Effects of Inhaling Secondhand Smoke on Cardiovascular Health

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ABSTRACT:

Introduction

Secondhand smoke is hazardous to an individual's health and has caused more than 41,000 deaths in a year. However, the relationship between secondhand smoke and its prognosis to heart failure is still not answered. The aim of this paper is to investigate the effects of inhaling secondhand smoke on cardiovascular health.

Methods

Relevant research articles were found and reviewed through PubMed and Google Scholar, which were written from 2003 to 2023. Key search terms used were "secondhand smoke", "cardiovascular health", "inhalation", "United States", and "environment".

Results

The results revealed that inhaling secondhand smoke results in increased rates of mortality, a negative effect on heart rate variability, and an increased chance of cardiovascular disease. The effects of exposure to secondhand tobacco smoke on cardiovascular health leads to myocardial infarction, peripheral artery disease, and transient ischemic attack.

Discussion

These findings emphasize the dangerous effects of inhaling secondhand smoke, and how it is a hazardous public health issue. The effects of inhaling secondhand smoke on mortality risk can be as dangerous and likely as first hand smoke exposure.

INTRODUCTION:

Secondhand smoke (SHS) is constantly in the air and inescapable in any environment like houses, parks, and offices. Based on surveys done between 2010 and 2018, the global prevalence of SHS exposure in 142 countries was 62.9% (95% confidence interval 61.7& - 64.1%) on one or more days [1]. The number of people who do not smoke but are exposed to SHS in the US has declined, however, the gaps in SHS exposure still remain [2]. SHS contains many toxic chemicals including formaldehyde, benzene, vinyl chloride, arsenic ammonia and hydrogen cyanide [3]. Regardless of short-term or long-term exposure to SHS, there is no risk-free level of exposure to SHS, which inturn can increase the chances of an individual's health being affected when it's inhaled [3]. SHS is an extreme health hazard and has caused more than 41,000 deaths per year [3]. SHS impacts many parts of the body and also can cause coronary heart disease (CHD). SHS causes about 34,000 early deaths among nonsmokers, due to CHD, each year in the United States. [4] Thus, SHS has become a prevalent factor in causes of deaths among many people

in the United States. Additionally, secondhand tobacco smoke (SHTS) is a type of SHS which leads to morbidity and premature mortality among people worldwide [5]. The people who's CVH is affected by any SHS also can include other social determinants like their race, ethnic minorities, and lower socioeconomic status [5].

The impact of SHS on the cardiovascular system was recognized about 20 years ago [6]. Based on a previous study which surveyed US residents, SHS has a clinically important effect on sensitivity to cardiovascular disease [8]. CVDs can be related to atherosclerosis, myocardial infarction, arrhythmia, and arterial stiffness [8]. These CVD can be caused by minutes or hours of SHS exposure is almost 80% to 90% greater than first hand smoke [8]. In addition, patients who already suffer with underlying health conditions also can have a great impact when SHS is inhaled.Thus, it is important to know the effects of the inhalation of SHS from the environment on cardiovascular health (CVH). However, the association between SHS and prognosis of heart failure is still unclear [7]. To decrease the risks to CVH, the impacts of SHS on the cardiovascular system need to be identified. Thereafter, effective interventions can be created to decrease mortality rates and risk for developing Cardiovascular Disease (CVD). Therefore it is important to examine the relationship between inhaling SHS and the CVH risks that become associated with it.

The present study is aimed to determine how the inhalation of SHS that is in the environment affects CVH. The study aims to identify the various CVDs that are caused through SHS and examine how prevalent it is to obtain those diseases through SHS. Additionally, the study aims to examine the trends of mortality rates due to these CVDs.

METHODS:

PubMed and Google Scholar were searched using the key search terms "secondhand smoke", "cardiovascular health", "inhalation", "United States", and "environment" to conduct a scoping literature review.

The inclusion criteria were articles written in 2003-2023 and conducted in the United States. Exclusion criteria included papers that gathered data from countries outside of the U.S., individuals under 17 years, studies done on pregnant or severely sick individuals, and literature reviews.

