

Cardiovascular Disease Secondary Prevention in India: Results from Registries and Large Cohorts

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Abstract: *In India, a number of records and quality improvement programmes have been created to look at and improve secondary prevention of CVD. The Tamil Nadu eST-Segment Elevation Myocardial Infarction (TN-STEMI) programme looked into and tried to make it easier for people who had an ST-elevation myocardial infarction (STEMI) to get revascularization. The Treatment and Outcomes of Acute Coronary Syndromes in India (CREATE), Indian Heart Rhythm Society-Atrial Fibrillation (IHRS-AF), and Trivandrum Heart Failure (THF) registries could only collect data. The Acute Coronary Syndromes: Quality Improvement in Kerala (ACS-QUIK) study used hospitals from the Kerala ACS registry to test a quality improvement kit for people with ACS. The Practice Innovation and Clinical Excellence India Quality Improvement Programme (PIQIP) gives useful information on the quality of care for people with CVD who are not hospitalised. Health workers and policymakers need to work together to find out what else they don't know and how to use new and old data to make decisions.*

Keywords: Secondary prevention Cardiovascular disease Registries, Quality improvement India

Abbreviations: PCI, percutaneous coronary intervention; PINNACLE PIQIP, Practice Innovation and Clinical Excellence India Quality Improvement Program; ROW, rest of the world; STEMI, ST-elevation myocardial infarction; THFR, Trivandrum Heart Failure Registry; TN-STEMI, Tamil Nadu ST-Segment Elevation Myocardial Infarction. ACEi, angiotensin-converting-enzyme-inhibitor; ACS, acute coronary syndrome; ACS QUIK, Acute Coronary Syndromes: Quality Improvement in Kerala; AF, atrial fibrillation; aOR, adjusted Odds Ratio; ARB, angiotensin receptor blocker; BB, beta-blockers; CABG, coronary artery bypass graft; CAD, coronary artery disease; CREATE, Treatment and outcomes of acute coronary syndromes in India; CVD, cardiovascular disease; HR, hazard Ratio; IHRS-AF, Indian Heart Rhythm Society-Atrial Fibrillation; NORIN STEMI, North Indian ST-Segment Elevation Myocardial Infarction; NSTEMI, Non-ST elevation myocardial infarction;

I. INTRODUCTION

Heart diseases (CVD) are becoming more common in places that aren't as developed as other parts of the world. More than three quarters of deaths from cardiovascular disease happen in countries with low wealth.¹ In India, too, about 3% of people living in rural areas and 7% of people living in cities have coronary artery disease (CAD).² Several projects in India have looked at the risk factors, symptoms, and treatment of CVD in order to lower the number of people who get sick and die from these conditions.³ Secondary prevention includes actions taken to lessen the effects of CVD on people who already have these illnesses.

A number of studies have shown that using data from registries to get more specific information and to combine the experiences of other patients in the registry can lead to better care. On top of that, these registries can be used as places to launch and then try efforts to make things better. This piece gives a quick outline of some of these programmes that have been aimed at preventing CVDs in the second place (Table 1). This review looks at big longitudinal registries and cohort studies that have come out in the last 10 years to give an overall picture.

PINNACLE (practice innovation and clinical excellence) India quality improvement program (PIQIP)

The PIQIP is India's first outpatient cardiovascular disease (CVD) quality improvement programme. It began in 2011 after the PIQIP tool was proven to work in a previous study. This tool was used to track and report on the outpatient CVD performance of people with CAD, heart failure, and AF. With 17 centres in 11 places (Adoni, Ahmedabad, Anand, Delhi, Hyderabad, Mumbai, Nagpur, Nashik, Patna, Pune, and Talegaon) taking part in the PIQIP, more than 100,000 patient encounters have been recorded.

In one of their earlier studies, the PIQIP looked at 68,196 patients to find out how common CVD was and what risk factors were present, such as high blood pressure, diabetes, bad cholesterol, and smoking.⁸ The study discovered that 14.8% of people had CAD, 4.0% had heart failure, and 0.5% had AF. In the community as a whole, 29.7% had hypertension, 14.9% had diabetes, 7.6% had dyslipidemia, and 6.5% had dyslipidemia. 48.6% of qualified CAD patients said they took aspirin, 37.1% said they took clopidogrel, and 50.6% said they took statins. Sixty-one percent of people with heart failure took RAAS inhibitors and 58.1% of people with heart failure took beta-blockers. On the other hand, only 37.0% of people with AF took oral anticoagulation.

