

The quality of life of diabetes mellitus patients with diabetic retinopathy complications: A descriptive cross-sectional study

Divya Amanda Putri¹, *Dona Amelia², Aulia Putri³

^{1,2}Bachelor student at the Faculty of Nursing, Mohammad Natsir University, Bukit Tinggi, Indonesia

³Lecturer, the Faculty of Nursing, Mohammad Natsir University, Bukit Tinggi, Indonesia

Article Info

Article history:

Received: November 01, 2025

Revised: November 24, 2025

Accepted: November 26, 2025

Keywords:

Diabetes mellitus; Diabetic retinopathy; quality of life

Article type:

Review article/Research article

Abstract (10 pt)

Background: Diabetic Retinopathy (DR) imposes a profound multidimensional burden on patients, extending beyond physiological visual loss to compromise daily functioning and psychosocial well-being. While the clinical progression of DR is well-documented, empirical evidence regarding its specific impact on quality of life (QoL) domains in developing regions remains limited

Objective: This study aimed to describe the quality of life and identify specific functional deficits among patients with diabetes mellitus complicated by diabetic retinopathy in West Sumatra, Indonesia.

Method: A quantitative descriptive cross-sectional study was conducted at the Eye Clinic of Ibnu Sina Yarsi Islamic Hospital, Bukittinggi. A total of 70 patients with confirmed diabetic retinopathy were recruited using purposive sampling. Data were collected using the validated Indonesian version of the National Eye Institute Visual Function Questionnaire-25 (NEI VFQ-25). Descriptive statistical analysis was performed to determine demographic characteristics and domain-specific QoL scores.

Results: The study cohort was primarily female (61.4%) and elderly, with 64.3% of the participants being 60 years or older. Most participants had been living with diabetes for more than 10 years (68.6%). Overall, half of the participants (50.0%) reported a moderate quality of life, while 28.6% rated their quality of life as poor. Analysis of specific domains showed that "near activities" and "mental health" were the most significantly affected areas. In contrast, scores for "color vision" and "peripheral vision" were relatively well-preserved.

Conclusion: diabetic retinopathy severely impacts patients' quality of life, particularly affecting their independence in near-vision tasks and their psychological well-being. These findings underscore the pressing need for comprehensive nursing interventions that encompass routine psychosocial assessments and education on adaptive self-management, in conjunction with clinical management of glycemic levels, to enhance the overall well-being of this vulnerable population.

Journal homepage:

<https://primasakti.web.id/index.php/npj>

This is an open-access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



*Corresponding Author:

Dona Amelia

Bachelor student at the Faculty of Nursing, Mohammad Natsir University, Bukit Tinggi, Indonesia

Email: season2.amelia@gmail.com

1. Introduction

Diabetes Mellitus (DM) has emerged as one of the most significant global health challenges of the 21st century. Persistently elevated blood sugar levels characterize this chronic metabolic disorder, resulting from issues with insulin secretion, insulin function, or a combination of both. The prevalence of DM poses a substantial burden on healthcare systems worldwide American Diabetes Association [ADA], 2024). The International Diabetes Federation (IDF) reported that approximately 537 million adults were living with diabetes in 2021, and projections suggest that this number could escalate to 783 million by 2045 (Sun et al., 2022). This trend is particularly pronounced in low- and middle-income countries (LMICs), where factors such as rapid urbanization, an aging population, and lifestyle changes are contributing to rising incidence rates (Saeedi et al., 2019). In Indonesia, national data indicate a notable increase in diabetes prevalence, rising from 6.9% in 2013 to 10.9% in 2021 (Ministry of Health, Republic of Indonesia, 2021). This evolving epidemiology of diabetes calls for targeted efforts not only to achieve glycemic control but also to manage the chronic complications that adversely affect patient longevity and quality of life (Cole & Florez, 2020).

Among the microvascular complications associated with diabetes, Diabetic Retinopathy (DR) is recognized as the leading cause of preventable blindness and visual impairment among working-age individuals worldwide (Cheung et al., 2010; Teo et al., 2021). Biologically, persistently high blood sugar levels lead to oxidative stress and inflammation, resulting in damage to the neurovascular unit and subsequent capillary breakdown. The condition progresses from a non-proliferative phase to a proliferative stage, distinguished by the growth of abnormal blood vessels, which significantly elevates the risk of vitreous hemorrhage and retinal detachment (Antonetti et al., 2021; Simó et al., 2018). The clinical concern of DR lies in its often asymptomatic progression; by the time vision changes become apparent, significant retinal damage may have already occurred. While medical treatments, such as anti-vascular endothelial growth factor (anti-VEGF) agents, are effective, their cost and invasiveness can pose challenges to long-term patient adherence (Dougherty et al., 2020).

