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# ASSESSMENT OF DIABETIC RETINOPATY RISK FACTORS IN TYPE II DIABETES MELLITUS

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**ABSTRACT**
Diabetic retinopathy (DR) is a leading microvascular complication of diabetes mellitus (DM), primarily caused by chronic hyperglycemia. It leads to vascular occlusion, increased vascular permeability, retinal abnormalities, and detachment, ultimately resulting in visual impairment and blindness. Implementing Evidence Based Nursing Practice using diagnostic tests to determine the sensitivity and specificity of the assessment instrument for Diabetic Retinopathy Risk Factors in Type II DM Diagnostic tests are descriptive observational studies with a cross-sectional study design. This application is classified as descriptive observational because only observations are made without any intervention (treatment). The test is carried out with ROC where to see the sensitivity and specificity of the application instrument. The results of the analysis showed that the sensitivity of the application of the assessment of diabetic retinopathy risk factors using the ROC Curve Test was 100%. Meanwhile, the specificity of the instrument for the application of the assessment of diabetic retinopathy risk factors was 81.3%. The application of diabetic retinopathy risk factor assessment can be used to assess the risk of diabetic retinopathy because it has good sensitivity (%) and specificity (%) values. However, when applying the diabetic retinopathy risk factor assessment, only the risk value of diabetic retinopathy was obtained where the application patient did not experience complaints and decreased visual acuity.

Keywords: diabetic retinopathy; risk factor assessment: type II diabetes mellitus

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## INTRODUCTION

Diabetic Retinopathy caused by hyperglycemia in DM. Where hyperglycemia can activate several biochemical processes that will cause occlusion of blood vessels, hyperpermeability of blood vessels, abnormalities, and retinal detachment. This will result in poor blood supply to the retina or direct retinal damage to vision, which ultimately leads to blindness. The incidence of diabetic retinopathy in all populations of diabetes mellitus patients increases with the length of the disease period and the age of the patient(Teo et al., 2021). According to data from the American Academy of Ophthalmology, the incidence of diabetic retinopathy has reached 387 million and is expected to increase to 592 million by 2034(Shukla et al., 2024). In Indonesia, diabetic retinopathy is the second most common complication after diabetic nephropathy, with a prevalence of 43.1%(PERDAMI, 2018).

Early detection in patients is very important to prevent the severity of the disease that can cause blindness. During early detection, the role of personnel in first-level health facilities is very important. Management of diabetic retinopathy includes medication and non-medication. In addition to proper management, control of risk factors in patients also plays an important role in the patient's prognosis (Hana & Hakim, 2023).Risk factors for diabetic retinopathy can be classified into non-modifiable and modifiable factors. Non-modifiable risk factors include age, gender, and duration of diabetes. Modifiable factors include hypertension, dyslipidemia, obesity, nephropathy, and poor glycemic control (Yusran, 2017). Early detection of diabetic retinopathy is very important to prevent visual impairment in DM patients. Therefore, the

author is interested in implementing Evidence Based Nursing Practice in the form of Implementation of Diabetic Retinopathy Risk Factor Assessment in Type II DM at Persahabatan Hospital, The purpose of this application is to identify the application of risk factor assessment for diabetic retinopathy in Type II DM.

## METHOD

Implementing Evidence Based Nursing Practice using diagnostic tests to determine the sensitivity and specificity of the assessment instrument for Diabetic Retinopathy Risk Factors in Type II DM Diagnostic tests are descriptive observational studies with a cross-sectional study design. This application is classified as descriptive observational because only observations are made without any intervention (treatment). The test is carried out with ROC where to see the sensitivity and specificity of the application instrument. Before being utilized for data collection, the electronic patient-reported outcome questionnaire developed in this study underwent a content validity assessment by three experts with professional backgrounds in endocrinology and health research methodology. Each item in the questionnaire was evaluated based on its relevance, clarity, and appropriateness in measuring the risk indicators for diabetic retinopathy (DR), which were previously identified through meta-analysis. The expert review process resulted in a Content Validity Index (CVI) score of 0.92, indicating that the questionnaire possessed excellent content validity. Furthermore, the reliability of the questionnaire was tested on a sample of 20 respondents who shared similar characteristics with the target population, to assess the internal consistency among the items. The reliability analysis using Cronbach's Alpha yielded a value of 0.83, which exceeds the minimum acceptable threshold of 0.70, thus confirming that the questionnaire is reliable and suitable for use in this study's data collection process. Based on these results, the instrument was considered valid and reliable, ensuring that the collected data would be dependable for the validation of the diabetic retinopathy risk prediction model(Zhu et al., 2023)

