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Out-of-Pocket Expenditures of Myocardial Infarction Patients in Pondicherry, South India

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A B S T R A C T

Background: Myocardial infarction (MI) is a leading cause of morbidity and mortality worldwide. In India, incidence of MI is rapidly increasing due to lifestyle changes, ageing and rising healthcare costs. The out-of-pocket expenditure (OOPE) for MI care in India can be substantial, as majority of healthcare costs are paid by patients or their families. However, little is known about the actual OOPE incurred by MI patients in tertiary care centres in Pondicherry, South India. This study aims at estimating the OPPE by MI patients attending the tertiary care centre in Pondicherry. The findings can inform policymakers and healthcare providers in developing interventions to reduce the financial burden of MI care in patients and their families.

Methods: This was a hospital-based, cross–sectional study conducted on patients attending Cardiology's outpatient department OPD, who had myocardial infarction in the past for about 3 months to 3 years at the time of enrolment in the study. A pre-designed and validated questionnaire was used to collect information regarding socio-demographic details and cost of health expenditures (direct medical and non-medical costs and indirect cost for both the participants and caregivers). Data analysis was done using $SPSS_{24}$ Software. The median and inter-quartile range was used for assessing the cost of health expenditures.

Results: Study participants underwent invasive and non-invasive procedure as part of their management. More than 93% underwent invasive, and the cost ranges from 1,694.03 USD to 2470.00 USD (1,20,000 INR to 1,75,000 INR). They spent 10.58 USD to 21.17 USD (750 INR to 1,500 INR) for their monthly medication. The travel expenses for each follow-up visit were between 5.64 USD to 70.57 USD (400 INR and 5000 INR). The majority of participants received health insurance or reimbursement of 1834 USD (1,30,000 INR) from their firm, 12.7% of the participants lost a payment of 162 USD to 776.28 USD (11,500 INR – 55,000 INR).

Conclusion: The cost of the invasive procedure for myocardial infarction patients was 1694.03 USD to 2470.00 USD, which was the major share from the out-of-pocket expenditure compared with the other direct and indirect costs.

Key words: Direct cost, Indirect cost, Out-Of-Pocket expenditure, Myocardial infarction

Introduction

Myocardial Infarction (MI), commonly known as heart attack, is a major cause of mortality and morbidity worldwide. It occurs when the blood flow to a part of the heart is blocked, leading to damage or death of the heart muscle. In addition to its physical and emotional toll, MI also imposes a significant economic burden on patients and healthcare systems. Out-Of-Pocket Expenditures (OOPE) are defined as direct payments made by patients for healthcare

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services, medications, and other related expenses that are not covered by health insurance or other third-party payment mechanisms. OOPE can be a significant financial burden on patients and their families, especially in low- and middle-income countries where access to affordable healthcare and health insurance is limited.

In India, Cardio Vascular Diseases (CVDs) are the leading cause of death, accounting for 28 % of all deaths (1). The burden of CVDs is expected to rise in India due to demographic and lifestyle changes. Despite the provision of free or subsidized healthcare services by the government, OOPE remain high for patients with CVDs, including MI.

Several studies have documented the high OOPE incurred by patients with CVDs in India. A study conducted in Kerala reported that the mean OOPE for hospitalization due to CVDs was approximately 596 USD (43,849 INR) per patient, which accounted for 35 % of the annual household income of the patients (2). Another study conducted in a tertiary care hospital in New Delhi reported that the mean OOP expenditure for hospitalization due to CVDs was approximately 911 USD (66,860 INR) per patient, which accounted for 39 % of the annual household income of the patients (3).

Therefore, understanding the extent and nature of OOPE for MI patients is crucial for policymakers and healthcare providers to design and implement effective interventions that can reduce the financial burden on patients and improve their access to care.

This study aims to estimate the OOPE incurred by MI patients in a tertiary care center in Pondicherry, South India. By providing insights into the economic burden faced by MI patients, this study can inform policy and practice to improve the affordability and accessibility of healthcare services for this vulnerable population.

