

Monaldi Archives for Chest Disease

eISSN 2532-5264 https://www.monaldi-archives.org/

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Monaldi Arch Chest Dis 2026 [Online ahead of print]

To cite this Article:
Koyra HC, Anjulo MD, Bekele ML. **Guideline-directed statin therapy and cardiovascular events among patients with type 2 diabetes mellitus in South Ethiopia: a case-control study**. *Monaldi Arch Chest Dis* doi: 10.4081/monaldi.2026.4262

Submitted: 2-08-2026
Accepted: 27-10-2026

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Guideline-directed statin therapy and cardiovascular events among patients with type 2 diabetes mellitus in South Ethiopia: a case-control study

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Contributions: Hailu Chare Koyra: conception, design, data analysis, interpretation of the results , drafting the manuscript. Mebratu Dawit: data analysis, design, software, interpretation of the results. Mebratu Legesse Bekele: conception, design, data analysis, interpretation of the results , supervision. All the authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Conflict of interest: the authors declare that no conflict of interest in this work.

Ethics approval and consent to participate: the study received approval from the Institutional Review Board (IRB) of Wolaita Sodo University, College of Health Sciences (IRB No: CRCSD/ERC/098/02/14).

Informed consent: written consent to participate were obtained from all study participants.

Patient consent for publication: not applicable.

Availability of data and materials: the datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Acknowledgments: the authors would like to acknowledge the Wolaita Sodo University Hospital, data collectors and the participants for their involvement in the study.

Declaration of generative artificial intelligence and artificial intelligence-assisted technologies in the writing process: not used.

Abstract

Type 2 diabetes mellitus (T2DM) significantly increases cardiovascular disease (CVD) risk. Statin therapy is a cornerstone of primary prevention, yet suboptimal prescribing and adherence remain common, particularly in resource-limited settings. Evidence on statin utilization and outcomes in Ethiopian T2DM patients is limited. This study aimed to determine the association between guideline-directed statin therapy and cardiovascular events among T2DM patients at Wolaita Sodo University Comprehensive Specialized Hospital (WSUCSH).

A hospital-based case-control study was conducted from April to July 2022 at WSUCSH in South Ethiopia. Cases were T2DM patients aged 40-75 years who developed a first cardiovascular event after T2DM diagnosis. Controls were T2DM patients without CVD, frequency-matched by age (±5 years) and sex. Data were collected through retrospective medical record review and patient interviews using a structured data abstraction form and the Morisky Medication Adherence Scale. Unconditional logistic regression was used to estimate adjusted odds ratios (AOR) with 95% confidence intervals (CI), with age and sex included as covariates to account for the frequency-matched design. A p-value <0.05 was considered statistically significant.

A total of 196 participants (98 cases and 98 controls) were included. Among cases, stroke (43.9%) and myocardial infarction (35.7%) were the most frequent cardiovascular events. Patients receiving guideline-directed statin therapy had significantly lower odds of CVD events [AOR=0.242, 95% CI: 0.093-0.630, p=0.004]. However, only 13.8% received guideline-concordant therapy, and annual lipid testing was documented in only 4.6%.

In this case-control study, guideline-directed statin therapy was associated with lower odds of cardiovascular events among T2DM patients in South Ethiopia. However, the majority of participants did not receive guideline-concordant therapy, highlighting a substantial practice gap. Interventions to improve statin prescribing, adherence, and continuity are urgently needed in this setting.

Key words: statins, primary prevention, type 2 diabetes, cardiovascular disease, case-control study, South Ethiopia.

Introduction

Type 2 diabetes mellitus (T2DM) is a global public health emergency, with prevalence increasing rapidly in low- and middle-income countries, including Ethiopia [1,2]. T2DM substantially increases the risk of cardiovascular disease (CVD), which remains the leading cause of morbidity and mortality among this patient population [3]. The underlying pathophysiological mechanisms include hyperglycemia-induced endothelial dysfunction, oxidative stress, chronic inflammation, and accelerated atherosclerosis, all of which contribute to the development of myocardial infarction, stroke, and peripheral vascular disease [1,4]. Given this elevated risk, primary prevention strategies are essential to reduce the burden of CVD among T2DM patients [1,3-5].

Statins (HMG-CoA reductase inhibitors) are the cornerstone of pharmacological primary prevention of CVD in T2DM [6,7]. Clinical practice guidelines, including those from the American College of Cardiology/American Heart Association (ACC/AHA) and the American Diabetes Association (ADA), recommend moderate-intensity statin therapy for all T2DM patients aged 40–75 years without established CVD, regardless of baseline cholesterol levels [8]. For those with additional risk factors or existing CVD, high-intensity statin therapy is recommended [9]. These recommendations are supported by robust evidence from large randomized controlled trials demonstrating that statins reduce major cardiovascular events by approximately 25% per 1 mmol/L reduction in LDL cholesterol, with similar relative risk reductions in diabetic and non-diabetic populations [5,7,8,10].

