# Assessment of Self-Care Activities Using Diabetes Self-Management Questionnaire in Diabetes Patients

Balgis[1⊠], Selfi Handayani[2], Sumardiyono[3], Nur Kholifah Putri Taufan[4]

[1]Public Health Department, Faculty of medicine, Sebelas Maret University, Indonesia
[2]Anatomy and Embryology Department, Faculty of medicine, Sebelas Maret University, Indonesia
[3]Occupational Safety and Health Department, Vocational School, Sebelas Maret University, Indonesia
[4]Vocational School, Sebelas Maret University, Surakarta, Indonesia

## Article Info

## Abstract

One of the non-communicable diseases found in all regions of the world, including rural areas, is Diabetes Mellitus, caused by a chronic metabolic disorder characterized by increased glucose levels in the blood due to impaired insulin secretion. Diabetic neuropathy is damage to peripheral nerves or peripheral nerves commonly experienced by people with type 2 diabetes mellitus, characterized by excessive pain and decreased sensitivity to touch. The purpose of this study was to determine the self-management carried out by diabetic patients in the city of Surakarta. This study is cross-sectional with a sample of 99 respondents using a purposive sampling technique with inclusion criteria of 40-60 years of age and type 2 DM patients. The tests carried out were the inter-class intercorrelation coefficient test and the Kruskal–Wallis test using SPSS. The results of this study mean the highest interclass correlation coefficient was the diabetic foot care subclass with a value of 0.773 representing the homogeneity of the DMSQ questions and a confidence interval of 0.687-0.839 at 95% with a significance of $p < 0.05$ in each subclass.

## Introduction

One of the non-communicable diseases found in all regions of the world, including rural areas, is Diabetes Mellitus (Bhagyalaxmi, Atul and Shikha, 2013), caused by a chronic metabolic disorder characterized by increased blood glucose levels due to impaired insulin secretion (Galicia-Garcia et al., 2020). Data based on The International Diabetes Federation (IDF), almost 537 million people worldwide suffer from diabetes (Saeedi et al., 2019). The IDF shows an estimation that in 2030 DM prevalence will be 643 million and keep on to increase up to 784 million in 2045 due to population growth, aging, obesity, and lack of physical activity as the primary causes of diabetes mellitus (Saeedi et al., 2019).

According to data from the Ministry of Health of the Republic of Indonesia in 2019, Indonesia was ranked 6th out of 10 countries with the highest number of people with diabetes worldwide, namely 10.7 million people (Amir and Munir, 2021). The percentage of death rate for people with diabetes mellitus in Indonesia is the 2nd highest after Sri Lanka (Ligita et al., 2019). These non-communicable diseases have increased from year to year and are mostly caused by unfavorable lifestyle factors such as smoking, unhealthy eating patterns, lack of physical activity, obesity, high blood pressure, and high cholesterol (Musaiger and Al-Hazzaa, 2012).

Two out of three people with diabetes mellitus in Indonesia do not know they have diabetes mellitus until they experience complications, which is why this disease is often referred to as a silent killer (Todkar, 2016). Chronic complications can be macrovascular, such as coronary heart disease and cerebrovascular. And microvascular

complications such as retinopathy, nephropathy, and neuropathy (Carmienke et al., 2020). Diabetic neuropathy is damage to peripheral nerves commonly experienced by people with type 2 diabetes mellitus, characterized by excessive pain and decreased sensitivity to touch (Kuate-Tegueu et al., 2015). About one-third to one-half of people with diabetes have peripheral neuropathy (Pop-Busui et al., 2017). The high level of diabetes complications in diabetes people in Indonesia highlights the lack of attention to the control of the condition and self-management as a cornerstone to optimal control of the disease. This disease costs a lot for the patients and affects both life quality and life expectancy and imposes health and economic burdens on the national budget for the loss of productivity (Jahangir et al., 2020).

