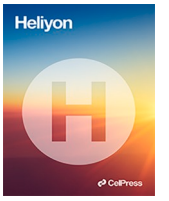
Heliyon 9 (2023) e22715

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Assessing exposure to secondhand smoke among Iranian patients with cardiac diseases; a cross-sectional study

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ARTICLE INFO

Keywords:
Secondhand smoke
Cardiac patients
SHS exposure

ABSTRACT

Introduction: Studies have linked secondhand smoke (SHS) exposure to adverse health effects. The high prevalence of heart disease necessitates the need for studies in this field. Therefore, the aim of the present study was to assess the exposure to SHS in cardiac patients.
Method: This study is a cross-sectional descriptive study. A total of 430 patients who were referred to Imam Ali Hospital in Kermanshah, Iran, in 2020 were included in the study based on predetermined inclusion and exclusion criteria. The researchers collected and recorded demographic information, disease history, and exposure to secondhand smoke (SHS) through a digital questionnaire. Bivariate analysis was conducted using a chi-square test and an independent T-test, depending on the variable scale.
Results: The results of the study showed that 237 patients were male (55.12 %) and 193 were female (44.8 %). The prevalence of exposure to secondhand smoke was 72.09 %. Notably, the highest rate of exposure to secondhand smoke was associated with 'exposure to tobacco smoke in public places' with a rate of 69.30 %. Additionally, it was observed that approximately 39.07 % of patients reported exposure to secondhand smoke in public places at least once a week.
Conclusion: The present study has found that cardiac patients frequently experience secondhand smoking exposure, with public settings being the primary location of exposure. Implementing intervention strategies and enacting laws that prohibit smoking can effectively mitigate the negative impact of SHS exposure.

1. Introduction

Health effects related to indoor air pollution account for 4.5 million deaths annually worldwide caused by stroke (34 %), ischemic heart disease (26 %), chronic obstructive pulmonary disease (22 %), pneumonia (12 %), and lung cancer (6 %) [1]. Among the contributors to indoor air pollution, smoking is considered the most significant, following the use of fuel-burning combustion appliances [2]. Numerous chemical compounds have been identified in tobacco smoke. The United States Food and Drug Administration

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https://doi.org/10.1016/j.heliyon.2023.e22715
Received 30 December 2022; Received in revised form 8 November 2023; Accepted 16 November 2023
Available online 19 November 2023

has classified the chemical compounds in tobacco products and tobacco smoke into subgroups: carcinogenic, respiratory toxic, cardiovascular toxic, reproductive and developmental toxic, and addictive [3]. According to the World Health Organization (2015), secondhand smoke (SHS) was responsible for 603,000 deaths among non-smoking children and adults worldwide in 2004, and this number is increasing [4]. According to studies, long-term exposure to secondhand smoke is a risk factor for many respiratory diseases in both children and adults, and its inhalation can lead to lung cancer and coronary heart disease in non-smokers [5]. Short-term exposure to tobacco smoke has also been linked to effects such as eye and respiratory tract irritation, adverse effects on the cardiovascular and respiratory systems, and an increase in mortality [5,6]. Studies revealed that the risks of heart disease caused by environmental smoke are 80 %–90 % as large as those from active smoking [7]. Studies conducted in this area have reported an increased prevalence of exposure to SHS in heart patients. It is estimated that SHS exposure raises the risk of an acute event of coronary heart disease [7–9].

As reports of studies confirm the harmful effects of exposure to SHS, smoke-free policies have been considered to reduce SHS exposure in many countries worldwide [10–12]. In Iran, smoke-free rules were adopted to protect individuals from the harmful effects of SHS Following the World Health Organization Framework Convention on Tobacco Control (2003). This is despite the fact that executive measures in this field have not yet been implemented in Iran [13]. Therefore, conducting studies in this field can be effective in providing sufficient evidence regarding the SHS exposure. It can be efficient for implementing appropriate preventive interventions and shaping health policies. So, the present study aimed to investigate the exposure to SHS in cardiac patients referred to Imam Ali Hospital. The objectives of this study included determining the level of SHS exposure among the included population at home, in the workplace, and in public and social settings. Additionally, statistical differences in terms of demographic information were examined to determine whether there are any significant differences between the two groups of patients, those with and without secondhand smoke exposure. Furthermore, the study aimed to identify the factors associated with second-hand smoke exposure in cardiac patients.