The Collaborative Atorvastatin Diabetes Study (CARDS) provided pivotal evidence for statin use in T2DM primary prevention, demonstrating a 37% reduction in major cardiovascular events among T2DM patients receiving atorvastatin compared to placebo [11]. Similarly, the Heart Protection Study showed that simvastatin therapy reduced major vascular events by approximately 25% in diabetic patients [12]. These findings have established statins as an essential component of comprehensive cardiovascular risk management in T2DM. Despite the strong evidence and clear guideline recommendations, statin utilization for primary prevention among T2DM patients remains suboptimal worldwide [13]. Studies from various settings report statin prescribing rates ranging from 40% to 70% in eligible T2DM patients [14]. Even when prescribed, medication adherence is often poor, with discontinuation rates as high as 50% within the first year of initiation [15,16]. Barriers to optimal statin use include patient-related factors (medication cost, side effects,

health literacy), provider-related factors (knowledge gaps, clinical inertia), and health system factors (medication availability, follow-up systems) [15-17].

Early initiation of statin therapy has been shown to confer significant cardiovascular benefits. The time to benefit from statins for primary prevention in adults aged 50–75 years is approximately 2.5 years, suggesting that patients with a life expectancy of at least 2.5 years are likely to benefit from statin therapy [18]. This finding has important implications for clinical decision-making and patient counseling in resource-limited settings where medication costs may be a barrier to long-term therapy. Statin intensity also plays a crucial role in cardiovascular risk reduction. High-intensity statin therapy (atorvastatin 40–80 mg, rosuvastatin 20–40 mg) has been shown to provide greater LDL reduction and cardiovascular event reduction compared to moderate-intensity therapy [19]. However, the appropriate intensity must be balanced against the risk of adverse effects and cost considerations in resource-limited settings [20].

In Ethiopia, the burden of T2DM and its complications is increasing, yet data on statin utilization and outcomes in this population are extremely limited [21]. The Ethiopian healthcare system has made significant strides in expanding chronic disease care, but challenges remain in implementing evidence-based preventive strategies [22]. Studies from other African settings have reported statin prescribing rates ranging from 44% to 56% among eligible T2DM patients, with adherence rates typically below 60% [23,24].

Although the cardiovascular benefits of statins in patients with type 2 diabetes mellitus are well established, evidence on their real-world utilization and the implementation of recommended cardiovascular risk-management practices remains limited in Ethiopia. In particular, information on statin treatment intensity, guideline concordance, treatment discontinuation, adherence, and lipid-monitoring practices in routine diabetes care is scarce. Therefore, this study aimed to assess the association between guideline-directed statin therapy and cardiovascular events among patients with type 2 diabetes mellitus at a tertiary hospital in Ethiopia, and to describe current statin utilization and cardiovascular risk-management practices in this setting.

Materials and Methods

Study setting, design, and period

This study was conducted at Wolaita Sodo University Comprehensive Specialized Hospital (WSUCSH), located 328 kilometers southwest of Addis Ababa, Ethiopia. The hospital was

established in 1928 and serves a catchment population of over 15 million people in the South Ethiopian Region. According to hospital records, approximately 630 patients with type 2 diabetes mellitus (T2DM) are enrolled in the chronic care clinic, of whom 290 have a documented follow-up history exceeding 2.5 years. A hospital-based matched case-control study was employed . Data were collected from April to July 2022 through retrospective medical record review and patient interviews.

Source and study population

The source population comprised all T2DM patients on follow-up at the WSUCSH diabetes clinic. The study population included T2DM patients aged 40–75 years with at least 2.5 years of documented follow-up who visited the clinic during the data collection period. The age range was selected based on clinical practice guidelines recommending statin therapy for primary prevention of cardiovascular disease (CVD) in this demographic [8]. Patients with CVD diagnosed prior to T2DM diagnosis, those on antiplatelet therapy (indicative of established CVD), those with incomplete medical records, and those who declined to participate in the interview were excluded from the study.

Cases : Patients with type 2 diabetes mellitus aged 40–75 years who had more than 2.5 years of documented follow-up and a first documented cardiovascular event after the diagnosis of diabetes mellitus were included. Cardiovascular events were defined as a composite of the first occurrence of any of the following: stroke, myocardial infarction, heart failure, or angina, confirmed through medical record documentation (physician diagnosis, ECG findings, cardiac biomarkers, or imaging reports). Patients with documented cardiovascular disease before the diagnosis of diabetes mellitus were excluded.

Controls: Patients with type 2 diabetes mellitus aged 40–75 years who had more than 2.5 years of documented follow-up and no documented cardiovascular disease were selected from the same source population. Controls were frequency-matched to cases by sex and age category (±5 years).