According to the Regulation of the Minister of Health of the Republic of Indonesia Number 4 of 2019 that health services that are by standards for all people with diabetes mellitus are the obligation of the Regency/City Government. On the other hand, the amount of health workers cannot accommodate the growth of diabetes cases (Todkar, 2016). The number of available health workers is not proportional to the increased number of diabetic patients (Jin et al., 2017). In this regard, an alternative way is needed, so that diabetic patients are also able to carry out diabetes care independently. In line with Korzs' statement in 2020, diabetes patients need to engage in sustainable self-management in self-care activities (Kamillah et al., 2022). Approximately 95% of diabetes therapy depends on self-care measures regardless of the type of diabetes and also the patient and his family taking self-care (Takele et al., 2021). Therefore diabetic patients must change their habits, such as adhering to prescribed medication, diet control, and doing some physical activity, especially for older patients, to prevent diabetes complications, which are potentially lethal (Gemeda and Woldemariam, 2022).

In addition to health care from the local government, Diabetic neuropathy can be treated with good self-management of diabetes (Adu et al., 2019). Several instruments can be used to measure the self-management of diabetes. One of them is the Diabetes Self-Management Questionnaire (DSMQ) (Schmitt et al., 2016; Vincze, Losonczi and Stauder, 2020). This instrument was developed at the Research Institute of the Diabetes Academy Mergentheim, covering the management of blood sugar levels, diet, physical activity, and diabetes foot self-care (Schmitt et al., 2013). Studies have reported that high-level fulfillment with self-management by diabetic patients is associated with improving glycemic control and reducing diabetes complications, even morbidity and mortality rate (Nakhaeizadeh and Khalooei, 2021). Another study states that DSMQ plays a vital role in preventing the progression of neurovascular complications in diabetes patients type 2, thereby helping to reduce the risk of diabetic foot (Uly, Fadli and Iskandar, 2022). The purpose of this study was to determine the self-management carried out by diabetic patients in the city of Surakarta. The choice of the location of Surakarta City is because data from the Central Java Provincial Health Office shows the highest cases of type 2 diabetes mellitus in Surakarta City, a total of 22,543. According to the Surakarta City Health Office, diabetes mellitus (DM) is still a problem that must be controlled, considering that this type of disease is one of the highest comorbidities in the mortality rate due to COVID-19. This study uses DSMQ as a research instrument. It is hoped that this research can increase awareness and compliance in the self-management of diabetes.

**Method**

This study is an analytical observational study using a cross-sectional design. The study population was people with type 2 DM in the Puskesmas work area in Surakarta city. Research data collection will be carried out from March 28, 2022, to May 25, 2022. The study population was dm type 2 sufferers in 5 health centers in 5 sub-districts in Surakarta City (Districts: Pasar Kliwon, Jebres, Banjarsari, Lawiyan, and Serengan). The study sample was determined using purposive sampling with inclusion criteria: age 40-60 years, patients with type 2 DM, and signed informed consent. Based on the sampling technique, the number of samples obtained totaled 99 people. The exclusion criterion is to have a psychiatric disorder and not be willing to be a respondent.

The research instruments used in this study were The DSMQ (Diabetes Self Management Questionnaire) questionnaire and medical record data. The number of DSMQ questions of 19 items includes Management of blood sugar levels (items 11, 12, 13, 14, 15), Diet control (items 1, 2, 3, 4, 5, 6, 7), Physical activity (items 8,9,10), and Diabetic foot care (items 16,17,18, 19). The free variable is Diabetes Self-Management using a categorical scale (Diet Control, Physical Activity, Management of blood sugar levels, and Diabetic foot care). The bound variable is the Answer Score of each question item on the DSMQ using an Ordinal Scale. The validity and reliability test refers to the research conducted by Schmitt et al. (Schmitt et al., 2013). The DSMQ is equipped with sample data i.e., gender and age. Age variable data are categorized into $\leq 40$ years, 41-50 years, 51-60 years, and $\geq 61$ years. The data obtained will be analyzed using the interclass correlation coefficient and Kruskal–Wallis test. Statistically, the difference is significant if the p-value <0.05.

