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Lipoprotein (a) testing patterns among subjects with a measured lipid panel: The Mayo Clinic experience

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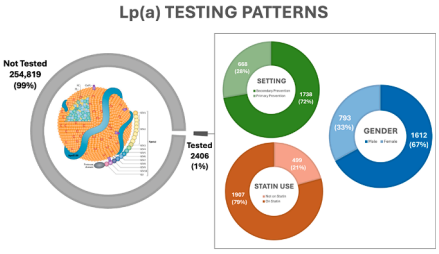
HIGHLIGHTS

- Lipoprotein (a) is undertested, even at tertiary referral centers.
- Females are less frequently tested than males, despite similar LDL-c values.
- Lp(a) testing mainly occurs in a secondary, rather than a primary, prevention setting.

GRAPHICAL ABSTRACT



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ABSTRACT

Objective: Lipoprotein(a) [Lp(a)] has been associated with Atherosclerotic Cardiovascular Disease (ASCVD). Approximately 20 % of the population has elevated Lp(a). Despite its well-recognized role in ASCVD, universal screening remains controversial. The aim of our study is to investigate laboratory testing patterns for Lp(a) in subjects screened with a standard lipid panel at a large tertiary referring US institution.
Methods: Data were retrospectively collected at Mayo Clinic from the Mayo Data Explorer (MDE). Subjects were included if they had a lipid panel measured between May 1, 2022, and April 30, 2023. Demographic data, Lp(a) measurements, statins and aspirin prescription and ASCVD events which occurred at any time in the life of a subject were recorded along with respective dates. The cumulative number of Lp(a) laboratory test orders were also tallied from 1994 to 2023 independently of the lipid panel requests.
Results: Between May 1, 2022, and April 30, 2023, 257,225 subjects had a lipid panel ordered. Of these, only 386 (0.15 %) had Lp(a) tested within 1 year of the lipid panel, while 2406 (0.94 %) had Lp(a) tested at any time. Lp (a) was tested more frequently in males (67 %) and in subjects who developed Myocardial Infarction (MI) at any time (12 %). Following Lp(a) results, there was no significant change in statin or aspirin prescription associated with Lp(a) levels. Secondary prevention was the main setting for ordering Lp(a) testing, and there was no change in this trend throughout the years.
Conclusions: Testing rates for Lp(a) in the general population are low and the main setting remains secondary prevention. Women are less tested than men. When Lp(a) is found to be elevated, often times there is no change in patient management to mitigate the ASCVD risk.

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1. Introduction

Lipoprotein(a) [Lp(a)] is a low-density lipoprotein (LDL)-like particle bound to apolipoprotein a. Lp(a) bears an independent risk for the development of Atherosclerotic Cardiovascular Disease (ASCVD). [1,2] The biomarker contains an LDL-like apolipoprotein B particle with a covalent bond to apolipoprotein (a). Lp(a) induces the expression of adhesion molecules fostering binding to endothelial cells. [3] Lp(a) is more susceptible to oxidation than low density lipoprotein (LDL), thus the cholesterol bound to Lp(a) is more rapidly uptaken by macrophages, [4] promoting plaque formation. In addition, in vitro studies demonstrate that Lp(a) is prothrombotic due to structural homology of apolipoprotein (a) with plasminogen. [5,6]

Several studies demonstrated that Lp(a) is associated with significant ASCVD risk. [7,8,9] Current guidelines from the American Heart Association (AHA)/American College of Cardiology (ACC) [10] support this biomarker as a risk enhancer and its testing is advocated primarily in patients with Familial Hypercholesterolemia (IIa level of evidence). A scientific statement from the AHA in 2022 reports that further implementation of the assays and of future mitigation strategy is needed before an actual universal screening could be strongly recommended. [11] In contrast, European [12] and Canadian [13] guidelines recommend a one-time measurement of this biomarker in all subjects. The National Lipid Association (NLA) has recently issued a statement recommending universal screening once in a lifetime, with a possible role of repeated testing in subject with intermediate Lp(a) values (30–50 mg/dl or 70–125 nmol/L). [14]

Approximately 20 % of the population is estimated to have elevated Lp(a). [15] The frequency of Lp(a) elevation may be even higher in black individuals. [16] Despite this high percentage, recent studies indicate a low rate of Lp(a) testing in the general population and in those with established ASCVD. [17,18,19,20]

The impact of Lp(a) elevations is becoming increasingly important since there are new promising therapeutic approaches emerging which will directly target Lp(a) levels.

