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Testimony of the Maine Municipal Association

In Support For

LD 444 - *An Act to Designate First Responders and Other Public Safety Professionals as a Special Risk Population for the Purposes of Improving Insurance Coverage for the Effects of Trauma*

January 23, 2024

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Sen. Bailey, Rep. Perry and distinguished members of the Committee on Health Coverage, Insurance and Financial Services, my name is Rebecca Graham and I am providing testimony in support for LD 444, *An Act to Designate First Responders and Other Public Safety Professionals as a Special Risk Population for the Purposes of Improving Insurance Coverage for the Effects of Trauma,* on behalf of MMA's 70 member Legislative Policy Committee, who are municipal officials elected by their peers to guide and inform state level policy from a broad level of community experience, and capacity.

The Association thanks Sen. Bailey for her consistent support for the legislative efforts to keep our public safety professionals healthy, resilient and in our communities, and for being an amazing supporter for this initiative. This bill is a result of an effort to address well established health problems that have been identified as realities for first responders, whom we collectively ask to face the worst of human behaviors and tragedies daily.

The legislature has confirmed through the enactment of workers comp presumptions that this population is far more likely to suffer from cardiac arrest, cancer, and mental and behavioral health effects from the repeated exposure to traumatic events, burning carcinogenic chemicals, challenging work hours, and significant stress. No other profession has a reality that one can do their job extremely well and still have a negative outcome regularly.

When needed, all first responders work together across political subdivisions and cooperate to address significant public safety threats jointly, though they return to communities with unequal resources to support the fall out to first responder health from those responses. Municipal officials are asking for a path to change this to help maintain their staff and level the playing field for all services who may provide health care but cannot provide the same screenings or services as adjacent communities.

Officials are asking for a path to a "mutual aid response" to first responder health that we expect from our first responders when addressing the very events that increase their health risks.

Those presumptive injuries are applied regardless of which agency a first responder works for or if they are a volunteer.

It is important to note that many of the preventative screenings necessary to capture their risks are not covered under current plans because these individuals are viewed by the same measures as the civilian population. While 7% of the civilian population will experience a heart attack under the age of 45, 45% of

the public safety professionals will experience their first heart attack under the age of 45. (Int. Journal of Emerge Med Health. 2013 15(4) 217-218). The average age of a civilian patient with a heart attack is 65 years old while public safety workers' average age is 49 years.

Exposure to excessive numbers of undesirable events with negative outcomes have been associated with increased risk for suicide (Pope & Vasquez, 2016) and increased risk of early cardiac health deterioration.

This bill is asking for the same uniform application for preventative coverage that would catch these health issues before the injury or address mental resiliency and remove cost barriers for first responders to access those preventative benefits, regardless of which policy they are covered under, within the controls of this statute.

There are folks coming behind me on zoom who will provide those cardiac related statistics in greater detail and are the authors of the study I have included in my testimony. Additionally, you will hear from other folks behind me their personal stories of attempting to navigate providers who also need to be educated about their risks and how to capture them. We hope provider education will be an additional benefit from this legislation.

Healthy resilient first responders lead more productive lives, cause less disciplinary issues, and live longer following their years of service especially when coupled with appropriate early detection of cardiac risks that manifest differently in this population. While this bill will not capture them all in the same way other efforts on the appropriation table would such as LD 1857, it is a step in the right direction to establishing the right norms and helping communities keep their first responders in the public safety profession.

We know it can be done because our neighbors in Massachusetts have already created a path to accepting screening programs, like one you will hear from today, as fully covered preferred providers for their police fire and related first responders in the Massachusetts Strategic Health Group. MMA understands that the language in the bill may need additional clarity for insurance carriers and we are asking that the committee help them come to the table to find a solution that lifts all public safety boats rather than issuing another denial to our first responders.

Journal of Occupational and Environmental Medicine

# Liposomal Associated Phospholipase A2 (Lp-PLA2) is More Effective in Predicting Cardiac Risk in Law Enforcement Than Framingham Risk Score and Coronary Artery Calcium Score Calculation

--Manuscript Draft--

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**Abstract:**

Objective
To clarify the methods for identifying officers at high risk for cardiac events.

Methods
This retrospective review included 3,330 patient charts. Classic cardiovascular risk factors, coronary artery calcium (CAC) scores, and endothelial inflammatory biomarker levels were compared between civilians and law enforcement officers (LEOs). The Framingham Risk Score (FRS) was compared with risk assessment using inflammatory biomarkers.

Results
The FRS failed to identify over 90% of LEOs at high risk of cardiovascular events. Similarly, the use of the CAC score was ineffective. Inflammatory biomarker analysis measuring the Lp-PLA2 activity was the most reliable method for identifying LEOs at high risk of cardiovascular events.

Conclusions
The use of the standard FRS and CAC scores is less effective than that of inflammatory biomarkers in identifying LEOs at high risk of cardiovascular events.

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## Abstract

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This retrospective review included 3,330 patient charts. Classic cardiovascular risk factors, coronary artery calcium (CAC) scores, and endothelial inflammatory biomarker levels were compared between civilians and law enforcement officers (LEOs). The Framingham Risk Score (FRS) was compared with risk assessment using inflammatory biomarkers.

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The use of the standard FRS and CAC scores is less effective than that of inflammatory biomarkers in identifying LEOs at high risk of cardiovascular events;

## Keywords

cardiovascular disease, coronary artery calcium score, coronary disease, Framingham risk score, inflammation, law enforcement officer, liposomal associated phospholipase A2

## Bulleted Learning Outcomes

Completing this educational activity would enable the following:

- Understanding the techniques most effective in predicting cardiovascular disease among law enforcement officers.
- Understanding the mechanism that accounts for the increased prevalence of cardiovascular disease among law enforcement officers.
- Assessing standard cardiovascular disease risk assessment techniques and comparing these techniques with novel advanced inflammatory biomarker analyses.

## Introduction and Objectives

The current literature suggests that a top cause of morbidity and mortality in law enforcement officers (LEOs) is cardiovascular disease (CVD). Although death from heart attack is consistently ranked the second or third most common cause of death by tracking organizations, such as the Officer Down Memorial Page or National Law Enforcement Officer Memorial Fund, these rankings do not include heart attack deaths that occur after the individual officer finishes the duty shift.[1] Extrapolating these numbers for a 24-h day would rank heart attack first as a cause of death among individuals in uniform. Furthermore, only approximately 3% of heart attacks are fatal, meaning that the collected and published data do not recognize thousands of heart attacks that cause significant morbidities in officers rather than death.[2] In addition to taking a toll on human life, heart attack treatment is one of the leading medical expenses incurred by police agencies. According to the Commission on Accreditation for Law Enforcement Agencies, the cost to taxpayers of in-service heart attacks ranges from $450k to $750k per incident.[3]

Previously published data suggests that the average age of a United States police officer and a civilian with an acute myocardial infarction (MI) is 46 and 65 years, respectively. Moreover, a civilian aged between 55 and 59 years has only a 1.5% chance of dying from cardiovascular (CV) causes, whereas LEOs in the same age range have a chance of >56%. More frequent heart attacks at younger ages contribute to the statistics of police officers having a life expectancy lower by 22 years than that of their civilian counterparts.[4] However, these findings are disputed. For example, the California State Employees' Retirement System Experience Study compared the life expectancies of male police officers with those of male workers and retirees not in the public safety field and found that individuals aged 50, 55, 60, or 65 years had similar life expectancies,

regardless of whether they were police officers or other workers.[5] An Illinois study on state police life expectancy yielded similar findings.[6] However this study did not consider officers' retirement ages, which may have occurred earlier than that of the population used to construct the actuarial tables. Furthermore, the California study only covered 10 years, making the conclusion less certain. Nevertheless, there is sufficient previously published data indicating the possibility that the risk of heart disease is higher in officers than in their civilian counterparts.[7]