Materials and Methods

A hospital-based, cross–sectional study was conducted between January 2018 and March 2019 on patients with MI for about 3 months to 3 years attending the cardiology's Out Patient Department (OPD) at the time of enrolment in the study. This was a part of another study aimed to assess the quality of life and estimate the out-of-pocket expenditure regarding myocardial infarction patients in a tertiary care centre in Puducherry, in South India. The sample size calculation was based on a study by Rani et al. (4); the proportion of participants with poor quality of life was 28.9 %. Using the formula $4pq/d^2$, the minimum sample size calculated was 328, where d= 5 %, and p= 28.9 %. Acutely ill patients and elderly patients above 80 were excluded. The data was collected using the pre-designed and pre-tested questionnaire after obtaining **written informed consent** from the study participants. Information regarding participant's socio-demographic details, past history, personal history, blood pressure and anthropometric measurements, BMI and OOPE were obtained. The **socio-demographic details** included age, sex, educational qualification, occupation, monthly income, per capita income, marital status, total number of family members; the **past and personal history** included history of angina according to CCS grading, breathlessness according to NYHA classification, smoking habits, alcohol consumption, medication intake, clinical history regarding the type of surgery done and duration of hospital stay; **examination** included blood pressure measurement, height, weight and BMI; **OOPE** included direct medical costs like invasive procedure, follow-up, consultation, checkups and cost of medication per month. D**irect non-medical costs** included the amount spent for travel and accommodation during follow-up visits. **Indirect medical costs** according to patient's perspective included loss of wage, the amount reimbursed for health expenses (health insurance/ coverage scheme) and the caregiver's perspective like the loss of pay in taking care of the patient. D**ata analysis** was done in $SPSS_{24}$ Software. The median and inter-quartile range was used for assessing OOPE. The informed consent and information sheet followed the ethical norms and values as stated in the ICMR National Ethical

Guidelines for Biomedical Research in India. The ethical approval (RC/17/64) was obtained from Pondicherry Institute of Medical Sciences (PIMS) Institutional Ethical Review Committee, Puducherry. There was no monetary compensation to the study participants; however, they were provided information regarding importance of adherence to medication as recommended by the treating physician.

Results

Three hundred and thirty participants enrolled in the study 255 (77 %) of whom were males and 75 (23 %) were female. The age-sex distribution of participants showed that the majority of participants were 51-60 males (Table 1).

Table 1. Age-sex distribution of study participants (n=330)

Age group (in years)	Male N	Female N	Total N
<	4	2	6
40-50	50	18	68
51-60	88	25	113
61-70	73	24	97
71-80	40	6	46
Total	255	75	330

Regarding occupation, 45 % of them were employed, and 24.5 % were housewives. Moreover, 95 % of them were married. According to B.G.Prasad's socio-economic scale (Jan 2019), 64.5 %, 17.6 %, 8.5 %, 7 %, and 2.4 % of the subjects belonged to social class I to V, respectively. Concerning the month of follow-up visit, 118 (36 %) of the visit were in 3rd to 12th month, while for 112 (34 %) participants, the visits were in the 2nd to 3rd year after MI. For coronary artery disease, 91 % and 6 % of the participants had single and double vessel disease respectively.

Study participants underwent invasive and non-invasive procedure as part of their management. More than 93 % underwent the invasive procedures like angioplasty (16.3 %), PTCA (17.8 %), and CABG (59.1 %). This was while 6.8 % of the participants were medically managed. 57.6 % of the cases consulted their doctor (follow-up) once every 3 to 6 months, and 24.5 % consulted once a year. Invasive and noninvasive procedures were the modes of treatment. 93.3 % underwent invasive procedure, of which the majority underwent Coronary Artery Bypass Graft (CABG). Among 330 participants, 308 stayed in the hospital for five days for the invasive treatment procedure, 159 took leave of absence for 25 days following their treatment and 135 caregivers took 10 days off. (Table 2)

Table 2. Duration of stay in the hospital, productivity loss for study participants and their caregivers (n=330)

Duration (days)	n	Median	IQR
Study participants:	308	5	3-5
Duration of stay in the hospital during the invasive procedure			
Duration of stay in the city at the time of follow-up	12	4	2-5
Number of days taken off work by the participant	159	25	15-30
Number of days taken off work by the participant's caregiver	135	10	10-14

The cost of invasive procedure for treatment of coronary artery disease ranged from 1,20,000 INR to 1,75,000 INR. The participants spent 750 INR to 1500 INR for their monthly medications. The travel expenses by 320 participants for each follow-up visit amounted to 400 INR and 5000 INR was spent on accommodation for eight participants in the city where tertiary care center was located. 42 participants lost 28,000 INR, whereas 218 cases received health insurance or reimbursement of 1,30,000 INR from their firm. The median loss of money by 91 caregivers was 5000/-INR (Table 3).

