

Article

# The effect of a nurse-led telephone-based care coordination program on the follow-up and control of cardiovascular risk factors in patients with coronary artery disease

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## Abstract

**Objective:** We sought to analyse the impact of a care coordination protocol on transiting patients with coronary artery disease who had undergone percutaneous coronary intervention (PCI) to primary care and its effect on cardiovascular risk factor control.

**Design:** A prospective observational study involving 492 patients who had undergone PCI either electively or after an acute coronary syndrome.

**Setting:** A tertiary institution in Singapore.

**Participants:** Patients who had undergone a PCI either electively or after an acute coronary syndrome.

**Interventions:** The SCORE (Standardized Care for Optimal Outcomes, Right-Siting and Rapid Re-evaluation) program was a nurse-led, telephone-based, care coordination protocol.

**Main Outcome Measures:** Transition to primary care within 1 year of enrolment, the achievement of low-density lipoprotein (LDL) level of <2.6 mmol/l within 1 year and hospital admissions related to cardiovascular causes within 1 year were studied.

**Results:** Under the SCORE protocol, a significantly higher number of patients transited to primary care and achieved the LDL target within 1 year, as compared with non-SCORE patients. Discharge to primary care and achievement of target LDL continued to be higher among those under the SCORE protocol even after multivariate analysis. Rates of hospital admission due to cardiovascular causes were not significantly different.

**Conclusions:** Care coordination improved the rate of transition of post-PCI patients to primary care and improved LDL control, with no difference in the rate of hospital admissions due to cardiovascular causes. These findings support the implementation of a standardized follow-up protocol in patients who have undergone PCI.

**Key words:** cardiovascular diseases, care pathways/disease management, cholesterol, coronary artery disease, percutaneous coronary intervention

## Introduction

The current conventional model of outpatient cardiac specialist care in many public hospitals in Singapore is not optimal, with limited time for patient education and physician decision-making in heavily overloaded clinics. The high patient load is in part due to the high demand for new appointments [1, 2] and low rates of transition of stable patients back to primary care (termed ‘right-siting’).

A number of approaches have been implemented to overcome these challenges. To reduce the specialist outpatient clinic workload, our institution developed the Delivering on Target Programme as a collaboration between specialists and primary care physicians, to facilitate referral of patients with stable chronic medical conditions to primary care [3, 4], in order to increase specialist outpatient capacity to see new patients. However, patients who have been on follow-up with specialists for several years are often reluctant to be referred to primary care because of the confidence in the specialist clinic that they have developed over time, and a belief that they will receive suboptimal care in the primary care setting.

We therefore developed a nurse-led telephone-based care coordination program known as the SCORE program (Standardized Care for Optimal Outcomes, Right-Siting and Rapid Re-evaluation) for patients with coronary artery disease who had undergone percutaneous coronary intervention (PCI). This article compares the clinical outcomes of the cohort of patients enrolled at the start of the SCORE program selected by lottery for a limited number of slots (SCORE group) with a control group (non-SCORE group) over the same period of follow-up.

## Methods

### Study overview

This was a single-institution controlled study conducted from 8 September 2011 to 31 August 2012 in a national referral cardiology centre, the National Heart Centre Singapore. The SCORE program was a nurse-led telephone-based care coordination program involving care coordinators who engaged patients and their family members during admission, provided educational materials and built rapport for subsequent follow-up phone calls. They contacted patients after discharge to monitor their symptoms, and reinforce lifestyle modifications and medication compliance. Patients were provided a telephone number to call if symptoms developed, and were given early appointments or referred to the emergency department when appropriate. Care coordination was designed to supplement and not supplant the care of the patient by their respective cardiologists, who were still responsible for overall decision-making. As part of the SCORE program, the attending cardiologists were also reminded at regular intervals to refer and transit suitable patients to primary care.

Patients were recruited into one of two SCORE protocols: the Post-Elective Percutaneous Coronary Intervention (Post-Elective PCI) protocol or the Post-Acute Coronary Syndrome (Post-ACS) protocol.

