Barriers for family doctors in Riyadh Military Hospital to initiate insulin therapy for patients with type 2 diabetes

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Abstract

Background Reducing Hb_{A1c} levels has been shown to lower the incidence of microvascular complications of diabetes, myocardial infarction and fatal cardiovascular events. But more than two thirds of adults with type 2 diabetes mellitus have not achieved glycemic control. There is reluctance from patients and physicians to initiate insulin. Such reluctance prolongs the time that blood glucose level is not optimally controlled, therefore increasing the risk of diabetic complications.

Objectives Since primary care physicians provide diabetes care for 82% of patients with type 2 diabetes, this study aimed to assess –in their opinion- the different barriers for initiating insulin therapy in type 2 diabetes mellitus patients.

Methods: A self administered questionnaire was distributed and collected from family physicians working in Riyadh military hospital from 15.5.2010 until 9.6.2010. The study included level four residents and above. The questionnaire included a demographical data assessment and twenty eight items as barriers divided in three sections namely doctor's related barriers, institutional related barriers and patient related barriers. Each barrier has an answer scale from one to five.

Results: 116 completed questionnaires out of 140 distributed (response rate 82.86%). 64 (55.17%) were males. Half were Saudis (n=58, 50%). Almost similar age categories. Twenty two consultants (19%), 26 senior registrars (22%), 43 registrars (37%), 10 service house officer (9%) and 15 level 4 residents (13%). It was found that 39% of the doctors agree or strongly agree that the initiation of insulin is one of the most difficult aspects of managing patients with type 2 diabetes. This study found the following barriers to initiate insulin therapy for patients with type 2 diabetes mellitus: patient education is the key to the initiation of insulin *with the weighted mean* (3.95), the injection route of administration (3.74), patient's social background (3.6), patient's education level (3.59), lack of family support (3.43).

Conclusion: The unwillingness of patients and physicians to initiate insulin therapy according to recommendations may prolong the time that blood glucose level is not controlled, therefore increasing the risk of neuropathic, microvascular, and macrovascular complications. Numerous barriers were identified, solutions should be sought and implemented to remove these barriers for better control of diabetes to prevent or delay diabetic complications.

Keywords: Insulin; type 2 diabetes; barriers; HbA$_1$c; microvascular complications

Running title: Barriers to initiate insulin therapy for patients with type 2 diabetes

Introduction

Diabetes mellitus is a group of metabolic disorders characterized by a chronic hyperglycemic condition resulting from insufficient action of insulin. [1]

There are three key defects in the onset of hyperglycemia in type 2 diabetes mellitus: increased hepatic glucose production, diminished insulin secretion, and impaired insulin action. [2,3] Insulin resistance refers to suppressed or delayed responses to insulin. Insulin resistance is generally 'post-receptor', which refers to a problem with the cells that respond to insulin rather than a problem with insulin production.[2]

The Kingdom of Saudi Arabia (KSA) is a rapidly developing country with a change that influenced the lifestyle of the people towards urbanization, particularly over the past 3 decades. Previous surveys from KSA suggested that diabetes is present in epidemic proportions throughout the country with exceedingly high rates concentrated in urban areas. [4,5]

Diabetes is linked to heart disease, stroke, and high blood pressure, among other health complications.[6] Measurement of glycated hemoglobin A1c (Hb_{A1c}) continues to be the criterion standard for evaluating glycemic control,[7] the ultimate goal of insulin therapy and a fundamental component of diabetes management [15]. Reducing Hb_{A1c} levels has been shown to lower the incidence of microvascular complications of diabetes and is associated with decreased risk of myocardial infarction and fatal cardiovascular events.[8] The American Diabetes Association and the American Association of Clinical Endocrinologists (AACE) in conjunction with the American College of Endocrinology (ACE) have published recommendations for glycemic control, including goals for Hb_{A1c} levels. [7,8] The American Diabetes Association recommends an Hb_{A1c} goal of less than 7.0% in general for adults with diabetes.[8] The AACE and the ACE,[7] as well as the International Diabetes Federation,[9] recommend an Hb_{A1c} goal of 6.5% or less in

general for patients with diabetes. These targets Hb_{A1c} values have been achieved in clinical trials[10, 11] and can be achieved and maintained by patients through careful adherence to a whole person treatment plan. [7]

