

The prevalence of diabetic foot ulcers and associated factors among Diabetes patients at Mekedonia Medium Clinic, Addis Ababa, Ethiopia

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Addis Ababa University

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¹ The prevalence of diabetic foot ulcers and associated factors among
Diabetes patients at Mekedonia Medium Clinic, Addis Ababa, Ethiopia

By: Galmee Tamiru (MD, Family Medicine Resident)

Advisor: Dr. Fikremariam Gudeta (Assistant Professor of Family Medicine)

¹ A final research thesis to be submitted to the Department of Family Medicine, School of
Medicine, College of Health Science, Addis Ababa University, in partial fulfillment of
specialty Certificate in Family medicine

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Statement of The Author

Hereby, I, Galmee Tamiru (MD, Family medicine resident), hereby declare that the research thesis entitled "The prevalence of diabetic foot ulcers and associated factors among Diabetes patients at Mekedonia Medium Clinic, Addis Ababa, Ethiopia", is my original work that is done under the guidance and advice of my advisor, Dr. Fikremariam Gudeta (Assistant Professor of Family Medicine)

This research project is submitted in partial fulfillment of specialty Certificate in Family medicine. The research has never been done before, and all sources of materials used for the study are duly acknowledged.

Name: Galmee Tamiru (MD, Family medicine resident)

Signature: _____

January, 2025

Advisor Approval Sheet

This is to certify that Galmee Tamiru (MD, Family medicine resident) has carried out the research on the topic "The prevalence of diabetic foot ulcers and associated factors among Diabetes patients at Mokedonia Medium Clinic, Addis Ababa, Ethiopia". The research is original and has not been carried out earlier through any other researcher.

Advisor: Dr. Fikremariam Gudeta (Assistant Professor of Family Medicine)

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January, 2025

Board of Examiners Approval Sheet

Research Thesis on "The prevalence of diabetic foot ulcers and associated factors among Diabetes patients at Mekedonia Medium Clinic, Addis Ababa, Ethiopia" by
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Lists of the Abbreviations and Acronyms

- DFU: Diabetic Foot Ulcer
- AAU: Addis Ababa University
- FMOH: Federal Ministry of Health
- FY: Fiscal Year
- GHI: Global Health Initiative
- HbA1c: Glycated Hemoglobin
- HCP: Healthcare Provider
- IRB: Institutional Review Board
- MCA: Mekedonia Charity Association
- PAD: Peripheral Arterial Disease
- PN: Peripheral Neuropathy
- QoL: Quality of Life
- SES: Socioeconomic Status
- WHO: World Health Organization

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Abstract

Background

DFUs remain a major complication of diabetes with high morbidity and mortality rates. Study on the prevalence and risk factors related to DFU is thus vital for the purposes of its prevention and management in resource constraint settings like Ethiopia.

Objective

This study aimed to evaluate the prevalence of DFUs and identify the key risk factors among diabetic patients at Mekedonia Charity Association Medium Clinic, Addis Ababa, Ethiopia.

Methods

The research implemented cross-sectional study from November 20-23, 2024, involving 174 diabetic patients selected via convenience sampling. Data were collected through structured questionnaires, interviews, and clinical assessments. Multivariate logistic regression was used to identify factors associated with DFU, with statistical significance set at a p-value < 0.05.

Results

The prevalence of DFUs in the study population was 22.99% (40 participants), with 91.1% of cases being type 2 diabetes. Factors significantly associated with DFUs included poor foot care (AOR: 3.932, 95% CI: 1.113–13.891), peripheral neuropathy (AOR: 6.223, 95% CI: 1.309–29.596), diabetes duration >10 years (AOR: 5.463, 95% CI: 2.603–28.013), HbA1c levels >7% (AOR: 50.0, 95% CI: 10.0–250.0), history of trauma (AOR: 4.5, 95% CI: 2.0–15.0), and obesity (AOR: 10.0, 95% CI: 2.5–40.0).

Conclusion

The study revealed a high prevalence of DFUs among diabetic patients, with poor foot care, peripheral neuropathy, prolonged diabetes duration, poor glycemic control, trauma, and obesity identified as significant risk factors. Focused interventions to improve foot care, enhance early detection of peripheral neuropathy, and optimize glycemic control are essential to reducing the burden of DFUs in this population.

1.1 Background

Diabetic foot ulcers represent one of the major global health burdens, especially in resource-limited settings like Ethiopia. Ulcers are among the major complications of diabetes mellitus that result in serious health consequences related to infections, gangrene, and even amputation of the lower limbs in the worst cases. The economic cost of DFUs burdens the health care systems significantly worldwide. This is the most distressing state of affairs in LMICs, given the general constraints in health resources and less developed healthcare infrastructures [1]. The rise in diabetes prevalence in Ethiopia and simultaneous incidence of DFUs call for prioritization. Effective preventive and management strategies should urgently be put forward to address the unique challenges associated with this environment.

The most common causes of DFUs are neuropathy and peripheral arterial disease, both complications of long-standing diabetes. Neuropathy leads to loss of sensation in the feet whereby patients are unaware of minor injuries that may develop into ulcers. Peripheral arterial disease impairs blood flow to the extremities, which impairs wound healing and increases the risk of infection. The lack of awareness on how to manage diabetes, along with a shortage in access to medical care and other socio-economic conditions in Ethiopia, promotes these factors. DFUs bear a heavy financial burden. It mostly includes very extended and numerous hospital admissions, surgical interventions, and high-priced wound care products, which most patients cannot afford in Ethiopia. The economic impact extends to the national healthcare system, which must use scarce resources to manage these complications, often at the expense of other health priorities. The cost of managing DFUs is not only a financial strain but also a resource allocation challenge, diverting attention and funds from preventive care and education initiatives that could reduce the incidence of diabetes and its complications.

The Association CARE for Mekedonia, based in Addis Ababa, provides care to both elderly and vulnerable groups of the population, including those with chronic illnesses like diabetes. Such a setting presents a very good opportunity to investigate the consequences of DFUs within one high-risk group that may face significant barriers to utilizing healthcare services. In fact, many of the residents in Mekedonia are either elderly, living with disabilities, or of limited financial means. This situation makes them so much more vulnerable to the

complications of diabetes. Knowing the prevalence and determinants of DFU will be important for targeted interventions that could improve health outcomes and reduce the burden of diabetic complications.

Indeed, studies have demonstrated that DFUs are preventable with comprehensive diabetes management programs, including patient education, regular foot examination, appropriate footwear, and timely treatment of minor injuries of the foot. However, the implementation of these programs is impeded in many parts of Ethiopia by inadequately developed healthcare infrastructure, lack of training for healthcare providers, and scarcity of resources. In addition, certain cultural beliefs and practices influence health-seeking behaviors and adherence to recommendations.

The management of DFUs in Ethiopia requires a multi-faceted approach that includes infrastructural improvement in healthcare, training of health workers, health education, and community sensitization. Successful initiatives would also have to take into account the wide ranges of social determinants of health, including poverty, education, and access to healthcare services. Targeting specific needs for at-risk populations, as done at the Mekedonia Charity Association, could provide appropriate interventions, which should reduce DFUs.

The most important is that DFUs represent a considerable public health concern in Ethiopia in light of increasing prevalence of diabetes and a very limited healthcare situation. The setting of Mekedonia Charity Association provides an ideal context within which to explore the impact of DFUs and go on to develop appropriate interventions. Understanding the root causes of DFUs and their comprehensive management may minimize the overall incidence and severity of ulcers, hence improving the quality of life among diabetic patients in Ethiopia. This study will provide critical insights for healthcare providers, policymakers, and stakeholders in the design and implementation of effective interventions to fight DFUs in resource-constrained environments..

1.2 Statement of the Problem

The prevalence and severity of diabetic foot ulcers among the Mekedonia Charity Association are not well characterized despite the ever-increasing diabetes epidemic in Ethiopia. In this setting, diabetic patients, being at high risk for developing DFUs, are mostly unmonitored for foot complications, which limits timely diagnosis and treatment. The absence of specific data on the prevalence of DFUs in this population limits the

implementation of focused prevention and management measures, thus exposing many patients to the disabling complications of advanced foot lesions. The lack of comprehensive insights into the prevalence and nature of DFUs will render health interventions ineffective and misdirected in the Mekedonia Charity Association, potentially increasing the magnitude of complications in the community.

²⁶ Diabetic foot ulcers pose a serious challenge to both patients and healthcare systems. If left untreated or poorly managed, DFUs can progress to chronic infections, gangrene, and even limb amputations that severely affect a patient's quality of life and independence. This progression results in not only the long-term complication of health but also involves high costs to the healthcare system since it requires continued wound care and surgical interventions which may include various admissions to hospital. In such settings, the management of severe DFUs further overextends the healthcare infrastructure that is already strained, like Mekedonia Charity Association. Preventive measures, early detection, and timely management reduce the burden not only in an individual but also economically on the health system.

Because of this critical gap, data on prevalence, risk factors, and practices of management need to become available locally to address DFUs. Recent evidence has shown how interventions need to be population-specific to meet the need for data at a localized level, as generalized approaches can seldom address the various unique challenges from different communities. In this respect, the determination of the magnitude and underlying factors for DFUs in Mekedonia will provide important insights for proposing relevant community-based interventions that aim at improving health outcomes for diabetic patients, reducing diabetic complications, and reinforcing the general healthcare system.

¹ 1.3 The Significance of the Study

The present study is very important because it will be able to provide critical insights into the prevalence and determinants of DFUs among a vulnerable population in Ethiopia. These findings shall be useful in informing healthcare providers, policymakers, and stakeholders on how best to design and implement tailored interventions for mitigating the incidence and impact of DFUs. This adds to the literature on diabetic complications in low-resource settings and provides background for comparison studies. It informs global health initiatives how diabetic care could be further improved around the world [3].