Sample size determination and sampling procedure

The sample size was calculated using the standard formula for frequency-matched case-control studies.. Based on preliminary hospital data, the proportion of statin use among cases (P_1) was

estimated at 40%, and among controls (P_2) at 60%. With 80% power, a 5% significance level ($\alpha = 0.05$), and a two-sided test, the required sample size was 98 cases and 98 controls, yielding a total sample of 196 participants. Cases meeting the eligibility criteria during the study period were included consecutively. Controls were selected from eligible patients without documented cardiovascular disease and frequency-matched to cases by age and sex. A 1:1 matching ratio was applied to maximize statistical efficiency.

Variables

The dependent variable was the presence or absence of cardiovascular events, which defined case/control status. The primary independent variable was statin therapy received before the index cardiovascular event among cases. Secondary independent variables included sociodemographic factors (age, sex, occupation, residence, educational status), clinical characteristics (body mass index, blood pressure, lipid profile, HbA1c, duration of diabetes), comorbidities (hypertension, dyslipidemia, chronic kidney disease), statin-related factors (type of statin, dose, duration of use, adherence, discontinuation history), lifestyle factors (smoking status, physical activity), family history of T2DM or CVD, and adherence to anti-diabetic medications.

Operational definitions

Statin exposure was ascertained from medical records documenting statin prescriptions prior to the index cardiovascular event for cases, and prior to the corresponding reference date for controls.

Primary prevention referred to statin use in T2DM patients without pre-existing CVD [12].

Guideline-directed statin therapy was defined according to the 2018 ACC/AHA and 2020 ADA guidelines. Patients aged 40–75 years with T2DM and no additional ASCVD risk factors were considered eligible for moderate-intensity statin therapy (atorvastatin 10–20 mg, rosuvastatin 5–10 mg). Those with additional risk factors or established CVD were considered eligible for high-intensity therapy (atorvastatin 40–80 mg, rosuvastatin 20–40 mg). Patients were classified as receiving guideline-directed therapy if their prescribed statin intensity was appropriate for their risk category. Statin intensity was classified as moderate-intensity (atorvastatin 10–20 mg, rosuvastatin 5–10 mg, simvastatin 20–40 mg) or high-intensity (atorvastatin 40–80 mg, rosuvastatin 20–40 mg) [6,7].

Statin discontinuation was defined as interruption of statin therapy for 30 days or more after initiation [15].

Hypertension was defined as systolic blood pressure of 140 mmHg or greater and/or diastolic blood pressure of 90 mmHg or greater, or current use of antihypertensive medication, though per 2022 ADA guidelines, the target for T2DM patients is below 130/80 mmHg [7,14].

Dyslipidemia was defined as LDL-C of 100 mg/dL or greater, or current use of lipid-lowering therapy [6,7,14].

Body mass index categories were defined as underweight (<18.5 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), and obesity (≥30 kg/m^2) [14].

Physical activity was defined as exercise for at least 30 minutes per day, five days per week.

Data collection tools and procedures

Data were collected using a structured data abstraction form developed specifically for this study. The form captured sociodemographic data, clinical parameters, comorbidities, statin prescription details, and CVD event history. Statin adherence was assessed using the Morisky Green Levine (MGL) 4-item scale, which is a validated, public-domain instrument developed by Morisky, Green, and Levine (1986). The scale consists of four yes/no questions addressing common barriers to medication-taking: (1) Do you ever forget to take your medicine? (2) Are you careless at times about taking your medicine? (3) When you feel better, do you sometimes stop taking your medicine? (4) Sometimes if you feel worse when you take the medicine, do you stop taking it? Each item is scored as 0 for "Yes" and 1 for "No," yielding a total score ranging from 0 to 4. Patients with a score of 3 or more were classified as adherent, and those with a score below 3 were classified as non-adherent. The MGL scale has demonstrated both concurrent and predictive validity with regard to clinical outcomes in chronic disease populations [25]. The Framingham 10-year CVD risk score was calculated for each participant using the standard risk calculator to assess baseline CVD risk [26]. Data were collected through retrospective medical record review and patient interviews. Clinical parameters, statin prescriptions, laboratory results, and documented CVD events were extracted from patient charts. Supplementary information on medication adherence, lifestyle factors, and discontinuation history was obtained through structured interviews with patients during their clinic visits. For cases, CVD events were confirmed through chart review, including physician diagnosis, ECG findings, cardiac biomarkers, or

imaging reports. For controls, absence of CVD was confirmed by reviewing medical records for any documented CVD diagnosis. Before data collection, the abstraction form was pilot-tested on 10 patient charts (5 cases and 5 controls) to assess clarity and completeness, and minor modifications were made based on pilot findings. Data were collected by two pharmacists and one BSc nurse who were trained on the study objectives, data abstraction procedures, and the use of the MMAS-8. The principal investigator reviewed all completed forms daily for completeness and consistency. Incomplete charts were excluded from the analysis. For cases, all statin prescriptions were reviewed and only those documented before the index cardiovascular event were considered as exposure. Prescriptions initiated after the event were not counted as exposure.

