

Identification of Factors Affecting the Incidence of Wounds in Patients with Diabetes Mellitus

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ABSTRACT

Background & Objective: Wounds in patients with diabetes mellitus are a chronic complication that contributes to high rates of amputation, hospitalization, and a reduced quality of life, particularly in patients with a long duration of the disease and peripheral neuropathy. This study aims to identify factors that influence the occurrence of wounds in patients with diabetes mellitus based on the patients' experiences. **Method:** This study used a qualitative design with a descriptive approach. The study population consisted of patients with diabetes mellitus who had wounds on their lower extremities. The sample comprised three women aged 56–60 years who had had diabetes mellitus for 6–10 years and had peripheral neuropathy; they were selected using purposive sampling. Data were collected through semi-structured in-depth interviews using an interview guide as the research instrument. The data were presented in narrative form and analyzed using content analysis to identify key themes related to the factors contributing to wound occurrence. **Result:** The study findings indicate that the duration of diabetes mellitus and the presence of peripheral neuropathy are dominant factors influencing the occurrence of wounds, as the loss of protective sensation causes minor injuries to go unnoticed until they develop into hard-to-heal ulcers. In addition, the lack of routine foot examinations and low understanding of foot care also increase the risk of complications. **Conclusion:** The occurrence of wounds in patients with diabetes mellitus is the result of an interaction between clinical factors and patients' preventive behaviors. Glycemic control, periodic neuropathy screening, and foot care education are important strategies in prevention efforts to reduce the risk of wounds and amputations.

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Introduction

Diabetes Mellitus (DM) is a chronic metabolic disease characterized by increased blood glucose levels due to impaired insulin secretion, insulin action, or both. The American Diabetes Association explains that chronic hyperglycemia in DM plays a role in the occurrence of various long-term complications, including microvascular and macrovascular complications (Elsayed, et al., 2023). One of the most common and serious complications is diabetic foot ulcer, which is tissue damage to the foot associated with peripheral neuropathy and vascular disorders (Dandona & Ghanim, 2021). This wound is chronic, difficult to heal, and at high risk of infection (Liu et al., 2022).

Chronic hyperglycemia that persists over a long period causes oxidative stress and endothelial dysfunction that worsens microcirculation damage, so the inflammatory process becomes prolonged and wound healing is inhibited. In addition, sensory neuropathy causes loss of protective sensation in the feet, so minor trauma is often unnoticed by patients and develops into deeper ulcers (Dawi et al., 2025; Wang et al., 2025).

Diabetic wounds are a significant global health problem. The World Health Organization states that approximately 15-25% of DM patients are at risk of experiencing foot ulcers during their lifetime (WHO, 2022). A global epidemiological study conducted by (Elsayed, et al., 2023) shows that diabetic foot ulcers are the leading cause of non-traumatic amputation worldwide. In addition, the recurrence rate of diabetic wounds remains high despite standard treatment, thereby increasing the burden on health services.

The recurrence rate of diabetic foot ulcers remains high after initial healing. Ulcer recurrence can reach approximately 40% within one to two years, and tends to increase beyond 60% within a period of three to five years. This indicates that diabetic foot ulcers are a chronic condition that often recurs, so comprehensive primary and secondary prevention strategies are needed, such as periodic neuropathy screening, routine foot care education, and optimal glycemetic control (Siepmann et al., 2021).

Globally, the prevalence of DFU reaches 4-10% in the general DM population, with a lifetime risk of 15%, and every 20 seconds a lower extremity amputation occurs due to DM. In Indonesia, which ranks sixth in the world with 10.3 million DM sufferers, the prevalence of diabetic ulcers is around 13-15%, becoming the leading cause of hospital admission (80% of cases) with an amputation rate of 30% and mortality of 32%. In 2020, diabetic ulcer cases increased significantly, with 69% in men and 31% in women, and 85% of amputations starting from foot wounds. The prevalence of diabetic ulcers in Indonesia reaches approximately 15%, with an amputation rate of 30% and mortality of 32%, where this ulcer is the leading cause of hospital admission in up to 80% of cases. In Indonesia, the incidence of diabetic foot ulcers continues to increase, with amputation risk in 14-24% of patients and recurrence up to 50% within three years (Listrikawati et al., 2023; Trisnawati et al., 2023).

Risk factors for wound occurrence in DM patients include advanced age, duration of DM more than 10 years, male sex, history of previous ulcers, obesity, poor glycemic control, neuropathy, peripheral arterial disease (PAD), lack of physical activity, and inadequate foot care. Non-modifiable factors such as age and genetics, as well as modifiable factors such as smoking, trauma, and poor nutritional status, further worsen the risk of wound occurrence (Ginting Liani, 2025; Santoso et al., 2021; Silalahi et al., 2022).

Among these various factors, diabetic peripheral neuropathy is the dominant factor contributing to more than 50% of diabetic foot ulcer cases, especially in patients with DM duration of more than five years (Yoshida et al., 2020).