All analyzes were performed using SPSS for Windows version 23.

**Result and Discussion**

In diabetes mellitus patients, the factors that influence self-care behavior are age and gender. Age affects the ability to learn in receiving skills, new information, and physical abilities. But with increasing age, especially in old age, there will be a decrease, especially after the age of 55. Then at the age of under 55 years, self-care management is still good. On the influence of sex on type 2 diabetes mellitus, the tendency occurs in women. It is because women tend to have higher cholesterol. Women are at 3-7 times the risk of developing type 2 diabetes mellitus because women's fat is higher than that of men. Female fat is 20-25% of body weight, while male fat is 15-20% of body weight. In this study, data on the characteristics of age and sex variables from 99 study respondents were seen in Table 1.

Table 1. Characteristics of Respondents

| Age Group | Gender | | Total |
|---|---|---|---|
| | Male | Female | |
| $\leq 40$ | 0 | 1 | 1 |
| 41-50 | 3 | 9 | 12 |
| 51-60 | 20 | 42 | 62 |
| $\geq 61$ | 3 | 21 | 24 |
| Total | 26 | 73 | 99 |

Source: Primary Data, 2022

Based on Table 1 above, the respondents in this study were dominated by respondents with an age range of 51-60 years, as many as 62 of 99 respondents. In general, 20% of the elderly have diabetes mellitus, and a similar proportion have undiagnosed diabetes mellitus (Chentli, Azzoug, and Mahgoun, 2015). According to research (González et al., 2012), a person over 50 years of age has a greater risk of developing diabetic neuropathy (Ratih et al., 2022). It is due to a person's physiological changes with age, which can decrease the body's metabolism. In a study (Rooney et al., 2021), patients over 45 years old have a higher risk of suffering from type II diabetes mellitus compared to younger patients (less than 45 years old). This study also shows not only age but co-morbid factors also

affect diabetes. Co-morbidities such as heart disease, hypertension, kidney disease, and decreased vision.

The female sex dominated the gender of the respondents in this study as many as 73 of 99 respondents. Research states that a person with a female gender has a greater risk of developing diabetic neuropathy. Women tend to be more at risk for complications of diabetes mellitus because of a large body mass index, menstrual cycle syndrome, and menopause which can facilitate fat accumulation, which causes inhibited glucose transport (Kautzky-Willer, Harreiter, and Pacini, 2016). Gender can affect the incidence of diabetic neuropathy where the sex of women is 2 times greater risk of complications than men. Hormonally,

estrogen causes women to get neuropathy more often because the absorption of iodine in the intestine is disrupted so that the process of forming nerve myelin does not occur. The hormone testosterone causes men to have less type 2 diabetes mellitus than women.

Self-care management is one of the factors that determine the health status and quality of life of dm type 2 patients. Self-care management, which includes the dimensions of maintenance, monitoring, and self-care, is the

process of intervention when complications of the disease are detected. In DM patients, good self-care management can improve metabolic control, quality of life and reduce cardiovascular risk, length of hospitalization, and disease-related complications. However, there are still many DM patients who have poor self-care management. In this study, the Adherence to Self-Care Activities among Diabetes Patients Question About Self-Care is seen in Table 2.