Even with these guidelines and the expansion of therapeutic options, the majority of patients with diabetes do not reach target Hb_{A1c} levels.[12] According to epidemiologic data from the National Health and Nutrition Examination Surveys (NHANES III[13] and NHANES 1999-2000[14]), the percentage of people with diabetes achieving glycemic control has decreased from 44.5% to 35.8%. More than two thirds of adults with type 2 diabetes mellitus have not achieved glycemic control.[12] A recent study conducted in Saudi Arabia showed a close result in which only 27% had reached the target Hb_{A1c} of <7%.[15]

The inability to achieve glycemic control in the majority of these patients, when combined with the disease's increasing prevalence, has implications for increasing morbidity and mortality among patients with diabetes. [7, 16] Clearly, diabetes care must be optimized to improve patient outcomes. Diagnostic and interventional efforts -including improved diet, pharmacologic therapy, and diabetes education- need to be more rigorous and comprehensive. [7, 16]

The unwillingness of patients and their physicians to initiate insulin therapy according to conventional recommendations has been referred to as "psychological insulin resistance".[17] Such reluctance may prolong the time that blood glucose level is not optimally controlled, therefore increasing the risk of neuropathic, microvascular, and macrovascular complications. Physicians should discuss insulin therapy as an effective treatment option with their patients. Negatively discussing insulin therapy at any time during patient encounters can result in patient reluctance to initiate insulin therapy, reduced patient compliance and reduced patient benefit.[18] For example, some patients may perceive the initiation of insulin therapy as a sign that the

disease has progressed to a serious stage. [17, 19] Other patients may interpret the need for insulin as an indication that they have not effectively self-managed diabetes through diet, physical activity, and prior use of oral antidiabetic drugs. [19] These misperceptions may be unintentionally reinforced by physicians who mention insulin use as a "threat" to control patient adherence to alternative treatment protocols, such as medical nutrition therapy, self-management, and oral antidiabetic agent therap. [17]

Because oral drug therapy alone will not reduce Hb_{A1c} levels by more than 2.0%, it is unlikely that patients with Hb_{A1c} levels greater than 10.0% will achieve glycemic control using oral agents alone.[20]However, oral agents still have a substantial role early in type 2 diabetes mellitus treatment. For example, in patients with impaired glucose tolerance or insulin resistance, recent studies have demonstrated that thiazolidinediones can substantially delay or prevent the progression of type 2 diabetes mellitus.[21, 22]

The aim of this study was to assess –in the opinion of family doctors- the different barriers for initiating insulin therapy in type 2 diabetes mellitus patients. This can lead for better diabetes control for patients, better outcome and lower cost for management of diabetic complications.

Subjects and methods

A self administered questionnaire was distributed and collected from physicians working in Riyadh military hospital, family medicine department in the period from 15.5.2010 until 9.6.2010. The study included level four residents and above since residents from level one to three have rotations in other departments and do not run family medicine clinics.

The questionnaire included a demographical data assessment including age, sex, degree level and numbers of years in practice. Then, there were twenty eight items as barriers divided in three sections namely doctor's related barriers, institutional related barriers and patient related barriers. Each barrier has an answer scale from one to five (from strongly disagree as 1 to strongly agree as 5).

The questionnaire included barriers like lack of knowledge, or training and fear of hypoglycemia which were put under doctor's related barriers. Institutional related barriers included items like short consultation time, lack of continuity of care and too few diabetic educators. Patient related barriers included items like patient's education level, fear of side effects and injection route of administration.

Item development for the questionnaire was based on a review of the literature on physician barriers to initiate insulin in patients with type 2 diabetes. [23-25] Some items were deleted due to repetitions.

The questionnaire was validated by a panel of four family medicine consultants. And a pilot study was conducted on 20 family doctors.

The results of the questionnaire forms distributed and collected were analyzed with a help of a biostatistician. Descriptive analysis like frequencies, percents and weighted mean where used. Demographical data and categorical variables were presented as frequencies and percentages. Weighted mean was used for each barrier. Differences between groups were assessed with ANOVA and scheffe's test. Statistical tests were used at 5% and 1% significance level. The SPSS program version 18 was used for all statistical analysis in this study.

This study conformed to good clinical practice guidelines. The hospital ethical committee approved its protocol. Each participant was kept anonymous and all information were dealt with

in confidentiality and only the researcher and the statistician had access to the completed questionnaires.