Wounds in diabetes mellitus patients (diabetic foot ulcers) are serious complications influenced by age, diabetes duration, medication adherence, and other risk factors such as retinopathy, hyperkeratosis, and education level. Research shows that most patients are over 60 years old, experience peripheral neuropathy, and have high risk based on the IWGDF classification. Early detection of these factors is important to prevent diabetic foot wounds and improve patient care outcomes (Bahati et al., 2025; Dee et al., 2020; Zantour et al., 2020).

Routine foot screening using the 10 g monofilament test to assess loss of protective sensation and Ankle Brachial Index (ABI) examination to evaluate the presence of peripheral arterial disease is recommended as a method for early detection of neuropathy and vascular disorders in diabetes mellitus patients. This annual screening effort has been proven effective in reducing the risk of diabetic foot ulcer occurrence by increasing early detection of major risk factors (Zhen et al., 2022).

Wounds in DM patients are caused by the triad of neuropathy (nerve damage causing loss of sensation), ischemia (impaired blood flow due to PAD), and recurrent infection, which inhibit the natural healing process. Chronic high blood sugar levels damage blood vessels and peripheral nerves, causing skin to become dry, cracked, and susceptible to minor trauma that develops into deep ulcers (Babo et al., 2024; Febrianti et al., 2023).

This condition is exacerbated by a decreased immune response in diabetes mellitus patients due to chronic hyperglycemia that disrupts the function of immune cells such as neutrophils, macrophages, and lymphocytes, so the body fails to control bacterial invasion and causes bacterial colonization in wounds, prolonging the inflammatory phase and slowing the healing process of diabetic foot wounds (Meri et al., 2024; Nuryani, 2022).

The occurrence of DM wounds causes hospitalization averaging 14 days, national costs of trillions of rupiah per year, and significant decline in quality of life (SF-36 score <50). The high prevalence is caused by patients' lack of understanding about routine foot care, blood sugar control, and lifestyle modification. Identification of risk factors enables early prevention through annual ABI-monofilament screening, off-loading education, and multifaceted interventions according to PERKENI 2021, although adherence is only 30-40% due to low literacy. Predictive models such as the

PDFU-risk score can reduce incidence by up to 50% (Alimurdianis et al., 2024; Listrikawati et al., 2023; Pitter et al., 2023).

Community-based preventive efforts and structured education have been proven effective in improving foot care behavior and reducing ulcer incidence by 30–50% in high-risk groups (Ferrari et al., 2020).

The high prevalence of DM wounds is caused by patients' lack of understanding about routine foot care, blood sugar control, and lifestyle modification, so preventive interventions such as education and monitoring are needed. Identification of risk factors enables early prevention to reduce amputation and treatment costs (Gumilar, 2025; Santoso et al., 2021).

The prevalence of diabetes mellitus wounds that remains high in Indonesia indicates the need for a more targeted preventive approach based on dominant risk factors. Various factors such as age, sex, duration of DM, and neuropathy are known to play a role in the occurrence of DM wounds. However, peripheral neuropathy is the factor most often associated with wound occurrence because it causes loss of protective sensation in the feet so that minor trauma goes unnoticed and develops into ulcers.

Objective

This study aims to analyze the relationship between age, gender, duration of diabetes, and neuropathy and the incidence of wounds in patients with diabetes mellitus, with a primary focus on the role of neuropathy as the factor most strongly associated with the development of diabetic wounds.

Method

This study is a qualitative study with a descriptive phenomenological design that aims to explore in depth the experiences of patients regarding factors that influence the occurrence of wounds in Diabetes Mellitus. The population in this study was all Diabetes Mellitus patients who had wounds on the lower extremities and were undergoing treatment at the health care facility where the study was conducted. The sampling technique used was purposive sampling, namely the selection of participants based on predetermined inclusion criteria. The inclusion criteria included: patients with a diagnosis of Diabetes Mellitus for at least one year, experiencing wounds on the lower extremities, with or without peripheral neuropathy, able to communicate verbally well, and willing to become participants by signing informed consent. The number of participants in this study was three people, and the recruitment process was stopped after the data reached saturation (data saturation). The study was conducted during a period determined by the researcher and took place at the health care facility where the participants underwent wound care.

The main instrument in this study was the researcher herself, with the assistance of a semi-structured interview guide as a supporting instrument. Data collection was carried out through in-depth interviews and field notes. All interviews were recorded with the consent of the participants and transcribed verbatim to maintain data accuracy. The method of data presentation was carried out in the form of descriptive

narratives containing direct quotations from participants. Data analysis used the Colaizzi phenomenological method, which includes reading transcripts repeatedly, identifying meaningful statements, formulating meanings, grouping them into themes, and compiling a comprehensive description of the factors that influence the occurrence of wounds. Data validity was maintained through member checking techniques and systematic documentation of the research process. This study also obtained ethical approval before the implementation of data collection.

Results

This study was conducted on patients with diabetes mellitus who had lower extremity wounds at the healthcare facility where the study took place. The participants consisted of three women aged 56 (P1), 58 (P2), and 60 (P3), all with a history of diabetes mellitus for more than seven years. P1 had been living with the condition for 10 years, while P2 and P3 had had it for approximately 6 years. All participants had been diagnosed with peripheral neuropathy prior to the onset of the wounds. The locations of the wounds varied, including the right leg, between the toes of the right foot, and the sole of the foot.