Table 2. Adherence of Self-Care Activities among Diabetes Patients Question about Self- Care

| Self-care questions | Almost Always | Often | Seldom | Never |
|---|---|---|---|---|
| I follow the meal plan (diet)as recommended | 2 (2.02) | 44(44.4) | 28(28.3) | 25(25.3) |
| I limit the number of servings of food so that my blood sugar levels arecontrolled | 7 (7.1) | 60 (67.7) | 26 (26.3) | 6 (6.1) |
| I am picky about food, so my blood sugar level isnor-mal cakes, biscuits, soy sauce,sweet tea, etc.) | 5 (5.1) | 66 (66.7) | 18 (18.2) | 10 (10.1) |
| I eat foods that are high infat (like meat, foods that contain oil or butter, etc.) | 20 (20.2) | 27 (27.3) | 45 (45.5) | 7 (7.1) |
| Every day I eat three servings of vegetables | 22 (22.2) | 54 (54.5) | 23 (23.2) | 0 (0) |
| Sometimes I eat a lot / of excessive food, espe-cially when there is a party | 1 (1) | 22 (22.2) | 38 (38.4) | 38 (38.4) |
| I do physical activity regularly 20-30 minutes/day so that my blood sugar level is normal | 4 (4) | 41 (41.4) | 36 (36.4) | 18 (18.2) |
| I do light exercises such as walking around the house. | 15 (15.2) | 50 (50.5) | 32 (32.3) | 2 (2) |
| I tend not to do planned physical activities | 3 (3) | 35 (35.4) | 48 (48.5) | 13 (13.1) |
| I check my blood sugar levelat the health service or independently at home. | 58 (58.6) | 31 (31.3) | 9 (9.1) | 1 (1) |
| I regularly come to see the doctor | 49 (49.5) | 41 (41.4) | 9 (9.1) | 0 (0) |
| I take medication or injectinsulin according to the doctor's instructions | 53 (53.5) | 36 (36.4) | 9 (9.1) | 1 (1) |
| I tend to forget to take diabetes medicine/insulin | 4 (4) | 19 (19.2) | 24 (24.2) | 52 (52.5) |
| I see health workers moreoften for my diabetes treatment. | 14 (14.1) | 64 (64.6) | 21 (21.2) | 0 (0) |
| I checked the feet (for sores and calluses) | 1 (1) | 44 (44.4) | 45(45.5) | 9 (9.1) |
| I clean my feet with soap | 11 (11.1) | 47 (47.5) | 37 (37.4) | 4 (4) |
| I dry between my toes after washing | 6 (6.1) | 36 (36.4) | 37 (37.4) | 20 (20.2) |
| I checked the inside of the sandal/shoe to be used | 7 (7.1) | 31 (31.3) | 50 (50.5) | 11 (11.1) |

Source: Primary Data, 2022

Self-management in diabetes mellitus is a set of behaviors carried out by individuals with diabetes to manage their condition, including taking medication, managing diet, doing physical exercise, self-monitoring of blood glucose, and maintaining foot care (Schmitt et al., 2013). Based on table 2 above shows that 100% of respondents eat three servings of vegetables every day, respondents regularly see doctors, and respondents often

see health workers for diabetes care. It shows that respondents still have concerns about their diabetes condition (Isroin, 2019). The results of the study relevant to this study showed a relationship between family support (Trisnadewi et al., 2020), low self-acceptance and moderate self-acceptance (Pranata, Mudatsir and Jannah, 2021), spirituality level (Zareipour et al., 2016), and physical activity (Chowdhury and Chakraborty, 2017) with

anxiety levels in people with type 2 diabetes mellitus.

Findings from a qualitative study found barriers to diabetes self-management practices. The barriers were a lack of knowledge on diabetes self-management, unfortunate perception of susceptibility and severity of diabetes mellitus complications, lack of motivation, and support from family on diabetes self-management practice. Related to the regulation of diet control, most respondents stated that they had difficulty managing a healthy diet. They eat like ordinary people and never follow dietary recommendations. Especially the culture of Indonesian people, who choose rice as their main food. Many of them eat sweet and fatty foods in large portions (Pamungkas et al., 2021).