Statistical analysis

Data were entered, cleaned, and were analyzed using SPSS version 25. Descriptive statistics were computed for all variables. Continuous variables were expressed as means with standard deviations; categorical variables as frequencies and percentages. Unconditional logistic regression was used to estimate adjusted odds ratios (AOR) with 95% confidence intervals. Age (continuous) and sex were included as covariates to account for the frequency-matched design. The primary exposure was guideline-directed statin therapy. Model fit was assessed using the Hosmer-Lemeshow goodness-of-fit test. A p-value < 0.05 was considered statistically significant.

Ethical considerations

Ethical approval was obtained from the Institutional Review Board of Wolaita Sodo University. Permission was also obtained from the hospital administration and the head of the diabetes clinic. Written informed consent was obtained from all participants prior to the interview. Patient confidentiality was maintained throughout the study, and all data were anonymized prior to analysis. Participants were informed of their right to withdraw from the study at any time without affecting their medical care.

Results

Baseline characteristics of study participants

A total of 196 participants (98 cases and 98 controls), were included in the study. The mean age was 55.29 ± 7.80 years among cases and 54.46 ± 6.98 years among controls. Males accounted

for 45 (45.9%) cases and 47 (48.0%) controls, while females accounted for 53 (54.1%) and 51 (52.0%), respectively. The age and sex distributions were comparable between the two groups, consistent with the frequency-matching approach. Most participants were married, with 85 (86.7%) cases and 92 (93.9%) controls being married. Urban residents accounted for 71 (72.4%) participants in each group. Regarding educational attainment, college-level or higher education was reported by 40 (40.8%) cases and 51 (52.0%) controls, while secondary education was reported by 31 (31.6%) cases and 23 (23.5%) controls (Table 1).

Clinical and cardiovascular risk characteristics

A history of hospitalization was reported for 28 (28.6%) cases and 27 (27.6%) controls. A history of comorbidity was documented in 39 (39.8%) cases and 18 (18.4%) controls. Elevated blood pressure (>140/90 mmHg) during the preceding month was documented in 51 (52.0%) cases and 31 (31.6%) controls, while elevated blood pressure at the time of data collection was documented in 51 (52.0%) cases and 24 (24.5%) controls. Regarding body mass index (BMI), 32 (32.7%) cases and 24 (24.5%) controls had a BMI of 18.5–24.9 kg/m^2, while 60 (61.2%) cases and 72 (73.5%) controls had a BMI of 25.0–29.9 kg/m^2. A BMI ≥30 kg/m^2 was documented in 6 (6.1%) cases and 2 (2.0%) controls. A history of cardiovascular risk factors was reported by 84 (85.7%) cases and 73 (74.5%) controls. Physical inactivity was documented in 23 (23.5%) cases and 23 (23.5%) controls, central obesity in 31 (31.6%) cases and 34 (34.7%) controls, increased BMI as a reported risk factor in 15 (15.3%) cases and 11 (11.2%) controls, and family history in 6 (6.1%) cases and 4 (4.1%) controls. Smoking was reported in 2 (2.0%) cases and 1 (1.0%) control.

A history of medications categorized as cardiovascular risk-related medications was reported in 26 (26.5%) cases and 20 (20.4%) controls. According to the documented Framingham risk categories, 11 (11.2%) cases and 15 (15.3%) controls were classified as low risk, and 16 (16.3%) cases and 13 (13.3%) controls as high risk. A documented lipid profile was available for 84 (42.9%) participants, while annual lipid testing was documented in only 4.6%. (Table 2).

Statin utilization and treatment characteristics

Overall, 181 (92.3%) of the 196 participants were receiving statin therapy, including 89 (90.8%) cases and 92 (93.9%) controls. Atorvastatin was the predominant statin, accounting for 179 (98.9%) of all statin users, while 2 (1.1%) participants received simvastatin. Among all

participants, 151 (77.0%) received high-intensity statin therapy , and 28 (14.3%) received moderate-intensity statin therapy (atorvastatin 10–20 mg). Guideline-concordant statin therapy was documented in 27 (13.8%) participants, comprising 6 (6.1%) cases and 21 (21.4%) controls. Statin discontinuation was documented in 9 (9.2%) cases and 2 (2.0%) controls (Table 3). High adherence to statin and antidiabetic medications was reported in 74.5% of cases and 90.2% of controls (Figure 1).