After this study, there was a report on how medical treatment based on guidelines was used in people with heart failure. The study looked at 15,870 patients from the PIQIP registry who had an EF of less than 40%. Angiotensin converting enzyme inhibitors (ACEi)/angiotensin receptor blockers (ARBs), BBs, or both were used by hospitalised patients with heart failure and low EF. In 33.5%, 34.9%, and 29.6% of cases, they found that ACEi/ARB, BB, or both were described. The study also found that the number of people who were using these drugs steadily grew over the course of the study.

In India, another study from PIQIP looked at differences between men and women in care and access to healthcare. Women (31,796) and men (66,245) were both part of the study. Even though women were younger, they had more chronic diseases than men. For example, 62.0% of women had hypertension and 45.6% of men did ($P < 0.01$), 39.4% had diabetes and 35% had it ($P < 0.01$), and 3.7% had hyperlipidemia and 3.1% had it ($P < 0.01$). During the study time, women had an average of 2.59 encounters compared to 2.82 encounters for men ($P < 0.001$). The most important change was in the prescriptions for medications that were based on guidelines. It was found that women with CAD were less likely than men to be prescribed aspirin (38% vs. 50.4% in men, $P < 0.001$), aspirin or thienopyridine mixture (46.9% vs. 57.2%, $P < 0.001$), and BB (36.8% vs. 47.8%, $P < 0.001$). The number of prescriptions for BB (30.8% vs. 37.0%, $P < 0.001$), ACEi or ARBs (29.3% vs. 34.9%, $P < 0.001$), and both (24.6% vs. 31.0%, $P < 0.001$) was lower for women with heart failure and low EF (EF 40%) compared to men. But among women with AF and CHADS2 score 2, more women than men were taking oral anticoagulants (19.6% vs. 14.6%, $P = 0.34$), even though both groups didn't use them very often. It's important to note that this study's group size for people with AF was small.

As part of a new report, the PIQIP looked at how electronic health records (EHR) affected the quality of care patients got. The study looked at how practices with and without integrated and functioning EHRs recorded the burden of CVD comorbidities (high blood pressure, diabetes mellitus, and high cholesterol) in CAD patients. The study compared practices with ($n = 2$) and without (15 practices) these conditions. The records of medical treatment based on guidelines for CAD, AF, and heart failure were also compared between these offices. The study discovered that practices with EHR had less information about patients with CAD who also had hypertension (49.8% at practices with EHR vs. 52.1% at practices without EHR; $P < 0.003$), diabetes (34.9% vs. 38.3%; $P < 0.001$), and hyperlipidemia (0.2 vs. 3.9%; $P < 0.001$). Instead, medical therapy that was based on guidelines was given more often at practices that used EHR. A lot more patients with CAD were given aspirin (63.2% in practices with EHR vs. 17.8% in practices without EHR; $P < 0.001$), clopidogrel (41.7% vs. 27.4%; $P < 0.001$), BB (61.4% vs. 9.8%; $P < 0.001$), and ACEi or ARBs (53.9% vs. 16.4%; $P < 0.001$) at practices with EHR. Also, people with heart failure were given BB (43.8% vs. 10.7%; $P < 0.001$) and ACEi or ARBs (40.8% vs. 16.1%; $P < 0.001$) more often at practices that had EHR. Patients with AF who went to offices with EHR were more likely to have their warfarin prescriptions recorded (42.5%) compared to 26.1% ($P < 0.001$).

In the end, the PIQIP register showed that quality improvement programmes could work in an outpatient cardiovascular setting in India. It also brought attention to the lower-than-ideal rates of GDMT, especially in women. The results aren't very applicable to a big part of India because most of the sites that participated were in cities. Also, the design of the study can only be used with patients who go back to the practices where they were first assessed. A big number of people are lost to follow-up because of this. Another thing is that statistics on medication contra-indications are not recorded because of a lack of time and resources. The data can't be used in all situations because only highly driven centres took

part. Lastly, the high cost of medicines may have affected the number of prescriptions for medical treatment that follows guidelines. The PIQIP registry will grow in the future to include semi-urban and rural practices and collect more data, such as socioeconomic status, biomarker data, drug contraindications, and so on.

Secondary prevention after myocardial infarction

Kerala acute coronary syndrome (ACS) registry

The Kerala ACS record is a prospective record that was made to look for patterns in how people with ACS show up, how they are treated, and how their lives turn out in Kerala. About 25,748 adults over the age of 18 who went to 125 hospitals with ACS between May 2007 and May 2009 were asked to fill out a survey.

