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Statin Prescribing Patterns, Intensity Appropriateness, and LDL-C Target Attainment in Adults With ASCVD: A Cross-Sectional Study

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ABSTRACT

Background: Statins are central to secondary prevention in adults with atherosclerotic cardiovascular disease (ASCVD), yet gaps in intensity selection and lipid goal achievement persist in routine care.
Objectives: To describe statin prescribing patterns, assess the appropriateness of statin intensity, and evaluate attainment of an LDL-C target <70 mg/dL among adults with ASCVD.
Methods: This hospital-based cross-sectional study was conducted from February 2025 to August 2025 at Sri Siddhartha Medical College and Hospital, Tumkur, Karnataka, India, by the Department of Pharmacology in collaboration with General Medicine. Adults (≥18 years) with documented ASCVD were enrolled (n=100). Current statin use and dose were recorded and intensity was categorized as high, moderate, or low. Intensity appropriateness was judged against contemporary guideline recommendations. LDL-C values (mg/dL) were extracted from laboratory records and target attainment (<70 mg/dL) was assessed overall and by intensity group.
Results: Mean age was 58.4±9.6 years and 64% were men. Any statin was prescribed in 92% of participants; 46% received high-intensity therapy, 38% moderate-intensity, and 8% low-intensity therapy, while 8% received no statin. Statin intensity was appropriate in 61%, under-treatment occurred in 31%, and over-treatment in 8%. Mean LDL-C was 68.4±18.6 mg/dL with high-intensity statins, 88.9±22.4 mg/dL with moderate-intensity statins, and 112.6±30.1 mg/dL among those on low-intensity or no statin. Overall, 42% achieved LDL-C <70 mg/dL, with the highest attainment in the high-intensity group.
Conclusion: Although statin prescribing was high, under-treatment and suboptimal LDL-C goal attainment were common. Systematic lipid monitoring and timely intensification of therapy are required to strengthen secondary prevention in ASCVD.

Keywords*: Atherosclerotic cardiovascular disease; statins; high-intensity statin; LDL-C; secondary prevention; prescription patterns.*

INTRODUCTION

Atherosclerotic cardiovascular disease (ASCVD) remains a major driver of premature death and long-term disability, largely through coronary artery disease, cerebrovascular disease, and peripheral arterial disease. In India, the burden of premature ASCVD is substantial and often coexists with diabetes and hypertension, making effective secondary prevention especially important. Lipid lowering is central to secondary prevention because low-density lipoprotein cholesterol (LDL-C) has a causal role in atherosclerotic plaque formation and progression, supported by convergent genetic, epidemiologic, and trial evidence [3]. Contemporary clinical practice guidelines position statins as foundational therapy for adults with established ASCVD, emphasizing intensity-based treatment, regular lipid monitoring, and adherence support to reduce recurrent ischemic events [1,2].

The clinical benefit of LDL-C lowering follows a consistent dose–response relationship across diverse populations. The Cholesterol Treatment Trialists' Collaboration demonstrated that more intensive LDL-C reduction produces additional decreases in major vascular events compared with less intensive regimens, supporting a "lower is better" paradigm in secondary prevention [4]. Earlier randomized trials after acute coronary syndromes also showed that intensive statin therapy improves outcomes compared with moderate dosing [10]. Outcome trials further show incremental benefit when LDL-C is lowered beyond what is achieved with statins alone. In IMPROVE-IT, adding ezetimibe to simvastatin after acute coronary syndromes lowered LDL-C and reduced cardiovascular events [5]. In FOURIER and ODYSSEY OUTCOMES, PCSK9 inhibition with evolocumab or alirocumab reduced major adverse cardiovascular events in ASCVD populations achieving very low LDL-C levels [6,7].

Guideline targets translate this evidence into actionable goals. Many secondary prevention frameworks use an LDL-C threshold of <70 mg/dL as a pragmatic treatment target for established ASCVD and recommend escalation to maximally tolerated high-intensity statins, followed by adjunct lipid-lowering agents when LDL-C remains above goal [1,2]. Indian expert consensus statements similarly advocate aggressive LDL-C targets for secondary prevention while acknowledging practical constraints such as affordability, access to lipid testing, and long-term medication persistence [8].

Despite strong evidence and clear recommendations, real-world practice frequently falls short. Real-world analyses report incomplete statin coverage, substantial use of moderate-intensity regimens where high-intensity therapy is indicated, and low LDL-C target attainment among secondary prevention populations [9,11]. Barriers include therapeutic inertia, concerns about adverse effects, polypharmacy, and inconsistent follow-up. Indian reports also indicate that residual dyslipidemia remains common after acute coronary events [11], and prescription audits in ischemic heart disease demonstrate variability in statin selection and dose optimization within routine care [12].

