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Quality of inpatient care in public and private hospitals in Sri Lanka

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Objective To compare the quality of inpatient clinical care in public and private hospitals in Sri Lanka.

Methods A retrospective, cross-sectional comparison was done of inpatient quality, in a sample of 11 public and 10 private hospitals in three of 25 districts. Data were collected for 55 quality indicators from medical records of 2523 public and 1815 private inpatient admissions. These covered treatment of asthma, acute myocardial infarction (AMI), childbirth and five other conditions, along with outcome indicators, and medicine prescribing indicators.

Results Overall quality scores were better in the public sector than the private sector (77 vs 69%). Performance was similar for management of AMI and childbirth and somewhat better in the private sector for management of asthma. The public sector performed better in those indicators that are not constrained by resources (94 vs 81%), but worse in indicators that are highly resource intensive (10 vs 31%). Quality was comparable in assessment and investigation, but the public sector performed better in treatment and management (70 vs 62%) and drug prescribing (68 vs 60%), and modestly worse in terms of outcomes (92 vs 97%).

Conclusions For a range of indicators where comparisons were possible, quality of inpatient clinical care in Sri Lanka was comparable to levels reported from upper-middle income Asian countries, and often approaches that in developed countries, although the findings cannot be generalized. Quality in the public sector is better than in the private sector in many areas, despite spending being substantially less. Quality in public hospitals is resource constrained, and needs greater government investment for improvement, but when resource limitations are not critical, the public sector appears able to deliver equal or better quality than the private sector. Overall similarities in quality between the two sectors suggest the importance of physician training and other factors.

Keywords Asthma, heart disease, hospitals, inpatient care, maternal care, private sector, quality of clinical care, quality measurement, Sri Lanka

KEY MESSAGES

- In Sri Lanka, quality of inpatient clinical treatment in higher-level public hospitals is equal to or better than in the private sector overall and in many specific conditions and areas, despite spending considerably less.
- Quality of inpatient care is comparable across many indicators to that in upper-middle income countries, and may approach that in developed countries in areas where resources are not the limiting factor.
- Resource constraints in Sri Lanka's public sector result in lower quality of inpatient care in areas that are resource intensive.
- Quality of care can be assessed in lower- and middle-income countries using methods used in high-income countries. Determining the optimal public–private mix in health systems depends in part on what differences exist in quality of clinical care between public and private sectors.

Introduction

In most low and middle-income countries (LMICs), for-profit private hospitals provide a significant share of all inpatient services, although private sector involvement tends to be less than in the case of outpatient care (Saksena *et al.* 2012). In systems where private hospitals are not subsidized by public financing, patients seek private care typically because of perceptions of better amenities and quality (Basu *et al.* 2012), and patients tend to be richer than those who do not (Saksena *et al.* 2012). The appropriate role of private providers in mixed healthcare systems is a subject of considerable controversy, but ultimately depends on factors such as differences between public and private providers in whom they treat, the costs to patients and society and differences in quality (Hanson *et al.* 2008; Sauerborn 2013). However, there is scant evidence on differences in the quality of inpatient care that patients receive in public and private settings in LMICs. What research has been done is often limited to measures of structural quality or even patient mortality (Eggleston *et al.* 2010), which are not good proxies for actual clinical quality of care (Das and Gertler 2007; Pitches *et al.* 2007).

To address this gap in evidence and to better characterize the nature of mixed healthcare delivery in one LMIC, this study aims to evaluate the levels of clinical quality in inpatient treatment in public and private hospitals in Sri Lanka, whether and how they differ, and how they compare with quality of care in other countries. The health system in Sri Lanka is known for providing high volumes of service delivery at relatively low cost (Rannan-Eliya and Sikurajapathy 2008), but whether this is at the expense of quality is not known.

Using a range of quality indicators based on medical record review, we assessed quality of care in samples of 2523 public and 1815 private inpatients treated during 2011 in 11 public and 10 private hospitals in three districts of Sri Lanka. We compared quality in 11 specific conditions, and overall, and assessed how it varied by type of process and level of resource intensity.

The setting

Sri Lanka is a lower-middle income country of 20.3 million people (2012) [Department of Census and Statistics (DCS) 2013], with three-quarters still residing in rural areas. The country spent 3.4% of gross domestic product (GDP) on healthcare in 2011, or an average of US$97 per capita, of which 58% was from private sources, mostly out-of-pocket spending. Inpatient expenditures amount to 30% of healthcare expenditures (Amarasinghe *et al.* 2013). Allocations by government of its health budget to hospital and inpatient services have been unusually high since the 1950s, and reflect a policy bias towards prioritizing financial risk protection, which has also led to some substitution of inpatient care for outpatient treatment (Rannan-Eliya and Sikurajapathy 2008). For a country with a per capita GDP of US$2923 in 2012 (World Bank 2014), health outcomes are exceptional, with infant mortality reaching 11 deaths per 1000 live births and life expectancy at birth 75 years (World Health Organization 2013).

The Ministry of Health (MOH) and nine provincial departments of health provide nominally free or nearly free medical services to the whole population through an extensive network of government hospitals and clinics. At the top end are teaching and specialist hospitals, and just beneath them provincial and base hospitals, which act as referral hospitals and provide a less extensive range of specialist services. Below these are a range of facilities ranging from district hospitals (basic secondary services) to freestanding clinics run by medical officers, midwives and nurses. However, patients can choose to pay for treatment at private hospitals, which treat around 4% of inpatients. Overall utilization of inpatient services is high, averaging over 270 admissions per 1000 persons a year, higher than in most Organization for Economic Co-operation and Development (OECD) nations (OECD/World Health Organization 2012). There is a steep income gradient in use of private hospitals, with the richest quintile of people accounting for 45% of all private sector admissions, and public sector admissions being equal to pro-poor in their distribution (Amarasinghe *et al.* 2013).

