

# Collaborative care in secondary prevention of cardiovascular disease in India: Findings from a multi-stakeholder, qualitative analysis

Kavita Singh (✉ [kavita@ccdcindia.org](mailto:kavita@ccdcindia.org))

Public Health Foundation of India <https://orcid.org/0000-0003-4330-666X>

Mark D. Huffman

Northwestern University Feinberg School of Medicine

Nikhil Tandon

All India Institute of Medical Sciences

Raji Devarajan

Centre for Chronic Disease Control

Dorairaj Prabhakaran

Public Health Foundation of India

Emily Mendenhall

Georgetown University

---

## Research

**Keywords:** Cardiovascular disease, collaborative care, secondary prevention, India

**Posted Date:** April 1st, 2021

**DOI:** <https://doi.org/10.21203/rs.3.rs-274478/v2>

**License:** © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

---

# Abstract

**Background.** Cardiovascular disease (CVD) is pervasive in India, and little is known about the perception of patients and providers about collaborative care in secondary prevention of CVD. To fill this gap, we performed a needs assessment and investigated the barriers and facilitators of the collaborative quality improvement (C-QIP) strategy for secondary prevention of CVD in India.

**Methods.** Between September 2019 – February 2020, we conducted semi-structured in-depth interviews with providers, health administrators, patients and caregivers to understand the challenges and facilitators of the C-QIP strategy consisting of electronic health records-decision support system (EHR-DSS), non-physician health worker and text messages for healthy lifestyle. Also, data were analyzed from the lens of consolidated framework for implementation research (CFIR) to guide effective implementation of the C-QIP strategy. We used an iterative approach for qualitative data analysis based on the framework method.

**Results.** We interviewed 38 physicians, 14 non-physician health workers (nurses, community health workers, pharmacists), 4 health administrators, 16 patients and their caregivers. Challenges perceived from providers' and health administrators' perspectives to implement quality in CVD care were related to CFIR actors and inner and outer settings: high patient volume, too few specialists, time-constraints, physician burnout, lack of robust communication system or referral linkage, paucity of electronic health records, lack of patient counsellors, polypharmacy and lack of sustainable financing schemes for outpatient services. In addition, low health literacy, high cost of treatment, misinformation bias, and difficulty in maintaining lifestyle changes were key barriers from patients' and caregivers' perspectives. Potential benefits of the C-QIP strategy emerged, such as standardized treatment protocol to minimize variation in care, reduced medication errors, improved physician-patient relationships, and enhanced self-care management. However, concerns were raised about feasibility, adoption, and implementation of EHR-DSS across heterogenous healthcare settings, including related to interoperability, patient confidentiality and data security, appropriateness across diverse patient groups, and care delivery costs.

**Conclusions.** Our findings reveal context-specific, patient-, provider- and health system factors that will influence C-QIP strategy implementation in India. Strategies to optimize chronic care of CVD need to be low-cost, culturally acceptable, targeted, and integrated into existing systems and care pathways to be successful.

## Contributions To The Literature

- Collaborative care involving clinical decision support, team-based care and audit-and feedback reports are proven effective in improving care in well-resourced settings. However, limited evidence exists on how patients and providers perceive about collaborative cardiovascular care to understand how it can potentially meet patients' needs and expectations and improve their health in Indian context.

- This study informs the development and implementation of a collaborative quality improvement (C-QIP) strategy consisting of electronic health records-decision support system, non-physician health workers and text messages for healthy lifestyle in secondary prevention of Cardiovascular disease in India.
- The use of Consolidated Framework for Implementation Research (CFIR) domains and constructs identified several barriers related to CFIR actors, inner and outer settings (high patient volume, physician burnout, paucity of electronic health records, lack of patient counsellors, and difficulties in maintaining lifestyle changes) and facilitators (standardized treatment protocol, reduced medication errors, improved physician-patient relationships, and enhanced self-care management) to the implementation of C-QIP strategy in Indian context.

## Introduction

Cardiovascular disease (CVD) is highly prevalent in India, with more than 70 million people with existing disease and a higher rate among urban Indians [1–3]. CVD poses challenges for patients in both home and clinical settings to prevent disease-related morbidity and mortality and to optimize health-related quality of life. People with CVD must navigate a different way of eating, moving, taking medicines, and seeking medical care. How people face these self-care challenges are varied, and important gender, socio-economic class and caste differences exist, which manifest in how people manage chronic diseases like CVD. These differences also exist in terms of how people access and adhere to recommended treatments, which further exacerbates inequities in clinical outcomes [4–6].

Several factors at the patient-level (e.g., health literacy, out-of-pocket costs), provider-level (e.g., knowledge, skills, time constraints, and high patient volume), and health system-level (e.g., weak policies, fragmented care) affect the quality, type, affordability, and continuity of CVD care [7]. Tackling clinical care quality is imperative as addressing barriers to access good medical care for people with chronic conditions. A 2018 systematic analysis of deaths in 137 countries found that poor quality of health care led to a larger burden of mortality than low access to care, causing 5 million preventable deaths (95% uncertainty interval [UI] 4.9–5.2 million) compared with 3.6 million deaths (UI 3.5–3.7 million), respectively [8]. The National Academy of Medicine 2018 report on Global Quality Chasm underscored the urgency for comprehensive efforts to close quality gaps around the world [9].

In the current study, we investigated how patients and providers perceive collaborative cardiovascular care to understand how it can potentially meet patients' needs and expectations and improve their health. Collaborative care involving clinical decision support, audit and feedback reports, and team-based care have been successful in well-resourced settings for improving care [10]. But less is known about trust, acceptability, and feasibility of collaborative care among patients and providers in India, or other contexts with less health system funding than in high-income countries. Team-based care involving specialists and community health workers to empower, encourage, and facilitate care processes for patients with a prior acute CVD event has shown improvements in medication adherence and systolic blood pressure [11]. Prior studies have also demonstrated the feasibility of implementing quality improvement (QI)

strategies, leading to improvements in cardiovascular risk factor control, prescription of guideline-directed medical therapy, and quality of life among patients with a prior acute coronary syndrome event or stroke and among those at high predicted cardiovascular disease risk [12–14].

The current study builds on this existing evidence of success and leverages pilot work on task-sharing and technology interventions to inform the development of the multifaceted collaborative *quality improvement* (C-QIP) strategy in secondary prevention of CVD in India. Ethnographic and qualitative research have demonstrated how quality worsens over time in care for people with CVD and related conditions like hypertension and type 2 diabetes mellitus [15, 16]. Qualitative, in-depth analyses of what chronic care of CVD is and how people experience are imperative to develop a deeper understanding of the context of care and to improve the quality of care. To fill the evidence-practice gap in chronic care of CVD, we performed a needs assessment and investigated the barriers and facilitators of the C-QIP strategy in secondary prevention of CVD in India.

## Methods

### Study Setting

This qualitative study was conducted among 3 different groups of stakeholders: 1) health care providers, 2) health administrators, 3) patients, their caregivers (i.e., family members). Health care providers constituted physicians, cardiologists, nurses, community health workers, and pharmacists engaged in providing care for patients with CVD. Care providers were selected from diverse settings across India and identified mainly through a faculty list of CVD and hypertension training programs coordinated by the Public Health Foundation of India. Health care administrators, patients, and caregivers were invited to participate in the qualitative interviews from four participating sites (2 public and 2 private hospitals in Delhi and Karnataka) in the C-QIP feasibility trial, drawing upon the breadth of clinical contexts in the 2 states.

### Study Design

This study was designed to inform development and implementation of the C-QIP strategy to ensure that it addressed the myriad factors that can facilitate, as well as impede, collaborative care programs. Since our goal was to standardize outpatient care delivery models for patients with CVD, we drew insights through semi-structured interviews with care providers, health administrators, patients, and caregivers in India. We drew upon key informants' experiences from several clinics from different parts of India and focused on what worked and what did not within and around the collaborative care model for CVD management. We used qualitative interviews to capture how people perceived CVD management using QI strategies, including strategies that used electronic health records-decision support systems (EHR-DSS), non-physicians health workers (NPHW), and text messages to encourage healthy lifestyles, in their everyday lives from various perspectives, including at the provider, health administrators, patient, and caregiver levels. These data can inform implementation of the C-QIP strategy to address clinical quality,

including related to patient-reported experiential measures—like feeling included or heard, being included and respected, and being recognized as a central or peripheral feature of the collaborative care—which may facilitate or impede success.

