Appropriateness-based reimbursement of elective invasive coronary procedures in low- and middle-income countries: Preliminary assessment of feasibility in India

GANESAN KARTHIKEYAN, UMESH SHIRODKAR, MEETA RAJIVLOCHAN, STEPHEN BIRCH

ABSTRACT

Background. Elective coronary interventional procedures are often overused and sometimes inappropriately used. The incentives for overuse are greater in low- and middle-income countries, where much of healthcare is provided by poorly regulated, fee-for-service systems. Overuse and inappropriate use increase healthcare costs and are potentially harmful to patients. Linking appropriate use of elective procedures to their reimbursement might deter overuse.

Methods. We explored the feasibility of introducing appropriateness criteria as a precondition to settling reimbursement claims in a publicly funded health insurance scheme in Maharashtra, India. Clinical algorithms were developed from the current best-practice criteria and used to determine appropriateness at the time of obtaining pre-authorization for elective percutaneous coronary intervention (PCI) and coronary artery bypass graft (CABG) surgeries. The number of PCIs as a proportion of the total number of procedures reimbursed under the scheme was the primary outcome measure. This proportion was compared for 1-year periods before and after implementation of appropriateness-based reimbursement, using the chi-square test. Comparisons were also made separately for public and private hospitals. The change in the proportion of CABG surgeries over the same time periods was used as a comparator (as they are less subject to inappropriate use).

Results. The insurance scheme provided cover to a population of 20 424 585 (18.2% of the population of Maharashtra) in 8 districts, through 106 hospitals (73 private and 33 public). There was a 12.3% (95% CI 8.9%–15.5%, p=0.0001) reduction in the proportion of PCIs performed in the 1-year period after the introduction of appropriateness-based reimbursement. The reduction was similar for public and private hospitals. There was no significant change in the proportion of CABG surgeries (2.3% v. 2.2%, p=0.20). At current rates, use of appropriateness-based reimbursement would result in approximately 783 (95% CI 483–1099) less PCIs with potential annual savings of about ₹57 million (US$ 0.93 million; 95% CI 0.57–1.3) to the government scheme.

Conclusions. It seems feasible to implement an appropriateness-based system for reimbursement of elective coronary interventional procedures in a government-funded health insurance scheme in a developing country. This potentially cost-saving approach may reduce inappropriate use.

INTRODUCTION

Overuse and inappropriate use of elective procedures are common across medical specialties and healthcare systems.[1,2] Much of healthcare in low- and middle-income countries (LMICs) is provided by poorly regulated, private sector, fee-for-service systems, thereby creating greater incentives for providing expensive and unnecessary care. For example, a World Bank study found that some hospitals under the government-funded Rashtriya Swasthya Bima Yojana (RSBY) scheme performed more hysterectomies than expected and tended to combine hysterectomies with salpingo-oophorectomies to claim reimbursement for multiple, related procedures.[3] Similar trends were observed with other elective procedures such as hernia surgery, appendicectomy and orthopaedic surgery.[3] Overuse leads to escalation of healthcare costs and exposes patients to the risk of harm from unnecessary procedures. This is particularly relevant for LMICs as they propose to implement insurance-based schemes to provide universal healthcare through health sectors dominated by private providers.[3,4]

In general, cost-containment strategies (such as fixed spending caps and procedure-specific rates) do not address the issue of unnecessary or inappropriate care. Employing appropriate use criteria as benchmarks for reimbursement, as part of pre-authorization for elective procedures may improve appropriateness of use and consequently, may free up resources to meet other healthcare needs. We tested the feasibility and efficacy of using such a system for settling reimbursement claims for elective percutaneous coronary intervention (PCI) under a government-run scheme in Maharashtra, India. We chose elective PCIs as a test case for two reasons. First, cardiac procedures consume a disproportionately large share of the budget allocations of health insurance schemes. Therefore, the opportunity costs of overutilization of cardiac procedures are likely to be high. Second, appropriate use criteria are readily available for coronary

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revascularization procedures including elective PCI;[5] thus, simple algorithms for clinical use could be easily developed.

METHODS

Maharashtra is the second most populous state in India with a population of 112 million. The Rajiv Gandhi Jeevandayee Arogya Yojana (RGJAY) is a public insurance scheme administered by the RGJAY Society, an autonomous body, and is run in collaboration with the National Insurance Company.[6] The scheme is funded by the Public Health Department, Government of Maharashtra.

