Factors related to achieving lipid targets in post-acute coronary syndrome patients at two cardiovascular referral centers

HUGO RAFAEL GRANADOS-CHARRIS, ERIKA JULIANA MARTÍNEZ-GALLEGO,
JHON SEBASTIÁN CORREA-ZAPATA • BELLO (COLOMBIA)
NELLY VELÁSQUEZ-LÓPEZ • MEDELLÍN (COLOMBIA)

DOI: https://doi.org/10.36104/amc.2024.2750

Abstract

Background and objectives: patients with coronary disease have a very high cardiovascular risk, with dyslipidemia being the most prevalent risk factor and the one most responsible for recurrence. In previous studies, we have found a low percentage of achievement of low-density lipoprotein cholesterol (LDL-C) targets, requiring additional treatments besides statins. Therefore, we decided to describe the proportion of patients who reach LDL-C cholesterol targets at our institution, and identify the factors associated with achieving these targets.

Patients and methods: this was an observational, retrospective cohort study carried out from January to March 2019. Patients with acute coronary syndrome and evidence of significant coronary atherosclerosis were enrolled. Using the SPSS v26 statistical program, independent variables like sociodemographic, cardiovascular risk, treatment and laboratory factors were described. The frequency with which LDL-C targets were reached was determined, and a bivariate analysis was done of the factors associated with reaching lipid targets, calculating the RR with its respective 95% CI.

Results: a total of 146 patients were identified, with an average age of 62.8 ± 9.3 years, and male predominance (63.7%). Altogether, 71.9% received high-intensity statins, but this percentage decreased to 60.3% after three months. A total of 53.4% of the population achieved the LDL-C targets. None of the factors associated with achieving the targets showed statistical significance. As a relevant finding, of the patients who were enrolled in the study with out-of-target LDL-C values (n=97), 43% were able to control their LDL-C levels during follow-up: these changes were statistically significant (p<0.0001).

Conclusions: high-intensity statin treatment is essential in atherosclerotic cardiovascular disease prevention, with a high percentage of lipid target achievement, along with a well-structured institutional cardiovascular prevention and risk factor control program, leaving a select group of patients for new lipid lowering drugs. **(Acta Med Colomb 2024; 49. DOI: https://doi.org/10.36104/amc.2024.2750).**

Keywords: *LDL targets, dyslipidemia, secondary prevention, statins, cardiovascular disease*.

Dr. Hugo Rafael Granados-Charris: Especialista de Medicina Interna y Cardiología, Magister en Epidemiología. Departamento de Cardiología Clínica; Dra. Erika Juliana Martínez-Gallego: Médico General, aspirante a posgrado de Epidemiología; Dr. Jhon Sebastián Correa-Zapata: Médico General. Departamento de Cardiología. **Clínica del Norte**. Bello (Colombia).
Dra. Nelly Velásquez-López: Especialista en Medicina interna y Cardiología. Departamento de Cardiología, Clínica Medellín de Occidente. Medellín (Colombia).
Correspondencia: Dr. Jhon Sebastián Correa-Zapata. Bello (Colombia).
E-Mail: sebasco3510@hotmail.com.
Received: 21/X/2022 Accepted: 18/VI/2024

Introduction

Cardiovascular disease (CVD) is the main cause of death worldwide. In Colombia, atherosclerotic coronary disease is the main cause of death, especially after the sixth decade of life (1). Over the last 50 years, life expectancy has risen from 50 to 72 years, and it is estimated that there will be 15.5 million people over the age of 60 by 2050. These changes will lead to growth in the CVD-prevalent population, and therefore the burden of this disease will continue to grow steadily (1).

Studies have shown that dyslipidemia is the most prevalent of the many atherosclerotic cardiovascular risk factors (CVRFs), with a population attributable risk (PAR) of 49.2% (OR 3.25: 95%CI; 2.81-3.76) (2).

