Sains Medika: Jurnal Kedokteran dan Kesehatan

journal homepage: http://jurnal.unissula.ac.id/index.php/sainsmedika/

RESEARCH ARTICLE

Evaluating the effectiveness of the indonesian diabetes self-management questionnaire in managing type 2 diabetes in primary care

Akhmad Azmiardi[1], Ratih Puspita Febrinasari[2]

[1] Department of Epidemiology, Magister of Public Health, Faculty of Public Health, Universitas Mulawarman, Indonesia
[2] Department of Pharmacology, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia;
*Correspondence: Akhmad Azmiardi; Address: Jl P. Suryanata, Samarinda Ulu, Samarinda, Kalimantan Timur, 79124;
Email address: aazmiardi@gmail.com

ARTICLE INFO

Keywords:
Type 2 Diabetes
Self-Management
DSMQ
Primary Care
Validity
Reliability

ABSTRACT

Effective self-management of diabetes is essential for controlling diabetes mellitus. This study evaluates the validity and reliability of the Indonesian Diabetes Self-Management Questionnaire (DSMQ) among patients with type 2 diabetes in primary care. A cross-sectional study involved 30 patients aged 20-75 from Singkawang City, Indonesia, who met specific criteria. Data were collected through structured interviews. The DSMQ assesses self-management behaviours using a four-point Likert scale. Construct validity was measured with Pearson's r correlation coefficients, while reliability was evaluated using Cronbach's alpha, with thresholds of >0.361 for validity and >0.70 for reliability. Participants were predominantly women (76.7%), mostly aged 50 or older (53.3%), and married (93.3%), with 40% only having a primary education. The DSMQ demonstrated strong validity and reliability, with Pearson's r values ranging from 0.393 to 0.865 and a Cronbach's alpha of 0.930, indicating excellent internal consistency. The Indonesian DSMQ is a reliable tool for assessing diabetes self-management, assisting healthcare providers in enhancing diabetes care strategies.

1. Introduction

Diabetes self-management is a vital component in controlling diabetes mellitus, particularly for the most common form, type 2 diabetes. Globally, approximately 537 million adults aged 20-79 live with diabetes, a number projected to rise to 643 million by 2030 and 783 million by 2045, with the majority residing in low- and middle-income countries. In 2021, diabetes was responsible for 6.7 million deaths (International Diabetes Federation, 2019). Characterised by the body's inability to produce or effectively use insulin, type 2 diabetes leads to elevated blood sugar levels and complications such as heart disease, stroke, kidney disease, and neuropathy (Azmiardi, 2020; Bosun-Arije *et al.*, 2019).

Diabetes Self-Management Education (DSME) is a systematic approach that encourages active patient involvement in monitoring health parameters and making informed decisions, utilising knowledge and skills gained through education (Azmiardi, 2020; Hailu *et al.*, 2018). The primary goal of DSME is to empower individuals with diabetes to manage their condition effectively, thereby improving metabolic control, preventing complications, and enhancing quality of life (Bekele *et al.*, 2021; Harindhanavudhi *et al.*, 2022). Self-management activities include diet management, physical activity, blood glucose monitoring, medication adherence, and foot care (Diriba *et al.*, 2020; Paulsamy *et al.*, 2021). Evidence shows

https://doi.org/10.30659/sainsmed.v16i1.39337
Received: 7 December 2024 | **Revised:** 7 March 2025 | **Accepted:** 3 May 2025 | **Available Online:** 15 June 2025

• pISSN: 2085-1545 • eISSN: 2339-093X/ © **2025 Author(s).** Published by Sains Medika: Jurnal Kedokteran dan Kesehatan. This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

that effective self-management significantly influences diabetes development and progression, emphasising the importance of patient education and support systems (Azmiardi *et al.*, 2021). Although many patients experience challenges in controlling blood sugar levels, interventions focusing on diet, medication adherence, and physical activity have shown promising results (Kueh *et al.*, 2017). Community-based programs and family involvement further support self-care behaviours, leading to better health outcomes (Azmiardi *et al.*, 2021).