The aim of our study was to explore providers' ordering patterns for Lp(a) at a large referring academic institution. We sought to identify whether testing patterns for Lp(a) differed from other centers [17,18,19,20] and whether testing was biased towards patients at high risk. Compared to other investigations assessing Lp(a) tests in either high risk subjects [21] or general population, [17,18,19] our approach was unique since we wanted to assess the frequency of the biomarker testing in a population at average risk requiring more risk stratification by lipid panel testing. Ultimately our study aims to raise awareness about the necessity of larger scale national screening programs.

2. Methods

2.1. Data selection

Data were retrospectively collected using the Mayo Data Explorer (MDE). MDE is a Mayo Clinic-developed, self-service data exploration web application. The electronic data warehouse gathers information from the unified patient clinical record. Other research teams previously used this valuable tool to evaluate both population characteristics [22] and disease-specific outcomes, [23] although, to our knowledge, this is the first work in the cardiovascular field. We included all patients with a lipid panel collected between May 1st, 2022, and April 30th, 2023. Subsequent data for Lp(a) concentration tested at any time, Myocardial Infarction (MI), stroke, transient ischemic attack (TIA), invasive coronary procedures such as percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG), aspirin and statin prescription were extracted from the patient clinical records. Additional covariates included the age at which Lp(a) was tested, gender, ethnicity, smoking, diabetes, and hypertension.

One single most recent Lp(a) measurement for each subject was used for analysis when multiple values were available. When multiple lipid panels were available, the highest LDL-c was utilized. We used the initial ASCVD event for statistical analysis.

2.2. Statistical analysis

Baseline characteristics of the population tested for Lp(a) vs non-tested were compared by Pearson's chi-square test for categorical variables and Wilcoxon Rank Sum test for medians of non-normally distributed data. Given that Lp(a) was measured both in mg/dL and nmol/L, we categorized the biomarker based on the European Atherosclerotic Society (EAS) consensus statement. [24] The cutoff values used were <30mg/dL or <70 nmol/L for "low", 30–50mg/dL or 70–125 nmol/L for "intermediate", >50mg/dL or >125 nmol/L for "high". Medians of continuous variables were compared by Kruskal Wallis rank sum test among different Lp(a) categories. Binary variables were compared by Chi-square testing.

LDL-c values were calculated according to Sampson equation, [25] and were stratified in three categories whether LDL-c was <100mg/dL, 100–190 mg/dL or >190mg/dL. Subjects were further subdivided into those receiving statin treatment or not at the time of Lp(a) testing. The Kruskal Wallis rank sum test was used to analyze the mean levels of Lp (a) among the different LDL-c categories, whereas counts were compared by Chi-square testing. As the two Lp(a) assays are not harmonized, calculations in mg/dL and nmol/L were considered as two separate entities.

MI data were extracted from the electronic medical record using the MDE system and the problem list. MI was defined per ICD-10 codes. The rates of Lp(a) testing were compared between subjects who had MI and subjects who did not have MI.

Lastly, we explored the setting in which Lp(a) testing was conducted, and considered primary prevention if subjects were tested for Lp(a) before having MI, stroke, TIA, or an invasive coronary procedure such as PCI or CABG. If subjects were tested after any of these events, the setting was considered secondary prevention. Stroke and TIA diagnoses, along with PCI or CABG interventions were extracted from the MDE using ICD-10 codes.

The analysis was conducted using R 4.3.2. Statistical significance was set at $p<0.05$. One author (J. W. M.) had full access to all the data in the study and takes responsibility for its integrity and the data analysis.

The study was approved by the Mayo Clinic Institutional Review Board (IRB number 23–011008)

3. Results

Between May 1, 2022, and April 30, 2023, 257,225 subjects had a lipid panel ordered and reported in the MDE. A flow chart of patients included in this study is provided in (Fig. 1).

During this time frame only 386 patients (0.15 %) had Lp(a) measured, while a total of 2406 subjects (0.94 %) had Lp(a) measured once in their lifetime.

Demographic data and baseline characteristics of the population studied are provided in (Table 1). The average age of testing was 60 (52,68) years old. Interestingly males were more frequently tested than females (67 % vs 33 %). Lp(a) – tested subjects were more frequently diabetic, had a higher rate of hypertension and were more likely to be smokers. Patients tested for Lp(a) had significantly higher rates of statin prescriptions (79 % vs 22 %) and more often had a prior MI compared to non-tested subjects (33 % and 2.3 %, respectively). Higher rates of cerebrovascular accidents were also reported in the Lp(a) tested group (6.2 % compared to 2.2 %). Within the lipid panel fractions, the most significant differences were observed in LDL-c and non-HDL-c median values, which were higher in patients not tested for Lp(a). (Table 1).