Results:

Out of 140 questionnaire forms distributed among all family doctors practicing in family centers in Riyadh military hospital, 116 were completed and analyzed with a response rate of 82.86%. Table 1 shows that 64 (55.17%) of the study participants were males while the rest 52 (44.83%) were females. Age categories are almost similar. Largest age category was those from 34 to 43 years old (n=43, 37.07%), then those from 24 to 33 years old (n=37, 31.90%), after that the age group who were 44 and above (n=36, 31.03%). The study sample ages represented all age categories. Half (n=58, 50%) of the study participants were Saudis and half were non Saudis. Looking at the sample distribution according to years in practice showed that the largest group was the group representing doctors having 0 to 7 years in practice (n=41, 35.34%). Followed by those having 8 to 14 years in practice (n= 39, 33.62%). Followed by those having 22 years or more in practice (n= 19, 16.38%) while the smallest group was that group including doctors who had 15 to 21 years in practice (n= 17, 14.66%). Also, it showed that most of the participants were from those having less than 15 years in practice (n= 80, 68.96%). Looking at the sample distribution according to degree level in table 1 showed that the largest group was the registrars (n= 43, 37.07) followed by senior registrars (n= 26, 22.41%) then consultants (n=22, 18.97%) followed by level 4 residents (R4 residents) (n= 15, 12.93%) and the smallest group were the service house officers (n =10, 8.62%).

Table 1: sample distribution of the study participants

sample		n Total= 116	%
sex	male	64	55.17%
	female	52	44.83%
age	24 - 33 years	37	31.90%
	34 - 43 years	43	37.07%
	44 or more	36	31.03%
Nationality	Saudi	58	50%
	non -Saudi	58	50%
Years in practice	0 to 7 years	41	35.34%
	8 to 14 years	39	33.62%
	15 to 21 years	17	14.66%
	22 years or more	19	16.38%
Degree Level	Consultant	22	18.97%
	Senior registrar	26	22.41%
	Registrar	43	37.07%
	Service House Officer	10	8.62%
	Resident (level 4)	15	12.93%

Table 2 shows that the mode of the participants' responses was "strongly disagree" on all the barriers of first section "doctor related barriers" except one barrier which has a mode of "agree" which was "The initiation of insulin is one of the most difficult aspects of managing my patients with type 2 diabetes". If a statement has a weighted mean of 3.41 or higher, that means it has a response of agree or strongly agree as a barrier. It was noticed that among the first section there was no barrier to initiate insulin because all the barriers have a weighted mean less than 3.41. From table 2 the barriers of first section "doctor related barriers" can be arranged according to the weighted mean as the following:

- The initiation of insulin is one of the most difficult aspects of managing my patients with type 2 diabetes with the weighted mean (2.78).

- (I have knowledge but I lack training to start insulin) and (I am afraid to start insulin because it might cause hypoglycemia) with the weighted mean (2.06).

- Fear of medico-legal problems in case any side effect occurs due to initiation of insulin with the weighted mean (1.83).

- I do not have enough knowledge to start insulin with the weighted mean (1.76).

- The risk of weight gain associated with insulin therapy makes me reluctant to prescribe it for most of my patients with BMI > 35 with the weighted mean (1.69).

- I am afraid to start insulin because I do not know how to determine the dose with the weighted mean (1.63).

- If complication of DM already established, no benefit from starting insulin with the weighted mean (1.34).

- I think insulin has no benefit in poorly controlled DM with the weighted mean (1.16).

Table 3 shows that in the second section "institutional related barriers" the mode of responses was (agree) on three barriers and (strongly disagree) on three barriers.

Barriers with (agree) mode were short consultation time is a barrier to start insulin, lack of continuity of care is a barrier to start insulin and too few diabetic educators is a barrier to start insulin while barriers with (strongly disagree) mode were excessive workload -on me- is a barrier to start insulin, lack of clear clinical guidelines is a barrier to start insulin and lack of more knowledgeable staff I can ask regarding initiation of insulin is a barrier to start insulin.

Table 3 shows that among the second section (institutional related barriers) there was no barrier to initiate insulin because all the barriers had a weighted mean less than 3.41.