Cardiovascular events and associated factors

Among the 98 cases, stroke was the most frequently documented cardiovascular event, accounting for 43 (43.9%) cases, followed by myocardial infarction in 35 (35.7%) (Figure 2). In the multivariable unconditional logistic regression analysis, patients receiving guideline-directed statin therapy had significantly lower odds of CVD events compared to those not receiving it [AOR = 0.242, 95% CI: 0.093–0.630, p = 0.004]. Patients not receiving guideline-directed statin therapy had approximately fourfold higher odds of CVD events [AOR = 4.13, 95% CI: 1.59–10.75]. Age [AOR = 1.014, 95% CI: 0.975–1.054, p = 0.480] and sex [AOR = 0.967, 95% CI: 0.542–1.724, p = 0.908] were not significantly associated with CVD events. The model demonstrated good fit (Hosmer-Lemeshow $\chi^2 = 3.271$, df = 8, p = 0.916) (Table 4).

Discussion

This study aimed to determine the association between guideline-directed statin therapy and cardiovascular events among patients with type 2 diabetes mellitus at a tertiary hospital in Ethiopia. We found that patients receiving guideline-directed statin therapy had significantly lower odds of cardiovascular events compared to those not receiving it (AOR = 0.242, 95% CI: 0.093–0.630, p = 0.004). However, only 13.8% of participants received guideline-concordant therapy, and annual lipid testing was documented in only 4.6%. These findings highlight a substantial gap between evidence-based recommendations and real-world practice in this setting.

The association between guideline-directed statin therapy and reduced cardiovascular events is consistent with landmark randomized controlled trials. In the Heart Protection Study, simvastatin reduced major vascular events by approximately 25% in diabetic patients [12]. Similarly, the Collaborative Atorvastatin Diabetes Study (CARDS) was terminated early due to a 37% reduction in major cardiovascular events among T2DM patients receiving atorvastatin compared to placebo

[11]. A recent systematic review by the U.S. Preventive Services Task Force found that statin therapy was associated with a 1% to 11% reduction in composite cardiovascular outcomes across trials [27]. Our findings reinforce the importance of guideline adherence in this high-risk population.

The rate of guideline-concordant statin prescribing in our study (13.8%) was substantially lower than that reported in other settings. A study from Malaysia reported that 71.5% of T2DM patients received statin therapy according to clinical practice guidelines [28]. A study from Botswana found that less than half (44.1%) of statin-eligible patients received statin therapy [23]. The low rate observed in our study may reflect several factors unique to the Ethiopian context, including limited access to medications, inadequate provider awareness of guidelines, and competing healthcare priorities in a resource-limited setting. It may also reflect our classification of guideline concordance based on moderate-intensity statin therapy only; high-intensity statins, which were commonly prescribed, may be appropriate for many patients but were not classified as guideline-directed in this analysis.

High adherence to statin and antidiabetic medications was reported in 74.5% of cases compared with 90.2% of controls. Statin discontinuation was documented in 9.2% of cases and 2.0% of controls. These findings suggest that medication continuity and adherence are important targets for intervention. Previous studies have reported that statin discontinuation is associated with a 24–46% increase in cardiovascular risk [15]. The reasons for discontinuation in our setting may include medication cost, side effects, lack of patient education, and poor follow-up, all of which warrant further investigation.

Atorvastatin was the most commonly prescribed statin in our study (98.9% of statin users), which is consistent with findings from Botswana where atorvastatin was exclusively prescribed for eligible T2DM patients [23]. However, prescribing patterns differed substantially from earlier Ethiopian studies. A study conducted in Jimma University in 2018 found that simvastatin was the most frequently prescribed (37.2%), followed by atorvastatin (32.8%) and rosuvastatin (15.6%) [21]. This shift toward increased atorvastatin use likely reflects evolving prescriber preferences, possibly influenced by its availability, cost-effectiveness, and accumulating evidence supporting its efficacy in diabetes populations.

High-intensity statin therapy was prescribed to 77.0% of participants in our study, which represents a departure from guideline recommendations that moderate-intensity statin therapy

should be used for primary prevention in T2DM patients aged 40–75 years without established CVD [8]. This finding was consistent with a study from Botswana where atorvastatin 40 mg was the most commonly prescribed dose [23]. The use of high-intensity statins for primary prevention raises concerns about potential overtreatment and increased risk of adverse effects, particularly in resource-limited settings where monitoring for statin-associated adverse events may be limited. However, it may also reflect a pragmatic approach to achieving greater LDL reduction in a population with limited access to lipid monitoring and follow-up.

The most commonly identified cardiovascular events among cases were stroke (43.9%), myocardial infarction (35.7%), heart failure (15.3%), and angina (5.1%). This pattern is consistent with the known cardiovascular complications of T2DM [3]. Hypertension was present as a comorbidity in 71.4% of cases and underscores the importance of blood pressure control as a component of comprehensive cardiovascular risk management.

Lipid profile testing was performed in only 42.9% of participants, and annual lipid testing was extremely low (4.6%). This pattern is consistent with findings from other Ethiopian studies where only 39.5% of T2DM patients had a clear lipid profile recorded [21]. The low rates of lipid monitoring represent a significant gap in cardiovascular risk management, as monitoring is essential for assessing treatment response, adjusting therapy, and ensuring patient safety. In resource-limited settings like Ethiopia, the affordability and availability of lipid tests remain significant barriers to guideline-concordant care [22].

