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Socioeconomic status, cardiac risk factors, and cardiovascular disease: A novel approach to determination of this association

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Original Article

Abstract

BACKGROUND: Socioeconomic inequality is one of the important issues in cardiovascular diseases (CVDs). The aim of this study was to investigate the distribution and relation between selected cardiac risk factors, type of CVD, and the socioeconomic status (SES) in the hospitalized patients with heart disease in Isfahan, Iran.

METHODS: This analytical and cross-sectional study was conducted in Isfahan in 2013. The population consisted of all patients with CVD admitted to the public and private hospitals. The sample size was 721. Data collection was conducted through one researcher-made questionnaire with three sections: demographic, disease, and SES questionnaires. To determine the SES of the patients, the indicators of income, housing status, occupation, family size, and education were used. Data analysis was conducted in two statistical levels of descriptive and inferential.

RESULTS: 69.1% of the patients were placed in the poor status, and there was no wealthy status within the subjects. The five most frequent CVDs were chronic ischemia, unstable angina, arrhythmia, congestive heart failure (CHF), and acute myocardial infarction (MI), respectively. The three highest frequent risk factors in the patients were hypertension (HTN) (47.2%), diabetes (33.6%), and hyperlipidemia (32.6%). Regression analysis of the risk factors and the type of heart disease on the SES revealed that there were statistically significant differences between patients who were smokers (P = 0.030) and those who had valve disease (P = 0.010), adjusted for age, gender, and marital status.

CONCLUSION: Our findings showed that the frequency of CVD risk factors were higher in lower SES groups and thus SES can be a strong predictor for the occurrence of the CVD risk factors as well as the CVDs.

Keywords: Risk Factors, Cardiovascular Diseases, Socioeconomic Factors

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Introduction

Cardiovascular diseases (CVDs) are the leading causes of death worldwide. They cause 17.5 million deaths in the world annually,[1] which accounts for 10% of the total deaths.[2] Out of these, 80% occur in middle or low-income countries.[1] The important point is that while the trend of CVD in developed countries is downward, it is upward in low and middle-income countries, so that about 85 percent of heart deaths occur in poor countries.[2]

Although it is well-recognized that CVD is a major and growing problem, less attention has been paid to the fact that this disease is the main cause of the widespread inequities in health status between the rich and the poor.[1,3] Evidence relating to the socioeconomic determinants of CVD, particularly in developing countries, indicates an inverse relationship between socioeconomic status (SES) and the occurrence of deaths by CVD. Although cardiovascular risk factors and diseases arose in higher SES groups first, but gradually the risk

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factors of the disease has spread to the lower SES groups over the last 50 years.[4-6]

Many studies have shown that cardiac patients with better SES receive treatments in more specialized hospitals with better-prescribed medicines in comparison to the lower SES groups.[7-9] Access to rehabilitation cares is also lower for the people with lower SES.[10]

In addition, socioeconomic factors, such as employment and income, also affect the death rate through the impact on risk factors related to the lifestyle before and after the heart attack.[11] After the heart attack, lower SES groups would face more serious health consequences in long run.[2] Socioeconomic inequities have been recorded in almost all western countries in the prevalence and occurrence of deaths from CVD.[12] Socioeconomic inequity is one of the major challenges in the CVD.[13] The aim of this study was to investigate the distribution and relationship between selected cardiac risk factors, type of CVD, and the SES of the hospitalized patients with heart disease. This study is one of the first studies which used cumulative indicators, calculated individual score for determining SES of the patients, and evaluated the relationship between SES and CVD risk factors.

Materials and Methods

This analytical and cross-sectional study was conducted in Isfahan, Iran, in 2013. The population consisted of all patients with CVD admitted to the public (8 hospitals) and private hospitals (3 hospitals) in Isfahan in all relevant wards, including cardiology, cardiac care unit (CCU), and post CCU. Cluster random sampling was done. The sample size was determined as 721 patients, taking into account the confidence level (CI) of 95%, the power of 80%, and the design effect of 1.8. The number of samples per hospital was determined through the sharing ratio, that is the number of patients with CVD who were admitted in previous year at each hospital was considered as a criterion for selecting the number of patients for the study.

Data collection was conducted through a researcher-made questionnaire. The questionnaires were completed in the first six months of 2013. As the questions were objective, preliminary studies were not needed to confirm the reliability. To determine the face and content validity, the questionnaire was given to 30 experts and cardiologists and after receiving their comments, the necessary amendments were made. The questions were divided into three sections: demographic, disease, and SES. The questions in demographic part included age, sex, and marital status. The disease part included the questions on the type of heart disease and associated risk factors. The patient's medical records were also reviewed to confirm the type of heart disease. These heart diseases included chronic ischemia, unstable angina, arrhythmia, congestive heart failure (CHF), acute myocardial infarction (MI), valve disease, and congenital heart defects (CHDs). Cardiac risk factors contained hypertension (HTN), diabetes, hyperlipidemia, family history of CVD, and smoking. The patients or their families completed the questionnaires.