Table 2: frequencies, percentages, weighted mean and arrangement of barriers of first section "doctor related barriers"

Serial	Barrier		strongly agree	agree	neutral	disagree	strongly disagree	Weighted Mean	arrange
1	I do not have enough knowledge to start insulin	F	9	3	4	35	65	**1.76**	5
		%	7.76	2.59	3.45	30.17	56.03		
2	I have knowledge but I lack training to start insulin	F	4	19	11	28	54	**2.06**	2
		%	3.45	16.38	9.48	24.14	46.55		
3	The initiation of insulin is one of the most difficult aspects of managing my patients with type 2 diabetes	F	10	35	23	16	32	**2.78**	1
		%	8.62	30.17	19.83	13.79	27.59		
7	I am afraid to start insulin because I do not know how to determine the dose	F	75	22	9	7	3	**1.63**	4
		%	64.66	18.97	7.76	6.03	2.59		
9	I think insulin has no benefit in poorly controlled DM	F	104	9	1	1	1	**1.16**	5
		%	89.66	7.76	0.86	0.86	0.86		
6	The risk of weight gain associated with insulin therapy makes me reluctant to prescribe it for most of my patients with BMI > 35	F	61	35	16	3	1	**1.69**	6
		%	52.59	30.17	13.79	2.59	0.86		
2	I am afraid to start insulin because it might cause hypoglycemia	F	46	36	18	13	3	**2.06**	7
		%	39.66	31.03	15.52	11.21	2.59		
8	If complication of DM already established, no benefit from starting insulin	F	92	16	3	2	3	**1.34**	8
		%	79.31	13.79	2.59	1.72	2.59		
4	Fear of medicolegal problems in case any side effect occurs due to initiation of insulin	F	59	31	14	11	1	**1.83**	9
		%	50.86	26.72	12.07	9.48	0.86		

Table 3: showing frequencies, percentages, weighted means and arrangements of barriers of second section ''institutional related barriers''

arrange	Weighted Mean	strongly disagree	disagree	neutral	agree	strongly agree		Barrier	Serial
5	**2.29**	39	32	23	16	6	F	Excessive workload -on me- is a barrier to start insulin	1
		33.62	27.59	19.83	13.79	5.17	%		
3	**2.71**	28	29	17	33	9	F	Short consultation time is a barrier to start insulin	2
		24.14	25.00	14.66	28.45	7.76	%		
2	**3.05**	20	25	17	37	17	F	Lack of continuity of care is a barrier to start insulin	3
		17.24	21.55	14.66	31.9	14.66	%		
1	**3.09**	19	21	23	37	16	F	Too few diabetic educators is a barrier to start insulin	4
		16.38	18.1	19.83	31.9	13.79	%		
4	**2.37**	39	31	15	26	5	F	Lack of clear clinical guidelines is a barrier to start insulin	5
		33.62	26.72	12.93	22.41	4.31	%		
6	**2.22**	42	32	20	19	3	F	Lack of more knowledgeable staff I can ask regarding initiation of insulin is a barrier to start insulin	6
		36.21	27.59	17.24	16.38	2.59	%		

From table 3, the barriers of second section "institutional related barriers" can be arranged according to the weighted mean:

- Too few diabetic educators is a barrier to start insulin with the weighted mean (3.09).

- Lack of continuity of care is a barrier to start insulin with the weighted mean (3.05).

- Short consultation time is a barrier to start insulin with the weighted mean (2.71).

- Lack of clear clinical guidelines is a barrier to start insulin with the weighted mean (2.37).

- Excessive workload -on me- is a barrier to start insulin with the weighted mean (2.29).

- Lack of more knowledgeable staff I can ask regarding initiation of insulin is a barrier to start insulin with the weighted mean (2.22).

Table 4 shows that the mode was "agree" for most of the barriers of the third section "patient related barriers" except for two barriers where the mode was "neutral" for (Training in the proper administration and usage of insulin is too complicated for most patients) and "disagree" for (Lack of transport to hospital in case of emergency is a barrier to start insulin)

Table 4 shows that among the third section (patient's related barriers) there were five barriers to initiate insulin because they had weighted means more than 3.41. these barriers were:

1. For most of my patients, education is the key to the initiation of insulin *with the weighted mean* (3.95).

2. For most of my patients, the injection route of administration is the greatest barrier to their acceptance of insulin therapy *with the weighted mean* (3.74).

3. Patient's social background is a barrier to start insulin *with the weighted mean* (3.6).

4. Patient's education level is a barrier to start insulin *with the weighted mean* (3.59).

5. Lack of family support is a barrier to start insulin *with the weighted mean* (3.43).

From table 4, the barriers of third section "patient related barriers" can be arranged according to the weighted means as the following:

-   For most of my patients, education is the key to the initiation of insulin *with the weighted mean* (3.95).

