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THE COSTS OF DELIVERING HEALTH SERVICES IN INDONESIA: REPORT ON A PROSPECTIVE SURVEY 2010-2011

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COOPERATION REPUBLIC OF INDONESIA FEDERAL REPUBLIC OF GERMANY

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THE COSTS OF DELIVERING HEALTH SERVICES IN INDONESIA: REPORT ON A PROSPECTIVE SURVEY 2010-2011

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Foreword

Assallamu'alaikum Wr. Wb

First of all, let us praise to God Almighty who has always bestow His mercy and guidance to all of us so that we could finalize the report of the Second Phase of Health Facility Costing study in Indonesia.

This project started 4 years ago, when the Ministry of Health Republic of Indonesia needed studies on cost of health care provision to embark in the development of National Health Insurance towards universal coverage. The government needed a study that was based on actual production cost of essential health care, both in hospital and health centers (puskesmas).

GIZ and AusAid answered the challenge by providing technical assistance and funding for this study. The study was designed, supervised and analyzed by Oxford Policy Management (OPM) team, and implemented by experts from University of Gajah Mada and University of Indonesia together with GIZ team.

The study consists of two phases, where the first phase was to develop a model of a Normative Costing. This model accommodates the need for cost modeling to develop proposal for health budget especially to implement the Minimum Service Standard known as Standar Pelayanan Minimal (SPM) in Indonesia at district level.

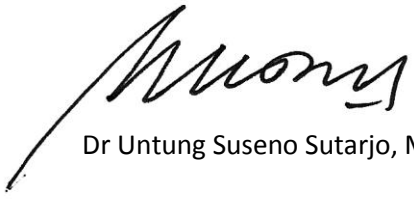
The second phase is to calculate the production cost of health care for the total basket of services – not limited to SPM. The study is a prospective study, conducted in 15 provinces, 30 districts, 234 heathcentres, 119 government hospitals and 81 private hospitals which were selected through stratified random sampling process.

Due to the amount of data collected and its coverage, the study was very complex with enormous obstacles. However, the team succeeded in finishing the study on time. On behalf of the government, we would like to convey our gratitude to GIZ and AusAid for the great effort in completing this study.

We hope that the result of the study can be used by decision makers all over the country to develop policies to improve health services in Indonesia. We also would like to urge researchers and academicians to use the data for further studies.

Jakarta, June 2012

Special Advisor to the Minister in Health Financing
as
Chair of the Technical Team



Dr Untung Suseno Sutarjo, MKes

Foreword

Indonesia has declared universal coverage in health as one of its priority goals. In order to base the implementation of universal coverage policy on sound information the Ministry of Health asked the "Deutsche Gesellschaft für Internationale Zusammenarbeit", GmbH (GIZ) to support a nationwide health facility costing study. The Health Facility Costing Study is funded by the German Federal Ministry for Cooperation and Development (BMZ) and the Australian Government Overseas Aid Programme (AusAID).

The study included a first phase developing a normative costing model and a second phase doing an empirical nationwide health facility costing study. A similar empirical study of such a wide scope involving 464 health facilities has never been carried out anywhere else before and as one participant in the dissemination workshop mentioned would merit to be mentioned in the Guinness Book of Records.

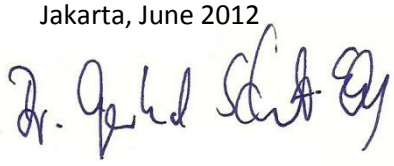
To design, plan, implement, collect, clean and analyze the data and bring this costing study to a successful end a great deal of effort has been made by a variety of stakeholders over a period of over two years.

This study has depended on the contribution and participation of many individuals, teams and organizations, which I want to thank for the overall good collaboration: first of all the Ministry of Health as the driving entity, local governments, the Universitas Gadjah Mada (UGM) and the University of Indonesia, the Oxford Policy Management (OPM) international experts having accompanied the study all along, the data collectors, the staff and teams in the health facilities and district offices, the experts from GIZ and AusAID. High workload occurred at the end to verify and clean all the data which was done by the GIZ data management team and to prepare them for the analysis through OPM to assure the quality and reliability of the study results.

The dataset developed during the second phase of the study contains a large number of variables, especially related to costing on primary and secondary health care in Indonesia for public and private facilities that can be used to inform a wide selection of policy questions including the development of health sector budgets, the base rates for provider payment systems and geographic resource allocation. The study and its results are of high relevance for the Indonesian government and it is hoped that the impact on improved budgeting and health financing will show, that the huge effort was worthwhile. Additional analysis and more information can be drawn from the rich dataset, available with National Institute for Research and Development (Badan Litbangkes) Ministry of Health.