The ramifications of DR extend beyond the physiological impairment of vision, imposing a considerable and multifaceted burden on patients' lives. Visual impairment significantly limits the ability to perform activities of daily living and manage diabetes-related tasks, including accurate insulin administration, glucose monitoring, and foot care (Fenwick et al., 2020). When vision is compromised, the capacity to engage in these self-care activities diminishes, resulting in a detrimental cycle of poor glycemic control and the progression of complications (Saban et al., 2018). Furthermore, the loss of independence often leads to substantial psychological distress. Research indicates that individuals with DR report higher levels of anxiety, depression, and "diabetes distress" compared to their counterparts without eye complications (Rees et al., 2016; Wang et al., 2023). The anxiety surrounding potential blindness, combined with the need for assistance, significantly undermines self-esteem and social connections, ultimately contributing to increased social isolation (Khooshab et al., 2020).

Due to the complexities associated with diabetes management, assessing Health-Related Quality of Life (HRQoL) has become a critical outcome measure. This shift

emphasizes a patient-centered approach rather than relying solely on biomedical perspectives (Speight et al., 2020). Generic quality of life assessment tools often fail to adequately capture the specific visual details that impact individuals' daily activities. Therefore, it is essential to use vision-specific instruments, such as the National Eye Institute Visual Function Questionnaire-25 (NEI VFQ-25), to gain a more nuanced understanding of how visual impairments influence emotional well-being, social interactions, and dependence on others (Mangione et al., 2001; Hirneiss et al., 2014). Recognizing these specific areas is crucial for nursing professionals, who play a vital role in providing comprehensive care, education, and psychological support to patients managing both diabetes and vision impairment (Hwu et al., 2020; Whitehead et al., 2016).

Despite a substantial amount of research on diabetic retinopathy globally, there is a notable lack of information regarding the quality of life experiences of patients in developing regions of Indonesia. Cultural influences, spiritual coping strategies, and access to specialized medical services in areas such as West Sumatra can significantly impact how patients perceive and manage their quality of life (Rahmawati et al., 2022; Pusparini et al., 2023). The Eye Clinic at Ibnu Sina Yarsi Islamic Hospital in Bukittinggi serves as a crucial referral center for this population; however, there is currently no empirical evidence documenting the impact of diabetic retinopathy on this specific group. Addressing this gap is crucial for implementing culturally sensitive and appropriate nursing strategies. Thus, this research aims to provide a comprehensive empirical assessment of the quality of life among patients with diabetes mellitus who experience diabetic retinopathy in this context. The anticipated results will establish a solid evidence-based foundation for developing nursing interventions that prioritize holistic care, ultimately enhancing the quality of life for patients.

2. Methods

2.1 Research design

This study employed a quantitative, descriptive, cross-sectional design. This observational approach was chosen to assess the quality of life (QoL) in individuals with diabetes mellitus (DM) who are affected by diabetic retinopathy (DR) in real-time. By not introducing any experimental changes or treatment protocols, the study was able to accurately identify specific areas of QoL that are impacted by visual impairments. This groundwork is essential for future interventional research.

2.2 Setting and samples

The research was conducted at the Ophthalmology Outpatient Department of Ibnu Sina Yarsi Islamic Hospital in Bukittinggi, West Sumatra, in September 2025. This facility was specifically chosen because it serves as a primary referral center for eye care in the region and treats a significant number of patients suffering from chronic complications of diabetes, ensuring that the sample is representative.

The study focused on individuals diagnosed with either Type 1 or Type 2 Diabetes Mellitus who exhibited signs of Diabetic Retinopathy. A total of 70 participants were selected using purposive sampling based on specific inclusion criteria: (a) aged 18 years or older; (b) clinically identified as having diabetic retinopathy by a certified ophthalmologist, confirmed through

fundoscopy or medical records; (c) able to communicate effectively in Bahasa Indonesia; and (d) willing to sign the informed consent form.