TABLE 1. Respondent Characteristics

Variable	N	%
<i>Age</i>		
<60	0	0
56-60	3	100,0
<i>Gender</i>		
Male	0	0
Female	3	100,0
<i>Has Neuropathy</i>		
Yes	0	0
No	3	100,0
<i>Duration of Diabetes</i>		
<7 Years	2	66,7
>7 Years	1	33,3

Based on data analysis using the Colaizzi method, three main themes were identified that influence the occurrence of wounds: the duration of diabetes mellitus, peripheral neuropathy as a predisposing factor, and a lack of early detection and foot care.

The first theme indicates that the duration of diabetes mellitus is a major risk factor. All three participants reported that their blood sugar levels were often unstable before the wounds appeared. P1 stated, "My mother has had diabetes for a long time... sometimes it goes up, sometimes it goes down. I didn't feel anything; before I knew it, she already had a wound..." (P1). P2 stated, "I've had diabetes for over six years... back then, I didn't really watch what I ate; sometimes I still ate sweets. I rarely checked my blood sugar, so it was often high, but I just let it be..." (P2). The duration of diabetes mellitus is significantly associated with the occurrence of diabetic foot ulcers, and adherence to blood sugar control is significantly associated with the risk of diabetic foot ulcers in patients with Type II diabetes mellitus, where patients with poor glycemic control are more likely to develop diabetic foot ulcers compared to patients who adhere to blood sugar control (Irwansyah et al., 2025).

The second theme is peripheral neuropathy as the dominant predisposing factor. All participants reported numbness and tingling before the wounds appeared. P3 stated, "At first, it was just numb... it didn't hurt, and before I knew it, there was a wound..." The loss of protective sensation causes minor injuries to go unnoticed and develop into wounds. This is supported by a study by McMorro et al. (2022), which states that peripheral neuropathy is the strongest risk factor for the development of foot ulcers due to reduced sensitivity to pain and pressure. The study confirms that patients with neuropathy are more likely to experience recurrent wounds.

The third theme relates to the lack of routine foot examinations and low awareness of foot care. P2 stated, "My feet were never really examined; they were just washed as usual..." (P2). P3 said, "I usually don't check my feet every day. If they don't hurt or I have no complaints, I don't really look at them. So sometimes I only realize there's a wound after it's already looking severe..." (P3). Foot care as part of self-care is significantly associated with the incidence of diabetic foot ulcers in patients with diabetes mellitus, where good foot care practices (including daily foot examinations) help reduce the incidence of foot ulcers (Hamim et al., 2025).

Overall, the results of this study indicate that the occurrence of wounds in patients with diabetes mellitus results from an interaction between clinical factors – such as disease duration and peripheral neuropathy – and behavioral factors – such as a lack of early detection and foot care. These findings reinforce the evidence that blood glucose control, periodic neuropathy screening, and foot care education are key strategies in preventing wound-related complications and amputations in patients with diabetes mellitus.

Discussion

Diabetes mellitus is a chronic metabolic disease characterized by chronic hyperglycemia resulting from impaired insulin secretion or action. Prolonged hyperglycemia can damage peripheral nerves and blood vessels, thereby reducing sensitivity in the feet and increasing the risk of wounds in the lower extremities. In addition, ulcers often develop unnoticed due to peripheral neuropathy, which reduces protective sensation in the feet of patients with diabetes mellitus (Hariftyani et al., 2021).

Based on interviews conducted with three respondents, it was found that all respondents were in the late-adult to elderly age range (56–60 years), were female, and had been living with diabetes mellitus for a considerable period – between 6 and 10 years. The interview results indicated that the respondents were aware that the wounds they experienced appeared several years after being diagnosed with diabetes mellitus. Respondent 1 stated, "I've had diabetes for about 10 years; at first, there were no wounds, but in the last few years, wounds have started to appear on my feet." Respondent 2 also said, "I've had diabetes for about 6 years; my feet would often feel tingling before the wounds appeared." A similar experience was shared by Respondent 3, who said, "I've had diabetes for a long time, and the wounds on my feet appeared after I'd been suffering from this disease for a long time."

Poor blood sugar control and a long duration of diabetes mellitus are determining factors associated with the occurrence of diabetic ulcers. In addition, low rates of ulcer risk screening and a lack of early detection through foot examinations –

such as the monofilament test—have also been shown to increase the proportion of patients at risk for diabetic ulcers. Efforts to identify risks early through foot screening are a crucial step in preventing diabetic ulcers (Nistiandani et al., 2023).

The results of this study indicate that the longer a person has had diabetes mellitus, the greater the risk of complications such as neuropathy and diabetic foot ulcers. This aligns with the study by Nasibu & Priasmoro (2025), which states that there is a significant association between the duration of diabetes mellitus and the occurrence of diabetic neuropathy; the longer the duration of the disease, the higher the risk of peripheral nerve damage.

