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Trends in Selected Heart Diseases Among Below Poverty Line Population From Karnataka State, South India

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Cover Page Footnote

Suvarna Arogya Suraksha Trust (SAST) , Bangalore

ORIGINAL STUDY

Trends in Selected Heart Diseases Among Below Poverty Line Population From Karnataka State, South India

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Abstract

Objective: **The poor socio-economic status is also one of the reasons for the growing cases of cardiovascular diseases among socially excluded sections today. The study aims to reveal the most common heart diseases found among the below-the-poverty-line (BPL) population in Karnataka State (South India) using SAST data.**

Method: **This study has been done using the data found in the Suvarna Arogya Suraksha Trust (SAST) (Government of Karnataka, India) on below-the-poverty line (BPL) categories who received treatment for various cardiovascular diseases during 2010−2021 using multinomial logistic regression.**

Results and discussion: **The study found that Coronary artery disease prevalence has remained high, affecting 89% of the population consistently from 2013 to 14 onwards, with minor fluctuations. People from underdeveloped regions (districts) have more cases of coronary artery disease. There has been a slight decrease in prevalence from 2018 to 19 to 2020−21. The prevalence rates for myocardial infarction were at 3.9%, Bradycardia at 2.3%, and pericarditis at 1.08% as found.**

Conclusion: **Coronary artery disease has shown a high trend. It is hypothesized that poverty, material deprivation, social exclusion, health disparity, and poor social cohesion throughout the life course among the BPL community could be the key reasons for poor cardiac care and related outcomes. Measures are required to address the health disparity among the poor.**

Keywords: Heart disease, Below the poverty line, Socio-economic status, Health disparity, Poverty

1. Introduction

Despite tremendous advances in science and technology, cardiovascular disease (CVD) or heart-related issues remain one of the primary causes of death in developing countries. Heart disease will be the cause of one out of every four fatalities in India [1]. Cardiovascular diseases account for 50% of all heart attacks in those under the age of 50 in India, accounting for 25% of all recorded heart attacks in people under the age of 40. Over the last three decades, health specialists have established a link between the population's socioeconomic status (SES) and heart-related disorders, even if the precise role of socioeconomic status in the prevalence of various cardiovascular disease risks is still unknown [2].

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According to estimates from multiple research studies, "*India has approximately 100 million BP, approximately 60 million diabetics, and nearly a million tobacco and alcohol-related deaths* [3]." Traditional risk factors for heart disease include high blood pressure, diabetes, family history, smoking, lifestyle, and other variables. According to the study, heart-related illnesses account for a significant part of mortality among the poor and homeless. Furthermore, multiple studies have connected increased heart problems related to morbidity and death to the hazardous environment to which largely impoverished individuals are constantly exposed [4–6].

According to studies, there is a clear and immediate connection between cardiovascular disorders and important variables such as low income, occupation, race, class, education level, household wealth, stress, poor lifestyle, and so on, according to studies [4,5]. According to research, poverty is the most significant socioeconomic predictor connected to cardiovascular disease cases, particularly mortality from coronary artery disease [5–7]. In India, caste and religion also play important roles when it comes to barriers to excellent health care and health disparities. It is also emphasised that physical activities, as well as cardiovascular health, are part of the occupation of disadvantaged individuals [2].

Furthermore, biological, behavioral, and psychosocial risk factors are more prevalent among the poor and contribute to the increased burden of CVD [7]. It has also been found that education, rather than wealth, is the most important factor in improving eating habits, lifestyles, and good health behaviours, especially among excluded people who face financial difficulties, work-related stress, and limited access to cutting-edge cardiac diagnostic services in underdeveloped areas [8]. The study's main goal is to use Suvarna Arogya Suraksha Trust Data (SAST) to uncover trends in selected cardiac illnesses among the BPL population in Karnataka state (South India).

