Impact of Socioeconomic Factors on Cardiovascular Health Disparity

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ABSTRACT:

Background

Cardiovascular disease (CVD) is one of the largest chronic conditions globally. The risk for CVD is closely associated with socioeconomic status, as lower SES communities are impacted by CVD at a higher rate. This scoping review aims to summarize the current literature around socioeconomic disparities in CVDs.

Methods

This review utilized PubMed and Google Scholar search engines to find relevant articles on the association between SES and CVD. Specific keywords regarding SES and CVD, such as socioeconomic, economic status, cardiovascular health, and cardiovascular disease, and inclusion criteria of original research published in the last 14 years, which helped identify the studies used in this review.

Results

Data from cross sectional analysis of respondents from Italy, Bosnia and Herzegovina, and the United states illustrated a clear correlation between CVD and SES. The data from the retrospective cohort studies also found a large gap in the CVD risk factors of lower SES populations in comparison to individuals with higher income and education.

Discussion

The data indicates that there is a large disparity between higher and lower SES populations. Further efforts should focus on developing initiative to decrease the disparity in cardiovascular health seen globally and reduce the impact of CVD on underprivileged communities.

INTRODUCTION:

Background

Cardiovascular disease (CVD) is currently one of the most prevalent chronic conditions affecting millions. CVD, being a non-communicable chronic disease, refers to a multitude of conditions that impact the cardiovascular system such as heart disease, heart attack, heart failure, stroke, and arrhythmia. Many of these conditions develop due to atherosclerosis (ASCVD), which is a form of heart disease that is caused by plaque build up in the arterial walls [1]. CVD impacted an

estimated 775 million individuals in 2022 and accounted for around 19.8 million deaths globally [2-3]. Disproportionate CVD mortality rates have been identified in less economically advantaged regions, with less economically stable regions of Eastern Europe having rates of cardiovascular related mortalities of 432.3 per 100,000 compared to high-income parts of the Asia Pacific with rates of 73.6 deaths per 100,000 [2,4]. Lack of resources and poor environment makes management and treatment of CVD difficult for less economically stable populations. Deficiencies in the management of one's cardiovascular health due to lifestyle and environment, such as exercise, access to quality food choices and healthcare, transportation, and financial priorities can make CVD prevention and treatment far from ideal [5]. Five major modifiable CVD risk factors, including high body-mass index (BMI)/obesity, high low-density lipoprotein cholesterol (LDLC)/hyperlipidemia, blood pressure (BP)/hypertension (HT), diabetes, and smoking, have been identified to contributed to the risk of CVD and mortality [3-6]. These modifiable risk factors make CVD a preventable disease with proper treatment and lifestyle choices; however, without proper resources, the management of these modifiable risk factors become difficult. Economic barriers to medications, treatment, and therapy limit the ability for lower SES individuals to properly manage and identify the modifiable risk factors that contribute to CVD. This consequently results in an increased risk for CVD in less economically advantaged populations, making addressing SES disparity an essential part of global cardiovascular health.

Previous studies have established a connection between SES and CVD by relating different socioeconomic demographics to modifiable CVD risk factors [4,7]. Furthermore, regional cohort studies have especially found connections between education and CVD risk and premature mortality [8-9]. While there is a known correlation between SES and CVD, there remains a lack of research that quantifies the CVD gap between higher and lower SES populations.

Objective

The purpose of this review is to analyze the extent of the effect of SES disparity on CVD and CVD risk factors between higher and lower income and SES populations. Specifically by analyzing cross-sectional research and cohort data between different SES populations, this study will establish an understanding on the disparity of cardiovascular health based on socio-economic factors.

METHODS:

Search Technique

For this review, PubMed and Google Scholar search engines were utilized to identify articles looking at the correlation between socioeconomic factors and cardiovascular health. For PubMed, the advanced search feature was utilized to identify the following key terms: socioeconomic, economic status, economic stability, cardiovascular health, and cardiovascular disease. The inclusion criteria for this scoping review was studies published within 14 years, clinical trials, meta-analyses, and randomized control trials. Exclusion criteria included

systematic reviews and review articles. These criteria helped find original research on the topic of SES and CVD. Cross sectional studies based on surveys and retrospective cohort studies were analyzed for the purposes of this review.

Data Organization

The data retrieved was split between the cross sectional studies and retrospective cohort studies with the data from the studies being reorganized. Some statistics were recalculated due to percentages being split between genders within an identified population for a characteristic rather than the overall population being split between genders and percentages for characteristics within each gender were found. This system for identifying the composition of characteristics in the observed populations was implemented for all studies that have not previously kept their statistics in this format for comparative purposes.