We used a purposive sampling frame to select an initial sample of participants who had diverse roles and experiences in the care of patients with CVD ranging from cardiologists and physicians to cardiac care unit nurses, pharmacists, community health workers to health administrators and policy makers. We then used a snowballing sampling technique based on the in-depth interviews to recruit additional participants with increasing variability until we achieved theoretical saturation at which point no novel concepts seemed to emerge. Patients or caregivers were interviewed from the 4 hospitals (3 in Delhi and 1 in Karnataka), and providers were selected from the 32 hospitals across India. The study was approved by the Institutional Ethics Committee of the Public Health Foundation of India.

## Data Collection

We conducted semi-structured interviews in person and over the phone between September 2019 and February 2020 using an interview guide specifically developed for each participant group: healthcare provider, health administrator, patient, and caregiver (see *supplement* for the interview topic guide). The interview guide broadly focused on 3 different aspects of collaborative CVD care. First, the interview questions were asked about challenges faced by providers, administrators, patients and their caregivers to manage CVD in India. Second, it delved into understanding how common CVDs are across age, gender, and socio-economic groups, as well as co-morbidities, patients' needs and understanding of CVD and related self-care, and how providers motivate patients' self-care. Third, interview questions focused on eliciting views of multiple stakeholders on the C-QIP strategy, perceived enablers and barriers to its implementation in diverse clinical practices (public, and private) within 4 sites, and broader relevance of collaborative care for CVD management in Indian context. Interview questions also probed the relative advantage, self-efficacy, and systems-level challenges or the cultural issues that might affect the implementation of the C-QIP strategy in Indian context.

Two members of the study team (KS and VSB) conducted the in-depth interviews, except for 2 interviews, which were conducted by a third researcher (RD) due to the opportunity of face-to-face interviews with the physicians at their preferred location. In-depth interviews began with open ended questions, and probes were used to elucidate emerging themes. All interviews with healthcare providers and health administrators were conducted in English, whereas patient and caregivers' interviews were conducted in the local regional languages (Hindi and Kannada) by a team member fluent in these languages. Interviews ranged from 30 minutes to more than one hour in length. Interviews were audiotaped, transcribed verbatim, and checked for their accuracy by study team members (KS and VSB).

## Analysis

An iterative approach was used for data analysis based on the framework method for qualitative research [17]. The first author developed a codebook based on the interview guide, what concepts emerged iteratively, and then what themes within themes were consistent through analysis. The first author (KS) discussed these codes with other coauthors before and while (EM, MDH, DP) the transcripts were coded. We then systematically evaluated the codes to see among whom and how they emerged; we used this analysis to develop a theoretical framework to describe key themes around challenges and facilitators to implement to the C-QIP strategy for outpatient CVD care. While reviewing the codes, we studied anthropological and public health qualitative research around care-seeking, including clinical challenges people face, while returning to the depth of context and experience of our study participants. Further, interview data were analyzed from the lens of Consolidated Framework for Implementation Research (CFIR) to inform effective implementation of the C-QIP strategy [18]. The CFIR is organized into five domains based on context (intervention characteristics, individuals involved, inner setting, outer setting, and process of implementation) [19]. We used MAXQDA software for data analysis and adhered to Consolidated Criteria for Reporting Qualitative Research standards [20].

## Results

Among the 3 stakeholder groups (N = 72 participants), we interviewed 38 physicians (mean age:  $56 \pm 7.8$  years, 88% men), 14 non-physician health workers ( $38 \pm 4.2$  years, 38% men), 4 health administrators or policy maker, 100% men with mean age:  $54.4 \pm 5.2$  years, and 16 patients ( $52.4 \pm 6.4$  years, and 62% men) and their caregivers ( $32.4 \pm 9.5$  years, and 52% men). Two physicians and a patient refused to participate in the interview due to personal reasons. Physician- and hospital-level characteristics are summarized in *Table 1*. Most (88%) of these participants were men, and cardiologists (78%) with >10 years of experience in practicing cardiology. On average, physicians provided care for 550 patients per month, spending 15 minutes with patients at their initial visit, and 5–10 minutes in follow-up visits. One-third of health facilities had a reminder system for clinic visit. Nearly half of health facilities had an electronic medical record keeping system and a physician performance feedback system, but these did not include audit and feedback reports for providers focusing on patient-level outcomes.

## Challenges for Implementing Quality (Needs assessment)

We found major gaps in existing care that provided strong motivation to develop and implement the C-QIP strategy in patients with CVD. Salient barriers to chronic care of CVD from the patient, provider, and health system perspectives are presented in *Table 2*, along with illustrative quotes. Most cardiologists (80%) identified *high patient volume, time-constraints, and low health literacy* among patients to be greatest challenges for providing optimal CVD care. In addition to their administrative duties, physicians found insufficient time to provide care in the first place. One cardiologist explained, *“Volume is too high that we are not able to spend time with each patient in a proper way...be it listening to their problems... then assessing and as I said because of the sheer volume we are not able to spare maybe 5–10 minutes for each patient. Sometimes we also feel that one particular patient needs more time than the other, but*

*we are always in the rush, finishing the rounds, coming here for the OPD (outpatient department), doing ECHO (echocardiography) procedure, then the CATH (catheterization) lab, then again rounds, so I feel it is the shortage of time (greatest barrier to chronic care of CVD)"*

Further, there are *too few specialists* and too many patients that need specialty care. One out of every three providers identified "physician burnout" to reflect, what they called, a "cultural syndrome", described by one provider when clinicians *"are no longer interested to be actively involved in patient management"* because *"the load is so much, every person has overloaded system, so in an overloaded system a single doctor cannot treat so many cases."* He went on to explain, *"most of the time is going in treating the patient and not in healing the patient. Healing requires both preventive as well as therapeutic (efforts)."* This idea of remedial approaches explicitly was common, as many recognized that *lack of focus on prevention efforts* such as tobacco cessation and management of other CVD risk factors such as hypertension and diabetes. This was recognized as an attitude problem: *"The attitude needs to be changed. We wait for the disease to develop and all the efforts of all the corporate hospitals and everybody is just for the disease to occur so that now they can be rectified. There is nobody interested in preventing the disease."* (physician).

*Lack of robust communication systems* within the healthcare and *poor referral linkage* were emphasized as barriers to provide collaborative care as described by a health administrator: *"Firstly, I think there is lot of misguidance to the patient, as to how, when and where they should approach which specialty. That is the thing that is not fixed in our country."* Another challenge was *paucity of electronic health records* in most hospitals as one physician quoted *"There is no mechanism where we monitor the follow-up of the patient. If there is a lot to follow-up, we do not remember also because nothing is computerized, no entries are made like that so sometimes they (patients) come for the follow-up"*.

Two-thirds of physicians recognized that *poor adherence to medications, polypharmacy and mixed recommendations from other traditional health practitioners* limited quality care across diverse healthcare settings. Adherence to prescribed therapy is an important aspect of patient self-care to achieve CVD risk factor targets and to reduce the risk of cardiovascular mortality and disability. Complex factors at multiple levels affect medication adherence, such as perceived side effects of multiple drugs, low awareness and knowledge of CVD, and managing multiple pills to be taken at different time. For example, a physician stated: *"One is the patient's financial condition, his intellectual condition, his understanding about the disease (that affects adherence to therapy)."* Another clinician explained, *"The secondary prevention (of CVD) in whom we advise them to continue medicines lifelong, but good number of them tend to stop their medicines 3 to 6 months from the time of the index event thinking that they are normal and even if after an angioplasty where it is mandatory that they have a few medicines lifelong quite a good number of them, especially on the governmental schemes get procedures done, tend not to continue medicines."*

Affordability of CVD treatment is a major consideration in low-income economies from patients' perspectives. Particularly for those belonging to the lower socio-economic groups, including among

individuals with low educational attainment, *high cost of treatment* and *low knowledge/awareness* about CVD were important concerns. On the other hand, people who are highly educated were thought to be susceptible to unreliable information from online sources. Nearly half of providers expressed concern that the *misinformation epidemic* circulating on WhatsApp and other social media platforms misleads patients with CVD. For example, one physician stated: *“There are lot of misinformation campaign goes on WhatsApp ... Because of that, lot of mistrust has arisen in patients and they just keep on changing doctors... many of the highly literate patients who are computer savvy, they are...what I call them is misinformed... of this misinformation because of this misinformation going on in various social media, so that misinformation epidemic has to be controlled so sometimes that takes lots of time”*.