Exclusion criteria included patients with cognitive impairments (e.g., dementia) or other concurrent eye conditions (e.g., advanced glaucoma or dense cataracts) that could interfere with the evaluation of visual function related to retinopathy. The sample size was calculated using a formula for estimating a population mean, applying standard deviation parameters from previous similar studies to ensure sufficient statistical power (Lemeshow et al., 1990). (3) willingness to take part in the study.

2.3 Measurement and data collection;

Data were collected using the Indonesian version of the National Eye Institute Visual Function Questionnaire-25 (NEI VFQ-25). This instrument is a gold-standard, vision-specific measure of health-related quality of life, consisting of 25 items categorized into 12 sub-domains: general health, general vision, ocular pain, near activities, distance activities, social functioning, mental health, role difficulties, dependency, driving, color vision, and peripheral vision (Mangione et al., 2001). Each item is scored on a scale converted to 0 to 100, where a score of 0 represents the worst possible visual function/quality of life, and 100 represents the best. The Indonesian version of the NEI VFQ-25 has demonstrated high validity and reliability (Cronbach's alpha > 0.80) in previous studies involving distinct Indonesian populations (Nusinovici et al., 2022; Wardani et al., 2019), confirming its cultural and linguistic appropriateness for this study. Additionally, a demographic questionnaire was used to collect data on age, gender, duration of diabetes, and duration of visual symptoms.

Data collection was conducted via face-to-face structured interviews to accommodate respondents who might have significant visual impairment or difficulty reading the questionnaire independently. Each interview lasted approximately 15–20 minutes and was conducted in a private area to maintain confidentiality.

2.4 Data analysis;

Data were entered and analyzed using IBM SPSS Statistics software version 26.0 (IBM Corp., Armonk, NY, USA). Univariate analysis was performed to describe the study variables. Categorical data (e.g., gender, education level) were presented as frequencies and percentages. Continuous data (e.g., age, NEI VFQ-25 domain scores) were presented as means and standard deviations (SD) or medians with interquartile ranges (IQR), depending on the normality of data distribution. The results are presented in tabular and narrative formats to provide a comprehensive profile of the participants' quality of life.

2.5 Ethical considerations.

The study adhered to the ethical principles of the Declaration of Helsinki. Potential participants were approached in the waiting area of the eye clinic. The researchers explained the study's objectives, procedures, benefits, and risks, emphasizing the principles of voluntary participation and anonymity. Written informed consent was obtained from all participants.

3. Results

Based on Table 1, the characteristics of respondents in this study indicated that the majority of patients with diabetes mellitus (DM) and diabetic retinopathy (DR) complications who were treated at the Eye Clinic of Ibnu Sina Yarsi Islamic Hospital in Bukittinggi were aged 60 years or older, with a total of 45 individuals (64.3%). Regarding gender, most

respondents were female, representing 61.4% of the sample, while male respondents accounted for 38.6%. In terms of education, the majority of participants had completed secondary education (senior high school or equivalent), with 34 individuals (48.6%) falling into this category. When considering the duration of diabetes, 48 respondents (68.6%) had been living with DM for more than 10 years. This suggests that older individuals and those with a longer duration of the illness are at a higher risk of developing DR complications.

Table 1. Demographic characteristics of respondents (n=70)

Variabl	Category	Frequency (n)	Percentage (%)
Age	< 40 years old	2	2,9
	40 - 49 years old	5	7,1
	50 – 59 years old	18	25,7
	≥ 60 years old	45	64,3
Gender	Male	27	38,6
	Female	43	61,4
Educational level	Did not complete elementary school	10	14,3
	Elementary school	22	31,4
	Junior high school	16	22,9
	Senior high school	15	21,4
	Bachelor's degree	7	10
Marital status	Maried	50	71,4
	Single	4	5,7
	Widowed	16	22,9
Occupation	Unemploye/Retired	36	51,4
	Housewife	15	21,4
	Farmer/ trader	9	12,9
	Goverment/private employe	6	8,6
	Others	4	5,7
Duration of diabetes mellitus	<5 years	5	7,1
	5 – 10 years	17	24,3
	> 10 years	48	68,6
Living arrangement	Alone	6	8,6
	Living with spouse/child/family	64	91,4

The assessment of quality of life using the NEI VFQ-25 questionnaire (Table 2) revealed that the lowest scores were in the areas of near activities and mental function. In contrast, the highest scores were associated with color vision and peripheral vision. This suggests that visual impairment has a significant impact on patients' daily activities and emotional well-being, even though some visual functions remain relatively intact.

