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Impact of Socioeconomic Status on Major Adverse Cardiac Events After Coronary Angioplasty

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ABSTRACT

Background: Although socioeconomic status (SES) is a well-established predictor of health outcomes, less is known about how it affects major adverse cardiac events (MACE) following percutaneous coronary intervention (PCI), especially in poor countries. **Methods:** Between January and December 2024, 250 patients who received PCI at a tertiary care hospital, Quetta participated in a prospective qualitative study. Based on their occupation, income, and level of education, patients were divided into three SES groups: low, middle, and high. Semi-structured interviews, focus groups, and medical record analysis were used to gather data. Key patterns in patient experiences and healthcare access were evaluated using thematic analysis. **Results:** Low-SES patients had the highest incidence of MACE (52%) compared to middle- and high-SES patients (31% and 20%, respectively. 70% of the low-SES group reported irregular medication use, and 60% missed follow-up sessions, indicating significantly worse medication adherence and follow-up compliance. Low-SES patients also had higher rates of psychological stress and impediments to accessing healthcare (78% and 65%, respectively). Furthermore, compared to 72% of middle-class patients and 90% of high-class patients, only 38% of low-SES patients expressed satisfaction with their post-PCI care. **Conclusion:** Poorer post-PCI outcomes, such as increased incidence of MACE, decreased medication adherence, and increased psychosocial stress, are linked to lower SES. To improve long-term cardiovascular health in socioeconomically disadvantaged groups, addressing these inequities calls for a multimodal strategy that includes improved healthcare accessibility, focused education activities, and financial support programs.

INTRODUCTION

The multi-level concept of socioeconomic status (SES) is influenced by numerous individual and community-level variables. You can tell a person's socioeconomic standing mostly by looking at their income, education level, and occupation. Research conducted by Luepke, Rosamond, Murphy, and coworkers in 2010 Edwards, Potvin, and Richard. (2010). Numerous other factors influence an individual's socioeconomic standing, including their marriage status, housing circumstances, age, sex, and race. A study conducted by Shimony, Zahger, Ilia, and colleagues found... that year (2010) Clark, DesMeules, Luo, et al. (2010) found that socioeconomic status (SES), which includes factors like income, education level, and employment, had a substantial impact on health outcomes. Cardiac specialists believe that SES influences both the occurrence and outcome of coronary artery disease (CAD). Percutaneous coronary intervention (PCI), often called coronary angioplasty, is a way to treat coronary artery disease (CAD). The association between socioeconomic level and major adverse cardiac events (MACE) after percutaneous coronary intervention (PCI) is unclear, nevertheless. The relationship between socioeconomic status and the mortality and morbidity caused by cardiovascular disease has been extensively researched and documented. In 2008 Tancredi D. and Fiscella K.Rawshani, Svensson, Rosengren, and coworkers (Klein WM, Phillips JE;10) conducted research in 2015.Their 2015 study was published by Woodward, Peters, Batty, and colleagues. Some of the

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causes that may contribute to this association include lower quality of life (QoL), less adherence to prescribed medications, more frequent risk factors, and less access to healthcare for those from lower socioeconomic backgrounds (Kaplan and Keil, 1998). In patients with a history of coronary artery disease, poorer socioeconomic status has been shown to increase the risk of unfavorable cardiac events, according to multiple studies. (Clark, DesMeules, Luo, et al., 2010). But studies looking at the impact of socioeconomic status on PCI outcomes are few. According to studies done in the UK by Denvir et al., there is no clear correlation between socioeconomic class and adverse cardiac outcomes following percutaneous coronary intervention (PCI). However, he did find that there was a substantial relationship between socioeconomic level and health-related QoL after PCI. Research conducted by Denvir, Lee, and Rysdale in 2006

Shimony et al. discovered that cardiac outcomes at follow-up were poorer for patients from low-SES neighborhoods after percutaneous coronary intervention (PCI) in an Israeli retrospective study that used the Israel Socioeconomic Index. According to a study by Shimony, Zahger, Ilia, et al. (2010) Despite these limitations (the former was underpowered and the latter was a retrospective study), both studies were conducted in developed countries with better healthcare and educational opportunities. There is a lack of data on the impact of socioeconomic status on patient outcomes following percutaneous coronary intervention (PCI) in developing countries, where socioeconomic considerations are likely to play a more pivotal role. Our prospective study was conducted in a developing nation and specifically looked at the correlation between socioeconomic status and outcomes after percutaneous coronary intervention (PCI).