2. Methods

The Government of Karnataka (South India) operates the Suvarna Arogya Suraksha Trust (SAST). This organization's job is to oversee all government health insurance programmes in the state of Karnataka. The current study has been conducted based on information acquired from the Trust for the years 2010 through 2021. BPL refers to individuals whose annual income is less than (about) Rs. 125,000 ($1751). The present study was done on BPL patients treated for various heart issues in the last ten years under various insurance programmes (2010–2021) in Karnataka state. The study uses a multinomial to consider the patients (less than 250) being treated for a specific heart condition during the study period. Therefore, logistic regression was used as a model for estimating the various determinants linked to the different heart diseases that led to a particular treatment procedure adopted by hospitals. The SAST contains data for a total of 28 different types of cardiac conditions and diseases. However, it is statistically challenging to consider cases that had fewer than 250 cases. Hence, seven heart procedures with more than 250 cases have been considered for the study. The remaining cardiac disorders are categorised as "OTHER TYPES" for the analysis.

We use the "OTHER TYPES" category as a base category while reporting the results of estimation. Heart diseases considered in the estimation are arrhythmia (an abnormal heartbeat), Bradycardia, Myocardial Infarction, Pericarditis, Valvotomy, Ductus Arteriosus, Coronary artery disease (blockages), and others. Independent variables used in the estimation are age, gender, the development status of districts, and caste. India has four major caste groups: Schedule Caste, known as SC (they are the most backward group in India), Scheduled Tribes (ST) (they are severally backward), OBC (other backward caste or economically backward), and the others who do not belong to any of the above-given groups. The interpretation of all coefficients concerning a particular heart procedure (cases) is in comparison with 'others, and in the case of categorical variables, it is concerning the base category of the variable as an additional condition. Districts have been classified as developed, developing, and underdeveloped as per the government survey report. There may be other socio-economic variables that influence the presence of a particular heart ailment among people. However, due to the non-availability of such variables, it won't be possible to include them. Since the study is based purely on secondary data, ethical approval will not apply.

3. Results

We have very limited socioeconomic data. Around 32% have studied up to primary education, while 34% have studied higher primary education, 12% up to college level, and others are unschooled. Most of them are from the very low-income group. More than 84% are from the unorganised sectors, and more than 63% are from rural backgrounds. Next, the district-wise distribution of patients who have

undergone different heart procedures (cases) and their respective percentages gives some interesting facts. The highest number of patients undergoing procedures for heart conditions is reported in underdeveloped districts of the state, followed by developing and developed districts. Underdeveloped districts and regions in the state have a higher population with low socio-economic status and poor health infrastructure. Further, among different heart diseases, coronary artery disease is the single-highest case found across all three categories of districts, accounting for about 89% of total cases. The caste-wise distribution of different heart cases gives a different picture. As seen in Table 1, the incidence of coronary artery disease dominates all other cases across different caste groups (India is basically a caste-based society, and caste is known as an 'endogamous group and marriage takes place

Table 1. Multinomial logistic regression result for determinants of different heart diseases.