2. Material and method

2.1. Study design

This is a cross-sectional descriptive study that was conducted to assess secondhand smoke exposure in cardiac patients referred to Imam Ali Hospital in Kermanshah, Iran.

2.2. Study area and population

The research population included cardiovascular patients referred to the hospital in 2022. Considering the expected proportion of 43 %, the Z statistic for a 95 % confidence level (1.96), a precision of 5 %, and around 15 % shed taking into account the final volume, a total of 430 patients referred to the hospital were conveniently included in the study (equation (1)) based on inclusion and exclusion criteria.

$$n = \frac{z^2 p(1-p)}{d^2} \tag{1}$$

2.3. Inclusion and exclusion criteria

The study included subjects with cardiovascular diseases, including unstable angina, ischemic disease, arrhythmias, heart failure, and valvular heart disease, who provided informed consent to participate. People with congenital cardiovascular disease, patients diagnosed by a doctor with depression or psychosis, individuals being treated with neuropsychiatric drugs, and individuals with chronic physical and mental illnesses, such as cancer, kidney failure, multiple sclerosis, and psychoses, were excluded from the study.

2.4. Data collection methods, instruments and procedure

Demographic and secondhand smoke exposure questionnaires were administered to the patients, and the research questionnaire was designed electronically. To accurately collect information and overcome the issues associated with online questionnaires, the questions were posed by an interviewer, and the questionnaire was completed accordingly. The demographic information checklist included age, household population, gender, residence (urban or rural), employment status, spouse's employment status, education, spouse's education, marital status, monthly income, sports habits, and type of heart disease. Information about the history of certain diseases was collected through a question that asked, "Have you had a history of certain diseases?" with a binary answer option (yes or no). In the case of a positive response, the type of disease was further inquired about. A history of disease in the past as well as a multiple-choice question, "Which diseases have you had in the past (diabetes, cancer, digestive diseases, depression, anxiety disorders, etc.)?" were asked. Subjects were also asked about their current disease history with a multiple-choice question: "Which diseases are you currently suffering from (diabetes, cancer, gastrointestinal diseases, depression, anxiety disorders, etc.)?" In addition, information on their exercise habits was obtained with the question, "What is your exercise habit? (Daily, three times a week, once a week, and twice a month; I have not exercised in the last three months; I have not exercised in the previous year)." The SHS questionnaire was researcher-made based on the tobacco questionnaire designed based on the Global Adult Tobacco Survey of the World Health Organization [14]. This questionnaire has ten questions about smoking, exposure, type of tobacco, duration of tobacco smoking, and

smoking environment.

2.5. Data quality assurance

For accurate data collection, we recruited and trained data collectors. The structured questionnaire was validated, and experts confirmed its content validity. In the current study, Cronbach's alpha was obtained at 0.89.

2.6. Data management, processing and analysis

The digitally collected data were checked for completeness and entered into SPSS version 22 software for further analysis. Descriptive statistical methods such as means (standard deviation) and frequencies (percentage) were used to describe the basic features of the data. After evaluating the normality, we used the chi-square test, independent T-test in the bivariate analysis, and multivariate logistic regression according to the variable scale. A significance level of 5 % was used for all analyses, and we presented the results in tables and prose.

Table 1
Demographic characteristics of the studied subjects (n = 430).