Law enforcement lay press and trade publications have suggested that police officers are 25 times more likely to die from a CV event than be killed by the violent action of a suspect. The data regarding this significant statement have not been sufficiently and scientifically evaluated nor have they been reproduced. However, this is anecdotal evidence that the risk of CV morbidity and mortality is a concern for police departments nationwide. Nonetheless, a current review of the published literature supports the concept that police officers worldwide have an increased prevalence of coronary disease and metabolic syndrome (hypertension, dyslipidemia, hyperglycemia, hypertriglyceridemia, and obesity). [7,8,9,10,11]

The cause of increased cardiac risk in policing remains elusive. Either the LEO population has an increased prevalence of known classic cardiac risk factors (including hypertension, high cholesterol, diabetes, age, smoking, and family history) or despite a relatively similar risk to that of civilians, MI in LEOs occurs more frequently owing to other mechanisms. This increased risk may be due to additional occupation-specific risks, such as mental stress induced by shift work, hypervigilance, psychological/physical trauma, or repeated exposure to a hyperadrenergic state caused by the inherent nature of police work, such as pursuits, use of force, rendering emergency

aid, or other acutely stressful incidences. Evidence has been published that reveals LEOs have more classic CV risk factors than their civilian counterparts.[12] However, this study was limited by its size (n=310); therefore, a larger analysis examining these classic risk factors was conducted.

Because of the discrepancy in the rates of CV events in the law enforcement population, this study aimed to determine the most effective way to identify LEOs at an elevated risk of CV events. We compared standard population-based CV risk modeling using the Framingham Risk Score and novel inflammatory biomarker analysis using lipoprotein-associated phospholipase A2 (Lp-PLA2). The FRS is a sex-specific algorithm for estimating an individual's 10-year CV risk. It was first developed based on data obtained from the Framingham Heart Study and considers age, sex, total cholesterol level, systolic blood pressure (SBP), treatment for hypertension, presence of diabetes, presence of peripheral vascular disease, and smoking status.[13] This information is used to determine individuals' 10-year risk of developing coronary heart disease (CHD) by categorizing them into low (<10%), intermediate (10–20%), or high (>20%) risk tertiles.

Lp-PLA2 is an enzyme primarily synthesized by macrophages and foam cells within atherosclerotic plaques. PLA2 is a ubiquitous enzyme that hydrolyzes the *sn*-2-acyl bond of phospholipids of the cell membrane and lipoproteins and yields free fatty acids and Lys-phospholipids, which are precursors of various proinflammatory lipid mediators, including leukotrienes, eicosanoids, prostaglandins, and platelet-activating factor.[14,15,16] Elevated Lp-PLA2 (measured as activity or concentration) levels have been associated with a severely increased risk of CHD and cerebral vascular disease because it is an indicator of rupture-prone plaque. [17,18,19,20,21,22,23,24,25,26,27,28] Data derived from Brilakis et al. demonstrated a large

increase in CV events over 4 years, even with slight elevations in Lp-PLA2 serum concentration above the upper normal limits.[28]

Furthermore, we analyzed the results of participants in our cohorts who underwent (CAC) score calculation to determine if this testing modality was effective in identifying LEOs at an increased risk for a CV event. Finally, we compared the prevalence of baseline classical CV risk factors in civilian and LEO populations to determine whether an increase in these well-known risk factors could elevate the cardiac events observed in the LEO population, as suggested by Joseph et al. [12]

## Methods

We conducted a de-identified, descriptive study using a retrospective review of medical records. Therefore, the comparative cohorts were not matched with control groups. The STROBE checklist was adhered to and is attached herein. The medical records of individuals who presented for their first clinical visit were reviewed to analyze their CV risk. The patients were seen at a private clinician's practice and/or as part of a cardiometabolic screening program on LEOs undertaken by Sigma Tactical Wellness™. Patients who were naïve to lipid treatment and had no known history of coronary artery disease, peripheral artery disease, or diabetes (insulin- and non-insulin-dependent) were included in the analysis. Patient data were collected between January 2015 and October 2022. During this time, 3,330 patients were evaluated, of whom 3,192 met all inclusion criteria, had complete datasets, and were included in the study. Statistical analyses were performed using Microsoft Excel and R. The same programs were used to run proportion tests on non-numerical data. Statistical analyses were performed by Roar Analytics,™ Rogers Arkansas. The

Cleveland Heart Laboratory, a subsidiary of Quest Diagnostics, performed all laboratory evaluations. The study was funded in its entirety by Sigma Tactical Wellness™.

## Results

Demographic data were collected from de-identified civilian and LEO clinic visits (Figure 1). The overall database contained 3,330 individuals, of whom 3,192 met the inclusion criteria, including 2,222 police officers and 970 civilians. Multiple variables were compared between the two groups (Table 1), including age (years), sex (male or female), systolic blood pressure mmHg (SBP) and diastolic blood pressure mmHg (DBP), hemoglobin A1c % (HbA1c), insulin level (mg/dL), low-density lipoprotein cholesterol (LDL) level (mg/dL), and smoking status (positive or negative). Lp-PLA2 positivity was defined as a level of >123 mg/dL (per Cleveland Heart Laboratory testing range) and was compared between the two groups. Individuals who were Lp-PLA2 positive were considered to be at high risk of coronary events.[27] Subsequently, all groups were identified as high or low risk using Lp-PLA2 measurement results, followed by the FRS (low, intermediate, or high risk), both with and without treatment for hypertension. The Student's t-test was used to compare statistical significance.

After analyzing the variables and identifying the covariates, several factors were identified that could be used to predict the significant influencers of Lp-PLA2 positivity. Using this Lp-PLA2 model enables better identification of individuals at high risk of CVD in law enforcement.

### Age and Sex

Age was similar between the male and female participants; however, the civilian cohort tended to be older ($p<0.001$). In this study, age appeared to be inversely related to Lp-PLA2 positivity; that is, younger individuals were more likely to be Lp-PLA2 positive ($p<0.001$) (Figure 2). The mean age of individuals who were Lp-PLA2 negative was 57 years, whereas that of individuals who were Lp-PLA2 positive was 46 years (Table 2). The observation that Lp-PLA2 was directly correlated with age was statistically significant (Figure 2) and was contrary to that of a previous report regarding age and Lp-PLA2 positivity.[28]

### Conventional CV Risk Factors

The SBP differed insignificantly between the two groups. Although there was a statistically significant difference in DBP, the difference of less than 5 mmHg does not appear to be clinically significant. The markers of prediabetes and diabetes were similar. Similarly, fasting insulin levels, which can be an indicator of prediabetes and pending metabolic syndrome, and HbA1c, differed insignificantly between LEOs and civilians. The civilian cohort smoked more than the LEO population (Figure 3 and Table 3). In a previously published study, the use of tobacco products was positively correlated with Lp-PLA2 elevation.[29] However, our analysis indicated that this relationship was absent. In addition, although the civilian population was using tobacco at a higher rate, its Lp-PLA2 levels were lower than those observed in the LEO cohort.

