INTERNATIONAL JOURNAL OF SOCIAL HEALTH
https://ijsh.ph/index.php/rp
Volume 4 Number 3 March 2025 E-ISSN: 2963-3036

Empowering Diabetes Patients: Indonesian Adaptation and Validation of the DSMQ-R

Riwisna Putunanga[1]*, Aulia Iskandarsyah[2], Hari Setyowibowo[3], Surya Cahyadi[4]
Universitas Padjadjaran, Indonesia[1,2,3,4]
Email: riwisna22001@mail.unpad.ac.id, surya@unpad.ac.id, a.iskandarsyah@unpad.ac.id, h.setyowibowo@unpad.ac.id

KEYWORDS
diabetes mellitus, DSMQ-R, psychometric assessment, self-management, validation

ABSTRACT
This study aimed to adapt and validate the Indonesian version of the Diabetes Self-Management Questionnaire-Revised (DSMQ-R), originally developed by Schmitt, to assess self-management behaviors in Indonesian patients with diabetes. Given Indonesia's high prevalence of diabetes, a culturally appropriate and psychometrically validated instrument is essential for improving patient self-care and informing healthcare interventions. A total of 141 diabetic patients participated in this study, completing the Indonesian DSMQ-R through in-person and online surveys. The adaptation process followed international linguistic validation guidelines, including forward and backward translation, expert review, and cognitive debriefing. Content Validity Index (CVI) was used to assess content validity, while Confirmatory Factor Analysis (CFA) was conducted to evaluate construct validity. Internal consistency and reliability were examined using Cronbach's alpha and composite reliability (CR). The CVI analysis demonstrated high relevance, clarity, and importance scores. CFA results indicated a well-fitting structural model, with factor loadings exceeding 0.8 and strong fit indices (RMSEA = 0.033, CFI = 0.993, TLI = 0.992). The instrument exhibited high internal consistency, with Cronbach's alpha of 0.825, confirming its reliability and validity for assessing diabetes self-management. The Indonesian DSMQ-R is a valid and reliable tool for evaluating self-management behaviors among Indonesian diabetic patients. Its strong psychometric properties support its application in clinical practice and research. However, this study is limited by its sample size and participant diversity, which may affect the generalizability of the findings. Future research should integrate glycemic control measures, such as HbA1c levels, and expand participant diversity to enhance its applicability.

DOI: 10.58860/ijsh.v4i3.291

Corresponding Author: Riwisna Putunanga*
Email: riwisna22001@mail.unpad.ac.id

INTRODUCTION

Diabetes mellitus (DM) is a serious and chronic condition that occurs when the body cannot produce enough insulin or cannot effectively use the insulin it produces (Ogurtsova et al., 2022). This is in line with the definition of DM which is described as a chronic disease that results from the failure of the pancreas to produce enough insulin or the body's inability to efficiently use the insulin it produces (Ngoatle & Mothiba, 2022).

According to the International Diabetes Federation (IDF), the number of people with diabetes. The prevalence of diabetes mellitus in Indonesia reached 10.8% in 2021, accounting for approximately 19 million individuals. Indonesia ranks fifth globally in terms of the highest number of diabetes cases. On a global scale, the prevalence of diabetes mellitus was 10.5% in 2021, affecting around 536 million people, and is projected to rise to approximately 783 million (12.2%) by 2045 (Ogurtsova et al., 2022).

Given this trend, the number of diabetes cases in Indonesia is also expected to increase. Despite these alarming statistics, there remains a gap in research regarding the effective self-management of diabetes and the psychometric validation of assessment tools such as the DSMQ-R in the Indonesian context. Addressing these gaps is crucial for developing targeted interventions to enhance diabetes self-care and management strategies.