Variable	Level	Number	Percent%
Gender	Male	237	55.12
	Female	193	44.80
Marital status	Single	7	1.63
	Married	376	87.44
	Divorced	2	0.47
	The widow/widower	45	10.47
Household population	Up to 3 members	171	65.77
	4-6 members	17	29.62
	7 or more members	12	4.62
Residence	Urban	375	87.21
	Rural	55	12.79
Employment status	Unemployed	66	15.35
	Self-employment	151	35.12
	Employee	13	3.02
	Housewife	185	43.02
	Retired	15	3.49
Spouse employment status	Unemployed	50	11.63
	Self-employment	90	20.93
	Employee	12	2.79
	Housewife	218	50.70
	Retired	6	1.40
Education	Illiterate	200	46.51
	Primary education	139	32.33
	Lower secondary education	45	10.47
	Upper secondary education	28	6.51
	Academic degree	18	4.19
Spouse education	Illiterate	146	33.95
	Primary education	154	35.81
	Lower secondary education	38	8.84
	Upper secondary education	26	6.05
	Academic degree	12	2.79
Monthly income	None very low	218	50.70
	Low	27	6.28
	Moderate	104	24.19
	High very High	65	15.12
		13	3.02
		3	0.70
Type of heart disease	Unstable angina	347	80.70
	Ischemic disease	38	8.84
	arrhythmia	2	0.47
	Heart failure	11	2.56
	valvular disease	10	2.33
	I don't know (uncertain)	14	3.26
Sports habits	Daily	8	1.86
	3 times a week	4	0.93
	1 time a week	2	0.47
	2 times a month	4	0.93
	I did not exercise for the past 3 months	28	6.51
	I did not exercise for the past year	384	89.30

3. Results

In the present study, we investigated 430 cardiovascular patients who were referred to Imam Ali Hospital in Kermanshah, Iran, to assess their exposure to secondhand smoke. These patients had an average age of 60.38 ± 11.50 years. Out of the 430 participants, 237 were male (55.12 %) and 193 were female (44.80 %). The average age of females (61.23 ± 11.74 years) was slightly higher than that of males (59.68 ± 11.28 years). More detailed information can be found in Table 1.

The highest rate of SHS exposure was associated with "exposure to tobacco smoke in public places," with a rate of 69.30 % (298 individuals). Approximately 39.07 % (168 individuals) of patients reported being exposed to SHS in public places almost once a week, 13.95 % (60 individuals) reported being exposed several times a week, and 16.28 % (70 individuals) reported being exposed rarely. Additionally, 10 % of the patients reported a prevalence of smoking in their family, and the most common form of smoking at home was cigarettes (7.91 %). Moreover, 89.53 % (385) of patients believed that exposure to secondhand smoke causes heart disease. Among them, 29.77 % (128) strongly believed in this connection, 38.60 % (166) moderately believed in it, and 21.16 % (91) slightly confirmed the link between exposure to SHS and heart disease (Table 2).

In Table 3, the demographic characteristics of the patients were compared in terms of exposure to secondhand smoke. In the present study, the prevalence of secondhand smoke exposure was 72.09 % (310). This prevalence was 53.23 % in men and 46.77 % in women. However, there was no statistically significant difference in gender between the two groups of patients with and without secondhand smoke exposure ($p > 0.05$). In both groups, the majority of patients were illiterate, and the prevalence of illiteracy in those exposed to SHS (47.42 %) was higher than in the non-exposed group (44.17 %). However, this difference was not statistically significant ($p = 0.448$). Regarding employment status, most patients in both groups were homemakers in the exposed group (44.19 %), slightly more than in the non-exposed group (40.0 %). Additionally, 3.9 % of the exposed groups were retired, which was lower than the percentage in the non-exposed group (2.50 %). However, none of these differences were statistically significant ($p > 0.05$). The prevalence of a daily sports habit in non-exposed patients (4.17 %) was higher compared to those exposed to secondhand smoke (0.97 %). Nevertheless, this difference was also not statistically significant (Table 3).

Using univariate logistic regression, we investigated the crude relationship between various variables (such as age, gender, marital status, education, etc.) and exposure to secondhand smoke in cardiac patients. None of these relationships were found to be statistically significant at the 0.05 significance level. To control for confounding variables, we employed a multivariable logistic regression model

Table 2
Prevalence of secondhand smoke exposure in cardiac patients.