-   For most of my patients, the injection route of administration is the greatest barrier to their acceptance of insulin therapy *with the weighted mean* (3.74).

-   Patient's social background is a barrier to start insulin *with the weighted mean* (3.6).

-   Patient's education level is a barrier to start insulin *with the weighted mean* (3.59).

-   Lack of family support is a barrier to start insulin *with the weighted mean* (3.43).

-   Poor vision is a barrier to start insulin *with the weighted mean* (3.37).

-   For most of my patients, the fear of side effects (hypoglycaemia and ∕ or weight gain) is the greatest barrier to their acceptance of insulin therapy *with the weighted mean* (3.32).

-   Patients who are not compliant on oral medication or life style will not be compliant on insulin *with the weighted mean* (3.27).

-   Having irregular meals is a barrier to start insulin *with the weighted mean* (3.21).

-   Patients resist & are unwilling to start insulin because they are shy to inject insulin in front of others *with the weighted mean* (3.06).

-   Training in the proper administration and usage of insulin is too complicated for most patients *with the weighted mean* (3.05).

-   Inability to refrigerate insulin is a barrier to start insulin *with the weighted mean* (2.87).

- Lack of transport to hospital in case of emergency is a barrier to start insulin *with the weighted mean* (2.69).

Table 4: frequencies, percentages, weighted means and arrangements of barriers of third section "patient related barriers"

arrange	Weighted Mean	strongly disagree	disagree	neutral	agree	strongly agree		Barrier	Serial
4	**3.59**	10	12	15	57	22	F	Patients education level is a barrier to start insulin	1
		8.62	10.34	12.93	49.14	18.97	%		
3	**3.6**	8	14	15	58	21	F	Patients social background is a barrier to start insulin	2
		6.9	12.07	12.93	50	18.1	%		
1	**3.95**	9	2	11	58	36	F	For most of my patients, education is the key to the initiation of insulin	3
		7.76	1.72	9.48	50	31.03	%		
8	**3.27**	7	25	29	40	15	F	Patients who are not compliant on oral medication or life style will not be compliant on insulin	4
		6.03	21.55	25	34.48	12.93	%		
7	**3.32**	10	18	29	43	16	F	For most of my patients, the fear of side effects (hypoglycaemia and ∕ or weight gain) is the greatest barrier to their acceptance of insulin therapy	5
		8.62	15.52	25	37.07	13.79	%		
2	**3.74**	11	12	11	44	38	F	For most of my patients, the injection route of administration is the greatest barrier to their acceptance of insulin therapy	6
		9.48	10.34	9.48	37.93	32.76	%		

arrange	Weighted Mean	strongly disagree	disagree	neutral	agree	strongly agree		Barrier	Serial
11	**3.05**	9	27	37	35	8	F	Training in the proper administration and usage of insulin is too complicated for most patients	7
		7.76	23.28	31.9	30.17	6.9	%		
10	**3.06**	11	22	38	39	6	F	Patients resist & are unwilling to start insulin because they are shy to inject insulin in front of others	8
		9.48	18.97	32.76	33.62	5.17	%		
9	**3.21**	9	20	28	56	3	F	Having irregular meals is a barrier to start insulin	9
		7.76	17.24	24.14	48.28	2.59	%		
12	**2.87**	19	30	20	41	6	F	Inability to refrigerate insulin is a barrier to start insulin	10
		16.38	25.86	17.24	35.34	5.17	%		
13	**2.69**	19	34	32	26	5	F	Lack of transport to hospital in case of emergency is a barrier to start insulin	11
		16.38	29.31	27.59	22.41	4.31	%		
5	**3.43**	8	13	24	63	8	F	Lack of family support is a barrier to start insulin	12
		6.9	11.21	20.69	54.31	6.9	%		
6	**3.37**	13	18	13	57	15	F	Poor vision is a barrier to start insulin	13
		11.21	15.52	11.21	49.14	12.93	%		

Table 5 shows that there were statistically significant (P= 0.01) differences between groups according to degree level in the means of most barriers in first section "doctor related barriers" except three barriers which have no statistically significant variance means:

- I think insulin has no benefit in poorly controlled DM

- The risk of weight gain associated with insulin therapy makes me reluctant to

prescribe it for most of my patients with BMI > 35

- If complication of DM already established, no benefit from starting insulin

After obtaining significant results of variance in six barriers for section one "doctor related barriers" Scheffé's test was applied to compare between groups according to degree level on those barriers.