The Diabetes Self-Management Questionnaire (DSMQ) is a widely used tool designed to assess self-care behaviours essential for glycemic control and overall health. Introduced in 2013, the DSMQ has been adapted and validated across various languages and populations, demonstrating its versatility and reliability. For instance, the Romanian version showed good internal consistency and validity, though further validation is necessary for broader application (Bukhsh *et al.*, 2019; Diaconu *et al.*, 2022). In Iran, the Persian DSMQ demonstrated strong internal consistency and a significant correlation with HbA1c levels, indicating its utility in predicting glycemic control (Mirzaei *et al.*, 2022). Similarly, the Hungarian adaptation exhibited good reliability and validity, with notable correlations to BMI and HbA1. However, its association with glycemic control was less pronounced in primary care settings compared to tertiary care (Márkus *et al.*, 2022). In India, the DSMQ effectively assessed self-care activities, emphasising medication adherence, blood sugar monitoring, and the roles of physical activity in diabetes management (Khan *et al.*, 2021). The Urdu version validated in Pakistan further supported its reliability, showing high internal consistency and a significant correlation with HbA1c (Bukhsh *et al.*, 2019).

Despite widespread use, there remains a notable gap regarding the adaptation and validation of the DSMQ for the Indonesian population. Given Indonesia's unique cultural, socioeconomic, and healthcare contexts, validating the DSMQ locally is essential to ensure it accurately captures self-management practices and challenges faced by Indonesian patients. Addressing this gap will enhance understanding of self-management in Indonesia and facilitate the development of tailored interventions to improve patient outcomes. Therefore, this study aims to evaluate the validity and reliability of the Indonesian version of the DSMQ among patients with type 2 diabetes in a primary care setting.

2. Materials and Methods

2.1 Study Design and Setting

This study utilised a cross-sectional design and was conducted among patients with type 2 diabetes mellitus (T2DM) attending primary healthcare centres in Singkawang City, West Borneo, Indonesia.

2.2. Population and Samples

Participants were selected through purposive sampling based on predefined eligibility criteria. A total of 30 patients diagnosed with T2DM, along with their accompanying family members, were recruited from outpatient services at local community health centres. The inclusion criteria were as follows: diagnosed with type 2 diabetes mellitus, routinely attending primary health care centres for diabetes management, aged between 20 and 75 years, willing to participate voluntarily, not pregnant or breastfeeding, free from physical, mental, or emotional conditions that could interfere with participation, and capable of participating in interviews or completing survey instruments.

2.3. Diabetes Self-Management Questionnaire (DSMQ): Translation and Adaptation Process

The Diabetes Self-Management Questionnaire (DSMQ) is a validated multidimensional tool designed to assess various aspects of diabetes self-care behaviours from the patient's perspective. It includes items related to diet, physical activity, medication adherence, blood glucose monitoring, and interactions with healthcare professionals. The translation of the DSMQ into Indonesian followed Beaton'sstandardizedd cross-cultural adaptation guidelines, consisting of five stages: (1) Forward Translation: Two independent bilingual translators translated the original English version into Indonesian; (2) Synthesis: The two forward translations weresynthesizedd into one version; (3) Back-Translation: Two independent translators, unfamiliar with the original questionnaire, translated thesynthesizedd Indonesian version back into English; 4) Expert Review: Two diabetes specialists (physicians) reviewed the translated and original versions for conceptual and content equivalence; (5) Pilot Testing and Validation: The final Indonesian version was tested for clarity, validity, and reliability among a sample of T2DM patients.

2.4. Data Collection

Data were collected through direct interviews and face-to-face meetings with participants. During the interviews, patients were asked to reflect on their self-management behaviours over the past few weeks. Interviewers provided clarification when needed to ensure participants' complete understanding of the questionnaire items.

Participants rated each item using a four-point Likert scale ranging from 0 ("does not apply to me")

to 3 ("applies to me very much"). The total score and subscale scores were calculated by summing item responses. Negatively worded items were reverse-scored so that higher total scores reflected better self-care behaviours (Schmitt *et al.*, 2016).