### Inclusion and exclusion criteria

Patients were recruited into the Post-Elective PCI protocol if they had undergone an elective PCI and did not have a myocardial infarction in the preceding 2 months. Patients were recruited into the Post-ACS protocol if they had undergone PCI for an ACS.

Patients were excluded from the program if there were plans for a staged PCI, or if they had any of the following co-morbidities: left ventricular ejection fraction  $\leq 40\%$ , atrial fibrillation, ventricular tachycardia, stage 4 or 5 chronic kidney disease, unresolved anaemia or other co-morbidities that precluded referral to primary care.

### Study population

Due to limited availability of care coordinators, only 80% of suitable candidates could be accommodated into the program. Consequently, during the first year of the program, from 8 September 2011 to 31 August 2012, patients were referred to SCORE based on a random lottery [5, 6]. Patients not enrolled into the SCORE program were managed as per conventional care at the discretion of their cardiologists, without care coordination.

This thus provided an opportunity to study, in an unbiased fashion, the impact of the SCORE program on right-siting to primary care and risk factor control. The study was approved by the Institutional Review Board, and funded by the Agency for Integrated Care, an agency set up by the Singapore government to facilitate efforts in care integration.

### Measures

Three clinical outcomes were assessed for all participants:

1. Transition to primary care (right-siting) within 1 year.
2. Achievement of target low-density lipoprotein (LDL) level of  $< 2.6$  mmol/l within 1 year.
3. Hospital admission due to cardiovascular causes within 1 year.

It was decided that 1 year would be the optimal time frame in which to transit stable patients to primary care, so that patients would not develop a dependence on their cardiologists. An LDL goal of  $< 2.6$  mmol/l was used, as per the Adult Treatment Panel III recommendations at the time of the study [7, 8], prior to the 2013 American College of Cardiology and American Heart Association revision [9]. The rate of hospital admissions due to cardiovascular causes was used as a surrogate measure for the safety of this intervention.

Data were collected by care coordinators based on case records. Medical data in Singapore are available in the electronic medical records unless one leaves the country or is admitted to a private care facility.

### Statistical analysis

Categorical variables were presented as numbers with percentages while continuous variables as means with standard deviations. Baseline demographic and clinical characteristics were compared using chi-square test, Fisher’s exact test or *t*-test, as appropriate. A two-sided *P*-value of  $< 0.05$  was considered to indicate statistical significance. The outcome comparison between the SCORE and non-SCORE groups was performed by calculating an odds ratio, with accompanying 95% confidence intervals, with the use of logistic regression analysis. Other variables compared included age, gender, race, hypertension, diabetes mellitus, dyslipidaemia and smoking status. In addition to being on the SCORE program, variables with a *P*-value of  $< 0.10$  during bivariate analysis were candidates for the multivariable logistic regression analysis. This included race for the outcome measure of right-siting, while both age and race were used for the achievement of target LDL. Statistical analyses were performed using SPSS version 19.0 (IBM Corporation).

## Results

A total of 492 patients were eligible to be enrolled under the SCORE program (Fig. 1). Of these, 223 patients underwent PCI electively (Post-Elective PCI group). There were 177 patients enrolled into the SCORE program (SCORE group) while 46 patients were in the non-SCORE group. Similarly, 269 patients underwent PCI after an ACS (Post-ACS group), of which 218 were in the SCORE group and 51 in the non-SCORE group.

Table 1 shows the baseline demographic and clinical characteristics of patients in the SCORE and the non-SCORE groups, as well as within the Post-Elective PCI and Post-ACS subgroups. Patients were typical of a PCI population: most were men, and the mean age was 58.5 years (SD 10.4) in the SCORE group and 61.0 years (SD 9.9) in the non-SCORE group. More than 90% of the patient population had dyslipidaemia and the majority had hypertension. There were 133 patients (33.7%) in the SCORE group and 42 patients (43.3%) in the non-SCORE group who had diabetes mellitus.