Most importantly, the management of DFUs in Ethiopia is very imperative. Without adequate preventive and management strategies, patients with diabetes run a high risk of developing debilitating ulcers, which may eventually lead to infections, amputation, and even death. Economically, DFU treatment also costs a great deal, burdening the country's already inadequate health resources [4]. By focusing on the unique challenges faced by the elderly and vulnerable populations served by the Mekedonia Charity Association, this study has the potential to drive meaningful change and improve the quality of life for those at highest risk [5].

It therefore makes targeted interventions targeting prevention and management of DFUs at both individual and healthcare service levels imperative with immediate effect in Ethiopia. By conducting this research through the context of the Mekedonia Charity Association, we stand a real chance of improving the living circumstances of the people who suffer the most because of this distressing diabetes complication. We can only achieve this through collaboration, innovation, and a commitment to better health outcomes: toward a future where DFUs no longer pose a major threat to the health and wellbeing of individuals in Ethiopia and beyond [6]. This study will also contribute to the global body of knowledge on diabetic foot care in resource-limited settings, with essential data that shall inform local healthcare improvements.

1.2. Hypothesis:

Poor glycemic control, long duration of diabetes, behavioral factors such as poor foot care practices, low socioeconomic status, inadequate access to health care resources, and poor practices in the management of diabetes are cumulatively hypothesized to contribute to a higher prevalence of DFUs among residents of Mekedonia Charity Association in Addis Ababa, Ethiopia.

CHAPTER 2: LITERATURE REVIEW

DFUs are a major and common complication of diabetes mellitus, influencing morbidity, mortality, and quality of life. This review focuses on the prevalence of DFUs and associated factors, especially in the context of the Makedonia Charity Association in Ethiopia. Moreover, it discusses the prevalence data from East African countries, Sub-Saharan Africa, other African regions, Europe, Canada, and America, and investigates the prevalence in charity associations providing geriatric care. The review also evaluates the association of various associated factors with the prevalence of DFUs.

2.1 The Prevalence of Diabetic Foot Ulcers

Global Prevalence

The prevalence is generally lower in developed countries with better health facilities and proper management of diabetes. In Europe, the prevalence rate ranges from 4-10%, although specific studies conducted in the UK revealed prevalence rates at around 6%⁸. In Canada, the prevalence among diabetic patients is around 2-6%⁹. In the United States, the prevalence estimates for DFU are between 4.5% and 7.2%⁸. This may be due to the fact that in these countries, there is better access to health care facilities, comprehensive patient education, and more effective management of diabetes and its complications. Prevalence in African Countries.

Prevalence in African Countries

For example, in Tanzania, the prevalence is reported to be about 15% among the diabetic patients in hospitals⁹. A tertiary care hospital-based study in Kenya estimated the prevalence of DFUs among diabetic patients to be around 4.6%¹⁰, while that among diabetic clinic attendees in Uganda is estimated at 11.9%⁴. These figures suggest that there is regional variation in the prevalence of DFU and that health care should be appropriately tailored to the prevailing conditions in each country. The prevalence of DFUs also varies significantly across Sub-Saharan Africa and other regions of the continent. For instance, in Nigeria, DFU prevalence rates can be as high as 9.5% among diabetic patients¹¹. Ghana reports an even higher prevalence, estimated at 15.6%¹². In South Africa, the prevalence is approximately 7.2%¹³. These variations in prevalence across these regions can be influenced by many factors, including healthcare access, patient education, and socio-economic

conditions. This disparity serves as a pointer to the fact that comprehensive care for diabetes and foot ailments needs to be embraced across the continent.

Prevalence in Charity Associations of Geriatric Care

In this context, charity associations that care for geriatric patients tend to have higher incidences of DFUs due to the older age and, arguably, poorer health status of their patients. Although data on DFU prevalence rates in such facilities is scant, related literature on the prevalence among geriatric populations in care facilities estimates prevalence rates of up to 20%, depending on underlying conditions and care provided (14). This high prevalence calls for emphasis on specialized care and preventive strategies in geriatric populations to reduce and manage DFU incidences.

Prevalence in Ethiopia

There is limited information on the prevalence of DFU at Mekedonia Charity Association. However, related settings in Ethiopia and studies conducted in comparable settings may provide an idea. For instance, in a study in Ethiopia, it was reported that 13.6% of diabetic patients attending clinics had DFU (15). Given the general vulnerability and usually lower access to health facilities in charity settings, it would be hypothetical that the prevalence at Mekedonia is among the high spectrums in clinical settings. .

2.2 Associated Factors and Their Impact

Diabetic foot ulcers are a serious complication of diabetes mellitus that may be due to several interrelated contributory factors. The three most common causes of DFUs include the following:

1. **Peripheral Neuropathy:** Peripheral neuropathy is damage to the peripheral nerves, which carry sensations such as pain, touch, and temperature from the extremities to the brain. Prolonged periods of high blood sugar in diabetic individuals can eventually destroy nerves, particularly those supplying the lower extremities and the feet. Neuropathy reduces sensation; this is a form of neuropathy known as sensory neuropathy. It reduces the sensation of pain or discomfort in the feet, and for this reason, an injury might go unnoticed, such as cuts, blisters, or abrasions resulting from poorly fitted shoes or minor trauma. These minor wounds, if not identified and treated early, may evolve into serious ulcers.

Essential prevention includes regular examination of the foot, education about foot care, and fitting of shoes and footwear properly. In maintaining blood sugar level, there is slowing down in the progress of neuropathy and reduces the incidence of DFU.

¹² 2. Peripheral Arterial Disease (PAD): In the ³⁴peripheral arterial disease, narrowed arteries ³⁵are there through which there is ¹⁴¹a reduction of blood flow, especially ⁸⁵to the legs and feet. Diabetes patients with PAD often have this situation compounded by other vascular complications associated with diabetes, such as atherosclerosis or plaque buildup within the arteries. Poor circulation denies the feet sufficient oxygen and nutrients, which are required to facilitate wound healing. Poor blood supply impairs the ability to fight infections and repair damaged tissues. Minor injuries can thus progress into skin ulcers and non-healing ulcers due to compromised blood supply.

Lifestyle modification, like cessation of smoking and controlling ¹⁰⁶blood pressure and cholesterol, ⁴⁶can reduce the risk of PAD in the management of diabetes. Regular assessment and ¹²early intervention for vascular problems are thus crucial to prevent DFUs in patients suffering from PAD.

3. Foot Deformities and Trauma: These include foot deformities such as bunions, hammertoes, or even Charcot foot-a condition whereby the bones in the foot weaken and fracture-as common manifestations among diabetic patients because of neuropathy and altered biomechanics. These deformities may create points of pressure and friction within the shoe that could ¹²lead to skin breakdown and the formation of ulcers. Deformities misalign the structure of the foot and ⁸⁵increase the risk of breakdown and ulceration due to pressure points. Trauma, whether cuts, burns, or even repetitive stress, can easily ¹⁰⁶lead to DFUs in diabetic patients with neuropathy.

Regular ⁴⁶foot assessment and ¹²care by a podiatrist are important in the early identification and management of foot deformity. Individually designed footwear and orthotics can distribute the pressure more evenly and reduce the risk of skin breakdown. Foot hygiene and use of appropriate, protective footwear may prevent trauma-induced DFUs.

In summary, ⁴⁶the development of diabetic foot ulcers is often multifactorial, involving a complex interplay of neuropathy, peripheral arterial disease, foot deformities, and trauma. Effective management strategies focus on comprehensive diabetic care, including glycemic control, regular foot examinations, patient education, and proactive measures to mitigate the

impact of these contributing factors on foot health. ⁶ Diabetic foot ulcers are influenced by a variety of factors, as evidenced by numerous studies:

Modifiable Factors

- Poor Glycemic Control: Poor glycemic control, manifested by HbA1c above 7%, increases the risk of DFUs manifold. Indeed, studies reported ORs from 2.1 to 4.3, thus outlining the utmost importance of blood sugar management in the prevention of DFUs (16).
- Inadequate ⁵ Foot Care and Health Education: Poor foot care practices and inadequate patient education are significant contributors to DFU prevalence. Studies report ORs ranging from 2.0 to 3.7 for those with poor foot care and education, emphasizing the need for comprehensive diabetes management and education programs (17).

Non-Modifiable Factors

- Duration of Diabetes: ³ The duration of diabetes is a non-modifiable risk factor strongly associated with DFUs. Patients with diabetes for over 10 years have ORs ranging from 1.8 to 3.5 for developing DFUs, emphasizing the cumulative effect of diabetes duration on foot health (14).

External Risk Factors

- Socioeconomic Factors: Lower socioeconomic status correlates with higher DFU prevalence rates. ORs in studies range from 1.5 to 3.0, reflecting disparities in access to healthcare, education, and resources that affect diabetes management and foot care practices (15).
- Trauma

Disease-Related Factors

- Peripheral Neuropathy: It is one of the strongest correlates of DFUs, with reported ORs between 3.2 and 6.0. In addition, peripheral neuropathy compromises the protective sensations of the feet and predisposes patients to unnoticed trauma and eventual ulceration. It therefore emphasizes regular foot examination and prevention measures (16).

- Peripheral Arterial Disease: Similarly, peripheral arterial disease contributes significantly to DFU development, with reported odds ratios ranging between 2.5 and 4.8. Poor circulation impairs tissue perfusion and healing, increasing the risk of ulceration and complications (17).