We subsequently categorized Lp(a) based on the European Atherosclerotic Society (EAS) consensus statement. [24] Of patients tested for Lp(a), 103 did not have a reported value in the MDE and were therefore

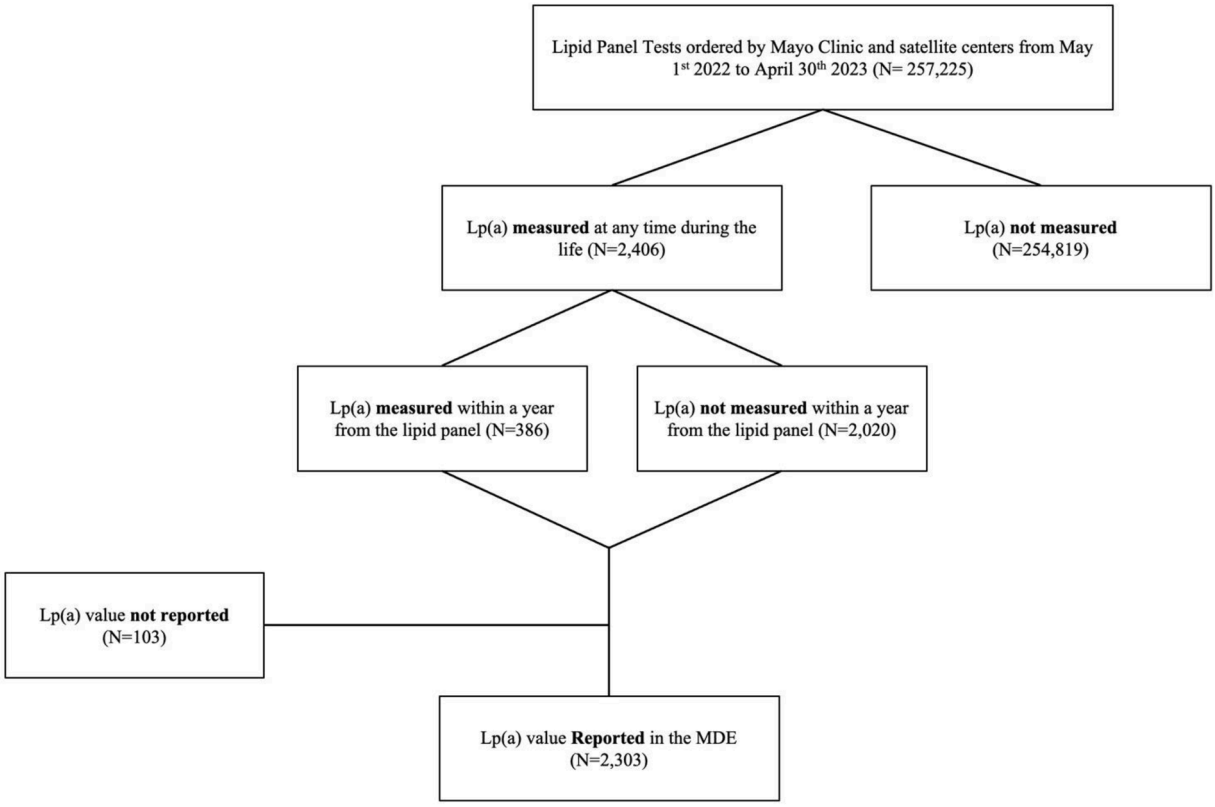

Fig. 1. Patient selection.

excluded from this section of the analysis. Lp(a) was low in 60 % of subjects, while 10 % had intermediate levels and 30 % had high levels. An important finding of our investigation is that aspirin and statin prescription after Lp(a) testing did not seem to differ among the three groups of Lp(a) (Table 2). There was a statistically significant difference in LDL-c values amongst these categories of Lp(a). Significantly higher levels of LDL-c were observed in the "high" Lp(a) group compared to the "intermediate" and "low" Lp(a) groups. (Table 2)

When stratifying our population by LDL-c values, subjects who were on statin therapy at the time of lipid panel testing were more frequently tested for Lp(a) (Table 3), and there was a U-shaped distribution of testing rates among the three different LDL-c categories ($p<0.001$).

Patients who were not on statin therapy at the time of lipid panel testing were also found to have a statistically significantly difference in Lp(a) testing frequency depending on the level of LDL-c. (Table 4) although the actual difference between these groups was minimal (0.4 % vs 0.2 % vs 0.3 %).