In government hospitals, doctors, nurses and other staff are all paid fixed salaries, and the price for routine inpatient treatment in the normal wards is zero. MOH hospitals have fixed operating budgets, and major inputs, such as clinical personnel, medicines and supplies, are largely determined centrally and provided to them. Private hospitals are almost all for-profit ventures, and their doctors are a mix of mostly visiting physicians, most of whom are government specialists engaging in private practice, and salaried physicians. Private patients pay the hospital, and often also the doctors separately for treatment. Government regulation of private hospitals is minimal, with licensing requirements not enforced in practice,

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and the regulatory agency unable to maintain even a reliable count of private hospitals (Amarasinghe *et al.* 2013).

Methods

Our study was conducted as part of a larger project that also included a study of quality of outpatient care in Sri Lanka. Findings from the outpatient study and further details about the overall project design are given in Rannan-Eliya *et al.* (2014). Both studies used an approach to measurement of quality that is comparable in concept to that used in quality of care research in USA, England and Australia (McGlynn *et al.* 2003; Asch *et al.* 2004; Steel *et al.* 2008; Runciman *et al.* 2012), which uses the RAND Quality Assessment Tools system (Kerr *et al.* 2000a,b; McGlynn *et al.* 2000a,b). This represents what is probably current best practice in quality of care survey methodology in developed countries.

We assessed the quality of inpatient clinical care by measuring a range of quality indicators in the treatment of individual patients, and across samples of patients treated by individual hospitals. Data for these indicators were collected by review of patient medical records, so indicators had to be ones that could be assessed retrospectively through record extraction.

Development of quality indicators

Following the definition of quality of care by Donabedian (1980), our quality indicators are a combination of mostly process indicators, which focus on the treatment received by patients, and a few outcome indicators. Process quality measures have the merit of being more readily actionable than outcome measures, require less risk adjustment and typically correspond to recommendations in national guidelines.

To identify potential indicators, we undertook an extensive review of the medical literature for specific diseases [e.g. asthma, acute myocardial infarction (AMI) and dengue], established national guidelines both in Sri Lanka and elsewhere, principally the United States (Kerr *et al.* 2000b; Mann *et al.* 2006; National Heart Lung and Blood Institute 2007; Krumholz *et al.* 2008; Jneid *et al.* 2012; O'Gara *et al.* 2012; The Joint Commission 2013), Australia, Canada, United Kingdom (National Institute for Health and Clinical Excellence 2013) and other European countries (Steg *et al.* 2012), indicators listed in the United States National Quality Measures Clearinghouse (Agency for Healthcare Research and Quality 2012), treatment guidelines published by international groups, such as the Global Initiative for Asthma (GINA) (2012), and indicators used in the RAND Quality Assessment (QA) Tools system. We also identified a number of drug prescribing measures that were obtained from a consensus list produced by Thomas *et al.* (2013).

To improve the statistical power and representativeness of the study, we also selected three tracer conditions, for which we would oversample patient records and collect more detailed data. These conditions were defined according to the diagnoses at discharge as coded using the International Classification of Diseases 10th Revision (ICD-10) (World Health Organization 2004). The three conditions were acute asthma (ICD-10 codes J45-J46), AMI (I21-I22), and childbirth (O80-O84). These were chosen as they are conditions for which quality of care is a significant concern, for which the literature indicated an adequate number of indicators that could be feasibly collected, they were representative of different modalities of care and types of patients, and since they account for a significant proportion of hospital case load in Sri Lanka (Table 1).

Hospital admission rates for asthma (Perera *et al.* 2009) and asthma mortality rates in younger adults (Rannan-Eliya *et al.* 2010) are exceptionally high in Sri Lanka, and both are recognized, high-level indicators of system underperformance (OECD 2011). Ischaemic heart disease is the leading non-communicable disease (NCD) and cause of mortality in Sri Lanka, and recent evidence suggests that the failure to reduce mortality is linked to inadequate treatment and care of patients (Mendis *et al.* 2005; Rannan-Eliya *et al.* 2010). The OECD and others recognize case management of AMI patients as indicative of health systems quality. Safe motherhood and maternal mortality reduction (Millennium Development Goal 5) are key health priorities in Sri Lanka, with national policy seeking to deliver all children in hospitals and to improve quality of maternity care. Obstetric cases account for 9% of all public inpatient admissions (Perera *et al.* 2009), and 98% of all mothers deliver in healthcare institutions (Department of Census and Statistics (DCS) and Ministry of Healthcare and Nutrition (MOH) 2009).

Our review yielded a short list of quality indicators that could be measured using potentially available data. We reduced this further by eliminating indicators that were unlikely to be consistently recorded in case notes in the Sri Lankan setting to avoid creating biases in the observed level of quality as a result of differences in recording practices. These indicators were then reviewed by a panel of Sri Lankan physicians to determine which were valid and contextually appropriate.

We finally arrived at 55 indicators that were used in the study, of which 7 were quality indicators for asthma, 15 for AMI, 10 for childbirth, 7 for another five conditions—acute chronic obstructive pulmonary disease, dengue, heart failure, pneumonia, and stroke and transient ischaemic attack, 9 deep vein thrombosis (DVT) prophylaxis indicators, 4 surgical antibiotic indicators and 3 general drug prescribing indicators. Ten of the indicators related to assessment and investigation, 39 to appropriate treatment and management and 6 to outcomes. Process indicators were also classified into three resource-limitation groups (low, medium and high) according to an assessment of the resource intensity of the appropriate action and evidence of resource constraints (inadequate supplies, lack of equipment or staff time) being significant in the public facilities. Table 2 gives an example indicator for each of the conditions or types of care, and Supplementary Table 1 gives full details of all the indicators.

