International Journal of Preventive Medicine

Original Article Open Access

Socioeconomic Status and in-hospital Mortality of Acute Coronary Syndrome: Can Education and Occupation Serve as Preventive Measures?

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How to cite this article: Abbasi SH, De Leon AP, Kassaian SE, Karimi A, Sundin Ö, Jalali A, *et al*. Socioeconomic status and in-hospital mortality of acute coronary syndrome: Can education and occupation serve as preventive measures?. Int J Prev Med 2015;6:36.

ABSTRACT

Background: Socioeconomic status (SES) can greatly affect the clinical outcome of medical problems. We sought to assess the in-hospital mortality of patients with the acute coronary syndrome (ACS) according to their SES.

Methods: All patients admitted to Tehran Heart Center due to 1st-time ACS between March 2004 and August 2011 were assessed. The patients who were illiterate/lowly educated (≤5 years attained education) and were unemployed were considered low-SES patients and those who were employed and had high educational levels (>5 years attained education) were regarded as high-SES patients. Demographic, clinical, paraclinical, and in-hospital medical progress data were recorded. Death during the course of hospitalization was considered the end point, and the impact of SES on in-hospital mortality was evaluated.

Results: A total of 6246 hospitalized patients (3290 low SES and 2956 high SES) were included (mean age = 60.3 ± 12.1 years, male = 2772 [44.4%]). Among them, 79 (1.26%) patients died. Univariable analysis showed a significantly higher mortality rate in the low-SES group (1.9% vs. 0.6%; $P < 0.001$). After adjustment for possible cofounders, SES still showed a significant effect on the in-hospital mortality of the ACS patients in that the high-SES patients had a lower in-hospital mortality rate (odds ratio: 0.304, 95% confidence interval: 0.094–0.980; $P = 0.046$).

Conclusions: This study found that patients with low SES were at a higher risk of in-hospital mortality due to the ACS. Furthermore, the results suggest the need for increased availability of jobs as well as improved levels of education as preventive measures to curb the unfolding deaths owing to coronary artery syndrome.

Keywords: Coronary disease, education, mortality, occupation

Access this article online

Quick Response Code:

Website: www.ijpvmjournal.net/www.ijpm.ir

DOI: 10.4103/2008-7802.156266

INTRODUCTION

Death due to cardiovascular problems is still the leading cause of mortality not only in industrialized[1] but also in many low- and middle-income countries. Meanwhile, socioeconomic inequality in health, especially in the cardiovascular field, continues to pose a challenge to health care providers. Mortality due to ischemic heart disease (IHD) started to decline in the 1970's and 1980's. This reduction in the mortality rate, however, has been different between lower and upper socioeconomic groups.[2]

Several studies have shown that a lower socioeconomic status (SES) is consistently associated with cardiovascular risk factors and cardiac disorders.[3] Nevertheless, the results of studies on the relationship between SES and mortality following IHD-related hospitalization are not consistent: While some studies have reported important socioeconomic gradients,[4-8] others have found no or weak associations.[9-12] Furthermore, most of these data come from western countries, and there is a dearth of information on the relationship between SES and the outcome of the acute coronary syndrome (ACS) in-hospitalized patients in developing countries. There may also be differences in the effects of the indicators of SES in various regions with diverse populations and cultures, which warrants research into the impact of these indicators in middle-and low-income countries.

The most frequently used indicators in the assessment of SES are education, income, and occupation. In this study, we employed the indicators of "education" and "occupation" to investigate the effects of SES on the in-hospital mortality of patients hospitalized due to the ACS in a developing country.

METHODS

Design and subjects

The present study utilized a cross-sectional design based on data available in the Patient Registry of Teheran Heart Center. A large tertiary heart hospital affiliated to Tehran University of Medical Sciences, this center is a referral hospital, which admits patients from all over the country. All patients admitted to Tehran Heart Center due to 1st-time ACS between March 2004 and August 2011 were included in this study. All the demographic, clinical, paraclinical and in-hospital medical progress data of the patients were recorded during the course of their hospitalization by trained physicians. Death during the course of hospitalization was considered the end point, and the patients' SES was assessed to investigate possible associations with in-hospital mortality.

Measurement of variables

The dependent variable of this study was all-cause, in-hospital mortality, defined as "died" during the hospitalization of the patients, who were admitted due to 1st-time ACS. The main independent variable of this study was SES. The SES of the patients was classified based on their educational levels and their employment status. The individuals who were illiterate/lowly educated (≤5 years attained education) and were unemployed were considered low-SES patients and those who were employed and had high educational levels (>5 years attained education) were regarded as high-SES patients.