Heart Diseases	Co-efficients	B	SE	df	*P* Value	Exp (Beta)	95% Confidence Interval for Exp (Beta)	
							Lower	Upper
Arrhythmia	Intercept	0.663	0.164	1	0.000			
	Age	−0.005	0.003	1	0.038	0.995	0.990	1.000
	Male	−0.734	0.090	1	0.000	0.480	0.402	0.573
	Female	0		1				
	Developed Region (Districts)	0.297	0.108	1	0.006	1.346	1.089	1.663
	Developing Region	0.230	0.111	1	0.038	1.258	1.013	1.563
	Under Developed Region	0		1				
	SC	0.001	0.157	1	0.992	1.001	0.737	1.361
	ST	0.394	0.251	1	0.117	1.483	0.907	2.427
	Others	−0.283	0.110	1	0.010	0.753	0.607	0.935
	Minority	−0.147	0.131	1	0.263	0.863	0.667	1.117
	Other backward caste (OBC)	0		1				
Bradycardia	Intercept	−2.224	0.174	1	0.000			
	Age	0.055	0.003	1	0.000	1.057	1.051	1.062
	Male	−0.359	0.082	1	0.000	0.698	0.595	0.819
	Female	0		1				
	Developed Region	−0.371	0.097	1	0.000	0.690	0.571	0.834
	Developing Region	0.114	0.096	1	0.238	1.120	0.928	1.353
	Under Developed Region	0		1				
	SC	0.269	0.147	1	0.067	1.309	0.981	1.745
	ST	0.814	0.236	1	0.001	2.256	1.421	3.583
	Others	0.498	0.094	1	0.000	1.645	1.367	1.978
	Minority	−0.124	0.125	1	0.320	0.883	0.692	1.128
	OBC	0		1				
Myocardial Infraction	Intercept	−0.253	0.147	1	0.085			
	Age	0.026	0.002	1	0.000	1.026	1.022	1.031
	Male	0.541	0.079	1	0.000	1.718	1.472	2.007
	Female	0		1				
	Developed Region	−0.982	0.091	1	0.000	0.374	0.313	0.448
	Developing Region	−0.061	0.088	1	0.488	0.941	0.791	1.118
	Under Developed Region	0		1				
	SC (Most backward group)	0.432	0.129	1	0.001	1.541	1.196	1.986
	ST (Severely backward group)	0.442	0.222	1	0.046	1.556	1.008	2.403
	Others	−0.284	0.091	1	0.002	0.753	0.629	0.900
	Minority	0.207	0.107	1	0.054	1.230	0.997	1.517
	Other backward caste (OBC)	0		1				
Pericarditis	Intercept	3.332	0.152	1	0.000			
	Age	−0.064	0.003	1	0.000	0.938	0.933	0.943
	Male	−0.579	0.094	1	0.000	0.560	0.466	0.673
	Female	0		1				
	Developed Region	−0.082	0.112	1	0.463	0.921	0.740	1.147
	Developing Region	−0.034	0.109	1	0.754	0.966	0.780	1.197
	Under Developed Region	0		1				
	SC	−0.912	0.161	1	0.000	0.402	0.293	0.550
	ST	−0.931	0.265	1	0.000	0.394	0.235	0.662
	Others	−1.139	0.115	1	0.000	0.320	0.256	0.401
	Minority	−1.046	0.143	1	0.000	0.351	0.266	0.465
	Other backward caste (OBC)	0		1				

(*continued on next page*)

Table 1. (continued)

Heart Diseases	Co-efficients	B	SE	df	*P* Value	Exp (Beta)	95% Confidence Interval for Exp (Beta)	
							Lower	Upper
Valve diseases	Intercept	2.447	0.151	1	0.000			
	Age	−0.028	0.002	1	0.000	0.972	0.968	0.977
	Male	−1.039	0.091	1	0.000	0.354	0.296	0.423
	Female	0		1				
	Developed Region	−0.638	0.109	1	0.000	0.528	0.427	0.655
	Developing Region	−0.333	0.105	1	0.001	0.717	0.584	0.880
	Under Developed Region	0		1				
	SC	−0.199	0.151	1	0.187	0.819	0.609	1.101
	ST	−0.168	0.251	1	0.502	0.845	0.517	1.381
	Others	−0.473	0.108	1	0.000	0.623	0.504	0.770
	Minority	−0.892	0.146	1	0.000	0.410	0.308	0.546
	Other backward caste (OBC)	0		1				
Ductus Arteriosus	Intercept	4.439	0.167	1	0.000			
	Age	−0.144	0.005	1	0.000	0.866	0.857	0.875
	Male	−0.764	0.118	1	0.000	0.466	0.370	0.587
	Female	0		1				
	Developed Region	−0.424	0.146	1	0.004	0.655	0.492	0.871
	Developing Region	−0.320	0.134	1	0.017	0.726	0.559	0.944
	Under Developed Region	0		1				
	SC	−1.475	0.191	1	0.000	0.229	0.157	0.333
	ST	−1.394	0.291	1	0.000	0.248	0.140	0.439
	Others	−1.939	0.143	1	0.000	0.144	0.109	0.190
	Minority	−1.458	0.171	1	1	0.233	0.167	0.325
	Other backward caste (OBC)	0		1	1			
Coronary artery disease	Intercept	2.902	0.123	1	0.000			
	Age	0.011	0.002	1	0.000	1.011	1.007	1.015
	Male	0.187	0.068	1	0.006	1.206	1.056	1.377
	Female	0		1				
	Developed Region	−0.612	0.078	1	0.000	0.542	0.466	0.632
	Developing Region	−0.390	0.080	1	0.000	0.677	0.579	0.792
	Under Developed Region	0		1				
	SC	1.086	0.117	1	0.000	2.962	2.354	3.727
	ST	1.503	0.201	1	0.000	4.496	3.029	6.673
	Others	2.145	0.079	1	0.000	8.544	7.323	9.968
	Minority	1.336	0.095	1	0.000	3.805	3.157	4.585
	Other backward caste (OBC)	0		1				