The fact that the support for the study involved different organizations gives great hope for widespread future use of the information. The commitment from the Indonesian side is key to ensure that users can fully benefit from the costing study and hereby contribute towards the ongoing process of providing better services for the Indonesian people at a reasonable price.

Jakarta, June 2012



Dr. Gertrud Schmidt-Ehry,
PA Consolidation Programme Health/Policy Analysis & Formulation in the Health Sector

Acknowledgement

The team wishes to thank the many administrators, nurses, doctors, midwives and other health facility staff that gave up their time to help provide information and take part in the questionnaires used to provide data from across the public and private health care sector. Without them, this study would not have been possible.

This study could not have accomplished without the support and cooperation of the Indonesian Ministry of Health. Among many others, invaluable assistance was provided by Prof. Dr. Ali Ghufron Mukti, M.Sc. Ph.D Vice Minister of Health, and Dr Untung Suseno Sutarjo M.Kes, Special Expert in Health Financing of the Ministry of Health and Advisor to the Minister.

Much gratitude goes out to Dr. Stephanus Indradjaya, PhD the driving force to get things done, for his knowledge, perseverance, and intellectual support throughout the study. He and the whole GIZ Health Facility Costing Study team: Laxmi Zahara, Linda Fitriwati, Ario Susilo and Asep Komarudin who has shown exemplary teamwork with an enormous commitment to get the job done under almost impossible circumstances. At the same time, much gratitude goes out to the formerly GTZ, now GIZ health teams who assisted the Indonesian MoH to initiate, continue and finalize the costing study, alternately under the guidance of Dr. Franz von Roenne, Dr. Paul Rueckert and Dr. Gertrud Schmidt-Ehry.

Many thanks to the AusAID team leaders: Dr. Ainsley Hemming, Dr. Helen Mc.Farlane and Dr. Debbie Muirhead for their ongoing interest and support.

Integral to both phases of the costing study has been Oxford Policy Management (OPM), in particular Prof. Timothy Ensor, PhD for his positive and constructive attitude and patience. He has not only been instrumental in shaping this study but has also offered ongoing moral and intellectual support throughout.

We are also indebted to the teams of University of Gadjah Mada, University of Indonesia, University of Airlangga and University of Hasannudin who have played an essential role in all steps of the study. Special thanks go out to two colleagues from UGM, i.e. Dr. Firdaus Hafidz for his technical inputs and tool development, as well as to Diah Ayu Puspandari, especially for her unwavering enthusiasm and inputs in the advocacy strategy.

Last but not least, many thanks to the Data Collection Team under Saniplan and PT Wastu Cipta Selaras, especially Prof. Purnawan Junadi, PhD who leads the team to undertake the difficult task in collecting such a huge data from different parts of Indonesia.

Contents

Executive Summary

Objective

The central objective of this study is to provide a better understanding of the cost of delivering health services across the country. The study is expected to inform policy in a number of ways including the development of geographic resource allocation, capitation formulae for primary care and the development of hospital payment systems. Understanding the determinants (drivers) of cost can help to understand how costs will change as a result of policies to increase utilisation of services as risk pooling is expanded.

The study follows a first phase which developed a normative model of costs of the essential package. The study draws upon a prospective costing of a stratified, representative sample of facilities from throughout the country collected between October 2010 and September 2011.

This report summarises the main methods and data collected and undertakes some preliminary analysis. The study has generated large datasets on facility productivity which will be of use to policy makers and health system researchers for policy related research.

Methods

The study aimed to develop an understanding of the full range of costs involved in delivering services. Expenditure data was supplemented by information on outstanding debts, valuation of drug stocks and valuation of equipment and buildings. A step-down accounting methodology was used to allocate these costs to cost-centres in order to provide unit costs of intermediate 'outputs' of facilities such as cost per minute of theatre time and cost per nursed bed-day as well as the cost of final activities of facilities; treated inpatients and outpatients. Econometric analysis of cost information was also undertaken to understand the associations between total costs and productivity and other drivers of cost.

