

# Beliefs About Medicine and Glycemic Control Among Type 2 Diabetes Patients: A Cross-Sectional Study in West Bank, Palestine

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## Abstract

**Introduction:** To examine the mean differences between patient beliefs about medicine with reference to adherence and glycemic control. **Methods:** This study utilized a cross-sectional questionnaire-based approach. Adherence to medication was measured with the Morisky Green Levine Medication Adherence Scale (MGLS); glycemic control as the last HbA1c test value; and beliefs about medicine with the Beliefs about Medicines Questionnaire (BMQ). **Results:** According to MGLS scale, 220 (57.9%) of the diabetic patients were classified as high adherent to their medications and 160 (42.1%) were classified as low adherent. Patients had strong beliefs in their medication, the mean necessity score was significantly outweighed the mean concerns score (17.7 vs 14.4;  $P < .001$ ). Low adherent patients had significantly more concerns about long term effect of medications (14.4 vs 13.8;  $P < .008$ ). No significant mean differences were found between glycemic controlled and uncontrolled group regarding necessity or concern domains. **Conclusion:** Assessing beliefs about medicine is crucial for recognizing patients at risk of low adherence, which offers a way to help patients with diabetes to achieve a better glycemic control.

## Keywords

diabetes mellitus, glycemic control, medication adherence, beliefs about medicine

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## Introduction

In the chronic disorder diabetes mellitus, blood glucose levels are abnormally elevated (hyperglycemia) as a result of insufficient insulin secretion and/or action.<sup>1</sup> An increasing global burden of diabetes has been triggered by international increases in obesity and unhealthy lifestyles.<sup>2</sup> According to current studies of the International Diabetes Federation, the 2017 prevalence of DM was 8.8% (7.2%–11.3%) in populations aged 20 to 79 worldwide, a value that is estimated to reach 9.9% (7.5%–12.7%) by 2045, making the cardiovascular complications associated with DM the main global cause of morbidity and mortality.<sup>3</sup> In Palestine, increasing prevalence of DM has resulted in massive increases in the costs of health care, disease treatment, and complication-related management.<sup>4</sup> A great deal of patient effort is required to successfully manage the disease. Patients with diabetes should eat healthy foods, exercise,

and track their blood sugar regularly; pharmacological and behavioral interventions may also be involved.<sup>5</sup> Strict glycemic control is required in order to decrease diabetes-related complications which will lead to improve diabetic and clinical patient's outcomes.<sup>6</sup>

The beliefs a patient holds concerning their medicine may influence their medication adherence. Some beliefs may increase adherence,<sup>7</sup> such as when a patient feels susceptible to the illness or its complications, believes that the disease or its effects could have serious health

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complications, and so expects that the treatment will be effectual.<sup>8</sup> In contrast, if a patient fears the treatment, thinks their disease is unmanageable, or holds certain types of religious beliefs (like believing that the disease is God's will and is unmanageable, or holds inbred fears and supernatural beliefs), this can contribute to a decrease in medication adherence.<sup>9</sup> Additionally, patient doubt concerning the efficacy of a treatment may translate into skepticism toward their prescribed medicines, along with consequent non-adherence.<sup>10</sup>

Beliefs about medicines in the Arab world may vary from those in Europe and other countries, due to variations in culture, religion, and knowledge of public health.<sup>11</sup>

As patient beliefs about medicine are an important determinant that decides achieving good adherence to medication,<sup>12</sup> in the treatment of DM, beliefs are a key factor for realizing optimum glycemic control and the subsequent management of DM and reduction of its complications.<sup>13</sup> Accordingly, this present research is significant for being one of a limited number of studies in the West Bank to evaluate the association of patient beliefs about medicine with adherence and with glycemic control.<sup>14</sup> The objective of this study to examine the mean differences between patient beliefs about medicine with reference to adherence and glycemic control among a sample of T2DM patients.