In the SCORE group, a significantly higher number of patients were right-sited and achieved the target LDL of <2.6 mmol/l within 1 year (Table 2). More than half of the patients in the SCORE group [ $n = 215$  (54.5%)], as compared with seven (7.2%) patients in the non-SCORE group, were right-sited within 1 year (unadjusted OR 15.36, 95% CI 6.94–33.98,  $P < 0.001$ ). After multivariate analysis, enrolment in the SCORE program was independently associated with a higher rate of discharge to primary care (adjusted OR 14.53, 95% CI 6.49–32.54,  $P < 0.001$ ). When outcomes were analysed separately in the Post-Elective PCI and Post-ACS groups, the SCORE program was associated with a significantly higher rate of right-siting within 1 year (Post-Elective PCI group-adjusted OR 32.08, 95% CI 6.96–147.75,  $P < 0.001$ ; Post-ACS group-adjusted OR 8.39, 95% CI 3.19–22.07,  $P < 0.001$ ).

With regard to achieving the LDL target of <2.6 mmol/l within 1 year, 277 (70.1%) patients in the SCORE group achieved this target, as compared with 55 (56.7%) patients in the non-SCORE group (unadjusted OR 1.79, 95% CI 1.14–2.83,  $P = 0.012$ ). After multivariate analysis, the SCORE program was independently associated with a higher rate of achieving target LDL within 1 year (adjusted OR 1.65, 95% CI 1.01–2.69,  $P = 0.044$ ). When analysed separately in the Post-Elective PCI and Post-ACS groups, there was no difference in the rate of achieving target LDL between the SCORE and non-SCORE groups (Post-Elective PCI group-adjusted OR 1.46, 95% CI 0.68–3.16,  $P = 0.335$ ; Post-ACS group-adjusted OR 1.73, 95% CI 0.91–3.30,  $P = 0.097$ ).

There was no difference in the rates of hospital admission due to cardiovascular causes between SCORE (17.5%) and non-SCORE (18.6%) patients (unadjusted OR 1.08, 95% CI 0.61–1.91,  $P = 0.801$ ). When analysed separately in the Post-Elective PCI and Post-ACS groups, hospital admission due to cardiovascular causes remained similar between the two groups (Post-Elective PCI group-adjusted OR 0.92, 95% CI 0.35–2.42,  $P = 0.858$ ; Post-ACS group-adjusted OR 1.28, 95% CI 0.61–2.69,  $P = 0.520$ ).