Table 3. Direct medical, non-medical and indirect costs imposed on the participants and their care givers:

S.No	Expenditures	n	Median (INR)	IQR (INR)	Median (USD)	IQR (USD)
	Direct medical costs:					
1	Invasive procedure	308	1,40,000	1,20,000-1,75,000	1976.00	1693.71-2470.00
2	Consultation during each follow-up visit	330	40	-	0.56	-
3	Checkups during each follow-up visit	71	300	140-600	4.23	1.97-8.46
4	Medications every month	303	1000	750-1500	14.11	10.58- 21.17
	Direct non- medical costs:					
5	Traveling to the hospital during each follow-up visit	320	400	150-888	5.64	2.11- 12.53
6	Accommodation in the city	8	5000	2125-5000	70.57	22.99-70.57
	Indirect costs imposed on participants:					
7	Loss of pay from the firm company/ business	42	28,000	11,500-55,000	395.20	162.31- 776.28
8	The amount reimbursed for health expenses by the firm / company/ Any insurance coverage	218	1,30,000	1,00,000 -1,60,000	1834.86	1411.43-2258.29
	Indirect costs imposed on care givers:					
9	Loss of pay from the firm company/ business	91	5000	3,500-10,000	70.57	49.40-141.14

Discussion

OOPE for study participants

CAD is one of the most important causes of morbidity in India, leading to a massive economic burden. Catastrophic health expenditure was reported to be more frequent in the uninsured than the insured participants with CVD is India. (5) Pankaj et al. (6) in his study concluded that the average health expenditure due to CHD in the study sample was 1124.5 USD (INR 79,674.4) ranging from 4.2 to 9,442.4 USD (INR 300-6,69,000).

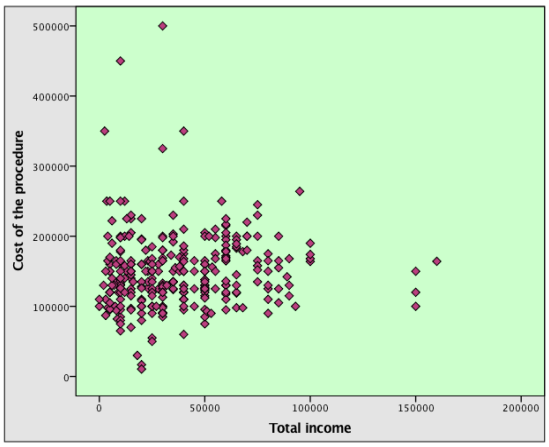

Figure 1. Correlation between total income and the cost of expenditure for the procedure

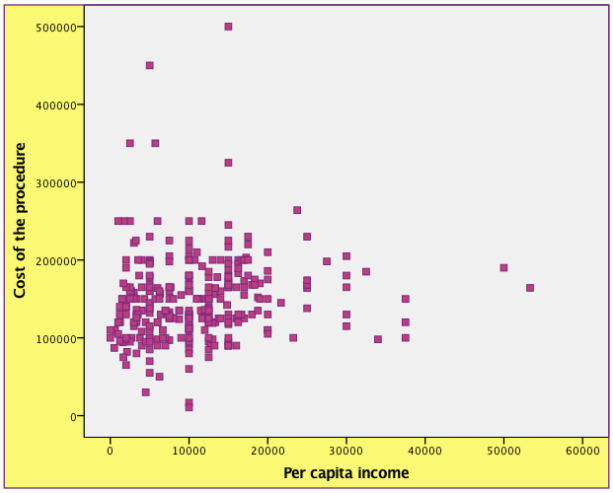

Figure 2. Correlation between per capita income and the cost of expenditure for the procedure