2.5. Validity and Reliability Testing

Construct validity of the Indonesian version of the DSMQ was assessed using Pearson's correlation coefficient. A value of $r > 0.361$ was considered acceptable for validity. Internal consistency reliability was evaluated using Cronbach's alpha coefficient, with a threshold of ≥ 0.70 indicating acceptable reliability.

3. Results

Table 1 presents the demographic characteristics of the 30 respondents. The majority were aged 50 years or older (53.3%), with 46.7% under 50 years. Females predominated, comprising 76.7% (n=23), while males accounted for 23.3% (n=7). Regarding education, most respondents had a primary school education (40.0%), followed by high school graduates (26.7%), with 20.0% having secondary education and 13.3% holding a university degree. Most respondents were married (93.3%), with only 6.7% single or widowed. In terms of occupation, the most common role was housewife (40.0%), followed by private sector workers (33.3%), civil servants (13.3%), and farmers (13.3%). Overall, the sample consisted mainly of women over 50 years old, who were married, with low educational

Table 1. Characteristics of the Subject

Variables	Respondent (n=30)	
	n	%
Age		
• < 50 years	14	46,7
• ≥ 50 years	16	53,3
Sex		
• Female	23	76,7
• Male	7	23,3
Level of Education		
• Primary School	12	40,0
• Secondary School	6	20,0
• High School	8	26,7
• University	4	13,3
Marital Status		
• Single/Widow	2	6,7
• Married	28	93,3
Occupation		
• Housewife	12	40,0
• Private	10	33,3
• Civil Cervant	4	13,3
• Farmer	4	13,3

Table 2. Pearson's r value and Cronbach's alpha coefficient for all DSMQ

Subscale and its items	Pearson's r value	Cronbach's Alpha
Glucose Monitoring		
• I check my blood sugar levels with care and attention.	0,844	0,930
• I record my blood sugar levels regularly (or analyse the value chart with my blood glucose meter)	0,700	0,930
• I do not check my blood sugar levels frequently enough, as would be required for achieving reasonable blood glucose control	0,691	0,930
Eating behavior		
• The food I choose to eat makes it easy to achieve optimal blood sugar levels	0,780	0,930
• Occasionally, I eat lots of sweets or other foods rich in carbohydrates	0,402	0,930
• I strictly follow the dietary recommendations given by my doctor	0,406	0,930
• Sometimes I overeat	0,524	0,930
Consult doctors/healthcare		
• I keep all the doctors' appointments recommended for my diabetes treatment	0,849	0,930
• I tend to avoid diabetes-related doctors' appointments.	0,608	0,930
• Regarding my diabetes care, I should see my medical practitioner(s) more often	0,663	0,930
Taking Medication		
• I take my diabetes medication (e.g., insulin, tablets) as prescribed	0,565	0,930
• I tend to forget to take or skip my diabetes medication	0,849	0,930
Physical activity		
• I do regular physical activity to achieve optimal blood sugar levels.	0,810	0,930
• I avoid physical activity, although it would improve my diabetes	0,865	0,930
• I tend to skip planned physical activity	0,393	0,930

levels, and primarily engaged as housewives or in the private sector.

Table 2 presents the validity and reliability analysis of the DSMQ subscales and individual items. The results show that most statements demonstrated strong construct validity, with Pearson's r values exceeding the threshold of 0.361, and excellent internal consistency, with Cronbach's alpha coefficients above 0.70.

In the Glucose Monitoring subscale, the statement "I check my blood sugar levels with care and attention" showed a Pearson's r of 0.844 and a Cronbach's alpha of 0.930, indicating high validity and reliability. Similarly, "I record my blood sugar levels regularly" had a Pearson's r of 0.700, also demonstrating strong validity. The item "I do not check my blood sugar levels frequently enough" had a Pearson's r of 0.691, slightly below the threshold but still considered valid, with high internal consistency (α=0.930). For the Eating Behaviour subscale, "The food I choose to eat makes it easy to achieve optimal blood sugar levels" had a Pearson's r of 0.780 and Cronbach's alpha of 0.930. Other items, such as "Occasionally I eat sweets or carbohydrate-rich foods" (r=0.402) and "I strictly follow dietary recommendations" (r=0.406), showed moderate validity but maintained high reliability.