## Discussion

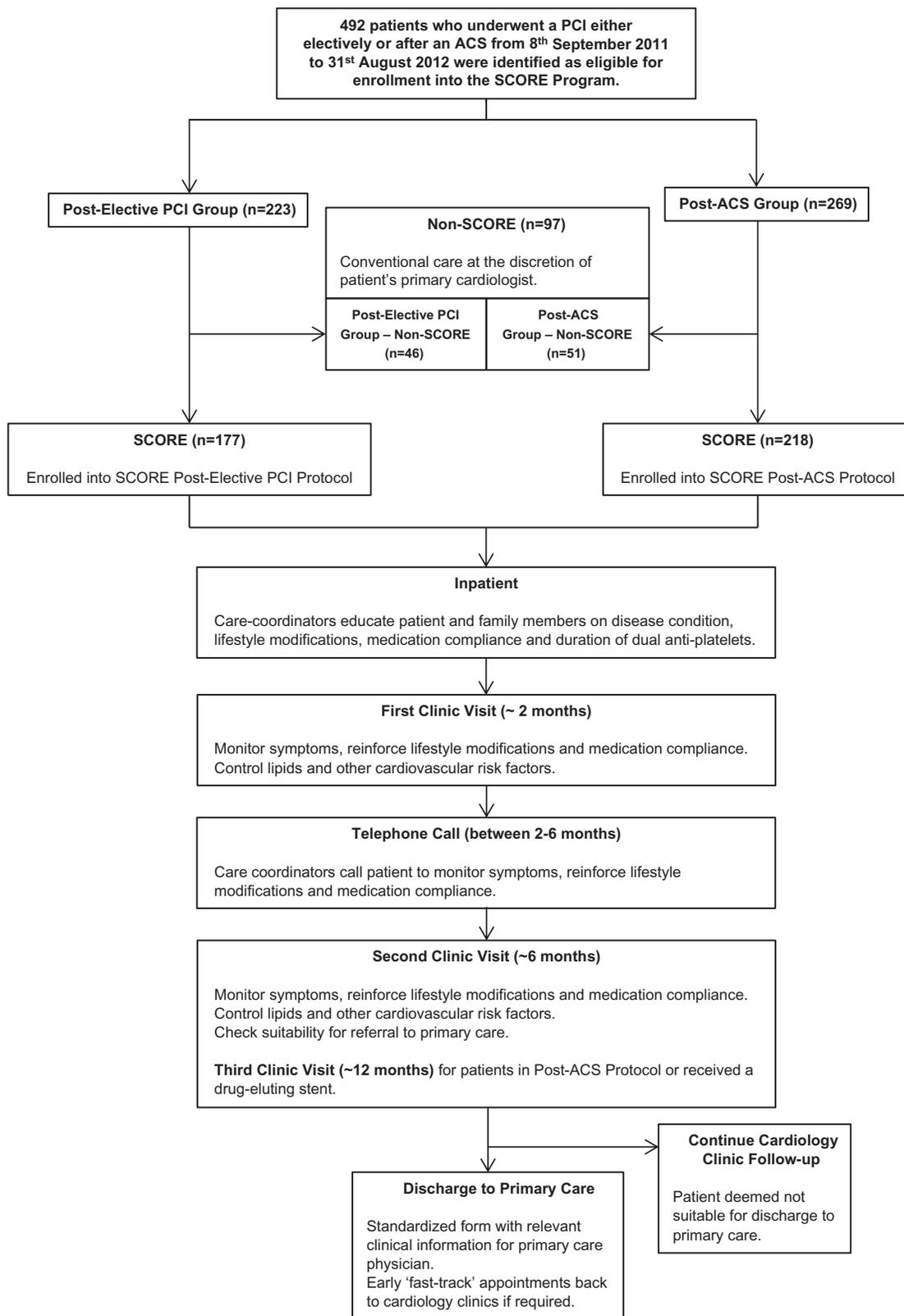
Published studies from around the world have shown that nurse-led care coordination can improve cardiovascular risk factor control and mortality in patients with coronary artery disease [10–12]. To the best of our knowledge, our study is the first to demonstrate the value of care coordination in patients with coronary artery disease in Asia. We found that, first, a nurse-led telephone-based care

coordination program is feasible to implement and acceptable to an Asian population. This was demonstrated by a low dropout rate of 11 patients (4 from the Post-Elective PCI group and 7 from the Post-ACS group). Second, our program resulted in significant improvements with regard to transitioning to the appropriate care setting, as well as the attainment of objective clinical benchmarks such as LDL-cholesterol levels. And third, there was no increase in hospital admissions noted with the implementation of such a program, suggesting that the protocol for earlier referral to primary care is safe and not associated with adverse outcomes.

Right-siting has been defined as ‘patients treated in the most appropriate locations by medically competent teams at the lowest possible cost’ [13]. In the past decade, there has been an increasing emphasis on right-siting in the healthcare community, with key drivers being the rapidly ageing population and the increased burden of chronic conditions [14]. Shifting care from tertiary to primary care has potential advantages of freeing specialist clinic resources to attend to new patients, as well as more emergent cases and mitigating rising healthcare costs.