Items		Frequency	%
Smoker in family	Yes	45	10.47
	No	385	89.53
Type of tobacco they use	Cigarettes	34	7.91
	Hookah	3	0.70
	Pipe or stick	0	–
	Other	1	0.23
	Unknown	7	1.62
Who smokes in the family	Father	6	1.40
	Mother	0	–
	Sister	0	–
	Brother	7	1.63
	Spouse	10	2.33
	Other family members	13	3.02
Frequency of exposure to secondhand smoke in home	Daily	20	4.65
	Weekly	3	0.70
	Monthly	8	1.86
	Less than monthly	0	–
	Never	14	3.26
Working in a built environment	Yes	58	13.49
	No	372	86.51
Tobacco use and type of tobacco in work places	No	372	86.51
	Yes (cigarette)	58	13.49
Frequency of exposure to secondhand smoke in the workplace	Daily	20	4.65
	Weekly	9	2.09
	Monthly	16	3.72
	Less than monthly	13	3.02
	Never	372	86.51
Exposure in public places	Yes	298	69.30
	No	132	30.70
Frequency of exposure to secondhand smoke in public places.	Usually (several times a week)	60	13.95
	Sometimes (once a week)	168	39.07
	Rarely	70	16.28
Does second hand smoke exposure cause heart disease	A lot	128	29.77
	Medium	166	38.60
	Little	91	21.16
	I do not give a possibility	45	10.47

Table 3
Comparison of the demographic characteristics of patients exposed to secondhand smoke and those not exposed (n = 430).

Variable	Secondhand smoke Exposure (Yes = 310)	Secondhand smoke Exposure (No = 120)	p-value
Age	60.20 ± 11.57	60.84 ± 11.33	0.606
BMI	27.76 ± 6.45	27.07 ± 3.42	0.264
Gender			
Male	165(53.23 %)	72(60 %)	0.205
Female	145(46.77 %)	48(40.0 %)	
Household population			
Up to 3 members	129(64.50 %)	42(70.00 %)	0.375
4-6 members	63(31.50 %)	14(23.33 %)	
7 or more members	8(4.00 %)	4(6.67 %)	
Education			
Illiterate	147(47.42 %)	53(44.17 %)	0.448
Primary education	100(32.26 %)	39(32.50 %)	
Secondary education	53(17.10 %)	20(16.67 %)	
Academic degree	10(23.3 %)	8(6.67 %)	
Spouse's education			
Illiterate	109(39.93 %)	37(35.92 %)	0.679
Primary education	113(41.39 %)	41(39.81 %)	
Secondary education	43(15.75 %)	21(20.39 %)	
Academic degree	8(2.93 %)	4(3.88 %)	
Employment status			
Unemployed	48(15.48 %)	18(15 %)	0.797
Self-employed	104(33.55 %)	47(39.17 %)	
Employee	9(2.90 %)	4(3.33 %)	
Housewife	137(44.19 %)	48(40.0 %)	
Retired	12(3.87 %)	3(2.50 %)	
Spouse's employment status			
Unemployed	35(12.82 %)	15(14.56 %)	0.561
Self-employed	71(26.01 %)	19(18.45 %)	
Employee	9(3.30 %)	3(2.91 %)	
Housewife	153(56.04 %)	65(63.11 %)	
Retired	5(1.83 %)	1(0.97 %)	
Sports habits			
Daily	3(0.97 %)	5(4.17 %)	0.222
3 times a week	3(0.97 %)	1(0.83 %)	
1 time a week	2(0.65 %)	0	
2 times a month	3(0.97 %)	1(0.83 %)	
I did not exercise for the past 3 months	23(7.42 %)	5(4.17 %)	
I did not exercise for the past year	276(89.03 %)	108(90.0 %)	

with all the variables to examine the factors influencing SHS exposure. Individuals with an academic education had a lower risk (0.11 (0.02–0.76)) of SHS exposure compared to those without education, and this relationship was statistically significant (p = 0.025). In other words, the chance of SHS exposure in illiterate individuals was 9.09 times higher than that of individuals with an academic

Table 4
Regression analysis of demographic variables and the secondhand smoke exposure in cardiac patients.