The present cross-sectional study was conducted in a teaching-hospital setting to generate context-specific evidence on lipid-lowering practice. The objectives were to (1) describe statin prescribing patterns and intensity distribution in adults with ASCVD, (2) assess the appropriateness of prescribed statin intensity against guideline-based recommendations, and (3) evaluate LDL-C target attainment (<70 mg/dL) across statin intensity categories.

METHODS

Study design and setting: A hospital-based cross-sectional study was conducted from February 2025 to August 2025 at Sri Siddhartha Medical College and Hospital, Tumkur, Karnataka, India. The study was coordinated by the Department of Pharmacology in collaboration with the Department of General Medicine. Reporting was aligned with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations for cross-sectional studies [13].

Participants: Adults aged ≥18 years with documented ASCVD were enrolled consecutively until a sample size of 100 was achieved. ASCVD was defined as: (i) coronary artery disease (history of myocardial infarction, angina with objective evidence, or prior coronary revascularization), (ii) cerebrovascular disease (ischemic stroke or transient ischemic attack), or (iii) peripheral arterial disease documented in the medical record. Patients were excluded if key prescribing information (drug name or dose) was not available in the case record, or if an LDL-C value was not available for analysis.

Data collection: A structured case record form was used to capture demographic variables (age, sex), comorbidities (hypertension, type 2 diabetes mellitus), smoking status, and ASCVD subtype. Current lipid-lowering therapy was recorded from prescriptions and medication charts, including statin molecule and dose. The most recent documented LDL-C value (mg/dL) available at the time of assessment was extracted from laboratory records.

Definitions and intensity classification: Statin therapy was categorized as high-, moderate-, or low-intensity using dose-based definitions consistent with major guideline frameworks [1,2,14]. The type of statin (atorvastatin, rosuvastatin, simvastatin) and the intensity category were recorded. For analysis, participants were grouped as high-intensity, moderate-intensity, or low-intensity/no statin.

Assessment of intensity appropriateness: Guideline concordance was assessed using a prespecified algorithm based on contemporary recommendations and expert consensus [1,2,8]. High-intensity statin therapy was considered appropriate for most adults with clinical ASCVD, particularly those ≤75 years, unless contraindicated or not tolerated. Moderate-intensity therapy was considered appropriate when high-intensity therapy was not recommended or was not tolerated (e.g., advanced age, potential drug interactions, or clinician-documented intolerance). Under-treatment was defined as prescription of moderate- or low-intensity statin (or no statin) when high-intensity therapy was indicated. Over-treatment was defined as high-intensity statin use when only moderate-intensity therapy was indicated based on the above criteria.

Outcome measures: The primary outcome was attainment of LDL-C <70 mg/dL, selected as a commonly used secondary prevention target in contemporary guidance and expert consensus [1,2,8]. Secondary outcomes included statin prescribing prevalence, intensity distribution, appropriateness categories (appropriate/under-treated/over-treated), and mean LDL-C levels across intensity groups.

Statistical analysis: Continuous variables were summarized as mean ± standard deviation and categorical variables as number (percentage). LDL-C target attainment was described overall and stratified by statin intensity. Categorical comparisons across intensity groups were explored using chi-square tests where appropriate, with a two-sided p value <0.05 considered statistically significant.

Ethical considerations: Institutional ethical approval was obtained prior to study initiation. Informed consent procedures were followed as per institutional requirements; the approval number and consent statement can be inserted during journal submission.

RESULTS

A total of 100 adults with established ASCVD were included in the analysis. Baseline demographic and clinical characteristics are summarized in Table 1. The mean age was 58.4 ± 9.6 years, with 64% men. Hypertension (72%) and type 2 diabetes mellitus (48%) were common comorbidities, and 34% reported current or former smoking. Coronary artery disease represented the largest ASCVD subgroup (62%), followed by cerebrovascular disease (24%) and peripheral arterial disease (14%).

Table 1. Baseline demographic and clinical characteristics of study participants (n = 100).

Variable	n (%) / Mean ± SD
Age (years), mean ± SD	58.4 ± 9.6
Age group	
<50 years	18 (18.0)
50–59 years	36 (36.0)
60–69 years	32 (32.0)
≥70 years	14 (14.0)
Sex	
Male	64 (64.0)
Female	36 (36.0)
Comorbidities	
Hypertension	72 (72.0)
Type 2 diabetes mellitus	48 (48.0)
Current / former smoking	34 (34.0)
Type of ASCVD	
Coronary artery disease	62 (62.0)
Cerebrovascular disease	24 (24.0)
Peripheral arterial disease	14 (14.0)

Statin prescribing patterns are presented in Table 2. Overall, 92 participants received any statin therapy, while 8 participants were not prescribed a statin. High-intensity statins were prescribed in 46% of the cohort, moderate-intensity statins in 38%, and low-intensity statins in 8%. Atorvastatin was the most frequently prescribed statin (62%), followed by rosuvastatin (28%) and simvastatin (10%). (Table 2).