*Lack of patient counsellor* as an interface between patients and providers was cited as another challenge, which otherwise enables patients to communicate more frequently and more clearly about their concerns with a patient counsellor. *Difficulties in maintaining lifestyle changes*, which includes heart healthy diet, exercise and tobacco cessation, and misconceptions around dietary and exercise habits were identified as major barriers at the patient-level. *“I had consulted one place, there the doctor said like you should not walk. So, can we do walking?” (patient)*

## Opportunities for Facilitating Quality

The qualitative data analyzed from the lens of the Consolidated Framework for Implementation Research [19], which offers a comprehensive approach encompassing intervention characteristics, individuals involved, inner and outer settings, and the process of implementation are reported below and in (*Figure 1*).

## Intervention Characteristics

*Evidence strength and quality*: Multifactorial strategies combining clinical decision support, audit-feedback reports, task-sharing, e/mHealth, and text messages are demonstrated to be more effective than single interventions in improving cardiovascular risk factor control as well as reducing death and readmission rates [21]. However, data on effectiveness and implementation of the C-QIP strategy that features EHR-DSS, NPHW support, and text messages for healthy lifestyle among patients with established CVD are lacking in Indian context. Despite limited exposure to the C-QIP strategy, when the conceptual collaborative care model and intervention components were described to the stakeholders, they perceived several *relative advantages* to the existing care. Physicians perceived that an EHR-DSS could help to better organize their workplace, standardize treatment protocols followed by different care teams within and among specialties, likely to reduce the time of (in)action, and reduce medication errors by busy practitioners. The mechanisms of these actions would be through timely and accurate DSS prompts, based on evidence-based guidelines, and action, which could potentially save time in patient care. *“So, given the busy clinic we (physician) miss out on certain essential prescription drugs which need to be there for heart failure patients for example. This DSS prompt can be an alert for the physician if*

*something is missed in the prescription.” [cardiologist] An EHR-DSS can encourage the prescription of generic drugs, which may reduce out-of-pocket treatment costs and improve adherence to prescribed therapy. EHR-DSS may offer additional value when used at the outpatient clinic because patient data can be used for to improve clinical care and outcomes, including patient-reported outcomes and measures of experiential quality. For example, physicians could be supported by NPHWs who will assist in collecting initial patient data on complaints, anthropometrics, and entering patient data into the EHR; this could allow for more consultation time with patients. "If you [researcher] are providing us, it [NPHW] is worthwhile, it is beautiful activity, it should be given. I strongly recommend that. 90% of your problems and recurrence will be stopped if you are able to modify the lifestyle, motivate them (patients) to modify their lifestyle.” [Health administrator]*

Text message-based reminders could increase patients’ retention in care through follow-up visits as well as improve adherence to prescribed pharmacotherapy. Due to wider availability and penetration of mobile phones across age, gender, socio-economic position, and geographic subgroups, most providers and patients perceived that text message-based reminders for clinic visits, lab appointments, and healthy lifestyle would be useful and acceptable. *“(E)ven a person in village today has a mobile, he (patient) has a WhatsApp, who is capable of reading anything in it.” [Nurse]*

*“It (text messages) will be very helpful. It will be like a reminder, so I don’t think it will add on any burden... So, if I get morning message that you will have to take care of your health, I will feel very good.” [Patient]*

However, physicians raised concerns about the *feasibility and adoption* of EHR-DSS given the diverse patient groups, CVD manifestations, and prognostic factors across different healthcare settings. Also, some respondents expressed concerns that EHR-DSS may not be successful if assistance from NPHWs were not provided to the physicians. *“Although some hospitals have introduced all this [EHR-DSS] in the outstation, I believe these physicians just do not use the computer, because to just enter all this data, it takes so much time, I am not going to do it.” [Cardiologist]*

Some respondents expressed concerns regarding the disconnect between EHR-DSS developers and end users (i.e., health care providers). One physician stated: *“Majority of them [EHR-DSS] are designed by non-medicals and they are designed in the IT lead offices who have really not visited the doctors, and they have not used. Their [software developers] advisors are not the real-time doctors, and they have not sat through in the clinic.” [Cardiologist]*

*Complexity:* The C-QIP strategy was perceived as a complex intervention because it involves multi-level implementation strategies, actors, and integration of different disciplines. To reduce the complexity of the C-QIP strategy, key informants suggested to provide standard operating procedures and have uniformity in data collection, entry, and execution of DSS plan. *Figure 2* illustrates potential benefits and concerns of the C-QIP strategy.

## Individuals Involved

*Knowledge and beliefs about the C-QIP strategy:* Patients had limited knowledge about CVD risk factors and reported that the C-QIP strategy could enhance their self-care management and improve doctor-patient relationship. Physicians had mixed views about the EHR-DSS usability and effectiveness but strongly believed in the involvement of NPHWs to provide patient counselling/education and text messages for chronic care of CVD. A few senior consultants also opposed the use of EHR-DSS: *“Decision support systems are something for people who don’t have their own algorithms in their own mind. For most of the people who have grey hair, they will actually reject them.” [Cardiologist]* Technology-averse attitudes of some physicians, slow typing speed, and less familiarity with computer interface were cited as barriers to the wider acceptability and adoption of EHR-DSS as concerned by a physician: *“They (physicians) would be so resistant to use computers [EHR-DSS] because it takes time for learning, so it is mind set, so there is a barrier within my own learning thought process.”*

Health administrators expressed that dedicated human resources (i.e., NPHWs) and information technology and administrative support would be necessary to effectively implement the C-QIP strategy.

## Inner Setting

*Culture, readiness for implementation and structural characteristics:* The inner setting is recognized as an active, interacting facet in implementation research. Key stakeholders at all levels openly expressed about what works and what does not to improve quality of CVD care. The 4 hospitals selected for the C-QIP trial are large, tertiary care teaching hospitals with a mix of 2 government (All India Institute of Medical Sciences, and GB Pant Hospital, New Delhi, India) and 2 private hospitals (Sir Gangaram Hospital, New Delhi and SDM Hospital, Karnataka, India). CVD management teams at these 4 sites included the senior consultants (n = 2–4), and professors in cardiology (n = 2–4), associate professors in cardiology (n = 4), senior residents (n = 6–8), staff nurses (n = 10), and physician assistants (n = 2). Physicians and nurses served on rotational basis across both inpatient and outpatient settings. *All 4 study sites selected for the feasibility trial lack an EHR-DSS system at baseline, use NPHWs in a minimal capacity, and do not use text messages to support patients’ self-care and management.* To improve the usability and acceptability of text messages, key informants suggested to make it available in the local language. Physicians raised concerns about obtaining legal permission, patient confidentiality, and data privacy issue with the introduction of EHR-DSS: *“(In) tertiary care system where there is a lot of disbelief for newer strategies while some people are very forthcoming to the top technologies, there are some who are absolutely against it because that will take away the human angle/touch from the care system.. so, it is very difficult to manage and convince the “so called” CEO of this system with several stakeholders that is the biggest challenge(to) implementing it” [Cardiologist]*

Most participants described that the hospital leadership strongly supports clinic change efforts to improve quality and will provide necessary support in terms of financial resources, training, staffing, equipment, and materials to cater to patients’ needs and improve quality of care.