Blood glucose levels, as defined by the WHO, range from 70 to 100 mg/dL (3.9 to 5.6 mmol/L) in healthy individuals. For patients with type 1 diabetes mellitus (T1DM), target glucose levels before meals are 90 to 130 mg/dL (5.0 to 7.2 mmol/L) for adults and adolescents (ages 13–19), 90 to 180 mg/dL (5.0 to 10.0 mmol/L) for children aged 6–12 years, and 100 to 180 mg/dL (5.5 to 10.0 mmol/L) for children younger than six. At bedtime or postprandial, T1DM patients are recommended to maintain glucose levels between 90 and 150 mg/dL (5.0 to 8.3 mmol/L) for adults and adolescents, 100 to 180 mg/dL (5.5 to 10.0 mmol/L) for children aged 6–12 years, and 110 to 200 mg/dL (6.1 to 11.1 mmol/L) for younger children. Meanwhile, for individuals with type 2 diabetes mellitus (T2DM), preprandial glucose levels should be maintained at 70 to 130 mg/dL (3.9 to 7.2 mmol/L), with postprandial and bedtime glucose levels not exceeding 180 mg/dL (10.0 mmol/L), as per the American Diabetes Association (cited in Dhaliwal, 2022).

This study underscores the importance of self-management in diabetes care, particularly in Indonesia, where the prevalence of the disease is high. A validated, culturally adapted self-management tool is crucial for empowering patients to maintain optimal glucose levels, thereby reducing complications. Additionally, integrating such a tool into healthcare systems can aid providers in delivering more personalized treatment and support policymakers in formulating effective diabetes management strategies.

Self-management plays a crucial role in achieving optimal blood sugar levels among individuals with diabetes (Schmitt et al., 2022). Diabetes self-care involves a complex and dynamic decision-making process aimed at maintaining overall health, particularly for individuals with chronic conditions such as diabetes mellitus (Baroni et al., 2022). Clinical guidelines for diabetes management serve as a foundational framework for physicians, providing essential directions to enhance patients' health and quality of life while mitigating the risk of diabetes-related complications (Vodolagin & Polukhin, 2021). The most important predictor in reducing morbidity and mortality due to diabetic complications is the level of blood sugar control achieved (Yosef et al., 2023). So to avoid life-threatening organ damage and premature death, patients with diabetes need greater, more systematic, and continuous medical care (Melkamu, Berhe, & Handebo, 2021).

Self-care in diabetes mellitus has been defined as an evolutionary process of developing knowledge or awareness by learning to survive with the complex nature of diabetes in a social context (Chindankutty & Devineni, 2023). Self-care practices for patients with diabetes mellitus are defined as adherence to prescribed guidelines related to diet, physical activity, self-monitoring of blood sugar levels, foot care, adherence to prescribed anti-diabetic medications or insulin use, and self-monitoring of blood sugar levels (Shrivastva et al., 2020) (Tewahido & Berhane, 2017).

The DSMQ is designed to assess self-care behaviors that can be associated with HbA1c measurement, the DSMQ consists of 16 items having 4 subscales: Glucose Management (GM), Dietary Control (DC), Physical Activity (PA), Health Care Use (HU) (Márkus et al., 2022); (Schmitt et al., 2016). The reasons for the DSMQ being revised to DSMQ-R were regarding grammar, previous studies showing reliability for cooperation with medical personnel, and insulin injection practices that adjust doses and correct blood sugar levels (Schmitt et al., 2022).

Medical treatment and lifestyle changes, self-management are important ways to achieve blood sugar control and prevent diabetes complications (Márkus et al., 2022). These behaviors have also been shown to positively affect quality of life, healthcare costs, and health perceptions in people with DM.

In addition, regular check-ups and follow-up for patients diagnosed with DM can help prevent or delay health complications (Krzemińska et al., 2021). Good self-care behaviors will keep diabetes management under control and prevent complications and make quality of life better (Uly et al., 2022).

The purpose of this study illustrates the translation of DSMQ-R 20+7 into Indonesian and evaluation of psychometric properties whether validity and its relationship with blood sugar level control in Indonesian patients with diabetes mellitus.