Table 2. Statin prescribing patterns among ASCVD patients (n = 100).

Statin therapy	n (%)
Any statin prescribed	92 (92.0)
No statin prescribed	8 (8.0)
Statin intensity	
High-intensity	46 (46.0)
Moderate-intensity	38 (38.0)
Low-intensity	8 (8.0)
Type of statin prescribed	
Atorvastatin	62 (62.0)
Rosuvastatin	28 (28.0)
Simvastatin	10 (10.0)

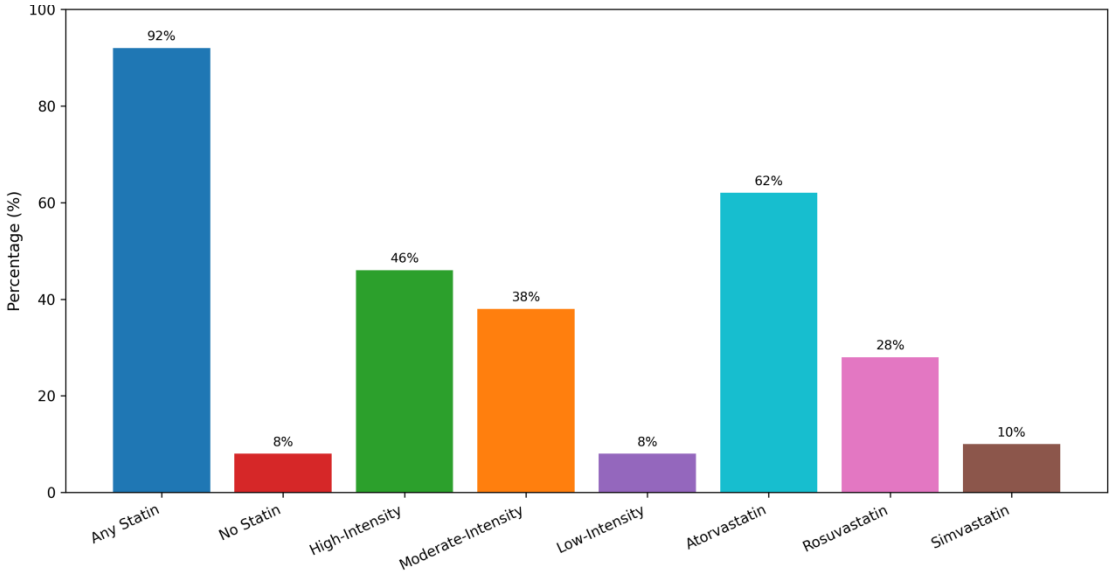

Figure 1: Statin prescribing patterns among ASCVD patients

Guideline-based assessment of intensity appropriateness is shown in Table 3. Statin intensity was appropriate in 61 participants. Under-treatment was identified in 31 participants and predominantly reflected use of moderate- or low-intensity statins despite indication for high-intensity therapy. Over-treatment was observed in 8 participants. (Table 3).

Table 3. Appropriateness of statin intensity based on guideline recommendations (n = 100).

Intensity appropriateness	**n (%)**
Appropriate intensity	61 (61.0)
Under-treatment	31 (31.0)
Over-treatment	8 (8.0)

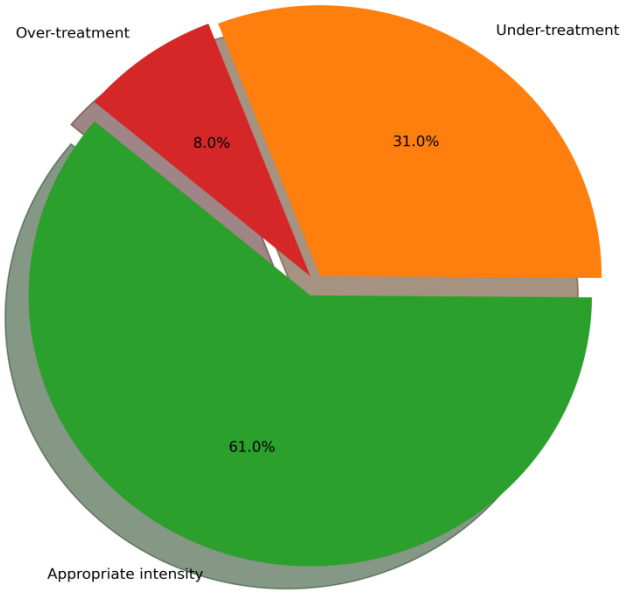

Figure 2: Appropriateness of statin intensity based on guideline recommendations

LDL-C levels and target attainment by statin intensity are shown in Table 4. Mean LDL-C was lowest in the high-intensity group (68.4 ± 18.6 mg/dL), higher in the moderate-intensity group (88.9 ± 22.4 mg/dL), and highest among those on low-intensity or no statin (112.6 ± 30.1 mg/dL). LDL-C <70 mg/dL was achieved by 63.0% of participants on high-intensity statins compared with 28.9% on moderate-intensity statins and 12.5% in the low-intensity/no statin group. Overall, 42% of the cohort achieved LDL-C <70 mg/dL. (Table 4).