Sampling

Owing to funding constraints, it was not feasible to conduct a fully representative national study. So we collected data in a convenience sample of 3 out of 24 districts in Sri Lanka, Colombo, Gampaha and Galle, located in 2 out of 9 provinces in Sri Lanka. These are, respectively, urban, semi-urban and

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Table 1 Characteristics of tracer conditions selected in study and corresponding patient statistics in MOH hospitals in 2005

Condition	ICD-10 codes	Discharges	Share of all discharges (%)	Typical patient profile
Acute asthma	J45-J46	174 749	4.0	All age groups with a preponderance of children <15 years old
AMI	I21-I22	13 637	0.3	Adult male, 45–64 years age group
Childbirth (single spontaneous delivery)	O80	240 096	5.5	Adult female, 22–35 years age group
All conditions		4 344 864	100.0	

Notes: Discharge estimates from report and data of Perera *et al.* 2009. ICD-10, International Classification of Diseases, 10th Revision. AMI, acute myocardial infarction.

Table 2 Examples of quality of care indicators used in study

Condition	Indicator	Type	Resource intensity
Acute asthma	Oxygen saturation measured	Assessment and investigation	High
Acute asthma	Received inhaled bronchodilator on admission	Treatment and management	Medium
AMI	Smoking status assessed in males	Assessment and investigation	Low
AMI	Live discharge	Outcome	—
Childbirth	Neonatal APGAR score recorded	Assessment and investigation	Low
Childbirth	Prophylactic antibiotics given during LSCS	Treatment and management	Medium
All conditions	Patient prescribed macrolide not given statin	Drug indicator	Low

Notes: A full list of all indicators is included in Supplementary Table S1. AMI, acute myocardial infarction. LSCS, lower segment Caesarean section.

largely rural districts, with Galle having income and poverty levels slightly worse than the national average. By design, we would argue that these represent a range of health service settings that are typical of the contexts in which three-quarters of the Sri Lankan population lives (further details of our reasoning are given by Rannan-Eliya *et al.* 2014). Furthermore, the sampled districts collectively account for four-fifths of all private hospital discharges (Amarasinghe *et al.* 2013), and so are representative of the areas in Sri Lanka for which it is meaningful to make a comparison between public and private inpatient sectors.

All MOH hospitals in the three districts were first stratified by type and by size and complexity (large general—MOH teaching hospitals; intermediate general—MOH base hospitals; obstetric; paediatric; all other specialist and lower level MOH hospitals). To ensure comparable public and private samples, we then selected a sample of 11 MOH hospitals through stratified random sampling by district from the first four strata. Private hospitals in the three districts were stratified by size and by type (large general: >50 beds, intermediate/small general: <51 beds; obstetric; paediatric; other specialist), and a sample of 10 private hospitals was selected by district through stratified random sampling. The sampling frame for private hospitals consisted of a listing maintained by the Institute for Health Policy, which is comprehensive. Our sampling excluded lower level and other specialist public hospitals, since the former, by design of the public system, do not have specialists unlike private hospitals, and the latter are specialized in ways with no equivalent in the private sector (cancer, chest, dental, eye and infectious disease). We excluded psychiatric hospitals in both sectors, because there is a relative lack of standardized quality measures and associated evidence base on assessing quality of mental health care (Kilbourne *et al.* 2010), and because of potential problems in accessing and using patient records.

Full details of the hospital strata and final samples are given in Table 3. Key comparative characteristics of the sampled hospital strata are given in Table 4. As indicated, the sampled public hospital strata account for 69% of all public sector discharges in the three districts, and the sampled private hospital strata 99% of all private sector discharges. Spending per inpatient is also 9 to 10 times more in private than in public hospitals, despite the broad similarity in patient case mix revealed by this study, averaging Sri Lankan rupees 10 300 (US$93) in public hospitals, and Sri Lankan rupees 94 600 (US$860) in private hospitals during 2011 (Table 4).

MOH endorsed the study design and requested sampled hospitals in both sectors to participate by letter. A separate letter was used to communicate with private hospitals which requested them to voluntarily participate, but did not instruct them to, since MOH lacks regulatory authority over these hospitals. If sampled hospitals refused to participate, they were replaced by another randomly sampled hospital from the same stratum, but only one private hospital refused participation.

At each selected hospital, we systematically sampled the records of at least 100 inpatients admitted during 1 January–31 December 2011, and then took an oversample of additional

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Table 3 Size of hospital strata and corresponding study samples nationally and by district

Strata	All facilities				Sampled facilities			
	National	Colombo	Gampaha	Galle	Colombo	Gampaha	Galle	Total
Public large	9	2	1	1	2	1	1	**4**
Public intermediate	20	3	1	2	2	1	1	**4**
Public obstetric	4	2	0	1	1	0	1	**2**
Public paediatric	2	1	0	0	1	0	0	**1**
Public other specialist	557	16	22	20	0	0	0	**0**
Total public	592	24	24	24	6	2	3	11
Private large	8	7	1	0	3	1	0	**4**
Private intermediate/small	114	27	21	5	1	2	2	**5**
Private obstetric	1	1	0	0	1	0	0	**1**
Private paediatric	0	0	0	0	0	0	0	**0**
Private other specialist	2	2	0	0	0	0	0	**0**
Total private	125	37	22	5	5	3	2	10

Source: Management Development and Planning Unit (2011) and Amarasinghe *et al*. (2013).