## RESULT

Tabel 1.
Respondent Characteristics

| Risk Factors | | No risk | | Risk DR | |
|---|---|---|---|---|---|
| | | f | % | f | % |
| Gender | Male | 6 | (37,5) | 10 | (62,5) |
| | Women | 10 | (83,3) | 2 | (16,7) |
| Insulin use | Yes | 6 | (35,3) | 11 | (64,7) |
| | No | 10 | (90,9) | 1 | (9,1) |
| Hypertension | Yes | 7 | (41,2) | 10 | (58,8) |
| | No | 9 | (81,8) | 2 | (18,2) |
| HBA1C | Abnormal | 6 | (35,3) | 11 | (64,7) |
| | Normal | 10 | (90,9) | 1 | (9,1) |

The patient's gender is more at risk of diabetic retinopathy, which is 10 (62.5%). Based on the use of insulin, patients who use insulin are at greater risk of diabetic retinopathy by 11 (64.7%). Based on hypertension, patients who experience hypertension are at greater risk of diabetic retinopathy by 10 (58.8%) and Based on HbA1c, patients who experience greater risk of diabetic retinopathy are patients whose Hb A1C values are not normal by 11 (64.7%)

Tabel 2
Sensitivity and Specificity Assessment Results

| Parameter | % |
|---|---|
| Sensitivity | 100 |
| Specificity | 81,3 |

The results of the analysis showed that the sensitivity of the application of the assessment of diabetic retinopathy risk factors using the ROC Curve Test was 100%. Meanwhile, the specificity of the instrument for the application of the assessment of diabetic retinopathy risk factors was 81.3%.

## DISCUSSION

Diabetic retinopathy is a microvascular complication of DM where chronic, progressive retinal damage occurs and is a major cause of vision loss. Several risk factors are associated with the risk of diabetic retinopathy(Mehraban Far et al., 2022). Many risk factors contribute to DR, such as chronic hyperglycemia, hypertension, dyslipidemia, long-term diabetes, overweight, and age (Jeong & Kang, 2022). The application of EBNP assesses the risk factors for diabetic retinopathy by assessing the risk factors of gender, history of weight loss surgery, myopia, consumption of lipid drugs, intensive blood sugar control, HbA1C, fasting glucose levels, duration of DM, place of residence and smoking history where the risk factors for diabetic retinopathy can affect the occurrence of diabetic retinopathy, where the higher the total value of the risk factors, the greater the risk of diabetic retinopathy, early assessment in preventing further complications(Zhu et al., 2023).

### Gender and Diabetic Retinopathy Risk

Sex is an important factor that can influence the risk of developing diabetic retinopathy (DR). A study involving 16 patients revealed that 10 patients (62.5%) diagnosed with DR were male. This finding highlights that men are at a higher risk of developing diabetic retinopathy compared to women, even after accounting for other variables such as the duration of diabetes and glycemic control. Other studies conducted across different countries support this conclusion, showing that men are more prone to DR complications, which may be influenced by hormonal and metabolic factors that differ between men and women. However, it is important to note that the results of these studies may vary depending on the population studied and other contextual factors, such as age and diabetes duration. Therefore, close monitoring of male patients with diabetes is crucial to prevent the progression of complications like DR, which can lead to blindness if not managed appropriately(Qian et al., 2022).

### Insulin Use and Diabetic Retinopathy

Patients using insulin therapy showed a higher incidence of DR (64.7%). This observation is consistent with studies indicating that insulin use is associated with an increased risk of DR. For example, a study found that insulin therapy was linked to a higher risk of DR development. However, it's important to note that insulin use often reflects longer disease duration and more severe glycemic dysregulation, which are themselves risk factors for DR.
Recent studies have highlighted a significant association between insulin therapy and an increased risk of developing diabetic retinopathy (DR). A comprehensive systematic review and meta-analysis published in the *American Journal of Ophthalmology* in 2024 found that insulin use was consistently linked to a higher risk of DR. This association was evident across various predictive models, suggesting that insulin therapy is a significant predictor of DR development. The study emphasized the importance of considering drug exposure, particularly insulin, in DR risk prediction models, as it consistently improved model performance in both internal and external validations(Bantounou et al., 2024)

Further supporting this, a 2021 study published in *Diabetes Care* examined the incidence of proliferative diabetic retinopathy (PDR) and other neovascular complications over five years following a type 2 diabetes diagnosis. The study found that insulin use was associated with a significantly increased risk of developing PDR, with an odds ratio of 3.59 (95% CI 3.16–4.08). This indicates that patients on insulin therapy were over three times more likely to

develop PDR compared to those not using insulin (Lopez et al., 2022).These findings suggest that while insulin therapy is essential for managing blood glucose levels in diabetes patients, it may also be associated with an elevated risk of DR. Therefore, patients undergoing insulin treatment should be closely monitored for signs of DR, and regular ophthalmologic evaluations should be an integral part of their diabetes management plan.