There were differences in the mean between (service house officer) and consultant group, senior registrar group and registrar group. The differences were in favor of service house officer group where the mean was bigger than the mean of the other three groups (consultant, senior registrar and registrar). Meaning that, service house officers agreed more on this barrier than consultants, senior registrars and registrars. Also, level 4 residents agreed more on the following barrier than consultants:

Barrier: I do not have enough knowledge to start insulin.

Also, (service house officers and level 4 residents) agreed on the following barriers more than consultants, senior registrars and registrars:

Barrier: I have knowledge but I lack training to start insulin

Barrier : I am afraid to start insulin because I do not know how to determine the dose

Service house officers agreed more on the following barrier than consultants. Also, level 4 residents agreed more on the following barrier than consultants, senior registrars and registrars:

Barrier: The initiation of insulin is one of the most difficult aspects of managing my patients with type 2 diabetes. Service house officers agreed more on the following barriers than consultants, senior registrar and registrars:

- Barrier: I am afraid to start insulin because it might cause hypoglycemia.

- Barriers: Fear of medico-legal problems in case any side effect occurs due to initiation of insulin.

Table 5: Result of One-way analysis of variance (ANOVA) to assess the differences of each barrier of first section (doctor related barriers) based on degree level

F and Sig.	Mean Square	df	Sum of Squares	Sources Of variance	Barrier	Srl
9.60**	9.97	4	39.9	Between Groups	I do not have enough knowledge to start insulin	1
	1.04	111	115.4	Within Groups		
15.09**	15.55	4	62.2	Between Groups	I have knowledge but I lack training to start insulin	2
	1.03	111	114.4	Within Groups		
5.73**	9.14	4	36.6	Between Groups	The initiation of insulin is one of the most difficult aspects of managing my patients with type 2 diabetes	3
	1.60	111	177.0	Within Groups		
18.96**	12.49	4	50.0	Between Groups	I am afraid to start insulin because I do not know how to determine the dose	4
	0.66	111	73.1	Within Groups		
0.52	0.16	4	0.6	Between Groups	I think insulin has no benefit in poorly controlled DM	5
	0.31	111	34.6	Within Groups		
1.75	1.28	4	5.1	Between Groups	The risk of weight gain associated with insulin therapy makes me reluctant to prescribe it for most of my patients with BMI > 35	6
	0.74	111	81.7	Within Groups		
8.80**	8.58	4	34.3	Between Groups	I am afraid to start insulin because it might cause hypoglycemia	7
	0.98	111	108.3	Within Groups		
1.20	0.83	4	3.3	Between Groups	If complication of DM already established, no benefit from starting insulin	8
	0.69	111	76.9	Within Groups		
5.79**	5.29	4	21.1	Between Groups	Fear of medicolegal problems in case any side effect occurs due to initiation of insulin	9
	0.91	111	101.4	Within Groups		
18.47**	390.27	4	1561.1	Between Groups	Total	
	21.13	111	2345.8	Within Groups		

* P- Value (0.05), ** P- Value (0.01).

Table 6 shows that there were statistically significant (P value 0.01) differences between degree level groups in the mean of most barriers of second section "institutional related barriers" except one barrier (Too few diabetic educators is a barrier to start insulin) which all groups "agreed" on it. After obtaining significant results of variance in five barriers of section two, Scheffé's test was applied to compare between degree level groups on those barriers.

For each barrier it was found that:

- Barrier: Excessive workload -on me- is a barrier to start insulin
- Barrier: Short consultation time is a barrier to start insulin

Level 4 residents agreed more on these barriers than consultants, senior registrars and registrars.

- Barrier: Lack of continuity of care is a barrier to start insulin

Senior registrars, service house officers, level 4 residents (R4) agreed more on this barrier than consultants. Also, level 4 residents (R4) agree more on this barrier than registrars.

- Barrier: Lack of clear clinical guidelines is a barrier to start insulin

Service house officers, level 4 residents (R4) agreed more on this barrier than registrars.

