertia in
604 patients with T2DM requiring insulin in family practice. Can Fam Physician
605 56: e418-424.

606 3. Davies M (2004) The reality of glycaemic control in insulin treated diabetes:
607 defining the clinical challenges. Int J Obes Relat Metab Disord 28: S14-S22.

608 4. Nichols GA, Hillier TA, Javor K, Brown JB (2000) Predictors of glycemic control
609 in insulin-using adults with type 2 diabetes. Diabetes Care 23: 273-277.

610 5. Janes R, Titchener J, Pere J, Pere R, Senior J (2013) Understanding barriers to
611 glycaemic control from the patient's perspective. J Prim Health Care 5: 114-
612 122.

613 6. Abu Hassan H, Tohid H, Mohd Amin R, Long Bidin MB, Muthupalaniappen L, et
614 al. (2013) Factors influencing insulin acceptance among type 2 diabetes
615 mellitus patients in a primary care clinic: a qualitative exploration. BMC Fam
616 Pract 14: 164.

617 7. Chen KW, Tseng HM, Huang YY, Chuang YJ (2012) The Barriers to Initiating
618 Insulin Therapy among People with Type 2 Diabetes in Taiwan - A
619 Qualitative Study. J Diabetes Metab Disord 3: 194.

620 8. Lee YK, Lee PY, Ng CJ (2012) A qualitative study on healthcare professionals'
621 perceived barriers to insulin initiation in a multi-ethnic population. BMC Fam
622 Pract 13: 28.

623 9. Sanal TS, Nair NS, Adhikari P (2011) Factors associated with poor control of type
624 2 diabetes mellitus: A systematic review and Meta-analysis. Journal of
625 Diabetology 3: 1-10.

626 10. Khattab M, Khader YS, Al-Khawaldeh A, Ajlouni K (2010) Factors associated
627 with poor glycemic control among patients with Type 2 diabetes. Journal of
628 Diabetes and its Complications 24: 84-89.

629 11. Sasi ST, Kodali M, Burra KC, Muppala BS, Gutta P, et al. (2013) Self Care
630 Activities, Diabetic Distress and other Factors which Affected the Glycaemic
631 Control in a Tertiary Care Teaching Hospital in South India. J Clin Diagn Res
632 7: 857-860.

633 12. Chlebowy DO, Hood S, LaJoie AS (2010) Facilitators and barriers to self-
634 management of type 2 diabetes among urban African American adults: focus
635 group findings. Diabetes Educ 36: 897-905.

636 13. Shakibazadeh E, Larijani B, Shojaeezadeh D, Rashidian A, Forouzanfar M, et al.
637 (2011) Patients' Perspectives on Factors that Influence Diabetes Self-Care.
638 Iran J Public Health 40: 146-158.

639 14. Singh H, Cinnirella M, Bradley C (2012) Support systems for and barriers to
640 diabetes management in South Asians and Whites in the UK: qualitative study
641 of patients' perspectives. BMJ Open 2.

642 15. Hu J, Amirehsani K, Wallace DC, Letvak S (2013) Perceptions of barriers in
643 managing diabetes: perspectives of Hispanic immigrant patients and family
644 members. Diabetes Educ 39: 494-503.

645 16. Matthew BM, Huberman AM (1994) Qualitative Data Analysis: An Expanded
646 Sourcebook: SAGE Publications.

17. Peyrot M, Barnett AH, Meneghini LF, Schumm-Draeger PM (2012) Insulin adherence behaviours and barriers in the multinational Global Attitudes of Patients and Physicians in Insulin Therapy study. *Diabet Med* 29: 682-689.
18. Frandsen KB, Smedegaard KJ (2000) Compliance with, and understanding of, mealtime advice in patients with Type 2 Diabetes. *Diabetes* 49: a176.
19. Frandsen KB, Kristensen JS (2002) Diet and lifestyle in type 2 diabetes: the patient's perspective. *Practical Diabetes International* 19: 77-80.
20. Murray S, Lazure P, Schroter S, Leuschner PJ, Posel P, et al. (2011) International challenges without borders: a descriptive study of family physicians' educational needs in the field of diabetes. *BMC Fam Pract* 12: 27.
21. Samuel-Hodge CD, Headen SW, Skelly AH, Ingram AF, Keyserling TC, et al. (2000) Influences on day-to-day self-management of type 2 diabetes among African-American women: spirituality, the multi-caregiver role, and other social context factors. *Diabetes Care* 23: 928-933.
22. Shacter HE, Shea JA, Akhabue E, Sablani N, Long JA (2009) A qualitative evaluation of racial disparities in glucose control. *Ethn Dis* 19: 121-127.
23. Peyrot M, Rubin RR, Lauritzen T, Snoek FJ, Matthews DR, et al. (2005) Psychosocial problems and barriers to improved diabetes management: results of the Cross-National Diabetes Attitudes, Wishes and Needs (DAWN) Study. *Diabet Med* 22: 1379-1385.
24. Paul C, Ayis S, Ebrahim S (2007) Disability and psychosocial outcomes in old age. *J Aging Health* 19: 723-741.
25. Peyrot M, Rubin RR, Kruger DF, Travis LB (2010) Correlates of insulin injection omission. *Diabetes Care* 33: 240-245.
26. Perlmuter LC (2008) Glycemic Control and Hypoglycemia. Is the loser the winner? *Diabetes Care* 31: 2072-2076.
27. Ong WM, Chua SS, Ng CJ (2014) Barriers and facilitators to self-monitoring of blood glucose in people with type 2 diabetes using insulin: a qualitative study. *Patient Preference and Adherence* 8: 237-246.
28. Yuan L, Guo X, Xiong Z, Lou Q, Shen L, et al. (2014) Self-monitoring of blood glucose in type 2 diabetic patients in China: current status and influential factors. *Chin Med J (Engl)* 127: 201-207.
29. Onwudiwe NC, Mullins CD, Winston RA, Shaya FT, Pradel FG, et al. (2011) Barriers to self-management of diabetes: a qualitative study among low-income minority diabetics. *Ethn Dis* 21: 27-32.
30. Kumpatla S, Medempudi S, Manoharan D, Viswanathan V (2010) Knowledge and Outcome Measure of HbA1c Testing in Asian Indian Patients with Type 2 Diabetes from a Tertiary Care Center. *Indian J Community Med* 35: 290-293.
31. Lawton J, Rankin D, Cooke D, Elliott J, Amiel S, et al. (2012) Patients' experiences of adjusting insulin doses when implementing flexible intensive insulin therapy: a longitudinal, qualitative investigation. *Diabetes Res Clin Pract* 98: 236-242.
32. Beverly EA, Ritholz MD, Brooks KM, Hultgren BA, Lee Y, et al. (2012) A qualitative study of perceived responsibility and self-blame in type 2 diabetes: reflections of physicians and patients. *J Gen Intern Med* 27: 1180-1187.