In its first report, the register found that unstable angina (32%), non-ST elevation myocardial infarction (31%) and ST-elevation myocardial infarction (37%) were the most common types of heart problems. There was a significant difference between the groups ($P < 0.001$). Patients with unstable angina were more likely to have had diabetes in the past compared to those with STEMI and non-STEMI (40.7% vs. 37.9% vs. 34.6% in STEMI), stroke (3.2% vs. 2.2% vs. 2.2%), and percutaneous coronary intervention or coronary artery bypass graft surgery (PCI or CABG) (0.7% vs. 0.1% vs. 0.1%; $P < 0.001$ for all). On the other hand, more STEMI and non-STEMI patients had a history of high blood pressure (40.4% in unstable angina vs. 48.2% in NSTEMI vs. 55.5% in STEMI) and smoked (30.2% vs. 37.9% vs. 35.3%; $P < 0.001$ for all). In 41% of patients with STEMI, thrombolytics were given. Nearly 19% of NSTEMI and 11% of unstable angina

Table 1: A summary of what secondary cardiovascular disease prevention registries and epidemiological groups in India have found.

Initiative Publication	Year of	Patient Population; Population size	Key Findings	Limitations
PINNACLE Quality Improvement Program (PIQIP)	India	Patients with coronary artery disease, heart failure, and atrial fibrillation evaluated in the outpatient setting. n > 100,000	<35% of HFREF patients had documentation of guideline-directed therapies. Women had lower rates of guideline-directed therapies documented for both, CAD and HF. Observed in-hospital mortality for ACS patients was around 8%.	High rate of missing data.
Kerala Acute Coronary Syndrome registry 2013		Patients presenting to the hospital with acute coronary syndrome (ACS). n ¼ 25,748	<50% of STEMI patients and <30% of non-STEMI/unstable angina patients underwent reperfusion (primary PCI or thrombolytic therapy).	Possible selection bias (ACS patients included only if survived to be admitted to a coronary care unit) Voluntary participation of hospitals.
Acute Coronary Syndromes: Quality Improvement in Kerala (ACS QUIK) 2017		Patients presenting to the hospital with acute coronary syndrome (ACS). Control group: n ¼ 10,066 Intervention group: n ¼ 11,308	Care of patients with the help of a quality improvement tool kit did not improve all-cause death, reinfarction, stroke, or major bleeding compared with standard care. However, it increased the prescription of optimal in-patient and out-patient medications.	Short-term follow up.

CREATE registry 2008	Acute myocardial infarction (STEMI or non-STEMI) or suspected myocardial infarction in patients with prior ischemic heart disease. n ¼ 20,937	Higher proportion of STEMI cases in India compared with other nations. 30-day mortality 9% for STEMI; 4% for non-STEMI. Mean age of patients with ACS around 10 years younger than the Western world.	Observational registry.
The Tamil Nadu e ST-Segment	Regional system-of-care program for STEMI patients. n ¼ 2420	Tamil Nadu e STEMI program included a regional system of care intervention through a hub-and- spoke model. Post-intervention: increased rates of coronary angiography, PCI and reduction in 1-year mortality (14.2% vs. 17.6% pre-intervention).	Heterogeneity between different regions of India may limit ability to scale the hub-and-spoke model to other states.
Detection and Management of Coronary Heart Disease (DEMAT) Registry 2013	Patients presenting with ACS at 10 tertiary care centers across 9 cities in India. Data were prospectively collected to compare gender differences in ACS presentation, management, and outcomes. n ¼ 1565	Women presenting with ACS had comparable in-hospital management, discharge management, and 30-day outcomes compared with men who presented with ACS.	Small sample size, short duration of follow up, convenient sampling and limited clinical endpoints.
North Indian ST-Segment Elevation Myocardial Infarction (NORIN STEMI) Registry 2019	All patients >18 years of age presenting with STEMI at two tertiary care hospitals in India. n~3500 (data collected on 558 patients thus far)	More data to follow after further enrollment.	Two hospitals in New Delhi, limiting generalizability
Prospective observational longitudinal registry of patients with stable coronary artery disease (CLARIFY) 2017	Patients with stable coronary artery disease. n ¼ 1537	Patients in India were significantly younger than rest of the world and had a higher prevalence of diabetes. Indian patients were also less likely to be on aspirin, statins, and beta-blockers. High LDL-C, low HDL-C was more common in Indian patients.	Participants were selected from major cities, leading to urban bias.