Furthermore, other studies have noted that peripheral neuropathy is a common complication in patients with diabetes mellitus and a major contributing factor to the development of diabetic foot ulcers. Neuropathy causes a decrease in sensitivity, so patients may not realize they have a wound or injury on their foot (Sriyati, 2024).

Diabetic ulcers are one of the chronic complications frequently observed in patients with diabetes mellitus due to impaired blood circulation (macroangiopathy) and peripheral nerve damage (neuropathy). This condition leads to reduced sensitivity in the lower extremities, particularly the feet, so that wounds often go unnoticed by patients and progress into chronic ulcers. In addition, uncontrolled hyperglycemia can inhibit tissue regeneration, increase the risk of infection, and slow wound healing. Clinically, diabetic ulcers are characterized by open wounds that are difficult to heal, the presence of exudate, an unpleasant odor, necrotic tissue, and may be accompanied by pain or, conversely, be painless due to peripheral neuropathy. If not managed optimally, this condition carries the risk of serious complications ranging from osteomyelitis to limb amputation (Bahati et al., 2025; Husen & Basri, 2021; Trisnawati, 2023).

Based on the interview results, all respondents experienced symptoms of neuropathy—such as tingling, numbness, and decreased sensitivity in the feet—before the onset of the injury. Respondent 1 stated, “My feet often tingle and feel numb; sometimes they feel completely numb.” Respondent 2 also said, “At first, my feet often felt like they were being pricked and went numb.” Meanwhile, Respondent 3 remarked, “My feet feel abnormal—numb, and I don’t feel anything when they come into contact with something.”

Peripheral neuropathy and peripheral arterial disease are major risk factors for the development of diabetic ulcers. A study (Dee et al., 2020) showed that more than half of patients with diabetes mellitus have peripheral neuropathy as determined by a 10-gram monofilament test, while the rest have impaired peripheral perfusion as indicated by their ankle-brachial index (ABI) values. Peripheral neuropathy causes a loss of sensation to pain and pressure, while peripheral arterial disease results in reduced oxygen supply to tissues, making wounds difficult to heal and prone to infection.

These findings indicate that diabetic neuropathy is a major factor contributing to diabetic foot ulcers. Neuropathy disrupts sensory nerves, preventing patients from feeling pain when a wound occurs, allowing the wound to progress unnoticed. This aligns with a study by Sriyati (2024), which states that peripheral neuropathy increases

the risk of diabetic foot ulcers by up to 11.2 times compared to patients without neuropathy.

Furthermore, diabetic foot ulcers are complications resulting from nerve damage and impaired blood flow, which make wounds difficult to heal and carry a risk of amputation if not properly managed. Diabetic foot ulcers are commonly found in patients with diabetes mellitus who have poor glycemic control. The majority of patients have had diabetes for more than 10 years and have HbA1c levels above 7%. The duration of the disease and blood glucose control have been shown to significantly influence the incidence of diabetic foot ulcers, whereas age, sex, and nutritional status do not show a significant association. These findings indicate that long-term exposure to hyperglycemia plays a key role in the development of diabetic foot complications (Budiman et al., 2024).

Other factors that contribute to the incidence of diabetic ulcers include structural changes in the feet and suboptimal preventive behaviors. These factors increase the feet's vulnerability to mechanical trauma and slow wound healing, particularly in patients with perfusion and neurosensory disorders (Nistiandani et al., 2023).

These findings align with a study (19) indicating that the duration of diabetes mellitus and obesity are significantly associated with the occurrence of diabetic ulcers. In addition to metabolic factors, patients' level of knowledge regarding diabetes care and the prevention of complications also influences the development of diabetic ulcers. Low knowledge leads to poor adherence to foot care and blood sugar control, thereby increasing the risk of chronic wounds in the lower extremities.

A study (Zantour et al., 2020) reinforces these findings by showing that sensory neuropathy, peripheral artery disease, foot deformities, and a history of ulcers or amputations are major risk factors that increase the severity of diabetic foot ulcers. Patients with a longer duration of diabetes, lower educational levels, and microvascular complications such as retinopathy are at higher risk of developing severe foot ulcers. Therefore, early screening for complications and patient education are crucial steps in the prevention of diabetic foot ulcers.

Based on the interview results, all respondents experienced foot wounds that were slow to heal and persisted for a long time. Respondent 1 stated, "The wound on my foot is slow to heal even though it has been treated." Respondent 2 said, "The wound on my foot takes a long time to heal and sometimes gets bigger." Respondent 3 also remarked, "The wound doesn't heal quickly and sometimes feels worse."

The results of this study indicate that diabetic foot ulcers are a serious complication of diabetes mellitus caused by impaired blood circulation and neuropathy. Diabetic foot ulcers result from complications of microangiopathy and neuropathy, which make the tissue vulnerable to injury and slow to heal (Moulidiya, 2025).