METHOD

This research followed a rigorous validation process in accordance with the Linguistic Validation Guidance of a Clinical Outcome Assessment (COA) by the MAPI Research Trust (2018) and the International Test Commission (2017). The first step involved obtaining permission via email from the developers of The Diabetes Self-Management Questionnaire-Revised (DSMQ-R). The cross-cultural adaptation process then proceeded through several stages: (1) forward translation of the English instrument into Indonesian by an expert with a background in English education and psychology, and another expert with a psychology background; (2) backward translation from Indonesian to English by two independent translators proficient in English and psychology; and (3) translation synthesis, where the authors and translators reviewed and discussed the translations to ensure accuracy and conceptual equivalence. To maintain objectivity, each translator worked without direct access to the original instrument. Additionally, Confirmatory Factor Analysis (CFA) and reliability testing were employed to validate the instrument statistically. While the sample size and selection criteria were well-defined, acknowledging potential biases in sample selection would further enhance transparency. (4) The results of the forward-backward translation were then subjected to readability tests or cognitive interviews with subjects who fit the participant criteria to see the understanding of the items before the research data collection. Readability tests or cognitive interviews were conducted with 5 diabetes patients with different sociodemographic backgrounds, such as age, gender, occupation, education, and how long they have been diagnosed with diabetes mellitus. After discussing with the patients, some words needed to be changed to make them more understandable to patients with different backgrounds in daily conversations. For example, replacing the word "glucose" with "blood sugar level," "physical activity" with "exercise," and "diabetes specialist" with "medical doctor and/or diabetes specialist." Furthermore, the authors carried out the validity testing phase by testing content validity, construct validity, and reliability.

In the process of collecting data, the authors go to the National Unity and Political Agency and the Health Office to ask permission to conduct the research. After obtaining permission, researchers were given access to be able to distribute questionnaires to patients with diabetes mellitus. Before filling out the scale, they were asked to read and fill out a consent sheet regarding their willingness to fill out the scale. The participants of this study were taken by non-probability sampling. In this study, the selection was based on the authors' decision, specifically selecting individuals who could meet the objectives or criteria of this study (Davis et al., 2017). The participants in this study were 174 patients with diabetes mellitus, for whom doctors recommended taking medicines orally and/or insulin injections.

Based on the demographic data obtained in this study, it can be described that most of the participants were female 88.4% (N = 119). Based on age, under 30 years old 3.4% (N=6), 30-40 years 5.7% (N=10), 41-50 years 13.8% (N=24), 51-60 years 37.9% (N=66), 61-70 years 30.5% (N=53) and more than 70 years old 8.6% (N-15). Based on education background, high-school 32.8% (N=57), bachelor degree 24.7% (N=43), master degree 1.1% (N=2), doctoral degree 1.1% (N=2) and the others 40.2% (N = 70). Based on duration diagnosis of DM, less than 1 year 6.9% (N=12), 1-5 years 55.2% (N=96), 6-10 years 19.5% (N=18), 11-15 years 10.3 (N=18), and more than 15 years 8.0% (N=14).

Based on therapy, most of participants take oral medication 86.2% (N=150), insulin medication 8.6 (N=15) and the rest of them take both oral and insulin medication were 5.2% (N=9). Based on complication, hypertension 31.0% (N=54), diabetic retinopathy 1.7% (N=3), diabetic neuropathy 1.9% (N=5), and others (decreased function of kidneys, cardiovascular, etc) 5.2% (N=9) and patients who have no complication 59.2% (N=103). Based on type diabetes mellitus, patients with T2DM 96.0% (N=167) and T1DM 4.0% (N=7).

To see the socio-demographic picture as gender, age, education background, duration diagnosis of DM, therapy, and complications descriptive statistics were used. Standard deviation and Mean were used to describe the variable. Data analysis used Content Validity Index (CVI) consisting of Item Content Validity Index (I-CVI) and Scale Content Validity Index (S-CVI).

RESULT AND DISCUSSION

In this study, the authors employed the Content Validity Index (CVI) to assess content validity. The comparability and similitude assessment followed the rating scale established by Sperber (2004), ranging from 1 to 7, in accordance with the ITC Guidelines for Adaptation (2018). Based on the assessment criteria, a mean score of 2.5 to 3 or higher indicates the need for revision, while a mean score below 2.5 is considered acceptable. The results demonstrated strong content validity, with a mean comparability score of 1.41, interpreted as good, and a mean similarity score of 1.32, interpreted as sound. These findings align with the statistical analyses supporting the robustness of the Indonesian DSMQ-R.