## Methods

### Design and Settings

Patients were eligible for inclusion if they were: diagnosed with T2DM, male or female and >18, taking DM medications for >3 months (in order to ensure that the patients were aware of their medications). Four hundred patients at the Primary Healthcare Unit in the Ministry of Health in Ramallah between February and May 2019 met the criteria for inclusion, making for a manageable sample size. Only 380 of those agreed to take part and gave a written consent form. After giving consent, the patients were presented with the questionnaires and asked to complete them while waiting to see their doctors. It took 15 to 20 min to interview a participant.

### Ethical Approval

Ethical approval for this study was provided by the Research Ethical Committee at Al-Quds University (Ref no. 80/REC/2019). Data collection was approved by the Palestinian Ministry of Health in Ramallah (Ref no. ADM295408). A description of the study was given to each patient. Patients were told that they could decline to take part, discontinue their participation at any time, and decline to answer any questions. The participants provided verbal consent forms in advance of completing the questionnaires.

## Tools

This study used an instrument comprised of 3 parts: demographic and clinical information obtained directly from patients and their medical files; Morisky Green Levine Medication Adherence Scale (MGLS) to determine medication adherence; and the Beliefs about Medicines Questionnaire (BMQ) to collect patients' beliefs about their medications. All questionnaires we used are validated and demonstrated to have reliability in patients with chronic diseases, and the translated Arabic versions are suitable and acceptable to be used in the Arab World.

The 4-item MGLS has dichotomous responses (No=0 score and Yes=1 score). Scores are added together to obtain a total that ranges between 0 and 4 and is used to classify adherence into 3 bins: high (0), medium (1-2), and low (3-4).<sup>15</sup> Its internal consistency is satisfactory (Alpha=0.61).

Glycemic control rate was also measured. A patient's glycemic control was considered controlled for HbA1c  $\leq$  7% and poor controlled for values >7%.<sup>16</sup>

Patient beliefs about medications were evaluated with the BMQ, an 18-item instrument that has been validated, and its internal consistency is acceptable, with Alpha values of 0.63 to 0.82. The BMQ is divided into 2 parts, which can be combined or used alone: (1) the BMQ-specific and (2) the BMQ-general. The Arabic version of the original BMQ is valid, reliable, and suitable for use in the Arab world. This validity is important, as patient concerns, beliefs, and attitudes are the most commonly reported factors for non-adherence in the Middle East.

The BMQ-specific section measures patients' beliefs about DM medications. It is comprised of 2 scales: (1) specific-necessity, 5 items measuring perceived necessity of medications, and (2) specific-concerns, 5 items measuring concerns about medications in terms of the risk of dependence, long-term toxicity, and harmful effects.<sup>17</sup>

Responses to the BMQ use a 5-point scale: strongly disagree (1), disagree, uncertain, agree, and strongly agree (5). Answers are added along each scale to give respective total scores (5-25).

The BMQ predicts that adherence to treatment relates more strongly to patient beliefs concerning their medications than to their beliefs about the actual illness. It estimates that patients understand the necessity and benefits of treatment, have concerns about negative effects, and are aware of the possibility of becoming dependent on the medication. That is, it provides a method for discussing the treatment benefits (need) and costs (concerns) as perceived by patients. Its relevance to the evaluation of adherence to treatment in various diseases and populations has been previously demonstrated.<sup>18</sup>

Diabetic complications are classified into micro-vascular complications and macro-vascular complication. Micro-vascular complications are retinopathy, nephropathy, and