Both subsets of subjects on statin treatment or not on treatment, showed that at higher LDL-c values Lp(a) values were also higher. Statistical significance was achieved only for subjects with Lp(a) measured in mg/dL who were already on statin therapy at time of lipid panel testing. Interestingly, an inverse trend was noted for Lp(a) measured in mg/dL in subjects who we were not on statin therapy, albeit not statistically significant (Table 4)

Of subjects who experienced MI at any time, 12 % had also Lp(a) measured, while only 0.6 % were tested for Lp(a) in the non-MI group. Testing for Lp(a) occurred more frequently after an ASCVD event, with 72 % of testing occurring after such an event. (Table 1)

To further identify testing patterns throughout the years, we evaluated the absolute numbers of subjects tested for Lp(a) for the past three decades. The oldest record of Lp(a) testing available in MDE from our population was in 1994. The absolute number of tests conducted has been relatively low and stable from 1994 until 2015, when rates started to increase, reaching a peak in 2022. When comparing the rate of Lp(a) tests to total lipid panels obtained throughout the years, a significant increase in the relative proportion is observed. (Fig. 2)

The main setting of testing remained secondary prevention throughout the years (72 %), While testing for primary prevention purposes was found in only 28 % of our study population. (Fig. 3).

4. Discussion

Consistent with other investigations, [17,18] our study recapitulates a paucity of Lp(a) testing in the general population at a large tertiary referral institution (Table 1). Unlike other investigations, which either included the general population [17,18,19] or subjects at high and very high risk, [21] our study included subjects at average risk who needed more risk stratification by a lipid panel obtained by current standard of care, per AHA/ACC recommendations and/or provider clinical judgement. [10] This is important since guidelines that endorse universal screening for Lp(a) also recommend that the initial testing occurs at the time of the first lipid panel. [12,13] Compared to other reports our study shows a significantly lower rate of Lp(a) testing [21] despite scrutinizing a population at slightly higher ASCVD risk given the concomitant lipid screen of these patients. Another unique finding of our study is that Lp(a) is more frequently tested in men than women (67 % vs 33 %). Although small differences have been reported in other studies, [17,18,19] such a wide gap has never been evidenced before. We could not discriminate from our analyses the reasons for this biased testing pattern, however our finding adds to the gender disparities in cardiovascular care already evidenced in several other areas of cardiology. [26,27,28]

One unique focus of our investigation concerns the setting of testing. The majority of Lp(a) tests were obtained for secondary prevention (72 % vs 28 %), with no change in trend throughout the years. (Fig. 3) We advocate that a shift towards reinforcing a primary preventive approach would align better with the goal of early detection and mitigation of ASCVD risk. This finding clearly demonstrates that there is a category of

Table 1
Population characteristics divided by Lp(a) Testing. Non-HDL-c: non-high-density-lipoprotein-cholesterol, HDL-c: high-density lipoprotein cholesterol, LDL-c: low-density lipoprotein cholesterol, TIA: transient ischemic attack.

Lp(a)	Tested, N = 2,406[1]	NOT Tested, N = 254,819[1]	p-value[2]
Demographics			
Gender			
Female	793 (33 %)	129,038 (51 %)	
Male	1612 (67 %)	125,743 (49 %)	
Non-Binary	0 (0 %)	22 (<0.1 %)	
Not Disclosed	1 (<0.1 %)	16 (<0.1 %)	
Race			
White	2360 (98 %)	247,989 (97 %)	
Non – White	46 (2 %)	6830 (3 %)	
Smokers	173 (7.2 %)	9506 (3.7 %)	<0.001
Diabetes	773 (32 %)	52,908 (21 %)	<0.001
Hypertension	1578 (66 %)	115,134 (45 %)	<0.001
Myocardial Infarction	802 (33 %)	5866 (2.3 %)	<0.001
Stroke - TIA	148 (6.2 %)	5568 (2.2 %)	<0.001
Statin	1907 (79 %)	57,162 (22 %)	<0.001
Aspirin	209 (8.6 %)	5789 (2.3 %)	<0.001
Lipid panel			
Lp(a) testing setting			
Primary prevention	668 (28 %)		
Secondary prevention	1738 (72 %)		
Age at Lp(a) test (y)	60 (52, 68)		
Total Cholesterol (mg/dL)	148 (124, 182)	180 (151, 212)	<0.001
LDL-c (mg/dL)	73 (56, 100)	101 (77, 129)	<0.001
HDL-c (mg/dL)	47 (39, 59)	52 (42, 64)	<0.001
Non-HDL-c	96 (76, 128)	124 (98, 154)	<0.001
Triglycerides (mg/dL)	114 (81, 164)	110 (78, 158)	<0.001

1 Median (IQR); n (%)
2 Wilcoxon rank sum test; Pearson's Chi-squared test

Table 2
Population characteristics divided by Lp(a) Categories. Non-HDL-c: non-high-density-lipoprotein-cholesterol, HDL-c: high-density lipoprotein cholesterol, LDL-c: low-density lipoprotein cholesterol, TIA: transient ischemic attack.