During the designing of the SCORE program, we had identified factors that we believed contributed to the low rate of right-siting of patients in our institution previously. Because of heavy clinic loads, physicians were apprehensive about discharging patients from their care because of the concern that they had not fully addressed all relevant medical issues. Also, they were worried that patients not being seen routinely in a specialist clinic would be poorly served in the primary care and result in more clinical events. There were also more mundane, yet important factors, such as the extra time taken to prepare discharge documentation or referral letters to primary care. Because of this, it frequently became more convenient for physicians to just give repeat appointments rather than refer to primary care. Similarly, patients also shared some of these concerns. Patients were concerned that their care may be suboptimal in the primary care and hence tended to want to stay in a specialist clinic. We therefore specifically designed measures to address these issues so as to increase the rate of referral to primary care under the SCORE program. Firstly, the SCORE protocol was placed in front of patients’ case notes and this served as a reminder for physicians to transit their patients to primary care at the appropriate time. Secondly, there were standardized letters in the form of a checklist for cardiologists to fill in to guide primary care doctors on the treatment goals for each patient, and this added convenience may have encouraged the cardiologists to transit their patients to primary care. Thirdly, care coordinators remained in contact with patients after they were discharged from the specialist clinic, easing the transition to primary care and providing patients with the reassurance that there would be quick access to their cardiologist if problems arose. This reassurance for both cardiologists and patients may have contributed to the increased rate of right-siting.

The improvement in LDL-cholesterol levels in the SCORE group could be explained by the following factors. Firstly, care coordinators provided more intensive and comprehensive education to both patient and caregiver during admission, with the aid of education materials. Secondly, they made follow-up telephone calls to improve patients’ adherence to medication and lifestyle modifications. Our findings are consistent with previous studies involving telephone-based care, which have improved cardiovascular risk factor control, such as blood pressure, lipid and glucose control [15–18]. To the best of our knowledge, there has however only been one other study analysing the impact of telephone-based care on lipid control among cardiac patients [19].



PCI = Percutaneous coronary intervention; ACS = Acute coronary syndrome

Figure 1 Workflow for patients enrolled under SCORE program.

**Table 1** Comparison of baseline characteristics between patients under the SCORE program (SCORE group) or conventional care under the primary cardiologist's discretion (non-SCORE group)

Characteristics		SCORE	Non-SCORE	P-value	Post-Elective PCI		P-value	Post-ACS		P-value
					SCORE	Non-SCORE		SCORE	Non-SCORE	
Age, year (SD)	Mean	58.5 (10.4)	61.0 (9.9)	0.030	59.3 (9.8)	62.2 (9.9)	0.849	57.8 (10.9)	59.9 (9.8)	0.626
Gender, no. (%)	Male	310 (78.5)	83 (85.6)	0.119	142 (80.2)	37 (80.4)	0.975	168 (77.1)	46 (90.2)	0.036
	Female	85 (21.5)	14 (14.4)		35 (19.8)	9 (19.6)		50 (22.9)	5 (9.8)	
Race, no. (%)	Chinese	307 (77.7)	50 (51.5)	<0.001	148 (83.6)	23 (50.0)	<0.001	159 (72.9)	27 (52.9)	0.017
	Malay	31 (7.9)	10 (10.3)		10 (5.6)	5 (10.9)		21 (9.6)	5 (9.8)	
	Indian	53 (13.4)	32 (33.0)		18 (10.2)	14 (30.4)		35 (16.1)	18 (35.3)	
	Others	4 (1.0)	5 (5.2)		1 (0.6)	4 (8.7)		3 (1.4)	1 (2.0)	
Hypertension, no. (%)	Yes	335 (84.8)	75 (77.3)	0.076	153 (86.4)	35 (76.1)	0.085	182 (83.5)	40 (78.4)	0.392
	No	60 (15.2)	22 (22.7)		24 (13.6)	11 (23.9)		36 (16.5)	11 (21.6)	
Diabetes mellitus, no. (%)	Yes	133 (33.7)	42 (43.3)	0.076	64 (36.2)	26 (56.5)	0.012	69 (31.7)	16 (31.4)	0.969
	No	262 (66.3)	55 (56.7)		113 (63.8)	20 (43.5)		149 (68.3)	35 (68.6)	
Dyslipidaemia, no. (%)	Yes	380 (96.2)	88 (90.7)	0.034	171 (96.6)	40 (87.0)	0.019	209 (95.9)	48 (94.1)	0.704
	No	15 (3.8)	9 (9.3)		6 (3.4)	6 (13.0)		9 (4.1)	3 (5.9)	
Smoking, no. (%)	Yes	96 (24.3)	15 (15.5)	0.005	30 (16.9)	7 (15.2)	0.315	37 (17.0)	4 (7.8)	0.009
	No	227 (57.5)	73 (75.2)		112 (63.3)	34 (73.9)		66 (30.3)	8 (15.7)	
	Previous	72 (18.2)	9 (9.3)		35 (19.8)	5 (10.9)		115 (52.7)	39 (76.5)	