Table 4 Comparative statistics of hospitals in sampled public and private hospital strata and all hospitals in study districts (2011)

Category	Hospitals	Beds	Admissions	Inpatient spending/bed (million rupees)	Inpatient spending/admission (thousand rupees)
Public hospitals in sampled strata					
Colombo	8	7144	645 643	1.4	15.6
Gampaha	3	2640	203 369	0.7	9.7
Galle	4	2581	244 022	1.1	11.3
All public hospitals in the three districts	72	20 949	1 588 987	0.8	10.3
Private hospitals in sampled strata					
Colombo	35	1653	147 260	9.7	108.9
Gampaha	22	524	32 385	2.3	37.8
Galle	5	164	9386	3.0	51.7
All private hospitals in the three districts	64	2395	190 434	7.5	94.6

Source: Management Development and Planning Unit (2011) and Amarasinghe *et al.* (2013).

[a]District-level data for public hospitals refer to sampled strata only—large, intermediate, obstetric and paediatric facilities only, and for private hospitals exclude private paediatric and other specialist facilities. [b]Inpatient spending refers to budgetary expenditures by public facilities, and inpatient revenues at private hospitals. [c]Exchange rate in 2011: 1 US dollar = 110 Sri Lankan rupees.

records of asthma, AMI and childbirth admissions. The final sample consisted of 2523 public inpatients (442 asthma, 307 AMI, 407 childbirth, 1367 other conditions) and 1815 private inpatients (205 asthma, 81 AMI, 436 childbirth, 1096 other conditions). We found fewer AMI cases in the private sector than expected, because there were almost no AMI cases admitted in the smaller private hospitals. We speculate that this is because AMI patients prefer to avoid smaller private hospitals.

Data collection

Data were collected from the sampled patient medical records archived in each hospital. Pre-intern medical graduates undertook the extraction of data from the patient case records using Apple iPad™ tablet computers, which allowed for pre-coding of common conditions, use of a medicines database to look up brand and generic names when entering medicines and standard data validity checks. A physician coded discharge diagnoses using ICD-10 after data collection was completed, and a second physician independently verified these.

The study design was reviewed and received ethical clearance by the Institute for Health Policy's Institutional Ethical Review Committee in Colombo, Sri Lanka (ERC Decision Number 06 A/2012).

Statistical analysis

All analyses were performed using Stata, version 12.1 (StataCorp 2011). We call each opportunity that a patient

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could potentially receive the care recommended by our list of indicators, a 'quality instance'. As there may be several quality indicators applicable for each condition and for each patient, this can produce many quality instances per individual patient, and in aggregate, more quality instances than overall patients. We determined whether each patient was eligible for each quality instance, and if eligible whether the patient received the specific process. Following the method of McGlynn *et al.* (2003), aggregate indicator scores for types of care were calculated by dividing the total number of times recommended care was given for each quality instance by the total number of quality instances. Scores were expressed as percentages (0–100%), and we used the bootstrap method to calculate standard errors as our data were clustered. This approach to aggregating quality scores and estimation of standard errors follows similar studies in developed countries (McGlynn *et al.* 2003; Asch *et al.* 2004; Runciman *et al.* 2012), and is supported by previous analyses as being appropriate for this type of study (Reeves *et al.* 2007).

We applied sampling weights to represent the original inpatient populations in the sampled hospital strata in the three districts from which the samples were drawn, and to adjust for the oversampling of tracer conditions in each facility, so that the weighted distribution of discharge diagnoses for asthma, AMI and childbirth within each facility reflected the proportion of discharges estimated to have been due to these three diagnoses in the facility in 2011. When making public–private comparisons, we also used weights to standardize the private sector sample to match the public sector sample, by gender and by age categories (0–4, 5–14, 15–29, 30–44, 45–59, 60–74, ≥75 years). This approach to sample weighting to match the underlying patient populations and standardization to control for patient mix differences when comparing between two patient populations follows similar studies in the USA (Asch *et al.* 2004, 2006), and is supported by previous analyses as being appropriate for this type of study (Reeves *et al.* 2007).

We used *t*-tests to compare aggregate quality scores between the public sector and standardized private sector samples for overall quality; subsets of quality indicators associated with the three tracer conditions; subsets of indicators classified according to resource intensity and limitation in the public sector, drug prescribing, assessment and investigation, treatment and management and positive outcomes.

Results

Characteristics of the study sample

The characteristics of patients in the two sectors after weighting are shown in Table 5, along with the *P* values for differences between the public and private sectors. The overall patient mix in the private hospitals resembles that in the public sector, except for a greater predominance of females and fewer admissions for urinary tract infection (UTI). The characteristics of patients after standardizing are also shown. The standardized patient profiles in the two sectors are similar with respect to diagnosis. There were no statistically significant differences in age, sex, average length of stay or distribution of top discharge diagnoses, except for a small difference in the proportion of patients discharged with UTI. The top three discharge diagnoses in both sectors were childbirth, acute lower respiratory tract infection and unspecified viral infections.

Overall quality of care

Results were obtained for a total of 55 indicators and 1898 patients, generating 2908 quality instances in the public sector and 2719 in the private sector. In 69–77% of quality instances overall, providers took the correct action, with rates being 63–69, 68, 89 and 81% of quality instances in asthma, AMI, childbirth and all other specific conditions respectively (Table 6).