Premature coronary artery disease in India: coronary artery disease in the young (CADY) registry 2017	Young patients (men age < 55 years and women age < 65 years) with CAD from 22 centers in India. n = 997	Conventional risk factors (family history of CAD, hypertension, dyslipidemia, tobacco use, diabetes mellitus) were highly prevalent in these patients. Females were older and had higher burden of comorbidities.	Lack of data on genetic risk factors.
Indian Heart Rhythm Society e Patients with atrial fibrillation. n = 1537 Atrial Fibrillation (IHRSAF) registry 2017	Patients with atrial fibrillation. n = 1537	Mean onset of AF in Indian patients occurs 10 years earlier than in the West.	Possible selection bias (patients primarily recruited from tertiary centers).
Trivandrum Heart Failure registry 2015	In-hospital heart failure admissions. n = 1205	Most common cause of heart failure in this registry was ischemic heart disease accounting for > 70% of cases. 25% of HFrEF patients prescribed guideline-directed therapies at discharge.	No drug-dosing data.

ACS: acute coronary syndrome; AF: atrial fibrillation; HDL: high-density lipoprotein; HFrEF: heart failure with reduced ejection fraction; LDL: low-density lipoprotein; NSTEMI: non-ST-elevation myocardial infarction; PCI: percutaneous coronary intervention; STEMI: ST-elevation myocardial infarction.

Patients who were admitted got thrombolytic treatment when it wasn't needed. Most of these happened in hospitals with low patient volumes that did not teach. Over 90% of people who were in the hospital used antiplatelets. There were a little more percutaneous cardiac interventions in STEMI cases (12.9% vs. 11.7% in NSTEMI and 10.9% in unstable angina; $P < 0.001$). A total of 76.4% of patients were sent home on aspirin, 79.4% were sent home on clopidogrel, 62.7% were sent home on beta-blockers (BB), 70.1% were sent home on statins, and 25.5% were sent home on ACEi/ARBs.

In a different study, differences between men ($n = 19,923$) and women ($n = 5825$) were looked at in terms of how they presented, were diagnosed, and were treated. The study found that women were older than men (mean age 64.4 years vs. 59.3 years, $P < 0.001$). Women were more likely than men to have had a previous MI (16% vs. 14%) but less likely to have high blood pressure (50% vs. 52%). Women were more likely than men to have chest pain (86% of women vs. 12% of men; $P = 0.06$), shortness of breath (11% vs. 12% of men; $P = 0.006$), or left bundle branch block (2% vs. 3% of men; $P = 0.03$). However, women were more likely than men to have positive cardiac biomarkers (60% vs. 57%) and to have coronary angiography (13% vs. 11%), with a P-value of less than 0.001 for all of them. In the Acute Coronary Syndromes: Quality Improvement in Kerala (ACS QUIK) study, 63 of the 125 hospitals in the Kerala ACS registry were randomly assigned to either the intervention or usual care group. Twelve government hospitals that were not in the Kerala ACS register were also included. A quality improvement tool kit with audit and feedback, checklists, patient information materials, and links to emergency cardiovascular care and quality improvement training was used by 15 hospitals in the intervention group to care for people with ACS. The study found that there was no difference between the two groups in the main outcome, which was death from any cause, a second heart attack, a stroke, or major bleeding (5.3% in the intervention group vs. 6.4% in the control group; adjusted odds ratio [aOR]: 0.98, 95% CI: 0.80e1.21). Also, there were no statistically significant differences in the advice given to quit smoking (96.0% vs. 94.7%; aOR: 1.06, 95% CI: 0.67e1.67). However, the rates of people taking the best in-patient medications (aspirin, adenosine diphosphate receptor

antagonist, anticoagulant, and BB) (31.7% vs. 35.8%; aOR: 1.45; 95% CI: 1.28e1.64) and the best medications for discharge (aspirin, adenosine diphosphate receptor antagonist, statin, and BB) (61.8% vs. 64.0%; aOR: 1.61, 95% CI: 1.42e1.82) were high.

In one study, 27 ACS providers from the ACS QUIK study were interviewed. These providers included cardiologists, emergency room doctors, emergency room nurses, coronary care unit nurses, cardiac catheterization laboratory technicians, ambulance paramedics, a hospital administrator, and a state government health policy official. The interviews were done to learn more about what helped and hindered pre-hospital ACS care, as well as the reasons behind these issues. The study found that (1) patients with ACS often think their symptoms are caused by something other than their heart; (2) emergency medical services are not often used in pre-hospital management; (3) Kerala's pre-hospital healthcare infrastructure is inadequate, which causes delays; and (4) patients make multiple stops, such as at a primary health centre and a peripheral hospital, before reaching a facility that can make a definitive diagnosis. The study also looked at how mobile health tools might be able to speed up the process of diagnosis and treatment.