The LEO population had higher total cholesterol and LDL levels and slightly lower high-density lipoprotein (HDL) levels (Figure 3 and Table 3). These differences were statistically significant and possibly contributed to the elevation of inflammatory marker levels [30]. However, our data

analysis indicated that LEOs have an increased odds of Lp-PLA2 positivity by >795% (odds ratio 8.95, 95% confidence interval 6.73, 11.96) compared with their civilian cohorts. Based on differences in the LDL levels alone, these differences in increased odds would only cause a 202% increase (using average LDL levels of civilians and LEOs of 93.5 and 136.3 mg/dL, respectively, along with the determination that for each 1 mg/dL increase in the LDL level, there is an increased odds of 4.74% of being Lp-PLA2 positive). This was far below the increased odds observed in the LEO cohort of 795% (Table 4).

### Framingham Score Calculation and Analysis

The FRS is an accepted tool for predicting the 10-year risk of developing CHD. The FRSs were calculated twice for all groups. First, by assuming that the SBP was not treated, followed by an assumption that antihypertensive treatment was used, as this factor can change the FRS. These calculations were performed because data on hypertension treatment were unavailable. There were insignificant differences in either group; therefore, untreated data points are presented in this paper.

### Lp-PLA2

On reviewing the Lp-PLA2 data, LEOs had a significantly higher proportion of Lp-PLA2 positivity than civilians ($p<0.001$) (Figure 4). This contradicts what was published previously, as Lp-PLA2 positivity has been shown to be directly correlated with age and tobacco usage. [28,29] In our study, despite being younger, smoking less, LEOs had significantly higher rates of inflammatory plaque, as measured by Lp-PLA2 activity (Figures 4,5 and Table 5).

### Low/Intermediate Framingham vs. Positive Lp-PLA2 Analysis

While Framingham Risk Score analysis is an effective method for predicting CHD/CVD risk in the general population, it significantly underestimates the risk in LEOs. We compared all data sets in our study population that had an FRS of "low or intermediate" risk and compared this to the percentage of individuals who were Lp-PLA2 positive. This comparison was conducted across LEO and civilian cohorts in separate male and female populations. In both the male and female population studies, the law enforcement cohort had a significantly greater percentage of Lp-PLA2 positivity than the civilian cohort, making the Framingham Risk Score analysis unreliable (Figure 5, Table 6). Lp-PLA2 activity measurement revealed that >92% of the LEOs identified as "low or intermediate" risk using the FRS were found to be at a high risk using inflammatory biomarker analysis (Figure 6). This was a significant distinction from that in civilians, among whom only 24% were not properly identified (Figures 7 and 8 and Table 7).

### Coronary Artery Calcium Score Calculation

Of the 3,330 patients screened, 3,250 (478 civilians and 2,772 LEOs) underwent CAC score calculation. For this analysis, the presence of identifiable coronary calcium was considered abnormal, that is, any Agatston Score of >0. The Agatston Score is calculated based on the total area and density of calcium deposition within the coronary arteries. A score of zero means no calcified plaque is detected. There was no standardization regarding the type of computed tomography (CT) scan used as multiple scanners were used in several cities throughout the United States, although standard Agatston scoring protocol was used. The CAC positivity in LEOs was similar to that in civilians (P=0.192 (Figure 9 and Table 8). This subset reproduces the data from Wanahita et al., who found a similar relationship in 2010. [31]

## Summary

Using the collected data and identifying covariates, a final model was derived by identifying the variables that significantly influenced Lp-PLA2 positivity. These variables included the profession as a LEO, male sex, and LDL concentration. Lp-PLA2 levels were inversely associated with age and tobacco use. That is, despite being older and using tobacco at a higher rate, civilians had lower levels of this inflammatory marker, which cannot be explained by the higher LDL concentration alone observed in the LEO cohort.

We exponentiated our logistic regression model using coefficient log odds estimates and obtained odd ratios for each variable. Therefore, with all other variables equal, our analysis revealed that LEOs were 8.95 times or 795.25% more likely to be Lp-PLA2 positive than civilians. Male individuals were 3.6 times or 260.05% more likely to be Lp-PLA2 positive than female individuals. For each 1 mg/dL increase in the LDL level, the likelihood of Lp-PLA2 positivity increases by 1.05 times or 4.74%. Current smokers are 1.22 times or 22.23% more likely to be Lp-PLA2 positive than non-smokers (Table 4).

Therefore, LEOs had an increased odds of 794.25% of being Lp-PLA2 positive compared with civilians ($P<0.001$). Male individuals had an increased odds of 260.05% of being Lp-PLA2 positive compared with female individuals ($P<0.05$). For each 1 mg/dL increase in the LDL level, there was an increased odds of 4.74% of being Lp-PLA2 positive ($P<0.05$). Smokers had an increased odds of 22.23% of being Lp-PLA2 positive (Table 4).

## Discussion

Our analysis considered the baseline levels of classic and accepted CV risk factors in the law enforcement and civilian cohorts to identify if the LEO cohort had a significantly increased presence of classic CV risk factors. These risk factors consist of age, dyslipidemia, hypertension, diabetes, family history, and tobacco use. The LEO and civilian cohorts had no clinically significant differences regarding age, SBP, insulin level, or HbA1c. However, LEOs (both male and female) had statistically higher LDL and total cholesterol levels. This mild elevation in LDL did not appear to account for the disproportionally elevated Lp-PLA2 levels. Interestingly in this study, civilians were older and used tobacco at significantly higher rates (two classically known cardiac risk factors). However, despite being younger and smoking less, LEOs had an increased risk via Lp-PLA2 positivity compared with their civilian counterparts, possibly owing to elevated LDL levels and job-specific duties performed by LEOs.

According to the data collected, standard population-based risk modeling using the FRS is inadequate for identifying LEOs possibly at high risk of a coronary event, as the score does not account for the individual risk of plaque rupture. When this risk was identified, approximately 92% of officers with low or intermediate risk determined via the FRS were at substantially high risk of acute coronary events when inflammatory biomarkers were evaluated. This rate was definitively greater than that in civilians, where the FRS only underestimated approximately 24% of individuals at low or intermediate risk using inflammatory biomarker analysis. This significant discrepancy can be explained by the substantial increase in Lp-PLA2 positivity observed in the LEO cohort, as the cohort had an increased odds of 795% of this positive marker. The reason LEOs had more inflammatory plaques than civilians despite similar age, SBP, HbA1c, insulin levels, and

less incidence of tobacco use is unclear. This discrepancy is likely owing to increased LDL concentrations and job-specific functions.

Law enforcement is a stressful profession and certainly not unique in this regard. However, police officers have a unique stress pattern vastly different from that of civilians. According to data from over 4,500 US LEOs between 1984 and 2010, the risk of sudden cardiac death is exceedingly elevated during restraints and altercations, pursuits, physical training, and medical/rescue operations.[32]

The inherent nature of policing comprises extended periods of routine and sometimes mundane patrols or investigations punctuated by short periods of intense excitement, causing accelerated adrenaline release. This is the so-called pattern of policing, described as 98% boredom and 2% sheer terror. These unexpected and recurrent adrenergic responses cause several rapid physiological changes that may cause intramural coronary plaques to become unstable. In these incidences, there are sudden increases in the heart rate, SBP and DBP, overall cardiac output, and shear forces within the arterial walls. During episodes of acute physical stress, oxygen stores are depleted, and metabolism begins to shift toward the anaerobic threshold with a corresponding increase in lactic acid production, associated with increased CV events.[33] In certain instances, when officers fight to survive, these episodes can be prolonged and last many minutes.[34] The recurrent hyperadrenergic state and its corresponding physiological changes possibly increase plaque instability, which can be detected by analyzing inflammatory biomarkers, Lp-PLA2 in particular.