## Outer Setting

*Patients' needs and resources:* Almost all providers and administrators were of the opinion that the C-QIP strategy should address patient barriers (e.g., low health literacy, cost of care, and poor adherence to pharmacotherapy) and should provide patient choices about various services part of the C-QIP strategy. To increase the acceptance of NPHW facilitated care, a cultural shift and sensitization along with policy-level changes related to NPHW scope of practice regulations are needed.

*External policy:* Given the epidemic proportion of CVD burden in India, the evidence-practice gaps in implementation of effective interventions, as well as heterogeneity in access and care delivery, the proposed multifaceted C-QIP strategy complements the existing infrastructure and activities emanating from the national program for prevention and management of CVD in India.

## Process of Implementation

Physicians and health administrators were willing to change and adopt the C-QIP strategy as they believed it will mitigate several structural and systemic barriers to quality care, such as lack of patient counsellors, poor referral linkages, lack of monitoring systems, and low health literacy among patients. This formative, qualitative study is part of a multi-step *exploration and preparation process* that included a scoping review, multi-stakeholder interviews, and expert consultation meeting to inform the development and implementation of the C-QIP strategy. Costs associated with this new care delivery model is important to inform feasibility and adoption of the C-QIP because for most patients in India treatment cost is a primary concern over the continuity of care (i.e., routine clinic visits or testing). *Public-private partnerships* may be explored in future to scale-up if C-QIP strategy is proven successful. Some providers' and administrators' concerns include: *"it (C-QIP strategy) should be cost effective, (and) it should not increase the cost of the care."* (Physician)

*"I think the government will have to take help from private groups to do this (scale-up). Programs which are primarily driven by government doesn't work usually (to scale-up a program), but if they are public-private partnership will work...So basically, the government has the bandwidth and the ability to have lot of things in place, they have the hospitals, people but they don't have trained personnel."* (Health administrator)

## Discussion

To our knowledge, this is the first comprehensive study of facilitators and barriers to implementation of outpatient cardiovascular quality improvement strategy for secondary CVD prevention in India. In this qualitative multi-stakeholder analysis, we found that the C-QIP strategy was acceptable and feasible to implement by most respondents with a potential for a relative advantage over current practice. The current study results also underscored the lack of policies to promote retention, continuity of care and minimize costs of outpatient care. Providers' lack of identification of their potential role in low quality

care—and in improving the quality of CVD care—seems related to very high clinical loads and potential burnout. Previous research illuminates the critical role of planning and organizing to identify and mitigate potential pitfalls that may hinder collaborative care before implementation [22, 23]. This study informs know-do gaps in secondary CVD prevention, where knowledge can facilitate what collaborative care can do to prevent CVD morbidity and mortality. Specifically, we found team-based care, patient education, and EHR-DSS can improve quality of care and health outcomes. However, successful implementation of the C-QIP strategy requires support of NPHWs because these multiple valences of support (i.e., team-based care, education, and DSS) cannot be achieved by physicians alone.

We found the most salient modifiable barriers to chronic CVD care were structural (i.e., treatments were often too expensive, people could not implement lifestyle changes due to non-supportive environments, systems or policies) and educational (i.e., people understood little about CVD care and navigated multiple channels of health education), which are consistent with previous studies[24, 25]. Physicians described how difficult it was due to care for many patients and were constrained by time, exhaustion, and focus on treatment as opposed to prevention. Successful implementation of the C-QIP strategy requires adequate human resources (qualified and trained healthcare professionals), communication systems (for referral linkages and patient follow-up), and financing (ensuring that patients can engage in the C-QIP strategy at a low financial cost).

Collaborative care represents an important extension to the existing care models by involving trained and certified NPHWs who can play a larger role than what is currently allowed within their scope of practice. NPHW could obtain recommendations from specialists and convey treatment plans to patients, though the potential for miscommunication exists with additional actors. Whether they provide education to patients for self-care management or more prescriptive activities, NPHWs could serve as the fulcrum of care by ensuring continuity of care for patients through coordination between providers and patients using EHR-DSS and text messages. e/mHealth will be necessary to facilitate the collaborative care model so that providers and patients can readily access health information [26–28]. Currently, 60% of Indian adults own a mobile phone, and half of smartphone owners have downloaded at least one mobile application (app) related to health, suggesting that Indian adults are eager to utilize these devices to manage their health [29–31]. These data emphasize how patients perceived that, by involving NPHW and text messages for health lifestyle, they may be empowered for self-management, improve their knowledge about cardiovascular risk factors, and increase trust in the healthcare providers. Patients were concerned about the financial viability of such C-QIP strategy given the priority that patients placed on out-of-pocket treatment cost for maintaining continuity of care.

The current study also identified implementation challenges for the C-QIP strategy, such as interoperability of EHR-DSS in varied health settings, particularly in hospitals that have their own proprietary interface technology to host patient electronic medical records. Additional security measures such as extensive training of health care teams, and strong data privacy and security policies will be essential to protect patient information stored in the EHR. Physicians identified barriers were related to: 1) limited familiarity with mHealth/eHealth tools in care provision, 2) fear of unknown that by introducing a

trained health worker will take away the responsibility of the treating physician to provide lifestyle counselling, or 3) having an EHR-DSS could take away physicians' opportunities for teaching junior doctors by review of manually prepared patient case reports.

Quality is a critical part of collaborative care for CVD. For example, the process evaluation of Acute Coronary Syndrome Quality Improvement in Kerala (ACS QUIK) trial indicated that implementation and acceptability of a QI toolkit were enhanced by hospital-level management support that leveraged available resources to implement the toolkit, ease-of-use of admission/discharge checklists, basic life support training provided to hospital staff in emergency department, and patient education materials [32]. Further, qualitative study findings from the CARRS (Centre for Cardiometabolic Risk Reduction in South Asia) Trial found that the relative advantages and compatibility of the EHR-DSS system with existing clinic set-ups influenced physicians' acceptance of it. Software complexities and data entry challenges were overcome by task sharing because the non-physician care coordinators in this trial collected patients' complaints, measurements and input data for the DSS, and provided a printed copy of DSS management plan for physicians' review and modifications [33]. In this study, physicians perceived that the C-QIP strategy could potentially standardize care delivery and enhance patient self-care management. Having access to clinical decision support through EHR-DSS could further reduce the time of inaction during the clinic visit because patient records would be more quickly accessible for decision making. Respondents also thought that EHR-DSS could potentially reduce prescription errors due to the clinical decision prompts based on evidence-based guidelines.

A disconnect between EHR-DSS software developers and care providers was noted as an implementation and effectiveness barrier of the C-QIP strategy, which can be addressed by using a co-design strategy [34–36] that involves providers and patients throughout stages of intervention design ideation, prototype testing, and implementation. For example, a 2015 study from Kenya demonstrated how researchers engaged in the entire care cascade across all health system levels by utilizing community resources, task-sharing, integrated health record, and clinical decision support to improve access to high-quality, and sustainable care for CVD [37]. Previous reports found that multicomponent QI strategies were associated with greater improvements in CVD risk factor control and improved quality of life, suggesting that a multi-pronged approach has greater effects on health outcomes than a single-pronged approach [12, 38, 39]. The C-QIP strategy may have similar effects on multiple targets: patient education and self-care, adherence/prescription of guideline-directed medical therapy, and coordinated teams and systems to follow-up patients.

This study also has some *limitations*. First, we focused on a breadth of views from diverse stakeholders as opposed to studying a single clinical setting. Because providers and patients in these settings face different challenges, the diluting of context within or across clinical settings may cause us to overlook certain facilitators or barriers to a program that might be seen when focusing explicitly on a more limited number of clinical settings. The study team will include considerations related to scale-out within the corresponding process evaluation of the feasibility trial evaluating the C-QIP strategy. Second, patients, caregivers and health administrators were selected from the 4 sites participating in C-QIP feasibility trial,

which might introduce the selection and social desirability biases. However, we utilized a purposive sampling frame to recruit key informants to achieve diverse representation and glean diverse perspectives on enablers and facilitators of the C-QIP strategy in India. Third, our findings are based on in-depth interviews with little observation using ethnographic methods, which could have provided insights into the actual clinic flow, dynamic interactions between clinicians, nurses, pharmacists, and patients, and process of care measures, so this paper is largely built on the self-reported participants' views and experiences. Future research is also required to generate empirical evidence on quality metrics or indicators to monitor implementation of the C-QIP strategy and program fidelity.