694 **Table 1** Summary of interview guide topic on factors influencing poor
695 **glycemic control despite using insulin**
696

PREAMBLE: Actually you have had diabetes for a long time and are now using insulin to control your blood sugar. Since you are using insulin to control your blood sugar, but your blood sugar is still not well controlled.	
<ul style="list-style-type: none">• Can you share with me what do you think are the reasons why your blood sugar is still not well controlled?	
Focussing on areas influencing poor glycemic control	
<ul style="list-style-type: none">• Do you face any problems in adjusting lifestyle for your diabetes care? (Probe: diet, exercise, medications). How?	
<ul style="list-style-type: none">• What barriers do you face when using insulin? (Probe: injecting insulin in the public, negative beliefs about insulin, fear of needle, pain, blood, body injury, marks and scars, weight gain, hypoglycaemia, knowledge and skills in administrating insulin)	
<ul style="list-style-type: none">• Does your family, friends, or employer takes part in managing your diabetes? Do you think they affect you in your blood sugar control? How?	
<ul style="list-style-type: none">• Do you face any health problems that makes it difficult for you to manage your diabetes? (Probe: vision problems, dexterity, mobility, poly-pharmacy, exercise)	
<ul style="list-style-type: none">• There are some people with diabetes who are depressed and stressed and that affect their sugar control. Do you face this problem? How does it affect you in controlling your blood sugar?	
<ul style="list-style-type: none">• Do you perform self-blood glucose monitoring? If no, why not? Does it affect your blood sugar control? If yes, how?	
<ul style="list-style-type: none">• What barriers do you face when consulting the doctor/nurse for your diabetes? (Probe: language, communication, and interaction). Does it affect your blood sugar control?	
<ul style="list-style-type: none">• What do you think of the hospitals and clinics that you go for your diabetes? (Probe: resources, complexity of system, accessibility, long waiting time, short consultation time) Does it affect your blood sugar control?	
<ul style="list-style-type: none">• Do you face any financial difficulties to care for your diabetes? (Probe: Medication cost, transportation to hospitals, SMBG)	

697
698
699

Table 2: Socio-demographic background and diabetes profile of participants

Characteristic	Participants (n=17)
Age (range)	22- 69 years
Sex	
Female	10
Male	7
Race	
Malays	8
Chinese	4
Indians	4
Nepalese	1
Education	
Secondary	9
Tertiary	5
Primary	2
No formal education	1
Years living with diabetes (range)	2-30
Years using insulin (range)	1-14

Table 3 Factors influencing poor glycemic control in people with type 2 diabetes using insulin

Theme		Category
1	Lifestyle challenges in adhering to medical recommendations	1. Difficulty integrating diabetes medical recommendations into work-life schedule
		2. Inability to control food cravings and eating habits
		3. Inappropriate diet recommendations by HCPs
		4. Health-limiting conditions affecting exercise
2	Psychosocial issues and emotional hurdles	1. Psychosocial-problems affecting diabetes self-care management
		2. Loss of motivation
		3. Perceived poor glycemic control as part of ageing
3	Diabetes treatment-related factors	1. Side-effects of insulin
		2. Perception of appropriate dietary practices related to insulin
4	Lack of knowledge and self-efficacy in diabetes self-care	1. Lack of knowledge of glycemic level and target
		2. Lack of self-efficacy in adjustment of insulin dosage

Title: Why do people with type 2 diabetes who are using insulin have poor glycaemic control? A qualitative study.

Corresponding author

Wen Ting Tong
Department of Primary Care Medicine, Faculty of Medicine, University of Malaya,
50603 Kuala Lumpur, Malaysia
e-mail: wentingtong@yahoo.com
Tel: 603-7949 2306
Fax: 603- 7957 7941

Shireene Ratna Vethakkan
Department of Medicine, Faculty of Medicine, University of Malaya, 50603 Kuala
Lumpur, Malaysia
e-mail: shireene@ummc.edu.my

Chirk Jenn Ng
Department of Primary Care Medicine, Faculty of Medicine, University of Malaya,
50603 Kuala Lumpur, Malaysia
e-mail: ngcj@um.edu.my

Keywords: Diabetes and endocrinology; qualitative research; social medicine

Abstract

Objective

This study aims to explore the factors influencing poor glycaemic control among people with type 2 diabetes using insulin.

Research design

This study used a qualitative methodology, comprising in-depth individual interviews. A semi-structured interview guide was used. The interviews were audio-recorded, transcribed verbatim and analysed using a thematic approach.

Participants

Seventeen people with type 2 diabetes using insulin with HbA1c $\geq 9\%$ for > 1 year participated in this study.

Setting

This study was conducted at the Primary Care Clinic and the Diabetes Clinic in the University of Malaya Medical Centre (UMMC), Malaysia.

Results

Data analysis uncovered four themes. They were lifestyle challenges in adhering to medical recommendations, psychosocial and emotional hurdles, diabetes treatment related factors and, lack of knowledge and self-efficacy in diabetes self-care.

Conclusion

This study identified factors, which explained the poor glycaemic control in people with type 2 diabetes using insulin. Healthcare providers may use these findings to address patients' concerns during consultations and help to improve glycaemic control.

