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Investigating Diabetes Mellitus Patients' Experiences with Self Monitoring Blood Glucose Methods

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Abstract. Diabetes mellitus (DM) is a common metabolic disease characterized by high blood glucose levels, and it is considered as a modern *global threat*. Glucose monitoring is an important component of modern therapy for diabetes mellitus. Self-monitoring blood glucose (SMBG) by finger pricking or flash glucose monitoring (FGM) allows individual planning of treatment. The aim of this study was to investigate patients' experiences with self-monitoring blood glucose methods. Methods: A cross-sectional study was conducted using the Glucose Monitoring Experiences Questionnaire (GME-Q), consisted of 22 items with an overall score ranging from 1 to 5 (higher score indicates better experiences). The study included adult patients with diabetes mellitus type 1 (DM 1) or type 2 (DM 2). Results: Out of 253 participants (mean age, 56.4 years), 65.6% were suffering from DM type 2 and 34.4% from DM type 1, whereas 48.6% were using SMBG and 49.8% FGM. The mean score of convenience and effectiveness were higher in the group of patients using FGM, while SMBG found to be more discreet. The results of the analysis suggested that there was no relation between gender and effectiveness, discreetness or convenience of the method used for glucose monitoring. Furthermore, participants with diabetes type 2 reported higher ¨convenient¨ and ¨discreetness¨ score than patients with diabetes type 1. The analysis also indicated that there was no relation between the age of the participants and the effectiveness, discreetness and convenience of any glucose monitoring method**.** Conclusions: Improved self-glucose monitoring experiences are an essential component to achieve effective management of patients suffering from both DM 1 and DM 2. More research should be conducted on the field of glucose monitoring experiences, related to the cost of the methods, the user's training and the ability to support insulin/diet calculations.

Keywords. Glucose monitoring, questionnaire, diabetes, experiences

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1. Introduction

Diabetes mellitus (DM) is a common metabolic disease (9.3% of adults worldwide aged 20-79), related to acute (hypoglycemia, hyperglycemia, diabetic ketoacidosis) and chronic complications (retinopathy, nephropathy, neuropathy, atherosclerosis, heart attack and stroke) [1;2;3]. Glucose monitoring is an important component of effective management for diabetes mellitus as it enables individual planning of treatment by health professionals, enables people with diabetes and their families to make appropriate adjustments to daily treatment, diet and insulin dose, whereas it demonstrates the tendency for hypoglycemia or hyperglycemia. Traditional Self-Monitoring Blood Glucose (SMBG) by finger pricking provides an accurate measure of capillary glucose concentrations. However, it is related with some impediments such as the pain due to multiple fingers sticks and the limited glucose data as it provides a single snapshot of glucose levels. Continuous Glucose Monitoring (CGM) is a technology that offers additional benefits to patients with the use of a sensor which measures glucose concentrations subcutaneously in interstitial fluid and provides continuous glucose data [4]. Flash Glucose Monitoring (FGM) used in the current decade allows for fast and accurate glucose measures with the combination of best-in-class accuracy continuous glucose monitoring and a device, such as a mobile phone. Glucose levels are viewed after scanning the sensor [5].

The aim of this study was to investigate patients' experience with the use of different self-glucose monitoring methods.

2. Methods

A cross-sectional study was conducted between February and September 2021, using the Glucose Monitoring Experiences Questionnaire (GME-Q). All participants were adults (able to read and write in Greek) diagnosed with DM 1 or DM 2 for at least one year receiving antidiabetic treatment for at least six months. Participants were patients who attended endocrinology outpatient clinics of the First Department of Internal Medicine of "Laiko" General Hospital of Athens, of the diabetes outpatient clinics of Kallithea Health Center and of the diabetes outpatient clinics of Tzaneio Hospital of Piraeus. Patients who gave informed consent, were asked to complete the GME-Q. Moreover, patients living in various other cities in Greece and abroad were interviewed via phone calls by independent field researchers. This sub-group of patients was asked to give their informed consent to the provider from which they purchased the flash glucose monitoring system they used, in order to forward their contact details to the independent field researchers. The GME-Q is a diabetes-specific instrument for evaluating patients' experiences with the glucose self -monitoring method. Participants were asked to state their agreement or disagreement (1 = "strongly disagree" to 5 = "strongly agree") on 22 statements about the monitoring method they were using, regarding "Effectiveness" (9 statements) (e.g. Helps patients keep their glucose levels within target), "Discreetness" (6 statements) (e.g. causes other people to stare or ask questions), and "Convenience" (7 statements) (e.g is easy to use). The GME-Q overall score ranges from 1 to 5, where a higher score indicates a more positive experience. In addition to the 22 statements, three open-ended questions investigating the best and the worst aspects of the self glucose monitoring method [6][7] were also included in the survey. Statistical analysis was performed using SPSS 21.0 (Statistical Package for