RESULTS:

Cross Sectional Studies

Data from a 2004-2005 National Survey conducted in Italy was analyzed as a cross sectional study to identify the correlation between SES and management of cardiovascular risk factors [9]. The observed population in Table 1 depicts the distribution of the respondents based on gender, age, education, occupational class, and risk factors [9]. The respondents were primarily composed of males and females aged 40-49, composing 40.4% and 38.9% of their respective gender groups [9]. Educational distribution varied between genders, with males having a 40.2% rate of having graduated highschool or further while females had a more bimodal distribution between primary school and highschool, composing 34% and 35.2% of their group respectively [9]. Even greater disparity was shown in education as males predominantly composed the lower occupational class but had 29.4% of their group working in the high occupational class compared to only 10.8% of women working in that class [9]. Low unemployment rates of around 3.9% for males was much lower than the 28.6% of unemployed females [9]. For the CVD risk factors identified in the population, women tended to have higher rates of hypertension, while men had higher rates of diabetes, smoking, and higher BMI [9]. Around 49.7% of males in this population showed BMI levels around being pre-obese [9]. Furthermore, females tended to monitor their CVD risk factors more often than males but the majority of both genders monitored all their levels except for only 43.2% of males monitoring their weight at least once a year [9]. Overall the demographic composition identified in this study was mostly those with an above average education level and there was an even distribution between occupational classes [9]. CVD risk factor rates for hypertension, diabetes, and obesity were relatively low in the observed population [9].

Table 1. Demographics of respondents observed in Italy (Damiani et al., 2011)

Study Type: Cross			

Sectional			
Country	Characteristic	% Identified	
Italy (2004-2005) [9]	**Age**	Male	Female
	40-49	40.4	38.9
	50-59	34.3	34.1
	60-69	25.4	27.1
	Education		
	≤ Primary School	25.3	34
	Secondary School	34.6	30.8
	≥ High School	40.2	35.2
	Occupational class		
	Unemployed	3.9	28.6
	Low	37.8	30.2
	Medium	28.8	30.4
	High	29.4	10.8
	Risk factors		
	Hypertension	17.9	20.1
	Diabetes	5.4	4.5
	Former smoker	32.9	16
	Current smoker	29.7	19
	Pre-obese (25 ≤ BMI < 30)	49.7	30.2
	Obese (BMI ≥ 30)	13.5	11.4
	Preventive behaviors (___ monitored at least once every (#) years)		
	Cholesterol (5)	78.9	82.4
	Glycaemia (1)	56	59.5

	BP (1)	67.3	72.1
	Weight (1)	43.2	59.9

This same study also found that higher educated individuals were more likely to monitor their CVD risk factors more often than lower educated populations being more defined in male populations compared to females [9]. This trend was also found between occupation classes as higher classes tended to manage their BP and weight at a higher rate than lower occupational classes [9]. For men, those who had an education of primary school and under had a 0.34 rate of regular monitoring of weight, 0.63 for BP, and 0.75 for cholesterol, while those with a highschool education and above monitored those factors at a rate of 0.51, 0.70, and 0.83 respectively, which was also reflected in the female population [9]. This illustrates that those with a higher education tended to monitor their weight, blood pressure, and cholesterol at a higher rate [9].

Table 2 put together the demographic data from a Cross Sectional study of a 2010 national survey in the middle-income nation of Bosnia and Herzegovina [10]. The distribution of the observed population was composed mostly of males and females aged 45-64 with 57.9% of males having a middle education, while 54.5% of females had a lower education [10]. For the labor force of Bosnia and Herzegovina, 67.7% of men and 41.1% of women were either employed or looking for work [10]. The wealth index of the respondents were bimodally distributed with 44.2% and 35.7% of men and women respectively being in the upper class and 37% and 43.6% of men and women in the lower class [10]. For the risk factors seen in the population, out of all participants, 36.7% had HT, 13% had Diabetes with sugar levels over 126 mg/dL, 49.2% were either current or former smokers, 32.8% were considered pre-obse, and 30.1% were obese [10].

Table 2. Demographics of respondents observed in Bosnia and Herzegovina (Janković et al., 2015)

Study Type: Cross Sectional			
Country	Characteristic	% Identified*	
Bosnia and Herzegovina (2010) [10]	**Age**	Male	Female
	25–44	34.1	31.1
	45–64	44	41
	≥65	21.9	28
	Education		

	Low	32	54.5
	Middle	57.9	38.8
	High	10.1	6.7
	Employment Status		
	Out of Labor Force	32.3	58.8
	In Labor Force	67.7	41.1
	Wealth Index		
	Lower	37	43.6
	Middle	18.8	20.7
	Upper	44.2	35.7
	Risk Factors	All Participants	
	Hypertension	36.7	
	Diabetes (≥126 mg/dL)	13	
	Former Smoker	16.8	
	Current Smoker	32.4	
	Pre-obese (25 ≤ BMI < 30)	32.8	
	Obese (BMI ≥ 30)	30.1	

*Data may be recalculated to represent percent per gender of the whole observed population to match other studies for comparative purposes.