In the Consult Doctors/Healthcare subscale, "I keep all doctors' appointments" was strongly valid (r=0.849), with an alpha of 0.930. The item "I tend to avoid diabetes-related doctor visits" had an r of 0.608, indicating adequate validity. The Taking Medication subscale showed "I forget or skip medication" with a Pearson's r of 0.849 and α=0.930, reflecting excellent validity and reliability. "I take my medication as prescribed" had a moderate validity of 0.565 but remained reliable. For Physical Activity, "I do regular physical activity" had a Pearson's r of 0.810 and an alpha of 0.930, indicating high validity and reliability. "I avoid physical activity" demonstrated even stronger validity (r=0.865). However, "I tend to skip planned physical activity" had a lower Pearson's r of 0.393 but still showed high internal consistency.

Overall, the DSMQ demonstrated strong internal consistency and construct validity across its subscales, with most items exhibiting acceptable validity (Pearson's $r > 0.361$) and high reliability (Cronbach's alpha > 0.70). This indicates that the instrument is suitable for assessing various dimensions of diabetes self-management in the studied population.

4. Disscussion

The present study aimed to assess the validity and reliability of the Indonesian version of the Diabetes Self-Management Questionnaire (DSMQ) for evaluating self-management behaviours among patients with type 2 diabetes in primary care. The results demonstrated strong psychometric properties, with most items showing high Pearson's r values and Cronbach's alpha coefficients, confirming that the Indonesian version of the DSMQ is both valid and reliable for this population.

The characteristics of the study population revealed that most respondents were aged 50 years or older. Older adults may experience distinct challenges in managing their diabetes compared with younger patients, such as the presence of comorbidities, physical limitations, or greater reliance on family members for daily care (Garnett *et al.*, 2018). Future studies could consider examining different age ranges to explore how age influences self-management behaviours. A majority of respondents were women (76.7%). Previous research has shown that women may adopt different approaches to chronic disease management than men, including engaging in more health-seeking behaviours, adhering more closely to prescribed treatments, and taking a more proactive role in managing their condition (Adu *et al.*, 2019). Future research should aim for a more balanced gender distribution to investigate potential sex-based differences in self-management patterns.

In terms of educational background, 40% of respondents had only completed primary education. Limited educational attainment can influence health literacy, which in turn may affect patients' understanding of diabetes care and their interpretation of questionnaire items (Tajdar *et al.*, 2021). This underscores the importance of ensuring that instruments such as the DSMQ are accessible and easily understood by individuals with lower education levels, potentially through simplified language or additional explanatory guidance.

The majority of respondents were married, which may provide a source of social and emotional support that facilitates adherence to prescribed treatments, healthy eating, and consistent diabetes care routines (Olagbemide *et al.*, 2021). Conversely, future research should explore whether being unmarried, widowed, or divorced affects diabetes self-management. Nearly half of the participants were housewives, a group that may have greater flexibility in managing household responsibilities alongside their diabetes care compared with individuals employed outside the home (Camargo-Plazas *et al.*, 2023). Future studies could examine the influence of employment status and work-related stress on self-management behaviours captured by the DSMQ.

The DSMQ has been validated in multiple countries and populations, consistently demonstrating strong reliability and validity in assessing diabetes

self-care behaviours. For example, the Hungarian adaptation involving 221 participants confirmed construct validity through significant correlations with glycated haemoglobin (HbA1c) and body mass index (BMI), with the DSMQ sum scale showing inverse associations with HbA1c ($r = –0.253$, $p < 0.01$) and BMI ($r = –0.214$, $p < 0.01$). Medication adherence also correlated significantly with the "glucose management" ($r = –0.291$, $p < 0.01$) and "healthcare utilisation" ($r = 0.236$, $p < 0.01$) subscales (Vincze *et al.*, 2020). Similarly, the Persian version, validated among 460 patients in Iran, demonstrated strong psychometric properties, with a four-factor structure confirmed via exploratory and confirmatory factor analyses and a Cronbach's alpha of 0.84 for the entire scale (Mirzaei *et al.*, 2022). In Lucknow, India, the DSMQ was also effective in identifying adherence levels and areas for improvement, with glucose management subscale scores ranking the highest (Khan *et al.*, 2021). These findings collectively support the DSMQ's ability to detect problematic self-management areas and guide targeted interventions (Vincze *et al.*, 2020).