Lp(a) category	**<30mg/dL / <70nmol/L**, N = 1384	**30–50mg/dL / 70–125nmol/L**, N = 229	**>50mg/dL / >125nmol/L**, N = 690	**p-value**[2]
Lp(a) mg/dL	8 (6, 15)	38 (34, 43)	91 (68, 125)	<0.001
Lp(a) – nmol/L	13 (7, 28)	95 (82, 110)	217 (172, 315)	<0.001
Non-HDL-c	95 (75, 126)	93 (74, 122)	101 (79, 132)	0.002
HDL-c	48 (39, 59)	46 (38, 57)	48 (40, 58)	0.5
Total Cholesterol	146 (122, 182)	144 (121, 177)	154 (130, 185)	0.002
Triglycerides	116 (81, 165)	108 (75, 168)	115 (83, 162)	0.3
LDL-c	72 (53, 100)	69 (55, 93)	79 (60, 104)	<0.001
Myocardial Infarction	461 (33 %)	75 (33 %)	229 (33 %)	>0.9
Stroke - TIA	84 (6.1 %)	8 (3.5 %)	48 (7.0 %)	0.2
Statin after testing	413 (39 %)	68 (36 %)	208 (36 %)	0.6
Aspirin after testing	131 (9.4 %)	17 (7.4 %)	61 (8.8 %)	>0.9

1 Median (IQR); n (%)
2 Kruskal-Wallis rank sum test; Pearson's Chi-squared test

patients with elevated Lp(a) who are missed in clinical practice and who may benefit from earlier and more aggressive interventions to mitigate their long-term risk.

Additionally, our investigation underscores that the medical community is not well versed in addressing Lp(a) elevation since there was

Table 3
Testing rate and median Lp(a) values in subjects stratified by LDL-c on statin at time of Lp(a) testing). LDL-c: low-density lipoprotein cholesterol, TIA: transient ischemic attack.

LDL-c	**<100**, N = 38,819[1]	**100–190**, N = 13,038[1]	**>190**, N = 600[1]	**p-value**[2]
Lp(a) tests	1429 (3.7 %)	358 (2.7 %)	25 (4.2 %)	<0.001
Lp(a) – mg/dL	18 (7, 58)	22 (8, 80)	103 (40, 149)	0.004
Lp(a) – nmol/L	46 (11, 183)	48 (11, 168)	81 (38, 169)	0.7
Myocardial Infarction	3892 (26 %)	1039 (8.0 %)	62 (10 %)	<0.001
Stroke - TIA	3153 (8.2 %)	830 (6.4 %)	55 (9.2 %)	<0.001

1 n (%); Median (IQR)
2 Pearson's Chi-squared test; Kruskal-Wallis rank sum test

Table 4
Testing rate and median Lp(a) values in subjects stratified by LDL-c not on statin at time of Lp(a) testing. TIA: transient ischemic attack.

LDL-c	**<100**, N = 86,660[1]	**100–190**, N = 113,456[1]	**>190**, N = 4652[1]	**p-value** [2]
Lp(a) tests	367 (0.4 %)	215 (0.2 %)	12 (0.3 %)	<0.001
Lp(a) – mg/dL	16 (7, 48)	11 (7, 37)	8 (7, 9)	0.088
Lp(a) – nmol/L	21 (8, 141)	30 (8, 145)	64 (41, 164)	0.5
Myocardial Infarction	1108 (1.3 %)	540 (0.5 %)	27 (0.6 %)	<0.001
Stroke – TIA	1031 (1.2 %)	624 (0.5 %)	23 (0.5 %)	<0.001

1 n (%); Median (IQR)
2 Pearson's Chi-squared test; Kruskal-Wallis rank sum test

no significant statin and aspirin prescription trend in the group with this biomarker elevation (Table 2). Higher levels of Lp(a) would require more aggressive LDL-c lowering strategies to address the elevated ASCVD risk. [29] This is partly due to the lack of currently available therapeutic strategies that reduce Lp(a) etiologically. Additionally, we believe that there is also a diminished awareness in the medical community of the risk carried by Lp(a) elevation.