## **Conclusion**

This study identified critical enablers and barriers to the implementation of the C-QIP strategy in the Indian context. The modifiable barriers were low health literacy of patients, high patient volume, too few specialists, physician burnout and time-constraints, and lack of robust communication, linkage, and referral systems. Team-based care, patient education, and EHR-DSS emerged as potentially useful strategies to improve quality and cardiovascular health outcomes for patients with existing CVD. Successful implementation and effectiveness of quality CVD care may improve process of care measures, clinical outcomes, patient-reported outcomes, and patient experiential quality.

## **Declarations**

### **Ethics approval and consent to participate**

This study is approved by the Institutional Ethics Committee—Public Health Foundation of India. Participants provided written signed consent prior to participating in the in-depth interview.

### **Consent for publication**

All authors reviewed and approved the final manuscript for submission to the Implementation Science.

### **Availability of data and materials**

Corresponding author has access to all study data. Data will be made available to the external researchers upon request.

### **Competing interests**

In the past 3 years, MDH received funding from the World Heart Federation to serve as its senior program advisor for the Emerging Leaders program, which has been supported by Boehringer Ingelheim, Novartis, Bupa, and AstraZeneca. MDH also received support from the American Heart Association, Verily, and

AstraZeneca and American Medical Association for work unrelated to this research. The George Institute for Global Health's wholly owned enterprise, George Health Enterprises, has received investment funds to develop fixed-dose combination products containing aspirin, statin and blood pressure lowering drugs. MDH plan to submit patents for heart failure polypills. All other authors declare that they have no competing interests.

## Funding

KS is supported by the Fogarty International Centre, National Institutes of Health (NIH), United States (grant award: 1K43TW011164). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

## Authors contribution

KS, MDH, NT, EM and DP conceived the study. KS, MDH, and EM developed the methods and the study tools. KS, and RD conducted the stakeholder interviews. KS had primary responsibility for the analysis and initial draft of the manuscript. All authors contributed substantially to the analysis, interpretation of the results, and completion of the manuscript. All authors approved the final manuscript.

## Acknowledgements

Authors acknowledge the contributions of Dr. Vedit Singh Bawa (Research Assistant, PHFI), who assisted with conducting in-depth interviews.

## References

1. Prabhakaran D, Singh K, Roth GA, Banerjee A, Pagidipati NJ, Huffman MD: *Cardiovascular Diseases in India Compared With the United States*. *J Am Coll Cardiol* 2018, 72(1):79–95.
2. India State-Level Disease Burden Initiative CVDC: *The changing patterns of cardiovascular diseases and their risk factors in the states of India: the Global Burden of Disease Study 1990–2016*. *Lancet Glob Health* 2018, 6(12):e1339-e1351.
3. Indian Council of Medical Research PHFI, and Institute for Health Metrics and Evaluation. GBD India Compare Data Visualization. New Delhi: ICMR, PHFI, and IHME; 2017. Available from <http://vizhub.healthdata.org/gbd-compare/india> (Accessed 16 Feb 2021).
4. Riegel B, Moser DK, Buck HG, Dickson VV, Dunbar SB, Lee CS, Lennie TA, Lindenfeld J, Mitchell JE, Treat-Jacobson DJ *et al*: *Self-Care for the Prevention and Management of Cardiovascular Disease and Stroke: A Scientific Statement for Healthcare Professionals From the American Heart Association*. *J Am Heart Assoc* 2017, 6(9).

5. Shaikh M, Miraldo M, Renner AT: *Waiting time at health facilities and social class: Evidence from the Indian caste system. PLoS One* 2018, *13*(10):e0205641.
6. Radhamanohar M: *Health and the Indian caste system. Lancet* 2015, *385*(9966):416.
7. Agarwal A, Davies D, Goenka S, Prabhakaran D, Huffman MD, Mohanan PP: *Facilitators and barriers of heart failure care in Kerala, India: A qualitative analysis of health-care providers and administrators. Indian Heart J* 2019, *71*(3):235–241.
8. Kruk ME, Gage AD, Joseph NT, Danaei G, Garcia-Saiso S, Salomon JA: *Mortality due to low-quality health systems in the universal health coverage era: a systematic analysis of amenable deaths in 137 countries. Lancet* 2018, *392*(10160):2203–2212.
9. *National Academies of Sciences, Engineering and Medicine. Crossing the Global Quality Chasm: Improving Health Care Worldwide. Washington, DC: The National Academies Press; 2018.*
10. Collaborators C-Q, Bradley SM, Adusumalli S, Amin AP, Borden WB, Das SR, Downey WE, Ebinger JE, Gelbman J, Gluckman TJ *et al*: *The Cardiovascular Quality Improvement and Care Innovation Consortium: Inception of a Multicenter Collaborative to Improve Cardiovascular Care. Circ Cardiovasc Qual Outcomes* 2021, *14*(1):e006753.
11. Xavier D, Gupta R, Kamath D, Sigamani A, Devereaux PJ, George N, Joshi R, Pogue J, Pais P, Yusuf S: *Community health worker-based intervention for adherence to drugs and lifestyle change after acute coronary syndrome: a multicentre, open, randomised controlled trial. Lancet Diabetes Endocrinol* 2016, *4*(3):244–253.
12. Ali MK, Singh K, Kondal D, Devarajan R, Patel SA, Shivashankar R, Ajay VS, Unnikrishnan AG, Menon VU, Varthakavi PK *et al*: *Effectiveness of a Multicomponent Quality Improvement Strategy to Improve Achievement of Diabetes Care Goals: A Randomized, Controlled Trial. Ann Intern Med* 2016, *165*(6):399–408.
13. Wu N, Gong E, Wang B, Gu W, Ding N, Zhang Z, Chen M, Yan LL, Oldenburg B, Xu LQ: *A Smart and Multifaceted Mobile Health System for Delivering Evidence-Based Secondary Prevention of Stroke in Rural China: Design, Development, and Feasibility Study. JMIR Mhealth Uhealth* 2019, *7*(7):e13503.
14. Huffman MD, Mohanan PP, Devarajan R, Baldrige AS, Kondal D, Zhao L, Ali M, Krishnan MN, Natesan S, Gopinath R *et al*: *Effect of a Quality Improvement Intervention on Clinical Outcomes in Patients in India With Acute Myocardial Infarction: The ACS QUIK Randomized Clinical Trial. JAMA* 2018, *319*(6):567–578.
15. Solomon EA WT: *Evaluation of a cardiovascular education intervention with motivational text messaging among West African immigrants. . Nurse Care Open Acces J* 2019, *2019*(5):166–173.
16. Curry LA, Nembhard IM, Bradley EH: *Qualitative and mixed methods provide unique contributions to outcomes research. Circulation* 2009, *119*(10):1442–1452.