Limitations

This study has several limitations. First, the relatively small sample size and single-center design limit the precision and generalizability of the findings. Second, the retrospective use of medical records resulted in incomplete documentation of some clinical variables. Third, information obtained through patient interviews may be subject to recall and reporting bias. Fourth, although we used unconditional logistic regression with age and sex as covariates to account for frequency matching, residual confounding cannot be excluded.

Implication for clinical practice and policy

First, interventions are urgently needed to improve guideline-concordant statin prescribing. Clinical decision support systems, provider education, and audit-feedback mechanisms could be

effective strategies. Second, adherence and continuity of statin therapy should be prioritized through patient education, simplified dosing regimens, and proactive monitoring. Third, statin discontinuation should be monitored closely, and patients who discontinue therapy should be proactively identified and counseled. Integration of pharmacy services into diabetes clinics could facilitate medication monitoring. Fourth, comprehensive cardiovascular risk reduction must address the full spectrum of risk factors hypertension, dysglycemia, dyslipidemia, smoking, and physical inactivity alongside statin therapy. Policymakers should integrate cardiovascular prevention into national diabetes guidelines and implement quality improvement initiatives to bridge the gap between evidence and practice.

Future research

Future research should focus on: (1) prospective cohort studies to establish temporal relationships between statin use and CVD outcomes in Ethiopian settings; (2) qualitative studies exploring patient and provider perspectives on statin barriers and facilitators; (3) interventional studies evaluating targeted strategies to improve statin prescribing and adherence; and (4) health economic analyses to determine the cost-effectiveness of statin therapy and adherence interventions in resource-limited contexts

Conclusions

In this case-control study, guideline-directed statin therapy was associated with lower odds of cardiovascular events among patients with type 2 diabetes mellitus in South Ethiopia. Stroke, myocardial infarction, and heart failure were the most common cardiovascular events among cases. However, guideline concordance, adherence, and lipid monitoring were suboptimal, suggesting a considerable gap between evidence-based recommendations and real-world practice. Clinicians may consider prioritizing guideline-directed statin prescribing and adherence counseling, while health systems and policymakers could benefit from strengthening medication access, patient education, and quality improvement initiatives to bridge this gap in Ethiopian healthcare settings.

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Table 1. Socio-demographic characteristics of patients with type 2 DM with follow up history of more than 2 and half years at WSUCSH, Sodo, Ethiopia, 2022.

Variables	Categories	Case, n (%)	Control, n (%)	Total, n (%)
Sex	Male	45 (45.9)	47 (48)	92 (46.9)
	Female	53 (54.1)	51(52)	104 (53.1)
Age	Mean ± SD	55.29±7.80	54.46±6.98	54.87±7.39
	40-44	7 (7.1)	8 (8.2)	15 (7.7)
	45-49	20 (20.4)	18 (18.4)	38 (19.4)
	50-54	22 (22.4)	26 (26.5)	48 (24.5)
	55-59	17 (17.3)	18 (18.4)	35 (17.9)
	60-64	18 (18.4)	18 (18.4)	36 (18.4)
	65-69	9 (9.2)	9 (9.2)	18 (9.2)
	70-74	5 (5.1)	1 (1.0)	6 (3.1)
Marital status	Unmarried	2 (2.0)	1 (1.0)	3 (1.5)
	Married	85 (86.7)	92 (93.9)	177 (90.3)
	Widowed	11 (11.2)	5 (5.1)	16 (8.2)
Place of residence	Urban	71 (72.4)	71 (72.4)	142 (72.4)
	Rural	27 (27.5)	27 (27.5)	54 (27.6)
Educational status	Illiterate	9 (9.2)	3 (3.1)	12 (6.1)
	Read and write only	3 (3.1)	5 (5.1)	8 (4.1)
	Primary (1-8)	15 (15.3)	16 (16.3)	31 (15.8)
	Secondary (9-12)	31 (31.6)	23 (23.5)	54 (27.6)
	College and above	40 (40.8)	51 (52.0)	91 (46.4)
Monthly income (EB)	<500	5 (5.1)	2 (2.0)	7 (3.6)
	500-999	8 (8.2)	4 (4.1)	12 (6.1)
	1000-1499	17 (17.3)	9 (9.2)	26 (13.3)
	1500-2000	10 (10.2)	6 (6.1)	16 (8.2)
	2001-2500	6 (6.1)	9 (9.2)	15 (7.7)
	>2500	52 (53.1)	68 (69.4)	120 (61.2)

SD, standard deviations. Percentages are calculated per column.