Understanding these multifaceted factors is imperative in developing comprehensive strategies that would effectively prevent and manage DFUs. Targeted treatment of modifiable risk factors besides enhancing access to care and foot education among persons at risk of DFUs therefore can reduce incidences and thus the impact, hence improving health outcomes of diabetes-related foot manifestations. Generally speaking, the burden of diabetic ulcers of the foot is remarkably varied in geographically different zones and settings: this may, of course be due to virtually everything. With compounded vulnerabilities, these make the prevalence high in charity settings like Mekedonia. Peripheral neuropathy, peripheral arterial disease, diabetes duration, poor glycemic control, socioeconomic status, and inadequate foot care are strongly associated with DFUs. Understanding these associations is crucial to the development of effective prevention and management strategies for reducing the global burden of DFUs.

2.3: Conceptual Framework

The conceptual framework for this study outlines the complex relationships between the prevalence of DFUs and various influencing factors among residents of Mekedonia Charity Association in Addis Ababa, Ethiopia. This framework is developed from an extensive review of the literature and includes the following dimensions: demographic factors, socioeconomic status, health-related behaviors, diabetes management practices, healthcare access, associated medical conditions, and environmental factors. It reflects the multifactorial nature of DFUs among diabetic residents and underlines the need to target individual, socioeconomic, and environmental factors in order to develop appropriate interventions aimed at reducing the prevalence and impact of DFUs. This framework will be used in this study for guiding data collection, analysis, and interpretation in a holistic approach to the problem and in providing necessary targeted healthcare strategies.

1. Demographic Factors

- Age: The prevalence of DFU is increased with advanced age due to the longer duration of diabetes and more chances of other comorbidities. As stated in the literature, risk increases with advancing age, especially after 60 years of age [19].

- Gender: Gender differences influence the prevalence and management of DFUs. Some studies suggest that ¹⁹men are more likely to develop DFUs than women, potentially due to differences in foot care practices and health-seeking behavior [20].

2. Socioeconomic Status

- Income Level: Lower income levels may reduce access to available healthcare services, proper nutrition, and necessary diabetes management supplies, thereby increasing the risk for DFUs. Research has shown that socioeconomic deprivation is a strong predictor of the prevalence of DFU [21].

- Level of Education: Generally, higher education levels are associated with better knowledge and practices in the management of diabetes and foot care that may reduce the risk of DFUs. ⁵⁹Studies have found that individuals with higher educational attainment are more likely to engage in preventive foot care behaviors [22].

3. Health-Related Behaviors

- Smoking: Smoking ⁶²is a significant risk factor for peripheral arterial disease (PAD), which can exacerbate the development of DFUs. Smokers have been found to have a ¹⁶higher incidence of DFUs compared to non-smokers [23].

- Physical Activity: ⁷³Regular physical activity can improve blood circulation and overall health, ⁷⁵potentially reducing the risk of DFUs. Evidence suggests that physical inactivity is associated with an increased risk of foot ulcers in diabetic patients [24].

4. Practice of Diabetes Management

- Glycemic Control: ³⁶Poor glycemic control, manifested by high levels of HbA1c, is a major ¹¹⁰risk factor in the development of DFUs. It is shown that tight glycemic control significantly reduces the incidence of DFUs [25].

- Foot Care Practices: Some of the best practices to prevent DFUs include regular foot inspection, proper footwear, and prompt care for minor foot injuries. Effective foot care education and practices have ⁹⁶been shown to reduce the incidence of foot ulcers [26].

5. Healthcare Access

• Availability of Healthcare Services: Easy access to healthcare facilities and regular medical check-ups are very important for early detection and management of diabetes-related complications, including DFUs. Access to comprehensive healthcare services acts as a protective factor against the development of DFUs [27].

• Access to Diabetes Education: The availability of education on diabetes management and foot care can help to drastically reduce the prevalence of DFUs. Indeed, various studies have confirmed that diabetes education improves self-care practices and reduces the incidence of DFUs [28].

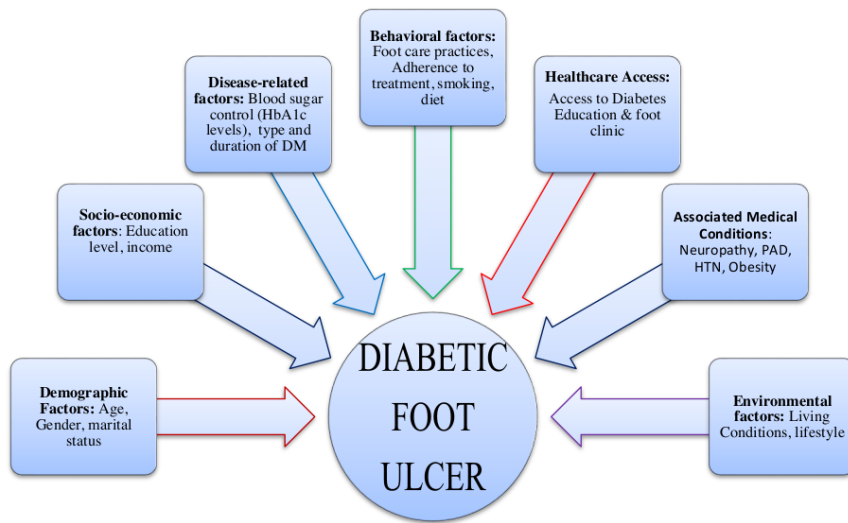
6. Comorbid Medical Conditions

• Peripheral Neuropathy: Common in diabetes, this condition causes the loss of sensation in the feet, increasing the risk of unnoticed injuries that may subsequently lead to ulcers. The presence of peripheral neuropathy is one of the strong predictors for DFU development [28].

• Peripheral Arterial Disease (PAD): It restricts the blood flow to the lower limbs, thereby preventing proper healing of injuries to the foot, hence predisposing them to DFU. Various literatures indicate that PAD is one of the significant risk factors for DFUs [29].

7. Environmental Factors

• Overcrowded or unsanitary living conditions can increase the risk of foot injuries and infections, leading to a higher prevalence of DFUs. Environmental factors such as poor living conditions have been linked to an increased risk of DFUs [29].



¹²
Figure 1. The Diagram of the Conceptual Framework of diabetic foot ulcer and associated factors

This conceptual framework forms the basis of how different factors interact to influence the prevalence of DFUs among residents of the Makedonia Charity Association. It guides the research in identifying key variables to be measured, analyzed, and interpreted to develop effective strategies for prevention and management of DFUs in this vulnerable population.

CHAPTER 3: OBJECTIVES²⁷

3.1 General Objective:

- To assess the prevalence of diabetic foot ulcers and factors associated with DEU¹ among residents of Mekedonia Charity Association attending the Clinic in Addis Ababa, Ethiopia.

3.2 Specific Objectives:

1. Identify the prevalence of diabetic foot ulcers among the diabetic residents within the Mekedonia Charity Association.
2. Identify the demographic and socioeconomic parameters that are associated⁶ with the development of diabetic foot ulcers

CHAPTER 4: METHODOLOGY

5.1 Study Design:

The current study has employed a cross-sectional design in which it determines the prevalence and determinants of DFU among diabetic residents at the Mekedonia Charity Association, Addis Ababa, Ethiopia.

5.2 Study Period:

Data collection for this study was conducted from 20th November, 2024 to 23rd November 2024. The present research thus attempts to gather comprehensive data regarding the prevalence of DFU and the risk factors associated with it, such as peripheral neuropathy and peripheral arterial disease, measures of glycemic control, trauma, and socio-demographic characteristics. It seeks to give insight into the health status of the population within this period, hence guiding appropriate interventions aimed at improving healthcare outcomes for diabetes patients within the community.

5.3 Study Area

Mekedonia Charity Association is a non-profit organization that was established in 2010 in Addis Ababa, Ethiopia, and works for the welfare of some of the most vulnerable members of society. Founded with the idea to assist 100 people, over time it grew and expanded to branches in Harar, Gore, Dire Dawa, Dessie, Adama, Gambella, Shashemane, Beke, and Adwa.

The head office of Mekedonia is strategically placed in the Hayat area, Addis Ababa, approximately 10 kilometers northeast of the city center, along a major route and easily accessible from different parts of the capital. This indeed serves as the central hub for the operations of the organization. This location alone currently provides care and support to more than 8,000 people, an indication of the important role it plays in addressing the needs within the community.

Mekedonia advances the lives of elderly people, those with mental incapacities, and other underprivileged groups to 'state of well-being', which involves basic health, nutrition, shelter, and emotional needs. A sizeable group of beneficiaries belongs to the geriatric category. Although Mekedonia lacks geriatricians or even special facilities, it does its best to address their very special needs to provide them with their dignity and quality of life within the resources available.

The core of the Addis Ababa operations is the Mekedonia Medium Clinic, which provides both outpatient and inpatient services. The pharmacy and laboratory at the clinic are not fully equipped and have certain limitations but continue to provide the necessary medications and basic diagnostic services. These facilities are crucial in addressing the health needs of the community.

More than health services, Mekedonia invests very much in the social outreach for the elderly and mentally handicapped: it organizes educational workshops, advocacy campaigns, and cooperation with local and international partners for systemic challenges so as to better the beneficiaries' quality of life.

The commitment by Mekedonia extends further toward research in further improving standards of care, along with advocating policy reforms. Working in partnership with academic institutions and healthcare providers to implement best practice and innovation, the Association engages in implementing evidence-based practice that informs innovative services.

The kind and holistic philosophy of Mekedonia Charity Association keeps the organisation as an exemplar of hope and resilience in Ethiopia, which has changed lives and empowered families and communities with a spirit of inclusiveness and social responsibility.