**Table 1.** Socio-Demographic and Clinical Patient's Information.

Characteristics	All patients (N = 380)	Adherent (n = 220)	Non-adherent(n = 160)	P value <sup>†</sup>
Gender, n (%)				.11
Male	220 (57.9)	120 (54.6)	100 (45.4)	
Female	160 (42.1)	100 (62.5)	60 (37.5)	
Age (years; mean $\pm$ SD)	52.9 $\pm$ 13.9	53.2 $\pm$ 12.4	52.6 $\pm$ 11.9	.66 <sup>‡</sup>
BMI				.09
Normal	8 (2.1)	5 (62.5)	3 (37.5)	
Over weight	297 (19.7)	190 (64.0)	107 (36.0)	
Obese	75 (78.2)	25 (33.3)	50 (66.7)	
Education, n (%)				.02
Primary	190 (50)	81 (42.6)	109 (57.3)	
Secondary	120 (31.5)	79 (65.8)	41 (34.1)	
University	70 (18.5)	60 (85.7)	10 (14.3)	
Marital status, n (%)				.4
Single	50 (13.2)	30 (60.0)	20 (40.0)	
Married	291(76.6)	170 (58.4)	121(41.6)	
Divorced/widowed	39 (10.3)	20 (51.3)	19 (48.7)	
No. of medications (median)	5 (1-9)	4 (1-7)	6 (1-9)	.01 <sup>€</sup>
Duration of disease, n (%)				.01
1-5 year	173 (45.6)	70 (40.5)	103 (59.5)	
6-10 years	91 (24.0)	75 (82.4)	16 (17.6)	
>10 years	116 (30.4)	75 (64.7)	41(35.3)	
Family history of diabetes				.11
Yes	257 (67.6)	146 (56.8)	111 (43.2)	
No	173 (32.4)	74 (42.8)	49 (57.2)	
HbA1c, n (%)				.01
HbA1c < 7 controlled	174 (45.8)	134 (77.0)	40 (23.0)	
HbA1c > 7 uncontrolled	206 (54.2)	86 (41.7)	120 (58.2)	
Diabetic complications, n (%)				.2
Yes	238 (62.6)	140(58.8)	98 (41.2)	
No	142 (37.4)	80 (56.3.0)	62 (43.6)	
Co-morbidities				.001
Yes	228 (60)	105 (46.1)	123 (53.9)	
No	152 (40)	115 (75.6)	37 (24.3)	

BMI, body mass Index; HbA1c, glycated hemoglobin.

<sup>†</sup>Chi square test. <sup>‡</sup>t-test. <sup>€</sup>Mann-Whitney test.

neuropathy. Macro-vascular complications are MI, stroke, coronary artery disease.

All diagnosis was confirmed by patient's physicians, besides patients' records were checked.

A complete examination for is part of the standards required in any routine checkup. Some parts of physical exam are given special attention. This include: measures of height and weight, blood pressure, cardiovascular monitoring, examination of the lower limbs and laboratory tests.