Variable	Univariate logistic regression		Multivariate logistic regression	
	Crude Model OR (95 % CI)	p-value	Fully Adjusted OR (95 % CI)	p-value
Age	0.99(0.98–1.01)	0.605	0.98(0.95–1.00)	0.108
Gender (Female)	1.32(0.86–2.02)	0.206	1.30(0.78–1.98)	0.403
Marital status	1.01(0.53–1.90)	0.982	0.98(0.51–1.90)	0.961
Residence (Rural)	0.77(0.42–1.41)	0.394	0.76(0.39–1.46)	0.415
Employment status (Unemployed)	Reference	–	Reference	–
Self-employment	0.83(0.44–1.58)	0.569	0.83(0.28–2.51)	0.754
Employee	0.84(0.23–3.08)	0.797	3.04(0.31–4.58)	0.548
Housewife	1.07(0.57–2.07)	0.834	4.04(0.31–5.72)	0.875
Retired	1.50(0.38–5.94)	0.564	6.79(0.78–9.75)	0.086
Education (Illiterate)	Reference	–	Reference	–
Primary education	0.92(0.57–1.50)	0.751	0.77(0.41–1.49)	0.451
Lower secondary education	0.80(0.39–1.62)	0.531	0.57(0.23–1.43)	0.235
Upper secondary education	1.32(0.51–3.44)	0.567	0.71(0.21–2.44)	0.588
Academic degree	0.45(0.17–1.20)	0.111	0.11(0.02–0.76)	**0.025**
History of psychiatric disorders (No)	1.96(0.43–8.89)	0.382	1.88(0.40–8.81)	0.423
Sports habits (yes)	0.59(0.22–1.57)	0.293	0.45(0.14–1.40)	0.168
Working in a built environment (No)	0.42(0.12–1.44)	0.166	0.32(0.08–1.23)	0.097

aOR: Odds ratio, CI: Confidence interval.

education. The remaining relationships were not statistically significant (Table 4).