The management of diabetic foot ulcers requires a comprehensive approach, including blood sugar control, infection prevention, and proper wound care. A study (Bahati et al., 2025) showed that severe diabetic foot ulcers are commonly found in elderly patients, patients with low treatment adherence, and patients without health

insurance. These conditions lead to delays in wound management and exacerbate the severity of diabetic ulcers.

Research findings (Al-mohaithef et al., 2022) indicate that uncontrolled blood glucose levels are significantly associated with the incidence and severity of diabetic ulcers. Patients with blood glucose levels ≥ 200 mg/dL tend to experience more severe diabetic foot ulcers. Chronic hyperglycemia leads to increased blood viscosity, impaired tissue perfusion, and a reduced ability of tissues to receive oxygen and nutrients, thereby slowing wound healing and increasing the risk of infection.

In addition, diabetic foot ulcers can also cause various physical and psychological impacts on patients, such as fear, anxiety, and limitations in daily activities. Phenomenological research indicates that patients with diabetic foot ulcers experience various problems, such as non-healing wounds, wound odor, and the risk of amputation (Indramsyah & Novira, 2023).

In addition to hyperglycemia, the chronic complication of peripheral neuropathy also plays a major role in the development of diabetic ulcers. A study (Jiang et al., 2022) states that peripheral neuropathy is one of the most common complications found in patients with diabetes mellitus. This condition causes patients to be unaware of wounds, friction, or repeated trauma to the feet. The condition is exacerbated by reduced blood supply to the tissues, making wounds difficult to heal and prone to infection. These findings underscore the importance of early screening for neuropathy and routine foot examinations.

In addition to clinical factors, patients' sociodemographic characteristics also influence the development of diabetic ulcers. A study (Tola et al., 2021) showed that educational level, occupation, and history of diabetes mellitus are significantly associated with the incidence of diabetic ulcers. Patients with low educational levels tend to have limited knowledge and awareness regarding the prevention of diabetes complications, including foot care. Additionally, jobs involving heavy physical activity or irregular work schedules can increase the risk of repeated trauma to the feet.

Based on the interview results, respondents stated that they did not fully understand the proper foot care methods to prevent wounds. Respondent 1 stated, "I didn't know that my feet needed special care." Respondent 2 said, "I didn't know that wounds could be prevented." Respondent 3 also remarked, "I only realized the importance of foot care after the wound appeared."

This indicates that a lack of knowledge about foot care is one of the contributing factors to the development of diabetic foot ulcers. Research shows that proper foot care can prevent diabetic ulcers and reduce the risk of complications (Sari & Dasuki, 2024).

In addition, early detection and routine foot care are crucial for preventing diabetic foot ulcers and more serious complications such as amputation (Noyumala et al., 2023).

In line with these educational and social factors, patients' health behaviors are a key aspect in the prevention of diabetic ulcers. A study (Husen & Basri, 2021) revealed a significant association between patients' levels of knowledge, attitudes,

and actions and the incidence of diabetic ulcers. Patients with low knowledge tend to exhibit inadequate foot care behaviors, such as rarely performing self-foot examinations, failing to wear appropriate footwear, and lacking adherence to blood glucose control. This underscores that ongoing health education plays a vital role in shaping behaviors that prevent diabetic ulcers.

In addition to behavioral factors, patients' physical condition and lifestyle also contribute to the development of diabetic ulcers. Research (25) indicates that advanced age, duration of diabetes, uncontrolled blood glucose levels, and low physical activity increase the risk of developing diabetic ulcers. A lack of physical activity worsens glycemic control and reduces peripheral blood circulation, thereby accelerating the onset of diabetic foot complications. Therefore, blood sugar control, increased physical activity, and long-term monitoring of patients with diabetes mellitus are important steps in the prevention of diabetic ulcers.

Conclusion

This study concluded that the main factors influencing the incidence of wounds in patients with diabetes mellitus are the duration of the disease and the presence of peripheral neuropathy, which causes a loss of protective sensation in the feet, exacerbated by a lack of routine foot examinations and care. Neuropathy has been shown to be a dominant factor because it prevents patients from noticing minor injuries, which can then progress into hard-to-heal ulcers. Conceptually, these findings underscore the importance of sensory perception and preventive behaviors within the framework of health psychology, particularly how reduced sensation and low risk awareness contribute to delayed wound detection. Practically, this study implies that preventive interventions should not only focus on medical aspects but also strengthen education, self-awareness, and behavioral changes in foot care among patients with diabetes mellitus as a strategy to prevent long-term complications.

Future research is recommended to involve a larger number of participants and employ a mixed-methods approach to deepen our understanding of the relationship between clinical factors and psychological behaviors in the occurrence of foot ulcers among patients with diabetes mellitus. Additionally, studies on education-based and behavior-change interventions can be conducted to more comprehensively test the effectiveness of foot ulcer prevention strategies.