5.4 Populations of the study

5.4.1. Source Population

The source population in this study involves all residents of Mekedonia Compound, located in Addis Ababa's Hayat area, Ethiopia, who receive follow-up care at the Mekedonia Medium Clinic. The compound primarily supports the elderly and those with mental illness, offering health, nutrition, and social services tailored to their needs.

The Mekedonia Medium Clinic offers primary and essential care through inpatient and outpatient services for approximately 300 diabetes patients. With limited facilities, such as an under-resourced pharmacy and laboratory, it offers necessary diagnosis, treatment, and education. This study ascertains DFU prevalence with associated factors among this unique population to inform the care strategy at the clinic.

5.4.2 Study Population

The target population is the diabetic patients who reside within the Mekedonia Compound and those attending at the Mekedonia Medium Clinic during the study period. The current study hence estimates the prevalence of DFU, besides defining some of the risk factors responsible for the occurrence of DFU that may lead to better strategies to improve the outcome in susceptible populations in the study area. Ultimately, the study shall bring about deeper understanding and guide health strategies that meet the needs particular to the community of Mekedonia Compound.

5.5 Sampling and Sample Size

The target frame includes all registered diabetic residents at Mekedonia Charity Association Medium Clinic, Addis Ababa, Ethiopia. The respondents of the study were selected by a convenience sampling method in which members would fall into either the available category or those who give their consent to be involved. The sample size was estimated with regard to the prevalence of DFUs and precision. Sample size calculation was performed with the usual standard formula for a prevalence study and assumed 5% margin of error with a 95% confidence level. The formula is:

$$N = \frac{Z^2 P (1 - P)}{d^2}$$

Where:

- N represents the required sample size.
- Z is the Z-score corresponding to the desired confidence level. For a 95% confidence level, Z is approximately 1.96.
- P is the estimated prevalence of the condition in the population (expressed as a proportion). Taking prevalence of DFU in Ethiopia, P=12.98%
- d is the margin of error, d=5%=0.05

$$Z^2 = 1.96^2 = 3.8416, P (1 - P) = 0.1298 \times (1 - 0.1298) = 0.1298 \times 0.8702 = 0.1129, d^2 = 0.0025$$

$$Z^2 P (1 - P) = 3.8416 \times 0.1129 = 0.4337$$

$$N = \{0.4337\} / \{0.0025\}$$

$$N = 173.57$$

Rounded up to the nearest whole number $n \approx 174$

With an estimated prevalence of 12.98% which is from ¹⁰ previous study in Ethiopia, and a margin of error of 5%, a sample size of approximately 174 participants is required to achieve a 95% confidence level.

¹¹⁷

5.6. Inclusion and Exclusion Criteria

Inclusion Criteria:

3. Age: Individuals aged 18 years and above.
4. Residency: Residents of Mekedonia Charity Association in Addis Ababa, Ethiopia.

Exclusion Criteria:

- Age: Individuals under the age of 18 years.
- Non-Diabetes Patients: Individuals without a confirmed diagnosis of diabetes mellitus.
- Incapacity: Participants who are unable to provide informed consent due to cognitive impairment or other reasons.

5.7. Variables

The variables used for the research to assess the diabetic foot ulcers (DFUs) among residents of Mekedonia Charity Association in Addis Ababa, Ethiopia:

Dependent Variable

- Diabetic Foot Ulcers (DFUs)

Independent Variables

- Age
- Sex
- Glycemic Control
- Duration of Diabetes
- Behavioral Factors (e.g., inadequate foot care practices, poor adherence to medical advice)

- ³⁴ Presence of Peripheral Neuropathy
- Presence of Peripheral Arterial Disease
- Hypertension
- Obesity
- Trauma history
- Access to Healthcare Resources

5.7.1. Operational Definitions:

1. **Diabetic Foot Ulcer (DFU):** refers to an open sore or wound that appears ⁵⁵ on the foot of an individual with diabetes. These ulcers are commonly found on the bottom of the foot or near the toes and may be accompanied by infection or tissue death. Diagnosis is typically made through a clinical assessment by a healthcare provider, which confirms the ulcer's presence through signs such as an open sore, redness, swelling, or pus discharge.
2. **Probable Diabetic Foot Ulcer (Probable DFU):** An area of intact skin presenting with signs of inflammation, such as redness, warmth, and swelling, in a person with diabetes, indicating a high likelihood of progressing to an open ulcer without intervention. It is Identified during clinical assessment as an area at risk for ulceration, requiring close monitoring and preventive measures.
3. **Possible Diabetic Foot Ulcer (Possible DFU):** A suspicious area ¹³² on the foot of a person with diabetes showing nonspecific signs such as localized warmth, tenderness, or discoloration is indicative of early tissue injury, which may further progress to an ulcer. It is identified during a clinical examination as an area needing further observation or diagnostic studies to confirm or rule out the presence of an ulcer.
4. **Prevalence of DFU:** The proportion of persons with diabetes in Makedonia Charity Association with a diagnosed active diabetic ¹⁰⁹ foot ulcer at the time of the study. ⁷⁶ Calculated as the number of persons with a diagnosed diabetic foot ulcer divided by the ¹¹ total number of persons with diabetes, expressed as a percentage.
5. **Diabetes Mellitus (DM):** A group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. ³ Confirmed by medical records showing fasting blood glucose levels ≥ 126 mg/dL, 2-hour plasma glucose ≥ 200 mg/dL during an oral glucose tolerance test, or a random plasma glucose ≥ 200 mg/dL in a person with symptoms of hyperglycemia.

6. **Peripheral Neuropathy**: A condition resulting from damage to the peripheral nerves, often causing weakness, numbness, and pain, typically in the hands and feet. Assessed through clinical tests such as the monofilament test, tuning fork test, or nerve conduction studies.
7. **Peripheral Arterial Disease (PAD)**: A common circulatory problem in which narrowed arteries reduce blood flow to the limbs. Diagnosed based on clinical symptoms (e.g., claudication) and confirmed by an ankle-brachial index (ABI) <0.9.
8. **Hypertension**: A condition in which the force of the blood against the artery walls is too high, often defined as blood pressure above 140/90 mmHg. Confirmed through repeated blood pressure measurements taken using a sphygmomanometer.
9. **Glycemic Control**: The typical levels of blood glucose in a person with diabetes. Assessed through glycated hemoglobin (HbA1c) levels, with good control defined as HbA1c <7%, moderate control as HbA1c 7-8%, and poor control as HbA1c >8%.
10. **Body Mass Index (BMI)**: A measure of body fat based on height and weight. Calculated as weight in kilograms divided by height in meters squared (kg/m^2). Classified as underweight (<18.5), normal weight (18.5-24.9), overweight (25-29.9), and obese (≥ 30).
11. **Duration of Diabetes**: The length of time since a person was diagnosed with diabetes. Recorded in years from the time of diagnosis to the time of the study.
12. **Smoking Status**: The current or past use of tobacco products. Classified as non-smoker, current smoker (smoked any tobacco in the last 30 days), or former smoker (previously smoked but quit more than 30 days ago).
13. **Foot Care Practices**: The behaviors and actions taken to care for the feet, particularly in people with diabetes. Assessed through a questionnaire evaluating practices such as daily foot inspection, proper footwear, and seeking medical advice for foot problems.
14. **Socioeconomic Status (SES)**: The social and economic factors that influence what positions individuals or groups hold within the structure of a society. Determined through indicators such as income, education level, and occupation.

5.8. Ethical Considerations:

Ethical approvals from the ethics committee or appropriate Institutional Review Board of each host country were issued before data collection could begin. Each participant received detailed information stating participation was totally on a volunteer basis, anonymity

guaranteed, and with the rights of withdrawal whenever a participant pleases without jeopardies.

1. Informed Consent: ³³ Informed consent was obtained prior to data collection from all eligible patients, encompassing medical chart review and examination.

2. Confidentiality: Participants' confidentiality was ensured by anonymizing data and storing all personal information in a secure manner.

¹¹² 3. Ethical Approval: Ethical approval for this study was ⁵⁸ sought from the relevant institutional review board or ethics committee before commencing the research.

¹³⁰ Diabetic foot ulcers among diabetic patients in Mekedonia, Addis Ababa, ^{are} indeed highly prevalent and call for highly valid and reliable data management practices. Thus, this study will employ a systematic approach toward data collection with quality assurance measures in terms of strict safety in storage and observance of ethical considerations to enrich the knowledge in the development of strategies to improve approaches in health and health outcomes for target populations in the community.

5.9. Data Management:

⁶ Effective data management will ensure that the data obtained from this study on the prevalence of diabetic foot ulcers and associated factors among diabetes patients in Mekedonia, Addis Ababa, is accurate, reliable, and secure. The proposed data management plan incorporates a range of crucial components that facilitate structured data collection, storage, analysis, and sharing.

⁴² 5.9.1. Data Collection:

The data collection was by structured questionnaires and clinical examination by trained health professionals. Sociodemographic details, the history of the patient, management practices concerning diabetes, status of DFU and its risk factors, glycemic control practices, and lifestyle habits were obtained. In order to minimize error and ensure completeness, filling out the questionnaires was typed electronically.

1. Questionnaire: A structured questionnaire will be developed on the basis of study objectives. The demographic, clinical, and socio-economic data were collected by structured questionnaires. The medical examination shall be carried out for diagnosis of DFUs. The tools shall assess demographic

information, history of diabetes, practices regarding foot care, life style factors, socio-economic status, access to health care, and challenges with diabetes management.

2. Medical Records Review: Data was gathered on the diagnosis of diabetes, treatment history, HbA1c levels, and history of diabetic foot ulcers by reviewing the medical records of participants.
3. Physical Examination: A physical examination of the presence and severity of diabetic foot ulcers was conducted for those participants who gave consent.