To determine the SES of the patients, the indicators of income, housing status, occupation, family size, and education were assessed. Finally, 5 SES groups were considered. The first group was in the lowest level and the fifth one was in the highest level. These groups included extremely poor, poor, moderate, good, and wealthy. The method of SES determination and cut points of groups is described in more details elsewhere in the methodology article of authors.[14,15] A tripartite classification for occupations was used. Individuals in high rank included large and moderate landowners, top-level managers, and professionals. People in average rank were lower managers, semiprofessionals, vendors, and artisans. Low-wage industrial workers, officers, retail sellers, services workers, unemployed, and pensioners were placed in low SES group. The detailed method of calculation was described in Davari et al. paper.[14] Income classification was based on Isfahan poverty line (PL). The PL means the level of consumption (or income) required for a household to reach basic needs. The Isfahan PL for 2013 was received from experts of bank system and was applied to calculate the level of patient's income.

Data analysis was conducted in two statistical levels of descriptive and inferential, using SPSS software (version 16, SPSS Inc., Chicago, IL, USA). Categorical and continuous data were reported as frequency (percent) and mean ± standard deviation (SD), respectively. The inferential statistics level was done using chi-square test, analysis of variance (ANOVA), and multiple logistic regression model. P-value less than 0.05 was considered as a significant level. Bonferroni correction was used to adjust P-value. In this correction method, P-value was dependent on the numbers of all risk factors and CVDs. In multiple logistic regression model, the coefficient regression of SES on outcome (each risk factor or CVDs) was estimated with controlling for all other variables in the model to consider

confounding effect, for example, odds ratio (OR) of SES on HTN, controlling for other risk factors. All the variables except age were nominal in this study. SES was determined based on calculation of different scores of its variables and overall score was included as a continuous quantitative variable in the multiple logistic regression model. Final individual scores for SES were calculated from the sum of the detailed individual scores. As a result, the lowest possible score was 100 (when all detailed parameters were considered at their minimum scores) and the highest possible score was 720 (when all ones were at their highest value). These scores were categorized into 5 groups, from the lowest to the highest one, for finding the SES of individuals. These groups consisted of extremely poor (scores 100 to 224), poor (scores 225 to 348), moderate (scores 349 to 472), good (scores 473 to 596), and wealthy (scores 597 to 720). In addition, ordinal classification was defined for labeling patients in different groups of SES.

Results

The frequency distribution of the SES characteristic of hospitalized patients with CVD is presented in table 1. The ranking of the patients based on their education factors showed that most of them (81.3%) were in high school level. Likewise, the majority of them were in medium occupational level (73.9%), 5 or more in family size (33.4%), home owner (84.5%), and equal or less than PL in the income level (53.5%). The results of SES classification showed that status II (poor) had the highest frequency (69.1%) and there was no wealthy status within the subjects at all (Table 1).

Results showed that 54.8% of the samples were men. In terms of marital status, the highest frequency (82.1%) was for the married, divorced/widowed were 15.1%, and singles 2.8%. Among the samples, the five most frequent CVDs were chronic ischemia (33.2%), unstable angina (22.4%), arrhythmia (9.3%), CHF (8.6%), and acute MI (7.0%), respectively.

The data also showed that the most frequent risk factors in the patients were HTN (47.2%), diabetes (33.6%), hyperlipidemia (32.6%), family history of CVD (23.9%), and smoking (23%), correspondingly. Among the extremely poor, poor, and moderate SES groups, ischemia, and among good SES group, unstable angina were the most frequent diseases. HTN was the most common risk factor in extremely poor and poor SES groups. Likewise, family history of CVD in moderate SES group, and smoking and hyperlipidemia in good SES group were the most common risk factors, respectively.

Table 1. Frequency distribution of the socioeconomic characteristics of hospitalized patients with cardiovascular disease (CVD)

Socioeconomic characteristics		n (%) (n = 721)
Education	High school and lower	586 (81.3)
	Bachelor	129 (27.9)
	MSc and higher	6 (0.8)
Occupational level	Low	12 (1.7)
	Medium	533 (73.9)
	High	176 (24.4)
Family size	≤ 2	186 (25.8)
	3	180 (25.0)
	4	114 (15.8)
	≥ 5	241 (33.4)
Housing	Renting	112 (15.5)
	Property	609 (84.5)
Income level	≤ 1/2 PL	386 (53.5)
	½ PL	278 (38.6)
	PL	35 (4.9)
	2PL	11 (1.5)
	3PL	9 (1.2)
	4PL	2 (3.2)
SES	I (extremely poor)	43 (6.0)
	II (poor)	498 (69.1)
	III (moderate)	165 (22.9)
	IV (good)	15 (2.1)
	V (wealthy)	0 (0)