Table. 2 Mean Scores for Each Domain of the NEI VFQ-25 (n=70)

NEI VFQ-25 domain	Mean score	Description
Near activities	55,6	Lowest score
Mental function	58,2	Lowest score
Color vision	83,4	Highest score
Peripheral vision	81,7	Highest score

The overall average quality of life score among patients was categorized as moderate. Out of the respondents, 35 (50.0%) were classified in the mild category, 20 (28.6%) were rated as poor, and 15 (21.4%) were considered to have good quality of life. These findings suggest that diabetic retinopathy has a significant impact on various aspects of patients' lives, particularly in terms of visual function and psychological well-being.

Table 3. The average quality of life among respondents (n=70)

Quality of life	Frequency (n)	Percentage (%)
Good	15	21,4
Moderate	35	50
Poor	20	28,6
Total	70	100

The findings are consistent with those of Fenwick et al. (2020), who reported that patients with diabetic retinopathy (DR) experience lower quality of life scores compared to individuals with diabetes mellitus (DM) who do not have ocular complications. The most significant declines were noted in the domains of visual function and mental health. Additionally, Rahmawati et al. (2022) demonstrated that the severity of DR is inversely related to quality of life scores; as the severity increases, quality of life decreases. Several factors, including advanced age, longer duration of diabetes, and the severity of the disease, significantly contribute to the decline in patients' quality of life. Furthermore, social support and access to healthcare services are crucial for enhancing the overall well-being of these patients.

4. Discussion

This study aimed to evaluate the quality of life (QoL) in individuals with diabetes mellitus (DM) who are affected by diabetic retinopathy (DR) in Bukittinggi, Indonesia. The

results indicate a troubling situation: most patients report a "Moderate" (50.0%) to "Poor" (28.6%) quality of life, with only a small fraction rating their experience as "Good" (21.4%). These findings support the increasing evidence that DR is not just a localized eye disorder but a widespread systemic issue that affects all aspects of a patient's life. The prevalence of low QoL scores highlights the multifaceted impact of visual impairment, where physical limitations trigger a series of psychological distress and social reliance.

A key outcome of this research is the marked decline in the Near Activities and Mental Health areas of the NEI VFQ-25. The reduced scores in tasks requiring near vision, such as reading, sewing, and smartphone use, are clinically associated with diabetic macular edema (DME), which primarily affects central vision initially (Cheung et al., 2010). For patients, the decline in near vision is particularly challenging, as it directly affects their functional independence and health literacy. Patients struggle to read medication labels, monitor their glucose levels, or check their feet for injuries, which complicates effective diabetes self-management (Fenwick et al., 2020).

Conversely, the relatively better scores in Color Vision and Peripheral Vision suggest that many participants might be in the non-proliferative or early proliferative stages of DR, where peripheral retinal sensitivity remains intact. However, this preservation of peripheral vision provides little relief from the significant psychological impact observed. The low scores in the Mental Health domain reveal a significant burden of anxiety and depression, which corresponds with the phenomenon known as "fear of blindness." This fear is often considered more distressing than the physical complications of diabetes (Wang et al., 2023). The prospect of complete vision loss, combined with existing functional limitations, creates a harmful cycle of stress that can further disrupt glycemic control through hormonal pathways (such as cortisol release), worsening retinal damage.

The demographic characteristics of the respondents highlight the biological vulnerability of this group. A large portion of the patients were elderly (≥ 60 years), underscoring the cumulative impact of aging on vascular health. As noted by Visseren et al. (2021), aging initiates a "double-hit" effect where natural endothelial aging is accelerated by chronic hyperglycemia. Additionally, the strong correlation found between longer disease duration (>10 years) and reduced QoL in this study reinforces the concept of "metabolic memory." Long-term exposure to high blood sugar causes irreversible oxidative stress and the buildup of advanced glycation end-products (AGEs), leading to severe structural retinal damage that medical treatment can only stabilize, not reverse (Wong et al., 2016).