A representative sample of primary health care facilities (puskesmas and network) and hospitals, both public and private, was drawn from across the country. Representation was assured by clustering provinces into strata based on common characteristics. A range of characteristics were selected that were thought to explain the contrasting epidemiological, economic and social differences between parts of the country that influence the local costs of providing medical services. These included disease profile (e.g. levels of malaria and TB), fiscal capacity and human development index encapsulating literacy, life expectancy and mortality and health service accessibility including average distance to the nearest health facility and travel time by facility staff to deliver community services. The result of this cluster analysis was the identification of four groups of provinces from which provinces (15 provinces out of 33 provinces) were randomly selected. These provinces are: Group 1 - Bali and Di Yogjakarta; Group 2 – Bangka Belitung, Riau, Jawa Timur and Sumatra Barat; Group 3 – Sulawesi Barat, Gorontalo and NTT; Group 4 – Sumatra Utara, Sulawesi Tengah, Kalimantan Selatan, Kalimantan Tengah, Jawa Barat and Sulawesi Selatan. A total of 15 provinces and 30 districts were sampled in rough proportion to population again using a clustering approach. Approximately eight puskesmas were selected at random from each district. All public hospitals from the 30 districts were selected. In addition, supplementary districts and hospitals were selected at random from each

provincial cluster to get more than 100 public hospitals required for the econometric analysis since there is mostly only one public hospital in a district. A final sample of 119 public hospitals, 109 private hospitals and 235 puskesmas was identified to be included in the study. Frequency weights were derived to adjust the final analysis so that the statistics reported reflect the country-wide population of health facilities.

After drop outs, which mostly occurred because private facilities were unable or unwilling to provide a full and accurate set of data, complete or nearly complete information was collected from a total of 234 puskesmas (1 drop out), 119 public hospitals (2 drop outs), 81 private hospitals (25 drop outs) and 30 district health offices. Statistical analysis shows that the remaining facilities participating in this study is still representative for the country.

Costs are composed of recurrent and capital items. Recurrent costs include staffing (salaries and incentives), costs of drugs and medical supplies, operational costs (e.g. fuel, food) and fixed overheads (e.g. utilities, maintenance). Capital costs are buildings, medical equipment, non-medical equipment and vehicles. All capital items and drugs are valued at current prices. Items not used during the year are excluded and outstanding debts are included as a cost.

Costs of providing puskesmas services

The study focused on the puskesmas-network as the unit of observation. Information was obtained on 234 puskesmas networks, 34% of which had beds and 33% had basic obstetric care functionality. Networks on average had 2.9 pustu, 2.6 polindes and 38 posyandu. The average catchment population for a puskesmas network was 26,922.

A substantial proportion of facilities reported problems with utility and medicines supply and delays in paying salaries and incentives. Particularly badly affected were the puskesmas in group three where a majority reported problems with disruption of electricity, water and salary payment. The availability of doctors varies considerably from less than one per network to more than 3. Nurses and midwives make up in numbers of a lack of doctors and the overall number of staff across the country is reasonably stable.

Patient loads vary considerably across the country: the number of general patients varies from 321 per 1,000 population in Sumatra Utara to more than 1,100 in NTT. Around 40% of the caseload are priority (SPM) communicable diseases.

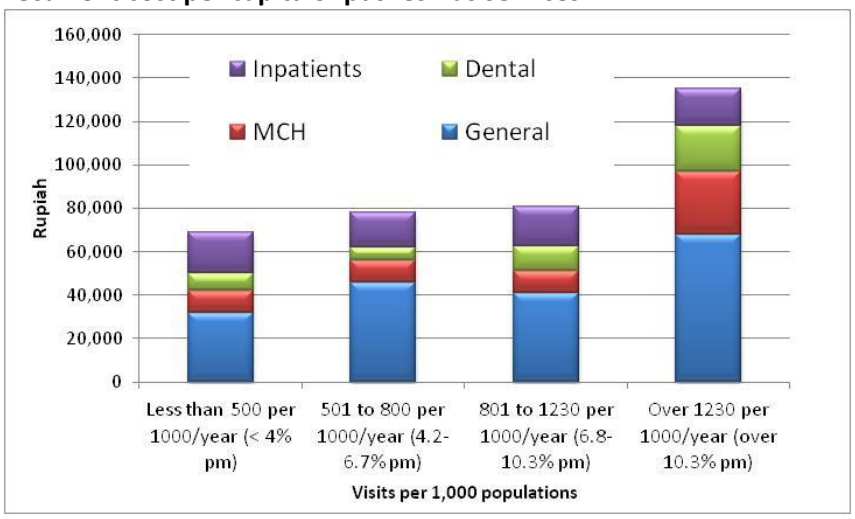
Across the country, it costs on average Rp. 2.16 billion (Median Rp. 1.9 bn) per year to provide care through the puskesmas and network for an average population of 26,922 (Mean Rp. 93,101 per capita/year; median Rp. 51,175). In urban areas the cost is estimated at Rp. 2.5 billion (median Rp. 2.3 bn) or Rp. 77,717 per capita/year (median Rp. 36,816). In rural areas the total cost is Rp. 2.0 billion (median 1.6 bn) or Rp. 99,180 per capita/year (median Rp. 57,406). Around 52% of the cost is staff, 27% drugs and medical supplies and 17% equipment and fixed capital.