MSc: Master of Science; PL: Poverty line; SES: Socioeconomic status

There were statistically significant differences by age ($P < 0.001$), gender ($P = 0.006$), and marital status ($P = 0.040$) between different SES groups. Older individuals were placed mainly in the extremely poor and poor groups. In addition, a higher percentage of men were placed in higher SES groups comparing to women. Based on the age of participants, post-hoc test on SES showed that the extremely poor group was statistically significant comparing to good ($P = 0.039$) and moderate groups ($P = 0.017$); this means that the average age of the patients was higher in lower SES groups. HTN ($P = 0.005$) and hyperlipidemia ($P < 0.001$), among risk factors, were statistically significant in SES groups (Table 2). Besides, 10.3% of the patients had two or more diseases simultaneously.

Table 3 showed that smoking patients ($P = 0.030$) and patients with valve disease ($P = 0.010$) had statistically significant relationship with the SES groups, adjusted for age, gender, and marital status.

Table 2. Frequency and univariate analysis of demographic characteristics, risk factors, and cardiovascular disease (CVD) on socioeconomic status (SES) in hospitalized patients with CVD

Variable		Total [n (%)]	SES				P*
			Extremely poor [n (%)] 43 (6.0)	Poor [n (%)] 498 (69.1)	Moderate [n (%)] 165 (22.9)	Good [n (%)] 15 (2.0)	
Age (mean ± SD)		57.4 ± 12.5	61.2 ± 13.3	62.9 ± 12.8	54.6 ± 13.6	50.8 ± 12.1	< 0.001
Gender	Male	395 (54.8)	19 (44.2)	258 (51.8)	109 (66.1)	9 (60.0)	0.006
	Female	326 (45.2)	24 (55.8)	240 (48.2)	56 (33.9)	6 (40.0)	
Marital status	Married	592 (82.1)	33 (76.7)	399 (80.1)	147 (89.1)	13 (86.7)	0.040
	Single/ divorced/ widow	129 (17.9)	10 (23.3)	99 (19.9)	18 (10.9)	2 (13.3)	
Risk factors							
HTN		340 (47.2)	16 (37.2)	258 (51.8)	60 (36.4)	6 (40.0)	0.005
Diabetes		242 (33.6)	10 (23.3)	181 (36.3)	46 (27.9)	3 (33.3)	0.100
Hyperlipidemia		235 (32.6)	7 (16.3)	181 (36.3)	40 (24.2)	7 (46.7)	< 0.001
Family history of CVD		172 (23.9)	9 (20.9)	113 (22.7)	47 (28.5)	3 (20.0)	0.450
Smoking		166 (23.0)	9 (20.9)	121 (24.3)	32 (19.4)	4 (26.7)	0.590
CVDs							
Chronic ischemia		236 (33.2)	15 (34.9)	162 (33.1)	56 (34.4)	3 (20.0)	0.720
Unstable angina		159 (22.4)	9 (20.9)	113 (23.1)	32 (19.6)	5 (33.3)	0.580
Arrhythmia		66 (9.3)	3 (7.0)	47 (9.6)	14 (8.6)	2 (13.3)	0.870
CHF		61 (8.6)	3 (7.0)	43 (8.8)	15 (9.2)	0 (0)	0.640
Acute MI		50 (7.0)	1 (2.3)	32 (6.5)	14 (8.6)	3 (20.0)	0.100
Valve disease		19 (2.7)	3(7.0)	14 (2.9)	2 (1.2)	0 (0)	0.360
CHD		9 (1.3)	0 (0)	6 (1.2)	3 (1.8)	0 (0)	-

* Analysis of variance (ANOVA) test was used for age and chi-square test was used for other parameters

SES: Socioeconomic status; SD: Standard deviation; HTN: Hypertension; CVD: Cardiovascular disease; CHF: Congestive heart failure; MI: Myocardial infarction; CHD: Congenital heart defect

However, the Bonferroni method, which was used to adjust the P-value, suggested that smoking and valve disease would be significant if the P-values were < 0.006 and < 0.001, respectively. Our results also confirmed that the good status of SES reduced the risk of valve disease (72%) and the smoking (39%) significantly (Table 3).

Discussion

The aim of this study was to find out whether the cardiac risk factors and CVDs have any relations with the patients' SES. Our findings showed that most of the patients were placed in the poor SES and there were no patients in the wealthy SES.