For patients with atherosclerotic coronary disease, both national and international guidelines recommend beginning treatment with high-intensity statins, to lower the baseline LDL cholesterol (LDL-C) by more than 50% and below 70 mg/dL. Statins are the preferred drugs due to their greater impact on stabilization and possible regression of atherosclerotic plaque (3, 4). Furthermore, various studies have shown that statin treatment is safe and reduces cardiovascular risk, showing a greater benefit in secondary prevention (5-7).

These recommendations are mainly based on the last Cholesterol Treatment Trialists (CTT) meta-analysis, which showed that a 40 mg/dL reduction in LDL-C was associated with a 22% reduction in the risk of nonfatal

cardiovascular episodes and a 10% reduction in overall mortality (8).

It has been proven that 67.3% of patients with established atherosclerotic CVD can achieve the target LDL-C (<70 mg/dL) with high-intensity statin monotherapy. If a second lipid lowering agent (ezetimibe) is added, up to 86% could achieve the target (9, 10). However, some factors could prevent LDL-C target achievement with statins, such as insufficient doses, poor adherence to pharmacological treatment and nonpharmacological measures like diet and physical activity, side effects leading to dose reduction or treatment suspension, the use of certain medications (thiazides, steroids, amiodarone), and uncorrected endocrine disorders like hypothyroidism, among others (11, 12).

Various cohorts have been published in different countries, showing the difficulty in achieving therapeutic targets, especially for patients with high cardiovascular risk. In this group, fewer than 40% of the patients have been able to achieve the LDL-C targets recommended in the guidelines, suggesting suboptimal treatment of hyperlipidemia globally and a lost opportunity for reducing cardiovascular risk (13, 14). As in the international findings, two studies in hospitals in Bogotá, Colombia reported achieving target LDL-C levels lower than 70 mg/dL in 22 to 50% of patients with very high cardiovascular risk (15, 16).

To date, Clínica Medellín de Occidente and Fundación Clínica del Norte have not evaluated the achievement of lipid targets in patients with very high cardiovascular risk. The objective of this study is to describe the proportion of patients who achieve the target, and the factors associated with this outcome.

Materials and method

An observational analytical (retrospective cohort) study was performed on patients over the age of 18 hospitalized at Fundación Clínica del Norte and Clínica Medellín de Occidente from January 1 to March 31, 2019. The study population consisted of 146 patients hospitalized for acute coronary syndrome who completed ambulatory follow up at the institutions where data was gathered two to six months after the event.

Follow up at Clínica Medellín was done through a cardiovascular prevention program led by the clinical cardiology group, in which patients were periodically assessed (the frequency depended on clinical and laboratory findings) by a general practitioner who is a cardiovascular risk "expert," based mainly on the dyslipidemia guidelines published by the Ministry of Social Protection in 2014 and the European dyslipidemia guidelines published in 2016. At Clínica del Norte, routine follow-up is carried out by the primary care clinic physicians, with variable cardiology follow-up depending on availability. Patients who did not have data available more than one month after the event and those with a lipid profile taken more than 24 hours after admission were excluded.

The study variables were cardiovascular history and risk factors (hypertension, diabetes mellitus and dyslipidemia); lipid-lowering agents used, with their doses, at discharge and 12-week follow-up; as well as other variables including age, sex, marital status, educational level, lipid profile on admission and at 12-week follow-up, thyroid stimulating hormone (TSH) levels at 12 weeks in patients with a history of hypothyroidism, glycosylated hemoglobin (HbA1c) levels at 12 weeks in patients with diabetes mellitus, medications being taken on follow-up that could interfere with target achievement, and nutritional assessment. An LDL-C level <70 mg/dL at the 12-week follow-up was considered to indicate target achievement.

All variables were taken from the patients' medical charts and arranged in an Excel matrix for statistical study using the SPSS v26 program. Categorical variables are presented as frequencies and proportions, and numerical variables are summarized using averages and standard deviation or interquartile range, depending on their distribution. The frequency of LDL-C target achievement in the total population and by patient subgroups, according to healthcare center, is reported.

A bivariate analysis was done, calculating RR with its respective 95%CI; the Chi square test of independence was used for qualitative variables.