Development and implementation of treatment algorithms

For each clinical syndrome of coronary artery disease, we first identified reasonable indications for PCI with bare-metal stents (the scheme did not cover the use of drug-eluting stents at the time of the study) and coronary artery bypass graft (CABG) surgery, based on current best practices.[5] The guidelines were adapted for local use (without any change in the recommendations) by a practising academic cardiologist and ratified in consultation with other academics and practising cardiologists. As an example, the algorithm developed for determining appropriateness of PCI for chronic stable angina is shown in Fig. 1. This information was incorporated into web-based forms for submitting pre-authorization requests. When submitting requests, care-providers were required to first choose a diagnosis from the list in a drop-down menu and upload information justifying the need for PCI (e.g. a moderate or strongly positive stress test report in patients who are minimally symptomatic) or CABG. In addition to presenting evidence for appropriateness, care-providers were also asked to give evidence of the use of aspirin, statins and other medical therapy. Procedures involving a single coronary stent were reimbursed at the rate of ₹60 000 (approximately US$ 975) per procedure. Additional stent placements were reimbursed at ₹20 000 per stent for up to two more stents. The National Insurance Company agreed to use the clinical protocols developed for the purpose of deciding eligibility for reimbursement.

Data collection and analysis

Data on the number of households and individuals covered, and the number and types of procedures performed were collected as
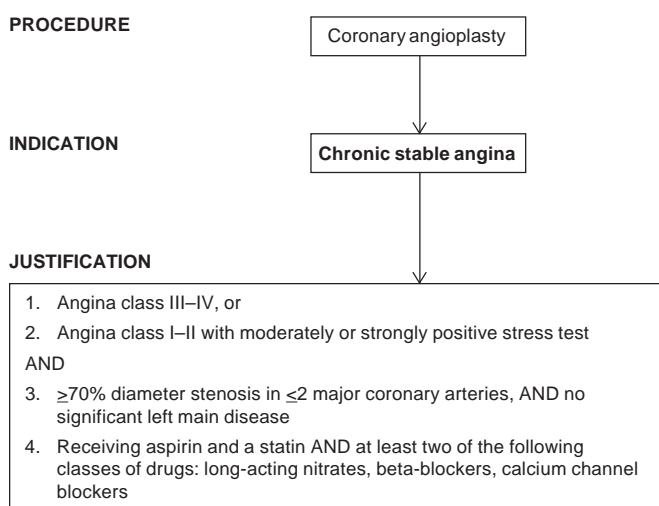
PROCEDURE

Coronary angioplasty

INDICATION

Chronic stable angina

JUSTIFICATION

1. Angina class III–IV, or
2. Angina class I–II with moderately or strongly positive stress test

AND

3. ≥70% diameter stenosis in ≤2 major coronary arteries, AND no significant left main disease
4. Receiving aspirin and a statin AND at least two of the following classes of drugs: long-acting nitrates, beta-blockers, calcium channel blockers

Fɪɢ 1. Simple criteria to decide on the appropriateness of angioplasty for chronic stable angina

part of routine documentation at the time of submission of the claim by participating hospitals and were updated at periodic intervals. The number of PCIs as a proportion of the total number of procedures reimbursed under the scheme was the primary outcome measure. The effect of appropriateness-based reimbursement was assessed by comparing the proportion of PCIs in the first year after implementation, with the proportion in the year before implementation (July 2012 to June 2013). In addition, during the implementation process, we also determined the proportion of PCIs at 6 months. These estimates were calculated separately for public and private hospitals. We used the chi-square test to determine if there was a statistically significant change. As CABG surgeries are highly unlikely to be used inappropriately,[7] we used the proportion of CABGs as a measure of changing population characteristics or treatment trends. Analyses were performed using Microsoft Excel 2013 (Microsoft Corporation, Redmond, WA). A p value of 0.05 was considered significant.

RESULTS

Phase I of the RGJAY scheme began in July 2012. The new system of appropriateness-based reimbursement was accepted in principle by all 106 hospitals (73 private and 33 public) under the plan and the scheme became operational in June 2013. No changes were made to any other aspect of the insurance plan. A total of 20 424 585 people (5 237 073 households) were covered under the scheme. This constitutes 18.2% of the population of Maharashtra.