Two separate studies observing survey data from American respondents analyzed individual data from respondents in the past decade, and Table 3 depicts SES and CVD data from respondents from the different surveys from 2005 - 2006 [7,11]. The respondents had a generally even distribution in education and a 19.6% unemployment rate [11]. Family income to poverty ratio had 40% of individuals right above the poverty line with a ratio of 100% - 299% with 22.8% in the 300%-499% group and 19.3% above 500% [11]. CVD risk factors observed in the 2006 respondents had 55.18% and 50.97% of males and females with HT [7]. Around 17.21% and 14.48% of males and females took diabetes medications and 41.1% and 33.89% of males and females were on cholesterol medications (antihyperlipidemics) [7]. The rate of smokers seen in

men and women were 16.19% and 13.26% respectively, which are significantly lower than the numbers found internationally in Italy and Bosnia and Herzegovina [7,10].

Table 3. Demographics of respondents observed in the United States (Jenkins & Ofstedal, 2014) and (He et al., 2021)

Study Type: Cross Sectional			
Country	Characteristic	% Identified	
United States (2005-2006) [7,11]**	**Age** [7]	Male	Female
	50–59	38.92	37.11
	60–69	31.86	28.76
	70–79	19.38	20.75
	80–89	9.85	13.39
	Education [11]	All Participants	
	≤ Highschool	27.8	
	Highschool	24.1	
	Some College	28.5	
	≥ College Graduate	19.6	
	Employment Status [11]		
	Unemployed	19.6	
	Employed, Student, or Retired	80.4	
	Family Income to Poverty Ratio % [11]		
	≤100%	16.9	
	100%-299%	41	
	300%-499%	22.8	
	≥500%	19.3	

	Risk Factors [7]	Male	Female
	Hypertension	55.18	50.97
	Diabetes	16.19	13.26
	Current Smoker	16.19	13.26
	On Cholesterol Medication	41.1	33.89

**Combined data from two different surveys may not represent the same observed populations.

Various trends identified by the 1999-2018 study on US respondents found correlations between education and income with CVD risk factors [11]. Between education levels, those with a college education and above had lower mean BMI, BP, hemoglobin A1c (HbA1c), smoking rate, and 10 year risk of ASCVD compared to those at lower education levels [11]. Those with an education below a highschool diploma had the highest rates of 10 year ASCVD risk and HbA1c [11]. Trends between different levels of family income found that those with a family income to poverty ratio of ≥500% had lower BMI, HbA1c, smoking rate, and 10 year risk of ASCVD with the inverse being true for those under the poverty line [11].

Retrospective Cohort Studies

The data from the retrospective cohort study on a Korean population illustrates the rates of CVD risk factors and mortalities between different SES levels with demographic data shown in Table 4 [12]. The age distribution of the observed population has the oldest mean population for the higher SES group, while the middle SES was the youngest on average[12]. Cardiovascular health tends to deteriorate with age and the rates of CVD risk factors tended to be the greatest in the high SES population, while also having the oldest mean age; however, rates of HT and diabetes tended to align closest to the low SES group [12]. Middle SES individuals had the lowest rates of HT of 36.5 compared to the high SES and low SES groups with 41.7% and 40.5% respectively [12]. The middle SES group also had the lowest rate for diabetes of 10% and the lowest mean BMI of 23.4 kg/mg^2, while having the highest rate of current smokers [12]. Despite lower observed CVD risk factors in low SES compared to high SES groups, in respect to CVD mortality, low SES populations had a much higher rate of cardiovascular deaths of 1.2% compared to the high and middle groups who had 0.7% and 0.8% respectively [12]. This illustrates a trend of older groups inherently having higher rates of CVD risk factors; however, despite the age gap between the high and low SES populations their cardiovascular health was similar, while the youngest middle SES group had significantly lower rates of CVD risk factors [12].

Table 4. CVD statistics from observed population in Korean (Sung et al., 2020)

Study Type:				

Retrospective Cohort Study				
Country	Characteristic	Identified (% or mean if specified)		
Korea (2020) [12]	SES:	High	Middle	Low
	Age (mean)	46.2	40.8	43.4
	CVD mortalities	0.7	0.8	1.2
	CVD Risk Factors			
	Hypertension	41.7	36.5	40.5
	Diabetes	11.7	10	11.3
	Former Smoker	6.6	4	2.4
	Current Smoker	31.7	36.3	27.8
	BMI (mean kg/m^2)	23.9	23.4	23.2
	Cholesterol (mean mg/dL)	198.2	192.1	191.8

Another study analyzed populations from two different regions: Australia, and Asia, using education as the measurement of SES to identify the relationship between SES and CVD [8]. CVD risk factor rates tended to increase among the “primary education” or “no education” groups showing an inverse relationship between education and CVD risk factors [8]. Diabetic rates were around 4.4% for the lowest educational group and 2.1% for the highest educational group [8]. Smoking rates were also more than double between the highest and lowest SES groups with 10% and 22% respectively [8].