Achievement of the LDL-C targets was the dependent variable. Independent variables included statins and their correct dose, chronic kidney disease, obesity, adherence to diet, hypothyroidism, diabetes mellitus and medications which could interfere with lipid target achievement. If the variables had an RR with a p value less than 0.05 on the bivariate analyses, a multivariate analysis would be run.

Ethical considerations

The study was classified as "no risk" according to Resolution 8430 of 1993. Approval was obtained from the ethics committee at Clínica del Norte and Clínica Medellín de Occidente to access the medical charts (Meeting Minutes 02-2019; Number 3.1). Approval was also obtained from the research committee at Universidad CES, through Meeting Minutes 206Proy024.

Results

A total of 146 patients were enrolled in the study from January 01 to March 31, 2019. The demographic characteristics of the population are recorded in Table 1.

Of all the patients evaluated, 93 (63.7%) were males, and the average age was 62.8 ± 9.3 years. The most common cardiovascular risk factors at the beginning of the study were hypertension, dyslipidemia and diabetes mellitus. The patients' average baseline LDL-C at the time of the event was 90 mg/dL (Table 2).

As far as lipid-lowering treatment ordered at discharge, 115 patients (78.8%) received atorvastatin, 21 patients (14.4%) received rosuvastatin, and fewer than 10% received

another statin or were not prescribed a statin. Of the patients who received statins (137), 71.9% received the proper dose, which for high-intensity statins is 80 mg of atorvastatin or 40 mg of rosuvastatin (Table 3).

At the three-month follow-up, LDL-C targets had been achieved in 78 patients (53.4%), 23.5% of whom were enrolled with controlled LDL-C and maintained this control, with an average of 66.5 mg/dL. However, the percentage of patients with an appropriate statin dose decreased from 71.9% to 60.3%; there was no reason given in the medical charts for reducing the statin dose. We also saw a change in the type of statin the patients received, with atorvastatin prescriptions decreasing from 78.8% to 61%, and the percentage of patients receiving rosuvastatin increasing from 14.4 to 31.5%.

The clinical factors that could interfere with lipid target achievement included obesity and chronic kidney disease in 19.2% of the patients, as well as uncontrolled comorbidities like diabetes and hypothyroidism (average follow-up HbA1c and TSH of 5.9% and 2.5 mIU/L, respectively), along with medications causing secondary dyslipidemia (13.7%), with hydrochlorothiazide being the most frequent (75%) (Table 4).

Of the patients with initially controlled LDL-C (n=43), 10 (23%) did not achieve the target at three months, while of those who were not controlled (n=97), 42 (43%) achieved LDL levels <70 mg/dL after three months of follow-up; these changes were statistically significant (p<0.0001) (Figure 1).

No statistically significant associations were found with any of the factors that could be associated with achieving the LDL-C targets (Table 5).

Table 1. *Population characteristics.*

Characteristics	n (%)
Female sex	53 (36.3)
Age (years)	62.8 (9.3)*
Institution [a] A B	 111 (76.0) 35 (24.0)
Level of schooling, **n:50** Illiterate Preschool Primary Secondary Technical College-graduate studies	 3 (6.0) 2 (4.0) 32 (64.0) 7 (14.0) 2 (4.0) 4 (8.0)
Marital status, **n:68** Married Single Cohabiting Divorced Widowed	 32 (47.1) 18 (26.5) 8 (11.8) 5 (7.4) 5 (7.4)
*Mean (standard deviation) [a] A=Clínica Medellín de Occidente; B=Clínica del Norte	

Discussion

This is one of the first studies in Colombia evaluating lipid (LDL-C) target achievement in patients with very high cardiovascular risk, most of whom were on high-intensity statins. We found that a high percentage of patients achieved the target, considering the low proportion of target achievement documented previously, both nationally and internationally.

The results of this observational analytical study suggest that adequate adherence to the medical treatment recommended by the various treatment guidelines could have a large impact on patients' lipid profiles and, consequently, reduce the incidence of adverse cardiovascular events. On average, target achievement in patients with very high risk tends to range from 20 to 40% (17, 18).

