

# Treatment adherence to oral glucose-lowering agents in people with diabetes: Using the Brief Medication Questionnaire

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## Article points

1. Low medication adherence to oral glucose-lowering agents is the main factor determining the failure of the proposed treatment and is influenced by many aspects.
2. The Brief Medication Questionnaire (BMQ) is an instrument that aids in the investigation of barriers to adherence by measuring three domains, namely, regimens, beliefs and recall.
3. Sociodemographic, clinical and anthropometric data, as well as data related to adherence to oral therapies, were associated with data obtained with the BMQ.
4. Although we did not find any statistically significant associations in clinical data, the results demonstrated that the recall domain had the lowest adherence score at 35%.

## Key words

- Brief Medication Questionnaire  
- Treatment adherence

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**Medication adherence among people with diabetes has a direct impact on metabolic control and is influenced by multiple factors. In this study, the Brief Medication Questionnaire (BMQ) was used to assess medication adherence to oral glucose-lowering agents in 60 people with diabetes. This instrument investigates barriers to adherence by assessing regimens, beliefs and recall from the perspective of the individual. Overall, 25.0% of participants had BMQ scores indicating complete adherence and 21.7% had scores indicating probable adherence to oral glucose-lowering agents. There were no significant associations between adherence and clinical or sociodemographic variables. The regimen domain predominated, indicating treatment adherence in 81.7% of participants. Our findings showed that factors other than medication use, such as an individual's beliefs and recall, can serve as a basis for intervention studies aimed at improving medication adherence to oral glucose-lowering agents in people with diabetes.**

Adherence to diabetes treatment is a complex process that involves lifestyle changes such as meal planning, physical exercise, glycaemic monitoring and taking prescribed medication. The most commonly used instruments to measure medication adherence in the literature are the Morisky–Green Test (Morisky et al, 1986), the Brief Medication Questionnaire (BMQ; Svarstad et al, 1999) and the Measure of Adherence to Treatment test (Delgado and Lima, 2001).

The current study aimed to assess medication adherence to oral glucose-lowering agents among individuals with diabetes through the use of the BMQ, which assesses drug regimens, beliefs and patient recall.

## Methods

### Participants

Participants were recruited from the ATEM DIMEL (Apoio Telefônico para o Monitoramento

em Diabetes Mellitus [Telephone Support for Monitoring Diabetes]) programme in a primary care service facility at a public hospital in the state of São Paulo, Brazil. Data were collected from May to October 2013. ATEM DIMEL participants of both genders, aged  $\geq 18$  years and taking oral glucose-lowering agents were eligible for recruitment. Participants were selected by convenience, through invitation by phone call.

Two instruments were used for data collection during interviews: one for sociodemographic and clinical data and the second, the BMQ. Participants were also assessed in terms of their weight, height, blood pressure and clinical laboratory data. The study was approved by the Human Subject Research Ethics Committee of the Ribeirão Preto College of Nursing (University of São Paulo).

### Brief Medication Questionnaire

The BMQ is composed of three sections that

**Table 1. Association between adherence to oral glucose-lowering agents and sociodemographic variables.**

Sociodemographic variable	Non-adherent (n; %)	Adherent (n; %)	Total (n; %)	P-value	Odds ratio	95% confidence interval
<b>Gender</b>						
Male	14 (23.4)	11 (18.3)	25 (41.7)	0.796	1.00	Reference
Female	18 (30.0)	17 (28.3)	35 (58.3)		1.20	0.43–3.37
<b>Age</b>						
<65 years	18 (30.0)	22 (36.6)	40 (66.6)	0.100	2.85	0.91–8.93
≥65 years	14 (23.4)	6 (10.0)	20 (33.4)		1.00	Reference
<b>Marital status</b>						
Single	1 (1.7)	1 (1.7)	2 (3.4)	0.643	1.00	Reference
Married	26 (43.3)	19 (31.7)	45 (75.0)		0.73	0.04–12.44
Widowed	3 (5.0)	6 (10.0)	9 (15.0)		2.00	0.09–44.35
Separated	2 (3.3)	2 (3.3)	4 (6.6)		1.00	0.03–29.81
<b>Years of schooling</b>						
1–4	12 (20.7)	11 (19.0)	23 (39.7)	0.894	1.26	0.37–4.29
5–8	8 (13.8)	8 (13.8)	16 (27.6)		1.38	0.36–5.24
≥9	11 (19.0)	8 (13.8)	19 (32.8)		1.00	Reference
<b>Occupation</b>						
Formal employment	2 (3.3)	1 (1.7)	3 (5.0)	0.931	1.00	Reference
Informal employment	4 (6.7)	2 (3.3)	6 (10.0)		1.00	0.05–18.9
Retired	17 (28.3)	15 (25.0)	32 (53.3)		1.77	0.15–21.47
Homemaker	7 (11.7)	7 (11.7)	14 (23.4)		2.00	0.15–27.44
Other	2 (3.3)	3 (5.0)	5 (8.3)		3.00	0.15–59.88