Word count: 163/250

Strengths and limitations of this study

- The major strength of this study lies in the fact that the reasons behind poor glycaemic control were uncovered from the perspectives of people with type 2 diabetes with sustained hyperglycaemia for more than one year despite insulin use, through in-depth interviews.
- This study found that issues such as adherence to regular meal and medication times, fear of hypoglycaemia, needles and pain and lack of knowledge and self-efficacy in diabetes care remain as barriers for poor glycaemic control among people with type 2 diabetes using insulin.
- Issues such as social stigma, ethnicity, socio-economic factors, family, friends, healthcare system and HCPs did not emerge as reasons for poor glycaemic control despite insulin use.
- The recruitment of participants was conducted in a single hospital, hence healthcare systems as a factor in poor glycaemic control cannot be further explored.
- The interviews conducted in the hospital environment may influence the participants to give a socially desirable response. However, they were informed that their responses would not affect their medical care and would be kept confidential.

Introduction

Insulin has been identified as the most effective glucose lowering agent, however, studies has showed that many people with diabetes who are using insulin still fail to achieve glycemic control [1,2].

The challenges of achieving glycemic control in people with diabetes using insulin were: the progression of the disease, the impact of hypoglycemia and weight gain, the burden of poly-pharmacy, lack of resources in provision of diabetes self-care education and support of patients; and the inherent limitations of subcutaneous exogenous insulin administration [3]. Other predictors of poor glycemic control among people with type 2 diabetes using insulin include younger age, shorter duration of diagnosis of diabetes, lower body mass index and poor physical functioning [4]. Barriers to glycaemic control highlighted in a qualitative study among people with T2DM using insulin were fear about illness, guilt or self-blame, shame, ideas or beliefs about causation of diabetes, personal or cultural beliefs, and difficulty finding common grounds with clinicians on diabetes management [5].

To date, many studies have been conducted on barriers to insulin initiation [6-8], whereas, research on identifying factors for associated with poor glycemic control among people with type 2 diabetes was largely by quantitative and tend to focus on specific treatment studies involving patients on various treatment modalities such as including lifestyle adaptations/modifications, OHAs (oral hypoglycemic agents), OHAs + insulin and insulin only [9-11]. In terms of qualitative studies, many focused on barriers to diabetes self-care management in general [12-15], rather than reasons for poor glycaemic control. Very few qualitative studies examined factors impacting

Formatted: Font: 12 pt

poor glycemic control from the patient's perspective, especially among people with type 2 diabetes using insulin with poor glycemic control.

Since insulin is the most effective glucose-lowering agent, it is pertinent to understand from the patient's perspective why people with type 2 diabetes who are on insulin still fail to achieve glycemic control. This study will help fill the gap in existing literature by exploring factors influencing poor glycemic control in people with type 2 diabetes using insulin. An understanding of the barriers to achieving glycemic control will help healthcare providers (HCPs) find ways to improve glycemic control in this sub-population.

Research Design and Methods

This study used a qualitative methodology, comprising in-depth individual interviews to help understand patient experiences, as well as take into account the circumstances which led to poor glycemic control among people with type 2 diabetes using insulin.

This study was conducted at the Primary Care Clinic and the Diabetes Clinic in the University of Malaya Medical Centre (UMMC). We purposively sampled patients who were diagnosed with type 2 diabetes, have been using insulin, either alone or in combination with OHAs and with poor control of diabetes ($HbA_{1c} \geq 9\%$) for at least one year. Participants were chosen from various socio-demographic backgrounds (age, ethnicity, education level) so that different perspectives on the reasons for poor glycemic control can be explored.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19 132 We used a semi-structured interview guide (Table 1), which was developed based on
20 133 the study's conceptual framework (Figure 1) drawn from literature review and
21 134 experts' opinion. We reviewed the literature to identify possible factors, concepts and
22 135 variables [16] that have been shown to influence glycaemic control among people
23 136 with diabetes. A preliminary conceptual framework was developed based on these
24 137 factors. Later, the conceptual framework was given to two researchers (NCJ and
25 138 SRV) (one is a family medicine specialist and another is an endocrinologist) to
26 139 provide feedback and strengthen the conceptual framework based on their clinical
27 140 experience and expertise. Subsequently, the interview guide was constructed based on
28 141 the revised conceptual framework.
29 142
30 143 The interviews were carried out between January and August 2013 in consultation
31 144 rooms in both clinics. Written informed consent and socio-demographic information
32 145 was obtained from patients who agreed to participate. During the interviews, the
33 146 participants were asked for the reasons why they think their blood sugar is not well
34 147 controlled despite using insulin. When the participant could not give any more
35 148 reasons that they could think of, the researcher would then probe other areas
36 149 contributing to poor glycaemic control, as developed in the interview guide. Data
37 150 saturation was achieved upon the 17th interview, when no new factors influencing
38 151 poor glycaemic control emerged from the interviews.
39 152
40 153 It is important to note that the participants of this study were recruited from the clinics
41 154 where SRV and NCJ conduct their clinical practice. Thus, in order to offset the
42 155 influence of power disparities between doctor and patient, all the interviews were
43 156 conducted by WTT. WTT was competent in English, Malay and Cantonese, hence the

interviews were conducted in three languages. Out of the 17 interviews, there were two interviews that were conducted in Cantonese and seven in Malay. Given that the Cantonese language has many colloquialisms, the recordings were translated directly into English by WTT so the meaning would not be lost. Other interviews that were conducted in English and Malay were given to experienced transcribers for verbatim transcription. All the transcripts were checked for accuracy and quality by WTT by listening to the audio recording and checked against the transcript, before exported into NVivo qualitative software for data analysis using a thematic approach. Malay transcripts were analysed in the said language and the selected quotes were later translated to English. The translated quotes were checked with other researchers to ensure the meaning were not lost or distorted.