The other independent variables considered for this study included age, sex, risk factors, past medical history (including chronic obstructive pulmonary disease [COPD], renal failure, and heart failure), number of involved coronary vessels, in-hospital complications (including ventricular failure, and renal insufficiency), final diagnosis (including unstable angina, non-ST elevation myocardial infarction [NSTEMI], and ST-elevation myocardial infarction [STEMI]), and body mass index (BMI).

Clinical and paraclinical measures

The term "ACS" refers to a range of acute myocardial ischemic states. In this study, patients with the ACS were divided into three different groups. If the symptoms of cardiac ischemia were associated with ST elevation on the electrocardiogram (≥0.2 mV in leads V1, V2, and V3 and ≥ 0.1 mV in the other leads)[13] and there was a rise in cardiac enzymes (troponin or creatine kinase-myocardial band), the patients were assigned as having STEMI. The symptomatic patients who had a rise in cardiac enzyme without ST elevation were considered NSTEMI patients. Finally, if the patients had symptoms suggestive of myocardial ischemia without ST elevation and there was no subsequent rise in their cardiac enzymes, they were labeled as unstable angina patients.

The patients' data including sex, age, marital status, clinical presentations, risk factors, past medical history, Killip class, vital signs, laboratory results, and BMI, were collected. The effect of the place of residence, depending on the longest place of residence of the patients in the last 10 years in Tehran (the capital of Iran), large cities, small cities, or villages, was assessed by allocating the patients to four different groups accordingly. Treating physicians' recommendations for the hospitalized patients (including medical follow-up, coronary artery bypass grafting [CABG], and percutaneous coronary intervention [PCI]) were also recorded. Major in-hospital complications were recorded, and death during the course of hospitalization was considered as the final end point.

Data analysis

The data analysis consisted of descriptive statistics and regression analysis. The continuous variables are presented as mean ± standard deviation, and the categorical variables are expressed as frequencies.

To compare the continuous and categorical variables, including demographic, laboratory, and clinical data, between the SES groups and in-hospital mortality, the Student's *t*-test, and Chi-squared tests were used, respectively.

The initial analysis included a comparison of the demographic, laboratory, and clinical data for each SES group of the study population. The variability of in-hospital mortality with regard to SES was evaluated via a logistic regression model so as to adjust the relationship on the basis of the detected potential confounders in this study. The analyzes were done using SPSS statistical software version 18 (Chicago, IL, USA). A two-sided $P < 0.05$ was considered statistically significant.

RESULTS

Between March 2004 and August 2011, 10999 patients (mean age = 61.30 ± 12.25 years; 6690 [60.9%] male) with a history of 1st-time ACS were admitted to Tehran Heart Center. Among them, 3290 patients met our criteria for low SES, and 2956 patients fulfilled the high-SES criteria. Therefore, a total of 6246 patients (mean age = 60.3 ± 12.1 years, male = 2772 [44.4%]) were included in our study. A comparison of the demographic, paraclinical, and clinical data for each SES group of the study population is presented in Table 1. As Table 1 shows, the low-SES individuals were significantly older than the other group ($P < 0.001$) and were more prevalently female ($P < 0.001$). Concerning risk factors, while positive family history, cigarette smoking, waterpipe (qalyan) usage, and opium usage were significantly more prevalent in the high-SES patients, hypertension, hyperlipidemia, and diabetes mellitus were more significantly seen in the low-SES patients (all *P*s < 0.001).

In past medical history, only heart failure was more frequently seen in the low-SES patients ($P < 0.001$) but the rates of COPD and renal failure prevalence were not significantly different between the low- and high-SES groups ($P = 0.971$ and $P = 0.076$, respectively). The BMI of the low-SES patients was significantly higher ($P < 0.001$). The number of involved coronary vessels was unequally distributed between the two groups and while single-vessel and two-vessel coronary involvements were more frequent in the high-SES group, three-vessel disease was more prevalent in the low-SES group ($P < 0.001$).The distribution of the ACS types between the two SES groups was also not equal: Whereas STEMI and NSTEMI were more prevalently seen in the high-SES group, unstable angina was more frequent in the low-SES group ($P < 0.001$).

Based on the outcome of this study (in-hospital mortality), a univariable analysis was performed [Table 2].