Non-adherence is defined as a BMQ rating of low adherence or probable low adherence; adherent participants are those with a BMQ rating of adherence or probable adherence.

identify self-reported barriers to adherence with respect to treatment regimens, patient beliefs and patient recall (ability to remember to take medication). In the original study, the regimen section showed 80% sensitivity and 100% specificity to predict repeated non-adherence (Svarstad et al, 1999). The instrument's total score consists of the sum of the scores of its three sections. Participants receive a score of 1 if their response indicates potential non-adherence and 0 if it indicates adherence.

The score for the regimen section ranges from 0 to 7, and the belief and recall sections both range

from 0 to 2. Thus, the maximum total BMQ score is 11 and any score greater than zero for any one of the sections indicates potential non-adherence to prescribed treatment. The BMQ classifies participants into the following categories: adherence (no positive response in any domain), probable adherence (positive response in one domain), probable low adherence (positive responses in two domains) and low adherence (positive responses in all three domains).

### Data analysis

The data were analysed through descriptive statistics, which allowed us to characterise the sample regarding the investigated variables. In order to verify associations between qualitative variables, the data were submitted to Fisher's exact test. Furthermore, any associations were measured using logistic regression models (Hosmer and Lemeshow, 1989) and the raw odds ratios were calculated and adjusted with respective confidence intervals of 95%. All statistical analyses were conducted with the help of SAS® 9.0 software (SAS Institute, Cary, NC, USA). *P*-values lower than 0.05 were considered significant.

## Results

### Sociodemographic and clinical data

The majority of participants were women, aged <65 years, married, and with an average of 6.7 years of schooling. Participants aged ≥65 years had a 2.8 times greater chance of adhering to the proposed medication therapy (defined as achieving a BMQ rating of adherence or probable adherence; *Table 1*). The most common duration of diabetes was 11–20 years, and hypertension was the most common disease associated with diabetes; overall, 40% of the sample was classified as having stage 1 hypertension (*Table 2*). Participants were eight times more likely to adhere to oral glucose-lowering agents in the first 5 years of treatment and those with a normal waist circumference (<102 cm in men and <88 cm in women; World Health Organization [WHO], 2008) were twice as likely to be adherent as those with a greater waist circumference (*Table 2*).

### BMQ scores

Total BMQ scores showed that 25.0% of participants had complete adherence and 21.7%

had probable adherence to oral glucose-lowering therapy. Regarding the three individual domains, the regimen domain indicated an 81.7% rate of adherence and a 5.0% rate of probable adherence, the belief domain indicated 55% adherence and 25% probable adherence, and the recall domain indicated 35.0% adherence and 33.3% probable adherence (Table 3).

### Association of adherence scores with HbA<sub>1c</sub>

Regarding HbA<sub>1c</sub> levels and BMQ adherence scores, our investigation revealed one participant whose scores for the regimen and belief domains classified him as adherent but who had an HbA<sub>1c</sub> of 139 mmol/mol (14.9%). The recall domain presented the most conflicting data, indicating adherence in one participant who had the study's highest HbA<sub>1c</sub> level: 145 mmol/mol (15.4%).

Analysis of total BMQ ratings showed that the median HbA<sub>1c</sub> for the combined domains was ≥65 mmol/mol (8.1%), regardless of adherence score. Median values ranged from 65 mmol/mol (8.1%) in adherent participants to 75 mmol/mol (9.0%) in low-adherence participants, and people with higher adherence scores had lower mean HbA<sub>1c</sub> values than those with lower scores (Table 4).

Figure 1 (page 348) illustrates HbA<sub>1c</sub> values in participants who demonstrated medication adherence and non-adherence.

### Discussion

The purpose of oral glucose-lowering agents is to reduce the risk of acute and chronic complications of diabetes, thus improving quality of life for people with this condition and their families. Barriers to adherence are often observed in chronic conditions such as diabetes, which require lengthy and complex treatments and lifestyle changes (Seley and Weinger, 2007).

The present study adopted the WHO definition of adherence, characterised as the extent to which a person's behaviour corresponds to recommendations from healthcare professionals regarding a proposed treatment. In other words, adherence is a person's ability to put recommendations made by healthcare professionals into practice (WHO, 2003).