Nagelkerke R Square is 0.216.

inside that group only'). However, it is highest among persons belonging to 'others (general category)' and lowest among the Other Backward Castes (OBCs).

In the case of an arrhythmia (irregular heartbeat) issue, age is negatively related and statistically significant. If there is an increase in age by one, it will lead to a decrease in abnormal heartbeat conditions by 0.995. Concerning gender, males have a lesser chance of having arrhythmias than females. As per the data, developed and developing districts have a higher chance of having arrhythmia cases than underdeveloped districts. In terms of caste groups, 'others' have a lesser chance of arrhythmia in comparison with OBCs, whereas for the rest of the groups, the coefficients are statistically insignificant (Table 1).

Concerning the Bradycardia (slow heartbeat rate) issue, age is found to be positively related. Males have a lesser chance of being affected by this problem in comparison with females. At the same time, the developed districts have fewer incidents of the problem that require advanced treatment. Except for the minority, all other caste groups have a higher chance of requiring this treatment in comparison with OBCs. For the myocardial infarction, age is positively related, and men have a higher chance of getting affected by the problem compared to women. Further, developed districts have a lower chance of having this problem in comparison with underdeveloped districts. As far as caste groups are concerned, people belonging to 'other' groups have a lesser chance of this problem, whereas all other groups are more vulnerable in comparison with OBCs (Table 1).

Regarding pericardial disease (pericarditis), age is negatively related, and males have a lesser chance

than females of getting affected by it. The developmental status of the district is not a significant determinant of this disorder. All caste groups have a lesser chance of getting *pericarditis* in comparison with the OBCs. Further, the determinants of valve diseases are the same as those of *pericarditis*. As far as the Ductus Arteriosus (opening between two major blood vessels) is concerned, babies of BPL families in developed and developing districts have a lower chance of developing the problem in comparison with underdeveloped districts. The rest of the determinants are the same as those of valve diseases and *pericarditis*.

Coronary artery disease (blocks in the arteries) is the most common health issue undergone by most people and is a treatment for opening clogged heart arteries. Here, age is positively related, and men have more chances of having an ailment requiring this treatment in comparison with women. Further, people living in developed and developing districts have a lesser chance of having blocked arteries than those living in underdeveloped regions. All caste groups have a higher chance of getting affected by the disorder in comparison with the OBCs, but the size of the positive impact of 'others' is substantially higher than the rest of the caste groups, which is on the expected lines. Regarding the trend, the percentage of patients with arrhythmia has shown a fluctuating trend over the years, ranging from 0.9% in 2017–18 to 4.4% in 2019–20. Next, Similar to arrhythmia, Bradycardia percentages have varied, reaching the highest at 6.9% in 2019–20. However, the percentage of patients with Myocardial Infarction has increased steadily, reaching 35.5% in 2019–20. Also, the percentage of pericardial diseases has been relatively stable, with a slight increase in 2020–21 and Valve diseases have shown a consistent presence, with 16.2% in 2019–20. However, the percentage of patients with Ductus Arteriosus has shown variations but remains relatively low. Coronary artery disease has fluctuated, reaching a peak of 902.6% in 2017–18 and the percentage of other types of heart diseases has shown variability, with the highest at 14.2% in 2017–18. There's an increase in the overall percentage of heart diseases from 2017 to 18 to 2019–20, with a decrease in 2020–21 (Table 2).