### Data Analysis

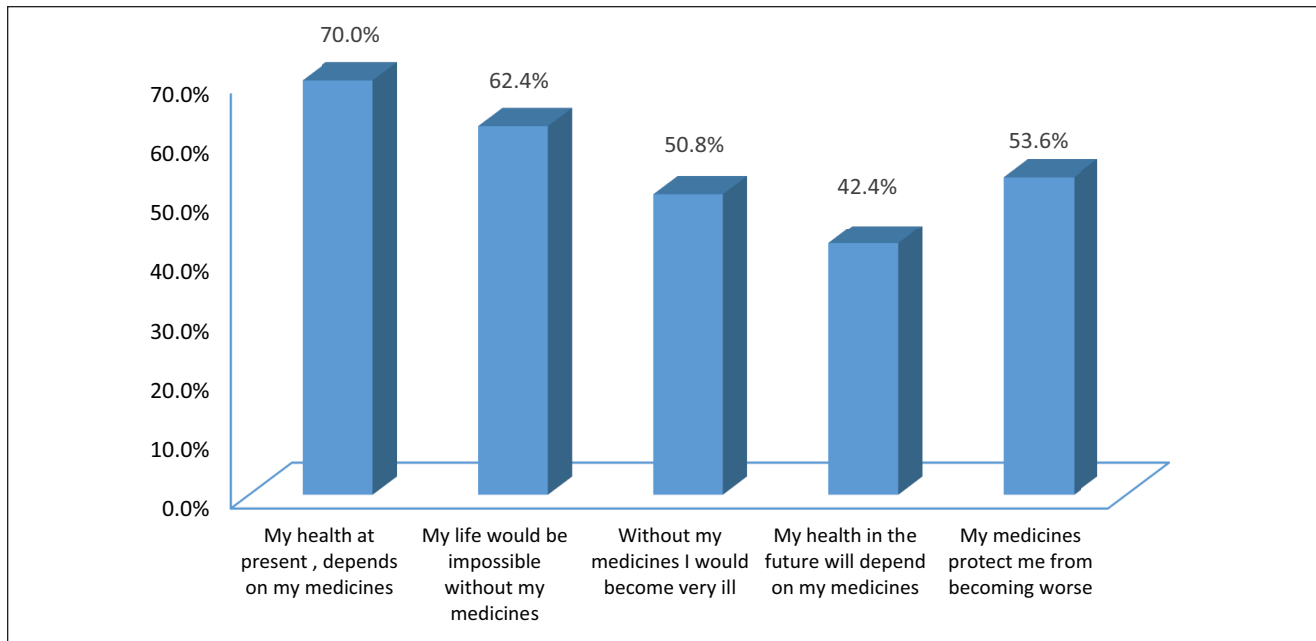
The Statistical Package for Social Sciences (SPSS) version 22.0 was used for all analyses. Continuous variables were expressed as mean  $\pm$  SD, while categorical variables were expressed as frequencies and percentages. In group comparisons, statistical significance was evaluated using

independent t-test, Mann Whitney for non-parametric data and chi square for categorical data. P-values  $\leq$ .05 were considered to be statistically significant.