Table 2. *Baseline clinical characteristics of the participants (n:146).*

Variable	n (%)
Hypertension	100 (68.5)
Dyslipidemia	76 (52.1)
Diabetes mellitus	35 (24)
Hypothyroidism	23 (15.8)
GFR ≤ 60 ml/min/1.73m^2	14 (9.6)
Obesity	14 (9.6)
LDL mg/dL, Mdn (IQR)[a]	90 (67)
HDL mg/dL, Mdn (IQR)[a]	35 (12.3)
TC mg/dL, Mdn (IQR)[a]	162 (82)
TGs mg/dL, Mdn (IQR)[a]	152.5 (105)
Nutritional assessment (Adherence to diet) n=49	
Adherent	24 (49)
Nonadherent	25 (51)
GFR: glomerular filtration rate; Mdn: median; IQR: interquartile range; LDL: low-density lipoprotein cholesterol; HDL: high-density lipoprotein cholesterol; TC: total cholesterol; TGs: triglycerides a: Kolmogorov – Smirnov normality test	

Table 3. *Lipd-lowering treatment at hospital discharge (n:146).*

Variable	n (%)
Type of statin	
Atorvastatin	115 (78.8)
Rosuvastatin	21 (14.4)
Simvastatin	1 (0.7)
None	9 (6.2)
Appropriate statin dose	
Yes	105 (71.9)

Table 4. *Clinical and treatment characteristics at three-month follow-up (n:146).*

Variable	n (%)
Target achievement (LDL-C < 70 mg/dL)	78 (53.4)
Institution A[a] (n:111)	66 (59)
Institution B[a] (n:35)	12 (34.2)
LDL-C control, Mdn (IQR)[b]	66.5 (44.3)
HbA1C% control, Mdn (IQR)[b]	5.9 (0.7)
TSH, Mdn (IQR) [b]	2.5 (2.6)
Type of statin	
Atorvastatin	89 (61)
Rosuvastatin	46 (31.5)
Simvastatin	1 (0.7)
None	10 (6.8)
Appropriate statin dose	
Yes Medications	88 (60.3) 20 (13.7)

a: A=Clínica Medellín de Occidente; B=Clínica del Norte
b: Kolmogorov – Smirnov normality tests
c: medications (thiazides, amiodarone, fibrates, glucocorticoids).

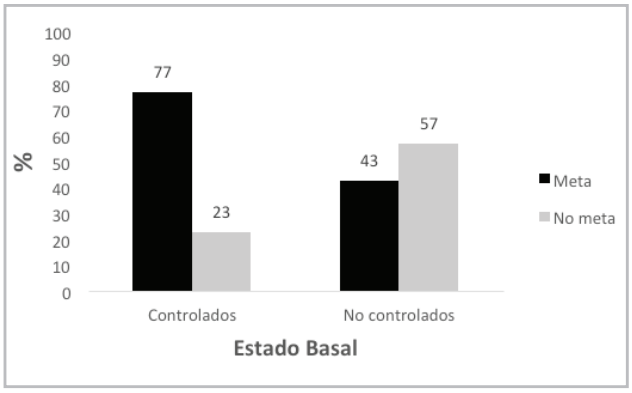

Figure 1. *Percentage of patients who achieved lipid control (LDL levels ≤69) according to their LDL control status on enrollment in the cohort. McNemar's test: p<0.0001.*

The LTAP study was the first of a very extensive series of studies that have shown the difficulty in target achievement, with 4,888 patients studied, and only 18% of those with established coronary disease achieving the target (13). Later, in LTAP-2, 26% of the group with very high cardiovascular risk achieved the targets (19). Likewise, a systematic review by Mitchell et al. included treatment guidelines and observational studies (17 guidelines and 42 studies), showing that 68 to 96% of patients with very high cardiovascular risk did not achieve the lipid target of <70 mg/dL (14). In the Fourier trial, 69% of the patients who were randomized were on high-intensity statins and their average baseline LDL-C was 92 mg/dL (20), which reflects the persistent difficulty in achieving targets with statins alone.