We show that the frequency of testing Lp(a) at our institution is lower that the frequency reported by other studies, [21] where the most recent yearly testing rate was 5.7 % compared to our 0.15 %. We suspect that this is due to fact that our population is more heterogenous as it included patients from all institution sites including our multiple satellite sites; despite having a slightly higher ASCVD risk due to lipid screening, our population is not limited to primary or cardiovascular care since it included all subjects with a lipid panel tested during the study period. Indeed, when looking at the testing rates in the population with previous ASCVD events, the testing rate is 12 % which is in alignment with other investigations. [21] Additionally there might also be a referral bias as our institution is one of the largest referral centers in the U.S.

Interestingly, Lp(a) was more frequently tested in the LDL-c category <100 mg/dL. We suspect this is due to testing of first-degree relatives of patients identified as carriers of high Lp(a) values. Another explanation may be that this subset of patients might have been treated for dyslipidemia at the time of Lp(a) testing (Table 3). Patients with LDL-c >190 mg/dL were also frequently tested for Lp(a), in line with AHA/ACC guidelines. [10] These individuals also had higher levels of Lp(a) (Table 3-4), likely attributable to the familial etiology of their dyslipidemia. [30] This finding suggests that the medical community is more apt to follow existing guidelines and supports a refinement of the current AHA/ACC [10] recommendations that could complement the recent NLA statement. [14]

Our investigation shows that Lp(a) is substantially more frequently tested in subjects with MI (12 % vs 0.6 % in the non-MI group). This is similar with previous publications, [17,18] but remarkably, in our cohort there is a steeper difference in testing between the two groups.

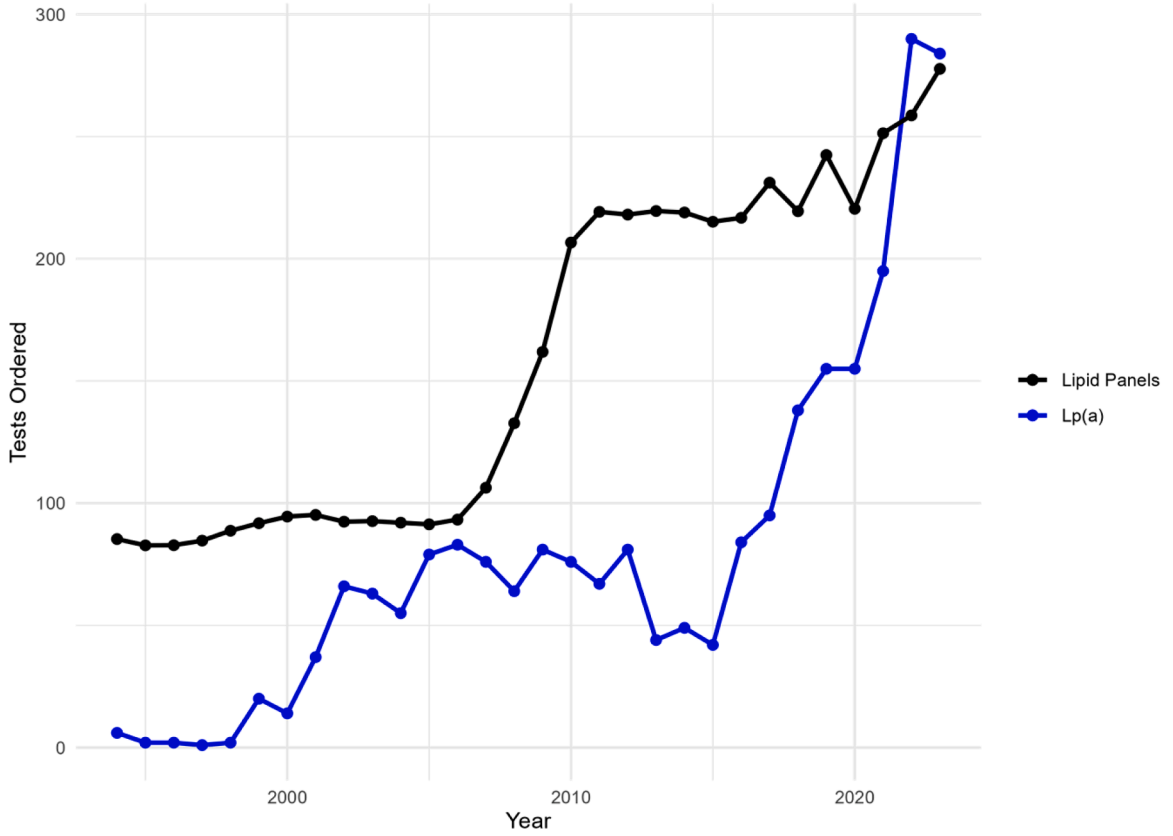

Fig. 2. Trend in absolute number of Lp(a) testing from 1994 to 2023.