Initially, the transcripts were read through for familiarization by the researchers and then codes were assigned to a particular phrase, sentence or paragraph that described the meaning of the text segment. Sentences that had a similar meaning were given the same code while texts with different meaning were given a new code. The whole transcript was analyzed until there were no new meanings from the texts to form new codes. Subsequently, all the codes were compared and related codes were clustered together under the same category. Irrelevant codes were omitted. The categories were later compared and further clustered under themes. The mapping of categories and themes resulted in the development of a coding frame. The coding frame was developed from the coding process on the first three transcripts by all the researchers (WTT, NCJ, SRV). The coding frame was finalized when consensus was reached on the categories and themes. The finalized coding frame was used to code for the remaining transcripts by WTT. New emerging codes were added into the list of

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19 182 categories and themes that were created through constant discussion with other
20 183 researchers to ensure the list of categories and themes produced the best
21 184 representation of data that was obtained. Researchers constantly challenged one
22 185 another's interpretation of the data to offset any potential biases when analyzing the
23 186 data.
24 187
25 188 **Results**
26 189
27 190 Socio-demographic and diabetes profile of participants
28 191 There were 17 participants in this study. Their socio-demographic and diabetes
29 192 profiles are listed in Table 2.
30 193
31 194 Emerging themes
32 195 Four themes, which corresponded to factors influencing poor glycemic control despite
33 196 insulin use, emerged from the data analysis (Table 3).
34 197
35 198 **Lifestyle challenges in adhering to medical recommendations**
36 199 Under this theme there are five subthemes identified.
37 200
38 201
39 202 *Difficulty integrating diabetes medical recommendations into work-life schedule*
40 203 Participants faced difficulties in integrating medical recommendations such as a
41 204 medication regimen and meal times when they did not match with their daily activity
42 205 schedule. When participants were too busy with their work-life, they tended to skip
43 206 meals which caused them to become hungry and overeat later. Skipping meals also
44 207 resulted in them missing or delaying their insulin injections.
45 208

209 *"The way I eat and take the medications is not consistent. Sometimes I*
210 *forget. Maybe I am too busy. Every time my insulin use would be*
211 *delayed. For example, usually we inject at 12 right, sometimes I will*
212 *inject at 2. Sometimes I did not inject at all"* – 58 years old housewife

213 One participant described how the nature of his occupation made it difficult for him to
214 adhere to healthy diet and insulin treatment.

215

216

217 *"We are going around okay. So we can't just go and get what we want*
218 *to eat. We can't go and pack something or bring the food from house.*
219 *Furthermore, like now I'm taking the short-acting insulin, so every*
220 *mealtime you have to inject. You just can't go and take insulin, you*
221 *see. I'm working as a bodyguard you see, you have to follow the boss*
222 *closely. I think so that is the reason [for poor blood sugar]". –*
223 *Thomas-36 years old personal bodyguard*

224

225 *Inability to control food cravings and eating habits*

226

227 Participants also reported that the temptation of eating something delicious would
228 lead them to lose control of their diet, causing them to overeat.

229

230 *"My eating habit. Like I like to eat sweets, like kuihs [local dessert] and*
231 *all that. But I have to control. I know I am not controlling. I must put a full*
232 *stop to that."* - 60 years old woman housewife

233

234 It is also difficult to resist food when there is a variety of food available and coming
235 from a lifestyle and culture where food and eating are a way of living.

Psychosocial issues and emotional hurdles

Three subthemes emerged under this theme.

Psychosocial problems affecting diabetes self-care

Participants felt that their poor glycemic control was attributed to personal problems which caused them to feel anxious, stressed and sad, which resulted in some adopting unhealthy eating habits and not taking their diabetes medications, including insulin.

"Actually when you have diabetes, you cannot be stressed. Previously when I was under stress [due to marital problems], my blood sugar level was very high because I did not eat and take my insulin. I was hoping to die." – 50 years old taxi driver

Loss of motivation

Participants admitted that they were tired of adhering to diabetes medications after having taken them for such a long time that sometimes they would intentionally skip doses.

"Sometimes I purposely miss them because I am just so tired of injecting". – 40 years old officer

Additionally, an absence of significant improvements in glycemic control despite efforts made to improve glycemic control led participants to 'give up' in controlling their blood sugar.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

285 “There’s one time actually I did go to the gym and the exercise was okay but
286 it didn’t really do anything to my weight. It does a little bit on my sugar but
287 after a while I just give up. I think it would be as well [contributed to her
288 poor glycemic control] because the main thing is that, I think that if I
289 actually lose weight, I would be able to control my sugar as well.” – 40 year
290 old officer
291
292
293 Perceived poor glycemic control as part of ageing
294 Many older participants of this study held the view that whatever their attempts to
295 control blood glucose levels, their glycemic control would still fall short due to their
296 advanced age.
297
298 “Maybe because I am getting old. As the days passed by, all my organs has
299 deteriorated. Like engine, the more it is used, it will become spoilt.” – 69
300 years old retiree
301
302
303

Diabetes treatment-related factors

There are two subthemes under this theme.

Side-effects of insulin

Participants reported they would tend to overeat to prevent or counter the effects of insulin-induced hypoglycaemia. However, it is when participants overeat that their glycemic control deteriorates.

"I had fit once (due to hypoglycaemia), that fear is always there. On and off. I used to eat more to make sure I don't go into hypoglycaemia fit. It is extremely painful". - 47 years old doctor

Participants also felt that insulin caused them to feel hungry, causing them to overeat, hence, raising their blood sugar levels.

"But if use insulin, it makes me eat. I feel that after using insulin, the blood sugar goes even higher". - 37 years old clerk

Fear of needles and pain also caused participants to delay insulin initiation as well as intentionally skipping injections, thus contributing to poor glycemic control.

"I don't quite like insulin actually. I'm very afraid of needles and the pain that follows. In a week I would say at least 3 times [skipping insulin injections]. Although my blood sugar was already up about 6 to 7 years ago, but I've only started insulin not far back from now. So that's the other reason [for poor glycemic control]". - 40 years old officer

329 *Perception of appropriate dietary practices related to insulin*

330 One participant felt that his poor glycemic control was attributed to the diet
331 recommendations given by the HCP. He voiced that the meal pattern recommended
332 was not right and would instead reduce the efficacy of the insulin.