In Colombia, two studies evaluated LDL-C target achievement. Merchán et al. reported that only 21.7% of the population with a history of coronary disease achieved the

Table 5. *Relationship between factors and lipid target achievement.*

Factors	Target achievement n/N (%)	RR (95%CI)	P value
Appropriate statin dose initially Yes No	 56/105 (53.3) 22/41 (53.7)	 1.0 (0.7-1.4)	 0.972
Appropriate statin dose at three-month Yes No	 44/88 (50.0) 34/58 (58.6)	 1.2 (0.9-1.6)	 0.307
Obesity Yes No	 6/14 (42.9) 72/131 (55.0)	 1.3 (0.7-1.4)	 0.388
Nutritional assessment, **n:49** Nonadherent Adherent	 14 /25 (56.0) 12/24 (50.0)	 0.9 (0.5-1.5)	 0.674
Creatinine clearance ≤60 mL/min >60 mL/min	 5/14 (35.7) 73/132 (55.3)	 1.5 (0.7-3.2)	 0.162
Use of medications Yes No	 10/20 (50.0) 68/126 (54)	 1.1 (0.7-1.7)	 0.741
Controlled TSH, **n:110** Yes No	 57/105 (54.3) 3/5 (60.0)	 1.1 (0.5-2.3)	 >0.999*
Controlled HbA1c, **n:122** Yes No	 58/105 (55.2) 10/17 (58.8)	 1.0 (0.7-1,6)	 0.782

**Fisher's exact test. The Chi square test was used for all other cases.*

target of LDL-C <70 mg/dL, highlighting that 56% of these individuals were being treated with lovastatin and only 16% were on atorvastatin or rosuvastatin (15). On the other hand, the study by Diaztagle et al. reported 66.6% target achievement in the very high risk group; an interesting point in this study is that all the patients were on lovastatin, considered to be a low to moderate-intensity statin (16).

The results of our study can be considered to be due to the high percentage of patients (71.9%) who were on high-intensity statins, unlike previous studies in which the most frequently used statin was lovastatin. Cannon et al. estimated a 63.7% achievement of lipid targets with statin monotherapy (9). However, at three-month follow-up, the percentage of patients on high-intensity statins had reduced to 60%, similar to what has been found in various studies in which adherence to medical treatment is less than 50% one year after prescription (3, 5).

Another significant aspect is the difference in target achievement between the two institutions, with better results in facilities with well-structured cardiovascular prevention programs and multidisciplinary, periodic, scheduled follow-up, continuously supported by cardiology or internal medicine. We tried to evaluate adherence to nonpharmacological treatment (diet) through a clinical chart review in the nutrition department, but unfortunately only obtained information on 49 patients that showed that 51% did not adhere to diet, indicating an opportunity for improvement to obtain better clinical and laboratory outcomes in these patients.

As far as factors related to lipid target achievement, such as female sex, obesity, uncontrolled type 2 diabetes mellitus, patient nonadherence to treatment, physician nonadherence to treatment guidelines, and statin intolerance (14, 21, 22), no significant association was found with lipid target achievement. These findings could be related to the low power of the study. However, different studies have yielded conflicting results regarding the association of these factors with lipid target achievement (19, 23-26).

Our study has several limitations. First, adherence to medical treatment was obtained from a medical chart review, and many times this information was not detailed, which introduces information bias. Second, blood sampling for lipid profiles was not standardized, was performed in several laboratories, and the fasting status was unknown, which could cause measurement bias. Third, periodic patient follow-up was conducted between two and six months after the acute event, depending on the availability of follow-up appointments, and using two different follow-up protocols (one more strict than the other); that is, not all patients had follow-ups at the same time. And the fourth limitation is the small sample size.

Conclusions

We found a high percentage of lipid target achievement in our study population with very high cardiovascular risk. Comparing these results with previously published studies, we confirmed that the use of statins as first line treatment continues to be the cornerstone of secondary atherosclerotic cardiovascular disease prevention, along with the control of cardiovascular risk factors like poor diets and sedentarism, leaving a small, very select group of patients for new lipid-lowering drugs.

Comment

Since this study was performed before the current European dyslipidemia treatment guidelines were published, we maintained the LDL-C target for that time, which was less than 70 mg/dL. With the advent of new evidence and the publication of new guidelines in August 2019, the LDL-C target for patients with very high cardiovascular risk was set at less than 55 mg/dL.