The innovations presented by the BMQ for measuring the use of oral glucose-lowering agents makes it difficult to compare our results with

**Table 2. Association between adherence to oral glucose-lowering agents and clinical variables.**

Clinical variable	Non-adherent (n; %)	Adherent (n; %)	Total (n; %)	P-value	Odds ratio	95% confidence interval
<b>Diabetes duration (years)</b>						
<5	2 (3.3)	6 (10.0)	8 (13.3)	0.240	8.00	1.00–63.96
6–10	7 (11.7)	7 (11.7)	14 (23.4)		2.67	0.49–14.46
11–20	15 (25.0)	12 (20.0)	27 (45.0)		2.13	0.46–9.84
>20	8 (13.3)	3 (5.0)	11 (18.3)		1.00	Reference
<b>Systemic arterial blood pressure (rating)</b>						
Excellent	3 (5.1)	2 (3.3)	5 (8.4)	0.140	n/a	n/a
Normal	3 (5.1)	1 (1.8)	4 (6.9)		n/a	n/a
Borderline	7 (11.9)	6 (10.3)	13 (22.2)		n/a	n/a
Stage 1 hypertension	14 (23.7)	10 (16.3)	24 (40.0)		n/a	n/a
Stage 2 hypertension	2 (3.3)	9 (15.2)	11 (18.5)		n/a	n/a
Stage 3 hypertension	2 (3.3)	0 (0.0)	2 (3.3)		n/a	n/a
<b>BMI (weight class)</b>						
Normal	1 (1.7)	3 (5.0)	4 (6.7)	0.626	1.50	0.09–25.39
Overweight	12 (20.0)	8 (13.3)	20 (33.3)		0.33	0.05–2.27
Class 1 obese	12 (20.0)	9 (15.0)	21 (35.0)		0.38	0.06–2.52
Class 2 obese	5 (8.3)	4 (6.7)	9 (15.0)		0.40	0.05–3.42
Class 3 obese	2 (3.3)	4 (6.7)	6 (10.0)		1.00	Reference
<b>Abdominal circumference</b>						
Normal	3 (5.1)	5 (8.5)	8 (13.6)	0.458	2.03	0.44–9.41
Altered	28 (47.5)	23 (38.9)	51 (86.4)		1.00	Reference

n/a=not analysed.

**Table 3. Adherence of study participants by BMQ domains and total score.**

BMQ	Adherence		Probable adherence		Low probable adherence		Low adherence	
	n	%	n	%	n	%	n	%
<b>Domain</b>								
Regimen	49	81.7	3	5.0	2	3.3	6	10.0
Belief	33	55.0	15	25.0	9	15.0	3	5.0
Recall	21	35.0	20	33.3	13	21.7	6	10.0
<b>Total BMQ</b>	<b>15</b>	<b>25.0</b>	<b>13</b>	<b>21.7</b>	<b>18</b>	<b>30.0</b>	<b>14</b>	<b>23.3</b>

BMQ=Brief Medication Questionnaire.

**Table 4. Association between HbA<sub>1c</sub> and adherence to oral glucose-lowering agents by BMQ domain and total scores.**

BMQ score	n	HbA <sub>1c</sub> (mmol/mol)				
		Mean	SD	Minimum	Median	Maximum
<b>Regimen domain</b>						
Adherence	49	75	2.1	41	70	139
Probable adherence	3	81	1.7	60	89	96
Probable low adherence	2	98	3.5	70	98	125
Low adherence	5	109	2.9	60	120	145
<b>Belief domain</b>						
Adherence	32	74	2.2	41	69	139
Probable adherence	9	84	2.4	50	75	127
Probable low adherence	7	79	1.8	60	72	115
Low adherence	11	89	2.8	53	91	145
<b>Recall domain</b>						
Adherence	20	75	2.4	46	65	145
Probable adherence	20	77	1.9	46	72	125
Probable low adherence	13	85	2.8	41	86	139
Low adherence	6	84	2.7	56	72	127
<b>Total BMQ score</b>						
Adherence	14	72	2.0	46	65	112
Probable adherence	14	79	2.5	41	70	139
Probable low adherence	18	79	2.2	43	80	127
Low adherence	13	86	2.6	56	75	145

BMQ=Brief Medication Questionnaire; SD=standard deviation.

those of other studies. Other authors measured medication adherence to glucose-lowering agents by using different instruments, such as the Measure of Adherence to Treatment and the Morisky–Green tests, and found values higher than those in the current study (Groff et al, 2011; Carvalho et al, 2012). Comparisons between the BMQ and these instruments showed that the BMQ is a more complete instrument for analysing the complex subject of adherence, as it is divided into three domains that indicate difficulties regarding regimens, beliefs and memory. On the other

hand, we must mention the limitations of using a self-reporting instrument in which participants can manipulate their responses.