References

- Adhikari, N., Baidya, S. K., Saha, A., & Jha, T. (2017). Structural insight into the viral 3C-like protease inhibitors: Comparative SAR/QSAR approaches. In *Viral Proteases and Their Inhibitors* (Issue January). <https://doi.org/10.1016/B978-0-12-809712-0.00011-3>
- Al-mohaithef, M., Abdelmohsen, S. A., Algameel, M., & Abdelwahed, A. Y. (2022). *Screening for identification of patients at high risk for diabetes-related foot ulcers: a cross-sectional study*. <https://doi.org/10.1177/03000605221087815>
- Alimurdianis, Brisma, S., Faiza Zubir, A., Zulkarnaini, A., & Anissa, M. (2024). Gambaran Penderita Ulkus Diabetikum yang Menjalani Tindakan Operasi. *Scientific Journal*, 3(4), 232-240. <https://doi.org/10.56260/sciena.v3i4.151>
- Babo, L. F., Muhith, A., Zahro, C., & Hasina, S. N. (2024). Analisis Faktor -Faktor Yang

- Berhubungan Dengan Kejadian Luka Pada Penderita Diabetes Mellitus Update: Systematic Literature Review. *Jurnal Penelitian Perawat Profesional*, 6(5474), 2889–2894. <http://jurnal.globalhealthsciencegroup.com/index.php/JPPP>
- Bahati, R., Kitua, D., Selestine, L., Mwangi, A., Urio, M., Mchele, G., & Antanamsu, D. (2025). Factors influencing the severity of diabetic foot ulcers: a cross-sectional study. *BMC Endocrine Disorders*, 25(1). <https://doi.org/10.1186/s12902-024-01785-0>
- Budiman, R. A., Nasir, P., Imran, M., & Putra, F. M. (2024). Faktor Risiko Terjadinya Ulkus Diabetik di Rumah Sakit Umum Daerah Kota Makassar Tahun 2020-2022. *Jurnal Pendidikan Tambusai*, 8, 10970–10975. <https://doi.org/https://doi.org/10.31004/jptam.v8i1.14031>
- Dandona, P., & Ghanim, H. (2021). Diabetes, Obesity, COVID-19, Insulin, and Other Antidiabetes Drugs. *Diabetes Care*, 44(September), 1929–1933.
- Dawi, J., Tumanyan, K., Tomas, K., Misakyan, Y., Gargaloyan, A., Gonzalez, E., Hammi, M., Tomas, S., & Venketaraman, V. (2025). Diabetic Foot Ulcers: Pathophysiology, Immune Dysregulation, and Emerging Therapeutic Strategies. *Biomedicines*, 13(5), 1–17. <https://doi.org/10.3390/biomedicines13051076>
- Dee, T. M. T., Sukartini, T., & Probawati, R. (2020). Factors Associated with Foot Ulcer among Diabetic Patients. *International Journal of Nursing and Health Services (IJNHS)*, 3(3), 358–363. <https://doi.org/10.35654/ijnhs.v3i3.222>
- Elsayed, N. A., Aleppo, G., Aroda, V. R., Bannuru, R. R., Brown, F. M., Bruemmer, D., Collins, B. S., Hilliard, M. E., Isaacs, D., Johnson, E. L., Kahan, S., Khunti, K., Kosiborod, M., Leon, J., Lyons, S. K., Murdock, L., Perry, M. Lou, Prahalad, P., Pratley, R. E., ... Gabbay, R. A. (2023). 2. Classification and Diagnosis of Diabetes: Standards of Care in Diabetes—2023. *Diabetes Care*, 46(January), S19–S40. <https://doi.org/10.2337/dc23-S002>
- Elsayed, N. A., Aleppo, G., Aroda, V. R., Bannuru, R. R., Brown, F. M., Bruemmer, D., Collins, B. S., Hilliard, M. E., Isaacs, D., Johnson, E. L., Kahan, S., Khunti, K., Leon, J., Lyons, S. K., Perry, M. Lou, Prahalad, P., Pratley, R. E., Seley, J. J., Stanton, R. C., & Gabbay, R. A. (2023). 13 . Older Adults : Standards of Care in Diabetes — 2023. *Diabetes Care*, 46(January), 216–229. <https://doi.org/https://doi.org/10.2337/dc23-S013> Nuha
- Febrianti, R., Saputri, M. E., & Rifiana, A. J. (2023). Analisis Faktor Yang Mempengaruhi Proses Penyembuhan Luka Pasien Ulkus Diabetikum Di Rs Dr. Suyoto Jakarta. *MANUJU: MALAHAYATI NURSING JOURNAL*, 32(3), 167–186. <https://doi.org/https://doi.org/10.33024/mnj.v5i8.9071>
- Ferrari, R., Pasquale, G. Di, & Rapezzi, C. (2020). Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID- 19 . The COVID-19 resource centre is hosted on Elsevier Connect , the company ' s public news and information. *International Journal of Cardiology*, January.
- Ginting Liani. (2025). Faktor-Faktor Yang Mempengaruhi Lama Penyembuhan Luka Diabetes Mellitus. *Jurnal Penelitian Perawat Profesional*, volume 7(April), 669–676.