In conclusion, Lp-PLA2 is an endothelium-dependent inflammatory biomarker disproportionally elevated in LEOs. This marker is an independent predictor of CVD and can be used to identify >90% of LEOs at high risk for CV events who cannot be identified using the FRS. Furthermore, the use of the CAC score cannot differentiate high-risk LEOs from their civilian counterparts. Therefore, law enforcement CV screening programs should include the measurement of Lp-PLA2 activity as an effective tool for identifying and subsequently reducing CVD across law enforcement occupations.

## Study Limitations

Although this study presents a very interesting concept that suggests using a novel biomarker approach to coronary risk determination in the law enforcement community, there are limitations in the study design. This study is a descriptive, retrospective chart review and therefore not as definitive as a prospective case-control study. Several factors could affect the resulting data. This retrospective analysis may inadvertently have caused selection and or information bias. Because Lp-PLA2 is expressed within the intravascular necrotic core and apoptotic macrophages [35], the standard covariate analysis performed in this study using the classic cardiac risk factors (HTN, age, tobacco, diabetes, and dyslipidemia) identifies that LEOs have elevation of Lp-PLA2 despite similar classic risk analysis. However, data regarding specific diet and exercise routines were not captured with this retrospective analysis. Although Lp-PLA2 is a novel predictor for acute coronary syndrome, this analysis did not look at the rate of coronary events in either the LEO or civilian cohort. As several already published studies support the independent predictive value of Lp-PLA2 for acute coronary events, it would certainly prove difficult (if not unethical) to withhold treatment from individuals who are found to have a serum elevation of this biomarker just to track

event rate. Despite its potential limitations, this retrospective analysis is the first step to forming hypotheses that can be confirmed with a future prospective study.

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# Figure Legends

Figure 1. Job group (civilians vs. law enforcement officers [LEOs]) by age and sex

Figure 2. Age by phospholipase A2 (PLa2) positivity

Figure 3. Cardiovascular risk factors

Figure 4. Liposomal-associated (Lp)-PLA2 positivity statistical significance by job group

Figure 5. PLa2 positivity by job group and sex

Figure 6. Low/intermediate Framingham risk vs. Lp-PLA2 positivity in LEOs

Figure 7. Low/intermediate Framingham risk vs. Lp-PLA2 positivity in civilians

Figure 8. Proportion test of low/intermediate Framingham risk: Lp-PLA2 positivity by job group