17. Gale NK, Heath G, Cameron E, Rashid S, Redwood S: *Using the framework method for the analysis of qualitative data in multi-disciplinary health research. BMC Med Res Methodol* 2013, 13:117.
18. Ndejjo R, Wanyenze RK, Nuwaha F, Bastiaens H, Musinguzi G: *Barriers and facilitators of implementation of a community cardiovascular disease prevention programme in Mukono and Buikwe districts in Uganda using the Consolidated Framework for Implementation Research. Implement Sci* 2020, 15(1):106.
19. Kirk MA, Kelley C, Yankey N, Birken SA, Abadie B, Damschroder L: *A systematic review of the use of the Consolidated Framework for Implementation Research. Implement Sci* 2016, 11:72.
20. Tong A, Sainsbury P, Craig J: *Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care* 2007, 19(6):349–357.
21. Rowe AK, Rowe SY, Peters DH, Holloway KA, Chalker J, Ross-Degnan D: *Effectiveness of strategies to improve health-care provider practices in low-income and middle-income countries: a systematic review. Lancet Glob Health* 2018, 6(11):e1163-e1175.
22. Huffman JC, Adams CN, Celano CM: *Collaborative Care and Related Interventions in Patients With Heart Disease: An Update and New Directions. Psychosomatics* 2018, 59(1):1–18.
23. Tully PJ, Baumeister H: *Collaborative care for comorbid depression and coronary heart disease: a systematic review and meta-analysis of randomised controlled trials. BMJ Open* 2015, 5(12):e009128.
24. Miller V, Nambiar L, Saxena M, Leong D, Banerjee A, Werba JP, Faria Neto JR, Quinto KC, Moniruzzaman M, Khandelwal S: *Exploring the Barriers to and Facilitators of Using Evidence-Based Drugs in the Secondary Prevention of Cardiovascular Diseases: Findings From a Multistakeholder, Qualitative Analysis. Glob Heart* 2018, 13(1):27–34 e17.
25. Kujawski SA, Leslie HH, Prabhakaran D, Singh K, Kruk ME: *Reasons for low utilisation of public facilities among households with hypertension: analysis of a population-based survey in India. BMJ Glob Health* 2018, 3(6):e001002.
26. Pfaeffli Dale L, Whittaker R, Jiang Y, Stewart R, Rolleston A, Maddison R: *Text Message and Internet Support for Coronary Heart Disease Self-Management: Results From the Text4Heart Randomized Controlled Trial. J Med Internet Res* 2015, 17(10):e237.
27. Hall AK, Cole-Lewis H, Bernhardt JM: *Mobile text messaging for health: a systematic review of reviews. Annu Rev Public Health* 2015, 36:393–415.
28. Chow CK, Redfern J, Hillis GS, Thakkar J, Santo K, Hackett ML, Jan S, Graves N, de Keizer L, Barry T et al: *Effect of Lifestyle-Focused Text Messaging on Risk Factor Modification in Patients With Coronary Heart Disease: A Randomized Clinical Trial. JAMA* 2015, 314(12):1255–1263.

- 29.V A: *Number of smartphone users in India in 2015 to 2020 with a forecast until 2025*. 2020.
- 30.A K: *Usage of health apps & smart health devices in India 2017*. 2017.
- 31.PwC (2012). *Emerging mHealth: Paths for growth*. Retrieved from <https://www.pwc.com/gx/en/healthcare/mhealth/assets/pwc-emerging-mhealth-full.pdf>. Accessed on 22 Jan 2021.
- 32.Singh K, Devarajan R, Mohanan PP, Baldrige AS, Kondal D, Victorson DE, Karmali KN, Zhao L, Lloyd-Jones DM, Prabhakaran D *et al*: *Implementation and acceptability of a heart attack quality improvement intervention in India: a mixed methods analysis of the ACS QUIK trial*. *Implement Sci* 2019, 14(1):12.
- 33.Singh K, Johnson L, Devarajan R, Shivashankar R, Sharma P, Kondal D, Ajay VS, Narayan KMV, Prabhakaran D, Ali MK *et al*: *Acceptability of a decision-support electronic health record system and its impact on diabetes care goals in South Asia: a mixed-methods evaluation of the CARRS trial*. *Diabet Med* 2018, 35(12):1644–1654.
- 34.Banbury A, Nancarrow S, Dart J, Gray L, Dodson S, Osborne R, Parkinson L: *Adding value to remote monitoring: Co-design of a health literacy intervention for older people with chronic disease delivered by telehealth - The telehealth literacy project*. *Patient Educ Couns* 2020, 103(3):597–606.
- 35.Eyles H, Jull, A., Dobson, R. *et al*. Co-design of mHealth Delivered Interventions: A Systematic Review to Assess Key Methods and Processes. *Curr Nutr Rep* 5, 160–167 (2016).  
<https://doi.org/10.1007/s13668-016-0165-7>.
- 36.Ospina-Pinillos L DT, Mendoza Diaz A, Navarro-Mancilla A, Scott EM, Hickie IB.: *Using Participatory Design Methodologies to Co-Design and Culturally Adapt the Spanish Version of the Mental Health eClinic: Qualitative Study*. . *J Med Internet Res* 2019, 2(8):e14127.
- 37.Vedanthan R, Kamano JH, Bloomfield GS, Manji I, Pastakia S, Kimaiyo SN: *Engaging the Entire Care Cascade in Western Kenya: A Model to Achieve the Cardiovascular Disease Secondary Prevention Roadmap Goals*. *Glob Heart* 2015, 10(4):313–317.
- 38.Katon WJ, Von Korff M, Lin EH, Simon G, Ludman E, Russo J, Ciechanowski P, Walker E, Bush T: *The Pathways Study: a randomized trial of collaborative care in patients with diabetes and depression*. *Arch Gen Psychiatry* 2004, 61(10):1042–1049.
- 39.de Waard AM, Wandell PE, Holzmann MJ, Korevaar JC, Hollander M, Gornitzki C, de Wit NJ, Schellevis FG, Lionis C, Sondergaard J *et al*: *Barriers and facilitators to participation in a health check for cardiometabolic diseases in primary care: A systematic review*. *Eur J Prev Cardiol* 2018, 25(12):1326–1340.

## Tables

**Table 1.** Physician's and hospital-level characteristics of the study sample.

<b>Variables</b>	<b>Total [N = 38]</b>
Age (in years, mean $\pm$ SD)	55.9 $\pm$ 7.8
Men, n (%)	32 (87.5)
<b>Highest academic qualification</b>	
DM - Cardiology, n (%)	30 (78.9)
<b>Number of years practicing cardiology</b>	
5 - 10 years, n (%)	3 (0.8)
10 - 20 years, n (%)	11 (30.0)
>20 years, n (%)	25 (65.7)
<b>CVD management guidelines followed</b>	
ACC/AHA and ESC, n (%)	25 (65.7)
ACC/AHA, and ESC with Indian guidelines, n (%)	14 (36.8)
Others (subjective to patient case), n (%)	3 (0.8)
<b>Patient consultations per month</b>	
Median (IQR)	550 (420 - 700)
<b>Time spent at initial visit (in minutes)</b>	
Median (IQR)	15 (10 - 20)
<b>Time spent at follow up visit (in minutes)</b>	
Median (IQR)	10 (5- 16)
<b>Consultation fee, Indian Rupees</b>	
Median (IQR)	325 (250 - 700)
<b>FACILITY-LEVEL FACTORS (N=32)</b>	
<b>Type of clinical setting</b>	
Individual Practice, n (%)	2 (6.25)
Group practice - Private, n (%)	3 (9.3)
Hospital - Government, n (%)	9 (28.1)
Hospital charity, n (%)	8 (21.8)
Hospital - Private for profit, n (%)	10 (31.2)
<b>Reminders for clinic appointments, Yes, n (%)</b>	11 (34.3)
<b>Types of reminders sent to patients</b>	
Text message, n (%)	10 (31.2)
Phone, n (%)	1 (3.1)
<b>Availability of patient record maintenance facility, Yes, n (%)</b>	27 (84.3)
<b>Patient electronic database system, Yes, n (%)</b>	16 (50)
<b>Availability of physician performance feedback system, Yes, n (%)</b>	15 (46.8)
<b>CVD management strategies</b>	
Patient education materials (booklets, poster), n (%)	4 (12.5)
Individual CVD counselling, n (%)	10 (31.2)
Group education + individual counselling, n (%)	18 (56.2)

ACC=American College of Cardiology, AHA=American Heart Association, ESC=European Society of Cardiology, IQR=Inter quartile range, DM=Doctorate in Medicine, Cardiology, SD=standard deviation, IQR=interquartile range, CVD=cardiovascular disease