That being said, the Kerala ACS registry is India's biggest ACS registry so far. It gives useful information that is being used to create programmes that make ACS handling better in India. The different types of people that live in India and the way things work in different parts of the country make it hard to apply data from the Kerala ACS registry to other parts of the country. Since people didn't have to be in the Kerala ACS register to use it, the data may not be accurate for all inpatient practices in Kerala. Also, some of the event rates may be too low because the data only came from people hospitalised in coronary care units. They couldn't get data from emergency rooms or other inpatient units because they didn't have enough resources.

Treatment and outcomes of acute coronary syndromes in India (CREATE)

People with ACS who went to 89 hospitals in 50 different Indian cities over the course of 4 years, finishing in 2005, were asked to join the CREATE registry. At the start of the study and after 30 days, prospective data were taken on these patients. Baseline clinical characteristics, demographics, medical history, time to get to the hospital, time until thrombolysis, treatments in the hospital, outcomes in the hospital and at 30 days, and socioeconomic indicators were some of the things that were gathered. Most of the people who took part were men (76.4%), with a mean age of 57.5 years. Twelve thousand four hundred eighty patients were screened and found to have STEMI, which is sixty-four percent. The average time of appearance was six hours after the first sign of the problem. People who had STEMI were more likely to be smokers (34.1% vs. 18.5%), but they were less likely to have had diabetes (26.9% vs. 35.8%), high blood pressure (31.4% vs. 47.5%), a myocardial infarction (11.5% vs. 26.6%), or heart failure (0.8% vs. 1.6%; $P < 0.001$ for all of these) in the past. About 97.9% of patients were given antiplatelet drugs at the time of presentation, and coronary angiography was done on 23.2% of them (21.8% with STEMI and 25.7% with NSTEMI). In 58.5% (n7261) of STEMI patients, thrombolysis was given. While in the hospital, 59.3% of patients were given BB, 52.0% were given lipid-lowering drugs, and 56.8% were given ACEi or ARBs. At 30 days, 8.6% of STEMI patients and 3.8% of NSTEMI patients had died. When it came to socioeconomic position, "rich" patients were more likely to have diabetes (40.9%) and high blood pressure (22.3%), but less likely to smoke tobacco (32.7%; $P < 0.001$ for trend for all). They also had the lowest rate of STEMI (47.3%), but they were the most likely to have coronary imaging (40.9%) and PCI (15.3%). The "rich" group had the fewest deaths (5.5%), while the "poor" group had the most (8.2%). Even after risk factors and the site of the infarct were taken into account, this difference did not go away.

The fact that 50 different towns in India were looked at makes the study strong. Because it was based on observations, the study has some flaws. Other factors, like exercise and schooling, may have been confounding factors that were not looked at. The study also didn't collect information about medicines at discharge or how well they were taken at follow-up.

TN-STEMI stands for the Tamil Nadu ST-Segment Elevation Myocardial Infarction programme.

The TN-STEMI programme is a prospective, international study that was started to look into and improve access to perfusion and PCI during STEMI. The study connected 4 facilities that could handle PCI to 35 health centres that couldn't handle PCI and a volunteer ambulance service that could get and send electrocardiograms (ECGs) and take patients from one hospital to another. People who had a STEMI were admitted in the programme before it started (n = 898) and after it

started ($n = 1522$), and the two groups were compared. The types of information gathered included the patient's medical history, demographics, mode of transportation, the time they arrived at the hospital, the time it took to do an ECG, the time they were managed in the hospital, and the results of their care while they were there. The study discovered that a big jump in the number of patients moving from healthcare centres that didn't have PCI to those that did after the programme started (3.7% before the programme started vs. 33.5% after it started; $P < 0.001$). One minute was added to the time between the first medical contact and the ECG, and five minutes were added to the time between the ECG and the PCI ($P = 0.02$). A higher percentage of STEMI patients had coronary angiography (3.5% vs. 31.3% of patients without the implant) and PCI (3.1% vs. 20.6% of patients with the device). The number of people who died in hospitals that weren't PCI centres dropped from 7.6% to 6.1% after the programme started. More antiplatelet drugs (59.2% vs. 82.3% for aspirin, 57.6% vs. 64.1% for clopidogrel, 3.7% vs. 15.5% for prasugrel, and 3.2% vs. 11.8% for ticagrelor) and statins (62.6% vs. 76.5%; $P < 0.001$ for all) were given at discharge because of the programme.