5.9.2 Data Collection Procedure, Storage and Security

Data collection was performed by two nurses and the researcher using a Google Forms questionnaire, interview, and chart review during the study period. Patients who attended the diabetic clinic and met the inclusion criteria were screened for DFU and interviewed. The clinical data regarding PVD, PN, hypertension, renal problems, HbA1c, and BMI were collected from patient medical records.

Data collected were stored in locked electronic databases with restricted access to authorized personnel only. Strict confidentiality and data protection regulations were followed. Personally identifiable information was anonymized during storage and analysis to maintain participant confidentiality and privacy.

5.9.3. Data Cleaning and Quality Assurance

Data cleaning has been done prior to analysis, including the detection and correction of errors, inconsistencies, and missing values. Quality checks will involve verification against source documents and validation procedures to ensure data integrity. Any discrepancies or anomalies were promptly attended to in order not to jeopardize the accuracy of the data.

5.9.4. Data Processing and Analysis

The data analysis, using appropriate statistical software, aimed at understanding the relation among variables, measuring the incidence of DFUs, and the major risk factors related to the condition. Descriptive statistics were used in the frequencies, means, and standard deviations that summarized data. Chi-square tests and logistic regression analyses were implemented for the relationships being tested or to forecast an outcome in the inferential statistics. Quantitative data analysis was done using SPSS software, version 26. The prevalence of DFUs was established and logistic regression was used to identify factors associated with the

ulcers. For qualitative data, responses from open-ended questions were thematically analyzed for recurring themes and issues on diabetes management and access to health care.

5.9.5. Reporting and Dissemination

The findings will be reported in adherence to ethical guidelines and research standards. Results will be disseminated through scientific publications, conference presentations, and community outreach. Summaries and reports will be shared with key stakeholders, including healthcare providers, researchers, policymakers, and the Makedonia Charity Association, to inform healthcare practices and drive targeted interventions.

CHAPTER 5: RESULTS

6.1. Demographic Profile of Participants

In this study, 174 individuals were surveyed, resulting in a complete response rate of 100%. The average age of the participants was 55 years. A significant portion, 98 respondents (56.4%), identified as male, and all participants were residents of the Mekedonia Charity Association located in Hayat, Addis Ababa.

Regarding marital status, 86 (49.2%) of the respondents were divorced. In terms of educational background, 127 (73.3%) had no formal education. Additionally, 115 (66.3%) of the respondents were unemployed.

Table 1. Demographic Profile of Participants at Mekedonia Medium Clinic, Addis Ababa, Ethiopia, November 2024 (n = 174)

91	Variable	Frequency (n = 174)	Percent (%)
	Gender		
	Male	98	56.4
	Female	76	43.6
	Age Group (years)		
	18–23	5	2.7
	24–29	7	4.1
	30–35	7	4.1
	36–41	21	12.3
	42–47	3	1.4
	48–53	5	2.7
	54–59	34	19.2
	60–65	19	11.0
	66–71	41	23.3
	72–77	26	15.1
	78–83	10	5.5
	>84	5	2.7
	Marital Status		
	Single	10	5.5
	Married	2	1.4
	Divorced	86	49.2
	Widowed	19	11.0
	Education Status		
	Has No formal education	127	73.3
	Attended Primary school	26	15.1
	Secondary school	14	8.2
	College and above	7	4.1
	Occupation		

Government employee	2	1.4
Part-time employee	10	5.5
Unemployed	115	66.3
Retired	36	20.5
Student	2	1.4
Others	7	4.1
Religion		
Orthodox	119	68.5
Muslim	29	16.4
Protestant	14	8.2
Catholic	10	5.5
Others	2	1.4

6.2. Respondents' Diabetes-Related Information

Among the participants, Type 2 diabetes was the predominant form, affecting 157 individuals, which accounts for 90% of the group. A significant portion, 125 respondents (72%), had been living with diabetes for fewer than 10 years. The most frequently utilized treatment for diabetes was oral anti-diabetic medications, which were reported by 147 participants, representing 85% of those surveyed.

Table 2. Respondents' Diabetes-Related Information at Makedonia Medium Clinic, Addis Ababa, Ethiopia, November 2024 (n = 174)

Variable	Frequency (n = 174)	Percent (%)
Type of Diagnosis		
Type 1	17	10.0
Type 2	157	90.0
Types of Diabetes Medications		
Insulin therapy	13	7.5
Oral hypoglycemic agents	147	84.5
Combination of injectable and oral medications	4	2.5
Changes in lifestyle habits	9	5.1
Duration of Diabetes		
< 10 years	125	72.0
≥ 10 years	49	28.0

Among the 174 participants, 80 (46%) had no known HbA1c levels. A total of 78 (45%) had HbA1c levels below 7%, indicating good glycemic control. Meanwhile, 16 (9%) had HbA1c levels greater than 7%, suggesting poor glycemic control.

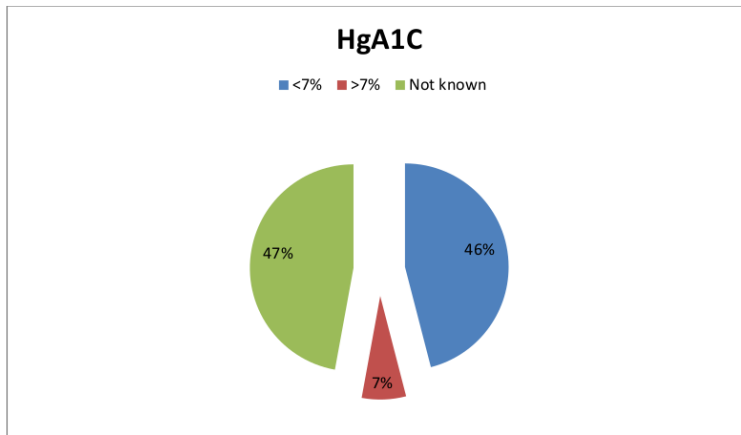


Figure 2. Glycemic control of diabetic patients by HGA1C at Mekedonia Medium Clinic, Addis Ababa, Ethiopia, November 2024, N=174

6.3. Clinical Characteristics of Diabetic Patients at Mekedonia Medium Clinic

Out of the 174 participants surveyed, 43 individuals, representing 24.9%, were identified as having hypertension. Additionally, 16 respondents, or 9%, were diagnosed with peripheral neuropathy, and 18 participants, accounting for 10.3%, were found to have peripheral vascular disease.

Regarding **body mass index (BMI)**, the majority of respondents, **124 (71.6%)**, had a normal BMI. However, **17 (9.5%)** of the respondents were classified as overweight or obese.

Additionally, **17 (10%)** of the respondents reported a history of smoking, and **38 (22%)** reported alcohol use.

6.4. Foot care characteristics of respondents

This bar chart illustrates the adherence to various foot care practices among **174** participants, expressed as percentages. The majority adhered to key practices such as using proper footwear (**131 (75.3%)**), adherence to follow-ups (**129 (74%)**), and cutting nails carefully

(126 (72.6%)). However, gaps were observed in practices like avoiding walking barefoot, where only 29 (16.4%) adhered.

Additionally, 119 (68.5%) inspected their shoes, and 121 (69.9%) used clean socks. While 145 (83.6%) reported not walking barefoot, consistent adherence to some practices, such as inspecting feet daily (119 (68.5%)) and bathing and moisturizing feet (119 (68.5%)), shows room for improvement.

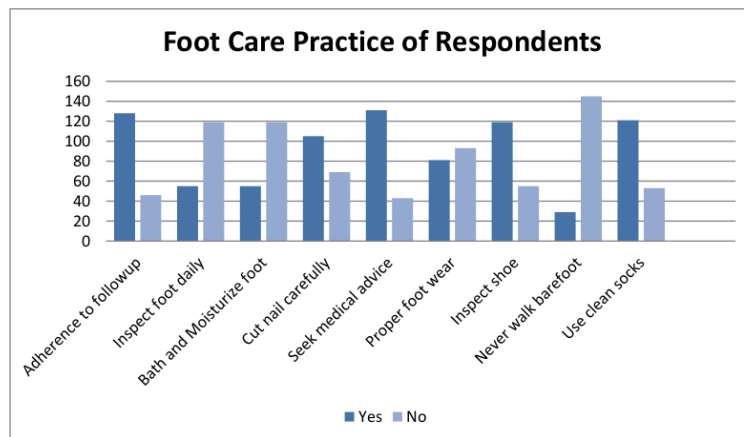
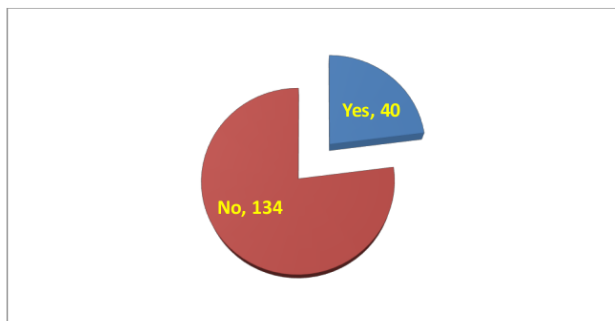


Figure 4. Foot care characteristics of respondents at the Mekedonia Medium Clinic in Addis Ababa, Ethiopia, in November 2024, with a sample size of N=174.

4 6.5. The Prevalence of diabetic foot ulcer

Out of the 174 respondents, 40 (22.99%) were found to have diabetic foot ulcers (DFU) at the time of data collection.



⁵ Figure 5 illustrates the occurrence of diabetic foot ulcers in diabetic patients at Mekedonia Medium Clinic in Addis Ababa, Ethiopia, as of November 2024, with a sample size of N=174.