In addition to comparability and similarity in assessing backward translation items with the source language, there is also an expert judgment assessment regarding forward translation. Expert judgment assesses each item regarding the extent of its suitability or relevance to the construct and function of the measuring instrument (relevancy), how essential the item is when associated with the construct and research context (importance), and clarity meaning whether it is clear and adequate (Delgado Rico et al., 2012) with I-CVI assessment criteria less than 0.78, which is interpreted as poor or needs to be reviewed, and I-CVI more than 0.78, which is interpreted as good or can be used.

In this study, the I-CVI results obtained on the DSMQ-R measuring instrument (relevance) were 0.98, which was interpreted as good or usable, I-CVI on how important it is about the construct and research context (importance) of 1.00, which can be interpreted as excellent or usable and S-CVI clarity of intent whether it is clear and sufficient of 0.89 which is interpreted as sound.

Confirmatory Factor Analysis (CFA)

The authors utilized CFA in AMOS software as an additional calculation for items 1–20. The factor loading analysis indicated that each item had a high standardized regression score, ranging from 0.811 to 0.907, suggesting a strong correlation. This finding demonstrates that each item consistently reflects the DSMQ-R aspects. Furthermore, in terms of reliability and validity, the obtained Composite Reliability (CR) score was 0.983, indicating excellent internal consistency (validity) and reliability of the items. The extracted variance (VE) score was 0.747, suggesting a high proportion of variance and strong convergent validity.

For model fit, the chi-square value was 190.731 with a p-value of 0.055, indicating an adequate fit as the p-value slightly exceeded the threshold of 0.05. The Root Mean Square Error of Approximation (RMSEA) was 0.033 (< 0.08), with a high p-value (PCLOSE = 0.955), suggesting an excellent model fit. Additionally, the Comparative Fit Indices demonstrated strong model fit, with TLI = 0.992, CFI = 0.993, and NFI = 0.957, all exceeding the recommended threshold of 0.95. The Goodness of Fit Index (GFI) was 0.901, and the Adjusted GFI (AGFI) was 0.871, both indicating a good model fit.

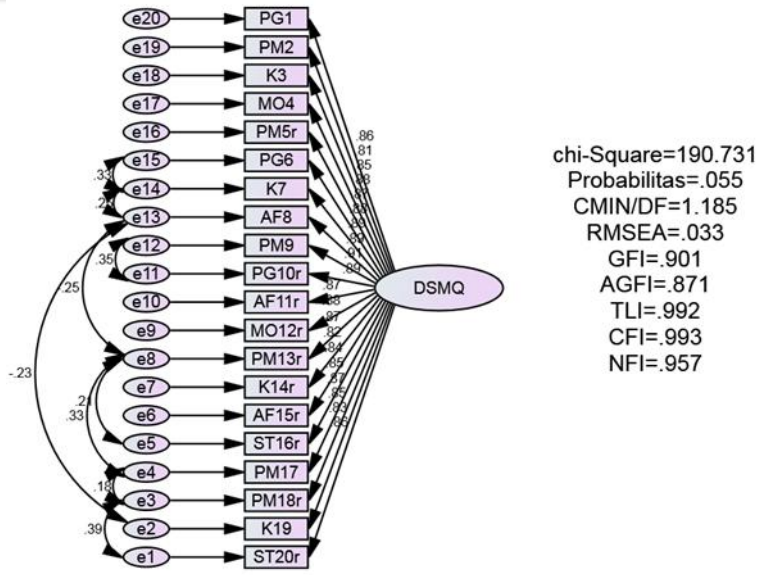

Figure 1. Confirmatory Factor Analysis (CFA) Model of DSMQ-R Items 1-20

Confirmatory Factor Analysis (CFA) Model of DSMQ-R using SEM. The standardized factor loadings range from 0.81 to 0.90, indicating strong correlations with the latent construct. Model fit indices suggest a good model fit: $\chi^2(190.731)$, p = 0.055, CMIN/DF = 1.185, RMSEA = 0.033, GFI = 0.901, AGFI = 0.871, TLI = 0.992, CFI = 0.993, and NFI = 0.957.