333
334 *"For example if you eat at 8pm, then you feel hungry and you eat again. So*
335 *if I follow his [doctor] advice I will eat but this is wrong. The mistake is if*
336 *lets say I eat at 7pm, then 8, 9, 10, 11, 12pm, for about 4 hours I will keep on*
337 *eating. So the insulin cannot fight with my diabetes. Because I have*
338 *experienced this so I know. The recommended cannot work. My diabetes*
339 *reach 20, 30 something". - 50 years old taxi driver*

340

341

342 **Lack of knowledge and self-efficacy in diabetes self-care**

343 Two subthemes were identified under this theme.

344

345 *Lack of knowledge of glycemic level and target*

346 Lack of knowledge of their glycemic level and target was also cited as a reason for
347 poor glycemic control, as participants were not aware to what extent they should
348 control their blood sugar. This lack of knowledge was attributed to difficulties in
349 performing SMBG due to financial reason, and some claimed that their HCPs did not
350 inform them about their glycemic levels and target.

351

352 *"I check less because sometimes when the needles are finished, I have to*
353 *wait for my salary to buy. I check once a week but if I need to see the doctor*

14

then only I will check 4 times a day. Actually it is not enough. When I don't check, I cannot control my diet so that's why my blood sugar is not good". - 37 years old clerk

"I don't know why he [doctor] wants to lower (blood sugar level) some more. No, because I don't know what is the target. The doctor never mentioned. I am also not sure. So I also don't know whether I am okay or not. If I know, I will control no matter what". - 31 years old marketing coordinator

Lack of self-efficacy in adjustment of insulin dosage

Despite receiving advice from the doctor that they could adjust their insulin dosage, some participants did not do so as they were afraid of making mistakes when adjusting the insulin dose, which could lead to hypoglycaemia and other complications.

"I'm just reluctant [to adjust insulin dosage] because they [doctor] won't be with me 24 hours. I didn't increase or decrease any of the medication. I just stick to it. So maybe that is the reason". - 36 years old personal bodyguard

Discussions

Our study revealed that people with type 2 diabetes using insulin attributed their sustained hyperglycemia to lifestyle challenges, psychosocial and emotional problems, treatment-related factors and lack of knowledge of glycemic levels and targets, as well as poor self-efficacy with regards to insulin dosage adjustment. Majority of the factors raised were not related to problems with insulin use per se, but were related to barriers in performing diabetes self-care tasks in general such as dietary control, adherence to exercise and medications including OHAs.

Our study participants faced difficulties in adhering to the recommended meal and insulin injection schedule due to work priorities and time constraints. In a multinational study involving 1530 people with type 1 diabetes (12.8%) and type 2 diabetes (88.2%) using insulin from eight countries, taking insulin at the prescribed time or with meals everyday was also reported to be difficult [17]. The lifestyle changes required for diabetes management in terms of diet and regular mealtimes were acknowledged to be hard to implement, even in people with type 2 diabetes using OHAs alone, who often report missed or delayed meals [18]. This showed that adherence to regular meal and medication times is a universal and major barrier to diabetes management among people with diabetes. It is crucial to overcome that, especially among people with type 2 diabetes using insulin, as insulin administration has to be synchronized with meals. When regular meal times cannot be followed, it often results in delayed or skipped insulin intake, as reported in our study, which explains poor glycemic control.

Our participants raised the issue of dietary recommendations by HCPs, which did not meet their dietary needs; the issues of the monotony of eating the same type of food every day and the recommended diet could not provide sufficient energy. Other people with type 2 diabetes using insulin have reported that clinicians would simply assume that patients would comply to the medical recommendations given; without considering their individual needs and preferences [5]. Additionally, it also appears that lack of understanding of the rationale behind dietary recommendations is common among type 2 diabetes patients. One participant of our study thought the meal pattern recommended by HCPs would thwart the efficacy of insulin, while type 2 diabetes patients on OHAs in another study perceived that frequent meals was a way to control their diabetes [19]. In fact, the main purpose of regular meals is actually to counter the effects of hypoglycemia, due to insulin and long acting sulfonylureas. HCPs may be a contributing factor to these barriers in adhering to dietary recommendations. In a collaborative study conducted in Austria, Canada, Germany and United Kingdom, it was found that general practitioners lack the knowledge and skills to educate, support and motivate patients on healthy lifestyle changes [20].

The issue of psychosocial factors and lack of motivation is crucial, as it affects all aspects of diabetes self-care including adherence to insulin, as evidenced from our study. Diabetes self-care is a complex task that demands behavioral change in the patient on a daily basis; the influences of social, cultural, familial and professional contexts further complicate management of the disease in diabetes patients as shown in other studies [21-23]. Furthermore, our participants also showed that when a patient's diabetes condition remains unimproved despite efforts to control it, this

leads to 'diabetes burn-out' stemming from frustration and loss of motivation; eventually resulting in neglect of diabetes self-care. Perhaps explaining the disease progression in type 2 diabetes and that the progressive loss of β -cell function is common, will lift the feeling of frustration and loss of motivation in them.

Older participants of our study perceived that they would never be able to achieve glycemic control due to their old age even with insulin use. Such misconceptions are alarming as they may decrease older people's perceived importance of glycemic control. They may lower their expected treatment target in order to cope with the challenges in managing diabetes at such an age [24]. There is a need to inform elderly people with type 2 diabetes that insulin has no upper limit dosage and they will still be able to control their glycemic levels even with increasing age.

Issues such as fear of hypoglycaemia and needles and pain have been well established as barriers to insulin initiation [6,7] and it is interesting to know that such problems still prevails even after participant initiate insulin use, as found in participants of our study. Moreover, these factors have been well established as factors for intentional insulin omission [25] and overeating to prevent insulin-induced hypoglycemia [5,26]. The UMMC has an established specialized diabetes clinic with trained diabetes nurses to provide education and skills training in diabetes self-care to patients. Therefore, our study participants would have been educated and trained on techniques of insulin administration and ways to prevent and manage hypoglycemia. In addition to providing diabetes education and skills training to people with type 2 diabetes using insulin, provision of counselling to address these fears is warranted.