References

1. **Bolívar-Meja A, E. B.** Burden of Cardiovascular Disease in Colombia. *Current Topics in Public Health* [Internet]. 2013 [citado 25 de octubre de 2018]. Disponible en: http://www.intechopen.com/books/current-topics-in-public-health/burden-of-cardiovascular-disease-in-colombia
2. **Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, et al.** Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet*. 2004;364(9438):937-52. doi: 10.1016/S0140-6736(04)17018-9.
3. **Schiele F, Farnier M, Krempf M, Bruckert E, Ferrières J, Angoulvant D, et al.** A consensus statement on lipid management after acute coronary syndrome. *Eur Heart J Acute Cardiovasc Care*. 2018;7(6):532-43.
4. **Muñoz O, Garcia A, Arteaga J, Sanchez G, Villalba Y, Angarita C, et al.** Guía de práctica clínica para la prevención, detección temprana, diagnóstico, tratamiento y seguimiento de las dislipidemias en la población mayor de 18 años. *Ministerio de salud y protección social*. 2014. doi: 10.1177/2048872616679791
5. **Merchán A, Campo R, Cuevas A, Ruiz A, Alonso R.** Hipercolesterolemia: ¿Debemos cambiar los conceptos de acuerdo a nuevos fármacos hipolipemiantes? *Rev Colomb Cardiol*. 2017;24:42.
6. **Catapano AL, Graham I, De Backer G, Wiklund O, Chapman MJ, Drexel H, et al**. 2016 ESC/EAS Guidelines for the Management of Dyslipidaemias. *Rev Espanola Cardiol Engl Ed*. 2017;70(2):115. doi: https://doi.org/10.1093/eurheartj/ehw272
7. **Anderson TJ, Grégoire J, Hegele RA, Couture P, Mancini GBJ, McPherson R, et al.** 2012 update of the Canadian Cardiovascular Society guidelines for the diagnosis and treatment of dyslipidemia for the prevention of cardiovascular disease in the adult. *Can J Cardiol*. 2013;29(2):151-67. doi: 10.1016/j.cjca.2012.11.032.
8. **Cholesterol Treatment Trialists' (CTT) Collaboration, Fulcher J, O'Connell R, Voysey M, Emberson J, Blackwell L, et al.** Efficacy and safety of LDL-lowering therapy among men and women: meta-analysis of individual data from 174,000 participants in 27 randomised trials. *Lancet*. 2015;385(9976):1397-405. doi: 10.1016/S0140-6736(14)61368-4.
9. **Cannon CP, Khan I, Klimchak AC, Reynolds MR, Sanchez RJ, Sasiela WJ.** Simulation of Lipid-Lowering Therapy Intensification in a Population With Atherosclerotic Cardiovascular Disease. *JAMA Cardiol*. 2017;2(9):959-66. doi:10.1001/jamacardio.2017.2289
10. **Schiele F, Ecarnot F, Chopard R.** Coronary artery disease: Risk stratification and patient selection for more aggressive secondary prevention. *Eur J Prev Cardiol*. 2017;24(3_suppl):88-100. doi: 10.1177/2047487317706586.
11. **Vodnala D, Rubenfire M, Brook RD.** Secondary causes of dyslipidemia. *Am J Cardiol*. 2012;110(6):823-5. doi: 10.1016/j.amjcard.2012.04.062.
12. **Stone NJ, Robinson JG, Lichtenstein AH, Bairey Merz CN, Blum CB, Eckel RH, et al.** 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol*. 2014;63(25 Pt B):2889-934. doi: 10.1016/j.jacc.2013.11.002
13. **Pearson TA, Laurora I, Chu H, Kafonek S.** The lipid treatment assessment project (L-TAP): a multicenter survey to evaluate the percentages of dyslipidemic patients receiving lipid-lowering therapy and achieving low-density lipoprotein cholesterol goals. *Arch Intern Med*. 2000;160(4):459-67. doi: 10.1001/archinte.160.4.459

14. **Mitchell S, Roso S, Samuel M, Pladevall-Vila M.** Unmet need in the hyperlipidaemia population with high risk of cardiovascular disease: a targeted literature review of observational studies. *BMC Cardiovasc Disord*. 2016;16:74. doi: https://doi.org/10.1186/s12872-016-0241-3

15. **Merchán A, Jaramillo C, Mendoza F, Agudelo JF.** ¿Se están alcanzando las metas en el perfil lipídico de personas con enfermedad coronaria previa? *Rev Colomb Cardiol*. 2011;18:262-7.