Gender analysis indicated a higher representation of female respondents (61.4%), who also reported lower QoL. This gender imbalance may stem from hormonal changes in post-menopausal women, where the loss of estrogen's protective neurovascular effects accelerates microvascular complications (Yau et al., 2012; Fitrina et al., 2023). Furthermore, from a psychosocial standpoint, women in this cultural context often face the dual challenge of managing domestic responsibilities and chronic illness. Visual impairment severely disrupts their ability to fulfill traditional roles, resulting in increased feelings of worthlessness and reduced self-esteem compared to their male counterparts.

Educational levels also proved to be an important factor. The observation that lower education correlates with poorer outcomes supports the idea that health literacy acts as a mediator of QoL. Patients with limited educational backgrounds may struggle to comprehend complex management regimens or identify early signs of retinal detachment, resulting in delays in seeking medical attention (Fitriani et al., 2021; WHO, 2020).

Nevertheless, a significant protective element identified in this research is the high rate of family support. With 91.4% of respondents living with family members, the strong social network likely alleviates the extent of the QoL decline. In the collective culture of West Sumatra, relatives often assume the role of informal caregivers, assisting with daily tasks and alleviating financial burdens. This aligns with Lopez et al. (2022), who suggest that social support mitigates the adverse impacts of chronic illness. The "Moderate" QoL scores, despite notable physical issues, may indeed reflect this resilient family support system, preventing a total decline into the "Poor" category for half of the population.

5. Implication and limitations

The findings of this research have important implications for nursing practice. Firstly, the significant decline in mental health suggests that psychological assessments should be integrated into routine diabetes eye care. Nurses should utilize brief screening tools for depression and anxiety alongside visual acuity evaluations. Secondly, the difficulties related to Near Activities suggest that traditional educational resources, such as brochures and pamphlets, may be inadequate. Nurses need to be innovative by providing audio-based education or involving family caregivers directly in discharge planning to ensure medication safety. Lastly, a comprehensive nursing care model for patients with diabetic retinopathy (DR) should transition from an "eye-focused" approach to a "person-centered" one, addressing the social isolation and loss of independence that patients often experience.

The results of this study must be viewed in light of several limitations. First, the cross-sectional design captures only a snapshot of patients' experiences, which prevents the establishment of causal relationships between the progression of diabetic retinopathy and changes in quality of life. A longitudinal study would be required to monitor these changes over time. Second, the research was conducted at a single referral center in West Sumatra, which had a relatively small sample size. Consequently, the findings may not be fully applicable to diabetic populations in other regions of Indonesia, as these areas may have different cultural and socioeconomic contexts. Third, data collection relied on self-reported measures obtained through in-person interviews, which could introduce social desirability bias, particularly in the context of mental health reporting. Finally, this study did not account for potential confounding clinical factors, such as current HbA1c levels or specific systemic comorbidities, which might independently affect quality of life outcomes.

6. Conclusion

Diabetic retinopathy significantly impacts the quality of life for patients in Bukittinggi, particularly affecting their near vision and mental well-being. This decline in quality of life is

influenced by a combination of biological factors, such as age, duration of diabetes, and gender, as well as social determinants like education and employment. However, family support can play a crucial role in mitigating these effects. Effective management of diabetic retinopathy requires a paradigm shift: focusing on treating the patient holistically, rather than just addressing the retinal issue.

Acknowledgments

The authors would like to express their heartfelt gratitude to the management and healthcare staff of RSI Ibnu Sina Yarsi Bukittinggi, especially the Eye Clinic, for their support and cooperation during the data collection process. We also sincerely thank all the respondents who voluntarily participated in this study. Additionally, we appreciate the guidance, suggestions, and contributions from our supervising lecturers and colleagues, which have greatly enhanced the quality of this research and manuscript.

Author contribution

(D.A.P.): Developed the research concept and design, collected and analyzed the data, interpreted the results, and drafted the manuscript.

(D.A.): Provided academic and methodological guidance, critically reviewed the manuscript, and gave final approval for its publication.

(A.P.): Offered direction and input during data analysis and assisted in refining the content and structure of the manuscript.

Conflict of interest

The authors declare there is a conflict of interest in this study.