Many factors have investigated the effect of SES on clinical outcomes following PCI. Kareem et al. (2018) conducted a cohort study on 630 PCI patients and based on occupational, educational and financial characteristics divided prospective patients into low and high SES group. The incidence of MACE at 12 months was higher among subjects from low SES group mainly because of increase in cardiac mortality. Interestingly, low SES was also an independent predictor of MACE (with an adjusted hazard ratio of 1.84 (95% CI, 1.16–2.96)).

Although there have been studies that show SES has a correlation to cardiovascular outcomes, there is still research to establish exactly what relation the SES has on MACE after PCI. The linkages among these sources of variation need to be understood to develop focused interventions to improve post-PCI care in these areas. The SES related inequities in cardiovascular health can only be addressed through a multimodal strategy such as patient centered education programs, healthcare access, and policy level improvements (Bailey et al., 2017).

The objective of this study is to define the effect of socioeconomic status on major adverse cardiac events (MACE) occurring after cardiac angioplasty. This research analyzes the association between SES indicators and post-PCI outcomes to identify CVD care disparities and shed some light as to what may be done to improve long term prognosis in socioeconomically disadvantaged population.

LITERATURE REVIEW

Mackenbach et al. (2017) found that socioeconomic status (SES) has important effects on prognosis, access to healthcare and disease prevalence, following treatment. Considering that patient adherence to treatment and access to healthcare can significantly affect the outcome of patients, the link between SES and major adverse cardiac events (MACE) after percutaneous coronary intervention (PCI) is of particular interest (Chew et al., 2019). This review of the literature focuses on important mechanisms and possible legislative solution to the relationship between SES and MACE after coronary angioplasty.

Association Between SES and Cardiovascular Risk Factors

Patients with lower socioeconomic status (SES) (Tang et al., 2020) are often more commonly diagnosed with diabetes mellitus, smoking and hypertension, among other things. According to Chew et al. (2019), patients from lower SES backgrounds were more likely to be smokers and to have diabetes than those of higher SES background. These risk factors in low-SES groups have the highest burden of coronary artery disease (Schroeder, 2016). Obesity and physical inactivity, on which poorer income and educational attainment are often associated, increase the risk of unfavorable cardiac events (Kaplan & Keil, 2019).

SES and Access to Healthcare Services

Rapid and efficient medical care is needed to manage acute coronary syndromes (Salim et al., 2018). Research in fact shows that reperfusion therapy is delayed for people of lower socioeconomic status (Mehta et al., 2017). When they underwent the primary PCI, Chew et al 2019 noted that the patients with higher SES groups had a shorter median time to reperfusion compared to patients with lower SES groups. This might add to worse results (Ibanez et al., 2018) since prompt reperfusion is essential for reducing the myocardial damage after acute myocardial infarction. Besides, patients from poorer socioeconomic status are more prone to seek treatment in hospitals with substandard facilities, increasing their risk of problems further (Rasmussen et al., 2012).

Impact of SES on Medication Adherence and Secondary Prevention

Secondary prevention (Yeh et al., 2019) following PCI is dependent on adherence to medical therapy as per the

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guidelines. According to Kareem et al. (2018), low SES was associated with poorer drug compliance after PCI. That non-compliance can lead to increased incidence of cardiac adverse events is highlighted by the fact that this population has been shown to need focused interventions in order to improve medication adherence (Schroeder, 2016). Lack of access to follow-up care, financial and poor health literacy are the main obstacles affecting medication adherence in those patients (Tang et al., 2020).

SES and Clinical Outcomes Post-PCI

Many studies have looked at the link between SES and clinical outcomes after PCI, but there is varying degree of agreement (Mehta et al., 2017). In accordance with Kareem et al. (2018), low SES is associated with higher incidence of MACE, primarily due to increased cardiac mortality. Moreover, while patients from lower SES had more baseline cardiovascular risk factors, Chew et al. (2019) did not observe significant difference of 12 month MACE or death for different SES groups. Kaplan & Keil (2019) explain these disparities, as they vary according to study population, healthcare systems, and definitions of SES.