In the present study, the glucose monitoring subscale exhibited particularly high validity and reliability, with Pearson's r values ranging from 0.691 to 0.844 and a Cronbach's alpha of 0.930. These results are in line with previous studies emphasising that regular and accurate blood glucose monitoring is a cornerstone of effective diabetes management (Schmitz *et al.*, 2013). The eating behaviours subscale showed moderate to high validity ($r = 0.406–0.780$) and similarly high reliability (Cronbach's alpha = 0.930). This aligns with findings from Alkhormi *et al.* (2022), who reported a significant positive correlation between glucose management and dietary control ($r = 0.557$, $p < 0.01$).

The consultation with physician/healthcare provider subscale also demonstrated strong psychometric performance ($r = 0.608–0.849$, Cronbach's alpha = 0.930), underscoring the importance of ongoing medical support in optimising diabetes care. Regular consultations facilitate patient education, adherence to treatment plans, and better health outcomes (Uy *et al.*, 2021). The medication-taking subscale similarly showed strong validity and reliability ($r = 0.565–0.849$, Cronbach's alpha = 0.930), reflecting the critical role of adherence to prescribed regimens in achieving glycemic control (Schmitt *et al.*, 2022).

The physical activity subscale demonstrated a wider range of Pearson's r values ($r = 0.393–0.865$) but maintained a high Cronbach's alpha of 0.930. This variability is consistent with observations by Márkus *et al.* (2022), who noted that despite the recognised importance of physical activity in diabetes care, patients often face significant barriers—such as time constraints, comorbidities, or lack of motivation—that can affect adherence and accuracy of self-reported data.

Overall, the findings confirm that the DSMQ is a robust instrument for assessing self-care behaviours among Indonesian patients with T2DM in primary care. Its subscales reliably capture key aspects of self-management, offering valuable insights for clinical practice and research.

This study has several limitations. First, the sample size was small ($n = 30$), which may limit generalizability. Future research should involve larger, more diverse samples to validate these findings further. Second, the cross-sectional design precludes assessment of changes in self-management behaviours over time. Longitudinal studies are needed to evaluate the stability of DSMQ measurements. Finally, reliance on self-reported data may introduce recall bias or social desirability bias. Future studies could consider combining self-reports with objective measures of diabetes management.

5. Conclusions

The DSMQ demonstrated strong psychometric properties across all subscales, confirming its reliability and validity as a tool for assessing diabetes self-management behaviours. Its use in clinical practice can help healthcare providers identify specific challenges faced by patients—such as medication adherence, dietary management, physical activity, or blood glucose monitoring—and enable the development of individualised treatment plans and targeted educational interventions. In research, the DSMQ offers a standardised, validated measure for evaluating the effectiveness of interventions designed to improve diabetes self-management, with the potential to track behavioural changes over time. Future studies should focus on refining specific subscale items to enhance cultural and contextual relevance, thereby improving their applicability across diverse patient populations.

Conflict of interest

All authors have no conflict of interest in this article.

Acknowledgment

We would like to thank the healthcare workers and all the participants who contributed to this study.

The authors acknowledge the use of artificial intelligence–based tools, including Grammarly (Grammarly Inc., San Francisco, California, United States) and Elicit (Ought Inc., San Francisco, California, United States), which assisted with language editing,

improving clarity, and organizing the literature search during manuscript preparation. AI tools were not used for the screening or selection of studies, critical appraisal of evidence, or formulation of conclusions; these tasks were performed entirely by the authors. All AI-assisted outputs were carefully reviewed, validated, and edited by the authors to ensure accuracy and appropriateness.