The average cost (mean) of a general outpatient visit at a puskesmas is Rp. 88,240 (Rp. 68,776 without capital costs) ranging from 41,000 to more than 300,000 (partly due to different patterns of utilisation). The means are increased by a small number of high cost facilities. The median cost of a general outpatient visit is Rp. 51,109 (Rp. 43,978 without capital cost). The cost of an MCH visit is around 20% higher than for general outpatients which largely reflect the relatively higher staff

commitment required to provide these services. The costs of puskesmas services is generally lower in urban areas reflecting a combination of lower utilisation and higher fixed costs in rural areas which lead to higher per patient capital and staffing costs.

The total and per capita costs of puskesmas and network services are driven substantially by the utilisation. Inpatient costs per stay is in average Rp. 1.56 million (Rp. 1.4 million recurrent only). The cost in puskesmas with low utilisation (fewer than 147 inpatients and 10,300 outpatients per year) is more than Rp. 2.5 million but this falls to just over 700,000 for a puskesmas with high utilisation (more than 644 inpatients and 30,200 outpatients per year). A similar trend is seen in the costs of other services

Recurrent cost per capita of puskesmas services



The per capita cost of providing services to a sub district population depends on the utilisation rate (see figure). Across the sample, the annual per capita recurrent cost of all services rise from around Rp. 70,000 in sub-districts with fewer than 500 visits per 1,000 population (4% monthly utilisation) to more than Rp. 135,000 in sub-districts with more than 1,200 visits per 1,000 population (10% monthly utilisation). The increase to around 1,230 visits per 1,000 is quite modest mainly because higher utilisation is associated with lower unit (average) costs. Beyond 1,230 visits per 1,000 (equating to around 32,000 visits in a sub-district of average size) per capita costs rise more steeply as the productivity savings from increased workload are exhausted.

Costs of providing hospital services

The study focused mainly on level B and C hospitals that are most common at the district level, although class A and D were also included. Four categories of ownership were identified: government hospital with autonomous status (29%), government hospital with no autonomy (31%), private not-for profit (21%) and private for-profit (20%). The majority of hospitals (58%) have accreditation with the main state accreditation body although this proportion falls to just 21% in the group three provinces.

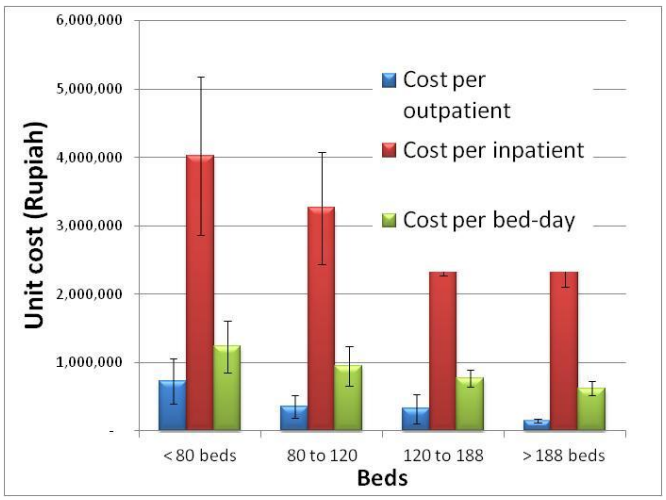
The functionality of hospitals was assessed by asking about disruption of utilities, delays in receiving resources and staff numbers. Delays in salaries are mostly confined to the public sector. There are substantial and variable delays reported in receiving medicines. There is little difference in the number of doctors per bed across the public and private sector. Nursing numbers are generally higher in the public sector.

Facilities demonstrate substantial variation in productivity across the country. Across provinces, bed occupancy rates vary from 41% to 76% while throughput varies from 56 to over 77 patients per bed,

per year. The most highly utilised hospitals, with consequently relatively low unit costs, tend to be larger facilities. Hospitals with a small number of patients relative to beds and short admission times tend to be smaller hospitals that have poor functionality and predominantly treating patients with communicable diseases.