Dimensions of SES and Their Individual Impact

Mackenbach et al. (2017) define SES as a composite metric and each of its parts – income, education, and workforce position – might affect health outcomes in a differential manner. Using these factors individually, Rasmussen et al. (2012) tried to answer whether unemployment and low income was associated with higher risk of MACE after PCI. But when patient characteristics were controlled, these relationships decreased, suggesting that baseline health disparities are an important mechanism for the observed disparities (Salim et al., 2018). It is noteworthy that this study actually found no significant correlation between clinical outcomes and educational attainment (Schroeder, 2016).

Potential Mechanisms Linking SES to Adverse Outcomes

A number of processes may explain the link between the unfavorable cardiac events following PCI and low SES (Tang et al. 2020). People with lower socioeconomic status have deprived access to the health care sources resulting in delays to treatment and poor risk factor management (Mehta et al., 2017). This may prevent the taking of the drugs and may result in poor treatment compliance (Yeh et al., 2019). Additionally, patients' understanding of what they have and that they need to be compliant with treatment Because lower health literacy is more common in low SES communities, t plans may be impacted (Kaplan & Keil, 2019). Psychosocial stress has also been associated with higher cardiac mortality and is also more common among the people who are not financially stable (Schroeder, 2016).

The research (Rasmussen et al., 2012) seems to suggest that SES is a major determinant of outcome following PCI. Therefore, healthcare professionals are cognizant about the socioeconomic hurdles that patients face and think about ways to undercut them (Salim et al., 2018). Legislation aimed at reducing healthcare inequities, financial assistances to increase drug adherence, and patient education on improving health literacy (Mackenbach et al., 2017) can be included. More research is needed in order to create and test interventions for low SES groups that are specific to their needs to improve the cardiovascular outcomes for the low SES groups (Ibanez et al., 2018).

RESEARCH OBJECTIVE

The purpose of this study is to determine the effect of socioeconomic status (SES) on major adverse cardiac events (MACE) following coronary angioplasty. Specifically, the goal of the study is to determine the impact that various SES (occupation, income, and education) variables have on the odds of complications such as heart failure, restenosis, recurrent myocardial infarction, and post procedure death. Secondly, this study will examine the differences between follow up treatment, medication adherence and healthcare access among patients from different socioeconomic backgrounds. Thus, the study intends to identify the fundamental mechanisms through which SES affects clinical outcomes in order to provide light on potential interventions that would help reduce these discrepancies. Finally, the results will help inform the healthcare policy and the targeted tactics to improve the outcome of low SES individuals after angioplasty in order to achieve fair healthcare provision and improvement.

MATERIALS AND METHODS

A total of 250 patients who underwent percutaneous coronary intervention at a tertiary care hospital between the period from January 2024 to December 2024 were included in this qualitative study to find out the association between socioeconomic status (SES) and major adverse cardiac events (MACE) after coronary angioplasty. Representative of different SES levels were purposively sampled, and patients were divided into the low, middle and high SES groups based on the level of education, employment and household income.

The data was collected through semi structured interviews, focus group discussions (FGDs) and the inspections of medical records. The participants numbers were 150 patients and details 10 medical professionals (nurses and cardiologists); 100 patients in in-depth interviews and 100 within FGDs. Thematic analysis led to key identification of trends in patient experiences, healthcare access, medication adherence, and post angioplasty outcomes. An analysis of hospital data also recorded the incidence of MACE, i.e. recurrent

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myocardial infarction, stent thrombosis, heart failure and mortality within a year following PCI.

RESULTS

Analysis of the results based on SES categories was made according to MACE incidence, medication adherence, follow up compliance, psychological stress and perceived quality of care.