References

Adu, M. D., Malabu, U. H., Malau-Aduli, A. E. O. O., & Malau-Aduli, B. S. (2019). Enablers and barriers to effective diabetes self-management: A multi-national investigation. *PloS One*, 14(6): 1-22. https://doi.org/10.1371/journal.pone.0217771

Alkhormi, A. H., Mahfouz, M. S., Alshahrani, N. Z., Hummadi, A., Hakami, W. A., Alattas, D. H., Alhafaf, H. Q., Kardly, L. E., & Mashhoor, M. A. (2022). Psychological health and diabetes self-management among patients with type 2 diabetes during covid-19 in the Southwest of Saudi Arabia. *Medicina*, 58(5): 1-14. https://doi.org/10.3390/medicina58050675

Azmiardi, A. (2020). Hubungan pengetahuan dengan praktik perawatan diri pada pasien diabetes mellitus tipe 2 di Surakarta. *Jurnal Ilmu Kesehatan Masyarakat Berkala*, 2(1), 18-22. https://doi.org/10.32585/jikemb.v2i1.812

Azmiardi, A., Murti, B., Puspita Febrinasari, R., & Gunawan Tamtomo, D. (2021). The effect of family involvement in diabetes self-management education on glycemic control in patients with type 2 diabetes mellitus: a systematic review and meta-analysis. *Journal of Public Health and Development*, 19(3): 164–190. https://he01.tci-thaijo.org/index.php/AIHD-MU/article/view/251881

Bekele, B. B., Negash, S., Bogale, B., Tesfaye, M., Getachew, D., Weldekidan, F., & Balcha, B. (2021). Effect of diabetes self-management education (DSME) on glycated haemoglobin (HbA1c) level among patients with T2DM: Systematic review and meta-analysis of randomised controlled trials. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, 15(1): 177–185. https://doi.org/10.1016/j.dsx.2020.12.030

Bosun-Arije, F. S., Ling, J., Graham, Y., & Hayes, C. (2019). A systematic review of factors influencing Type 2 Diabetes Mellitus management in Nigerian public hospitals. *International Journal of Africa Nursing Sciences*, 11(June): 1-7. https://doi.org/https://doi.org/10.1016/j.ijans.2019.100151

Bukhsh, A., Khan, T. M., Nawaz, M. S., Ahmed, H. S., Chan, K. G., & Goh, B. H. (2019). Association of diabetes knowledge with glycemic control and self-care practices among Pakistani people with type 2 diabetes mellitus. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy,* 12: 1409–1417. https://doi.org/10.2147/DMSO.S209711

Camargo-Plazas, P., Robertson, M., Alvarado, B., Paré, G. C., Costa, I. G., & Duhn, L. (2023). Diabetes self-management education (DSME) for older persons in Western countries: A scoping review. *PLOS ONE,* 18(8): 1-37. https://doi.org/10.1371/journal.pone.0288797

Diaconu, L., Gaita, L., Timar, B., Deaconu, L., Lazar, S., Timar, R., & Popescu, S. (2022). Validation and cross-cultural adaptation of the diabetes self-management questionnaire (DSMQ) and the social phobia inventory (SPIN) in Romanian patients with diabetes mellitus. *Medicina*, 58(12): 1-10. https://doi.org/10.3390/medicina58121823

Diriba, D. C. D. C., Leung, D. Y. P. P. D. Y. P., & Suen, L. K. P. L. K. P. P. (2020). The effects of diabetes self-management interventions on physiological outcomes in people living with diabetes in Africa: A systematic review and meta-analysis. *Diabetic Medicine,* 38(5), e14501. https://doi.org/10.1111/dme.14501

Garnett, A., Ploeg, J., Markle-Reid, M., & Strachan, P. H. (2018). Self-management of multiple chronic conditions by community-dwelling older adults: A concept analysis. *SAGE Open Nursing,* 4 (237796081775247): 1-16. https://doi.org/10.1177/2377960817752471

Hailu, F. B., Hjortdahl, P., & Moen, A. (2018). Nurse-led diabetes self-management education improves clinical parameters in Ethiopia. *Frontiers in Public Health,* 6(OCT). https://doi.org/10.3389/fpubh.2018.00302

Harindhanavudhi, T., Areevut, C., Sahakitrungruang, T., Tharavanij, T., Kietdumrongwong, P., Ngimruksa, O., Songsiri, P., Pitukweerakul, S., Tanathornkirati, N., Kaewprasert, N., Hathaidechadusadee, A., & Reutrakul, S. (2022). Implementation of diabetes care and educational program via telemedicine in patients with COVID-19 in home isolation in Thailand: A real-world experience. *Journal of Diabetes Investigation,* 13(8): 1448–1457. https://doi.org/10.1111/jdi.13804

International Diabetes Federation. (2019). *IDF Diabetes Atlas,* 9th edn. In Atlas de la Diabetes de la FID.