Table 2 shows that 52.2% of respondents forget to take their diabetes/insulin medication. Researchers also mentioned that controlling blood sugar levels must be adjusted between patients and healthcare providers to make appropriate treatment adjustments. Healthcare providers function as patient-centered training and support providers to carry out good self-management so the patient's blood glucose is controlled (Jutterström et al., 2016). Several serious complications can be suffered by patients with diabetes, such as complications related to the foot. Of the average mortality rate within five years after suffering from diabetic foot, 43-74% get foot amputation as this condition is related to bad habits, poor management of diabetes, and lack of preventive actions (Mahdalena and Ningsih, 2016). Based on the data above, it shows that most respondents have low knowledge about preventing diabetic foot. Clinicians and other healthcare professionals should take up positive roles in giving education and training on both medication and lifestyle matters to patients with diabetes, to have a positive effect on the health outcomes of diabetic patients by improving their self-care practices (Al-Qahtani, 2020).

Table 3. Subscale Characteristics and Average Intraclass Correlation among Diabetics

| Self- management Questionnaires | Question Number | Mean | The average correlation coefficient between classes | Lower bond | Upper bond |
|---|---|---|---|---|---|
| Control Diet | 1,2,3,4,5,6,7 | 2.511 | .160 | -.068 | .365 |
| Physical Activity | 8,9,10 | 2.539 | -.020 | -.363 | .259 |
| Management of Blood Sugar Levels | 11,12,13,14,15 | 2.004 | .168 | -.008 | .341 |
| Diabetic FootCare | 16,17,18, 19 | 2.586 | .773 | .687 | .839 |

Source: Primary Data, 2022

Based on the results in Table 3, the highest average interclass correlation coefficient is the diabetic foot care subclass, with a value of 0.773 representing the appropriate homogeneity of the DSMQ questions and a confidence interval of 0.687-0.839 at 95%. The physical activity subscale shows the average value of the negative interclass correlation coefficient and the maximum average value compared to other subscales. The study (Khan et al., 2021) showed that a high average correlation coefficient value represented a matched similarity of DSMQ items.

Table 4. Significant Differences between Questions Using Kruskal–Wallis Test

| Diabetes Self-Management Questionnaires | Questions | Mean Rank | Chi-Square | Degree of Freedom | P-value |
|---|---|---|---|---|---|
| Diet Control | I follow the meal plan (diet) as recommended | 397.15 | 106.46 | 6 | .000 |
| | I limit the number of servings of food so that my blood sugar levels are controlled | 300.67 | | | |
| | I am picky about food, so my blood sugar level is normal | 300.29 | | | |
| | I eat snacks or drink sweet drinks, which contain lots of carbohydrates (such as cakes, biscuits, sweet tea, etc.) | 378.78 | | | |
| | I eat foods that are high in fat (like meat, foods that contain oil or butter, etc.) | 331.48 | | | |
| | Every day I eat three servings of vegetables | 238,94 | | | |
| | Sometimes I eat a lot / of excessive food, especially when there is a party | 481,68 | | | |
| Physical Activity | I do physical activity regularly 20-30 minutes/day so that my blood sugar level is normal | 162,06 | 23,631 | 2 | .000 |
| | I do light exercises such as walking around the house. | 117,35 | | | |
| | I tend not to do planned physical activities | 167,60 | | | |
| Management of blood sugar levels | I check my blood sugar level at the health service or independently at home. | 179,83 | 190,005 | 4 | .000 |
| | I regularly come to see the doctor | 194,64 | | | |
| | I take medication or inject insulin according to thedoctor's instructions | 189,15 | | | |
| | I tend to forget to take diabetes medicine/insulin | 400,59 | | | |
| | I see health workers more often for my diabetes treatment. | 275,80 | | | |
| Diabetic foot care | I checked the feet (for sores and calluses) | 202,44 | 12,829 | 3 | .005 |
| | I clean my feet with soap | 166,35 | | | |
| | I dry between my toes after washing | 214,61 | | | |
| | I checked the inside of the sandal/shoe to be used | 210,61 | | | |