Table 5 Differences between public and private sector patient samples

Characteristic	Weighted, unstandardized			Weighted, standardized		
	Public sector ($n=2523$)	Private sector ($n=1815$)	*P* value for difference	Public sector ($n=2523$)	Private sector ($n=1815$)	*P* value for difference
Average age (years)	36.8	38.7	0.64	36.8	37.0	0.97
Male sex (%)	47.9	41.8	0.29	47.9	47.8	0.99
Discharge diagnoses						
Asthma (%)	1.0	1.2	0.69	1.0	1.2	0.66
AMI (%)	0.6	0.7	0.79	0.6	0.7	0.77
Childbirth (%)	6.9	7.0	0.97	6.9	6.2	0.87
Acute lower respiratory tract infection (%)	3.3	3.4	0.94	3.3	3.6	0.75
Viral infection, unspecified site (%)	2.7	4.4	0.16	2.7	5.5	0.08
Viral gastroenteritis (%)	2.1	2.7	0.38	2.1	2.8	0.37
Abdominal pain (%)	2.4	2.1	0.77	2.4	2.2	0.84
Chronic ischaemic heart disease (%)	0.4	3.2	0.29	0.4	3.3	0.28
Urinary tract infection (%)	2.7	0.9	0.00	2.7	0.8	0.00
Dengue fever (%)	2.2	2.5	0.67	2.2	2.7	0.46
Average length of stay (days)	3.6	3.0	0.07	3.6	3.0	0.05

Note: AMI, acute myocardial infarction.

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Table 6 Comparison of quality of care between public and private sectors in weighted, standardized samples

Indicator category	Indicators (*n*)	Public			Private			Difference (95% CI) percentage points
		Patients (*n*)	Eligible events (*n*)	Mean score (%)	Patients (*n*)	Eligible events (*n*)	Mean score (%)	
Overall	55	955	2908	76.9	943	2719	69.3	7.6 (1.5 to 13.7)*
Disease category								
Asthma	7	25	164	63.4	22	136	69.2	−5.8 (−12.4 to 0.8)
AMI	15	15	205	68.4	13	177	68.5	−0.1 (−14.1 to 14.0)
Childbirth	10	173	1407	89.4	113	978	88.9	0.6 (−4.8 to 5.9)
Other specific conditions	7	82	99	81.4	93	101	81.3	0.0 (−31.4 to 31.5)
Resource limitation								
Low	12	665	955	93.8	710	1061	81.3	12.5 (7.8 to 17.2)***
Medium	33	557	1147	57.5	516	1109	47.8	9.7 (−0.3 to 19.7)
High	4	41	73	10.3	35	62	30.6	−20.3 (−30.7 to −9.9)***
Drug prescribing (all indicators)	36	955	1525	68.0	943	1760	59.7	8.3 (0.8 to 15.8)*
DVT prophylaxis	9	205	205	0.0	354	359	0.9	−0.9 (−2.5 to 0.7)
Surgical antibioitic prescribing	4	508	508	68.4	526	526	57.7	10.7 (0.9 to 20.5)*
Clinical area								
Assessment and investigation	10	214	480	78.5	148	339	71.4	7.1 (−10.4 to 24.6)
Treatment and management	39	955	1695	70.0	943	1893	61.8	8.2 (2.2 to 14.2)**
Outcome indicators	6	214	733	92.0	148	487	97.3	−5.3 (−9.5 to −1.2)*

Notes: For most categories, there are several quality indicators, and each patient may be eligible for some or all of these indicators. Therefore, the number of eligible events can be larger, sometimes several times larger, than the number of patients that have the condition. Significance of difference indicated by $^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$. 95% confidence intervals calculated using bootstrapped standard errors. AMI, acute myocardial infarction; DVT, deep vein thrombosis.

In the results for overall quality, two specific findings stand out. First, there was a clear reduction in quality in both sectors as the resource intensity of indicators increased. For indicators categorized as low resource intensity, providers took the correct action more than 80% of the time, but with high resource intensity indicators, this fell to less than one-third of the time. Second, there was a single, isolated area of universally poor performance—DVT prophylaxis. Here providers undertook the correct action less than 1% of the time.

Comparisons of quality of care between public and private sectors

Table 6 presents the main results of our analyses comparing the quality of care between the public hospital and standardized private hospital samples, adjusting for age and gender. The public sector performed better than the private sector in the overall quality aggregate (77 vs 69%, respectively), with the difference being statistically significant at the 5% level. Performance was similar in both sectors for the management of AMI (68%) and childbirth (89%), and slightly better in the private sector for management of asthma (63 vs 69%), although this was not significant at the 5% level.

The major differences that are evident are when comparing quality indicators by resource intensity. In particular, the public sector performs better in indicators that are not constrained by resources (94% compared with 81% in the private sector), but performs worse in indicators that are resource intensive and likely to be subject to resource limitations (10% compared with 31%). However, the public sector performed better in indicators pertaining to drug prescribing (68% compared with 60% in the private sector). The public sector also performed better in the domains of assessment and investigations, as well as treatment and management, the latter being statistically significant. The private sector performed better in outcome indicators (97 vs 92% in the public sector).

Comparisons of quality of care between districts

Amalgamated quality scores with comparisons among the three districts for overall quality domains, with weighting and standardization of the samples, are shown in Table 7. Overall quality in the public sector in Galle was better than in Colombo (difference of 6.7%; $P < 0.01$), with no significant differences in the assessment and investigation domains. The private sector in Gampaha performed better than in Colombo in treatment and management (difference of 12.7%; $P < 0.05$), while the public sector in Gampaha performed better than Colombo in outcome indicators (difference of 8.4%; $P < 0.01$).