- Barrier: Lack of more knowledgeable staff I can ask regarding initiation of insulin is a barrier to start insulin

Service House Officers agreed more on this barrier than consultants, senior registrars and registrars. Also, Level 4 Residents (R4) agreed more on this barrier than registrars.

Table 6: Result of One-way analysis of variance (ANOVA) to assess the differences of each barrier of second section (institutional related barriers) based on degree level

F and Sig.	Mean Square	df	Sum of Squares	Sources Of variance	Barrier	Srl
7.07**	8.64	4	34.5	Between Groups	Excessive workload -on me- is a barrier to start insulin	1
	1.22	111	135.5	Within Groups		
5.34**	8.07	4	32.3	Between Groups	Short consultation time is a barrier to start insulin	2
	1.51	111	167.7	Within Groups		
8.12**	11.87	4	47.5	Between Groups	Lack of continuity of care is a barrier to start insulin	3
	1.46	111	162.2	Within Groups		
1.65	2.77	4	11.1	Between Groups	Too few diabetic educators is a barrier to start insulin	4
	1.68	111	186.1	Within Groups		
7.58**	10.03	4	40.1	Between Groups	Lack of clear clinical guidelines is a barrier to start insulin	5
	1.32	111	146.9	Within Groups		
7.27**	8.28	4	33.1	Between Groups	Lack of more knowledgeable staff I can ask regarding initiation of insulin is a barrier to start insulin	6
	1.14	111	126.5	Within Groups		
9.20**	248.87	4	995.5	Between Groups	Total	
	27.06	111	3003.7	Within Groups		

* P- Value (0.05), ** P- Value (0.01).

Table 7 shows that there are statistically significant (P= 0.01) variances between degree level groups in the means of three barriers in the third section "doctor related barriers". These barriers were:

- Patients who are not compliant on oral medication or life style will not be compliant on insulin

- Training in the proper administration and usage of insulin is too complicated for most patients

- Patients resist & are unwilling to start insulin because they are shy to inject insulin in front of others

The other barriers in this section had no statistically significant variances.

After obtaining significant results of variance in three barriers of the third section, Scheffé's test was applied to compare between degree level groups on those barriers and the total.

There are statistically significant differences for two barriers:

- barrier : Patients who are not compliant on oral medication or life style will not be compliant on insulin
- barrier: Training in the proper administration and usage of insulin is too complicated for most patients

For these two barriers that service house officers agreed more on these barriers than consultants.

Table 7: Result of One-way analysis of variance (ANOVA) to assess the differences of each barrier of third section (patient related barriers) based on degree level

F and Sig.	Mean Square	df	Sum of Squares	Sources Of variance	barrier	Srl
1.10	1.48	4	5.9	Between Groups	Patients education level is a barrier to start insulin	1
	1.35	111	150.0	Within Groups		
2.10	1.33	4	5.3	Between Groups	Patients social background is a barrier to start insulin	2
	1.27	111	140.4	Within Groups		
3.10	1.24	4	5.0	Between Groups	For most of my patients, education is the key to the initiation of insulin	3
	1.18	111	130.7	Within Groups		
3.76**	4.32	4	17.3	Between Groups	Patients who are not compliant on oral medication or life style will not be compliant on insulin	4
	1.15	111	127.5	Within Groups		
1.74	2.26	4	9.0	Between Groups	For most of my patients, the fear of side effects (hypoglycaemia and ∕ or weight gain) is the greatest barrier to their acceptance of insulin therapy	5
	1.30	111	144.2	Within Groups		

1.43	**2.31**	**4**	**9.2**	**Between Groups**	For most of my patients, the injection route of administration is the greatest barrier to their acceptance of insulin therapy	6
	1.61	**111**	**179.0**	**Within Groups**		
3.93**	**4.02**	**4**	**16.1**	**Between Groups**	Training in the proper administration and usage of insulin is too complicated for most patients	7
	1.02	**111**	**113.6**	**Within Groups**		
4.13**	**4.17**	**4**	**16.7**	**Between Groups**	Patients resist & are unwilling to start insulin because they are shy to inject insulin in front of others	8
	1.01	**111**	**111.9**	**Within Groups**		
0.76	**0.79**	**4**	**3.2**	**Between Groups**	Having irregular meals is a barrier to start insulin	9
	1.04	**111**	**115.9**	**Within Groups**		
2.43	**3.40**	**4**	**13.6**	**Between Groups**	Inability to refrigerate insulin is a barrier to start insulin	10
	1.40	**111**	**155.5**	**Within Groups**		
2.12	**2.57**	**4**	**10.3**	**Between Groups**	Lack of transport to hospital in case of emergency is a barrier to start insulin	11
	1.21	**111**	**134.6**	**Within Groups**		
1.15	**1.17**	**4**	**4.7**	**Between Groups**	Lack of family support is a barrier to start insulin	12
	1.03	**111**	**113.8**	**Within Groups**		
0.90	**1.34**	**4**	**5.4**	**Between Groups**	Poor vision is a barrier to start insulin	13
	1.49	**111**	**165.7**	**Within Groups**		
2.67*	**151.14**	**4**	**604.6**	**Between Groups**	Total	
	56.58	**111**	**6280.6**	**Within Groups**		