Source: Primary data, 2022

Based on the results of the Kruskal-Wallis test in Table 4, the average ranking of the DSMQ question items that respondents most often do is 1, 7, and 14. Question item number 1 is about following a diet plan according to the recommendation that the majority of respondents do so the average rating on that item is 397.15; Diet is related to the increase in cases of diabetes mellitus because a poor diet and lack of exercise can lead to obesity as a trigger for diabetes mellitus (Oktora and Butar, 2022). Question item 7 regarding overeating habits, especially when most respondents do this. So that the average rating on the item is 481.68; question item number 14 is about the tendency to forget to take diabetes/insulin medication, which the majority of respondents do, so the average rating on that item is 400.59. Each subclass had $p<0.05$, meaning there were differences between the subclasses of diet, physical activity, blood sugar management, and diabetic foot care. The factor of forgetting to take medication is a vital factor to consider regarding self-care management in patients with diabetes mellitus because taking medication every day is a real inconvenience for some patients (Wang, Bian and Mo, 2013).

**Conclusion**

This research provides evidence that the DSMQ is an efficient assessment instrument for self-management in diabetic patients. Adherence and consistency to diabetes medication should always be done. Along with the help from clinicians and every healthcare providing education about the importance of self-management in diabetes control. This study was only conducted in one city, which cannot represent the entire population. In addition, the assessment of self-care behavior is only based on self-report by the respondents. As such, data may be affected by bias arising from overreporting or underreporting.

**References**

Adu, M.D., Malabu, U.H., Malau-Aduli, A.E.O., & Malau-Aduli, B.S., 2019. Enablers and Barriers to Effective Diabetes Self-Management: A Multi-National Investigation. *PLoS ONE*, 14(6), pp.1–22.

Al-Qahtani, A.M., 2020. Frequency and Factors Associated with Inadequate Self-Care Behaviors in Patients with Type 2 Diabetes Mellitus in Najran, Saudi Arabia. *Saudi Medical Journal*, 41(9), pp.955–964.

Amir, H., & Munir, N.W., 2021. Effect of Health Education on Improving the Knowledge among Diabetes Mellitus Patients in the Prevention of Diabetic Ulcer in Regional Hospital of Tidore Island. *International Journal of Nursing and Health Services (IJNHS)*, 4(4), pp.379–384.

Bhagyalaxmi, A., Atul, T., & Shikha, J., 2013. Prevalence of Risk Factors of Non-Communicable Diseases in a District of Gujarat, India. *Journal of Health, Population and Nutrition*, 31(1), pp.78–85.

Carmienke, S., Baumert, J., Gabrys, L., Heise, M., Frese, T., Heidemann, C., & Fink, A., 2020. Participation in Structured Diabetes Mellitus Self-Management Education Program and Association with Lifestyle Behavior: Results from a Population-Based Study. *BMJ Open Diabetes Research and Care*, 8(1), pp.1–10.

Chentli, F., Azzoug, S., & Mahgoun, S., 2015. Diabetes Mellitus in Elderly. *Indian Journal of Endocrinology and Metabolism*, 19(6), pp.744–752.

Chowdhury, S., & Chakraborty, P., 2017. Universal Health Coverage - There is More to It Than Meets the Eye. *Journal of Family Medicine and Primary Care*, 6(2), pp.169–170.

Galicia-Garcia, U., Benito-Vicente, A., Jebari, S., Larrea-Sebal, A., Siddiqi, H., Uribe, K.B., Ostolaza, H., & Martín, C., 2020. Pathophysiology of Type 2 Diabetes Mellitus. *International Journal of Molecular Sciences*, 21(17), pp.1–34.

Gemeda, S.T., & Woldemariam, Z.B., 2022. Assessment of Self-Care Practice Amongst Patients with Type II Diabetes Attending Adama Hospital Medical College, Ethiopia. *BMC Endocrine Disorders*, 22(1), pp.1–10.