Comparisons of quality of care with other countries

Although the primary objective of the study was to compare quality differences between public and private sectors in Sri Lanka, since most of the quality indicators we had selected were derived from the global literature, we assumed at the outset that we would be able to make systematic comparisons with other countries. So we undertook a literature search to identify studies that reported adherence in other countries to our individual quality indicators, so as to benchmark our

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Table 7 Differences in quality of care with public and private sectors by district of facility

Indicator category	Indicators (*n*)	District	Public				Private			
			Patients (*n*)	Eligible events (*n*)	Difference in score from reference group, % (95% CI)		Patients (*n*)	Eligible events (*n*)	Difference in score from reference group % (95% CI)	
Assessment and investigation	10	Colombo (reference)	12	270	0.0		112	250	0.0	
		Gampaha	42	94	0.0	(−17.3 to 17.3)	21	50	−17.0	(−53.6 to 19.6)
		Galle	52	115	−2.8	(−31.1 to 25.6)	15	39	−1.6	(−19.5 to 16.4)
Treatment and management	39	Colombo (reference)	618	1072	0.0		788	1572	0.0	
		Gampaha	156	297	1.2	(−7.0 to 9.4)	104	196	12.7	(1.7 to 23.6)*
		Galle	181	326	7.7	(−2.6 to 17.9)	52	124	14.3	(−3.3 to 32.0)
Outcome indicators	6	Colombo (reference)	120	411	0.0		112	393	0.0	
		Gampaha	42	141	8.4	(2.2 to 14.7)**	21	53	0.1	(−2.0 to 2.3)
		Galle	52	181	5.8	(−0.7 to 12.2)	15	42	−1.3	(−3.6 to 1.1)
Overall	55	Colombo (reference)	618	1753	0.0		788	2,216	10.0	
		Gampaha	156	532	3.7	(−1.0 to 8.5)	104	298	6.3	(−5.2 to 17.7)
		Galle	181	622	6.7	(1.7 to 11.6)**	52	205	10.2	(−8.2 to 28.7)

Notes: Weighted and standardized samples used. Significance of difference indicated by * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$. 95% confidence intervals calculated using bootstrapped standard errors.

findings. Surprisingly, we found only three such studies from other Asian low-income/lower-middle income countries (LI/LMICs). None of these LI/LMIC studies were generalizable at the national level, either being from academic tertiary centres (Samad *et al.* 2002; Hussain *et al.* 2005), or from clinical or intervention trials, where the intent was to document impact of interventions, and not specifically to assess patterns of quality (Yusuf *et al.* 2004).

We had more success in finding studies involving larger and more representative samples of providers in Asian upper-middle/high-income countries (UM/HICs) and other non-Asian HICs (Supplementary Tables S2–S4). Although the indicator level comparisons identified cannot be said to be representative, in general both sectors in Sri Lanka performed as well as or better than Asian UM/HICs and similar to non-Asian HICs for individual indicators with low or medium resource limitation, including prescribing inhaled bronchodilators in asthma patients, aspirin and clopidogrel on presentation for AMI patients, and initiating breastfeeding after delivery (Wildman *et al*. 2003; Sandin-Bojo *et al*. 2006; Peterson *et al*. 2008; Tsai *et al*. 2009; Flather *et al*. 2011; Somma *et al*. 2012). In other indicators involving medium resource limitations, one or both sectors performed similarly to Asian UM/HICs, but worse than non-Asian HICs, including administering systemic corticosteroids to asthma patients, beta blockers for AMI patients and thrombolysis for ST elevation myocardial infarction (STEMI) patients (Yusuf *et al.* 2004; Peterson *et al.* 2008; Tsai *et al.* 2009; Somma *et al.* 2012). For the few highly resource-limited indicators for which comparisons were possible, performance in Sri Lanka was poor compared with HICs, including percutaneous intervention and echocardiograms for AMI (Peterson *et al.* 2008; Bernheim *et al.* 2010).

Discussion

Our study assessed quality of inpatient clinical care in government secondary and tertiary hospitals and private hospitals in Sri Lanka, focusing on three tracer conditions. In 63–69, 68 and 89% of quality instances in asthma, AMI and childbirth respectively, and in 69–77% overall the appropriate action was taken. To put this into context, studies using similar methods and similar indicators in developed countries have reported that physicians take the correct action only 51–67% of the time (McGlynn *et al.* 2003; Asch *et al.* 2004; Runciman *et al.* 2012). However, it must be noted that these studies aggregate data over a larger number of indicators and conditions, including more highly resource intensive indicators that would have been excluded in our study as being inappropriate in the local context.

The overall results, the comparisons with studies that have examined single indicators in other countries, and the results of studies in developed countries that have used the RAND methodology (and incidentally many indicators common to our study) indicate that the quality of clinical care provided to inpatients in Sri Lanka is relatively good, and comparable in many areas to that reported in UM/HICs. Performance is best and most comparable in the domains of treatment and management and patient outcomes, with indicators across our three tracer conditions matching rates seen in richer economies. Performance is less good in assessment and investigation domains, but it could be argued that this matters less than quality in treatment and management.

However, performance is poor in two areas, where resource limitations are likely to play a dominant role. The first is where treatment required use of capital and skill-intensive technologies, e.g. angiography and echocardiography facilities. These

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equipment or services are not available in most hospitals in Sri Lanka, and when they are accessed may be inadequate to allow use in all indicated clinical situations, and availability of trained operators might be limited.

The second area was assessment and investigation in asthma, specifically measuring oxygen saturation, forced expiratory volume in one second (FEV1) or peak expiratory flow rate (PEFR). The relevant diagnostic procedures require specific pieces of equipment (pulse oximeters, spirometers, etc.), which are not that costly, but where limited supplies budgets or inefficient purchasing in the public sector has resulted in inadequate availability. The shortage of devices such as pulse oximeters in Sri Lankan public hospitals is similar to the situation reported in other LI/LMICs (Funk *et al.* 2010). This suggests that some substantial improvements in quality are feasible with modest increases in investment and improvements in budget processes. Although practices were somewhat better in the private sector, they still fell far below desired standards. It is not clear why resource constraints would be a limiting factor in the private sector for these items, but a possible explanation is that since most Sri Lankan private hospital physicians are both trained in and work concurrently in the public sector, that public sector physician practices have adapted to manage patients without making use of or insisting on such tools, and carry over into clinical practice in the private sector.