Table 1: Patients characteristics (*n*=6246)*

	Low SES (*n*=3290)	High SES (*n*=2956)	*P* value
Age (year)	62.20±10.64	54.77±11.24	<0.001
Sex			<0.001
Female	3251 (98.8)	223 (7.5)	
Male	39 (1.2)	2733 (92.5)	
Risk factors			
PFH	584 (18.1)	871 (30.1)	<0.001
C/S	123 (3.7)	1208 (40.9)	<0.001
Waterpipe**	16 (0.5)	22 (0.7)	<0.001
Opium	38 (1.2)	379 (13.4)	<0.001
Hyperlipidemia	1893 (58.6)	2563 (39.1)	<0.001
DM	1322 (40.4)	622 (21.2)	<0.001
Hypertension	2343 (71.3)	1075 (36.4)	<0.001
Past medical history			
COPD	63 (1.9)	57 (1.9)	0.971
Heart failure	55 (1.9)	11 (0.4)	<0.001
Renal failure	111 (3.4)	77 (2.6)	0.076
BMI (kg/m^2)	28.71±5.21	26.71±4.04	<0.001
No of involved vessels			<0.001
0	113 (20.8)	59 (21.6)	
1	102 (18.8)	57 (20.9)	
2	115 (21.2)	66 (22.0)	
3	211 (38.9)	96 (35.2)	
ACS groups			<0.001
NSTEMI	738 (22.4)	725 (24.5)	
STEMI	499 (15.2)	893 (30.2)	
UA	2054 (62.4)	1338 (45.3)	

SES=Socioeconomic status, PFH=Positive family history, C/S=Cigarette smoking, DM=Diabetes mellitus, COPD=Chronic obstructive pulmonary disease, BMI=Body mass index, NSTEMI=Non-ST elevation myocardial infarction, STEMI=ST elevation myocardial infarction, UA=Unstable angina. *Data are presented as mean±SD or *n* (%). **Waterpipe (qalyan) is an instrument for vaporizing and smoking flavored tobacco

Total in-hospital mortality was 79 (1.26%), which was significantly higher in the low-SES group (1.9% vs. 0.6%; $P < 0.001$). As is depicted in Table 2, in-hospital mortality was significantly more frequent in the older patients ($P < 0.001$) and it had almost an equal gender distribution ($P = 0.060$). In the diabetics, mortality was significantly greater ($P < 0.001$) and in the patients with hyperlipidemia, cigarette smoking, and positive family history, lower mortality rates were detected ($P = 0.046$, $P < 0.001$, and $P < 0.001$, respectively). For the other risk factors, no significant differences were observed in the mortality rate. Patients with renal or heart failure and those who developed either ventricular fibrillation or renal insufficiency during their hospital admission showed a higher rate of mortality (all *P*s < 0.001). The number of involved coronary arteries yielded a positive relation with in-hospital mortality as a higher mortality rate was detected in the patients with three-vessel disease and lower rates were detected in those with no- or single-vessel disease ($P < 0.001$). Type of the final diagnosis had a

Table 2: Demographic, clinical, and paraclinical comparison between dead and alive patients (*n*=6246)*