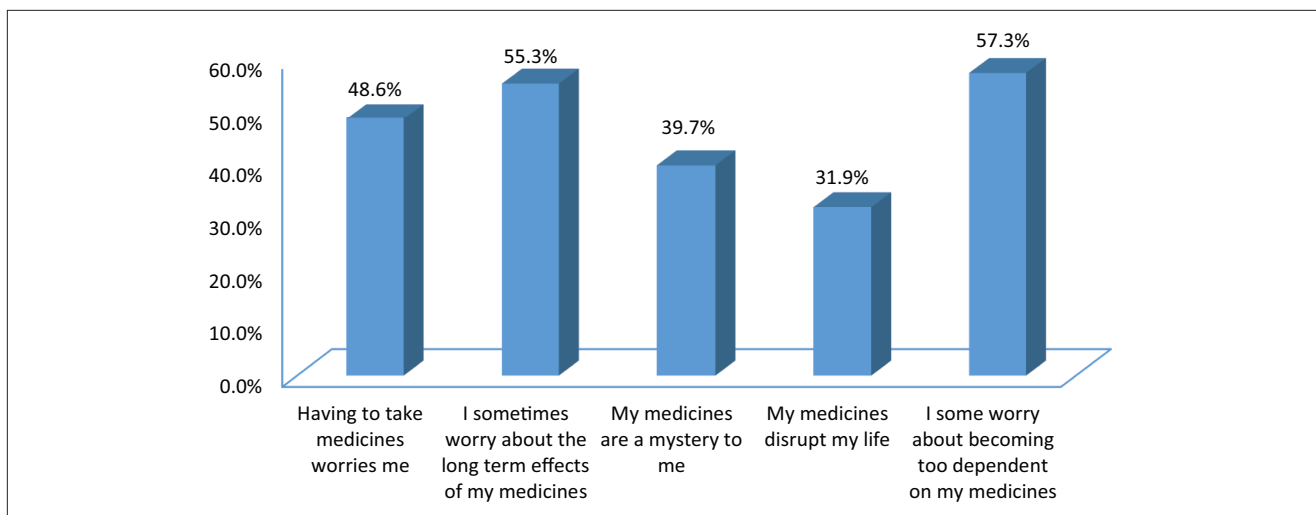
## Results

### Patients' Characteristics

A total of 400 patients were met during the study period, of which 380 met the inclusion and exclusion criteria and therefore counted as eligible for this study. Of them, 42.1% were women, most were married (76.6%), and a minority (18.5%) had higher education. The mean age was 52.97  $\pm$  13.95. A majority of patients (78.2%) were obese. A minority (30.5%) had been diagnosed with diabetes for at least 10 years. More than half of Participant (62.6%) reported that they had diabetic complications Table 1.



**Figure 1.** Respondent agreement (agree/strongly agree) with questionnaire statements (necessity-statements).



**Figure 2.** Percent of patients that agree with the concern score questions.

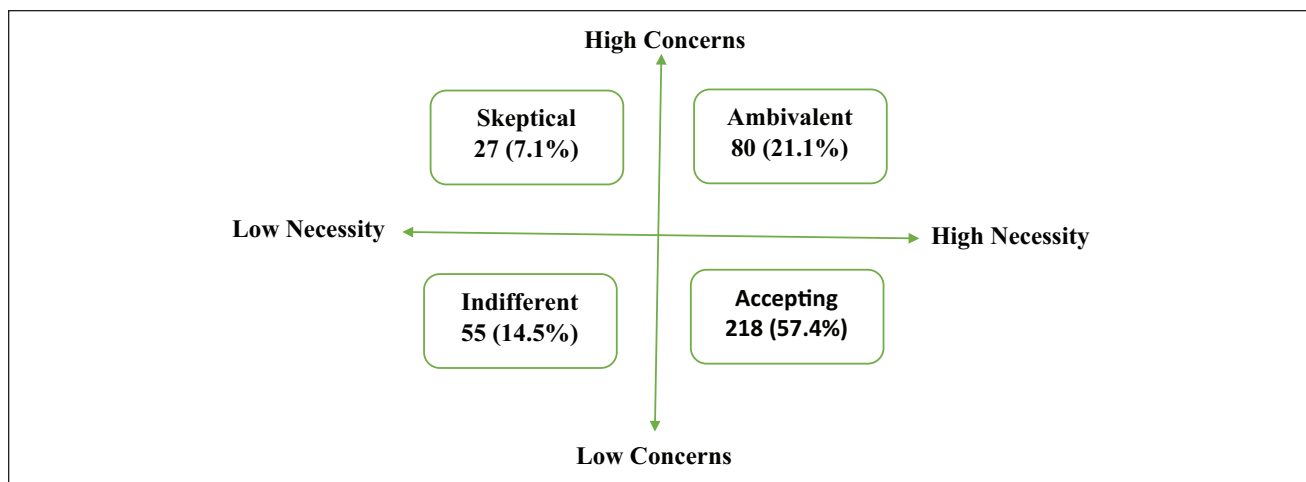
Factors associated with the level of adherence were higher education ( $P=.02$ ), number of medications ( $P=.01$ ), glycated hemoglobin (A1c)  $< 7$  ( $P=.01$ ) and no associated comorbidities ( $P=.01$ ).

### Patients' Beliefs About Medicine

Participants in our study expressed strong beliefs concerning the necessity of their medications (Figure 1). Specifically, 70% answered that their present health depended on their medicines, 62.4% that their life would be impossible without their medicines, 53.6% that their medications

prevent their condition from worsening, 50.8% that they would become very ill without their medicines, and 42.4% that their future health depended on their medicines.

Despite generally holding positive beliefs about the necessity of their medications, patients also reported concerns about their medications (Figure 2). Specifically, 57.3% answered that they sometimes worry about medication dependence, 55.3% that long-term effects are sometimes a concern, 48.6% that needing to take medication was concerning, 39.7% that their medicines are mysteries to them, and 31.9% that their medicines disrupt their lives.