There is wide variation in the costs of running a hospital which is largely determined by the size of hospital and utilisation. The total cost of a class D hospital is less than 25% of the total cost of a class A hospital. There is less variation in the cost per bed. Around 43% of government and 32% of the costs of running a non-government hospital is staffing (salaries and incentives). Drugs and medical supplies account for 15% of costs in government and 17% of costs in non-government hospitals. Capital costs (equipment and buildings) account for 11% of total costs. Much of the cost of equipment is in the radiography department and operating theatres. An analysis of the age of equipment suggests that B to D public hospitals are more likely to have older equipment that exceeds standard useful life spans compared to class A public or private sector hospitals.

Unit cost by size of hospital (numbers of beds)



The average cost (mean) of an outpatient visit across all classes of hospital was Rp. 415,453 (Rp. 368,174 recurrent cost only) and for an inpatient admission Rp. 3.5 million (Rp. 3.1 million, recurrent cost only). The median cost is Rp. 235,271 for an outpatient and Rp. 2.9 million for an inpatient. The unit cost of inpatient and outpatient care decline as the number of beds increase. Costs appear to be lowest for hospitals of around 160 to 200 beds which is in line with international evidence on the size of hospitals. The unit cost of low level (C/D) hospitals is similar to those for high level hospitals (A/B). This is both because admission rates are usually higher in the A/B hospitals and expensive facilities and equipment are shared across more patients. For hospitals with similar utilisation, the unit cost of inpatients for C/D hospitals is lower than for A/B.

Intermediate unit costs provide a way of examining the cost of individual conditions across facilities. Unit costs vary considerably across the country, reflecting differences in patient workload. Cost of doctor time is computed by dividing the salary and incentive cost of full time doctors by the amount of useful time in a facility per day (on average 3.5 hours). Unit costs are often higher at lower level facilities because of the low workloads at these facilities. These costs can be used to develop case costing based on a bottom up (ingredients) listing of drugs, supplies and laboratory tests together with the immediate unit costs. Unit costs for a small number of conditions were computed and compared between a small hospital with low admission rate (less than 4,000 per year) and a size efficient hospital (more than 180 beds and high throughput). The results suggest that surgical conditions (appendectomy and caesarean section) are 30% more expensive and medical conditions (dengue, diarrhoea, gastritis) 25% more expensive in the small hospital compared to the size efficient hospital.

Discussion and next steps

The dataset developed during the study contains a large number of variables on primary and secondary care in Indonesia that can be used to inform a wide selection of policy questions including the development of health sector budgets, development of base rates for provider payment systems and geographic resource allocation.

The unit costs of the puskesmas-network depend on two main factors. Firstly, the per capita cost of running the network is unsurprisingly higher in rural areas where a larger network of peripheral facilities is maintained in order to maintain coverage. Secondly, it is apparent that unit costs are strongly dependent on utilisation. Utilisation rates are currently quite low across the country, around one visit per person, but could increase substantially as risk pooling/insurance is extended to more of the population. An increase in use increases the overall costs of care but the decline in average cost means that it should be possible to expand services for a relatively low additional cost.

The cost of inpatient care in puskesmas is extremely variable. When utilisation rates are high, the survey suggests that puskesmas with beds offer a much cheaper alternative to hospital based care for suitable conditions. On the other hand, low utilisation rates lead to unit costs that are as high or even higher than in hospitals. This suggests policy that focuses on where puskesmas with beds are likely to be most effective in providing a transition level of inpatient care for a substantial number of patients. Changes in clinical practice and incentives to treat at the puskesmas level could help to stimulate the more effective use of puskesmas beds provided that care can safely be delivered at this level. Patient safety will also be improved by providing similar care for a larger number of patients.

At the hospital level, unit costs are determined substantially both by productivity and also the overall size of the hospital. The survey suggests that small hospitals (crudely measured by bed size) have substantially higher unit costs. This is line with international evidence that lowest costs are achieved in hospitals of 200 beds or more (although there is little benefit in very large hospitals). Relatively low unit costs are possible in lower class hospitals (C/D) provided that efforts are taken to increase utilisation rates. This may require improvements in the quality of the service, deployment of staff and changes in referral patterns and access. Consideration of these factors will be vital in preparing the supply side for universal coverage.

A number of further analyses are planned using the data including:

1. Adjusting for case mix
2. Further econometric modelling
3. Projections of future system cost

The data were cleaned and analysed in STATA. Data files with cleaned data are available by module and will be available through Badan Litbangkes. The data can be converted to other formats such as SPSS and excel.