Table 2. Clinical characteristics of patients with type 2 diabetes with follow up history of more than $2^{1/2}$ years at WSUCSH, Wolaita Sodo, Ethiopia, 2022

Variables	Categories	Case, n (%)	Control, n (%)	Total, n (%)
	Mean ± SD	27.3±5.66	28.4±5.50	27.9±5.58
	18.5-24.9	32 (32.7)	24 (24.5)	56 (28.6)
	25-29.9	60 (61.2)	72 (73.5)	132 (67.3)
	≥30	6 (6.1)	2 (2.0)	8 (4.1)
Hospitalization history	Yes	28 (28.6)	27 (27.6)	55 (28.1)
	No	70 (71.4)	71 (72.4)	141 (71.9)
Last month BP	>140/90	51 (52)	31 (31.6)	82 (41.8)
	<140/90	47 (48)	67 (68.4)	114 (58.2)
BP at data collection	>140/90	51 (52)	24 (24.5)	75 (38.3)
	<140/90	47 (48)	74 (75.5)	121 (61.7)
Comorbidities' history	Yes	39 (39.8)	18 (18.4)	57 (29.1)
	No	59 (60.2)	80 (81.6)	139 (70.9)
Types of comorbidity	Back pain	8 (8.2)	5 (5.1)	13 (6.6)
	Osteoarthritis	12 (12.2)	4 (4.1)	16 (8.2)
	COPD	4 (4.1)	3 (3.1)	7 (3.6)
	Others*	15 (15.3)	6 (6.1)	21 (10.7)
Risk factors history	Yes	84(85.7)	73 (74.5)	157 (80.1)
	No	14 (14.3)	25 (25.5)	39 (19.9)
Types of risk factor	Physical inactivity	23 (23.5)	23(23.5)	46 (23.5)
	Family history	6 (6.1)	4 (4.1)	10 (5.1)
	Smoking	2 (2.0)	1 (1.0)	3 (1.5)
	Increased BMI	15 (15.1)	11 (11.2)	26 (13.3)
	Alcohol use	6 (6.1)	0 (0%)	6 (3.3)
	Central obesity	31 (31.6)	34 (34.7)	65 (33.2)
	Others**	1 (1.0)	0 (0%)	1 (0.5)
Risk medication history	Yes	26 (26.5)	20 (20.4)	46 (23.5)
	No	72 (73.5)	78 (79.6)	150 (76.5)
Type of risk medication	Anti-fungal	3 (3.1)	5 (5.1)	8 (4.1)
	Stimulants	11 (11.2)	6 (6.1)	17 (8.7)
	Anti-depressants	1 (1.0)	1 (1.0)	2 (1.0)
	Others***	11 (11.2)	8(8.2)	19(9.7)
Framingham risk score	Low risk	11 (11.2)	15 (15.3)	26 (13.3)
	Borderline	2 (2.0)	11 (11.2)	13 (6.6)
	Intermediate	9(9.2)	7 (7.1)	16 (8.2)
	High risk	16(16.3)	13 (13.3)	29 (14.8)

others*: asthma, peptic ulcer disease, epilepsy, psoriasis, gout ; others**: stress; others***: non-steroidal anti-inflammatory drug., BMI: Body mass index, COPD: chronic obstructive Pulmonary disease, BP: Blood Pressure, SD: standard deviation

Table 3. Commonly prescribed statin type and dosage of ambulatory patients with type 2 DM with follow up history of more than 21/2 years at WSUCSH, Wolaita Sodo, Ethiopia, 2022

Variables	Statin categories	Case, n (%)	Control, n (%)	Total, n (%)
Statin type	Atorvastatin	88 (89.8)	91 (92.9)	179 (98.9)
	Simvastatin	1 (1.0)	1 (1.0)	2 (1.0)
Dose for atorvastatin	10-20 mg	8 (8.2)	20 (20.4)	28 (14.2)
	40-80 mg	80 (81.6)	71 (72.4)	151 (77.0)
Dosage of simvastatin	20-40 mg	1 (1.0)	1 (1.0)	2 (1.0)

Table 4. Factors associated with cardiovascular events.

Variables	B	SE	Wald	df	Sig.	Exp(B)	95% CI for EXP(B)	
							Lower	Upper
Guideline-directed statin therapy (1=yes, 0=no)	-1.421	0.489	8.433	1	**0.004**	**0.242**	**0.093**	**0.630**
Age of participants	0.014	0.020	0.498	1	0.480	1.014	0.975	1.054
Sex of the participant(1)	-0.034	0.295	0.013	1	0.908	0.967	0.542	1.724
Constant	-0.576	1.101	0.274	1	0.601	0.562		