4. Discussion

This study has the aim of tracing the trend of heart ailments among poverty-ridden people in south India. Although there is no strongly proven association between socioeconomic status and cardiovascular illnesses, there is undoubtedly a potential connection between these two crucial elements. This study has demonstrated that there is a connection between socio-economic issues and the incidence of some cardiac ailments among the BPL population, especially in the underdeveloped districts of Karnataka state. More heart-related cases in the underdeveloped districts might be due to low economic resources, unemployment, material deprivation, a low human development index, ecology, work hazards, poverty, poor health infrastructure, a lower per capita income, etc. [9]. The percentage of Arrhythmia remained consistently low from 2010 to 11 to 2017–18 (below 1%). A noticeable increase occurred from 2017 to 18 (0.9%) to 2019–20 (4.4%), followed by a slight decrease in 2020–21 (2.4%). Arrhythmia is common due to smoking, poor sleep quality, a poor lifestyle, drug abuse, stress, and alcohol, which may lead to arrhythmia as per previous studies and are sometimes common among poor people. Similar to arrhythmia, the percentage trend of Bradycardia remained very low initially, then increased notably from 2017 to 18 (2.3%) to 2019–20 (6.9%), and slightly decreased in 2020–21 (4.5%). Sometimes Bradycardia is due to heavy consumption of BP, alcohol, smoking, continued

Table 2. Trend analysis of heart diseases among BPL patients.

Year	Arrhythmia	Bradycardia	Myocardial Infraction	Pericardial disease	Valve diseases	Ductus Arteriosus	Coronary Artery Disease	OTHER TYPES	Total
2010–11	0.0	0.0	0.0	0.4	0.5	0.1	98.5	0.4	100.0
2011–12	0.0	0.0	0.0	0.0	0.0	0.0	99.3	0.0	100.0
2012–13	0.0	0.0	0.0	0.0	0.0	0.0	99.5	0.0	100.0
2013–14	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
2014–15	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
2015–16	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
2016–17	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
2017–18	0.9	2.3	2.3	0.6	1.0	0.6	89.6	0.8	100.0
2018–19	3.0	5.5	6.4	3.0	3.8	2.0	79.4	2.7	100.0
2019–20	4.4	6.9	15.5	4.0	4.4	2.4	80.6	3.1	100.0
2020–21	2.4	4.5	11.3	4.1	1.5	1.3	77.7	2.2	100.0

[a]Total column represents the sum of percentages for each category, and the values in each row add up to 100%.

stress and anxiety, and poor diet, which are found to be more common among disadvantaged sections.