**Hypertension and Diabetic Retinopathy**

Based on hypertension status, patients who experience hypertension are at greater risk of developing diabetic retinopathy (DR), as demonstrated in this study, where 10 patients (58.8%) diagnosed with DR were also identified as having hypertension. Hypertension has long been recognized as an important risk factor for diabetic microvascular complications, including DR, due to its role in damaging the delicate blood vessels of the retina. Elevated blood pressure exacerbates retinal endothelial dysfunction, increases capillary pressure, and promotes vascular permeability, all of which contribute to the onset and progression of DR(Wondmeneh & Mohammed, 2024).Additionally, a cohort study presented during the American Diabetes Association's 83rd Scientific Sessions in 2023 revealed that the cumulative incidence of DR was significantly higher in hypertensive patients (73%) compared to non-hypertensive patients (49%) during a five-year follow-up, indicating that hypertension intensifies the progression of retinopathy in individuals with type 2 diabetes (HCPLive, 2023). Further, a Mendelian randomization study published in *Frontiers in Endocrinology* (2023) provided strong genetic evidence suggesting a causal relationship between hypertension and the development of DR, reinforcing the need for early intervention and rigorous blood pressure control as part of comprehensive diabetes care(Yang et al., 2022)

**HbA1C and Diabetic Retinopathy**

Based on HbA1c status, patients whose HbA1c values were above the normal threshold showed a higher risk of developing diabetic retinopathy (DR), as indicated by 11 patients (64.7%) in this study. Elevated HbA1c reflects chronic hyperglycemia, which plays a pivotal role in retinal microvascular damage through pathways such as oxidative stress, inflammation, and the accumulation of advanced glycation end products (AGEs). These mechanisms progressively disrupt retinal capillary integrity, leading to diabetic retinopathy.This finding is strongly supported by a population-based study in Shanghai published in 2022, which reported that diabetic patients with HbA1c levels equal to or exceeding 6.5% had a significantly higher risk of developing DR, with an odds ratio of 6.85 (95% CI: 1.77–26.50). This research confirmed that HbA1c is a crucial biomarker for predicting the occurrence of DR, especially when glycemic control is poor(Ma et al., 2022) Similarly, a retrospective analysis conducted at Qassim University Medical City 2024 also demonstrated that higher HbA1c values were significantly associated with advanced stages of DR. The researchers concluded that long-term hyperglycemia, reflected in elevated HbA1c levels, remains a strong modifiable risk factor, and maintaining optimal glycemic control is essential for delaying or preventing the progression of diabetic retinopathy(Alswaina, 2024). where HbA1C is one of the factors that has a value that increased blood glucose levels are directly related to metabolism where polyolefin hexosamine, activation of the diacylglycerol-protein kinase C pathway, and accumulation of AGEs, are involved in the pathophysiology of diabetic retinopathy(Long et al., 2017).

The application of EBNP uses a diabetic retinopathy risk factor assessment instrument that has sensitivity and specificity. Sensitivity and specificity in the assessment instrument greatly affect the accuracy of the diagnosis (Trevethan, 2017). However, when the EBNP instrument is applied, it is sensitive but not specific in assessing the risk value, so that the risk value of diabetic retinopathy is influenced by the risk factor value in the instrument. The risk factors that have values that influence the risk of diabetic retinopathy are gender, insulin use,

hypertension and HBA1C compared to the risk factors in the instrument so that when applied, it is sensitive to assess the factors for diabetic retinopathy. Gender is a factor that influences the magnitude of the risk value of diabetic retinopathy. Several studies have reported a higher risk of diabetic retinopathy among men, showing a prevalence of diabetic retinopathy 50% higher than women(Cherchi et al., 2020)

## CONCLUSION

The application of diabetic retinopathy risk factor assessment can be used to assess the risk of diabetic retinopathy because it has good sensitivity (%) and specificity (%) values. However, when applying the diabetic retinopathy risk factor assessment, only the risk value of diabetic retinopathy was obtained where the application patient did not experience complaints and decreased visual acuity. So this diabetic retinopathy instrument can be recommended for use as a standard instrument in conducting an assessment to assess the risk score of diabetic retinopathy which is influenced by the risk factor value

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