Table 5. CVD statistics from observed population in Australia (Woodward et al., 2015)

Study Type: Retrospective Cohort Study				
Continent	Characteristic	Identified (% or mean if specified)		
Australia (2015) [8]	Education:	Tertiary	Secondary	≤ Primary
	Age (mean)	56	58	61
	CVD Risk Factors			

	Systolic Blood pressure (mean mm Hg)	132	135	136
	Diabetes	2.1	3.3	4.4
	Current Smokers	10	19	22
	BMI (mean kg/m^2)	25.3	26	26.9
	Cholesterol (mean mg/dL)	98.6	100.4	101.4

The observed populations in Asia (Table 6) illustrated a similar distribution of ages, but the secondary education group was the youngest with an average age of 48 [8]. CVD risk factors trended the same direction as the Australian population as the lowest education group had higher rates and mean measured CVD risk factors than the highest SES group [8]. However, mean total cholesterol levels trended the opposite direction as the tertiary education group had a mean total cholesterol of 88.1 mg/dL while the lowest education group had 86.3 mg/dL [8]. There was higher disparity in the smoking rates between SES compared to the Australian population and higher rates of smoking as the lowest SES group was composed of 42% current smokers and 16% in the highest group [8].

Table 6. CVD statistics from observed populations in Asia (Woodward et al., 2015)

Study Type: Retrospective Cohort Study				
Continent	Characteristic	Identified (% or mean if specified)		
Asia (2015) [8]	Education:	Tertiary	Secondary	≤ Primary
	Age (mean)	50	48	55
	CVD Risk Factors			
	Systolic Blood pressure (mean mm Hg)	123	124	124
	Diabetes	4.3	4.6	4.7
	Current Smokers	16	30	42
	BMI (mean kg/m^2)	22.7	22.9	23.3
	Cholesterol (mean mg/dL)	88.1	87.2	86.3

DISCUSSION:

Though a correlation between SES and CVD had been previously identified, a quantified measure of the disparity in cardiovascular health caused by economic factors was generally unknown. The key finding of this review is that there is a strong correlation between SES and CVD, with a large gap in CVD risk factors between lower and higher SES populations. In Bosnia and Herzegovina, higher disparity in rates of CVD risk factors of HT, smoking, diabetes, and cholesterol were found, which aligns with the high SES inequality shown in the bimodal distribution of wealth index in the respondent population. Another factor that was utilized as a measure of SES was education and occupational status, which showed a strong correlation with CVD risk factors. The highest educated groups were associated with increased management rate for CVD risk factors, while having lower BMI, BP/HT, rate of diabetes, and smokers. The lowest educational groups exhibited the highest rates of CVD risk factors and lower rates of management in comparison to higher educated groups, which was also found between occupational classes. This trend could be identified in most analyzed populations with the exception of South Korea, who illustrated an inverse relationship with higher CVD risk rates associated with the highest SES group, which could be explained by the age distribution of the population with the majority of higher SES individuals being much older than the lower and middle SES groups. Despite this relationship found in South Korea, the low SES population had the highest mortality rates from CVD compared to the high SES group. Another relationship found throughout this review was high socio-economic disparity found between genders as males tended to have higher occupation and educational status compared to females; however, no explicit trend was found regarding CVD risk disparity between males and females in this review. The data shows that despite factors such as age and gender, lower SES populations based on educational attainment and occupational status tended to be disproportionately impacted by higher rates of CVD risk factors and tended to monitor their cardiovascular health less compared to higher SES groups. This shows a clear deviation in health related behavior between different SES populations that manifests itself through worsened cardiovascular health and higher rates of CVD in less advantaged populations.

The implications of understanding the gap in health and treatment of different SES populations and their CVD risk can help lower SES communities' susceptibility towards CVD. With proper knowledge on the importance and extent of the disparity between higher and lower income individuals can help make steps towards taking down the economic and educational barriers to healthcare and treatment that lower SES people face. Though this review is limited in its global scope of the issue of CVD and only looks at socioeconomic factors such as education, employment, and income without considering the multitude of economic and global factors that could impact the cardiovascular health of a population. Furthermore, data utilized for the purposes of this review may not be reflective of current populations and trends, especially given the potential confounding variables that could be playing a role in different countries. Additionally, self-reported data from surveys introduces biases into the responses that may have skewed the data. This review, however, is still essential towards understanding the detrimental effect of CVD on lower SES communities. It is advised that further research and initiative is

taken towards helping lower SES communities with their cardiovascular health to eliminate SES disparities in CVD.

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