Lack of knowledge of glycemic level and targets was also a reason for poor glycemic control in our participants. They were unsure to what extent they should control their glucose levels. The issue of lack of knowledge of glycemic levels and targets in our study stemmed from lack of SMBG and perceived minimal feedback from HCPs. Our participants reported financial constraints in carrying out effective SMBG, as costs for SMBG supplies are not subsidized by the Malaysian government. The impact of economic factors on SMBG adherence have been reported as an issue that limits glycemic control in other studies [27,28]. In a study by Onwudine et al., (2011), the study participants reported that they were not informed by their doctor of their target blood glucose levels and perceived that as a barrier to diabetes self-management [29]. HCPs have a crucial role to play in discussing glycemia results with their patients and formulating mutually agreed glycemic targets. A study has shown that knowledge of HbA1c and target goal had a positive impact on maintaining better glycemic control among people with type 2 diabetes [30].

Self-adjustment of insulin dosage have been shown to be a technically complex regimen for people with type 1 diabetes [31] and people with diabetes spend most of their time managing their diabetes away from healthcare professionals. It is thus not surprising that our participants were still apprehensive about self-adjustment of their insulin dose; for fear of hypoglycemia. Dependent and deferential attitudes towards health professionals were cited as the reasons why type 1 diabetes patients do not adjust their insulin dosage [31] and this may also be the reason for failure to adjust insulin dosing among our participants. Furthermore, the lack of skills to educate patients on how to monitor their glycaemic levels and adjustment of insulin has also been found to be a common challenge faced by general practitioners [20].

Some factors for poor glycaemic control as highlighted in the conceptual framework did not emerge in our study findings even when the participants were probed. The issue of social stigma was not raised by our participants as a reason for poor glycaemic control. We assumed that our participants had overcome this barrier upon initiation of insulin since they have been on insulin for at least one year; as they also reported of performing adaptive strategies such as injecting insulin in private in public places, for example in the toilet or in their car. Ethnicity was also not raised as a factor for poor glycaemic control in this study. Instead, the participants described eating culture as a way of living for Malaysians in general. Therefore, participants of this study might have adapted to the 'Malaysian' culture whereby they share and practise culture of others. Even if the recommended diet by HCPs may not be the types of food familiar with the specific ethnic group or culture, nevertheless, they could still follow the recommended diet. No specific ethnicity barrier was also reported for diabetes treatment aspects. Socio-economic was not a factor for participants in this study to seek healthcare treatment as the company where they or their spouses are working subsidized the medical costs. It should also be noted that the Malaysian government provides relatively cheap health care for the people and the cost for insulin is subsidized. However, this is not the case for SMBG where patients have to pay out-of-pocket for glucometer and test strips. This is the reason why the lack of knowledge of glycaemic status due to low performance of SMBG was raised as a reason for poor glycaemic control. Our participants did not blame their family, friends, healthcare system or HCPs for their poor glycaemic control. They however expressed dismay at the short consultation times and not being able to see the same doctor for their diabetes. Our participants expressed that diabetes control is a personal responsibility, therefore they tended to focus on their personal inadequacies when it came to poor

glycemic control. This may be due to diabetes self-care playing a huge role in disease control, hence people with type 2 diabetes may have felt greater responsibility for self-care. Thus, when glycemic control cannot be achieved, this resulted in self-blame [32].

The strengths and limitations of the study

The major strength of this study lies in the fact that the reasons behind poor glycaemic control were gained from the insights of people with T2DM with sustained hyperglycaemia for more than one year despite insulin use, through in-depth interviews to explain why their diabetes remains poorly controlled despite being on insulin. To researchers' knowledge, such findings has never been reported before. This study found that issues such as adherence to regular meal and medication times, fear of hypoglycaemia, needles and pain and lack of knowledge and self-efficacy in diabetes care remain as barriers for poor glycaemic control among people with type 2 diabetes using insulin, whereas, issues such as social stigma, ethnicity, socio-economic factors, family, friends, healthcare system factors and HCPs were found not to be reasons for poor glycaemic control despite insulin use.

This study has a few limitations. The recruitment of participants in this study was only conducted in a single hospital, hence healthcare systems as a factor in poor glycemic control cannot be further explored. The interviews were conducted in the hospital where the participants were recruited, hence the environment may influence them to give a socially desirable response. However, they were informed that their responses would not affect their medical care and would be kept confidential.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19 525 **Clinical recommendations**
20 526 HCPs should create individualized plans with people with type 2 diabetes using
21 527 insulin, to ensure a routine that allows for proper meal times and exercise, which
22 528 would enable them to take their diabetes medication, including insulin, in a timely
23 529 manner. Patients reported they face problems with treatment recommendations, hence
24 530 HCPs should continuously assess the efficacy and feasibility of treatment provided to
25 531 their patients and clarify patient misconceptions. It is also pertinent for HCPs to
26 532 recognise the psychological and emotional problems that impact on their patients'
27 533 diabetes self-care and provide affective support to them. Lastly, HCPs should discuss
28 534 glycemic readings and adjustment of insulin dosage, as well as formulate a mutually
29 535 agreed target with patients to facilitate improvement of glycemic control.
30 536
31 537 Murray et al., (2011) has identified the common challenges faced by general
32 538 practitioners when caring for people with type 2 diabetes across international and
33 539 health system borders and they were related to knowledge, skills, attitudes,
34 540 behaviours and context [20]. Some of the challenges faced by HCPs may explain the
35 541 reasons for poor glycaemic control as faced by participants of this study such as the
36 542 lack of knowledge and skills to: give clear explanations to the patients, actively
37 543 engage their patients in their health management, educate patients on how to monitor
38 544 their glycaemic levels, engage in shared decision making with patients and provide
39 545 support and motivation to patients in their efforts towards lifestyle changes for better
40 546 glycaemic control. Therefore, it is pertinent that HCPs are equipped with accurate and
41 547 latest knowledge and skills about diabetes and its treatment and be able to impart
42 548 them to their patients to empower them to perform effective diabetes self-care tasks.
43 549

Future research recommendations

More research is needed pertaining to this topic to uncover other factors that could influence poor glycemic control despite insulin use. In addition, exploring views from HCPs and caretakers of the patients would provide a more holistic understanding of factors for poor glycemic control despite insulin use. Accurate assessment of patient's knowledge, actual self-care practices, and, clinical characteristics could also be conducted. This would allow triangulation of multiple sources of data which would then provide more comprehensive understanding and better identification of reasons for poor glycemic control. Ultimately, the factors identified may help to develop a tool to be used by HCPs, as a checklist to address the barriers faced by people with type 2 diabetes using insulin in achieving glycemic control. In addition, future study should look into the motivators of better glycaemic control among people with type 2 diabetes using insulin who is succesful in gaining glycaemic control. Understanding both the barriers and the motivators would help to improve glycaemic control among this subpopulation.