**Table 2.** Major barriers to chronic care of cardiovascular disease in India.

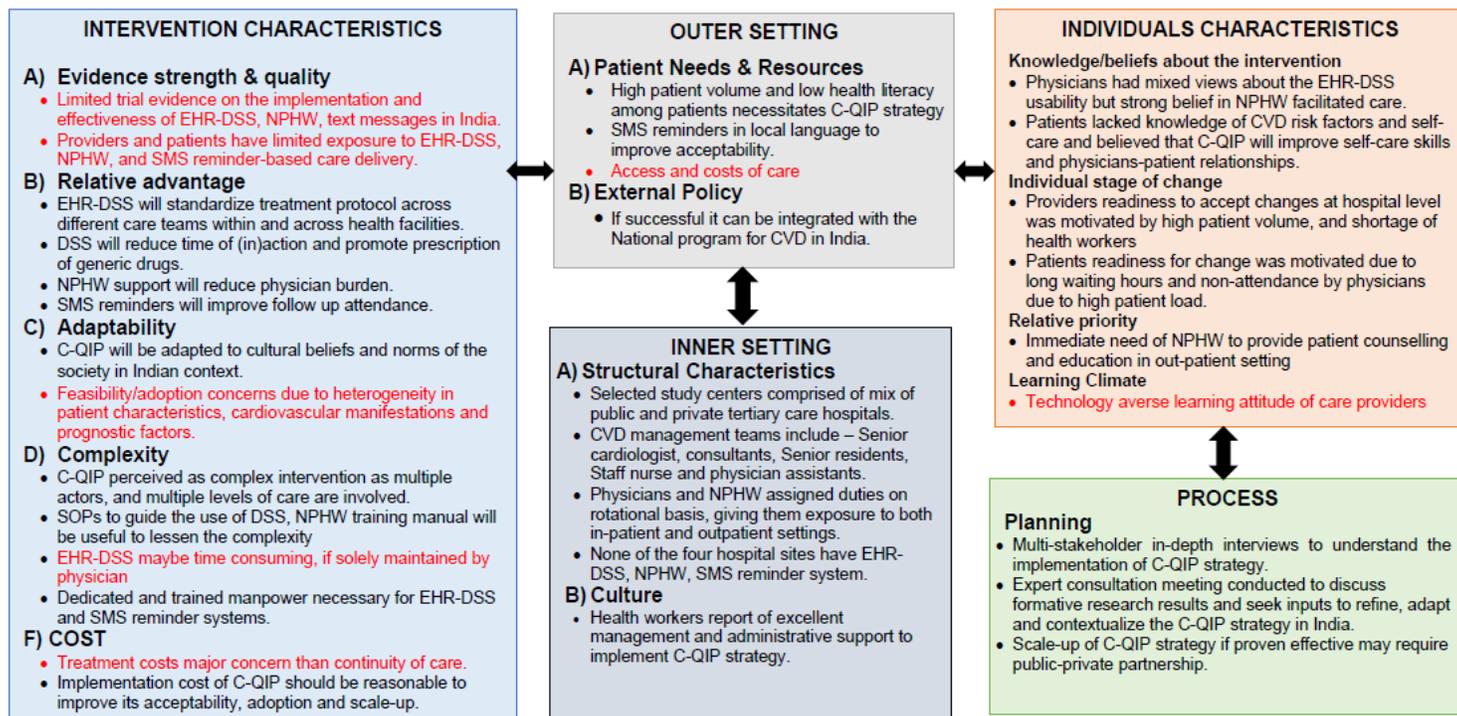
Category	Specific Barrier	Illustrative quotes
patient	Low health literacy	<p>"I don't know about (CVD) symptoms. Earlier I had an accident." (Patient-02).</p> <p>"He had an accident, he fainted, and he got his senses back only after 24 hours. He had some bruises on hands and legs. So, I took him to orthopaedic. Many other places (clinics, hospitals, doctors) I took him. X-ray was done. So, when this accident happened, he started having this (CVD) problem. (Carer-02) "No, I don't know (when asked about CVD symptom/risk factors). I just felt breathless." "We don't remember even if he (doctor) said." (patient-12)</p>
	Socio-economic status (Poverty)	<p><i>"If they don't have money to eat well the question about avoiding disease, (CVD) you know...so there is where the problem starts...mainly in lower economic status" (carer-02)</i></p>
	Cost of care (affordability)	<p><i>"It is not only the cost of the medicine, it costs the travelling expenses, the stay expenses, loss from their routine jobs, to the attendants so there are many things that we need to look at." (patient-09)</i></p> <p><i>"There is one medicine Vymada (medicine to treat heart failure), that one strip is around 1075 Rs. He has to take 60 tablets in a month. So, it's around 4000 Rs for us. We sell milk, we sell crop then only we are able to get it. We are farmers." (Carer-04)</i></p>
	Lack of knowledge and awareness of self-care goals (target blood pressure, lipids, glycemia)	<p><i>"Lack of education about CVD in the common public. That is the greatest challenge." "So, people are still unaware about risk factors for CVD" (physician-09)</i></p>
	Difficulties in maintaining self-care habits: misconceptions around diet, exercise, tobacco, alcohol use	<p><i>"One is the patient's financial condition, his intellectual condition, his understanding about the disease (affects self-care)." (physician-03) "many patients have a mis-conception like once you undergo a procedure, don't do any physical activity." "the biggest misconception they have is they need to exercise only in the morning. They feel that benefit of exercise comes only in the morning and no benefit after that." (physician-07)</i></p> <p><i>"I had consulted one place, so there the doctor said like you should not walk. So, can we do walking? (male patient-04)</i></p>
	Competing obligations and lack of family support	<p><i>"I think females are coming, although I feel they are not getting that much priority by the family. I feel the resistance of female is much higher (to receive treatment) than that of men. but female will try and keep on hiding the things until it crosses the limit and the male counterpart will get her to the hospital." "with the fragmentation of the family, the family is getting nuclear, there are not many people to take care of elderly" (caregiver 12)</i></p>
	Beliefs about AYUSH/traditional medicine practices	<p><i>"Some patients are having their own ideas about getting treatment from some alternative sources of medicine like Ayurvedic medicine or Yunani medicine or something like that, so they don't listen to us and they take what they want." (Physician-14)</i></p>
provider	Time constraints	<p><i>"Sometimes we feel that one particular patient needs more time than the other, but we are always in the rush, finishing the rounds, coming here for the OPD, doing some ECHO, then the CATH lab, then again rounds, so I feel it is the shortage of time..(greatest barrier to chronic care of CVD)" (cardiologist-26)</i></p>
	High patient volume	<p><i>"Volume is too high that we are not able to spend time with each patient in a proper way, be it listening to their problems... then assessing and as I said because of the sheer volume we are not able to spare maybe 5-10 minutes for each patient" (Cardiologist-10)</i></p>
	Physician-burnout	<p><i>"Many people sort of develop cultural syndrome or physicians burn out, after some time they are no longer interested to be actively involved in patient management so, I think that is another problem which is quite prevalent in our country and</i></p>