* P- Value (0.05), ** P- Value (0.01).

Discussion

This study identified numerous doctors', institutional and patients' related barriers to the initiation of insulin therapy. While 39% of the participants of primary care doctors agreed that initiating insulin is the most difficult part of managing patient with diabetes, we notice that junior doctors (level 4 residents and service house officers) agreed more on lack of knowledge, lack of training and knowledge of proper dosing than senior doctors like consultants and senior registrars. Half of the participants of a study done by Haque et al identified a gap in knowledge and training on the initiation of insulin therapy.[24]This indicates lack of knowledge regarding many aspects of diabetes in general and insulin therapy in particular. The need for more teaching and continuing medical education is essential. In fact, we may need to go back to medical schools' curriculums and make changes; medical students should be given more time to study diabetes and its management. Interns and residents should be exposed to more outpatient diabetes management. The current medical training system does not prepare physicians, when graduating from internal medicine programs, to adequately manage patients with diabetes. This was suggested also by Rubin et al.[26]

Too few diabetic educators, Lack of continuity of care and Short consultation time were the most important institutional related barriers according to our study participants. All groups of the study participants agreed that the lack of diabetic educators was a barrier to initiate insulin. Measures should be taken to make full use of the available diabetic educators, enhancing the appointment system for diabetic educators. Arranging for group education or public lectures or increasing number of available diabetic educators. Actions should be implemented to arrange booking system to ensure the continuity of care. We also find that level four residents agreed more on the lack of time than other group of doctors, which maybe because they lack experience

or because they wanted to be comprehensive in one consultation. While 36% of our study participants agreed or strongly agreed on having a short consultation time is a barrier to initiate insulin, 40% of the participants of a study done by Hayes et al[25] agreed or strongly agreed that training of their patients is too time-consuming for their staff. Also, lack of continuity of care and time constraints were common barriers for initiating insulin according to the same study by Haque et al.[24]

Participants of our study agreed on most of the patient related barriers. While 68% of our participants agreed or strongly agreed on the fact that patients' education level and social background are barriers to initiate insulin therapy, Haque et al found that there was a strong perception that poor socio-economic conditions impeded patients' compliance with treatment.[24]However, in a UK study,[27] glycaemic control was not related to age, social class, lifestyle, attitude, or knowledge of patients but rather to better facilities, mini-clinics, and doctors with special interest in diabetes.

Eighty percent of our study participants agreed or strongly agreed on the fact that patients' education is the key to the initiation of insulin. Nearly all participants of the study done by Hayes et al[25] agreed that for most patients, education is the key to insulin initiation. However, Brunton et al[28] pointed out that this education is usually given when diabetes has progressed to the point that insulin is the only alternative for glucose control. They further stressed the importance of educating the patient at diagnosis about the progression of diabetes and the inevitability of needing insulin to maintain good glycaemic control, rather than using insulin as a threat to motivate patients.[28] There should be plans to educate diabetic patient and their families early in the disease course by various means of lectures, activities, leaflets or by public media like newspapers and television.

More than 70% of our study participants agreed or strongly agreed that the injection route of insulin administration is the greatest barrier to patients' acceptance of insulin therapy, Similar to the finding of the study of Hayes et al[25] where most of their participants agreed on this barrier. However, studies are conducted to produce insulin which can be used by other routes than injection like inhaled insulin[29] which can remove an important barrier for initiating insulin therapy for diabetic patients.

In conclusion, this study identified numerous doctors', institutional and patients' related barriers to the initiation of insulin therapy. Solutions should be sought and implemented to remove these barriers for better control to prevent or delay diabetic complications.

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