Social Sciences). The Kolmogorov-Smirnov test of normality was applied to assess the normal distribution of GME–Q. Relations included Student's t-test and Pearson's and Spearman's correlation coefficients. The two-sided significance level was set at 0.05. Patient enrollment in the study was initiated following the research protocol approval by the Bioethics Committee of the Nursing Department and the Scientific Committees of the study centers/hospitals.

3. Results

Out of 253 participants (mean age 56.4 years, standard deviation 18.81; 45.5 % women), 65.6% were suffering from DM 2 and 34.4% from DM 1, whereas 48.6% were using SMBG and 49,8% FGM. Participants using FGM reported overall better experience than participants using SMBG (Table 1). In particular, the mean score of convenience and effectiveness were found statistically significant higher in the group of patients using FGM, while SMBG found to be more discreet. The results of the analysis suggested that there was no relation between gender and effectiveness, discreetness or convenience of the method used for self-glucose monitoring. Furthermore, participants with DM 2 reported higher ¨convenience and ¨discreetness¨ score than patients with DM 1 (Table 2). The analysis also revealed that there was no correlation between the age of the participants and the effectiveness, discreetness and convenience of any glucose monitoring method.

Table 1: GME-Q scores for participants using SMBG vs participants using FGM

GME-Q Score (highest score: 5): Mean	**SMBG**	**FGM**	**P-value**
Overall	3.84	4.10	<0.001
Convenience	4.11	4.36	0.02
Effectiveness	3.58	4.16	<0.001
Discreetness	3.94	3.66	0.03

Table 2: GME-Q scores for participants suffering from DM1 vs participants suffering from DM2

GME-Q Score (highest score: 5): Mean	**DM 1 (N=85)**	**DM 2 (N=163)**	**P-value**
Overall	3.90	4.00	0.089
Convenience	4.12	4.29	0.018
Effectiveness	3.95	3.83	0.19
Discreetness	3.57	3.90	<0.001

In relation to open-ended questions, a minority of the participants reported some comments referring to small discrepancies of the FGM method compared to blood glucose levels measured with SMBG related to the interstitial glucose measurement via FGM. Also, some participants mentioned skin issues due to the adhesive that is used to attach the sensor.

4. Discussion

This is one of the first studies in the literature using GME-Q to investigate experiences with self-monitoring blood glucose methods of patients suffering from both diabetes

type 1 and type 2. In our cross-sectional study, participants reported overall better experiences with FGM than with SMBG. In a previous study (HypoCOMPaSS trial) conducted by Speight et al., (2019) adults with long-standing DM1 were randomized to use real-time continuous glucose monitoring (RT-CGM) and (SMBG) in order to estimate (via the GME-Q) the change of experiences over time. Based on the results of HypoCOMPaSS trial, participants demonstrated improved experiences trends toward significance at six months, compared to baseline, in "effectiveness" and "intrusiveness" score (r = 0.42 and r = 0.27 respectively) but not in "convenience" score (p = 0.139), and these improvements sustained at two years. However, HypoCOMPaSS results didn't demonstrate superiority of either the SMBG or CGM method [8].

5. Conclusion

Improved self-glucose monitoring experiences are an essential component to achieving effective management of patients suffering from both DM 1 and DM 2. Evaluating users' experiences and satisfaction is of great need while new technologies are developing, meaning that more research should be conducted related to the cost of the methods, the user's training and the ability to support insulin/diet calculations.

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