16. **Diaztagle JJ, Chaves WG, Sprockel JJ, Sastoque JA, Nieto JA, Barreto GA, et al.** Achievement of lipid goals in patients with secondary prevention hospitalized in the internal medicine service. 2013;38:7.

17. **Collins R, Reith C, Emberson J, Armitage J, Baigent C, Blackwell L, et al.** Interpretation of the evidence for the efficacy and safety of statin therapy. *Lancet*. 2016;388(10059):2532-61. doi: 10.1016/S0140-6736(16)31357-5

18. **Drozda JP, Ferguson TB, Jneid H, Krumholz HM, Nallamothu BK, Olin JW, et al.** 2015 ACC/AHA Focused Update of Secondary Prevention Lipid Performance Measures: A Report of the American College of Cardiology/American Heart Association Task Force on Performance Measures. *J Am Coll Cardiol*. 2016;67(5):558-87. doi: https://doi.org/10.1161/HCQ.0000000000000014

19. **Waters DD, Brotons C, Chiang C-W, Ferrières J, Foody J, Jukema JW, et al.** Lipid treatment assessment project 2: a multinational survey to evaluate the proportion of patients achieving low-density lipoprotein cholesterol goals. *Circulation*. 2009;120(1):28-34. doi: 10.1161/CIRCULATIONAHA.108.838466

20. **Sabatine MS, Giugliano RP, Keech AC, Honarpour N, Wiviott SD, Murphy SA, et al.** Evolocumab and Clinical Outcomes in Patients with Cardiovascular Disease. *N Engl J Med*. 2017;376(18):1713-22. doi: 10.1056/NEJMoa1615664

21. **Foley KA, Denke MA, Kamal-Bahl S, Simpson R, Berra K, Sajjan S, et al.** The impact of physician attitudes and beliefs on treatment decisions: lipid therapy in high-risk patients. *Med Care*. 2006;44(5):421-8. doi: 10.1097/01.mlr.0000208017.18278.1a.

22. **Halava H, Huupponen R, Pentti J, Kivimäki M, Vahtera J.** Predictors of first-year statin medication discontinuation: A cohort study. *J Clin Lipidol*. 2016;10(4):987-95. doi: 10.1016/j.jacl.2016.04.010

23. **Munawar M, Hartono B, Rifqi S.** LDL Cholesterol Goal Attainment in Hypercholesterolemia: CEPHEUS Indonesian Survey. *Acta Cardiol Sin*. 2013;29(1):71-81.

24. **Egan BM, Li J, Qanungo S, Wolfman TE.** Blood pressure and cholesterol control in hypertensive hypercholesterolemic patients: national health and nutrition examination surveys 1988-2010. *Circulation*. 2013;128(1):29-41. doi: 10.1161/CIRCULATIONAHA.112.000500.

25. **Wang K-F, Chang C-C, Wang K-L, Wu C-H, Chen L-C, Lu T-M, et al.** Determinants of low-density lipoprotein cholesterol goal attainment: Insights from the CEPHEUS Pan-Asian Survey. *J Chin Med Assoc JCMA*. 2014;77(2):61-7. doi: 10.1016/j.jcma.2013.10.013.

26. **Yiğiner O, Ozmen N, Ozçelik F, Inanç T, Kardeşoğlu E, Uz O, et al.** Adherence to statin therapy and LDL cholesterol goal attainment in type 2 diabetics and secondary prevention patients: the role of education and knowledge. *Turk Kardiyol Dernegi*. 2010;38(8):544-50.