<https://doi.org/https://doi.org/10.37287/jppp.v7i2.6296>

- Gumilar, T. A. M. A. G. S. I. I. D. (2025). Faktor-Faktor yang Mempengaruhi Lama Penyembuhan Luka Diabetes Mellitus di Klinik Pratama Hanifah Kota Tangerang 2024 Fakultas Ilmu Sosial , Program Studi Manajemen , Universitas Bhakti Asih Tangerang , Universitas Bhakti Asih Tangerang , Indonesia Pratom. *Vitamin : Jurnal Ilmu Kesehatan Umum*, 3(Dm).
- Hamim, N., Rahmat, N. N., & Narsih, U. (2025). Determinants Self-Care of Diabetic Foot Ulcer Incidence Diabetes Mellitus Patients. *Jurnal Keperawatan Muhammadiyah*, 10(4), 115–119.
- Hariftyani, A. S., Novida, H., & Edward, M. (2021). Profile Of Diabetic Foot Ulcer Patients At Tertiary Care Hospital In Surabaya, Indonesia. *Jurnal Berkala Epidemiologi*, 9(3), 293–302. <https://doi.org/10.20473/jbe.v9i32021.293>
- Husen, S. H., & Basri, A. (2021). Faktor-Faktor yang Mempengaruhi terjadi Ulkus Diabetik pada Penderita Diabetes Melitus di Diabetes Center Kota Ternate. *Promotif: Jurnal Kesehatan Masyarakat*, 11(1), 75–86. <https://doi.org/10.56338/pjkm.v11i1.1522>
- Indramsyah, I., & Novira, D. (2023). Studi Fenomenologi Persepsi Pasien dan Keluarga tentang Luka Kaki Diabetes. *Health Information : Jurnal Penelitian*, 15(3), e970. <https://doi.org/10.36990/hijp.v15i3.970>
- Irwansyah, I., Sultan, S., Rahmani, S., Gairi, I., & Ohorella, F. (2025). Kepatuhan Kontrol Gula Darah dengan Risiko Ulkus Diabetikum pada Pasien Diabetes Mellitus Highlight: manajemen kasus diabetes itu sendiri dengan maksud diabetes yang tidak dikelola dengan. *Jurnal Keperawatan Profesional*, 6(1), 19–26.
- Jiang, M., Gan, F., Gan, M., Deng, H., Chen, X., Yuan, X., Huang, D., Liu, S., Qin, B., Wei, Y., Su, S., & Bo, Z. (2022). *Predicting the Risk of Diabetic Foot Ulcers From Diabetics With Dysmetabolism: A Retrospective Clinical Trial*. 13(July), 1–11. <https://doi.org/10.3389/fendo.2022.929864>
- Listrikawati, M., Minarti, S. I., Azali, L. M. P., & Prastiwi, F. (2023). Analisis Karakteristik Luka Diabetes Mellitus Pada. *Jurnal Kesehatan Tambusai*, 4, 2601–2607.
- Liu, S., Pai, M. P., Lester, C. A., & Lester, L. P. (2022). Medication Use Among U.S. Adults After Bariatric Surgery: A Population-Based Analysis of NHANES 2015–2018. *Diabetes Care*, 45(3), e54–e55. <https://doi.org/10.2337/dc21-2285>
- McMorrow, R., Nube, V. L., & Manski-Nankervis, J. A. (2022). Preventing diabetes-related foot ulcers through early detection of peripheral neuropathy. *Australian Journal of General Practice*, 51(11), 833–838. <https://doi.org/10.31128/AJGP-06-22-6456>
- Meri, M., F. L. M., & Liswanti, Y. (2024). Unveiling cellular immunity : A study on diabetes mellitus patients with gangrene wounds. *Science Midwifery*, 12(1).
- Moulidiya, E. (2025). Diabetic Foot Ulcer menyebabkan komplikasi akut dan kronis serta dikenal sebagai the great imitator . Salah satu Galenical is licensed under a Creative Commons Attribution-ShareAlike Alamat : Islam : Geulanggang Baro.