Direct medical cost incurred

The mean OOPE of initial hospitalizations in countries like China, India, and Malaysia was 3237 USD (7) and in Australia, the cost of the invasive procedure was $120.18 (INR 8713.6) (8). Moleeregpoom W et al. (9) stated that the acute costs for angina in a Thai hospital regarding

acute coronary syndrome patients was $ 2893**.** In this study, the direct medical cost of the invasive procedure for the treatment of CAD imposed on the participants was 1976 USD (Rs.140,000) 1693.7 – 2470 USD (IQR 120,000 – 175,000). Pankaj et al.(6) concluded the cost of the surgical procedure was Rs. 88,167. 8. In a study conducted by Hyun KK et al. (8) and SN Pankaj et al. (6), the cost of medications per month was to $66.25 (INR 4803.4) and Rs. 812 respectively, and the cost of transportation amounted to $30.95 (INR 2244.03) From 330 participants, 308 patients stayed for five days in the hospital regarding the invasive treatment procedure. During the follow-up visit to the tertiary care hospital, 12 participants stayed for 4 days in the city, and 159 participants took leave of absence for 25 days during their treatment in hospital; 135 caregivers also took 10 days off work for the same reason. In this study, the amount spent on medication every month was 14.114 USD (Rs.1000) 10.58 – 21.1 USD (IQR 750-1500). The mean length of hospital stay for initial acute episode was 7.4 days in a study conducted in Australia (10). However, the duration of stay in the hospital in this study for invasive procedure was 5 days (IQR 3-5). In a study conducted by Pankaj et al, (6) the average hospitalization cost in public hospital was INR13,336, in charitable hospital, INR 24,600, and in private hospital it was INR 88,167. Kumar L et al. (11) in a study on CAD patients at public tertiary care hospital revealed that the average annual cost was INR 15691.4; 78.5 % of which was attributed by direct cost.

Direct non-medical costs

The direct non-medical costs like the amount spent for traveling to hospital was 5.64 USD (400 INR) 2.1 – 12.5 USD (IQR 150 – 887.5) during follow-up, and in case of accommodation in the city, 70.5 USD (5000 INR) 29.99- 70.5 USD (IQR 2125 – 5000) was spent. In Van Minh et al. 's study, the amount spent during the follow-up visits in Vo Nhai District, Thai Nguyen Province was VND 19,575 (INR 59.4) in Vietnam. Similarly, the expenses during the hospitalization were estimated VND 480,000 (INR 1456.9) (12).

Indirect medical costs:

Indirect medical costs like loss of payment from the firm/ company / business was 395.20 USD (28,000 INR) 162.3 – 776.2 USD (IQR 11,500 – 55,000) for patients and 70.5 USD (5000 INR) 49.4 – 141.1 USD (IQR 3,500 – 10,000) for patients' caregiver. Similarly, in a study conducted in Mumbai in 2016 (5), the loss of wage for patients was 12,430 INR and for the patients' caregiver was 5,464 INR. 218 subjects received health insurance or reimbursement of 1834.86 USD (1,30,000 INR) 1411.4- 2258.2 USD (IQR 1,00,000 – 1,60,000 INR) from their firm or insurance company. In a study conducted in New Delhi, the indirect costs (wage loss of the patient and caregiver during the days of hospitalization) were 21.5 % of the average annual costs - i.e. INR 15691.4 for CAD patients. (11)

Association between socio-demographic factors and cost of the procedure

The socio-demographic factors like age, sex, education and occupation were not statistically significant regarding the amount spent for the invasive procedure as part of management of myocardial infraction participants. However, the median cost of procedure increased with the age of the participants. Statistically, there was no difference in the amount spent for the treatment of male and female patients admitted for surgical management of coronary artery disease. There was no gender disparity in terms of the amount spent for the managing this condition. There was no association between educational qualification and the cost of the procedure. In fact, the median cost of procedure spent by a participant with primary school education was the same as a graduate participant (Rs.1, 50,000). In the same way, there was no association between occupation and the cost of the procedure. The median cost of the procedure was Rs.1, 50,000 for both housewives and the unemployed participants. However, Hetemaa et al. 's (13) study showed that

women, angina pectoris patients, and people with lower socioeconomic status received fewer procedures during the one-year follow-up than men, MI patients, and those with higher socioeconomic status. Socioeconomic differences in the utilization of cardiac procedures were similar in both angina pectoris and myocardial infarction groups regarding both men and women and by all socioeconomic indicators: social class, education, and income. There were gender inequities reported in few studies. Male patients in the low social class level underwent CABG surgery less than those in the high social class level according to needs in a study conducted by Ancona et al.(14)