A third area of poor performance was DVT prophylaxis in surgical cases, where providers almost universally in the study took no action. This finding confirms an earlier study, which also found low levels of DVT prophylaxis in Sri Lankan hospitals (Seneviratne *et al.* 2012). Discussions with clinicians suggested that one explanation is a belief that DVT prophylaxis is not warranted in South Asians as they do not suffer from the complications that prophylaxis is intended to prevent, but we found no evidence in the literature to support this belief. This failure to provide prophylaxis may be resulting in hundreds of deaths and unnecessary patient morbidity each year. There is a need for urgent action in Sri Lanka to educate physicians about the importance of DVT prophylaxis and the evidence base behind it and to introduce treatment protocols in the public sector and other measures to encourage rapid adoption of better practices.

This research came about because of discussions between the Government of Sri Lanka and the World Bank about the appropriate role of the private sector in Sri Lanka's health system, and how to improve management of the public–private mix, which led to the Institute for Health Policy being contracted to undertake an assessment of quality in public and private sectors. Such discussions are commonplace in most developing countries, and consideration of levels of quality, its differences between providers and determinants, must be part of any complete assessment of the policy issues. So when we conceived and designed this research, we assumed that we would be able to compare any findings with similar studies in other LI/LMICs. This was notably not the case.

Despite significant debate about the respective roles of public and private sectors in mixed health systems (Hanson *et al.* 2008), there is a scarcity of research about quality of care in developing countries (Berendes *et al.* 2011; Das *et al.* 2012), and almost no published research on the quality of inpatient clinical care in LIC/LMICs, in particular process quality. What work exists on process quality has either focused on single conditions, or been the by-product of clinical trials. For example, Basu *et al.* (2012) undertook a systematic review of studies that compared performance of public and private providers, and of the 102 studies they identified, only five dealt with hospitals, and almost all the studies that considered process quality dealt only with outpatient care.

The lack of published research on inpatient quality can be contrasted with the significant increase in the last decade in work on outpatient quality of care using both direct observation and standardized patient methods (Berendes *et al.* 2011; Basu *et al.* 2012). This is not due to the lack of methodologies, because there is substantial research and monitoring of quality of inpatient clinical care in high and upper-middle income countries. Instead, we surmise the constraint has been the perceived difficulty and cost of adapting the methods used in more developed countries to the context of LIC/LMICs, and possibly lack of awareness by researchers working in developing countries of methods used in developed countries.

We believe that our study of quality of inpatient care in public and private sectors in Sri Lanka is the first of its kind in a LIC/LMIC. It shows that it is indeed feasible to apply methods pioneered by RAND researchers in high-income countries to assess levels and differences in quality in a LIC/LMIC, at least in situations where both public and private hospitals maintain and archive patient case records on a routine basis. Specifically, we have demonstrated in Sri Lanka: (a) that it is feasible to use a combination of literature review and consultations with local clinicians to generate quality indicators that are measurable and have local relevance and command consensus amongst local experts; (b) that many of these indicators match those selected in similar studies in developed countries; (c) that it is possible to collect representative data from both public and private hospitals using retrospective record review; (d) that it is possible to generate composite quality scores as in the RAND approach; and (e) that such composite quality scores can be used to assess and compare quality of care overall, within selected domains and between types of provider. Further, the falling costs of tablet computers make field collection of these data increasingly affordable, and circumvent the barriers that exist when hospital systems do not maintain electronic medical record systems, as is the case in LIC/LMICs. Although budget constraints limited the representativeness of our findings by preventing us from increasing the number of tracer conditions and quality indicators assessed or expanding geographical coverage, scaling up the approach in Sri Lanka would be achievable at modest cost given proof of concept.

At the same time, it is relevant to address some potential concerns and limitations with our study. The first concerns the potential reliability and validity of the individual quality indicators selected. The method we used to select individual indicators, which involved systematic review of the literature and local expert consensus, provides a strong basis for the content validity of our quality indicators. This assessment is strengthened by it being the same method used in the RAND approach, and by many of the indicators we used being also included or sourced directly from the RAND work, for which evidence exists for reliability and content and predictive validity (Campbell *et al.* 2002).

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A second potential concern concerns the validity and reliability of the method of aggregation of indicators into a composite indicator. This issue is discussed in detail in Rannan-Eliya *et al.* (forthcoming), but in brief we adopted a method that has been assessed to be the best for comparing different healthcare organizations if the patient mix is similar or if comparing similar types of care (Reeves *et al.* 2007).

Another concern is whether our sample size (5627 quality instances based on 55 indicators collected from 1898 patients) is large enough to draw generalizable conclusions about the mix of conditions examined. For reasons discussed at length in Rannan-Eliya *et al.* (2014), this is more than adequate. First, the number of patients is in fact comparable to those deemed acceptable in previously published, national reference studies from developed countries, such as Australia ($N = 1154$) and USA ($N = 6712$) (McGlynn *et al.* 2003; Runciman *et al.* 2012). Second, analyses of similar quality of care study data by van Doorn-Klomberg *et al.* (2013) have concluded that although relatively large patient samples ($N = 100$) are needed to achieve moderate precision (10% points on a performance score) when dealing with individual quality indicators, the required patient numbers decrease significantly ($N < 50$) when combining multiple quality indicators into a composite score, as we have done. These findings indicate that our study does have sufficient sample size to be able to generate meaningful comparisons of quality between provider groups or between major groupings of quality indicator.

A fourth issue concerns the potential generalizability of our results to the Sri Lankan context, given that data were collected in only three districts, two of which were more urbanized and developed than other parts of the country. Here we note two mitigating factors. The first is that we did not find significant district disparities in quality or lower quality of care in the poorest and most rural district—Galle, in fact quality was better, which counters the possibility that we have overestimated quality through our geographical sampling. The second is that these three districts alone account for eight-tenths of all private sector admissions in Sri Lanka (Amarasinghe *et al.* 2013), with the non-sampled districts more closely resembling Galle than Colombo or Gampaha. So although our findings may have limited generalizability to the Sri Lankan public sector as a whole, they are quite representative of public and private services in the areas in which it is meaningful to make public–private comparisons and where patients have an actual choice.