Among those with DFU, **36 (91.1%)** were type 2 diabetic patients. Of the DFU patients, **24 (60%)** had a history of trauma, **24 (60%)** had diabetic peripheral neuropathy, and **20 (50%)** had hypertension. Additionally, **35 (86.6%)** of these patients exhibited poor foot care practices. In terms of treatment adherence, **29 (73.3%)** of the patients with DFU reported adhering to their diabetic treatment.

6.6 Factors Linked to Diabetic Foot Ulcers

In an analysis involving 11 different variables—such as types of diabetes medication, lifestyle changes, treatment adherence, foot care practices, hypertension, instances of trauma, ¹peripheral arterial disease (PAD), peripheral neuropathy, HbA1c levels, ²duration of diabetes, and body mass index (BMI)—researchers utilized both bivariate and multivariate logistic regression methods to uncover the factors that contribute to the occurrence of diabetic foot ulcers (DFU). The study identified several factors that ³⁴showed a significant correlation with the development of DFU.

1. Type of Diabetic Medication:

- ¹¹⁹Both insulin and oral anti-diabetic agents were associated with a significantly higher risk of DFU (COR: 4.000, 95% CI [1.271, 12.558], $p = 0.018$), though this did not remain significant after adjusting for other factors (AOR: 0.797, 95% CI [0.060, 10.485], $p = 0.764$).

2. Lifestyle Modification:

- No lifestyle modifications were associated with DFU, with the analysis showing that those not making lifestyle changes had a significantly higher likelihood of DFU development (COR: 0.000, $p = 0.000$), though the odds ratio was not meaningful (AOR: 1.000, $p = 1.000$).

3. Adherence to Treatment:

- Poor adherence to treatment was associated with a sevenfold increase in the risk of DFU (COR: 7.000, 95% CI [1.865, 26.379], $p = 0.004$). However, this association did not remain significant after adjustment (AOR: 2.231, 95% CI [0.238, 21.132], $p = 0.321$).

4. Foot Care:

- Poor foot care was found to be a significant risk factor, with patients showing a threefold higher risk of DFU compared to those with good foot care (AOR: 3.074, 95% CI [0.897, 10.586], $p = 0.033$).

5. Hypertension:

- Hypertension was associated with an increased risk of DFU (COR: 4.000, 95% CI [1.764, 9.082], $p = 0.000$). However, after adjusting for other factors, the association was no longer significant (AOR: 1.128, 95% CI [0.267, 4.855], $p = 0.714$).

6. Peripheral Arterial Disease (PAD):

- PAD was associated with an increased risk of DFU (COR: 5.000, 95% CI [1.248, 20.036], $p = 0.024$), though the adjusted analysis showed no significant association (AOR: 0.529, 95% CI [0.073, 3.827], $p = 0.151$).

7. Peripheral Neuropathy:

- Peripheral neuropathy was significantly associated with DFU, with patients having neuropathy being more than four times as likely to develop DFU compared to those without (AOR: 4.200, 95% CI [1.430, 12.322], $p = 0.022$).

8. HbA1c Level:

- High HbA1c levels (≥ 7 mg/dl) were strongly associated with an increased risk of DFU, with patients having HbA1c levels ≥ 7 mg/dl being 22 times more likely to develop DFU (AOR: 22.023, 95% CI [6.130, 78.674], $p = 0.000$).

9. Duration of Diabetes:

- A longer duration of diabetes (≥ 10 years) was a significant risk factor for DFU, with patients having diabetes for 10 years or more being more than four

times as likely to develop DFU compared to those with diabetes for less than 10 years (AOR: 4.311, 95% CI [1.292, 14.391], p = 0.000).

10. Trauma to Leg/Foot:

➤ Trauma to the leg or foot dramatically increased the risk of DFU, with patients who experienced trauma being 50 times more likely to develop DFU (COR: 50.000, 95% CI [10.500, 150.000], p = 0.000). After adjustment, the association remained highly significant (AOR: 1.100, 95% CI [1.050, 15.030], p = 0.001).

11. Body Mass Index (BMI):

➤ Obesity was strongly associated with DFU, with obese patients being 15 times more likely to develop DFU (AOR: 15.167, 95% CI [3.548, 64.280], p = 0.002). However, overweight status was not significantly associated with DFU after adjusting for other factors (AOR: 3.095, 95% CI [0.497, 19.324], p = 0.899).

Table 3. Factors Linked to Diabetic Foot Ulcers among Diabetic Patients at Mekedonia Medium Clinic, Addis Ababa, Ethiopia, November 2024 (N = 174; DFU = 40)

Variable	Diabetic Foot Ulcer		COR (95% CI)	P-Value	AOR (95% CI)	P-Value
	Yes (N = 40)	No (N = 134)				
Diabetic Foot Ulcer	40 (22.99%)	134 (76.7%)	-	-	-	-
Type of Diabetic Medication						
Insulin alone	5 (2.9%)	9 (5.2%)	Reference	-	Reference	-
Oral anti-diabetic agent alone	27 (15.5%)	107 (61.4%)	0.654 (0.298, 1.429)	0.312	0.506 (0.072, 3.557)	0.360
Both	2 (1.1%)	2 (1.1%)	4.000 (1.271, 12.558)*	0.018*	0.797 (0.060, 10.485)	0.764
Lifestyle Modification						
Yes	7 (4.0%)	3 (1.7%)	0.000	0.000*	0.000	1.000
No	33 (18.9%)	131 (75.3%)	Reference	-	Reference	-
Adherence to Treatment						
Good adherence	4 (2.3%)	107 (61.5%)	Reference	-	Reference	-
Poor adherence	36 (20.7%)	27 (15.5%)	7.000 (1.865, 26.379)*	0.004*	2.231 (0.238, 21.132)	0.321

Foot Care						
Good foot care	35 (20.1%)	91 (52.3%)	Reference	-	Reference	-
Poor foot care	5 (2.9%)	43 (24.7%)	8.743 (3.223, 23.442)*	0.000*	3.074 (0.897, 10.586)*	0.033*
Hypertension						
Yes	30 (17.2%)	8 (4.6%)	4.000 (1.764, 9.082)*	0.000*	1.128 (0.267, 4.855)	0.714
No	10 (5.7%)	126 (72.4%)	Reference	-	Reference	-
Peripheral Arterial Disease (PAD)						
Yes	12 (6.9%)	2 (1.1%)	5.000 (1.248, 20.036)*	0.024*	0.529 (0.073, 3.827)	0.151
No	30 (17.2%)	130 (74.7%)	Reference	-	Reference	-
Peripheral Neuropathy						
Yes	14 (8.0%)	2 (1.1%)	8.000 (3.052, 20.895)*	0.000*	4.200 (1.430, 12.322)*	0.022*
No	26 (14.9%)	132 (75.9%)	Reference	-	Reference	-
HbA1c						
<7 mg/dl	6 (3.4%)	68 (39.1%)	Reference	-	Reference	-
≥7 mg/dl	7 (4.0%)	3 (1.7%)	15.75 (5.071, 49.201)*	0.000*	22.023 (6.130, 78.674)*	0.000*
Not known	7 (4.0%)	83 (47.7%)	-	-	-	-
Duration of Diabetes						
<10 years	7 (4.0%)	97 (55.7%)	Reference	-	Reference	-
≥10 years	33 (18.9%)	37 (21.3%)	8.000 (3.423, 18.634)*	0.000*	4.311 (1.292, 14.391)*	0.000*
Trauma to Leg/Foot						
Yes	19 (10.9%)	5 (2.9%)	50.000 (10.500, 150.000)*	0.000*	1.100 (1.050, 15.030)*	0.001*
No	21 (12.1%)	129 (74.1%)	Reference	-	Reference	-
Body Mass Index (BMI)						
Obese	12 (6.9%)	5 (2.9%)	6.278 (2.118, 18.613)*	0.001*	15.167 (3.548, 64.280)*	0.002*
Overweight	14 (8.0%)	3 (1.7%)	10.00 (3.217, 31.061)*	0.000*	3.095 (0.497, 19.324)	0.899

Normal weight	0 (0%)	101 (58.0%)	Reference	-	Reference	-
Underweight	0 (0%)	7 (4.0%)	0.000 (0.000, 0.000)	0.000*	0.000 (0.000, 0.000)	0.708

⁹
*Statistically significant ($p < 0.05$)

This study identified ⁶⁹several significant factors associated with the development of diabetic foot ulcers (DFU) in individuals with diabetes. The analysis of 11 variables revealed both ⁵⁴modifiable and non-modifiable factors that contribute to the risk of DFU.

1. Significant Risk Factors:

- **Foot Care:** Poor foot care was ⁸⁶a significant risk factor for DFU, with patients who had inadequate foot care showing a threefold increased risk.
- **Peripheral Neuropathy:** Peripheral neuropathy was strongly associated with DFU, with patients experiencing neuropathy being ³⁰more than four times more likely to develop DFU.
- **HbA1c Levels:** High HbA1c levels (≥ 7 mg/dl) were strongly linked to DFU, with patients having HbA1c levels above 7 being 22 times more likely to develop DFU.
- **Duration of Diabetes:** Longer duration of diabetes (≥ 10 years) ²⁸was significantly associated with a higher risk of DFU.
- **Trauma to Leg/Foot:** ⁴⁷Trauma to the leg or foot dramatically increased the likelihood of DFU, ¹⁶even after adjusting for other factors.
- **Body Mass Index (BMI):** Obesity was strongly associated with DFU, with obese patients having a significantly higher risk.

