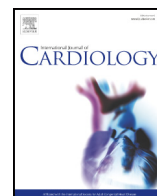




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An alarming trend: Change in the risk profile of patients with ST elevation myocardial infarction over the last two decades

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ABSTRACT

Background: Coronary artery disease (CAD) is the leading cause of mortality around the world. We sought to study changes in the risk profile of patients presenting with ST elevation myocardial infarction (STEMI).

Methods: We retrospectively studied all patients presenting with STEMI to our center between 1995 and 2014. Patients were divided into four quartiles, 5 years each. Baseline risk factors and comorbidities were recorded. Sub-analysis was done for patients with established CAD and their household incomes.

Results: A total of 3913 patients (67.9% males) were included; 42.5% presented with anterior STEMI and 57.5% inferior STEMI. Ages were 64 ± 12 , 62 ± 13 , 61 ± 13 and 60 ± 13 in the four quartiles respectively. Obesity prevalence was 31, 37, 38 and 40% and diabetes mellitus prevalence was 24, 25, 24 and 31%, while hypertension was 55, 67, 70 and 77%, respectively, $p < 0.01$ for all. Smoking prevalence was 28, 32, 42 and 46, $p < 0.01$. When subgroup analysis was done for patients with history of CAD, prevalence of smoking, obesity, diabetes and hypertension significantly increased across the four quartiles. When patients were divided to four groups based on household income (poor, low middle, middle and high income), prevalence of diabetes, hypertension, smoking and obesity were significantly higher in patients with low income.

Conclusion: Despite better understanding of cardiovascular risk factors and more focus on preventive cardiology, patients presenting with STEMI over the past 20 years are getting younger and more obese, with more prevalence of smoking, hypertension, and diabetes mellitus. This trend is greater in the lower income population.

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1. Introduction

Cardiovascular disease (CVD) remains the most common cause of mortality in the United States, with ST elevation myocardial infarction (STEMI) being the most dramatic acute presentation of the disease [1,2]. Over the past two decades, intensive nationwide efforts have been made to improve the quality of care that patients with STEMI receive in United States' hospitals, and to increase access to primary percutaneous coronary intervention within the recommended time window [3–5]. Moreover, innovations emerge every year in anti-thrombotic therapy, type and quality of stents used, and other tools in the interventional cardiology field [6–11].

Since publication of the Framingham study in the 1970's [12], clinicians' awareness about the importance of primary prevention of CVD increased, and it is now widely accepted that attacking common cardiovascular risk factors before development of clinical disease is the most

important factor in reducing morbidity and mortality from acute myocardial infarction [13]. In 2002, The American Heart Association published an important guideline statement highlighting the importance of primary prevention of CVD [13].

In this context, we sought to evaluate trends of traditional risk factor profiles in patients presenting with STEMI to our tertiary care center over the past two decades.

2. Methods

As a part of an observational study, we included all patients who presented to our institution from January 1995 to December 2014 with STEMI. STEMI was defined as presence of ≥ 1 mm ST segment elevation (≥ 2 mm in men and ≥ 1.5 mm in women for leads V2 and V3) in two or more contiguous anatomical leads, or new or presumed new left bundle branch block (LBBB). In addition to rise and fall in cardiac biomarkers and presence of ischemic symptoms.

Patients were divided into four quartiles, 5 years each: group 1 ranged from 1995 to 1999, group 2 from 2000 to 2004, group 3 from 2005 to 2009 and group 4 from 2010 to 2014. Baseline demographic characteristics were electronically recorded prospectively at the time of initial encounter. For the present study, all data were manually extracted from the electronic medical records. Risk factors before index STEMI included in our study were the following: age, gender, history of diabetes mellitus (DM), hypertension (HTN), tobacco use, hyperlipidemia (HLP), obesity (body mass index ≥ 30 kg/m²), and chronic renal impairment (CRI). Then, percentage of patients with ≥ 3 traditional risk

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Table 1
Baseline characteristics of the study population. CAD: Coronary artery disease, STEMI: ST-elevation myocardial infarction, CABG: Coronary artery bypass grafting.

Variable	1995–1999	2000–2004	2005–2009	2010–2014	P value
Number	725	953	1081	1153	NA
Age	63.6 ± 12.2	61.5 ± 13.2	60.6 ± 12.9	60.3 ± 12.7	<0.001
Sex (males)	69%	67.6%	66.9%	68.2%	0.8
Diabetes mellitus	24.6%	25.4%	23.9%	30.6%	0.002
Hypertension	56.7%	66.7%	69.7%	77.3%	<0.001
Current smoker	27.7%	31.6%	42.3%	45.4%	<0.001
Hyperlipidemia	18%	21.5%	20.4%	22.2%	0.4
Renal insufficiency	4.8%	5.4%	4.5%	6.3%	0.3
Obesity	31.6%	36.8%	37.9%	39.6%	0.007
Post infarction Ejection fraction	45 ± 13%	44 ± 11%	44 ± 12	48 ± 13	0.001
Type of STEMI					
Anterior	43.5%	42.9%	39.8%	44.4%	0.1
Inferior	56.5%	57.1%	60.2%	55.7%	
History of CAD	35.3%	38.1%	33.2%	30.1%	<0.001
Traditional risk factors ≥ 3	67.7%	74.9%	77.5%	85.3%	<0.001
Modifiable risk factors ≥ 2	43.6%	50.6%	56.6%	67.1%	<0.001
Modifiable risk factors = 0	17.7%	11.9%	9.1%	5.6%	<0.001