RESULTS:

A study was conducted where 88 patients were exposed to household SHS and 484 weren't, after a mean follow up 9.2 years later, there were 72 deaths in the exposed group and 403 deaths in the unexposed group [7]. After adjusting other social determinant factors like demographic variables and socioeconomic variables, household SHS exposure was associated with a 43% increase in mortality risk (Hazard Ratio: 1.43, 95% Confidence Interval: 1.10 - 1.86, p = 0.007) [7]. The associations between household SHS and mortality risks didn't significantly differ between people who have never smoked and ex-smokers (p > 0.1) [7].

Another study was conducted with flight attendants to analyze the effects when they were exposed to secondhand tobacco smoke [5]. Secondhand tobacco smoke (SHTS) is a type of SHS which leads to

morbidity and premature mortality among people worldwide [5]. Other social determinants such as: their race, ethnic minorities, and lower socioeconomic status, can also impact the level to which SHTS affects people [5]. The effects of SHTS exposure on CVH led to myocardial infarction (MI) (Odds Ratio (OR) = 1.40, 95% CI: 1.04, 3.27), peripheral artery disease (PAD) (OR = 1.27, 95% CI: 1.00, 1.97), and transient ischemic attack (TIA) (OR = 1.11, 95% CI: 0.84, 1.68) [5]. Workers, like the flight attendants, exhibited low morbidity when exposed to SHTS because being healthy is required to maintain employment [5].

A study panel conducted among residents in the United States analyzed the association between 15 - 240 minute SHS fine particulate matter (PM2.5) movement and signs of heart rate variability (HRV) [9]. The associations between PM2.5 moving average exposure decreases and increases HRV regardless of short term or long term SHS exposure [9]. When an individual was exposed to 15 minutes (short-term) of moving average PM2.5 in SHS and 240 minutes (long-term) of moving average PM2.5 in SHS their HRV decreased [9]. However, when an individual was exposed to 120 minutes of moving average PM2.5 in SHS their HRV increased [9]. When people are exposed to SHS for any amount of time, it in turn has a negative association with CVH [9].

Finally, a survey which was conducted analyzed the biomarkers which were affected by SHS that leads to CVD in never smoking adults [10]. After analyzing blood samples, people who were exposed to SHTS had increased amounts of cotinine, found in tobacco leaves, in their blood [10]. People who had: no cotinine (a metabolite of nicotine) in their blood increased by 5%, low cotinine in their blood increased by 18%, high cotinine in their blood increased by 56% [10]. Regardless of the high and low groups of cotinine, both groups had higher levels of fibrinogen and homocysteine, biomarkers of CVD [10]. Having a low-level exposure to SHS has a clinically significant effect on the vulnerability to CVD since the levels of cotinine won't be as high meaning that fibrinogen and homocysteine levels won't be as significantly affected to increase the chances of CVD [10]. Exposure to SHS is suitable to be a crucial avoidable cause of CVD in the United States population [10].

DISCUSSION:

There has been extensive research on how inhaling SHS affects cardiovascular health. The results indicate that household SHS exposure was associated with a higher risk of death among heart failure patients [7]. Additionally, when other social determinant factors were considered as variables, the mortality risk increased by 43% [7]. SHTS also leads to MI, PAD, and TIA, which increases the chance of morbidity and mortality [5]. Additionally, when an individual is exposed to SHS it has a negative impact on their heart variability and can cause the rhythms to increase or decrease [9]. The CVD's that occur from SHS inhalation result from cotinine levels in blood increasing, which in turn increases the levels of fibrinogen and homocysteine [10].

It is suggested that the effects of household SHS on mortality risk can be as great as first hand smoke exposure [7]. These results should be taken into account when considering how SHS can be just as harmful as first-hand smoke. This data also suggests that inhaling SHS is a dangerous public health issue. Additionally, these results provide an insight into the relationship between how elevated CVD biomarkers, fibrinogen and homocysteine, can lead to CVD such as MI, PAD, and TIA [7,10]. These

results build off the existing knowledge of how SHS can affect certain organs in the body, specifically the heart.

The limitation of this paper is that due to this being a scoping review, not all research papers were able to be analyzed in this paper. Additionally, the effects of inhaling e-cigarette smoke on CVH was not discussed in this paper. Therefore comparing this to the effects of SHTS can't fully apply to e-cigarette smoke.

Further research should focus on how SHS exacerbates health disparities in individuals who already have CVD or other existing health conditions. Through this research the mortality rates can be observed to see if there is a significant impact. Additionally future research should analyze the effectiveness of smoke free laws, and if it positively or negatively affects CVH.

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