González, R., Pedro, T., Martinez-Hervas, S., Civera, M., Priego, M.A., Catalá, M., Chaves, F.J., Ascaso, J.F., Carmena, R., & Real, J.T., 2012. Plasma Homocysteine Levels are Independently Associated with the Severity of Peripheral Polyneuropathy in Type 2 Diabetic Subjects. *Journal of the Peripheral Nervous System*, 17(2), pp.191–196.

Isroin, L., 2019. The Acceptance and the Development of Renal Function of People with Diabetes Mellitus. *Jurnal Kesehatan Masyarakat,* 14(3), pp.419–425.

Jahangir, F., Kavi, E., Masmouei, B., Bazrafshan, M., Delam, H., Shokrpour, N., Namjoonasab,

M., Foruozandeh, H., & Zarei, E., 2020. Self-Management Status in Patients with Diabetes and Disease Control Indicators in Lamerd City, Iran. *Jundishapur Journal of Chronic Disease Care*, 9(2).

Jin, Y., Zhu, W., Yuan, B., & Meng, Q., 2017. Impact of Health Workforce Availability on Health Care Seeking Behavior of Patients with Diabetes Mellitus in China. *International Journal for Equity in Health*, 16(1), pp.1–10.

Jutterström, L., Hörnsten, Å., Sandström, H., Stenlund, H., & Isaksson, U., 2016. Nurse-led Patient-Centered Self-Management Support Improves HbA1c in Patients with Type 2 Diabetes-A Randomized Study. *Patient Education and Counseling*, 99(11), pp.1821–1829.

Kamillah, S., Panduragan, L.S., Poddar, S., & Abdullah, B.F., 2022. Patients Experiences in Using Diabetes Self-Management Application: a Scoping Review. *Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)*, 17(1), pp.67–73.

Kautzky-Willer, A., Harreiter, J., & Pacini, G., 2016. Sex and Gender Differences in Risk, Pathophysiology and Complications of Type 2 Diabetes Mellitus. *Endocrine Reviews*, 37(3), pp.278–316.

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

Kuate-Tegueu, C., Temfack, E., Ngankou, S., Doumbe, J., Djientcheu, V.P., & Kengne, A.P., 2015. Prevalence and Determinants of Diabetic Polyneuropathy in a Sub-Saharan African Referral Hospital. *Journal of the Neurological Sciences*, 355(1–2).

Ligita, T., Wicking, K., Francis, K., Harvey, N., & Nurjannah, I., 2019. How People Living with Diabetes in Indonesia Learn About Their Disease: A Grounded Theory Study. *PLoS ONE*, 14(2), pp.1–19.

Mahdalena., & Ningsih, E.S.P., 2016. Effectivity of Foot Care Education Program in Improving Knowledge, Self-Efficacy and Foot Care Behavior Among Diabetes Mellitus Patients in Banjarbaru, Indonesia. *Kesmas*, 11(2), pp.56–60.

Musaiger, A.O., & Al-Hazzaa, H.M., 2012. Prevalence and Risk Factors Associated with Nutrition-Related Noncommunicable Diseases in the Eastern Mediterranean Region. *International Journal of General Medicine*, 5, pp.199–217.

Nakhaeizadeh, M., & Khalooei, A., 2021. Psychometric Properties of the Persian Version of the Diabetes Self-Management Questionnaire for Patients with Type 2 Diabetes in Iran. *International Journal of Preventive Medicine*, 12(120), pp.1–7.

Oktora, S.I., & Butar, D.B., 2022. Determinants of Diabetes Mellitus Prevalence in Indonesia. *Jurnal Kesehatan Masyarakat*, 18(2).

Pamungkas, R.A., Chamroonsawasdi, K., Charupoonphol, P., & Vatanasomboon, P., 2021. A Health-Based Coaching Program for Diabetes Self-Management (DSM) Practice: A Sequential Exploratory Mixed-Method Approach. *Endocrinologia, Diabetes y Nutricion,* 68(7), pp.489–500.