factors (male sex, age > 45 for male and >55 for female, DM, HTN, HLP and tobacco use) and percentage of patients with ≥2 modifiable risk factors (DM, HTN, HLP and tobacco use) were calculated. To study the interaction between socioeconomic status and risk profiles observed in the recent years, we used the American census data on household incomes by zip codes in 2010. Zip codes were divided into four groups based on median household income (High >\$100,000/year, middle: \$50,000–\$100,000/year, lower middle: \$30,000–\$50,000 and low: <\$30,000/year); and these groups were compared regarding risk factor prevalence. We excluded patients presenting with non-ST elevation myocardial infarction or unstable angina. All procedures and data collection were approved and monitored by the Cleveland Clinic Institutional Review Board (IRB).

2.1. Statistical analysis

Continuous variables were expressed as mean ± standard deviation (SD), or median and inter-quartiles for skewed distributions. Comparisons were made using the Student's *t*-test or ANOVA (for normally distributed variables) or the Wilcoxon test (for non-normally distributed variables). Categorical data were expressed as a percentage and compared using Fisher's exact or Chi-Square test. Logistic regression analyses were performed for binary variables, and regression analyses, for continuous variables, all *p*-values were two sided with cutoff of <0.05 for statistical significance. Statistical analysis was performed using JMP pro version 10.0.

3. Results

A total of 3913 patients were included in the study. Baseline patient characteristics of each group are shown in Table 1. Age showed

Table 2
Subgroup analysis for patients with history of documented obstructive coronary artery disease across the four quartiles.

Variable	1995–1999	2000–2004	2005–2009	2009–2014	p-Value
Number	255	363	359	348	<0.001
Age	64.1 ± 11.8	62.4 ± 12.6	62.1 ± 12.3	61.8 ± 12.3	0.11
Current smoker	24.6%	26.4%	40.4%	42.7%	<0.001
Obesity	29.8%	38.4%	39.0%	40.3%	0.0497
Diabetes	25.4%	28.4%	30.4%	41.5%	<0.001
Hypertension	60.9%	70.0%	77.4%	89.0%	<0.001

significant downtrend across the four groups. Prevalence of DM, HTN, obesity and tobacco use increased over time across the four groups. The proportion of patients with ≥3 traditional and patients with ≥2 modifiable cardiovascular risk factors increased significantly across time (Fig. 1). When subgroup analysis was done specifically for patients with history of coronary artery disease, the rising trend in the prevalence of smoking, obesity, diabetes mellitus, and hypertension remained significant (Table 2).

Analysis of distribution of different risk factors across the four levels of income is shown in Table 3. Age of presentation with STEMI was consistently younger with lower median income. Patients in the low-income group were more likely to have diabetes, hypertension, obesity, smoking, renal insufficiency, COPD and history of stroke). Further, patients from lower income groups were less likely to follow up compared to other groups.

4. Discussion

This study demonstrates a significant decrease in the age of patients presenting with acute STEMI to our institution over the past two decades, along with an increase in the prevalence of known traditional and modifiable cardiovascular risk factors. The prevalence of major risk factors such as diabetes, hypertension, obesity, and tobacco use increased over four quartiles of time, 5 years each. This persisted with subgroup analysis for patients with a history of documented obstructive CAD.

Populations with lower levels of cardiovascular risk factors have the lowest incidence and prevalence of CVD and stroke; additionally, the simple measures of maintaining healthy body weight, healthy diet, physical activity and tobacco avoidance can reduce risk of CVD by up to 84% [14–16]. With CVD being the most common cause of death worldwide, these facts emphasize the impact of primary prevention on public health.

In 2007, 33% of CVD-related deaths occurred in patients under 75 years, much younger than the average life expectancy of 78 years.

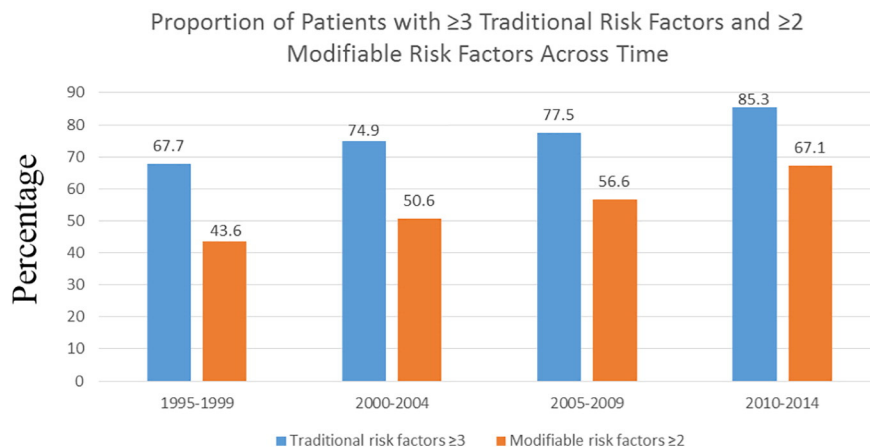


Fig. 1. Trend of proportion of patients with ≥3 traditional risk factors and patients with ≥2 modifiable risk factors across time.

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