Abbreviations: DSMQ-R = Diabetes Self-Management Questionnaire-Revised. RMSEA = Root Mean Square Error of Approximation, CFI = Comparative Fit Index, TLI = Tucker-Lewis Index, NFI = Normed Fit Index. PM = Eating behavior; MO = Medication intake; PG = Glucose monitoring; AF = Physical activity; K = Collaboration with the diabetes care team; ST = Items included only in the total scale. Items marked with 'r' indicate reverse-coded items

Table 1. Validity and Reliability Analysis of DSMQ-R Using Confirmatory Factor Analysis (CFA) Items 1-20

Item	Factor Loading	Factor Loading^2	Measurement Error	CR	VE
ST20r	0.860	0.740	0.260		
K19	0.834	0.696	0.304		
PM18r	0.850	0.723	0.278		
PM17	0.870	0.757	0.243		
ST16r	0.852	0.726	0.274		
AF15r	0.838	0.702	0.298		
K14r	0.819	0.671	0.329		
PM13r	0.866	0.750	0.250		
MO12r	0.883	0.780	0.220	0.983	0.747
AF11r	0.867	0.752	0.248		
PG10r	0.894	0.799	0.201		
PM9	0.907	0.823	0.177		
AF8	0.890	0.792	0.208		
K7	0.891	0.794	0.206		
PG6	0.878	0.771	0.229		
PM5r	0.871	0.759	0.241		
MO4	0.882	0.778	0.222		

Item	Factor Loading	Factor Loading^2	Measurement Error	CR	VE
K3	0.852	0.726	0.274		
PM2	0.811	0.658	0.342		
PG1	0.862	0.743	0.257		

Factor loadings exceed the recommended threshold (≥ 0.5), supporting construct validity.
Abbreviations: DSMQ-R = Diabetes Self-Management Questionnaire-Revised; CR = Composite Reliability; VE = Variance Extracted. PM = Eating behavior; MO = Medication intake; PG = Glucose monitoring; AF = Physical activity; K = Collaboration with the diabetes care team; ST = Items included only in the total scale. Items marked with 'r' indicate reverse-coded items

Validity and Reliability

Due to the limited sample size during the validation process for items 21–27, the analysis was conducted using SPSS software. The validity results showed that each item had a significant correlation with the total score, with most correlation values exceeding the minimum r-table threshold of 0.404 and a significance level below 0.05. This indicates that the items are valid and effectively measure the intended aspects.

Furthermore, the reliability analysis yielded a Cronbach's Alpha value of 0.825, which exceeds the accepted threshold of 0.7. This demonstrates good internal consistency, indicating that the items function cohesively in measuring the same concept.

Table 2. Reliability Analysis of DSMQ-R Items 21-27

Cronbach's Alpha	N of Items
.825	7

Reliability analysis was conducted on DSMQ-R items 21-27 using SPSS. The results yielded a Cronbach's Alpha of 0.825, exceeding the acceptable threshold of 0.70, indicating strong internal consistency of the scale.

The adaptation and validation of the Indonesian version of the Diabetes Self-Management Questionnaire-Revised (DSMQ-R) demonstrated strong psychometric properties, confirming its reliability and validity for assessing diabetes self-management behaviors among Indonesian patients with diabetes mellitus (DM). The findings of this study align with previous research on the DSMQ-R, which has been validated in various settings and populations, further supporting its applicability in measuring self-management behaviors effectively (Márkus et al., 2022) (Schmitt et al., 2022).

The content validity index (CVI) analysis confirmed that the translated version accurately captures key self-management behaviors. The high scores indicate that the translation process preserved the meaning of the original questions while making them culturally and linguistically relevant (ITC, 2018). This supports previous research emphasizing the importance of careful translation and adaptation when using self-report questionnaires in different cultural contexts (Chindankutty & Devineni, 2023).

The confirmatory factor analysis (CFA) results showed that the questionnaire has a solid structure, with each item strongly linked to the overall concept of diabetes self-management (Schmitt et al., 2016). The composite reliability (CR = 0.983) and variance extracted (VE = 0.747) indicate excellent internal consistency, meaning that the questionnaire reliably measures what it is supposed to (Brown, 2015). Model fit indices, such as RMSEA (0.033) and CFI (0.993), confirm that the structure of the Indonesian DSMQ-R is strong and comparable to previous validations (Márkus et al., 2022).