Table 4. LDL-C levels and target attainment according to statin intensity (n = 100).

Parameter	High-intensity (n = 46)	Moderate-intensity (n = 38)	Low-intensity / No statin (n = 16)
Mean LDL-C (mg/dL), mean ± SD	68.4 ± 18.6	88.9 ± 22.4	112.6 ± 30.1
LDL-C <70 mg/dL	29 (63.0%)	11 (28.9%)	2 (12.5%)
LDL-C ≥70 mg/dL	17 (37.0%)	27 (71.1%)	14 (87.5%)

DISCUSSION

This cross-sectional study describes statin prescribing, intensity appropriateness, and LDL-C control among adults with established ASCVD in a teaching-hospital setting in southern India. Statin use was high (92%), yet only 46% of patients received high-intensity therapy and overall LDL-C target attainment (<70 mg/dL) was 42%. The results underline that secondary prevention performance depends not only on whether a statin is prescribed, but also on whether intensity is guideline-concordant and whether lipid values are monitored and acted upon.

Real-world evidence shows that LDL-C goal attainment in secondary prevention remains challenging. Analyses in routine practice report that many ASCVD patients remain above recommended LDL-C thresholds despite treatment, reflecting incomplete intensification and variable follow-up [9,11]. In the present study, a similar gap was evident: fewer than half received high-intensity statins and only two-fifths met the LDL-C target.

Under-treatment (31%) was predominantly driven by moderate- or low-intensity regimens in patients who otherwise met criteria for high-intensity therapy. Common barriers include concerns about adverse effects, drug–drug interactions, polypharmacy, inconsistent follow-up, and patient-level factors such as cost and persistence. Indian data provide similar signals: residual dyslipidemia remains common after acute coronary syndromes despite statin use [11], and prescription audits in ischemic heart disease demonstrate variability in statin selection and dose optimization in routine care [12].

LDL-C control in this study showed a clear intensity gradient. Mean LDL-C was lowest with high-intensity statins and goal attainment was highest in this group, whereas patients receiving moderate-intensity therapy and those on low/no statin had progressively higher LDL-C levels and poorer target attainment. This pattern supports guideline recommendations that high-intensity statins (or maximally tolerated statins) should be the default in most adults with clinical ASCVD, with moderate intensity reserved for intolerance, contraindications, or other clearly documented reasons [1,2,8].

Even among patients on high-intensity statins, more than one-third remained above target, indicating residual risk and the need for systematic escalation. Evidence from outcome trials supports add-on therapy in patients who do not reach LDL-C goals: IMPROVE-IT showed benefit with ezetimibe added to statin therapy after acute coronary syndromes [5], while FOURIER and ODYSSEY OUTCOMES demonstrated event reduction with PCSK9 inhibition in ASCVD populations [6,7]. Together with meta-analytic evidence that greater LDL-C lowering yields greater event reduction [4], these data reinforce the importance of structured intensification pathways.

From a quality-improvement perspective, three actions are suggested: (i) prescribe guideline-recommended intensity and document reasons when deviation occurs, (ii) link LDL-C monitoring to action (dose titration, adherence reinforcement, and add-on therapy when above goal), and (iii) use patient counseling and shared decision-making to address misconceptions and support persistence. Implementing such steps within routine outpatient follow-up can help close the evidence-to-practice gap in ASCVD secondary prevention.

Limitations

This single-center cross-sectional analysis provides associations at one time point and does not establish causality. The sample was limited to patients attending one teaching hospital, restricting external generalization. Prescribing data were obtained from records and did not quantify adherence, persistence, or reasons for dose selection. LDL-C was based on the most recent available value and did not capture longitudinal trends or post-titration changes.

CONCLUSION

In adults with established ASCVD evaluated at a tertiary teaching hospital, statin prescribing was common; however, high-intensity therapy was used in less than half of patients and nearly one-third were under-treated relative to guideline recommendations. LDL-C control remained suboptimal, with only 42% achieving the secondary prevention target of <70 mg/dL. Patients receiving high-intensity statins demonstrated lower mean LDL-C and higher target attainment than those on moderate-intensity therapy or no/low-intensity therapy, underscoring the clinical value of appropriate intensity selection. Routine lipid monitoring, documentation of intolerance, timely dose escalation, and structured pathways for adding ezetimibe or PCSK9 inhibitors when LDL-C remains above goal are essential to strengthen secondary prevention in routine practice.

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