The study's results show that a referral model like the one suggested in this study may be the key to getting more people with ACS to get standard care. But for the plan to work, the primary, secondary, and tertiary care hospitals need to work together well. The different ways that healthcare is set up in India might make this plan less useful there.

The DEMAT register is for finding and treating coronary heart disease.

People with ACS who went to 10 tertiary care centres in 9 Indian cities were asked to join the DEMAT register. During the hospital stay, after discharge, and at the 30-day follow-up, prospective data were gathered. A total of 1565 people who were thought to have ACS were signed up, and 334 of them (21.3%) were women. In the study, women who came in with ACS were older than men (mean age 60.8 years vs. 57.2 years; $P < 0.001$) and less likely to have STEMI (38% vs. 55%; $P < 0.001$) than men. More women than men had high blood pressure (62% vs. 42%; $P < 0.001$) and diabetes (46% vs. 38%; $P = 0.01$), but more men than women used tobacco (2% vs. 33%; $P < 0.001$). Low HDL (15.6% vs. 15.0%; $P = 0.81$) and stroke (0.9% vs. 1.5%; $P = 0.37$) were about the same in both groups. Neither group had significantly different in-hospital management. There were about the same rates of PCI (49.4% vs. 49.0%; $P = 0.90$) and CABG (5.8% vs. 6.6%; $P = 0.61$), as well as the same rates of aspirin (93.7% vs. 96.1%; $P = 0.06$), clopidogrel (92.5% vs. 93.7%; $P = 0.42$), BB (76.4% vs. 79.2%; $P = 0.26$), and unfractionated or low-molecular weight heparin (52.1% vs. 51.5%; $P = 0.85$). Women were given thrombolytic treatment 16.2% of the time, while men were given it 25.4% of the time ($P < 0.01$). Similar rates of prescriptions for aspirin (94.4% vs. 93.9%; $P = 0.74$), BB (77.3% vs. 80.0%; $P = 0.28$), and statins (86.2% vs. 88.5%; $P = 0.26$) were found between the two groups when they were sent home. Men were more likely than women to be prescribed clopidogrel when they were released (87.2% vs. 91.8%; $P = 0.01$). At 30 days, the rates of death (3.0% vs. 1.8%; aOR: 1.40, 95% CI: 0.62–3.16) and death, rehospitalization, or cardiac arrest (13.5% vs. 12.5%; aOR: 1.00, 95% CI: 0.67–1.48) were the same in both groups.

One of the first studies to compare results between men and women with ACS was the DEMAT registry. The study does have some flaws, though, like a small group size and only a short period of follow-up.

North Indian ST-Segment Elevation Myocardial Infarction (NORIN STEMI) registry

There are two big, mostly free tertiary medical centres in New Delhi, India, that are home to the NORIN STEMI registry. It is a prospective cohort study. These organisations are paid for by the government and help people who aren't getting enough help. The study's objective is to look into risk factors (including high blood pressure, high cholesterol, kidney disease, and diabetes mellitus), practice patterns (including how long it takes for patients to present with STEMI and receive PCI), and the outlook for patients who appear with STEMI at these tertiary care hospitals. The study began taking patients in January 2019, and its goal is to have 3500 people take part. A recent study showed that the median age of the patients was 55 years, with 34% of them being younger than 50 years old. The data came from 558 patients. 29% of people had high blood pressure, 23% had diabetes mellitus, 5% had hyperlipidemia, and 60% were currently smoking. It's important to note that 45% of patients went to the emergency room more than one hour after their symptoms started. The study stands out because it uses up-to-date data and talks about how people present and are treated in two big tertiary care hospitals. While results from this registry after all participants have been enrolled are still being expected, early results show worrying trends.

Prevention of atherothrombosis in stable coronary artery disease

Prospective observational longitudinal registry of patients with stable coronary artery disease (CLARIFY)