Ringkasan Eksekutif

Tujuan

Tujuan utama dari studi ini adalah memberikan pemahaman yang lebih baik tentang biaya yang diperlukan untuk penyediaan pelayanan kesehatan di Indonesia. Studi ini diharapkan menyediakan berbagai informasi untuk penyusunan kebijakan misalnya pengembangan alokasi sumber daya secara geografis, formulasi kapitasi sumber daya untuk pelayanan kesehatan primer, dan pengembangan sistem pembayaran rumah sakit. Pemahaman tentang determinan biaya dapat membantu memahami bagaimana biaya akan berubah sebagai akibat dari kebijakan untuk meningkatkan pemanfaatan pelayanan seiring dengan berkembangnya pooling resiko (asuransi).

Studi ini merupakan lanjutan dari fase pertama dimana telah dikembangkan model normatif untuk penghitungan biaya Standar Pelayanan Minimal (SPM). Studi ini merupakan studi prospektif dari sampel yang diambil secara *stratified random sampling dan representatif untuk Indonesia*. Data yang dikumpulkan adalah data satu tahun meliputi periode Oktober 2010 – September 2011.

Laporan ini memberikan gambaran singkat tentang metode penelitian, jenis data yang dikumpulkan serta beberapa hasil analisis awal. Melalui studi ini telah terkumpul dan tersusun dataset yang besar dan kaya tentang produktivitas fasilitas kesehatan yang akan bermanfaat bagi penentu kebijakan dan juga bagi peneliti sistem kesehatan yang akan melakukan kajian untuk mendukung kebijakan kesehatan.

Metode

Studi ini bertujuan untuk memperoleh gambaran dan pemahaman yang lebih baik terhadap keseluruhan jenis biaya yang dikeluarkan dalam penyediaan pelayanan kesehatan. Data belanja dilengkapi dengan informasi tentang utang yang belum terbayar (*outstanding debts*) dan penghitungan nilai stok obat serta peralatan dan bangunan. Metode *step-down accounting* digunakan untuk mengalokasikan biaya-biaya ini ke dalam pusat biaya (*cost-centres*) sehingga dapat dihitung biaya satuan 'output antara (*intermediate output*)' dari fasilitas kesehatan seperti biaya per menit pelayanan di kamar bedah, biaya per hari rawat; dan biaya di pusat biaya akhir (*final cost centre*) dari suatu fasilitas kesehatan yaitu biaya rawat jalan dan rawat inap. Dilakukan pula analisa ekonometrik untuk memahami hubungan antara biaya total dan produktivitas serta determinan biaya lainnya.

Dalam studi ini diambil sampel yang representatif dari puskesmas dan jaringannya serta rumah sakit pemerintah maupun swasta di seluruh Indonesia. Keterwakilan fasilitas kesehatan dipastikan dengan mengelompokkan provinsi-provinsi ke dalam strata yang didasarkan pada karakteristik tertentu. Dipilih serangkaian karakteristik yang dianggap mampu menunjukkan perbedaan epidemiologi, ekonomi, dan sosial antara berbagai tempat di Indonesia dan yang mempengaruhi biaya lokal dalam penyediaan pelayanan medis. Karakteristik dimaksud adalah pola morbiditas (misalnya tingkat prevalensi malaria dan TB), kapasitas fiskal dan Indeks Pembangunan Manusia (yang mencakup tingkat melek huruf, angka harapan hidup, angka kematian) serta ketersediaan aksesibilitas fasilitas kesehatan yang mencakup jarak rata-rata ke fasilitas terdekat dan waktu tempuh yang diperlukan petugas untuk menyediakan pelayanan kepada masyarakat. Hasil dari analisa cluster/kelompok ini adalah teridentifikasinya empat kelompok provinsi, dimana dari dalam kelompok tersebut dipilih secara acak provinsi yang akan dilibatkan (15 dari 33 provinsi). Provinsi-provinsi terpilih adalah:

Kelompok 1 - Bali dan DI Yogjakarta; Kelompok 2 – Bangka Belitung, Riau, Jawa Timur dan Sumatra Barat; Kelompok 3 – Sulawesi Barat, Gorontalo dan NTT; Kelompok 4 – Sumatra Utara, Sulawesi Tengah, Kalimantan Selatan, Kalimantan Tengah, Jawa Barat dan Sulawesi Selatan. Selanjutnya dari 15 provinsi tersebut dipilih secara acak 30 kabupaten/kota sebagai sampel dengan mempertimbangkan jumlah penduduk dengan mengunakan pendekatan analisa cluster yang sama. Kemudian sekitar 8 Puskesmas dipilih secara acak dari setiap kabupaten/kota terpilih. Semua rumah sakit pemerintah di 30 kabupaten/kota terpilih diikutsertakan dalam studi ini. Di samping itu, dilakukan penambahan sampel rumah sakit secara acak di setiap kelompok provinsi sehingga diperoleh lebih dari 100 rumah sakit pemerintah yang dibutuhkan untuk melakukan analisa ekonometrik. Tambahan ini diperlukan karena di hampir setiap kabupaten/kota hanya terdapat satu rumah sakit pemerintah. Akhirnya secara keseluruhan terdapat 121rumah sakit pemerintah, 106 rumah sakit swasta dan 235 Puskesmas yang disertakan dalam studi ini. Pembobotan frekuensi dilakukan untuk menyesuaikan analisa akhir sehingga angka-angka yang dilaporkan mencerminkan populasi fasilitas kesehatan yang ada di seluruh Indonesia.

Setelah drop out yang sebagian besar terjadi karena fasilitas tidak mampu atau tidak bersedia menyediakan data yang lengkap atau akurat, informasi yang lengkap atau hampir lengkap telah terkumpul dari 234 puskesmas, 119 rumah sakit pemerintah (2 drop out), 81 rumah sakit swasta (25 drop out), dan 30 dinas kesehatan kabupaten/kota. Analisa statistik menunjukkan bahwa sampel yang tetap berpartisipasi dalam studi ini masih representatif secara nasional.

Biaya terdiri dari biaya rutin dan biaya modal. Biaya rutin mencakup gaji dan tunjangan pegawai, biaya obat dan bahan medis habis pakai, biaya operasional lain (misalnya bahan bakar, makanan) serta biaya overhead tetap (misalnya listrik, air, pemeliharaan, dll). Biaya modal mencakup bangunan, peralatan medis dan non medis dan kendaraan. Semua yang termasuk modal dan obat-obatan dinilai berdasarkan harga saat ini. Bahan-bahan yang tidak digunakan pada tahun berjalan tidak diperhitungkan, sedangkan hutang belum terbayar dimasukkan sebagai biaya.

Biaya penyediaan pelayanan di Puskesmas

Studi ini memusatkan perhatian pada puskesmas dan jaringannya (Puskesmas induk, Pustu, Polindes, Poskesdes, Posyandu, dan Pusling) sebagai unit observasi. Informasi diperoleh dari 234 puskesmas; 34% diantaranya memberikan pelayanan rawat inap dan 33% memiliki fungsi perawatan dasar obstetrik. Rata-rata puskesmas mempunyai 2,9 pustu, 2,6 polindes dan 38 posyandu. Rata-rata populasi penduduk di wilayah kerja sebuah jaringan Puskesmas adalah 26.922.

Banyak fasilitas kesehatan melaporkan adanya masalah ketersediaan perlengkapan dan obat serta keterlambatan pembayaran gaji dan insentif. Puskesmas yang paling banyak melaporkan masalah adalah Puskesmas yang berada di dalam provinsi-provinsi dalam kelompok tiga dimana sebagian besar melaporkan adanya masalah gangguan air, listrik, dan pembayaran gaji. Ketersediaan dokter juga sangat bervariasi mulai kurang dari satu sampai lebih dari tiga per puskesmas.

Beban kerja puskesmas sangat bervariasi : jumlah pasien umum bervariasi mulai dari 321 per 1000 penduduk di Sumatra Utara sampai lebih dari 1.100 di NTT. Sekitar 40% kasus merupakan penyakit menular yang masuk dalam prioritas SPM.

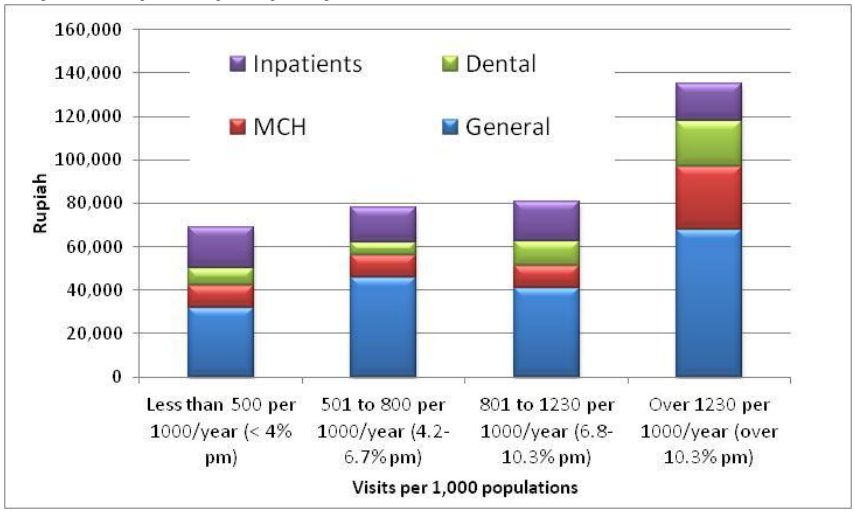
Secara nasional diperlukan biaya sekitar Rp. 2,16 milyar untuk menyediakan pelayanan kesehatan melalui puskesmas dan jaringannya (yang biasanya terdiri dari 3 pustu, 2-3 polindes & poskesdes