In the year before implementation of the new reimbursement system, 72 586 procedures were reimbursed, of which 4908 (6.8%) were PCIs. Nearly 73% (3558) of the PCIs were done at private hospitals, constituting 7.3% of all procedures reimbursed at these hospitals. The number of PCIs performed at public hospitals was 1350 (5.7% of all procedures). Reimbursement for all procedures increased by 21.4% during the first year of implementation—the total number of procedures reimbursed increased to 88 092. However, the total number of PCIs as a proportion of all procedures reduced to 5.9% (5225/88 092). This represented a fall of 12.3% from baseline (95% CI 8.9%–15.5%, p=0.0001) contributed by reductions in both public and private hospitals. There was an absolute fall in the number of PCIs performed at public hospitals and the proportion of PCIs reduced from 5.7% (1350/23 886) to 4.8% (1265/25 898), a 0.8% absolute reduction (95% CI 0.4%–1.2%, p=0.0001). In private hospitals, the proportion of PCIs reduced from 7.3% (3558/48 700) to 6.4% (3960/62 194), an absolute reduction of 0.9% (95% CI 0.6%– 1.2%, p=0.0001). The reduction in procedures was observed at 6 months and was maintained at one year after implementation of the appropriateness-based system (Fig. 2). A total of 1695 CABG surgeries were performed in the year before implementation of the new reimbursement scheme. There was no significant change in the number of CABGs as a proportion of all procedures, after implementation of the scheme (2.3% to 2.2%, p=0.20).

The number of elective PCIs avoided by the introduction of the new reimbursement guidelines is estimated to be 584 (95% CI 390–787) at private and 199 (95% CI 93–312) at public hospitals (total avoided 783, 95% CI 483–1099). Based on a weighted average cost of ₹72 848 per procedure, this could potentially result in annual savings of approximately ₹57 million (95% CI ₹35.2–80 million; US$ 0.93 million, 95% CI 0.57–1.3 million).

DISCUSSION

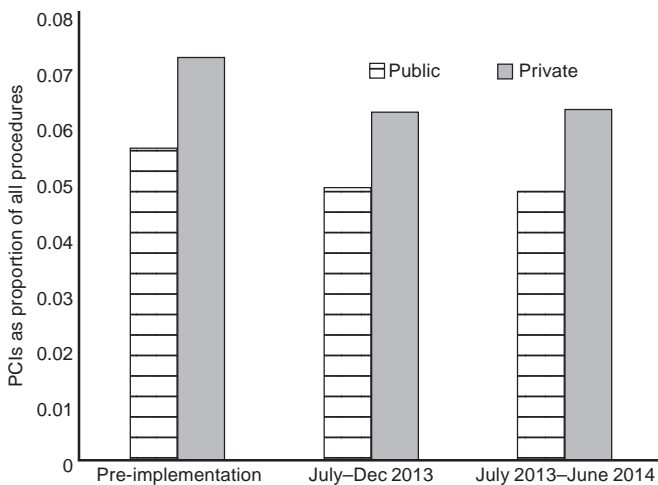We have shown the feasibility of linking reimbursement decisions

FIG 2. Effect of the introduction of appropriateness criteria for reimbursement on the number of elective percutaneous coronary interventional procedures (PCIs) performed at public and private hospitals. The number of elective PCIs as a proportion of all procedures reduced from 6.8% to 5.9% (12.3% reduction, p=0.0001). The absolute reduction was 0.8% (95% CI 0.4%–1.2%, p=0.0001) and 0.9% (95% CI 0.6%–1.2%, p=0.0001) for public and private hospitals, respectively

to the appropriateness of elective PCIs performed under a government-funded health insurance scheme in a developing country. We have also shown that implementation of such a scheme reduced the number of elective PCI procedures as a proportion of all procedures reimbursed under the scheme, perhaps because of reduced inappropriate use. Implementation of the appropriateness-based reimbursement scheme was only possible because the state government (the payer) was convinced of its merit.

Comparison with a control population, where reimbursement was not linked to appropriateness, would have provided the most reliable evidence of reduced inappropriate use, but such data were not available. However, data from another government-funded health insurance scheme in the state of Tamil Nadu (Chief Minister's Comprehensive Health Insurance Scheme, CMCHIS), where appropriateness criteria are not in use, showed no reduction in PCIs. On the contrary, in keeping with the national trends,[8] there was an increase in the number of PCIs (as a proportion of all procedures) in the first 6 months of 2014 (1.3% to 3.4%), compared to 2013 (Dr T.S. Selvavinayagam, Joint Director, CMCHIS, personal communication).[7] There was no significant change in the proportion of CABGs during the study period. As <2% of elective CABGs are considered inappropriate, a concomitant reduction in the proportion of CABG surgeries would have pointed to temporal changes in patient characteristics or treatment trends as possible explanations for the fall in the proportion of PCIs. Thus, the lack of change in the proportion of CABG surgeries with the implementation of appropriateness-based reimbursement suggests that the reduction in PCIs was due to improved appropriate use. Though we were unable to track the number of refused pre-authorization requests, the 15% (783 avoided/5225 PCIs performed) reduction in the number of procedures observed in this study is consistent with the proportion of elective PCIs categorized as inappropriate (12%) in previous studies.[1]