The CLARIFY register was done in 45 different parts of the world so that researchers could learn more about the people who lived there, how they showed up in the clinic, and how they were treated for CAD. Twenty-one people in the registry had stable CAD and at least one of the following: coronary stenosis >50% on coronary angiogram; a history of myocardial infarction (MI) more than three months ago; chest pain with myocardial ischemia shown by stress electrocardiogram, stress echocardiography, or myocardial imaging; or a history of CABG or PCI more than three months ago. One study from this registry looked at how common coronary artery disease risk factors were, how well they were controlled, and how different people in India and the rest of the world (ROW) were affected by them. People who lived in India were much younger than people who lived in the ROW (59.6 ± 10.9 years vs. 64.3 ± 10.4 years). In this study, more Indian patients (42.9% vs. 28.8%) had diabetes, but fewer ROW patients had a family history of early CAD (21.3% vs. 28.7%), dyslipidemia (63% vs. 75.2%), peripheral artery disease (4.8% vs. 10%), abdominal aortic aneurysm (0.1% vs. 1.6%), and carotid disease (1.8% vs. 7.7%). Along with that, Indian patients were less likely to be taking aspirin (85.6% vs. 87.8%; $P = 0.0443$), statins (77.9% vs. 90%; $P < 0.001$), and BB (69.4% vs. 75.4%; $P < 0.001$). Indian patients were more likely than ROW patients to have high LDL cholesterol (LDL cholesterol < 70 mg/dL) (41.6% vs. 31.2%) and low HDL cholesterol (41.6% vs. 31.2%). They were also less likely to be fat (27.2% vs. 48.4%).

Premature coronary artery disease in India: coronary artery disease in the young (CADY) registry

In the Indian population, the CADY register is a prospective, multi-centric, observational study that looked at risk factors for early CAD in men aged 55 to 64 and women aged 55 to 54.22 CAD was defined by a good stress test, a clear imaging method, or a history of PCI or CABG in the past. People from 22 centres in India took part in the study. The average age of the 997 patients was 49.1 years, with 46.7 years for men and 55.1 years for women. About 680 people (68%) showed up with ACS (51% STEMI and 49% NSTEMI). 49.4% of the group had a family history of CAD, 11.4% had hypertension, 38.6% had dyslipidemia, 44.2% had diabetes mellitus, and 56.4% had a BMI of 23 or more. Diabetes mellitus (62.2% vs. 37.1%) and hypertension (72.1% vs. 40.3%; $P < 0.0001$ for all) were more prevalent in females with premature CAD compared with males, while tobacco use (52.7% vs. 3.2%; $P < 0.001$) was more common in males. The study also found that patients with ACS were more likely to be given BB (54.6% vs. 38.7%) and statins (80.8% vs. 63.5%) than patients without ACS. Antiplatelet drugs (80.5% vs. 91.8%) and ACEi/ARBs (35.9% vs. 53.3% of the time) were given less often to people with ACS compared to people who did not have ACS.

The CADY register was a big project that found out what made people in India more likely to get CAD early. The study also found that women have a better chance of being prevented because they have a higher rate of comorbidities. The study had some problems because it didn't have enough information on family risk factors, which are big reasons why people in this group get CAD.

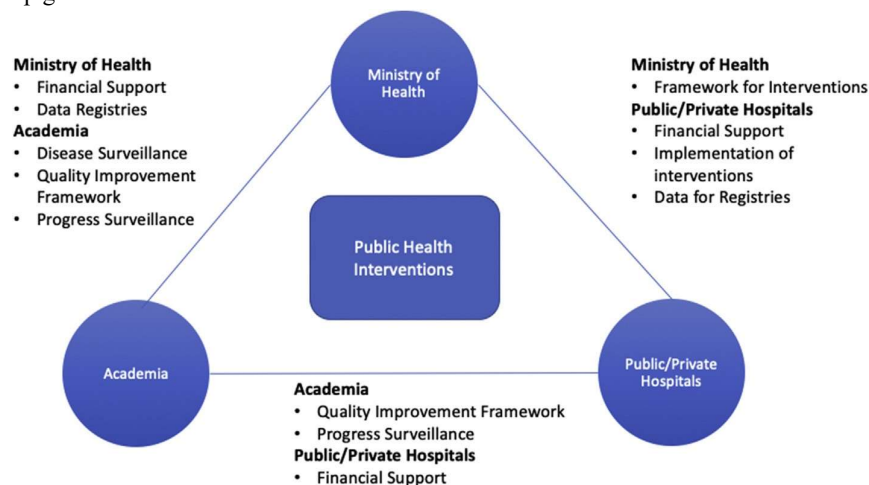


Fig. 1. Potential framework for collaboration between academia, ministry of health and public/private hospitals.