Figure 1: Age by Job Group and Gender

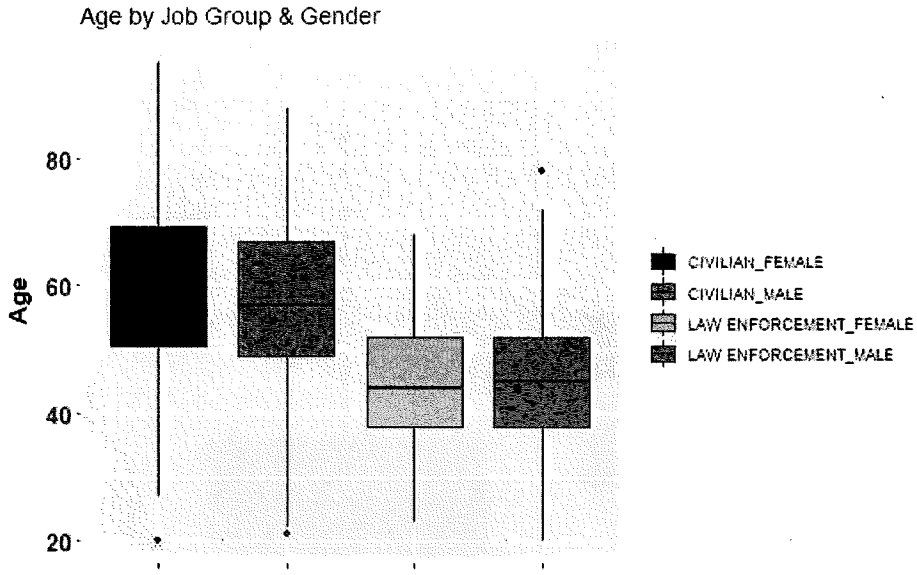


Figure 2: Lp-PLA2 Positivity by Age

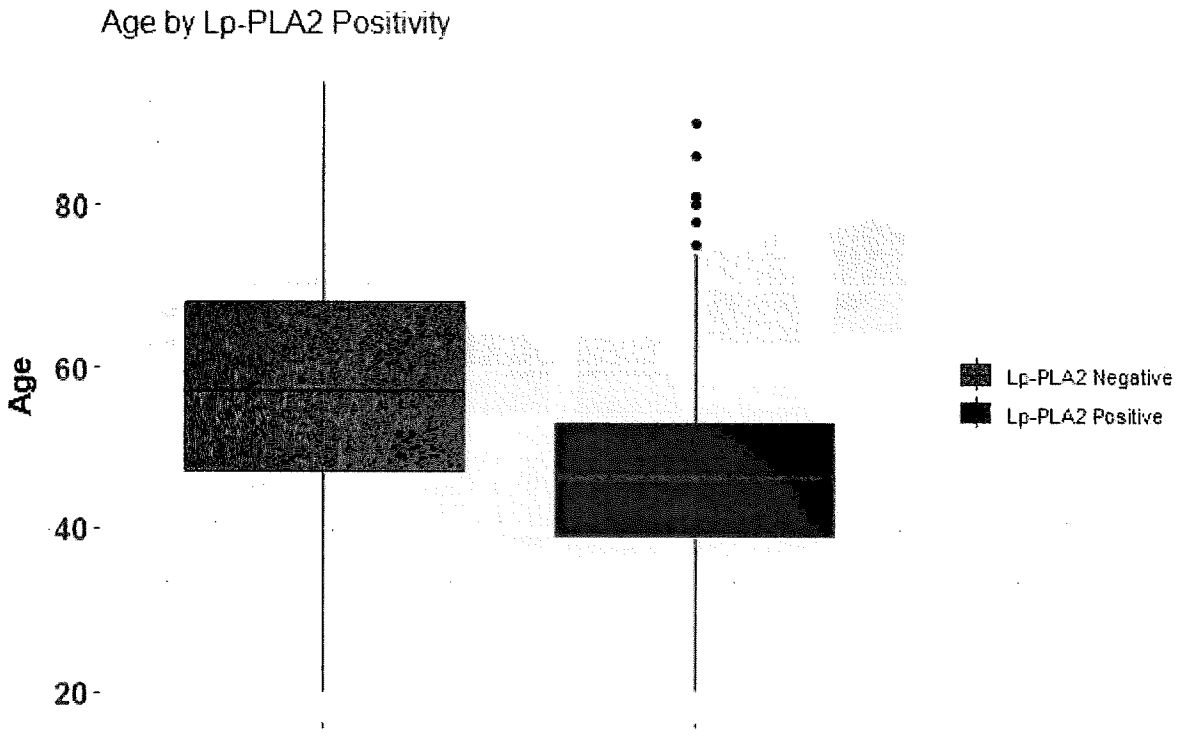


Figure 3: Demographics

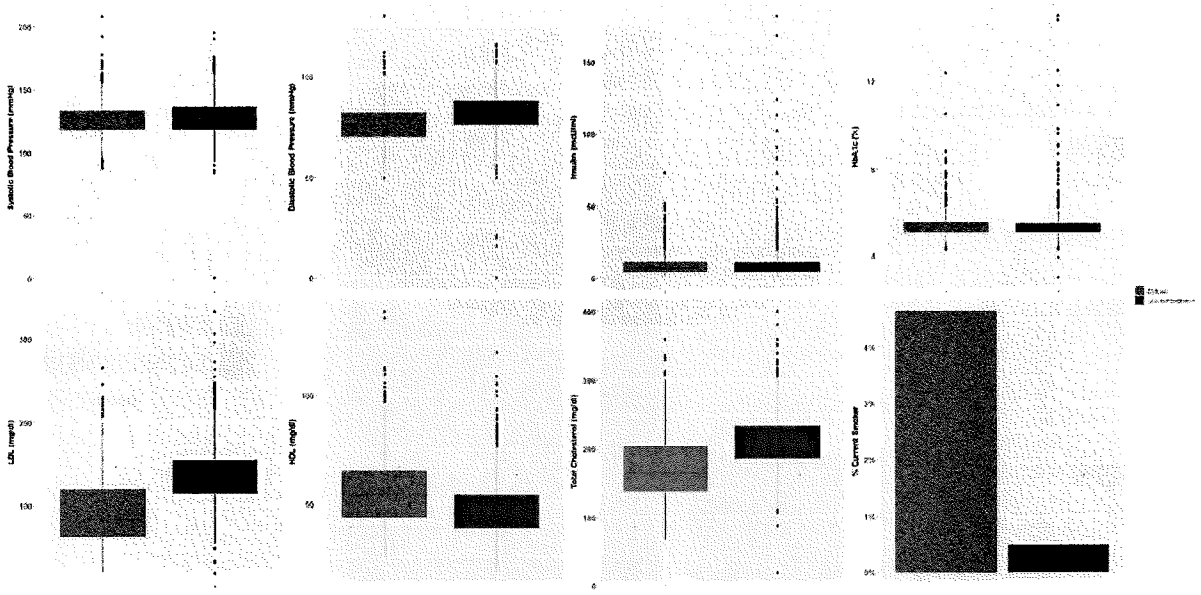


Figure 4: Lp-PLA2 Positivity by Job Group.

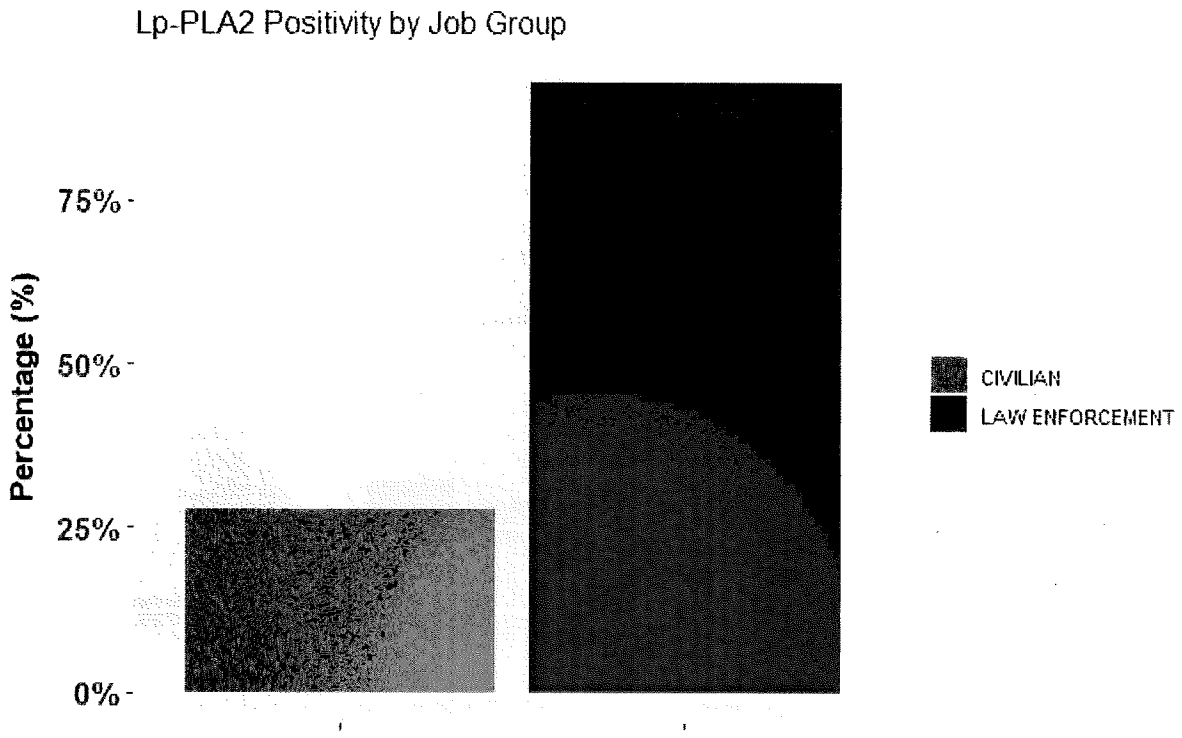


Figure 5: Lp-PLA2 Positivity by Job Group and Gender

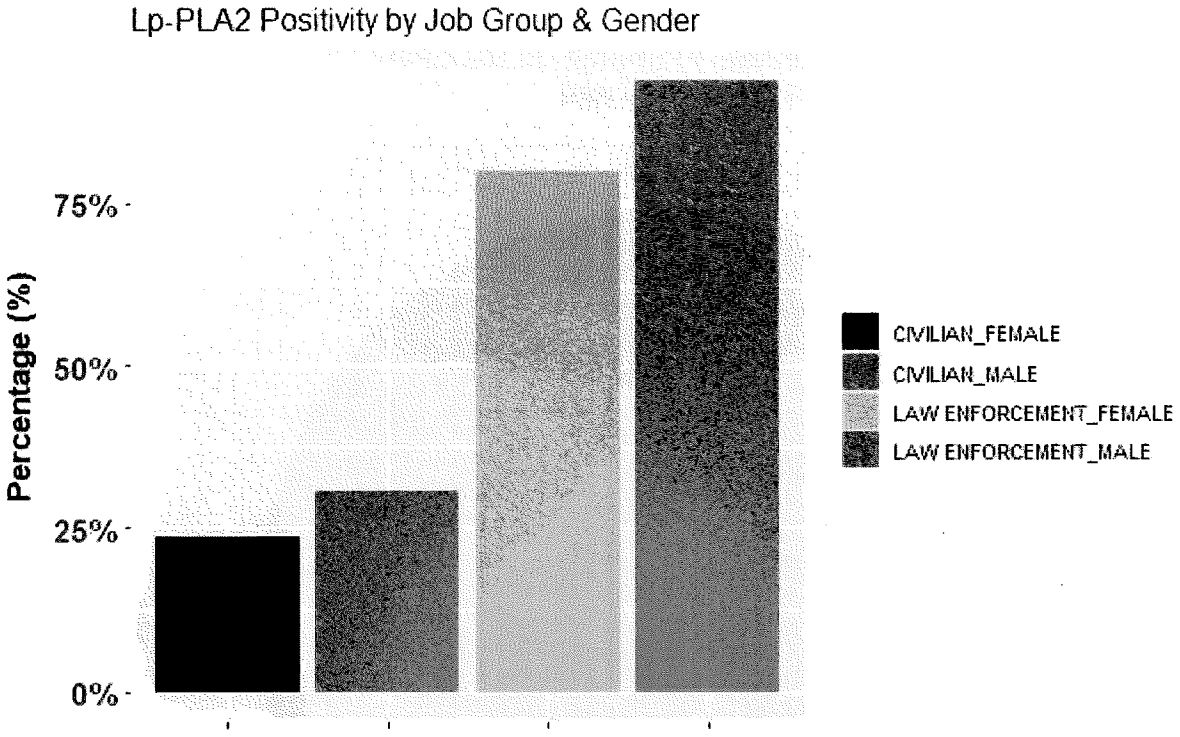


Figure 6: Percent of Low-to-Intermediate Framingham Risk Patients with Positive Lp-PLA2: Law Enforcement