Conclusions

Our findings revealed lifestyle challenges, psychosocial and emotional problems, treatment-related factors and lack of knowledge of glycemic levels and targets, and poor self-efficacy with regards to insulin dosage adjustment as factors for poor glycemic control despite insulin use. Healthcare providers could look into these factors and help patients with type 2 diabetes using insulin to address their concerns during consultations and thus improve glycemic control.

Contributorship statement

All authors (WTT, SRV, CJN) of this study conceived and designed the study, researched and analysed the data, contributed to discussion, wrote, edited, reviewed and approved the final version of the manuscript.

Competing interests

None ~~declared~~.

Funding

We would like to thank the University of Malaya, Malaysia for funding this project (reference: PV109-2012A).

Ethics approval

This study received ethical approval from the University of Malaya Medical Centre Medical Ethics Committee (926.18).

Data sharing

No additional data are available.

References

1. Cramer JA, Pugh MJ (2005) The influence of insulin use on glycemic control. *Diabetes Care* 28: 78-83.
2. Harris SB, Kapor J, Lank CN, Willan AR, Houston T (2010) Clinical inertia in patients with T2DM requiring insulin in family practice. *Can Fam Physician* 56: e418-424.
3. Davies M (2004) The reality of glycaemic control in insulin treated diabetes: defining the clinical challenges. *Int J Obes Relat Metab Disord* 28: S14-S22.

4. Nichols GA, Hillier TA, Javor K, Brown JB (2000) Predictors of glycemic control in insulin-using adults with type 2 diabetes. *Diabetes Care* 23: 273-277.
5. Janes R, Titchener J, Pere J, Pere R, Senior J (2013) Understanding barriers to glycaemic control from the patient's perspective. *J Prim Health Care* 5: 114-122.
6. Abu Hassan H, Tohid H, Mohd Amin R, Long Bidin MB, Muthupalaniappen L, et al. (2013) Factors influencing insulin acceptance among type 2 diabetes mellitus patients in a primary care clinic: a qualitative exploration. *BMC Fam Pract* 14: 164.
7. Chen KW, Tseng HM, Huang YY, Chuang YJ (2012) The Barriers to Initiating Insulin Therapy among People with Type 2 Diabetes in Taiwan - A Qualitative Study. *J Diabetes Metab Disord* 3: 194.
8. Lee YK, Lee PY, Ng CJ (2012) A qualitative study on healthcare professionals' perceived barriers to insulin initiation in a multi-ethnic population. *BMC Fam Pract* 13: 28.
9. Sanal TS, Nair NS, Adhikari P (2011) Factors associated with poor control of type 2 diabetes mellitus: A systematic review and Meta-analysis. *Journal of Diabetology* 3: 1-10.
10. Khattab M, Khader YS, Al-Khawaldeh A, Ajlouni K (2010) Factors associated with poor glycemic control among patients with Type 2 diabetes. *Journal of Diabetes and its Complications* 24: 84-89.
11. Sasi ST, Kodali M, Burra KC, Muppala BS, Gutta P, et al. (2013) Self Care Activities, Diabetic Distress and other Factors which Affected the Glycaemic Control in a Tertiary Care Teaching Hospital in South India. *J Clin Diagn Res* 7: 857-860.
12. Chlebowy DO, Hood S, LaJoie AS (2010) Facilitators and barriers to self-management of type 2 diabetes among urban African American adults: focus group findings. *Diabetes Educ* 36: 897-905.
13. Shakhbuzadeh F, Larijani B, Shojaezadeh D, Rashidian A, Forouzanfar M, et al. (2011) Patients' Perspectives on Factors that Influence Diabetes Self-Care. *Iran J Public Health* 40: 146-158.
14. Singh H, Cinnirella M, Bradley C (2012) Support systems for and barriers to diabetes management in South Asians and Whites in the UK: qualitative study of patients' perspectives. *BMJ Open* 2.
15. Hu J, Amirehsani K, Wallace DC, Letvak S (2013) Perceptions of barriers in managing diabetes: perspectives of Hispanic immigrant patients and family members. *Diabetes Educ* 39: 494-503.
16. Matthew BM, Huberman AM (1994) *Qualitative Data Analysis: An Expanded Sourcebook*: SAGE Publications.
17. Peyrot M, Barnett AH, Meneghini LF, Schumm-Draeger PM (2012) Insulin adherence behaviours and barriers in the multinational Global Attitudes of Patients and Physicians in Insulin Therapy study. *Diabet Med* 29: 682-689.
18. Frandsen KB, Smedegaard KJ (2000) Compliance with, and understanding of, mealtime advice in patients with Type 2 Diabetes. *Diabetes* 49: a176.
19. Frandsen KB, Kristensen JS (2002) Diet and lifestyle in type 2 diabetes: the patient's perspective. *Practical Diabetes International* 19: 77-80.
20. Murray S, Lazure P, Schroter S, Leuschner PJ, Posel P, et al. (2011) International challenges without borders: a descriptive study of family physicians' educational needs in the field of diabetes. *BMC Fam Pract* 12: 27.