To further test the questionnaire's reliability, we analyzed DSMQ-R items 21-27 using SPSS. The correlation results showed that each item was significantly related to the total score, with most

exceeding the threshold of 0.404. The Cronbach's Alpha value of 0.825 indicates strong internal consistency, meaning that the questionnaire's items work well together to measure the same concept.

The results from CVI, CFA, and SPSS confirm that the Indonesian DSMQ-R is a reliable and valid tool for measuring diabetes self-management behaviors. Managing diabetes effectively requires patients to engage in self-care behaviors like taking medications, following a healthy diet, staying physically active, and monitoring blood sugar levels. The Indonesian DSMQ-R provides healthcare professionals with a way to assess how well patients are managing their condition, which can help guide treatment plans and interventions (Baroni et al., 2022) (Krzemińska et al., 2021). Given Indonesia's high diabetes prevalence (Ogurtsova et al., 2022), having a culturally adapted tool is essential for improving patient care and education.

Study Limitations

While this study provides strong evidence of the DSMQ-R's validity and reliability, there are some limitations. Future collaborations with hospitals and healthcare facilities could help obtain objective clinical data, such as HbA1c levels, to strengthen the connection between self-management behaviors and glycemic control. This would allow for a more comprehensive assessment of the DSMQ-R's effectiveness in predicting diabetes outcomes. We did not have access to HbA1c data, which could have provided a more direct link between self-management behaviors and blood sugar control (Schmitt et al., 2022). Additionally, most participants in this study were using oral medication rather than insulin, which may limit the generalizability of the findings. Future studies should aim to include a more diverse sample and incorporate objective health data, such as HbA1c levels, to further validate the tool.

CONCLUSION

The Indonesian DSMQ-R has been confirmed as a valid and reliable instrument for assessing diabetes self-management behaviors, demonstrating strong psychometric properties that support its utility in both research and clinical practice. To further enhance its applicability, future research should explore the integration of glycemic control measures and expand the participant pool to ensure broader generalizability. Addressing these areas will strengthen the DSMQ-R's role in improving diabetes management and empowering patients to take better control of their health. Additionally, future studies could investigate its adaptability to diverse demographic groups and healthcare settings. All participants provided informed consent before taking part in this study, including consent for the publication of anonymized responses. All procedures adhered to ethical standards and were approved by the ethics committee of Universitas Padjadjaran, Bandung, Indonesia. Furthermore, data collection was conducted with formal authorization from the health office. The authors declare no conflict of interest in this study and extend their sincere gratitude to all the patients who participated and shared valuable insights. We also appreciate the cooperation of healthcare professionals who facilitated the recruitment process. A special acknowledgment is extended to the MAPI Research Trust for their generous support and provision of resources that greatly contributed to this study. Their cooperation in granting access to essential materials was instrumental in the successful adaptation of the DSMQ-R for the Indonesian population. This research certainly has its limitations. The limitations of this research include the lack of available HbA1c data to support a more in-depth analysis. Future studies should integrate clinical data, such as HbA1c levels, by collaborating with healthcare facilities to strengthen the link between self-management behaviors and glycemic outcomes. Additionally, there is an uneven distribution of subjects between patients using oral medication and those using insulin injections, which affects the data processing and the validity of the results.

REFERENCES

Baroni, I., Caruso, R., Dellafiore, F., Ausili, D., Barello, S., Magon, A., Conte, G., Russo, S., Vangone, I., & Guardamagna, L. (2022). Self-care and type 2 diabetes mellitus (T2DM): a literature review in sex-related differences. *Acta Bio Medica: Atenei Parmensis*, *93*(4), e2022277.

Brown, T. A. (2015). *Confirmatory factor analysis for applied research*. Guilford publications.

Chindankutty, N. V., & Devineni, D. (2023). Self-efficacy and adherence to self-care among patients with type 2 diabetes: A systematic review. *Journal of Population and Social Studies [JPSS]*, *31*, 249–270.