**Table 2** Comparison of outcomes between SCORE and non-SCORE groups, including within Post-Elective PCI and Post-ACS subgroups

Outcomes (within 1 year)	SCORE, n (%)	Non-SCORE, n (%)	Unadjusted odds ratio (95% CI) <sup>a</sup>	P-value	Adjusted odds ratio (95% CI) <sup>b</sup>	P-value
Right-sited						
All patients	215 (54.4)	7 (7.2)	15.36 (6.94–33.98)	<0.001	14.53 (6.49–32.54)	<0.001
Post-Elective PCI group	108 (61.0)	2 (4.3)	34.44 (8.09–146.64)	<0.001	32.08 (6.96–147.75)	<0.001
Post-ACS group	107 (49.1)	5 (9.8)	8.87 (3.39–23.17)	<0.001	8.39 (3.19–22.07)	<0.001
Achieve LDL <2.6 mmol/l						
All patients	277 (70.1)	55 (56.7)	1.79 (1.14–2.83)	0.012	1.65 (1.01–2.69)	0.044
Post-Elective PCI group	132 (74.6)	28 (60.9)	1.89 (0.95–3.73)	0.068	1.46 (0.68–3.16)	0.335
Post-ACS group	145 (66.5)	27 (52.9)	1.77 (0.95–3.27)	0.071	1.73 (0.91–3.30)	0.097
Hospital admission for cardiovascular causes						
All patients	69 (17.5)	18 (18.6)	1.08 (0.61–1.91)	0.801		
Post-Elective PCI group	27 (15.3)	6 (13.0)	0.83 (0.32–2.16)	0.707	0.92 (0.35–2.42)	0.858
Post-ACS group	42 (19.3)	12 (23.5)	1.29 (0.62–2.67)	0.495	1.28 (0.61–2.69)	0.520

<sup>a</sup>The odds ratio is for the SCORE group as compared with the non-SCORE group.

<sup>b</sup>Variables with a P-value of <0.10 in the univariate analysis were candidate for multivariate analysis.

One concern raised about right-siting is the possibility that early referral to primary care could increase adverse outcomes and hospital admissions [20]. However, our study demonstrated that the rate of hospital admissions for cardiovascular causes was similar in both the intervention and control groups. Therefore, it appears that follow-up in the primary care setting does not seem to result in more clinical events if patients are appropriately selected and empowered with education and lifestyle advice as in our program. This is reassuring to both cardiologists and patients and encourages early right-siting.

### Limitation

At the time of the study, the latest guidelines recommending the use of high-dose statin therapy for all patients with known cardiovascular disease, regardless of LDL-cholesterol levels, had not been published. As such, the dose and type of statin prescribed was at the discretion of the treating physician. Unfortunately, we did not have data on the actual dose and type of statin. But it can be postulated that patients in the SCORE program, by virtue of being monitored more closely, may have had more aggressive statin titration. This

may not be so relevant now with the latest guidelines, but the improvement in LDL control does highlight one of the advantages of being in the SCORE program.

### Conclusion

Our study demonstrated that a nurse-led telephone-based care coordination program was associated with a higher rate of right-siting to primary care and better LDL target achievement for post-PCI patients in a tertiary cardiac centre. Referral to primary care was not associated with higher rates of readmission or cardiac events.

### Funding

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