Khan, M. S., Mahmood, S. E., Ahmad, A., Khan, A. A., & Arfin, I. (2021). Assessment of Self-Care Activities Using Diabetes Self-Management Questionnaire (DSMQ) amongst Diabetes Patients Attending a Rural Health Training Centre in Lucknow. *Journal of Evolution of Medical and Dental Sciences,* 10(18): 1324–1328. https://doi.org/10.14260/JEMDS/2021/279

Kueh, Y. C., Morris, T., & Ismail, A.-A.-S. (2017). The effect of diabetes knowledge and attitudes on self-management and quality of life among people with type 2 diabetes. *Psychology, Health & Medicine,* 22(2): 138–144. https://doi.org/10.1080/13548506.2016.1147055

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(2): 1-11. https://doi.org/10.1186/s12875-021-01615-5

Mirzaei, H., Siavash, M., Shahnazi, H., Abasi, M. H., & Eslami, A. A. (2022). Assessment of the psychometric properties of the Persian version of the diabetes self-management questionnaire (DSMQ) in patients with type 2 diabetes. *Journal of Diabetes and Metabolic Disorders,* 21(1): 123–131. https://doi.org/10.1007/S40200-021-00946-5

Olagbemide, O. J., Omosanya, O. E., Ayodapo, A. O., Agboola, S. M., Adeagbo, A. O., & Olukokun, T. A. (2021). Family support and medication adherence among adult type 2 diabetes. *Annals of African Medicine,* 20(4): 282–287. https://doi.org/10.4103/aam.aam_62_20

Paulsamy, P., Ashraf, R., Alshahrani, S. H., Periannan, K., Qureshi, A. A., Venkatesan, K., Manoharan, V., Govindasamy, N., Prabahar, K., Arumugam, T., Venkatesan, K., Chidambaram, K., Kandasamy, G., Vasudevan, R., & Krishnaraju, K. (2021). Social support, self-care behaviour and self-efficacy in patients with type 2 diabetes during the covid-19 pandemic: A cross-sectional study. *Healthcare,* 9(11): 1-10. https://doi.org/10.3390/healthcare9111607

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(823046): 1-16. https://doi.org/10.3389/fcdhc.2021.823046

Schmitz, N., Gariépy, G., Smith, K. J., Malla, A., Wang, J., Boyer, R., Strychar, I., & Lesage, A. (2013). The pattern of depressive symptoms in people with type 2 diabetes: A prospective community study. *Journal of Psychosomatic Research*, 74(2): 128–134. https://doi.org/10.1016/j.jpsychores.2012.09.021

Tajdar, D., Lühmann, D., Fertmann, R., Steinberg, T., van den Bussche, H., Scherer, M., & Schäfer, I. (2021). Low health literacy is associated with a higher risk of type 2 diabetes: a cross-sectional study in Germany. *BMC Public Health,* 21(1): 510. https://doi.org/10.1186/s12889-021-10508-2

Uy, A. B., Chiu, H. H., Larrazabal Jr., R., & Jimeno, C. (2021). An exploration of knowledge and themes on diabetes during outpatient consultation in a tertiary referral hospital. *Journal of the ASEAN Federation of Endocrine Societies,* 36(1): 31–36. https://doi.org/10.15605/jafes.036.01.05

Vincze, A., Losonczi, A., & Stauder, A. (2020). The validity of the diabetes self-management questionnaire (DSMQ) in Hungarian patients with type 2 diabetes. *Health and Quality of Life Outcomes,* 18(1): 1–9. https://doi.org/10.1186/S12955-020-01595-7