Results regarding glycaemic control and its association with adherence to oral glucose-lowering agents revealed a median HbA<sub>1c</sub> of  $\geq 65$  mmol/mol (8.1%) across all three domains. Other studies investigating medication adherence to diabetes drugs have shown characteristics similar to these (Gimenes et al, 2009; Faria et al, 2013).

The belief domain revealed an association between adherence score and the number of medications taken daily, and between adherence score and the educational process conducted by health professionals before and during treatment. This finding can be explained by the difficulty for people aged  $\geq 65$  years who are taking a great number of medications every day, and also by the effects of the professional–patient relationship on treatment adherence (WHO, 2011). Another significant factor in treatment adherence is the level of self-efficacy presented by people regarding their ability to follow through with the proposed treatment (Gherman et al, 2011).

Another representative piece of data was that one participant who was considered adherent according to the score in the recall domain presented with an HbA<sub>1c</sub> of 145 mmol/mol (15.4%). This finding suggests that medication recall and awareness of the importance of taking oral glucose-lowering drugs do not guarantee that people will adhere to medication or the other pillars of metabolic control: physical activity and diet. It is also consistent with the idea that non-adherence does not cause short-term harmful effects, even if it increases the probability of late and untreatable future complications (Loke et al, 2012).

### Research limitation

As with all research involving self-report questionnaires, these findings are limited by the possibility that participants can easily manipulate the answers given and, consequently, transmit a false impression of medication adherence.

### Conclusion

Owing to the high prevalence of diabetes and the complexity of treating such chronic health conditions, it is essential that adherence be studied

**“We conclude that the Brief Medication Questionnaire can serve as a support tool in intervention studies as, in addition to measuring adherence, it also investigates barriers to this process that can be overcome with the help of health education.”**

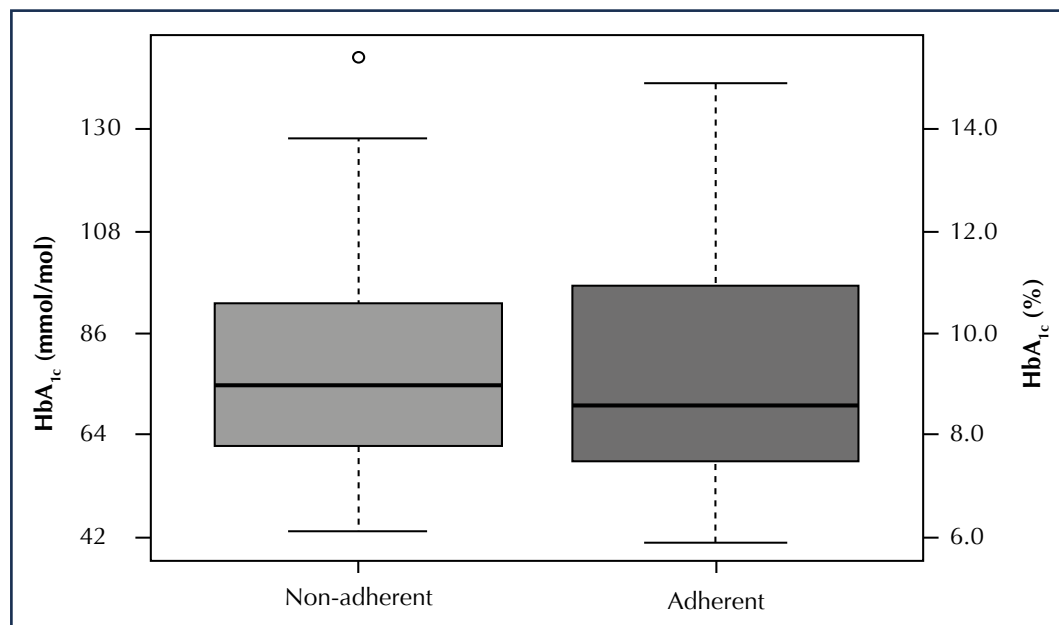


Figure 1. Boxplot of HbA<sub>1c</sub> values in non-adherent and adherent participants. Non-adherence is defined as a BMQ rating of low adherence or probable low adherence; adherent participants are those with a BMQ rating of adherence or probable adherence. BMQ= Brief Medication Questionnaire.

in order to improve the quality of healthcare and reduce the complications of the disease. Although we did not find any statistically significant associations between sociodemographic and clinical variables and medication adherence to oral glucose-lowering agents among these people, some factors came to our attention. For example, the probability of individuals adhering to the use of medication was eight times higher in those who were in their first 5 years of treatment. As most of the population in our study had been diagnosed with diabetes for 11–20 years, this suggests that education strategies must be used to avoid deterioration in adherence during the course of the disease.

We conclude that the BMQ can serve as a support tool in intervention studies as, in addition to measuring adherence, it also investigates barriers to this process that can be overcome with the help of health education. ■

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