Table 4. Correlation between socio-demographic factors and the cost of the procedure (N=307)

Demographic details	Median cost of the procedure (INR) [IQR]	P*value
Age		0.482
Below 40 (n=6)	125000 [106340.75-155638.75]	
40-50 (n=68)	135000 [115000 – 165000]	
51-60 (n=113)	139000 [112500 – 168750]	
61-70 (n=97)	150000 [124500 – 180000]	
71-80 (n=46)	160000 [116000 - 192561]	
Sex		0.659
Male (n=255)	139000 [120000 – 169500]	
Female (n= 75)	150000 [110000-180000]	
Educational qualification		0.110
Illiterate (n=22)	160000 [120000 – 198590]	
Primary School (n=38)	150000 [98750 – 172500]	
Middle School (n=47)	130000 [100000 – 160000]	
High School (n=104)	135000 [120000 -171750]	
Graduate (n=96)	150000 [120000 – 177250]	
Occupation		0.334
Employed (n=135)	135000 [110000 – 165000]	
Housewife (n=53)	150000 [120000 -175000]	
Retired (n=78)	145000 [125000 – 178674.75]	
Unemployed (n=41)	150000 [115000 – 193500]	

(Pearson Correlation and Mann-Whitney test were used to find association between age, sex, and the cost of the procedure respectively. Kruskal Wallis test was used to find the association between educational qualification, occupation and the cost of the procedure)

* P_value ≤ 0.05 is considered statitsically significant

This study paves the way for researchers to evaluate the quality of life regarding a cohort of post-myocardial infarction patients over a period of time longitudinally. Other perspectives like societal perspective can also be studied. Results of this study included a couple of implications for clinical practice; a) symptom management may also increase awareness of post-myocardial infarction patients in early diagnosis of a severe condition and prompt action. Therefore, they can get into the system earlier for treatment, b) effective symptom management strategies help accomplish a desirable level of life quality in post-myocardial patients, c) symptomatic patients with functional limitation, female patients, lower socio-economic status and unemployed patients should be targeted for such transitional care or symptom management.

Health insurance schemes are fragmented, and each offers a different benefit package. There is a great need for a standardised package in India. Government health insurance schemes are targeted mainly at below poverty line population. It should be standardised and recommended for every citizen of the country. The Ayushman Bharat

– National Health Protection Mission (AB-NHPM) is one such initiative for the vulnerable section of the Indian population; implemented effectively, it will help the nation move closer to the sustainable development goal of universal health coverage'.

The strengths of this study is that all aspects of costs were included namely, direct medical costs, direct non-medical costs, and indirect costs of patients' perspective

The limitation is that the study was conducted at a medical college hospital; therefore, it cannot be generalised to all MI patients treated at different settings in the country. However, it may be applicable in similar settings elsewhere.

Conclusion

The study on out-of-pocket expenditures by myocardial infarction patients in a tertiary care centre in Pondicherry, South India highlights the significant financial burden faced by patients and their families in accessing healthcare. Findings revealed that a majority of patients spent a considerable amount of their income on medical expenses, and the cost of invasive procedure accounted for a major share of the total health expenditures within the study period. This project highlights the need for policies that address financial barriers to accessing healthcare and provide adequate financial protection for patients in need.

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Conflict of interests

The author declared no conflict of interests.

Authors' Contributions

Arokiaraj MC ,Prabakaran S ,Purty and AJ Manjunatha C.H designed research; Sahanaa C conducted research, analyzed data, and wrote the paper. Sahanaa C primary responsibility for final content. All authors read and approved the final manuscript.

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