	Alive patients (*n*=6167)	Dead patients (*n*=79)	*P* value
Age (year)	60.16±12.09	68.46±10.99	<0.001
Sex			0.060
Female	3410 (98.2)	64 (1.8)	
Male	2757 (99.5)	15 (0.5)	
SES			<0.001
Low	3229 (98.1)	62 (1.9)	
High	2939 (99.4)	17 (0.6)	
Risk factors			
Family history			<0.001
Positive	1446 (99.4)	9 (0.6)	
Negative	4584 (98.5)	69 (1.5)	
Cigarette smoking			<0.001
Smokers	1326 (99.6)	5 (0.4)	
Non-smokers	4842 (98.5)	74 (1.5)	
Waterpipe**			0.450
Smokers	37 (97.4)	1 (2.6)	
Non-smokers	6122 (98.7)	78 (1.3)	
Opium			0.504
Users	431 (99.1)	4 (0.9)	
Non-users	5737 (98.7)	75 (1.3)	
Hyperlipidemia			0.046
Hyperlipidemics	3133 (98.9)	348 (1.1)	
Non-hyperlipidemics	3024 (98.6)	44 (1.4)	
Diabetes mellitus			<0.001
Diabetics	1906 (98.0)	38 (2.0)	
Non-diabetics	4233 (99.1)	40 (0.9)	
Hypertension			0.283
Hypertensives	3370 (98.6)	48 (1.4)	
Normotensives	2790 (98.9)	31 (1.1)	
Previous medical history			
COPD			0.222
Positive	117 (97.5)	3 (2.5)	
Negative	6049 (98.8)	76 (1.2)	
Renal failure			<0.001
Positive	175 (93.1)	13 (6.9)	
Negative	5988 (98.9)	66 (1.1)	
Heart failure			<0.001
Positive	59 (89.4)	7 (10.6)	
Negative	5375 (98.7)	70 (1.3)	
No. of involved vessels			0.014
0	171 (99.4)	1 (0.6)	
1	158 (99.4)	1 (0.6)	
2	172 (98.3)	3 (1.7)	
3	292 (95.1)	15 (4.9)	
In-hospital complication			
VF			<0.001
Yes	22 (57.9)	16 (42.1)	
No	6145 (99.0)	63 (1.0)	
Renal insufficiency			<0.001
Yes	511 (95.3)	25 (4.7)	
No	5656 (99.1)	54 (0.9)	
Final diagnosis			<0.001
UA	3377 (99.6)	15 (0.4)	
NSTEMI	1443 (98.6)	20 (1.4)	
STEMI	1348 (96.8)	44 (3.2)	
BMI (kg/m^2)	27.73±4.80	26.64±5.00	0.044

Contd...

Table 2: Continued

SES=Socioeconomic status, COPD=Chronic obstructive pulmonary disease, VF=Ventricular fibrillation, UA=Unstable angina, NSTEMI=Non-ST elevation myocardial infarction, STEMI=ST elevation myocardial infarction, BMI=Body mass index. *Data are presented as mean±SD or *n* (%). ** Waterpipe (qalyan) is an instrument for vaporizing and smoking flavored tobacco

relation with mortality too in that the patients with STEMI had higher, and those with unstable angina had lower rates in this regard ($P < 0.001$). In-hospital mortality was lower in the patients with a higher BMI ($P = 0.044$).

In a risk-adjusted model, SES still showed a significant effect on the in-hospital mortality of the ACS patients [Table 3], and the high-SES patients had a lower in-hospital mortality rate (odds ratio [OR]: 0.304, 95% confidence interval [CI]: 0.094–0.980; $P = 0.046$).

DISCUSSION

The results of the current study showed a statistically significant association between SES and in-hospital mortality in that the low-SES patients were more likely to die from the ACS than their high-SES counterparts. Whereas in western countries socioeconomic deprivation has shown a correlation with disease-specific mortality, in developing countries this association is not well documented.[6,14] Furthermore, even in different western settings, this association has not been consistent.[15] However, the association between SES and in-hospital mortality has been found elsewhere. For instance, Welch *et al.*,[16] who assessed 84,423 patients of a critical care unit in England, found an association between increased socioeconomic deprivation and increased risk of hospital mortality (OR: 1.19, 95% CI: 1.10–1.28). Furthermore, Hutchings *et al.*[17] studied 51,572 patients admitted to intensive care units and found that, compared to the most socioeconomically deprived patients, the OR for hospital mortality in the least deprived patients was 0.70 (95% CI: 0.58–0.84). Lower-SES groups may also suffer from receiving lower quality treatment. A study by Shen *et al.*[18] on 95,971 patients with acute MI in the United States found that disadvantaged patients might even receive fewer specialized procedures probably due to higher levels of severity and financial barriers. However, other studies have found contrary results reporting

Table 3: Adjusted effect of socioeconomic status on in-hospital mortality

	Wald statistic	*P* value	OR	95% CI	
				Lower	Upper
SES	3.972	0.046	0.304	0.094	0.980
Family history	0.166	0.683	1.261	0.413	3.4847
Diabetes mellitus	1.998	0.157	1.942	0.774	4.871
Hyperlipidemia	0.089	0.765	0.871	0.353	2.152
Final diagnosis					
NSTEMI	3.868	0.145	1.000	0.395	3.389
STEMI	0.071	0.790	1.157	0.148	1.164
UA	2.795	0.095	0.414		
Renal insufficiency	6.839	0.009	3.636	1.382	9.566
Ventricular fibrillation	38.498	<0.001	59.944	16.485	218.426
Age	1.665	0.197	1.028	0.986	1.072
Heart failure	7.730	0.005	7.523	1.816	31.206
BMI	1.903	0.168	1.055	0.978	1.139