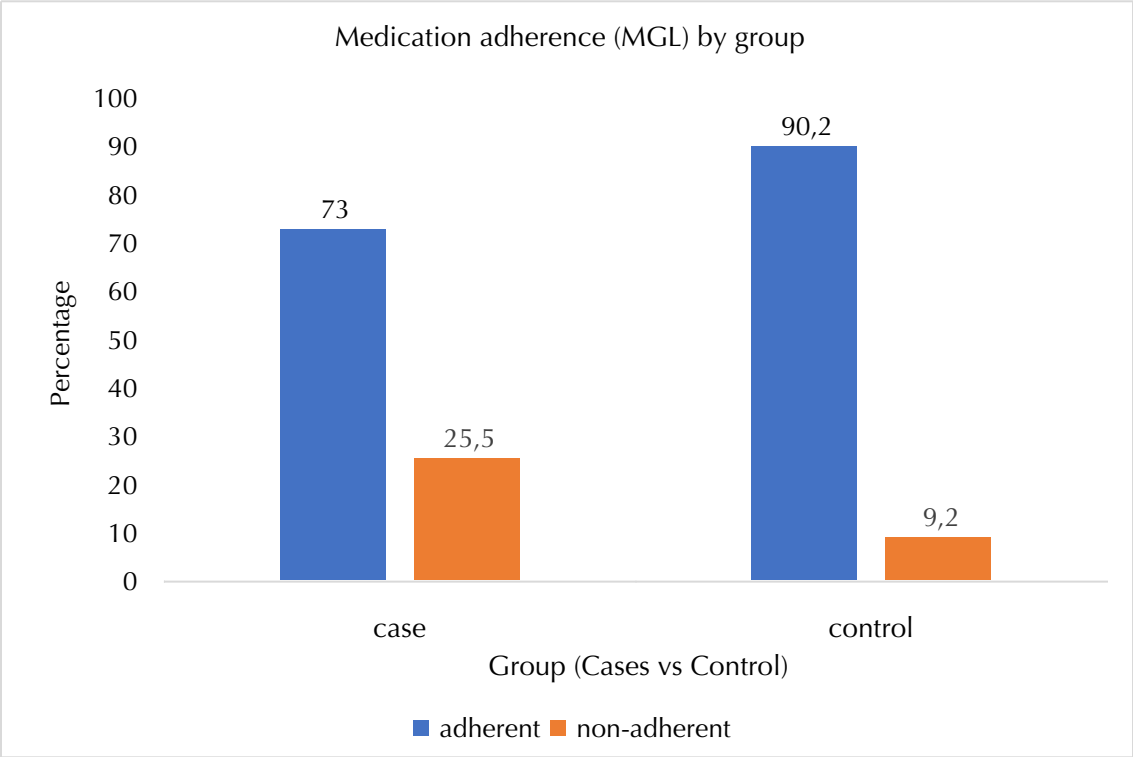


Figure 1. Adherence level of statin and DM medications among type 2 DM patients age group between 40-75 years of study participants at WSUCSH Wolaita Sodo, Ethiopia, 2022

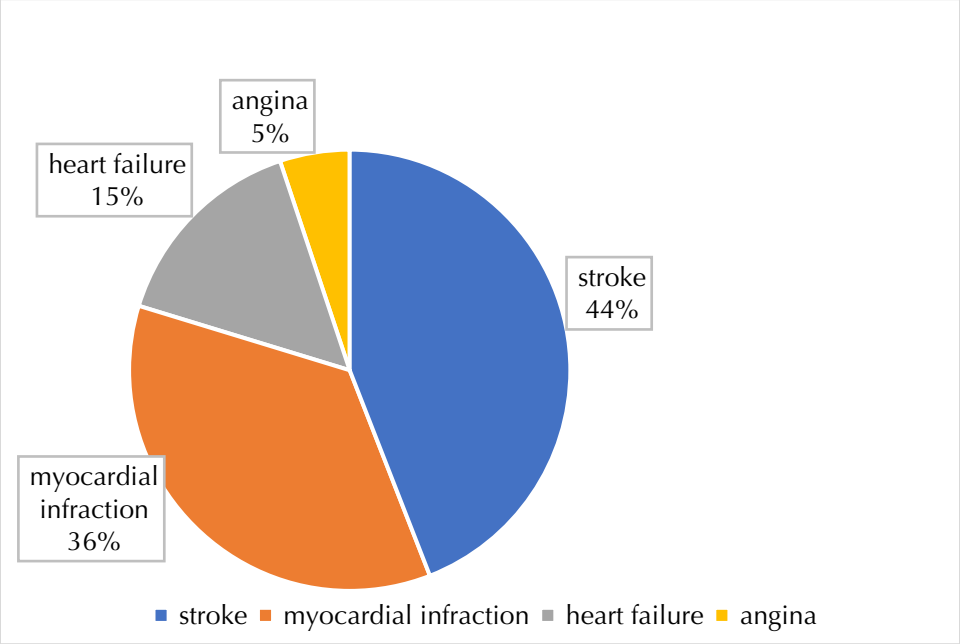


Figure 2. Types of cardiovascular events among type 2 DM patients (cases, n=98) age group between 40-75 years of study participants at WSUCSH, Ethiopia, 2022