- Nasibu, F. A., & Priasmoro, D. P. (2025). Hubungan Antara Lama Menderita Diabetes Melitus Tipe 2 Dengan Terjadinya Neuropati Sensorik The Relationship Between Duration Of Type 2 Diabetes Mellitus And The Occurrence Of Diabetic Sensory Neuropathy At Bulawa Community. *Jurnal Penelitian Keperawatan Kontemporer*, 5(5), 535–547. <https://jurnal.ikbis.ac.id/index.php/JPKK/article/view/1129>
- Nistiandani, A., Hakam, M., Sutawardana, J. H., & Widayati, N. (2023). IDENTIFIKASI RISIKO TERJADINYA ULKUS DIABETIK Abstrak. 6(2).
- Noyumala, Asriadi, & Musaidah. (2023). Deteksi Dini Luka Kaki Diabetes Melalui Skrining Kaki Diabetes Pada Pasien Diabetes menyebabkan gangguan aliran darah ke seluruh tubuh . Diindonesia timur prevalensi resiko V o l u m e 1 . N o . 3 I I 15 E- ISSN : 3025-2458. *Jurnal Pengabdian Masyarakat Gunung Sari*, 1(3), 15–21.
- Nuryani, N. (2022). Efek Hyperglikemia Terhadap Innate Immunity dan Kerentanan Terhadap Infeksi. *Tirtayasa Medical Journal*, 1(2), 49–60. <https://jurnal.untirta.ac.id/index.php/TMJ/article/view/15320>
- Pitter, D. A., Mamurani, M., Jamaluddin, A., & Mutmainna. (2023). Analisis Faktor Risiko Terjadinya Luka Kaki Diabetik Pada Penderita Diabetes Melitus Tipe Ii Di Klinik Perawatan Luka Etn Centre Dan Rsud Kota Makassar. *JIMPK : Jurnal Ilmiah Mahasiswa & Penelitian Keperawatan*, 3, 2023. <https://jurnal.stikesnh.ac.id/index.php/jimpk/article/view/913/881>
- Santoso, P., Alimansur, M., & Susilowati, E. (2021). Faktor Yang Mempengaruhi Terjadinya Luka Pada Penderita Diabetes Melitus Tinjauan Literatur. *Jurnal Penelitian Perawat Profesional*, 3(4), 89–94. <https://doi.org/https://doi.org/10.37287/jppp.v3i4.688>
- Sari, L. A., & Dasuki, D. (2024). Pengetahuan Perawatan Kaki pada Pasien Diabetes Mellitus. *Jurnal Ilmu-Ilmu Kesehatan*, 10(2), 17–23. <https://doi.org/10.52741/jiikes.v10i2.108>
- Siepmann, T., Gruener, C., Simon, E., Sedghi, A., Kitzler, H. H., Pallesen, L. P., Barlinn, J., Reichmann, H., Puetz, V., & Barlinn, K. (2021). Video-oculography-assisted head impulse test and caloric testing for detecting stroke in acute vertigo patients via modified hints plus. *Journal of Clinical Medicine*, 10(19). <https://doi.org/10.3390/jcm10194471>
- Silalahi, K. L., Munthe, D. S., Saragih, N. P., & Suchyo, D. S. (2022). Faktor-faktor yang Mempengaruhi Lama Penyembuhan Luka DM. *Jurnal Keperawatan Jiwa*, 10(3), 519. <https://doi.org/10.26714/jkj.10.3.2022.519-526>
- Sriyati, S. (2024). Neuropati Diabetes Sebagai Faktor Predisposisi Terjadinya Luka Pada Kaki. *Jurnal Ilmiah STIKES Yarsi Mataram*, 14(1), 46–52. <https://doi.org/10.57267/jisym.v14i1.336>
- Tola, A., Regassa, L. D., & Ayele, Y. (2021). Prevalence and associated factors of diabetic foot ulcers among type 2 diabetic patients attending chronic follow-up clinics at governmental hospitals of Harari Region , Eastern Ethiopia : A 5-year (2013 – 2017)

- retrospective study. <https://doi.org/10.1177/2050312120987385>
- Trisnawati. (2023). *Indonesian Journal of Nursing and Health Sciences*. 4, 85–94.
- Trisnawati, Anggraini, R. B., & Nurvinanda, R. (2023). Faktor-Faktor Yang Berhubungan Dengan Terjadinya Ulkus Diabetikum Pada Penderita Diabetes Melitus. *Indonesian Journal of Nursing and Health Sciences*, 4(2), 85–94. <https://doi.org/https://doi.org/10.37287/ijnhs.v4i2.1563>
- Wang, R., Li, B., Dong, M., Zhu, H., Jin, P., & Zou, Y. (2025). Targeting oxidative damage in diabetic foot ulcers: integrative strategies involving antioxidant drugs and nanotechnologies. *Burns and Trauma*, 13(March). <https://doi.org/10.1093/burnst/tkaf020>
- WHO. (2022). *WHO consolidated guidelines on tuberculosis: module 5: management of tuberculosis in children and adolescents*. WHO. <https://www.who.int/publications/i/item/9789240046764>
- Yoshida, R., Yoshizako, T., Sonoyama, H., Ryoji, H., Iwahashi, T., Ishikawa, N., Tajima, Y., & Kitagaki, H. (2020). Gossypiboma penetrating into the small intestine similar to Meckel's diverticulum: a report and literature review. *Radiology Case Reports*, 15(6), 655–659. <https://doi.org/10.1016/j.radcr.2020.02.037>
- Zantour, B., Bouchareb, S., El Ati, Z., Boubaker, F., Alaya, W., Kossomtini, W., & Sfar, M. H. (2020). Risk assessment for foot ulcers among Tunisian subjects with diabetes: A cross sectional outpatient study. *BMC Endocrine Disorders*, 20(1), 1–8. <https://doi.org/10.1186/s12902-020-00608-2>
- Zhen, J., Ren, Y., Zhang, H., Yuan, X., Wang, L., Shen, H., Liu, P., & Chen, Y. (2022). Effect of Different Dietary Regimes on the Gut Microbiota and Fecal Metabolites of Père David's Deer. *Animals*, 12(5), 1–19. <https://doi.org/10.3390/ani12050584>