Pop-Busui, R., Boulton, A.J.M., Feldman, E.L., Bril, V., Freeman, R., Malik, R.A., Sosenko, J.M., & Ziegler, D., 2017. Diabetic Neuropathy: A Position Statement by the American Diabetes Association. *Diabetes Care*, 40(1), pp.136–154.

Pranata, A., Mudatsir., & Jannah, S.R., 2021. Diabetes Distress in Patients with Type 2 Diabetes Mellitus of the Aceh Tamiang Regional Hospital. *EAS Journal of Nursing and Midwifery*, 3(6), pp.294–297.

Ratih, P.F., Solikah, T.A., Nasirochmi, D., & Dilma'aarij., 2022. The Affecting Factors of Compliance Diabetes Mellitus Treatment of Type 2 in Pandemic Era. *Jurnal Kesehatan Masyarakat*, 4, pp.574–582.

Rooney, M.R., Rawlings, A.M., Pankow, J.S., Tcheugui, J.B.E., Coresh, J., Sharrett, A.R., & Selvin, E., 2021. Risk of Progression to Diabetes among Older Adults with Prediabetes. *JAMA Internal Medicine*, 181(4), pp.511–519.

Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., Colagiuri, S., Guariguata, L., Motala, A.A., Ogurtsova, K., Shaw, J.E., Bright, D., & Williams, R., 2019. Global and Regional Diabetes Prevalence Estimates for 2019 and Projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th Edition. *Diabetes Research and Clinical Practice,* 157, pp.107843.

Schmitt, A., Gahr, A., Hermanns, N., Kulzer, B., Huber, J., & Haak, T., 2013. The Diabetes Self-Management Questionnaire (DSMQ): Development and Evaluation of an Instrument to Assess Diabetes Self-Care

Activities Associated with Glycaemic Control. *Health and Quality of Life Outcomes*, 11(1).

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 Reducedglycaemic Control. *PLoS ONE,* 11(3), pp.1–12.

Takele, G.M., Weharei, M.A., Kidanu, H.T.M., Gebrekidan,K.G., & Gebregiorgis, B.G., 2021. Diabetes Self-Care Practice and Associated Factors Among Type 2 Diabetic Patients in Public Hospitals of Tigray Regional State, Ethiopia: A Multicenter Study. *PLoS ONE*, 16, pp.1–11.

Todkar, S., 2016. Diabetes Mellitus the &#145;Silent Killer' of Mankind: An Overview on the Eve of World Health Day!. *Journal of Medical and Allied Sciences,* 6(1), pp.39.

Trisnadewi, N.W., Adiputra, I.M.S., Oktaviani, N.P.W., Suapriyanti, P.A., & Saraswati, N.L.G.I., 2020. Correlation between Stress Level and Family Support Towards Fasting and Postprandial Glucose Level in Type 2 Diabetes Mellitus. *Bali Medical Journal,* 9(3), pp.811–815.

Uly, N., Fadli, F., & Iskandar, R., 2022. Relationship between Self-Care Behavior and Diabetes Self-Management Education in Patients with Diabetes Mellitus Type 2. *Macedonian Journal of Medical Sciences*, 10(E), pp.1648–1651.

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), pp.1–9.

Wang, J., Bian, R.W., & Mo, Y.Z., 2013. Validation of the Chinese Version of the Eight-Item Morisky Medication Adherence Scale in Patients with Type 2 Diabetes Mellitus. *Journal of Clinical Gerontology and Geriatrics*, 4(4), pp.119–122.

Zareipour, M., Abdolkarimi, M., Valizadeh, R., Mahmoodi, H., Khazir, Z., & Ghojogh, M.G., 2016. Perceived Stress and Its Relationship with Spiritual Health in Patients with Diabetes in the City of Urmia, Iran. *Bioscience Biotechnology Research Communications*, 9(4), pp.750–755.