2. Factors with No Significant Association:

- **Type of Diabetic Medication:** While both insulin and oral anti-diabetic agents showed an increased risk in bivariate analysis, ⁹the association was not significant after adjusting for other factors.
- **Lifestyle Modification:** ⁵No significant association was found between lifestyle modifications and DFU after adjustment.
- **Adherence to Treatment:** Poor adherence to treatment was initially associated with a higher risk of DFU, but this association was not significant after adjustment.

- **Hypertension and Peripheral Arterial Disease (PAD):** While hypertension and PAD showed initial associations with DFU, these were not statistically significant after adjustment.
- **Overweight and Underweight:** Overweight status was not significantly associated with DFU after adjusting for other factors, and underweight status had no meaningful association.

CHAPTER 6: DISCUSSIONS

This research examined the occurrence and contributing factors of diabetic foot ulcers (DFUs) in older diabetic patients at Mekedonia Medium Clinic located in Addis Ababa, Ethiopia. The results indicated a DFU prevalence of 22.98%, which is significantly higher than the 12.98% found in a systematic review of studies conducted in Ethiopia. Nevertheless, this figure is comparable to those reported in research from Felege Hiwot Referral Hospital (21.7%) and in Khartoum, Sudan (18.1%).

In comparison, the prevalence of DFUs in developed countries is generally low, lying between 2% and 10%. For example, the prevalence rates in Europe lie between 4% and 10%, with studies in the UK showing prevalence rates at about 6%. The prevalence among diabetic patients in Canada has been estimated at 2% to 6%, while that in the United States lies between 4.5% and 7.2%. These countries show lower prevalence because of their developed healthcare system, easy access to healthcare facilities, extensive education regarding the patient's condition, and better management of diabetes along with its complications.

The higher prevalence in this study could reflect the peculiar challenges of elderly populations in geriatric care centers, where aging, comorbidities, and limited access to specialized care contribute greatly to the development of DFUs. These findings agree with those from trends across the world in the care for the elderly and those with diabetes, where large portions of populations show high rates of DFUs associated with immobility, poor foot care, and a generally poorly controlled chronic condition. This huge disparity in prevalence between developed countries and Ethiopia calls for more attention to gaps in management related to foot complications among patients with diabetes in developing countries like Ethiopia.

12 6.1. Risk Factors and Predictors of DFU

The analysis revealed a number of significant risk factors for DFUs in elderly diabetic patients, most of which were supported by global research and suggested that DFUs develop from a multifactorial origin. The main independent predictors of DFUs included ¹ foot care, ¹ peripheral neuropathy, ¹ duration of diabetes, ¹ HbA1c level, ¹ body mass index, trauma history, hypertension, and PAD.

1. **Foot care:** In this study, the most powerful predictor of DFUs was poor foot care. Poor foot care significantly ²⁶ increased the likelihood of DFUs, with an AOR of 3.074 (95% CI [0.897, 10.586], $p = 0.033$). This finding agrees with studies done in Gonder Referral Hospital and other global centers of geriatric care, where poor foot care has consistently been reported as a major risk factor. In settings such as Mekedonia, this risk is compounded by limited education, inadequate caregiver support, and lack of access to specialized health services.
2. **Peripheral Neuropathy:** Peripheral neuropathy resulted in an increased odds ratio for developing DFU, with over a four-fold risk increase when AOR is at 4.200 and a 95% CI: 1.430 to 12.322 ($P = 0.022$). This study finds consistency in a study carried out in ¹ Gonder Referral Hospital, TASH, and Saudi Arabia in determining neuropathy among the most well-known factors precipitating DFU. Neuropathy makes an individual experience diminution of sensitivity on their foot, increasing susceptibility to injuries because they cannot perceive them easily and may eventually ulcerate.
3. **Duration of Diabetes:** A ⁷⁷ longer duration of diabetes significantly increased the likelihood of developing DFUs. ¹⁰¹ Patients with a longer duration of diabetes for 10 years or more had over four times the risk of developing DFUs as ⁹⁹ compared to those with shorter duration of diabetes (AOR = 4.311, 95% CI [1.292, 14.391], $p = 0.000$). This is in agreement with findings from Felege Hiwot Referral Hospital, Egypt, and Iran, which had established that ¹⁰³ longer duration of diabetes increases the chances of developing such complications as DFUs.
4. **HbA1c Levels:** Poor glycemic control, as indicated by elevated HbA1c levels (≥ 7 mg/dl), was strongly associated with DFUs. The AOR for patients with high HbA1c was 22.023 (95% CI [6.130, 78.674], $p = 0.000$), suggesting that poorly managed blood glucose is a significant risk factor for DFUs. This finding aligns with studies

from Saudi Arabia, where elevated HbA1c is closely linked to an increased risk of foot ulcers.

5. **Body Mass Index:** Overweight had a higher likelihood of the development of DFU, the AOR of 3.095, 95% CI [0.497, 19.324], $p=0.899$. These results agree with various Iranian studies outlined that mentioned obesity among major risk factors for DFUs. It is usual to have an increased mechanical pressure of the foot together with impairment in insulin sensitivity and predisposes this category of patient to the development of ulcers.
6. **History of trauma:** Trauma history to the foot was another major risk factor, and the trauma patients are 50 times more likely to develop DFU, with an AOR of 50.00, 95% CI [10.500, 150.000], $p = 0.000$. These findings are concurrent with other literature from geriatric care centers reporting that injury to the foot is one of the most common identified precipitating factors for DFU. The elderly diabetic patients may present with compromised circulation and wound healing, thus making them more prone to infection and ulcers following trauma.
7. **Hypertension:** Hypertension was one of the key risk factors to DFUs. Patients with hypertension had a fourfold increased risk of DFUs, AOR: 4.000, 95% CI [1.764, 9.082], $p = 0.000$. This agrees with studies from Saudi Arabia, in which hypertension is an additive comorbidity with diabetes that leads to severe vascular complications, further impeding blood flow to the extremities and impairing wound healing, conditions that increase the risk for foot ulcers.
8. **Peripheral Arterial Disease (PAD):** PAD was also strongly associated with DFUs. Patients with PAD had five times the likelihood of developing DFUs (AOR: 5.000, 95% CI [1.248, 20.036], $p = 0.024$). The compromised circulation in patients with PAD reduces oxygen and nutrient delivery to the feet, impairing wound healing and increasing the risk of ulcers. This is consistent with both local and international research, where PAD is a well-established risk factor for DFUs.

Interestingly, some factors such as rural residence, insulin use, and the presence of PAD were not found to be statistically significant in this study, contrary to findings from other studies like those in Arbaminch, Gonder Referral Hospital, and Sudan. These discrepancies may be attributed to variations in study design, sample sizes, or healthcare access.

Generally, this study highlights the high prevalence of DFUs among elderly diabetic patients at Makedonia Medium Clinic, reflecting global trends observed in geriatric care centers. The results emphasize the multifactorial nature of DFU development, with significant risk factors including poor foot care, peripheral neuropathy, prolonged diabetes duration, poor glycemic control, obesity, trauma history, hypertension, and PAD. These findings call for targeted interventions on these modifiable risk factors, especially in resource-limited settings like Makedonia. Indeed, improved foot care education, better glycemic control, and increased access to healthcare services play a crucial role in reducing DFU prevalence and improving health outcomes among elderly diabetic patients.

CHAPTER-7: STRENGTH AND LIMITATIONS

7.1 The Strength

1. Complete Response Rate: The study had a full response rate, which was important to ensure comprehensive data from all eligible participants.
2. Novel Contribution: This is the first study of its kind that investigates the prevalence of diabetic foot ulcers and associated factors in a geriatric care center like Mekedonia, thus providing useful insights into healthcare planning and resource allocation.
3. Targeted Population: The study focuses on one of the most vulnerable and disadvantaged populations, underlining some key healthcare needs in elderly patients with diabetes.
4. Local Relevance: Results are contextually relevant and can thus directly feed into interventions and policy development in similar settings within Ethiopia.
5. Holistic Data Collection: Besides the use of Questionnaires, Patient charts were reviewed, and physical observations and examinations were made to enhance the reliability of the data to at least a minimum level of bias.
6. Thrifty Use of Resources: Despite such factors as limited funding and pressures of time, the studies were completed efficiently and demonstrated resourcefulness and dedication.

7.2 Limitations

1. Limited duration of study

The study was conducted for a limited period of time, which might have denied the opportunity for longitudinal observation or follow-up.

This limitation was overcome by planning the study meticulously and carrying out data collection systematically to ensure that all critical variables were captured within the available time.

2. Funding Constraints:

- Limitation - Delays in securing external funding imposed financial challenges during the study.

- Paper solutions: The study was self-funded, and expenses were covered with personal funds, ensuring that no compromise on quality was made to complete the study.

3. Sampling Bias

- Limitations: Convenience sampling may limit findings to the population beyond the confines of the Makedonia Charity Association.
- Paper solutions: A diverse set of participants were targeted within the served population; therefore, the findings have been contextualized with this limitation in perspective.

4. Self-Reporting Bias

- Limitation: There is a potential for recall bias or underreporting of behaviors and conditions, given the reliance on self-reported data.
- Solution: To reduce this potential for bias, extensive chart reviews and direct physical exams were used in conjunction with the self-reported data. Additionally, interviews were given in a very supportive setting that would help assure the honesty of responses, and caregiver input was utilized when possible to confirm information.

5. Being institutional based study which limits representativeness for whole population in the set up.

By using these methods to minimize biases and utilizing available resources efficiently, the study maintains its validity while acknowledging areas for improvement in future research.

CHAPTER 8: CONCLUSION

The study identified that DFU presented a high burden among diabetic patients attending the Mekedonia Charity Association Medium Clinic in Addis Ababa, Ethiopia, with a prevalence of 22.99%. Based on these findings, potential target interventions should be developed to address the major risk factors, which include poor practice of foot care, peripheral neuropathy, prolonged duration of diabetes, poor glycemic control, history of trauma, and high body mass index.