**Figure 3.** Classification of patients on the basis of their beliefs about medicine.

**Table 2.** Correlation of Beliefs About Medicine Scores With Adherence Level and Glycemic Control.

	All patients mean (SD)	Adherent mean (SD)	Non-adherent mean (SD)	Mean difference	P-value <sup>€</sup>	CI 95%
Necessity	17.72 (5.71)	17.90 (6.34)	17.46 (4.70)	0.44	.431 <sup>€</sup>	-0.66 to 1.56
Concern	14.42 (5.52)	13.81 (6.05)	15.26 (4.57)	-1.45	.008	-0.33 to -0.38
NCD	3.18 (6.03)	3.97 (6.83)	2.09 (5.32)	1.88	.03	3.15 to 3.11

	All patients mean (SD)	Control mean (SD)	Un-control mean (SD)	Mean difference	P-value <sup>€</sup>	CI. 95%
Necessity	17.72 (5.71)	18.27 (5.33)	17.06 (6.07)	1.21	.41	-2.30 to -0.62
Concern	14.42 (5.52)	13.92 (6.05)	15.26 (4.57)	-1.34	.104	-2.03 to 0.19
NCD	3.18 (6.03)	3.25 (6.26)	3.10 (6.36)	0.15	.819	-1.42 to 1.13

CI, confidence interval; SD, standard deviation; NCD, necessity concern differential.

<sup>€</sup>t-test glycemic control (HbA1c ≤ 7), glycemic un-control (HbA1c > 7).

### Patient Attitudes About Medicine

Combined necessity and concerns scores were used to classify overall patient attitudes toward their medicines as accepting, skeptical, ambivalent, or indifferent. Overall, 57.4% of patients classified as accepting, 14.5% as indifferent, 21.1% as ambivalent, and 7.1% as skeptical (Figure 3).

### Beliefs About Medicines in Relation to Adherence Level

On the necessity scale, adherent patients as a group scored 17.90 ± 6.34 (mean ± SD), while non-adherent patients scored 17.46 ± 4.70 (Table 2). These high scores reflect strong patient beliefs in the need for their drugs to maintain their health. On the concerns scale, adherent patients scored 13.81 ± 6.05, while non-adherent patients scored 15.26 ± 4.57. The mean concern score correlated significantly with adherence (P=.008), and the low score of adherent patients indicates higher concern for their anti-diabetic medications having possible adverse effects.

The lower necessity score differential (NCD) for non-adherent participants compared with adherence group (2.09 vs 3.97) indicates that among that group, their perceived needs for anti-diabetic agents were similar to their concerns about the long-term use of those medications. However, the higher NCD scores for adherent patients indicating that adherent believed anti-diabetic medication was necessary for their health.

### Beliefs About Medicines in Relation to Glycemic Control

On the necessity scale, patients with HbA1c < 7% had mean score of 18.27 ± 5.33 (mean ± SD), while patients with HbA1c > 7% had mean score of 17.06 ± 6.07 (Table 2). On the concerns scale, controlled patients scored 13.92 ± 6.05, while uncontrolled patients scored 15.26 ± 4.57. In terms of NCD, uncontrolled patients had a lower score than the controlled group (3.10 vs 3.25), revealing that their perceived needs for anti-diabetic agents were similar to their concerns about the long-term use of these medications. Glycemic



**Table 3.** Association of Participant Characteristics With Beliefs Necessity Scores.

Variables	N	Pearson's correlation	P value
Age (year, SD)	380	0.044	.39
Number of medications taken	380	-0.133	.08
HbA1c	380	-0.28	.02*
Duration of disease	380	0.03	.21
Number of comorbidities	380	0.29	.02*
Number of complications	380	0.23	.08
Mean adherence score	380	-0.39	.01**

SD, standard deviation; HbA1c, glycated hemoglobin.