4. Discussion

This study was conducted with the aim of investigating the exposure of cardiac patients to secondhand smoke. The results of the study showed that the prevalence of exposure to second-hand smoke was 72.09 % in cardiac patients. It appears that the rate of exposure is higher in cardiac patients compared to the general population [15,16]. In a study conducted in Greece that quantified the association between SHS exposure and 10-year cardiovascular disease (CVD) risk among never-smokers (n = 2020), it was found that despite the implementation of the national smoking ban, 44.6 % (n = 406) of never-smokers reported being exposed to SHS. The study also revealed that SHS exposure accounted for 32 % of the increased population-attributable risk (PAR) for 10-year CVD events among non-smokers, with the highest rates (PAR: 52 %) observed among those exposed to SHS in the workplace [2]. Other studies have also reported a high prevalence of SHS exposure among patients with coronary heart disease. According to the study conducted by Abu-Baker et al. (2020) in Jordan, the highest levels of SHS exposure were found in public and social areas (64 %, n = 256) [17]. In a study conducted by Law et al. (1997), the relative risk of ischemic heart disease associated with exposure to SHS was 1.30 (95 % confidence interval 1.22–1.38) at age 65 [18]. Another study, which reviewed the effects of ambient tobacco smoke on the risk of cardiovascular disease, found that SHS exposure increases the risk of an acute coronary event by 25–35 % [8]. According to the findings of a review study, the toxins in secondhand smoke have a significant impact on various aspects of the cardiovascular system, including arterial stiffness, platelets, endothelial function, oxidative stress, atherosclerosis, inflammation, energy metabolism, heart rate variability, and increased infarct size. This study reveals that the effects of SHS are between 80 % and 90 % as large as those from active smoking [7]. Additionally, another review study has reported that exposure to SHS promotes atherothrombosis through endothelial dysfunction, inflammation, platelet adhesion, and plaque instability. It was reported that the primary component of SHS is responsible for significant cardiovascular morbidity and mortality by creating a proatherogenic environment [19]. The results of our study showed that the frequency of SHS exposure was 53 % in men and 47 % in women, and the difference was not statistically significant. These results align with the findings of studies conducted in this field. In a study conducted in Kerman, Iran, Hamideh Salimzadeh et al. reported that women (30.1 %) experienced higher levels of SHS exposure compared to men (25.0 %) [20]. Women's exposure to SHS may be higher due to their spouses being smokers. Additionally, the prevalence of SHS exposure at home was reported to be 47.1 % in the Global Adult Tobacco Survey (GATS) I and 34.7 % in the GATS II in India [21]. The findings of the present study also revealed that the highest rate of exposure to secondhand smoke was associated with "exposure to tobacco smoke in public places," with a rate of 69.30 % (298 people). According to Ahmadizadeh Fini's (2012) study, individuals were primarily exposed to hookah smoke at home, in coffee shops, and in restaurants, with rates of 93.4 %, 17.1 %, and 11.5 %, respectively. They were also exposed to SHS in public vehicles (52.2 %) and at home (31.3 %). When considering the factors influencing exposure to SHS, the results of the present study indicated that individuals with academic education had a lower risk of SHS exposure compared to those who were uneducated. Abu-Baker et al. (2020) conducted a study on the exposure to SHS among patients diagnosed with coronary heart disease (CHD). A study investigated the relationship between exposure to secondhand smoke and factors associated with CHD, and reported that lower education level, being male, working, and being younger all significantly predicted higher exposure to SHS. Both the number of admissions and exposure to SHS are positively correlated with CHD complications, while the age at CHD diagnosis is negatively correlated [17]. The results showed that 89.53 % (385 people) of patients believed that exposure to secondhand smoke causes heart disease. Additionally, a high percentage of exposure occurs in public areas. Therefore, implementing legislation regarding smoke-free places can be effective in reducing SHS exposure [22]. It is important to interpret this study in light of its limitations. One limitation is the lack of objective measures of exposure, such as cotinine measurement, which could have provided more accurate data. Another limitation is the absence of data on important confounders, which could have influenced the results. Additionally, the use of questionnaires for assessing SHS exposure introduces the potential for false reporting, underreporting, and overreporting, which makes the data less reliable. Furthermore, the study used a convenient sampling approach, which limits the generalizability of the findings. Lastly, it is worth noting that this investigation focused only on SHS exposure in a small number of cardiac patients at a specific point in time, without comparing it to a sample from the general population. This narrow focus restricts the broader applicability of the study's findings.

5. Conclusion

Exposure to SHS has been associated with negative health effects; therefore, this study aimed to investigate the prevalence of SHS exposure among cardiac patients. Additionally, we studied the factors related to secondhand smoke exposure. The study findings revealed that the majority of SHS exposure occurred in men rather than women. Furthermore, exposure to SHS in public places accounted for a significant proportion of overall exposure, and individuals with academic education had a lower risk of SHS exposure than uneducated individuals. It seems that considering measures such as prohibiting tobacco smoking in public and social settings to reduce exposure to SHS can be effective in reducing its effects.

Ethical statement

The ethics committee of the Kermanshah University of Medical Sciences approved the study protocol (Ethics registration code: IR.KUMS.REC.1401.307).

Data availability statement

Data associated with this study has not been deposited in to a publicly available repository. Data will be made available on request.

CRediT authorship contribution statement

Hosna Janjani: Writing – review & editing, Conceptualization. **Sayeh Motevaseli:** Methodology, Formal analysis. **Nahid Salehi:** Writing – review & editing. **Sepideh Naseri:** Investigation. **Mehdi Fazlzadeh:** Methodology, Conceptualization. **Parisa Janjani:** Writing – review & editing, Supervision, Conceptualization.

Declaration of competing interest

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

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e22715.

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