A fifth issue concerns the interpretation of public–private differences in outcomes. It is likely that patient outcomes also depend on a range of other patient characteristics, such as socioeconomic and nutritional status, severity of disease and length of delay in seeking treatment, which probably vary systematically between public and private sectors. Our standardization procedure does not control for these factors, so differences in outcome indicators are potentially biased.

The comparisons with other countries that we have reported are on an individual indicator basis, using different studies in each case. This prevents us making any generalizations about overall levels of quality compared to other countries. However, as a number of indicators that we used are also common to studies in USA, Australia and other countries that have used the RAND QA Tools approach, we are undertaking further work to make more systematic comparisons using a common set of indicators. Findings from that work are beyond the scope of this article, and will be reported separately, but they suggest that for sets of indicators that are in common with studies from the USA and Australia, quality of care in the Sri Lankan hospitals sampled was comparable.

Finally, we note that our study examined quality of care only from a clinical process perspective. Funding limitations meant that we could not interview patients or attempt to assess other dimensions of quality such as patient responsiveness, interpersonal quality and other aspects of patient experience. Doing so would have required adoption of other survey modalities, which was not feasible.

Conclusions

Our findings indicate that despite the low level of health spending in Sri Lanka (US$97 per capita in 2011), inpatient providers achieve what we would argue are reasonable levels of quality, given tentative indications of comparability with levels of quality seen in UMICs and HICs. This suggests that a high level of clinical quality may play a significant role in combination with high levels of medical care utilization in achieving Sri Lanka's good health outcomes, the latter having already been identified as a determinant (Caldwell *et al.* 1989; De Silva *et al.* 2001). It also indicates that, where resources of equipment or supplies are not an issue, it is possible for physicians working in Sri Lanka's resource constrained environment to achieve high standards of clinical practice. Further, in several areas where quality is deficient, in particular asthma management, it should be feasible within current spending levels to take remedial action to improve quality of care and ultimately patient outcomes. These findings concur with similar conclusions by Peabody and Liu (2007) about the potential for physicians in resource constrained environments to improve quality.

In terms of differences in quality of care between the public and private sectors, the most significant finding is how similar quality levels are, despite the 3- to 5-fold differences in spending per patient and also the differences in financial incentives faced by physicians in the two sectors. We do not find this that surprising, given that the same physicians serve in both sectors, and since most Sri Lankan physicians were trained and did their apprenticeship in the public sector. We speculate that the quality of physician training may be an important determinant of quality of care in the Sri Lankan health system, which would underline the importance of targeting physicians as has been suggested by other authors (Peabody and Liu 2007).

Despite having less financial resources than the private sector, public hospitals perform as well as or even better than the private sector in many areas of quality, performing worse only in areas where resource constraints are likely to be the key constraint. Further, the public sector generally did significantly better for indicators with low resource requirements, e.g. giving aspirin or clopidogrel on admission to AMI patients, or correct antibiotic prophylaxis before Caesarean

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sections, suggesting that when resource constraints are similar the public sector may be inherently better able to deliver high quality. Our study cannot explain why the public sector does better in these indicators, but we speculate that the reasons include the greater capacity of the public sector to institute and enforce standard operating procedures, better team work and communication between physicians and nurses, the benefit in larger public sector hospitals of academic affiliations and academic clinical specialists, greater accountability of physicians to hospital management, and more co-ordinated delivery arrangements. The staff model of employment at public sector hospitals may explain much of this, in contrast to the predominant model of independent, visiting physicians at private hospitals in Sri Lanka. These reasons resemble those suggested by Asch *et al.* (2004) to explain why public sector Veterans Administration hospitals in the USA performed better on quality than other (mostly private sector) hospitals.

Where the public sector did worse than the private sector was mostly in areas where the private sector has the advantage of more resources, particularly equipment and supplies. The public sector also did worse in these areas when benchmarked against HICs. This indicates that quality of inpatient clinical care in Sri Lanka's public sector and ultimately the overall health system is largely resource constrained, and substantial improvements in quality of care will require increased investments by government. At the same time, the findings do not reveal that the public sector is less inherently capable than the private sector to translate a given amount of inputs and money into quality services, since in dimensions where there were no apparent resource constraints in both sectors, the public sector did as well or even better in quality terms. From a policy perspective, this means that if the government wants to improve quality in a cost-effective manner, the public sector delivery system remains its best and cheapest option, with our findings providing no evidence to believe that the private sector will be able to deliver higher quality with the same funding levels.

These results are pertinent to the global debate about whether governments in developing countries should directly fund and deliver services or whether governments should purchase care from the private sector. In Sri Lanka, the public sector is known to reach the poor more than the private sector, and to deliver services at lower overall costs (Rannan-Eliya and Sikurajapathy 2008). Our findings add to this by showing that the public sector achieves reasonable levels of quality despite the government's low level of spending, and is more cost-effective than the private sector in achieving quality of care. In contrast, the government lacks significant capacity to regulate the private sector, being unable even to count the limited number of private hospitals in the country or to enforce basic licensing (Amarasinghe *et al.* 2013) for various reasons, which are discussed in detail in the accompanying article by Rannan-Eliya *et al.* (2014). In such a situation of effective public sector delivery capacity and weak capacity to regulate the private sector, at least in Sri Lanka the choice of public financing and delivery remains the best option for government to use its limited financial resources to guarantee access to adequate quality care to most citizens, including the poor.

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Conflict of interest statement. None declared.

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