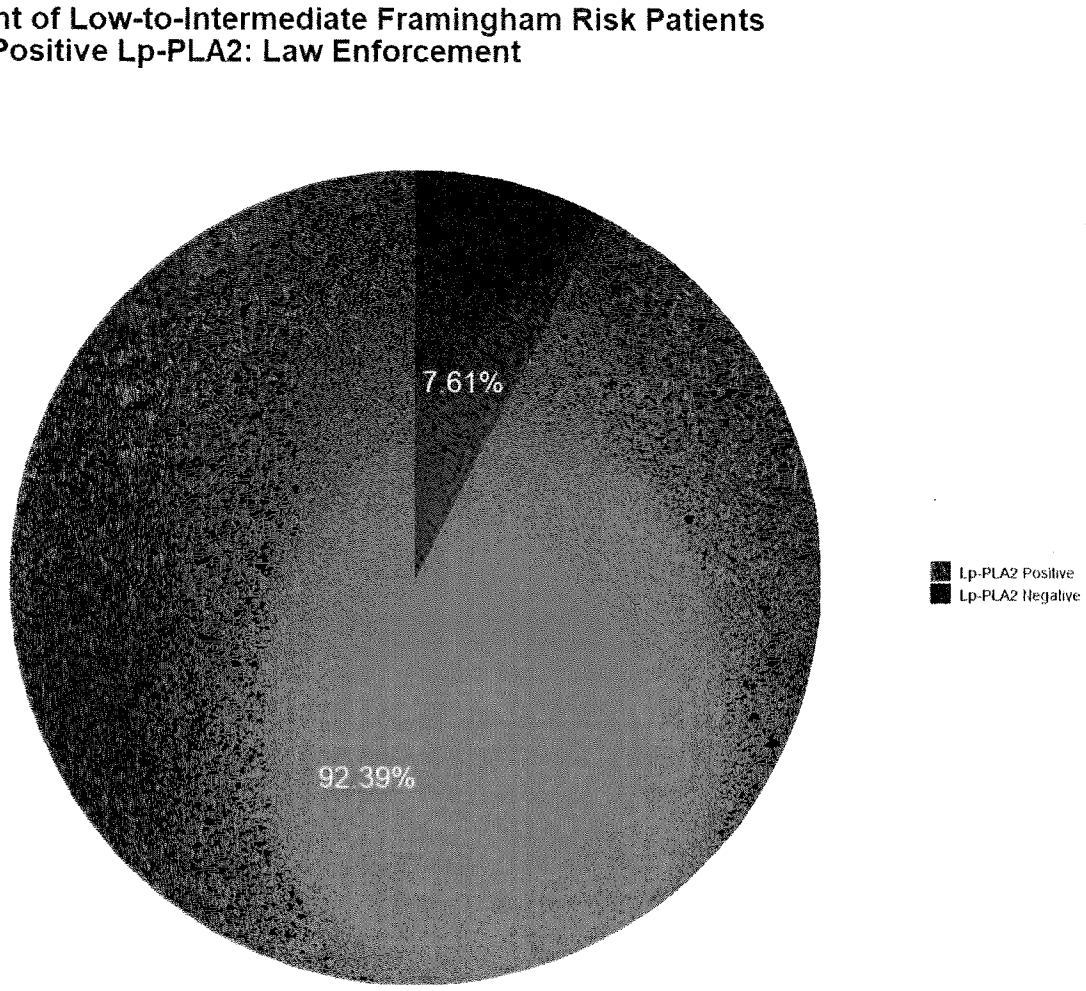


Figure 7: Percent of Low-to-Intermediate Framingham Risk Patients with Positive Lp-PLA2: Civilians

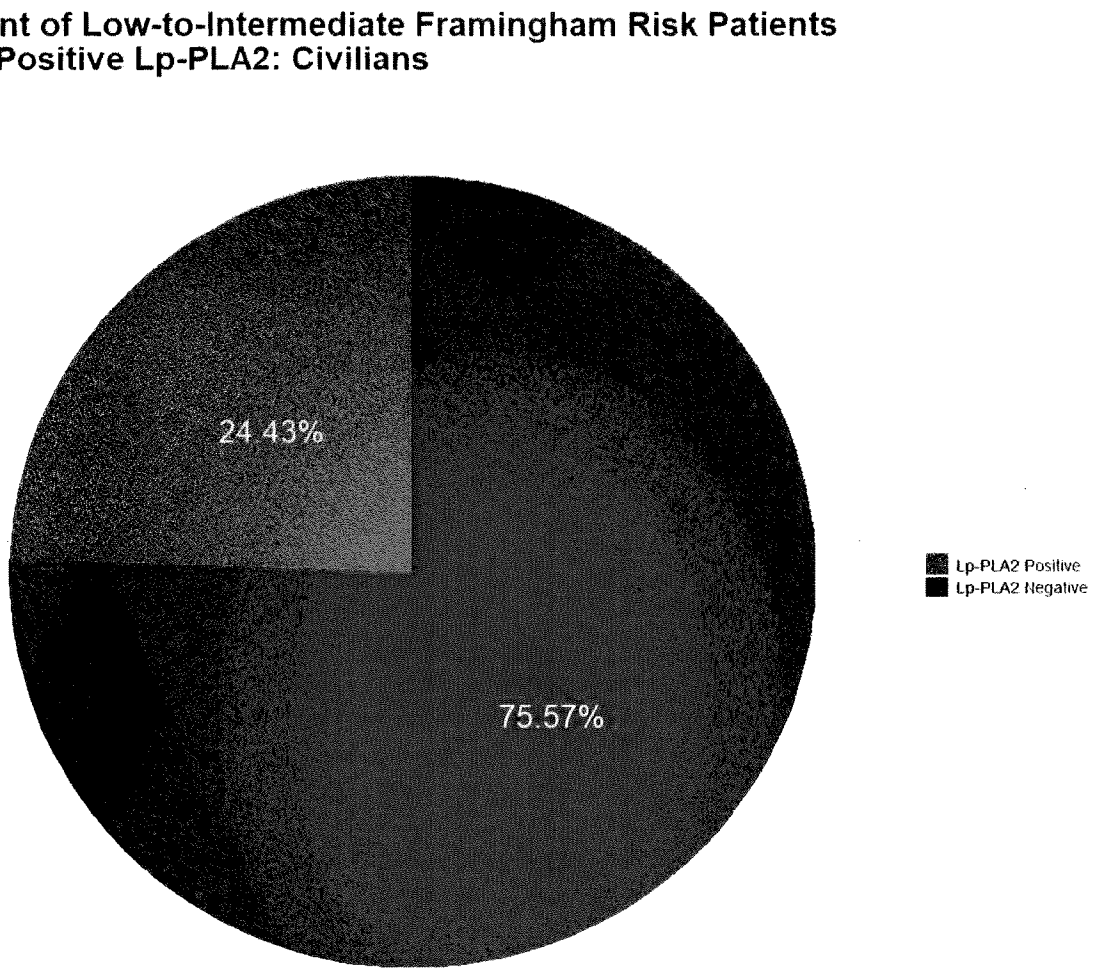


Figure 8: Percent of Low-to-intermediate Framingham Risk Patients with positive Lp-PLA2