\*Significant ( $P < .05$ ). \*\*Significant ( $P \leq .01$ ).

control was not significantly associated with either necessity score ( $P = .41$ ) or concern score ( $P = .104$ ).

Association of participant characteristics with beliefs necessity scores was performed (Table 3), the mean necessity scores for men was not significantly different than women (15.9 vs 16.8;  $P = .13$ ). Using Pearson's correlation necessity beliefs scores were significantly associated with HbA1c ( $-0.28$ ;  $P = .02$ ), number of comorbidities (0.29;  $P = .02$ ) and adherence scores ( $-0.39$ ;  $P = .01$ ).

## Discussion

In our study, adherent participants believed strongly that their medication was necessary, with a mean necessity score of  $17.90 \pm 6.34$ . This may relate to the poor glycemic control leading to the realization that glucose lowering agents were essential to patients' present and future health.

Nonetheless, adherent participants also held moderate concern regarding the negative effects of regularly taking glucose-lowering drugs, having a mean score on the concerns scale of  $13.81 \pm 6.05$ . This may reflect patient experiences with adverse drug effects and the medications interfering with their everyday activities. In addition, during counseling, health care providers may not have sufficiently addressed patient concerns about their medicines.<sup>19</sup> Another study similarly reported a moderate concern score ( $14.0 \pm 4.3$ ) of patients regarding the possible side effects of their anti-diabetic medications.<sup>14</sup>

Among adherent participants in this study, a higher mean score was observed for necessity than for concerns ( $17.90 \pm 6.34$  vs  $13.8 \pm 6.05$ ). This supports the expectation that high levels of medication adherence will cause better glycemic control.<sup>20</sup>

Non-adherent patients had higher concerns scores than the adherent group (15.26 vs 13.81). This means they were more likely to have more concerns about their diabetes. We found no significant mean difference between adherence level and the necessity scale ( $P = .431$ ), but observed a significant and negative mean differences of adherence level with the concern scale ( $P = .008$ ). These findings are consistent with a recent meta-analysis that

reported greater adherence to be correlated with less concerns about treatment and greater perceived need for treatment.<sup>21</sup>

The higher necessity scores of glycemic controlled patients indicate stronger beliefs regarding need for their medications (18.27 vs 17.06), while the higher concerns scores of uncontrolled patients indicate greater worries about long-term medication use and potential future side effects (15.26 vs 13.92). We found no significant mean difference of glycemic control with the necessity scale ( $P = .41$ ), and similarly no significant mean differences of glycemic control with the concern scale ( $P = .104$ ). In other words, there is no significant mean difference of patient glycemic control and their beliefs about medicine. This is consistent with another study conducted at Kaiser Permanente Northwest, which found no connection between patient glycemic levels and beliefs about medications.<sup>22</sup> Even when considering physician beliefs regarding diabetic treatment and HbA1c goals, only restricted association was observed with their patients' degree of glycemic control.

Clinical pharmacists have a duty to educate patients about the importance of medication adherence<sup>23</sup>: to address patient beliefs concerning their treatment regimens in order to improve patient adherence and therapeutic outcome<sup>24,25</sup>; and finally to clarify to patients that better glycemic control is critical for the delay of disease progression and management of complications.<sup>26</sup> Also this applied to community pharmacists in Palestine as the role of community pharmacists expanded and become more patient's centered and provide counseling about medications efficacy and side effects.<sup>27</sup>

As a conclusion evaluating beliefs about medicine is critical for identifying patients at risk of low adherence, and provides a means for helping diabetic patients develop better glycemic control.

## Limitations

The main limitations of our study are (1) the effect of hypoglycemia on patient adherence to medications was not taken into account, (2) the questionnaires used may not always be

precise, which may contribute to knowledge bias and (3) the patients were recruited from one area, and therefore it is not possible to generalize our findings to populations throughout the world. The conclusion made from univariate analysis may have an impact on the generalization of this study's findings, further work is needed.

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