	<i>nobody talks about it. The load is so much, every person has overloaded system, so in an overloaded system a single doctor cannot treat so many cases" (Physician-09)</i>
Mis-information epidemic	<i>"There are lot of mis-information campaign goes on WhatsApp. Because of that lot of mistrust has arisen in patients and they just keep on changing doctors." Most of the patients have good knowledge but many of the highly literate people who are computer savvy, they are (What I call them is misinformed) of this misinformation because of this misinformation going on in various social media so that misinformation epidemic has to be controlled so sometimes that takes lots of time (Physician-09)</i>
Lack of focus on prevention (attitude problem)	<i>"most of the time is going in treating the patient and not in healing the patient. Healing requires both preventive as well as therapeutic." "we know what is killing us, we are not prepared to stop it because the smoking industry is more powerful than the few doctors who are concerned about it" (Cardiologist-04)</i>
Polypharmacy	<i>"When you have 20 drugs, they have to make sure that he understands which drugs are essential. So, it is a challenge" (Physician-09)</i>
Poor adherence to medications during chronic asymptomatic phase	<i>"The secondary prevention (of CVD) in whom we advise them to continue medicines lifelong but good number of them tend to stop their medicines three to six months from the time of the index event thinking that they are normal and even if after an angioplasty where it is mandatory that they have a few medicines lifelong quite a good number of them, especially on the governmental schemes get procedures done, tend not to continue medicines." (Cardiologist-05)</i>
Mixed recommendations from other health practitioners	<i>"They (patients) have to follow one and then follow the other one and sometimes there may be overlap of therapies which may not be properly addressed. (doctor)," (Physician-12)</i>
Inadequate uptake of evidence-based guidelines	<i>"Lack of repeated upgradation of knowledge among the physicians. What you are doing is right, is something which you believe is right, so you have to keep updated with the evolving knowledge. Many of the physicians are not keeping themselves updated with the knowledge. That is a very big problem." (Physician-09)</i>
Shortage of trained manpower (too few specialists)	<i>"I think number one challenge is the (limited) availability of the (trained) manpower because emergency happen all the time, so they need to have qualified people available in the hospital around the clock" (Health administrator-01) "we don't have a dedicated heart failure staff - heart failure nurse, heart failure dietician" (Cardiologist-24)</i>
Lack of counsellor or patient care coordinator	<i>"The things which are missing are you know there is a concept something called as a counsellor which is not there too much in Indian health infrastructure" (Female Physician-02)</i>
Lack of robust communication systems	<i>"Firstly, I think there is lot of misguidance to the patient, as to how, when and where they should approach which specialty. That is the thing that is not fixed in our country." (Physician-09)</i>
Poor referral linkages	<i>"Lack of a good referral physician who could help them with these things, so we see it becomes much more challenging going to different so-called specialists. So called specialist subspecialties with nobody in charge of overall care." (Physician-14) "Unless the patient is very sick and they (private clinics) want to get rid of the patient or if the patient in due course become sick they refer otherwise they keep the patient and after that once the patient spends 60-70 thousand rupees they send the patient for government scheme, there we are supposed to treat the patient, do angioplasty, everything it is very difficult for us so we can't tell it</i>

	<i>openly because if you tell it openly that doctor is not going to refer to you at all.” (Cardiologist-26)</i>
Lack of monitoring systems to follow-up patients	<i>“There is no mechanism where we can monitor the follow-up of the patient. If there is a lot to follow-up we don’t remember also because nothing is computerized” (Cardiologist-02)</i>
Distance to health facility	<i>“I really do feel our patients you know, they come from far off places in Himachal Pradesh and we are able to just spend 4-5 mins I would say.”</i>
Long queues	<i>“They have to spend a full day almost a full day in getting registered here then to take medicines, then to take the doctor’s opinion, so it is very time-consuming process for them.” (Cardiologist-01)</i> <i>“When we came first time, we got referred, so they said in emergency that you can take him in cardiology department. Here the line starts midnight 2 am. So, I stand in line. Then they said they will make a card in morning 11 am. Cardiologist doctor comes here at 2pm. So, we got the number and showed to doctor.” (patient-04)</i>
Lack of financing for out-patient care	<i>“It is not health specific (prevention is not the focus of health financing schemes).” (health administrator-02)</i>
Poor availability of medications at government pharmacies	<i>“People who are living in far-off places you know the non-availability of medicines in their place (a major challenge). So (as a) result many times we see that they (patients) stop, I mean they had to stop medicine because it is not available. The (non)availability of medicines is a big problem.” “Medicines, there are Jan aushadi, generic medicines they are cheap for them. When these are not available due to the cost, they used to stop taking the medicines” (Cardiologist-06)</i>

\*AYUSH= Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homeopathy. These are the six indigenous systems of medicine practiced in India.

## Figures



\*Red fonts indicate "barriers" to successful implementation of collaborative quality improvement strategy.

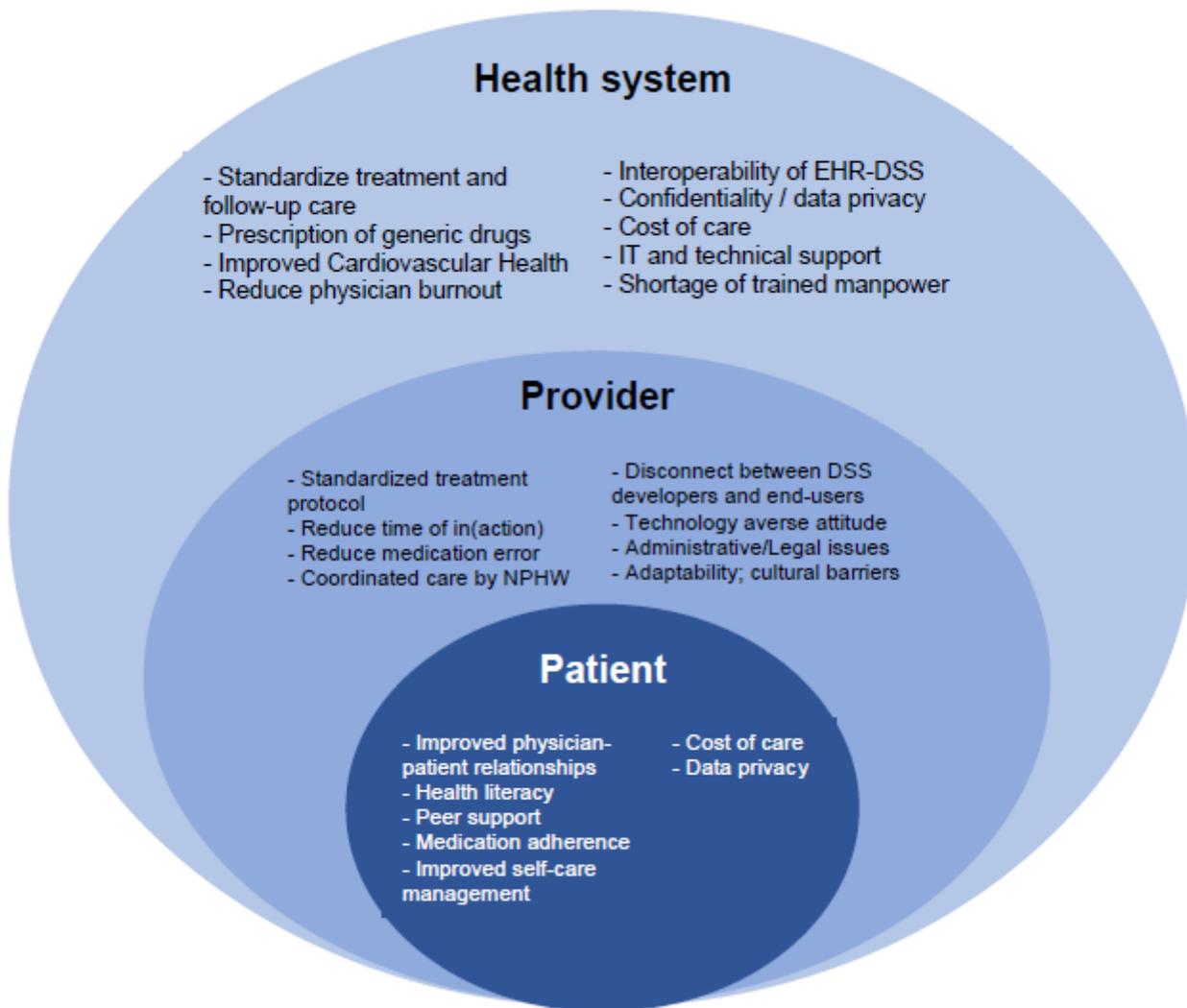
C-QIP=collaborative quality improvement strategy, EHR-DSS=electronic health records-decision support system, NPHW=non-physician health workers, SOPs=Standard operating procedures, CVD=Cardiovascular Disease

Figure 1

Consolidated framework for Implementation Research (CFIR) model to guide the implementation of the C-QIP strategy.

## BENEFITS

## CONCERNS



**Figure 2**

Potential benefits and concerns related to the C-QIP strategy in India.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [COREQchecklist.pdf](#)
- [Suppl1Interviewguide.pdf](#)