21. Samuel-Hodge CD, Headen SW, Skelly AH, Ingram AF, Keyserling TC, et al. (2000) Influences on day-to-day self-management of type 2 diabetes among African-American women: spirituality, the multi-caregiver role, and other social context factors. *Diabetes Care* 23: 928-933.
22. Shacter HE, Shea JA, Akhabue E, Sablani N, Long JA (2009) A qualitative evaluation of racial disparities in glucose control. *Ethn Dis* 19: 121-127.
23. Peyrot M, Rubin RR, Lauritzen T, Snoek FJ, Matthews DR, et al. (2005) Psychosocial problems and barriers to improved diabetes management: results of the Cross-National Diabetes Attitudes, Wishes and Needs (DAWN) Study. *Diabet Med* 22: 1379-1385.
24. Paul C, Ayis S, Ebrahim S (2007) Disability and psychosocial outcomes in old age. *J Aging Health* 19: 723-741.
25. Peyrot M, Rubin RR, Kruger DF, Travis LB (2010) Correlates of insulin injection omission. *Diabetes Care* 33: 240-245.
26. Perlmutter LC (2008) Glycemic Control and Hypoglycemia. Is the loser the winner? *Diabetes Care* 31: 2072-2076.
27. Ong WM, Chua SS, Ng CJ (2014) Barriers and facilitators to self-monitoring of blood glucose in people with type 2 diabetes using insulin: a qualitative study. *Patient Preference and Adherence* 8: 237-246.
28. Yuan L, Guo X, Xiong Z, Lou Q, Shen L, et al. (2014) Self-monitoring of blood glucose in type 2 diabetic patients in China: current status and influential factors. *Chin Med J (Engl)* 127: 201-207.
29. Onwudiwe NC, Mullins CD, Winston RA, Shaya FT, Pradel FG, et al. (2011) Barriers to self-management of diabetes: a qualitative study among low-income minority diabetics. *Ethn Dis* 21: 27-32.
30. Kumpatla S, Medempudi S, Manoharan D, Viswanathan V (2010) Knowledge and Outcome Measure of HbA1c Testing in Asian Indian Patients with Type 2 Diabetes from a Tertiary Care Center. *Indian J Community Med* 35: 290-293.
31. Lawton J, Rankin D, Cooke D, Elliott J, Amiel S, et al. (2012) Patients' experiences of adjusting insulin doses when implementing flexible intensive insulin therapy: a longitudinal, qualitative investigation. *Diabetes Res Clin Pract* 98: 236-242.
32. Beverly EA, Rittholz MD, Brooks KM, Hultgren BA, Lee Y, et al. (2012) A qualitative study of perceived responsibility and self-blame in type 2 diabetes: reflections of physicians and patients. *J Gen Intern Med* 27: 1180-1187.

Table 1 Summary of interview guide topic on factors influencing poor glycemic control despite using insulin

PREAMBLE: Actually you have had diabetes for a long time and are now using insulin to control your blood sugar. Since you are using insulin to control your blood sugar, but your blood sugar is still not well controlled.
<ul style="list-style-type: none"> Can you share with me what do you think are the reasons why your blood sugar is still not well controlled?
Focussing on areas influencing poor glycemic control
<ul style="list-style-type: none"> Do you face any problems in adjusting lifestyle for your diabetes care? (Probe: diet, exercise, medications). How? What barriers do you face when using insulin? (Probe: injecting insulin in the public, negative beliefs about insulin, fear of needle, pain, blood, body injury, marks and scars, weight gain, hypoglycaemia, knowledge and skills in administering insulin) Does your family, friends, or employer takes part in managing your diabetes? Do you think they affect you in your blood sugar control? How? Do you face any health problems that makes it difficult for you to manage your diabetes? (Probe: vision problems, dexterity, mobility, poly-pharmacy, exercise) There are some people with diabetes who are depressed and stressed and that affect their sugar control. Do you face this problem? How does it affect you in controlling your blood sugar? Do you perform self-blood glucose monitoring? If no, why not? Does it affect your blood sugar control? If yes, how? What barriers do you face when consulting the doctor/nurse for your diabetes? (Probe: language, communication, and interaction). Does it affect your blood sugar control? What do you think of the hospitals and clinics that you go for your diabetes? (Probe: resources, complexity of system, accessibility, long waiting time, short consultation time) Does it affect your blood sugar control? Do you face any financial difficulties to care for your diabetes? (Probe: Medication cost, transportation to hospitals, SMBG)

Table 2: Socio-demographic background and diabetes profile of participants

Characteristic	Participants (n=17)
Age (range)	22- 69 years
Sex	
Female	10
Male	7
Race	
Malays	8
Chinese	4
Indians	4
Nepalese	1
Education	
Secondary	9
Tertiary	5
Primary	2
No formal education	1
Years living with diabetes (range)	2-30
Years using insulin (range)	1-14

Table 3 Factors influencing poor glycemic control in people with type 2 diabetes using insulin

Theme	Category
1 Lifestyle challenges in adhering to medical recommendations	1. Difficulty integrating diabetes medical recommendations into work-life schedule 2. Inability to control food cravings and eating habits 3. Inappropriate diet recommendations by HCPs 4. Health-limiting conditions affecting exercise
2 Psychosocial issues and emotional hurdles	1. Psychosocial-problems affecting diabetes self-care management 2. Loss of motivation 3. Perceived poor glycemic control as part of ageing
3 Diabetes treatment-related factors	1. Side-effects of insulin 2. Perception of appropriate dietary practices related to insulin
4 Lack of knowledge and self-efficacy in diabetes self-care	1. Lack of knowledge of glycemic level and target 2. Lack of self-efficacy in adjustment of insulin dosage

Figure 1 Conceptual framework of study

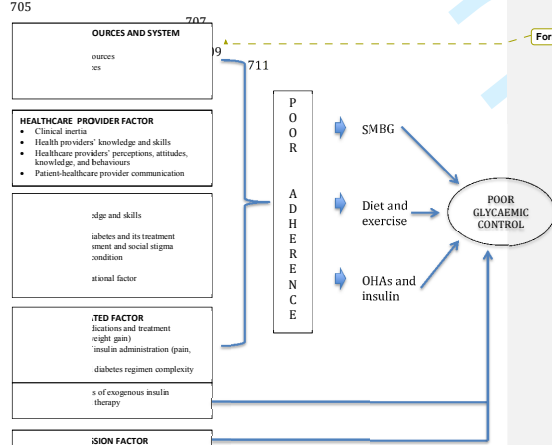


Figure 1 Conceptual framework of study