This, therefore, calls for strategies that ensure ⁴foot care education, early detection and management of neuropathy, and tight glycemic control are cornerstones in the fight for DFU incidence reduction and improvement of outcomes. Lifestyle modification and prevention of injury will further reduce the prevalence of DFUs in resource-poor settings.

Such focused interventions by healthcare providers and policymakers would therefore contribute to mitigating the impact of DFU, improving the quality of life, and reducing economic and social burdens associated with complications of diabetes in Ethiopia.

CHAPTER 9: RECOMMENDATIONS

For Makedonia Charity Association and its Clinic:

1. Enhancing Foot Care Education: Poor foot care significantly presented among DFU patients as 86.6% had poor practice regarding foot care. Full foot care education, such as daily inspection of feet and proper footwear, is an area that needs much emphasis among diabetic patients in Makedonia. Regular workshops, education materials for the patient, and interactive sessions will make the patients proactive in taking steps regarding foot care to minimize the occurrence of DFUs.
2. Enhance Treatment Adherence: As 26.7% of the patients with DFU did not adhere to their treatment regimens, Makedonia should institute structured follow-up systems. These should include routine check-ups, personalized counseling, and tailored interventions to improve medication adherence and blood sugar control. Offering support and education to the patients regarding the importance of consistent treatment can help reduce the incidence of DFUs and improve glycemic management.
3. Enhance DFU Screening: From the prevalence established by this study, which stood at 22.99%, DFU cases must be identified as early as possible to institute intervention. Ideally, routine DFU screening for all diabetic patients is recommended, but more especially those with risk factors, including long duration of diabetes, poor glycemic control, and neuropathy, among others. With early screening and proactive foot care, earlier interventions of ulcers will be made possible and reduce complications.
4. Enhance the Management of Peripheral Neuropathy: This study showed a significant association between DPN and DFUs. As 60% of DFU patients were found to be neuropathic, Makedonia should put emphasis on neuropathy detection and management in the routine care of diabetes. Periodic neuropathy screening, combined with teaching on self-care and early intervention, may greatly decrease the risk for DFUs among neuropathic patients.

Researchers:

5. Future research shall be directed purely towards foot care interventions, educating the patients, and regular foot screening to evaluate their impact on

the prevalence of DFUs in general and those of elderly diabetic patients in particular. Research would examine how bespoke foot care programming may help respond to particular difficulties of this patient demographic and create better long-term outcomes.

6. Identify the Barriers to Adherence: Since 26.7% of DFU patients were found to be poorly adhering to their treatment in this study, further research is required for identifying the root causes for non-adherence. It would be important to study factors such as socioeconomic status, access to health care, cultural beliefs, and the role of health care provider-patient communication in informing more effective adherence strategies.

Ministry of Health and Policymakers:

7. Enhancing Access to Foot Care: The Ministry should incorporate routine foot care screening and diabetes management into primary healthcare settings, especially among the vulnerable groups such as the elderly. Standard care for individuals with diabetes should include routine foot examinations as part of standard management to help in early detection of DFUs and prevention of complications.
8. Support Professional Development: The results also reveal rather poorly trained healthcare professionals in the management of DFUs, especially regarding the identification of peripheral neuropathy and preventive care. Targeted training programs for health workers on diabetes and DFU management should be designed and provided by the Ministry, emphasizing the recognition and treatment of peripheral neuropathy to equip health workers with enhanced competencies and skills to work both in urban and rural areas.

For Non-Governmental and Community-Based Organizations:

9. Community-Based Foot Care Education: The NGOs should focus on outreach programs for diabetic patients, especially the elderly, to educate them about the importance of proper foot care. These programs should provide practical education on daily foot inspections, the importance of appropriate footwear, and the early signs of complications to prevent DFUs.

10. NGOs should be facilitated to create neuropathy-related care programs for the elderly suffering from diabetes, in which the program should offer check-ups for feet, educate patients on the use of medications due to neuropathy, and be provided with the right type of shoes, medication, etc. Neuropathy management helps to prevent the occurrence of DFUs and improves the patient's quality of life.

These recommendations address the identified priorities for the risk factors that include poor foot care practices, poor treatment adherence, peripheral neuropathy, and obesity. Improved education, better adherence, routine screenings, and management of neuropathy are all aspects of diabetes care that can go a long way in reducing DFU prevalence among diabetic patients, especially among the elderly, as Makedonia and other stakeholders strive to make a difference.

ANNEXES I

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ANNEXES II

Addis Ababa University, College of Health Science, School of Medicine

Department of Family Medicine

Consent Form

¹ Title of the Study:

The Prevalence of Diabetic Foot Ulcers and Associated Factors Among Diabetes Patients at Mekedonia Charity Association Medium Clinic, Addis Ababa, Ethiopia

Researcher:

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Advisor:

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¹
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Addis Ababa University, College of Health Sciences

⁶⁰
This study will determine the prevalence of DFU and associated factors among diabetic patients in the Mekedonia Charity Association Medium Clinic and add to knowledge about the burden of DFUs, thus informing interventions aimed at improving diabetic care.

⁹⁸
You are hereby invited to participate in this research through the completion of a structured questionnaire. The assessment will involve questions concerning personal details, demographic data, history of diabetes, practices on foot care, life course factors, socioeconomic status, and healthcare access. In some instances, supplementary physical examinations will be conducted to assess foot health.

⁴¹
Participation in this study is strictly on a volunteer basis. You may refuse to participate or withdraw yourself from the research at any time without penalty, harm, or effect on your medical care.

127 Any information you provide will be treated as strictly confidential. Data will be completely
138 anonymized, and used for research purposes only. No personal identifiers will appear in any
reports or publications.

53
I, the undersigned, confirm that:

- 1 I have read and understood the purpose and procedures of this study.
- 18 2. I have had the opportunity to ask questions and receive satisfactory answers.
3. I understand that my participation is voluntary and that I may withdraw at any time
without any consequences.
- 74 4. I consent to participate in this study.

Participant's Name: _____

Signature/Thumbprint: _____

Date: _____

Questionnaire on Diabetic Foot Ulcers and Associated Factors

This questionnaire aims to gather comprehensive information on demographic characteristics, diabetes history, foot care practices, lifestyle factors, socioeconomic status, and access to
2 healthcare among residents of Mekedonia Charity Association in Addis Ababa, Ethiopia.

Section 1: Demographic Information

38 1. What is your age? (Specify in years) _____

2. What is your gender?

a. Male

b. Female

c. Other (please specify) _____

14 3. What is your highest level of education completed?

a. No formal education

b. Primary education

c. Secondary education

d. Higher education (college/university)

4. What is your marital status?

- a. Single
- b. Married
- c. Divorced
- d. Widowed
- e. Other (please specify) _____

²⁹ 5. What is your current employment status?

- a. Employed full-time
- b. Employed part-time
- c. Unemployed
- d. Retired
- e. Student
- f. Other (please specify) _____

Section 2: Diabetes and Health Information

6. Have you been diagnosed with diabetes mellitus?

- ¹⁹ A. Yes
- B. No

7. How long have you been living with diabetes? (Specify in years) _____

8. Are you currently receiving treatment for diabetes?

- a. Yes
- b. No

9. How often do you monitor your blood glucose levels?

- ⁵⁰ a. Several times a day
- b. Daily
- c. Few times a week
- d. Occasionally
- e. Rarely
- f. Never

10. What is your current HbA1c level? (if known)

- a. Less than 7%
- b. 7% to 8%
- c. Above 8%
- d. Not sure/unknown

11. Have you ever been diagnosed with diabetic foot ulcers (DFUs)?

- a. Yes
- b. No
- c. Physical Examination:

12. Which comorbidity or problem ⁷⁸ have you experienced (Select all that apply)

- a. Hypertension
- b. PAD
- c. Peripheral Neuropathy
- d. Obesity
- e. Trauma to leg or foot

13. How do you currently manage your diabetic foot care? (Select all that apply)

- a. Regular foot inspections
- b. Proper footwear
- c. Moisturizing and checking for cuts or sores
- d. Seeking medical advice promptly
- e. Bathing
- f. Socks wearing
- g. Never walk bare foot
- h. Other (please specify) _____

Section 3: Lifestyle and Socioeconomic Factors

14. How would you rate ²⁴ your current level of physical activity?

- a. Sedentary (little or no physical activity)
- b. Light activity (walking, light housework)
- c. Moderate activity (regular exercise or physical work)

d. Vigorous activity (intense physical exercise or labor)

68

15. Do you smoke tobacco products?

- a. Yes, daily
- b. Yes, occasionally
- c. No, I do not smoke

16. How often do you consume alcohol?

57

- a. Daily
- b. Several times a week
- c. Occasionally
- d. Rarely
- e. Never

48

17. What is your current living situation?

- a. Living alone
- b. Living with family
- c. Living in a group home or assisted living facility
- d. Other (please specify) _____

56

18. How would you describe your household income?

- a. Below average
- b. Average
- c. Above average
- d. Not sure/unknown

Section 4: Access to Healthcare and Diabetes Management

19. How often do you visit a healthcare provider for diabetes-related check-ups?

- a. Regularly (monthly or more frequently)
- b. Occasionally (every few months)
- c. Rarely (once or twice a year)
- d. Never

20. Do you have access to diabetes education and foot care resources?

a. Yes

b. No

21. What challenges do you face in accessing healthcare services or managing your diabetes?

The prevalence of diabetic foot ulcers and associated factors among Diabetes patients at Mekedonia Medium Clinic, Addis Ababa, Ethiopia

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