Improving outcomes in patients with heart failure and atrial fibrillation)

Indian Heart Rhythm Society-Atrial Fibrillation (IHRS-AF) registry

The goal of making the IHRS-AF was to collect epidemiological statistics on atrial fibrillation (AF) in India. The study looked at 1537 people with AF who were entered in advance from 24 inpatient or outpatient settings in 12 Indian cities. The information gathered included information about the patients' backgrounds, how they presented, any other illnesses they had, the treatments they received, and how they did after one year. The people who took part were, on average, 54.7 ± 15.9 years old, and 51.5% of them were women. This was a lot younger than the average age of people with AF in the US, which was 75 years old. Also, 47.6% of the people who took part had rheumatic heart disease. There was high blood pressure (31.4%), heart failure (18.7%), and coronary artery disease (16.2%) in the patients. Twenty-four percent of patients had paroxysmal AF at their first visit, thirty-three percent had persistent AF, and thirty-five percent had constant AF. At a follow-up after one year, 45.6% of patients still had permanent AF, while only 10.5% and 20.3% still had paroxysmal and persistent AF, respectively. At one year, about 22.6% of people did not have AF. Rate control strategy was the main part of care for 75.3% of patients at the first visit, and that number rose to 79% at the end of the first year. At the end of one year, about 66% of patients had their rate under control (heart rate < 90 beats per minute). At one year, 1.03% (n=16) of patients had a stroke. Of these, 8 had an ischemic stroke (mean INR 1.85), 4 had a hemorrhagic stroke, and 2 had an unknown stroke. Heart failure killed 35% of the 100 patients who had died after one year. This was followed by myocardial infarction (14%), sudden cardiac death (12%), and stroke (4%).

The IHRS-AF shows that people in India who have AF are younger than people in the West. It also showed that this group of people had a lot of rheumatic heart disease. One big problem with this study was that it had selection bias because the patients came only from special care centres. In other words, this might not really show how common and what causes AF in the group.

Trivandrum Heart Failure Registry (THFR)

The THFR was made to look at how people with heart failure show up, how they are treated, and how well they do after treatment in Trivandrum, an Indian city in the state of Kerala. There were 18 hospitals in the district that signed up. Questionnaires were used to collect information on heart failure patients who were brought to these hospitals. After 90 days, these patients were followed up with either outpatient visits or calls. Out of the 1209 patients who signed up for the register, 834 (69%) were men. Heart failure was most often caused by ischemic heart disease (72%), then dilated cardiomyopathy (13%), and finally rheumatic heart disease (8%). The average length of stay in the hospital was 6 days (IQR: 4–9 days), and almost all of the patients (94% of them) were given diuretics. 54% of patients were given BB, 46% were given ACEi/ARBs, and 44% were given aldosterone blockers. Only 19% of patients with left ventricular systolic dysfunction (defined by the researchers as $EF < 45\%$) were on standard medical therapy (a mix of BB, ACEi or ARB, and aldosterone receptor blockers) while they were in the hospital, and only 25% were given standard medical therapy when they were sent home. At 30 days, 12.5% of people had died, and at 90 days, 18.1% had died. Guideline-directed medical treatment patients had lower death rates (HR: 0.28, 95% CI: 0.14–0.53; $P < 0.001$) compared to patients who did not receive it. Greater risk of death at 90 days was found in people who were older (>55 years old) (hazard ratio [HR]: 1.50, 95% CI: 1.05–2.15), had New York Heart Association Class IV symptoms (HR: 1.60, 95% CI: 1.18–2.16), had less than primary education (HR: 1.82; 95% CI: 1.04–3.17), and had worse renal function (HR: 1.22, 95% CI: 0.82–1.52; $P < 0.05$ for all).

The study shows that this group of people doesn't get a lot of prescriptions for medical treatment that is based on guidelines. The study also found that heart failure was more common in younger people, men, and people with ischaemic heart disease. It is, however, limited by the fact that it doesn't give information on drug dosages and because it is an observational study, it can't be used to draw conclusions about cause and effect. Also, because this study took place in a hospital, many cases that didn't happen in a residential setting would have been left out.

In short, the results show that people in India who come in with CVD are younger and have more risk factors for CVD. There is also a rate of guideline-recommended treatment that is lower than it should be. It is suggested that local health professional groups make a bigger push for primary prevention, maybe at younger ages, since the risk of getting CAD early is higher. To improve patient care, work also needs to be done to find problems in routines and push for changes at the system level. To reach these goals, health workers in government, private, and academic settings must work together

and use these data to help make policy. As shown in Fig. 1, we suggest one such model in which the Health Ministry gives public and private hospitals a framework for interventions. The hospitals are then responsible for putting these plans into action and giving financial support for them. In the same way, universities are in charge of providing frameworks for improving quality and keeping an eye on the progress of health measures in exchange for information and money from hospitals and the Health Ministry.

II. CONCLUSION

India needs help right away with its heart disease crisis. A look at the data shows that Indian patients who come in for secondary prevention are younger and have more CVD risk factors. Health professionals from the government, the business sector, and academia need to work together to find knowledge gaps and use that information to shape policy.

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