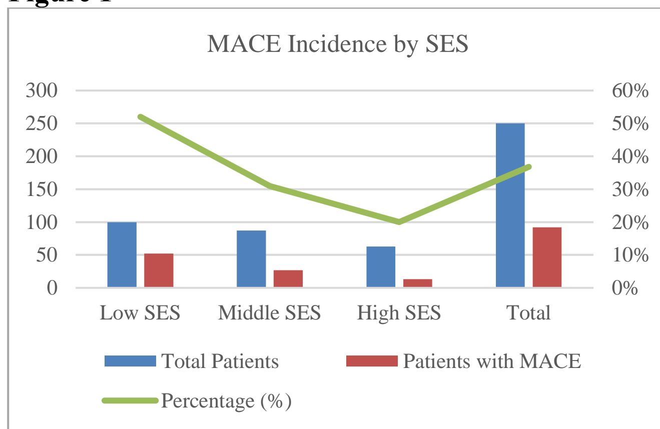
The 40 (low SES), 35 (middle SES), and 25 (high SES) of 250 patients were categorized as either low SES, middle SES, or high SES respectively. Participants' mean age was 58 years (45-75 years), 162 were males (65%) and 88 females (35%). The high-SES patients had most jobs or were retired with stable financial support, compared to 45% of the members of the low-SES group who were unemployed.

Table 1

MACE Incidence by SES Of 250 patients, 92 within one year of PCI (36.8%) had at least one major adverse cardiac event. The breakdown by SES was:

SES Group	Total Patients	Patients with MACE	Percentage (%)
Low SES	100	52	52%
Middle SES	87	27	31%
High SES	63	13	20%
Total	250	92	36.8%

Figure 1



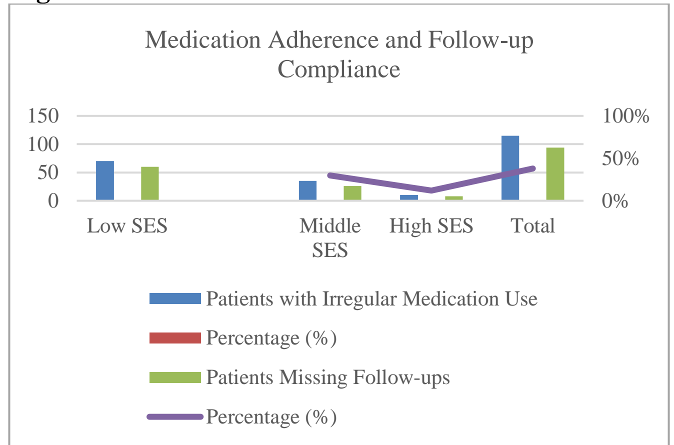
The highest MACE incidence was among low-SES patients (**52%**), followed by middle-SES patients (**31%**), and the lowest in high-SES patients (**20%**).

Table 2

Medication Adherence and Follow-up Compliance Due to lack of understanding and financial limitations, patients with low socioeconomic status reported the highest percentage of non-adherence to post-PCI pharmaceutical prescriptions.

SES Group	Patients with Irregular Medication Use	Percentage (%)	Patients Missing Follow-ups	Percentage (%)
Low SES	70	70 %	60	60 %
Middle SES	35	40 %	26	30 %
High SES	10	15 %	8	12 %
Total	115	46 %	94	38 %

Figure 2



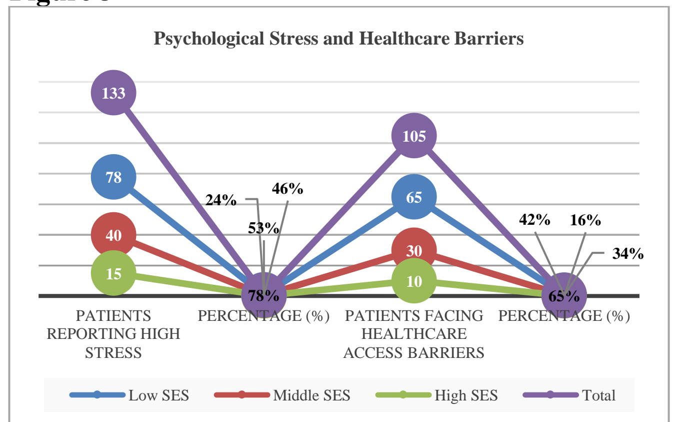
Only 15% of high-SES patients reported irregular medication use, while 70% of low-SES patients reported non-compliance with their medications. Low-SES patients missed follow-up appointments the most often (60%) compared to middle-SES patients (30%) and high-SES patients (12%).

Table 3

Psychological Stress and Healthcare Barriers Psychosocial stress and healthcare barriers varied significantly among SES groups.