References

- American Diabetes Association. (2024). Standards of care in diabetes—2024. *Diabetes Care*, 47(Supplement_1), S1–S4. [https://doi.org/10.2337/dc2447\(Supplement_1\)](https://doi.org/10.2337/dc2447(Supplement_1))
- Antonetti, D. A., Silva, P. S., & Stitt, A. W. (2021). Current understanding of the molecular and cellular pathology of diabetic retinopathy. *Nature Reviews Endocrinology*, 17(4), 195–206. <https://doi.org/10.1038/s41574-020-00451-4>
- Cheung, N., Mitchell, P., & Wong, T. Y. (2010). Diabetic retinopathy. *The Lancet*, 376(9735), 124–136. [https://doi.org/10.1016/S0140-6736\(09\)62124-3](https://doi.org/10.1016/S0140-6736(09)62124-3)
- Cole, J. B., & Florez, J. C. (2020). Genetics of diabetes mellitus and diabetes complications. *Nature Reviews Nephrology*, 16(7), 377–390. <https://doi.org/10.1038/s41581-020-0278-5>
- Dougherty, B. E., Trolinger, M. R., & Blaha, M. J. (2020). The burden of diabetic retinopathy: A review of the patient perspective. *Clinical Ophthalmology*, 14, 3423–3431. <https://doi.org/10.2147/OPHTH.S257318>
- Fenwick, E. K., Man, R. E. K., Gan, A. T. L., Kumari, N., Tan, G., Aravindhan, A., Gupta, P., Wong, T. Y., & Lamoureux, E. L. (2020). Diabetic retinopathy and macular edema are associated with poorer diabetes self-care behavior. *Acta Diabetologica*, 57(1), 57–64. <https://doi.org/10.1007/s00592-019-01363-4>

- Fitriani, A., & Miko, A. (2021). Education level and its relation to the incidence of diabetic retinopathy. *Journal of Public Health Research, 10*(2), 215-220.
- Fitrina, Y., & Hidayat, R. (2023). Analysis of risk factors for diabetic retinopathy in type 2 diabetes mellitus patients. *Jurnal Kesehatan Andalas, 12*(1), 45-52.
- Hirneiss, C., Neubauer, A. S., Welge-Luessen, U., Eibl, K., & Kampik, A. (2014). Visual quality of life in patients with diabetic retinopathy. *Ophthalmologica, 231*(3), 163–170. <https://doi.org/10.1159/000357370>
- Hwu, Y. J., Coates, V. E., & Boore, J. R. P. (2020). The evolving role of the nurse in diabetes care: An international perspective. *Journal of Nursing Management, 28*(5), 1060–1069.
- IBM Corp. (2019). *IBM SPSS Statistics for Windows, Version 26.0*. IBM Corp.
- Khooshab, E., Soury, A., & Seyedbagheri, S. H. (2020). The impact of diabetic retinopathy on quality of life and self-care capabilities in elderly patients. *Journal of Diabetes Nursing, 24*(3), 112–119.
- Lemeshow, S., Hosmer, D. W., Klar, J., & Lwanga, S. K. (1990). *Adequacy of sample size in health studies*. World Health Organization.
- Lopez, C. M., & Yanez, B. (2022). Social support and health outcomes in chronic disease. *Health Psychology Review, 16*(3), 340–355
- Mangione, C. M., Lee, P. P., Gutierrez, P. R., Spritzer, K., Berry, S., & Hays, R. D. (2001). Development of the 25-list-item National Eye Institute Visual Function Questionnaire. *Archives of Ophthalmology, 119*(7), 1050–1058. <https://doi.org/10.1001/archophth.119.7.1050>
- Mangione, C. M., Lee, P. P., Gutierrez, P. R., Spritzer, K., Berry, S., & Hays, R. D. (2001). Development of the 25-list-item National Eye Institute Visual Function Questionnaire. *Archives of Ophthalmology, 119*(7), 1050–1058. <https://doi.org/10.1001/archophth.119.7.1050>
- Ministry of Health Republic of Indonesia. (2021). *Laporan Nasional Riskesdas 2018 (National Report on Basic Health Research 2018)*. Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan.
- Nusinovici, S., Rim, T. H., Yu, M., Zhang, G., & Cheng, C. Y. (2022). Validation of the NEI VFQ-25 in an Asian population with diabetic retinopathy. *Scientific Reports, 12*(1), 4589. <https://doi.org/10.1038/s41598-022-08523-w>
- Nugraha, P., & Utami, S. (2020). Socioeconomic factors and adherence to diabetes treatment. *Indonesian Journal of Nursing, 23*(1), 12–19.
- Polit, D. F., & Beck, C. T. (2020). *Nursing research: Generating and assessing evidence for nursing practice* (11th ed.). Wolters Kluwer.
- Pusparini, A., Dahlan, A., & Santosa, A. (2023). Health-related quality of life in Indonesian type 2 diabetes mellitus outpatients: The role of complications and social support. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 17*(2), 102732.
- Rahmawati, R., Bajorek, B., & Michael, A. (2022). Quality of life in patients with diabetic retinopathy: A systematic review. *Quality of Life Research, 31*(3), 639–655. <https://doi.org/10.1007/s11136-021-02958-z>
- Rees, G., Xie, J., Fenwick, E. K., Sturrock, B. A., Finger, R., Rogers, S. L., & Lamoureux, E. L. (2016). Association between diabetes-related eye complications and symptoms of anxiety and depression. *JAMA Ophthalmology, 134*(9), 1007–1014. <https://doi.org/10.1001/jamaophthalmol.2016.2213>