Our institution is a tertiary referral center for cardiovascular diseases with increased awareness about the ASCVD risk associated with Lp(a) elevation, which may explain the more abrupt difference in biomarker testing.

Lp(a) testing volumes have increased for the past three decades, (Fig. 2) suggesting that the medical community is becoming more aware of this important biomarker of ASCVD risk. We identified a rapid increase in testing starting 2015 which was likely attributable to an intensified educational initiative emphasizing the significance of Lp(a) at our institution, coupled with a modification in the order sets which added Lp(a) to other cardiovascular panels.

To date, there is no clear consensus on the management of patients with elevated Lp(a). The current lack of etiologic pharmacotherapeutic interventions aimed at reducing Lp(a) makes clinicians less prone to request testing, Although PCSK9 modulators reduce Lp(a) to a certain extent, [31,32,33] they are not approved by the FDA for this indication. We agree with Kronenberg et al. who suggest a more intense lifestyle intervention and pharmacologic LDL-c lowering strategies depending on the risk profile in patients with elevated Lp(a). [24]

However, this clinical scenery may soon change. Several clinical trials are investigating the role of small interfering RNAs, [34–36,42,43] Antisense Oligonucleotides, [37,38,41] and small molecule inhibitors. [39] These drugs are very promising based on preliminary data. A summary of the principal features of these new compounds is provided in Table 5. Some of these agents lower Lp(a) by more than 90 %, which might have a different clinical impact when compared with current available approaches, such as PCSK9 modulators, which can lower Lp(a) by 20–30 % only. [31,32,33] Given the foreseen entry in the market of these novel drugs, an awareness program has been recently initiated by AHA [40] which could enhance knowledge and lead to changes in screening strategies nationwide. Our study supports this initiative as we demonstrate how awareness and education programs can lead to increases in ordering volumes for Lp(a).

4.1. *Strengths and limitations*

Our study was carried out at a large tertiary referral institution. We divided our subjects by LDL-c levels, aiming to determine clinicians' testing practices according to these values, and whether these results had an influence on the likelihood of Lp(a) testing. Moreover, we investigated primary and secondary prevention settings for testing among our population, which has never been explicitly evidenced before. We show for the first time a strong and significant bias in testing patterns based on gender.

Our study has some limitations. First, we only included subjects on statin therapy as data regarding other lipid lowering agents was not available in the MDE system. Given that PCSK9 modulators are relatively new therapies we suspect that only a minority of our subjects were treated with these agents. Aspirin is a non-prescription drug and may not be present in all patients' charts, however its use was concordant with statin use in our population, suggesting the same trend.

Regarding LDL-c categories, more validated classifications are present, [44] but for the purposes of our analysis, the cutoffs used are more representative of the everyday clinical practice at the time the data were registered in the MDE.

Some additional risk factors/enhancers were not included in our analysis such as kidney function, as these parameters were not available using the MDE system. Therefore, we did not control the population studied by such data which may partially influence our results. However, our analysis controlled for the majority of traditional risk factors for ASCVD.

Our population mainly includes white subjects. Results should be interpreted with caution in other ethnic groups.

Though the rate of subjects with Lp(a) >50mg/dL or >125nmol/L was slightly elevated compared to the general population, potential selection bias must be acknowledged, given our inclusion criterion of subjects who underwent a lipid panel test. However, this practice of Lp