Davis, C. S., Gallardo, H. P., & Lachlan, K. A. (2017). Straight talk about communication research methods. *(No Title)*.

ITC Guidelines for Translating and Adapting Tests (Second Edition). (2018). *International Journal of Testing*, *18*(2), 101–134. https://doi.org/10.1080/15305058.2017.1398166

Krzemińska, S., Lomper, K., Chudiak, A., Ausili, D., & Uchmanowicz, I. (2021). The association of the level of self-care on adherence to treatment in patients diagnosed with type 2 diabetes. *Acta Diabetologica*, *58*(4), 437–445. https://doi.org/10.1007/s00592-020-01628-z

Márkus, B., Hargittay, C., Iller, B., Rinfel, J., Bencsik, P., Oláh, I., Kalabay, L., & Vörös, K. (2022). Validation of the revised Diabetes Self-Management Questionnaire (DSMQ-R) in the primary care setting. *BMC Primary Care*, *23*(1), 2. https://doi.org/10.1186/s12875-021-01615-5

Ngoatle, C., & Mothiba, T. M. (2022). How Is It to Live with Diabetes Mellitus? The Voices of the Diabetes Mellitus Clients. *International Journal of Environmental Research and Public Health*, *19*(15), 9638. https://doi.org/10.3390/ijerph19159638

Ogurtsova, K., Guariguata, L., Barengo, N. C., Ruiz, P. L.-D., Sacre, J. W., Karuranga, S., Sun, H., Boyko, E. J., & Magliano, D. J. (2022). IDF diabetes Atlas: Global estimates of undiagnosed diabetes in adults for 2021. *Diabetes Research and Clinical Practice*, *183*, 109118. https://doi.org/10.1016/j.diabres.2021.109118

Schmitt, A., Kulzer, B., Ehrmann, D., Haak, T., & Hermanns, N. (2022). A Self-Report Measure of Diabetes Self-Management for Type 1 and Type 2 Diabetes: The Diabetes Self-Management Questionnaire-Revised (DSMQ-R) – Clinimetric Evidence From Five Studies. *Frontiers in Clinical Diabetes and Healthcare*, *2*. https://doi.org/10.3389/fcdhc.2021.823046

Schmitt, A., Reimer, A., Hermanns, N., Huber, J., Ehrmann, D., Schall, S., & Kulzer, B. (2016). Assessing diabetes self-management with the diabetes self-management questionnaire (DSMQ) can help analyse behavioural problems related to reduced glycaemic control. *PloS One*, *11*(3), e0150774.

Shrivastva, A., Phadnis, S., Rao N, K., & Gore, M. (2020). A study on knowledge and self-care practices about Diabetes Mellitus among patients with type 2 Diabetes Mellitus attending selected tertiary healthcare facilities in coastal Karnataka. *Clinical Epidemiology and Global Health*, *8*(3), 689–692. https://doi.org/10.1016/j.cegh.2020.01.003

Tewahido, D., & Berhane, Y. (2017). Self-Care Practices among Diabetes Patients in Addis Ababa: A Qualitative Study. *PLOS ONE*, *12*(1), e0169062. https://doi.org/10.1371/journal.pone.0169062

Uly, N., Fadli, F., & Iskandar, R. (2022). Relationship between Self-Care Behavior and Diabetes Self-Management Education in Patients with Diabetes Mellitus Type 2. *Open Access Macedonian Journal of Medical Sciences*, *10*(E), 1648–1651. https://doi.org/10.3889/oamjms.2022.10879

Vodolagin, M. V., & Polukhin, N. V. (2021). The Main Factors Influencing Adherence to drug Therapy in Patients with Diabetes Mellitus. *Journal of Pharmaceutical Research International*, 385–393. https://doi.org/10.9734/jpri/2021/v33i46A32880

Yosef, T., Nureye, D., Tekalign, E., Assefa, E., & Shifera, N. (2023). Medication adherence and contributing factors among type 2 diabetes patients at Adama Hospital Medical College in Eastern Ethiopia. *SAGE Open Nursing*, *9*, 23779608231158976.