Difficulties in assessing appropriateness of use in LMICs
Ensuring the appropriate use of elective procedures in LMICs is difficult for at least two reasons. First, determination of appropriateness of use is in general not possible because of the lack of data. Poor medical record-keeping[9] is a major impediment to evaluations of appropriateness, which are performed in healthcare systems that mandate detailed documentation.[1,10] Second, insurance schemes in LMICs focus primarily on establishing that the procedure for which reimbursement is being sought has indeed been performed, rather than on establishing its appropriateness. Consequently, the information required for settling reimbursement claims under currently operating insurance schemes in India is not sufficient to establish appropriateness. For example, the only documentation required for settling claims for coronary angioplasty are pre- and post-procedure angiograms, with no requirement for any details of the diagnosis or indication for the procedure. Nearly half (49%) of elective PCIs in India are performed in patients with post-myocardial infarction (MI) and those with stable coronary disease,[8] where their appropriateness is determined by parameters other than lesion severity on the coronary angiogram (such as symptom status, ischaemia burden and myocardial viability). A system of reimbursement that does not require information on clinical status or results of non-invasive testing therefore creates incentives for performing PCI in situations where it may be of little benefit to the patient.

Appropriateness-based criteria for reimbursement
To permit evaluation of appropriateness we shifted the paradigm of reimbursement from the existing *procedure-based* system to a *diagnosis-based* system. This required us to seek more clinical information at the time of pre-authorization to be able to judge if the procedure was indicated. Our strategy is different from reimbursement based on diagnosis-related groups (DRGs), which are primarily used as cost-containment strategies in well-developed healthcare systems where uniformity of practice and appropriate use of therapies are ensured by adherence to guidelines and audits. The primary objective of our strategy was to ensure appropriateness, which echoed calls for similar approaches for other elective procedures.[11] While we have shown the utility of such a system in the context of elective PCI, similar clinical algorithms can be devised for other elective procedures based on the best available evidence. Measures to deter inappropriate use and overuse of elective procedures are particularly relevant to LMICs that propose to provide insurance-based universal healthcare to their citizens.[4] Healthcare in most LMICs is dominated by unregulated, fee-for-service practitioners, and there are potentially large incentives for overuse.[3] Besides monetary incentives, inappropriate use and overuse may also be driven by considerations such as greater recognition among peers (for example, high PCI volumes). It is therefore not surprising that we found similar reductions in the proportion of elective PCIs in both private and public hospitals in our study.

An appropriateness-based reimbursement system has several limitations. First, reduced utilization of certain procedures may be offset by compensatory overutilization of others within the scheme. This is unlikely to have occurred in our case because the algorithms were simultaneously implemented across the entire range of invasive cardiology and cardiac surgical procedures covered, and there was no change in the number of CABG procedures. Second, as an unintended consequence of implementing stringent requirements for reimbursement, patients may be convinced by

providers to purchase procedures out-of-pocket when the indications are not covered under the insurance scheme. Periodic surveys of beneficiaries to identify such practices and deterrents to curb them (such as de-listing, blacklisting, etc.) may be needed to preserve the integrity of the scheme. Third, by making algorithms simple to use, some appropriate indications may be excluded. Though in our particular case we believe that the identified indications covered the most commonly encountered scenarios in clinical practice, continuous monitoring will be required to identify situations that may be inappropriately excluded. Finally, the reimbursement system can be gamed by providers by deliberate mis-categorization of patients thereby defeating its very purpose (e.g. symptom class can be misreported as New York Heart Association [NYHA] class III or IV to avoid performing stress tests in mildly symptomatic patients with stable coronary disease). We did not observe any 'catch-up' increase in PCI numbers in the latter half of the implementation phase to suggest such practices. While such behaviour may be uncovered by careful monitoring, efforts to foster a culture of evidence-based practice and self-regulation by physician organizations are likely to be the most effective and durable deterrents.

Conclusions

It is feasible to implement a system of reimbursement based on the appropriateness of elective coronary interventional procedures performed under a publicly funded insurance scheme in an LMIC. Linking the appropriateness of elective procedures to their reimbursement may encourage evidence-based practice and contain costs.

Competing interests. None

Contributions

Study conception and design: GK, MR, US, SB; Data acquisition: US, MR; Data analysis and interpretation: GK, MR, SB, US; Writing the first draft: GK; Critical revision of manuscript for important intellectual content, final approval for publication: GK, SB, MR, US. All the authors agree to be accountable for all aspects of the work.

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NOTE: The cost calculations predate the implementation of price ceilings for coronary stents.