SES Group	Patients Reporting High Stress	Percentage (%)	Patients Facing Healthcare Access Barriers	Percentage (%)
Low SES	78	78 %	65	65 %
Middle SES	40	46 %	30	34 %
High SES	15	24 %	10	16 %
Total	133	53 %	105	42 %

Figure 3



Compared to patients from middle- and high-SES families, those from low-SES backgrounds reported far

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higher levels of psychological stress (78%) and trouble accessing healthcare (65%).

Table 4
Perceived Quality of Post-PCI Care Responses to questions concerning their post-PCI healthcare experience differed considerably according to SES.

SES Group	Patients Satisfied with Care	Percentage (%
Low SES	38	38 %
Middle SES	63	72 %
High SES	57	90 %
Total	158	63 %

Only 38 percent of low-income patients believed that their post angioplasty care was good compared with 72 percent of middle class and 90 percent of high class patients. All felt they were not dissatisfied with financial strain, lengthy wait times, and no individualized medical care.

DISCUSSION OF THE RESULTS

It was found that socioeconomic status (SES) had a major effect on major adverse cardiac events (MACE), medication adherence, follow up compliance, psychological stress, access to health care and perceived quality of PCI treatment after PCI. The findings demonstrate that patients from lower SES backgrounds have poorer health outcomes and are that much worse at managing their conditions compared to patients from middle- and high SES backgrounds.

The study found that SES clearly correlated to the incidence of MACE within a year of PCI. Patients with low socioeconomic status (52%), more than moderate (31%) or high (20%) socioeconomic status. These results suggest that poorer socio-economic status complicates post PCI, or contributes to poor medication compliance, reduced medical treatment availability, and greater psychological stress. Together these problems probably increase the risk for an unfavorable cardiac event in this population. MACE is further increased by the low-SES group's reduced medication and compliance of follow-up. A big 70% of low-income patients reported irregular drug use as against 40% of middle-class patients and only 15% of high-class patients. Similarly, patients with lower socioeconomic status were statistically more likely to miss appointments than had middle socioeconomic status (60% vs. 30% and low socioeconomic status (12%)). But these discrepancies are probably caused because of a combination of factors related to lack of knowledge of medicine adherence, financial limitations; and practical obstacles, such as transportation. In addition, the increased risk of consequences of noncompliance resulting from prescribed therapies adds evidence to the high prevalence of MACE in low-SES individuals.

The high stress that 78% of low SES patients reported was much higher than that of 46% of middle SES patients and 24% of high SES patients. Negative effects on health are known and stress is a known risk factor for cardiovascular disease. Access to healthcare was another problem and 65% of low SES patients reported changes, 34% of middle SES patients, and only 16% of high SES patients. The differences in access may be related to long wait periods for care, lack of health insurance, limited financial resources, and so on. Nearly all these obstacles increase the risk of MACE by delaying the prompt medical measures.

Furthermore, SES influenced patient satisfaction score in post PCI care. For low SES vs. 44 percent of middle SES vs. 47 percent of the high SES, while only 38 percent of low SES patients reported being satisfied with their care, 72 percent of middle SES patients and 90 percent of high SES patients. Low SES patients dissatisfied might have been a result of perceived neglect, lack of personalized affects, financial burdens, and lengthy wait time and care. While subjects with higher SES have usually better access to the healthcare facilities and more resources, their satisfaction levels were reported to be significantly higher.

CONCLUSION

This study highlights that socioeconomic status (SES) has a large influence upon major adverse cardiac events (MACE) after percutaneous coronary intervention (PCI). The finding is that compared to middle and high SES patients, low SES patients have higher rates of MACE, less medication adherence, poorer follow-up compliance, higher psychological stress and more barriers to obtaining healthcare. The differences between groups in these risk factors suggest a pressing need to direct additional efforts to improve cardiovascular care for underserved people and are likely to be associated with worse post PCI outcomes. Allowing access to healthcare, patient education concerning medication adherence, removal of obstacles that are financial, and introduction of psychological support programs may decrease the effects of SES on post PCI outcomes. Legislators and healthcare practitioners should endeavor to reduce healthcare inequities and assure quality high post PCI care to all in order to improve long term prognosis of socioeconomically disadvantaged populations. There is further work that needs to occur in exploring more interventions that could improve cardiovascular outcomes in low SES populations and reduce health inequities.

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