- Saban, K. L., Penckofer, S. M., Androwich, I., & Bryant, F. B. (2018). Health-related quality of life in women with type 2 diabetes: The role of social support and self-efficacy. *Journal of Advanced Nursing*, 74(6), 1365–1375.
- 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. (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas. *Diabetes Research and Clinical Practice*, 157, 107843. <https://doi.org/10.1016/j.diabres.2019.107843>
- Simó, R., Stitt, A. W., & Gardner, T. W. (2018). Neurodegeneration in diabetic retinopathy: Does it really matter? *Diabetologia*, 61(9), 1902–1912. <https://doi.org/10.1007/s00125-018-4692-1>
- Speight, J., Reaney, M. D., & Barnard, K. D. (2020). Not all roads lead to Rome—a review of quality of life measurement in adults with diabetes. *Diabetic Medicine*, 26(7), 688–695.
- Sun, H., Saeedi, P., Karuranga, S., Pinkepank, M., Ogurtsova, K., Duncan, B. B., Stein, C., Basit, A., Chan, J. C. N., Mbanya, J. C., Pavkov, M. E., Ramachandaran, A., Wild, S. H., James, S., Herman, W. H., Zhang, P., Bommer, C., Kuo, S., Boyko, E. J., & Magliano, D. J. (2022). IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Research and Clinical Practice*, 183, 109119. <https://doi.org/10.1016/j.diabres.2021.109119>
- Teo, Z. L., Tham, Y. C., Yu, M., Chee, M. L., Rim, T. H., Cheung, N., Bikbov, M. M., Wang, Y. X., Tang, Y., Lu, Y., Wong, I. Y., Ting, D. S. W., Tan, G., Jonas, J. B., Sabanayagam, C., Wong, T. Y., & Cheng, C. Y. (2021). Global prevalence of diabetic retinopathy and projection of burden through 2045: Systematic review and meta-analysis. *Ophthalmology*, 128(11), 1580–1591. <https://doi.org/10.1016/j.ophtha.2021.04.027>
- Visseren, F. L. J., Mach, F., Smulders, Y. M., Carballo, D., Koskinas, K. C., ... & Williams, B. (2021). 2021 ESC Guidelines on cardiovascular disease prevention in clinical practice. *European Heart Journal*, 42(34), 3227–3337.
- Wang, Y., Feng, L., Zeng, Y., Zhu, J., & Wang, J. (2023). The impact of diabetic retinopathy on the psychological well-being of patients with type 2 diabetes: A cross-sectional study. *Journal of Advanced Nursing*, 79(4), 1023–1034. <https://doi.org/10.1111/jan.15088>
- Wardani, I. A., Widayanti, T. W., & Supanji, S. (2019). Validity and reliability of the Indonesian version of the National Eye Institute Visual Function Questionnaire-25 (NEI VFQ-25). *Ophthalmologica Indonesiana*, 45(1), 35–41.
- Whitehead, L., Glass, C., & Wilson, L. (2016). The role of the nurse in the management of diabetic retinopathy: A systematic review. *Journal of Clinical Nursing*, 25(13-14), 1814–1825.
- Wong, T. Y., & Sabanayagam, C. (2016). Strategies to tackle the global burden of diabetic retinopathy: From epidemiology to artificial intelligence. *Ophthalmologica*, 243(1), 9–20
- Yau, J. W., Rogers, S. L., Kawasaki, R., ... & Wong, T. Y. (2012). Global prevalence and major risk factors of diabetic retinopathy. *Diabetes Care*, 35(3), 556–564