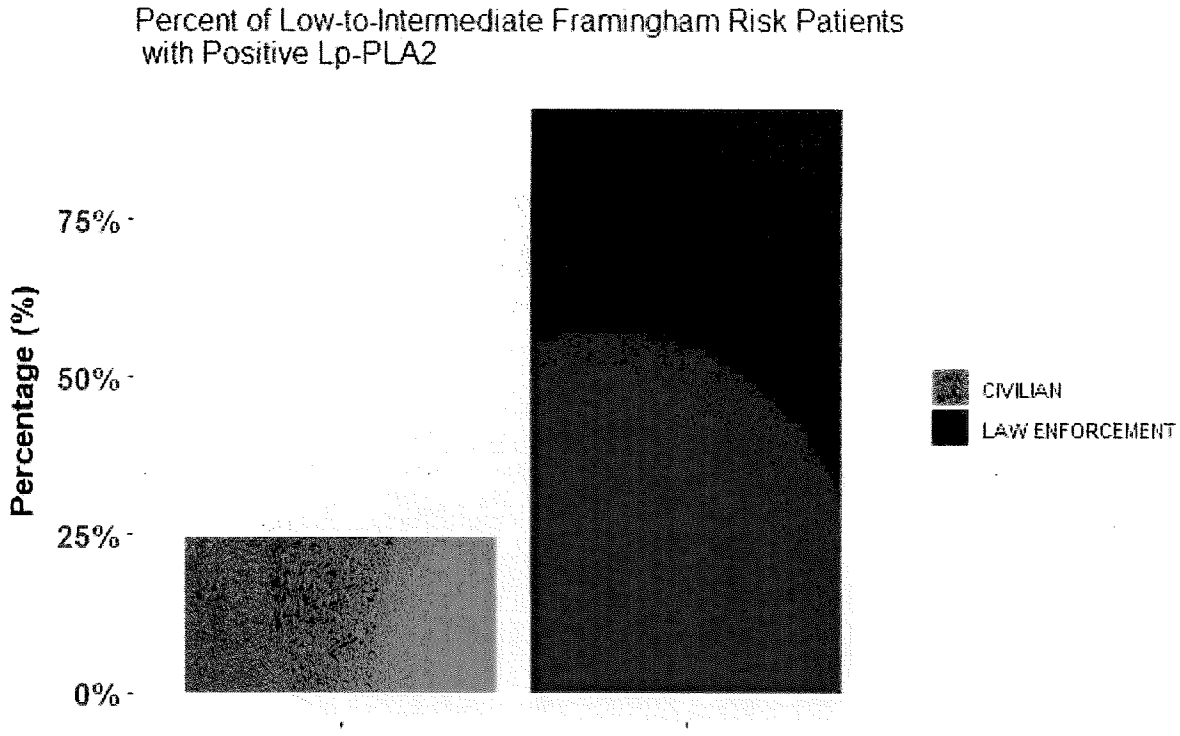


Figure 9: Positive CAC Score by Job

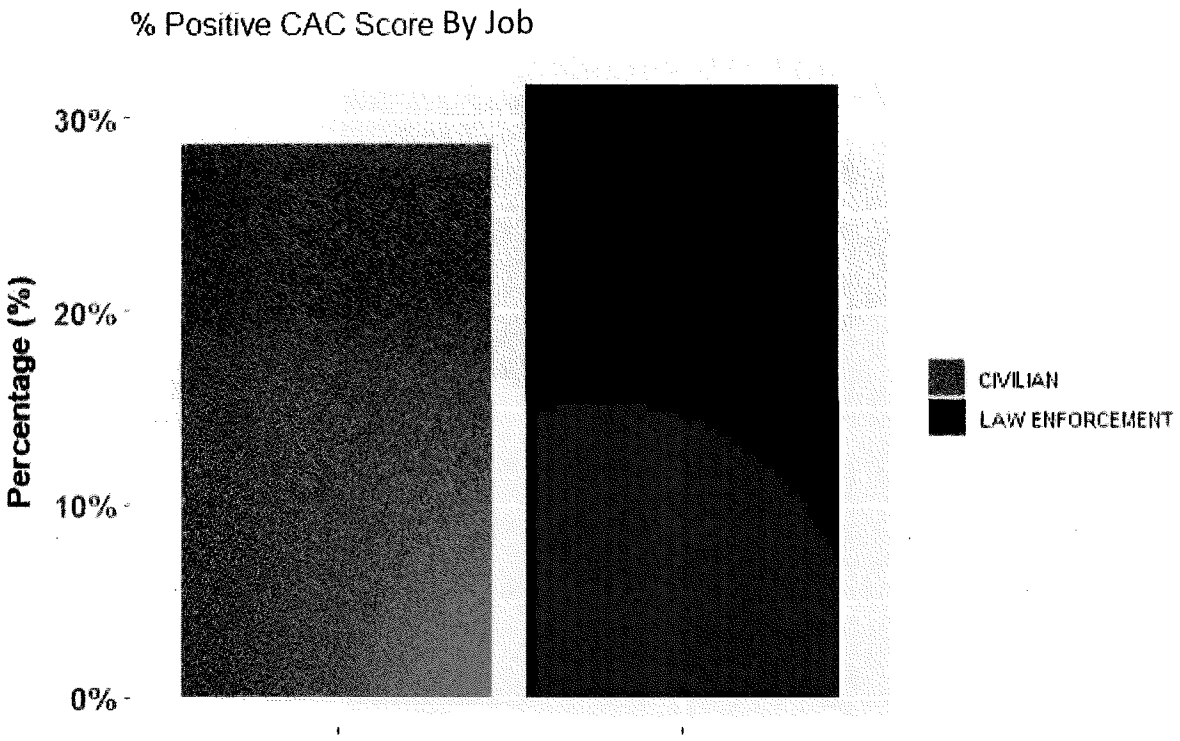


Figure 9: Positive CAC Score by Job

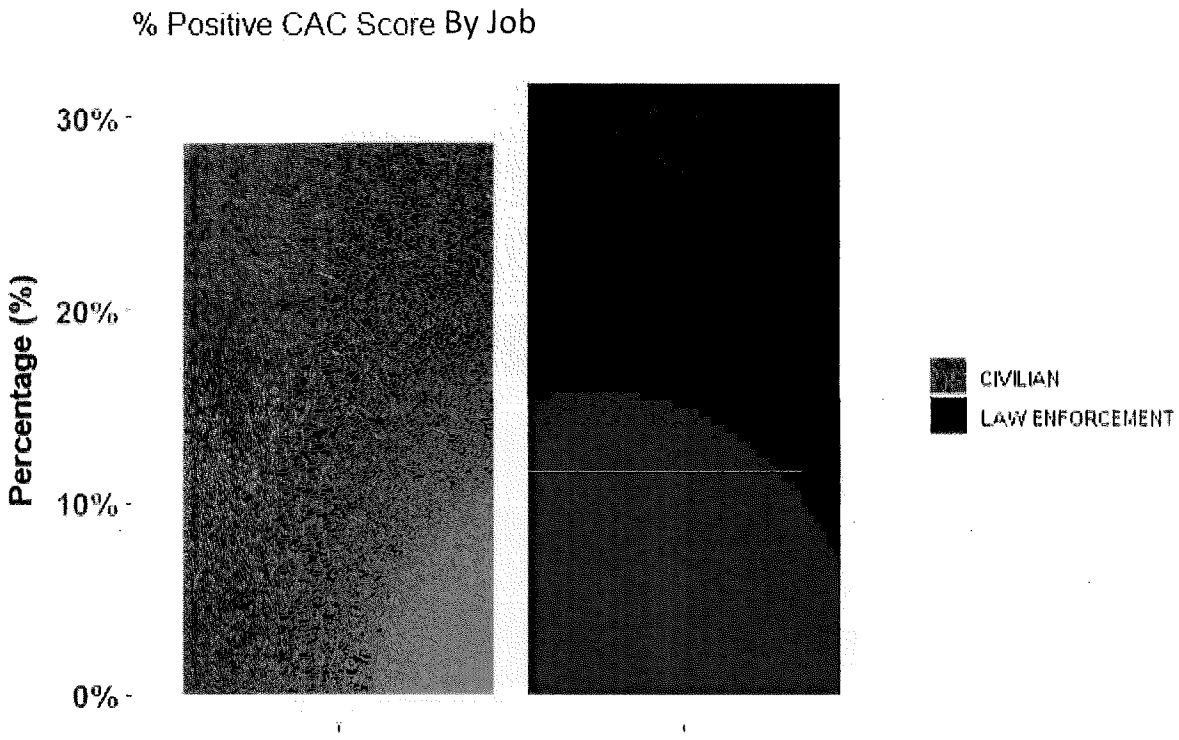


Table 1. Overall average biometric values for comparing law enforcement officers (LEOs) with civilians

| Average metric values comparing LEOs with civilians | | |
|---|---|---|
| **Metric** | **LEO** | **Civilian** |
| n | 2,222 | 970 |
| Age (year) | 45 | 58.36 |
| SBP (mmHg) | 127.02 | 126.03 |
| DBP (mmHg) | 81.96 | 77.27 |
| Insulin (mc U/mL) | 9.55 | 8.91 |
| HbA1c (%) | 5.40 | 5.39 |
| TC (mg/dL) | 210.75 | 171.73 |
| LDL (mg/dL) | 136.3 | 93.54 |
| HDL (mg/dL) | 47.56 | 56.16 |
| Current smoker (+/-) | 0.5% | 4.64% |
| Positive CCS (%) | 31.78% | 28.66% |
| Framingham (untreated SBP) (score) | 6.85 | 9.56 |
| Framingham (treated SBP ) (score) | 8.1 | 11.18 |
| Positive Lp-PLA2 (%) | 92.84% | 27.73% |
| Positive Lp-PLA2 (low-intermediate Framingham Risk Score) (%) | 92.39% | 24.43% |
| Positive Lp-PLA2 (low-intermediate Framingham Risk Score; treated SBP) (%) | 92.17% | 24.42% |

Table 2. Age statistical significance by Lp-PLA2 positivity

| | Age statistical significance by Lp-PLA2 positivity | | |
|---|---|---|---|
| **Populations compared** | **Mean age (yrs)** | **Standard Deviation** | **Statistical significance (expressed as the P-value)** |
| Lp-PLA2 negative | 57.2 | 14.31 | P<0.001 |
| Lp-PLA2 positive | 46.05 | 9.74 | |

Table 3. Univariate differences between Civilians and LEOs

| **Measure** | **Civilian** | **LEO** | **P-value** |
|---|---|---|---|
| SBP (mmHg, mean) | 126.03 | 127.02 | 0.08513 |
| DBP (mmHg, mean) | 77.27 | 81.96 | <0.001 |
| Insulin (mc U/mL, mean) | 8.91 | 9.55 | 0.05768 |
| HbA1c (%, mean) | 5.39 | 5.4 | 0.7058 |
| LDL (mg/dL, mean) | 93.54 | 136.3 | <0.001 |
| HDL (mg/dL, mean) | 56.16 | 47.56 | <0.001 |
| TC (mg/dL, mean) | 171.73 | 210.75 | <0.001 |
| Smoking | 4.64% | 0.495% | <0.001 |

Table 4. Logistic regression model to predict the probability of being Lp-PLa2 positive

| **Coefficient** | **Logit Estimate** | **Odds Ratio** | **P-value** |
|---|---|---|---|
| Intercept | -6.9493 | 0.0010 | <0.001 |
| | | 95% CI [0.0004, 0.0018 | |
| Job group law enforcement | 2.1919 | 8.9524 | <0.001 |
| | | 95% CI [6.7327, 11.9557] | |
| Male sex | 1.2810 | 3.6005 | <0.001 |
| | | 95% CI [2.5658, 5.0773] | |
| LDL (mg/dL) | 0.0463 | 1.0474 | <0.001 |
| | | 95% CI [1.0423, 1.0527] | |
| Current smoker | 0.2007 | 1.2222 | 0.637 |
| | | 95% CI [0.5229, 2.7705] | |