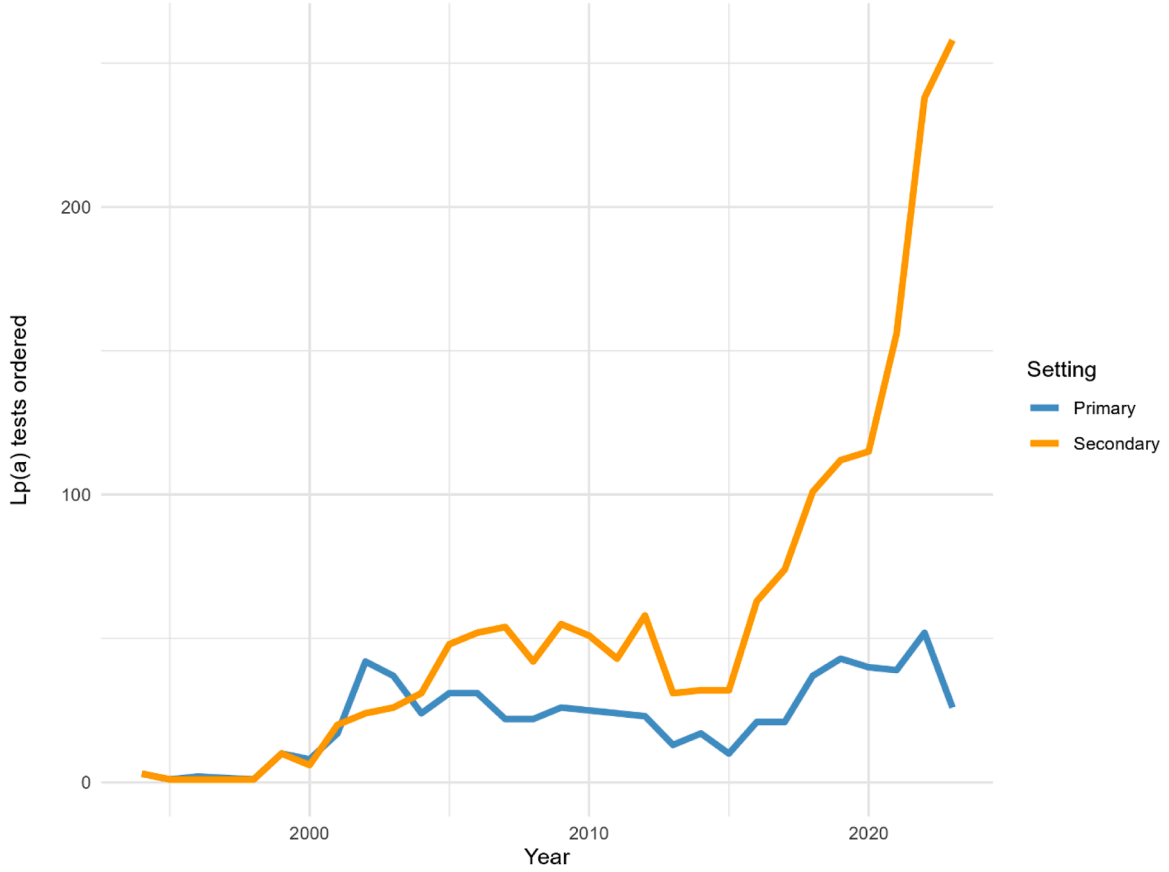

Fig. 3. Setting of Lp(a) testing throughout the years from 1994 to 2023.

Table 5
Summary of novel compounds targeting Lp(a) currently in clinical trials. Adapted from: Manzato M, Wright RS, Jaffe AS, Vasile VC. Lipoprotein a: underrecognized risk with a promising future. Rev Cardiovasc Med. 2024. In Press.

Medication	Clinical Trial Phase	Mechanism of Action	%Lp(a) reduction	Effect on LDL-c	References
Pelacarsen	Phase 3	ASO directed toward Apo (a) mRNA	>90 %	15–50 % Reduction	37,38,41
Olpasiran	Phase 3	siRNA directed toward Apo (a) mRNA	70–90 %	22–25 % reduction	34
Zerlasiran	Phase 2	siRNA directed toward Apo (a) mRNA	85–95 %	13–26 % reduction	35,42,43
Lepodisiran	Phase 2	siRNA directed toward Apo (a) mRNA	96–98 %	Not disclosed	36
Muvalaplin	Phase 2	Small molecule inhibitor preventing Apo(a)-ApoB-100 bond formation	63–65 %	No change	39

(a) testing at the time of initial lipid panel reflects the standard of care in countries where Lp(a) screening is universal. [12,13] Moreover, our population revealed a high number of ASCVD events, which may potentially create further selection bias, explaining the higher prevalence of Lp(a) elevation.

Despite limitations related to the extraction system, our data clearly demonstrates a paucity in testing of the biomarker and enriches data published from other medical centers with new insights. [17,18,19,20]

5. Conclusions

Lp(a) is as a potent mediator of ASCVD, yet its risk remains significantly underappreciated by the medical community. The overall rate of Lp(a) testing is low at our tertiary referral center and there is a lack of clearly defined measures following the identification of elevated levels. There is a strong bias for testing in males and for secondary prevention.

Considering ongoing clinical trials, there is a need for comprehensive national awareness and education regarding the critical importance of screening for Lp(a). Additionally, a refinement of existing national guidelines is desirable to address the current gap in the identification and management of elevated Lp(a) values.

CRediT authorship contribution statement

Matteo Manzato: Methodology, Validation, Formal analysis, Data curation, Writing – original draft, Project administration. **Jeffery W. Meeusen:** Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – review & editing. **Leslie J. Donato:** Validation, Supervision, Writing – review & editing. **Allan S. Jaffe:** Validation, Supervision, Writing – review & editing. **Vlad C. Vasile:** Conceptualization, Methodology, Validation, Resources, Writing – original draft, Writing – review & editing, Supervision, Project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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None

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