SES=Socioeconomic status, NSTEMI=Non-ST elevation myocardial infarction, STEMI=ST elevation myocardial infarction, UA=Unstable angina, BMI=Body mass index

an absence of association between SES and hospital mortality. Ciccone *et al*.[19] studied 49,949 patients admitted to a general hospital in Turin, Italy. After adjustment for possible confounders, the authors found that social class had no association with in-hospital mortality. Furthermore, a study in Canada by Pilote *et al*.,[20] who investigated 145,882 patients admitted to acute care hospitals, found no significant association between SES and short-or long-term mortality. Another study by Zarzaur *et al*.,[21] on 17,658 adults admitted to a trauma center in Shebly County, TN, USA, assessed the relation between neighborhood SES and in-hospital mortality and showed that there was no relation in this regard. Interestingly, Kim *et al*.,[22] in their study on 18,961 CABG patients in California, USA, showed that while in the high-volume hospitals (with a minimum of 490 CABG procedures per year), the low-SES patients had a greater in-hospital mortality rate than the high-SES patients, this relation was not present in the low-volume hospitals (with fewer than 240 CABG procedures per year). A similar social gradient has been found in some Asian countries, with more strong SES effects in South-East Asia as compared to East Asia.[14] Maybe the level of economic disparity in a given population is an important factor in the magnitude of the impact of SES on health, as the South-East Asians have higher inequality in income than East Asians.

The current data concur with most previous reports showing higher prevalence of conventional risk factors among lower-SES patients. In all probability, people with lower income and unemployed individuals tend to eat less healthy food and lower educated people possess less knowledge about what exactly constitutes a healthy lifestyle and diet. Therefore, either due to lesser health knowledge or owing to financial constraints, it is not surprising to find higher prevalence of risk factors among low-SES people. Interestingly, these results in our and most global studies are in disagreement with the earlier findings of Sethi *et al*.,[23] who reported higher prevalence of risk factors among their high-SES Indian patients. It seems that Indian people are somewhat different in this regard as those in low-SES tend to have lower risk factor prevalence. However, most commonly, individuals with a lower SES are highly likely to have more risk factors and after developing disease, they are less likely to have access to appropriate treatment measures. Reducing these inequalities through meticulously planned measures has become a health priority for many countries.

In our study, to define the SES of the patients, we employed "education" and "occupation" indicators. SES is most often measured based on three different indicators, namely education, occupation, and income. Some researchers use these indicators interchangeably believing that they measure the same underlying phenomenon. Some others use a different combination of these indicators to classify the SES of individuals. Nonetheless, it seems that, albeit correlated, education, occupation, and income measure different phenomena and cannot be used interchangeably.[24] Therefore, a combination of these indicators may confer a better insight into the SES of individuals.

Strengths and limitations

To the best of our knowledge, this is the first large-scale registry data to assess the association between two SES indicators and the in-hospital mortality of 1st-time ACS patients in the Middle East. While most of the evidence for socioeconomic inequalities in health comes from western countries, the results of this study may not necessarily be generalizable to other contexts. Different countries may have specific contextual and cultural factors at play, which can influence lifestyle. The other strength of this study is that all the data were recorded by trained physicians and the validity of the data were checked by re-abstracting 10% of the entered data and by randomly re-entering 5% of the recorded data.

Nevertheless, the study has some limitations. First, we were unable to measure one of the indicators of SES. In this study, we assessed the occupation and education of our patients because income is a sensitive issue in the Iranian context. Second, we were unable to use detailed job descriptions but instead used employment status (employed vs. unemployed).

CONCLUSIONS

The current study, which is the first large-scale study of its kind in the region, found a social gradient in the in-hospital mortality among 1st-time patients admitted due to the ACS: The patients with a low SES were more likely to die in-hospital due to the ACS as compared to their high-SES counterparts. In addition, our results may have important implications as regards both prevention and clinical practice. In the prevention of the in-hospital mortality of the ACS, increasing the level of education and providing jobs for jobless individuals can play important roles. Concerning medical practice, when treating patients hospitalized due to the ACS, it is advisable that SES be deemed a prognostic indicator and that treating physicians exercise due caution as their socioeconomically deprived patients may need more meticulous medical care.

Received: 12 Jan 15 **Accepted:** 01 Feb 15
Published: 04 May 15

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Source of Support: Nil, **Conflict of Interest:** None declared.