The trend of Myocardial infarction Showed a significant increase from 2017 to 18 (2.3%) to 2019–20 (15.5%), and then decreased slightly in 2020–21 (11.3%). Myocardial infarction has strong social determinants, including material deprivation, income, race, caste, health disparity, poverty, migration status, education, social support, and poor health services, as some noted studies found [10–12]. Corroborating this, a study done in Bangladesh also revealed socio-demographic and other changeable risk factors for myocardial infarction. However, a Canadian-based study found no link between socioeconomic class and mortality 1 year after being hospitalised for myocardial infarction [13]. Further, pericardial diseases remained relatively stable from 2017 to 18 to 2020–21, fluctuating between 0.6% and 4.1%. Study found pericardial diseases more in poor and developing nations [4]. Regarding valve diseases, initially low but showed a steady increase over the years, with fluctuations. Increased notably from 2017 to 18 (1.0%) to 2019–20 (4.4%) and then decreased slightly in 2020–21 (1.5%). A study partially proved the link between poor rural backgrounds and the low socioeconomic status of the patients [14]. This corroborates the current study, as the majority of the BPL are from areas in India. Next, Ductus Arteriosus remained consistently low over the years, with minor fluctuations as the trend found with slight presence (2.4%) in 2019–20. It has been found that Ductus Arteriosus have a link to poor nutrition during pregnancy, a lack of anti-natel checkups, smoking and chewing gutka or jarda by the mothers, heredity, etc., among the parents belong to the poor section like BPL [15,16]. The trend of coronary artery initially high in 2010–11 (98.5%) and remained relatively stable until 2017–18. A noticeable decrease occurred from 2017 to 18 (89.6%) to 2019–20 (80.6%), followed by a further decrease in 2020–21 (77.7%). Coronary artery disease was found to be the major heart-related issue among BPL sections as per the data (Table 2), and studies have shown that unhealthy lifestyles, obesity, poor diet, drugs, smoking, and the habit of consuming more junk foods and low-quality food made out of rich trans-fats, consuming more alcohol and cigars, health disparity, social disadvantage, and health care behaviours, which are common among low socio-economic sections of society, lead to a higher prevalence of coronary artery disease [17–19]. Regarding other type of heart issues, a small percentage in 2010–11 (0.4%) and remained stable until 2017–18 can be seen. A slight increase occurred from 2017 to 18 (0.8%) to 2019–20 (3.1%), followed by a decrease in 2020–21 (2.2%) also noted [20].

It is suggested that, through NGOs, the government take steps to educate the BPL sections about the importance of yearly health check-ups, health literacy, and good health behaviors. The government and NGOs must regularly conduct screening camps in areas where a high proportion of BPL people live. Additionally, the state must speed up the process to improve the socio-economic conditions of the BPL sections. Strengthening universal health care is also a need of the hour [14,15]. The primary limitation of the study is the absence of comprehensive socioeconomic profiles for every BPL patient with the SAST trust. The study is cross-sectional and based on survey data. Since the data is from a single source, the information may not be an accurate reflection of the BPL sections of the state as a whole. Heart patients who underwent surgery or received treatment were the only ones included, and those who had already passed away were not. Work hazards and environmental issues are not found in the data. It is advised that future research is required to find out the link between socio-economic status and the post-cardio-surgery survival rate among BPL sections in the state or country. Also, longitudinal studies need to be done on large-scale cases and treatment disparities [21].

5. Conclusion

This study is based on the data retrieved from the Suvarna Arogya Suraksha Trust (2010–2020) to understand the trend in the occurrence of heart ailments among BPL families. A total of 27 different heart problems have been noted in the data. From 2010 to 11 to 2017–18, the prevalence of Arrhythmia, Bradycardia, Myocardial Infarction, Pericardial Disease, Valve Diseases, and Ductus Arteriosus diseases remained at 0%, indicating very low occurrences. However, from 2017 to 18 to 2020–21, there is a noticeable increase in the prevalence of these diseases, especially from 2018 to 19 to 2019–20. From 2019 to 20 to 2020–21 onwards, there is a slight decrease in prevalence rate. Coronary arteries were found to be the highest in the study. The prevalence of Coronary Artery Disease remained consistently high from 2013 to 14 onwards, with minor fluctuations and there is a slight decrease in prevalence from 2018 to 19 to 2020–21. There is a gradual increase in the prevalence of "Other Types" of heart diseases from 2010 to 11 to 2017–18 and from 2017 to 18 to 2019–20, there is a significant increase in prevalence, followed by a slight decrease in 2020–21. People from the

underdeveloped regions of the state and people from backward castes have reported more cases of coronary artery disease because of low SES and poor health infrastructure. Further investigation into the underlying causes of these trends would be necessary for a comprehensive understanding. The politico-economics of the poverty alleviation programme and health inequality and infrastructure issues require greater attention than ever today.

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Conflict of interest

None.

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