Table 3. Multiple logistic regression analysis of the socioeconomic status (SES) on each of risk factors and type of cardiovascular diseases (CVDs) by controlling age, gender, and marital status

Variable		OR (95% CI)	P
Risk factors	Diabetes	1.34 (0.92-1.95)	0.120
	HTN	1.02 (0.70-1.49)	0.880
	Hyperlipidemia	1.17 (0.80-1.72)	0.400
	Smoking	0.61 (0.38-0.97)	0.030
	Family history of CVD	0.79 (0.52-1.18)	0.250
CVDs	Chronic ischemia	1.14 (0.82-1.60)	0.430
	Unstable angina	0.82 (0.57-1.20)	0.310
	Arrhythmia	1.13 (0.67-1.92)	0.640
	CHF	0.99 (0.57-1.71)	0.970
	Acute MI	1.18 (0.66-2.13)	0.580
	Valve disease	0.28 (0.10-0.76)	0.010
	CHD	1.61 (0.43-6.09)	0.470

Mean socioeconomic status (SES): 308.90 ± 67.37, minimum: 180, maximum: 549.50

OR: Odds ratio; CI: Confidence interval; CVD: Cardiovascular disease; HTN: Hypertension; CHF: Congestive heart failure; MI: Myocardial infarction; CHD: Congenital heart defect

This fact may primarily suggest that the SES of the society might be inappropriate. Although patients with CVD cannot be considered as an ample representative of the total population, other studies in Tehran, Iran,[16] and Rafsanjan, Iran,[17] also have shown that very small percentage of people belong to the wealthy SES. The second justification explaining this fact is that the wealthy group might have referred to better hospitals to get better and high-quality medical services, i.e., hospitals in Tehran or abroad. There is, however, no evidence to support this explanation. Many studies have drawn upon the relationship between different socioeconomic indicators and concluded that people in poor SES group had more health problems.[13,18-23] These findings led to the conclusion that the SES is a strong predictor for the occurrence of CVD and cardiovascular side effects. This theory could be applied to explain third possible justification for our findings. This justification is supported by numerous studies, which revealed that the occurrence of heart failure (HF) is very much related to the lower SES, both in the society and among the admitted patients in the hospitals.[13,18-23] Many studies have shown that the risk factors are more common in the lower SES group.[24-29]

Our results indicated that some demographic variables such as age and gender were associated with SES. Aging makes the SES of the people worse. Older patients usually are involved with CVD longer, which can affect their SES.[30,31]

Among the patients, smokers also had lower SES. Smoking habit inflicts a huge financial burden upon people that can make their SES worse. Another study also indicated that cardiac patients from lower SES group had higher rates of smoking. They also had higher rates of heart attacks.[32] Many studies have suggested that the most common risk factor among patients with CVD was smoking.[33-35]

Like the smokers, the women also were placed in lower SES group as compared to the men. It is obvious that some of the women were the heads of their households. It is obvious that men normally have better income than women. Nevertheless, the prevalence of CVD was higher among men. Other studies supported our findings and showed that CVD was more common among men than women.[33,36-38]

The findings showed that the most and the least frequent risk factors in patients with CVD were HTN and smoking, respectively. The prevalence of HTN is expressed variously in Iranian studies. For instance, HTN prevalence among Iranians under 65 years was 20.9%.[39-41] Though smoking was the least CVD risk factor in the patients, this habit in Iranian people has risen from 0.4% to 41.0% in various subpopulations during 1999-2007.[42]

Our results showed that SES groups were statistically significant between patients who smoked and those who had valve disease. Indeed, adjusting the P-value through Bonferroni method indicated that smoking and valve disease would be significant if the P-values changed. Also the good status of SES in contrast to poor status would decrease the risk of valve disease and smoking. Many studies showed that risk factors related to CVDs were more common in lower SES group of society.[24-29] As a result, by improving the level of SES, the frequency of cardiac risk factors such as smoking will be decreased.

This study has some strengths and limitations. The most important strength and novel approach of this study was using the SES model to determine the SES of the patients with heart disease. This model is selected as a more comprehensive approach to determine SES in Iran. Another strength of this study is the use of statistical methods such as Bonferroni correction to show the accuracy of the study that is referred to along with regression. The limitation of this study was the number of patients who eventually were in each group of SES. In fact, after sampling patients, according to the SES score, most of the patients were in the poor and moderate classes, which was due to the context of Iran economic status.

Conclusion

Our findings showed that the frequency of CVD risk factors was higher in lower SES groups and thus SES can be a strong predictor for the occurrence of CVD risk factors as well as CVDs. Our analysis of the risk factors and the type of heart disease on the SES revealed that smoking and valve disease could have significant relationship with each other if the sample size of target population was larger.

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Conflict of Interests

Authors have no conflict of interests.

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