Table 5. Low/intermediate Framingham Risk Score: Lp-PLA2 positivity by job group

| Lp-PLA2 positivity, Civilian vs. Law enforcement | | |
|---|---|---|
| | **Yes** | **No** |
| Civilian | 269 (27.73%) | 701 (72.27%) |
| Law enforcement | 2,063 (92.84%) | 159 (7.16%) |
| P-value | <0.001 | |

Table 6. Lp-PLA2 positivity statistical significance by job group and sex

| Lp-PLA2 positivity, Civilian vs. Law enforcement | | |
|---|---|---|
| | **Yes** | **No** |
| Civilian female | 92 (23.5%) | 300 (76.5%) |
| Civilian male | 177 (30.6%) | 401 (69.4%) |
| Law enforcement female | 143 (79.9%) | 36 (20.1%) |
| Law enforcement male | 1,920 (94%) | 123 (6%) |
| P-value | <0.001 | |

Table 7. Low/intermediate Framingham Risk Score: Lp-PLA2 positivity by job group

| Lp-PLA2 positivity, Civilian vs. Law enforcement | | |
|---|---|---|
| | **Yes** | **No** |
| Civilian | 215 (24.4%) | 665 (75.6%) |
| Law enforcement | 1,397 (92.4%) | 115 (7.6%) |
| P-value | <0.001 | |

Table 8. CCS positivity by job group

| Lp-PLA2 positivity, Civilian vs. Law enforcement | | |
|---|---|---|
| | **Yes** | **No** |
| Civilian | 137 (28.66%) | 341 (71.34%) |
| Law enforcement | 881 (31.78%) | 1,891 (68.22%) |
| P-value | 0.192 | |

# Clinical Significance

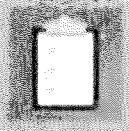
Cardiovascular disease is a leading cause of morbidity and mortality in law enforcement officers. Identifying early strategies to detect heart disease in the pre-clinical stages is imperative. The use of inflammatory biomarkers is better at detecting heart disease than that of the standard Framingham risk score or coronary artery calcium score.

Visual Abstracts

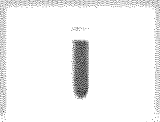
Click here to access/download;Visual Abstracts;Visual abstract 9.13.png

# Most Effective Method for the Detection of Heart Disease in Law Enforcement

Coronary artery disease is the largest causes of police officer morbidity and mortality



3330 patients were evaluated using Framingham Risk Score, coronary artery calcium scoring, and novel endothelial biomarker measurement



Coronary calcium scoring and Framingham Risk were NOT as effective as measuring Lp-PLA2 activity to predict Heart Disease in police officers

**Liposomal Associated Phospholipase A2 (Lp-PLa2) is More Effective in Predicting Cardiac Risk in Law Enforcement When Compared to Framingham Risk Score (FRS) Calculation and Coronary Artery Calcium (CAC) Scoring.** Jonathan Sheinberg, MD, FACC, Pranav Rajaram, BS, Joshua Callaway, MS

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