serta 38 posyandu) yang melayani rata-rata 26.922 penduduk (Rata-rata *Mean*: Rp.93,101 per kapita/tahun; median Rp. 51,175). Di daerah perkotaan dibutuhkan sekitar Rp. 2,5 milyar (median Rp. 2,3 milyar) atau Rp. 77.717 per kapita/tahun (median Rp. 36.816). Di daerah perdesaan diperlukan Rp. 2,0 milyar (median 1,6 milyar) atau Rp. 99.180 per kapita/tahun (median Rp. 57.406). Sekitar 52% biaya total digunakan untuk biaya staf, 27% untuk obat-obatan dan bahan habis pakai dan 17% untuk peralatan dan modal tetap.

Biaya rata-rata (*mean*) untuk kunjungan rawat jalan umum di puskesmas adalah sebesar Rp.88.240 (Rp. 68.776 tanpa biaya modal) berkisar antara 41.000 sampai lebih dari 300.000 (yang sebagian diakibatkan perbedaan pola pemanfaatan). Biaya rata-rata ini dipengaruhi oleh sebagian kecil puskesmas yang berbiaya tinggi. Biaya median adalah sebesar Rp. 51.109 (Rp. 43.978 tanpa biaya modal). Biaya untuk kunjungan KIA sekitar 20% lebih tinggi daripada biaya kunjungan rawat jalan umum yang secara garis besar merefleksikan lebih tingginya komitmen yang dibutuhkan oleh petugas untuk menyelenggarakan pelayanan ini. Biaya pelayanan puskesmas pada umumnya lebih rendah di daerah perkotaan yang mencerminkan kombinasi dari lebih rendahnya tingkat pemanfaatan dan lebih tingginya biaya tetap di daerah perdesaan yang mengakibatkan tingginya biaya modal dan biaya staf per pasien.

Biaya total dan biaya per kapita di puskesmas sangat dipengaruhi oleh tingkat pemanfaatan. Biaya per admisi rawat inap rata-rata sebesar Rp. 1,56 juta (atau Rp. 1,4 juta tanpa biaya modal). Biaya ini di Puskesmas yang tingkat pemanfaatannya rendah (kurang dari 147 pasien rawat inap dan 10.300 kunjungan rawat jalan per tahun) adalah lebih dari Rp. 2,5 juta. Namun biaya ini turun sampai menjadi hanya sekitar Rp. 700.000 untuk puskesmas dengan tingkat pemanfaatannya tinggi (lebih dari 644 pasien rawat inap dan 30.200 kunjungan rawat jalan per tahun). Trend yang sama terlihat pada biaya-biaya pelayanan lainnya.

Biaya rutin per kapita pelayanan Puskesmas



Biaya per kapita untuk penyediaan pelayanan bagi masyarakat di sebuah kecamatan tergantung pada tingkat pemanfaatan (lihat gambar). Untuk semua sampel, biaya rutin per kapita per tahun untuk semua jenis pelayanan meningkat dari sekitar Rp. 70.000 di kecamatan dengan kunjungan kurang dari 500 kunjungan per 1.000 penduduk (tingkat pemanfaatan per bulan =4%) menjadi Rp. 135.000 di kecamatan dengan lebih dari 1200 kunjungan per 1.000 penduduk (tingkat pemanfaatan per bulan =10%). Peningkatan biaya di kecamatan yang kunjungannya sampai 1.230 per 1.000 penduduk cukup rendah karena pemanfaatan yang lebih tinggi mengakibatkan rendahnya rata-rata biaya satuan. Di atas 1.230 kunjungan per 1.000 penduduk (kurang lebih sama dengan sekitar 32.000 kunjungan di kecamatan yang berukuran rata-rata) biaya per kapita naik lebih tajam karena kapasitas yang ada telah terpakai seluruhnya sehingga dibutuhkan penambahan sumber daya baru.

Biaya penyediaan pelayanan rumah sakit

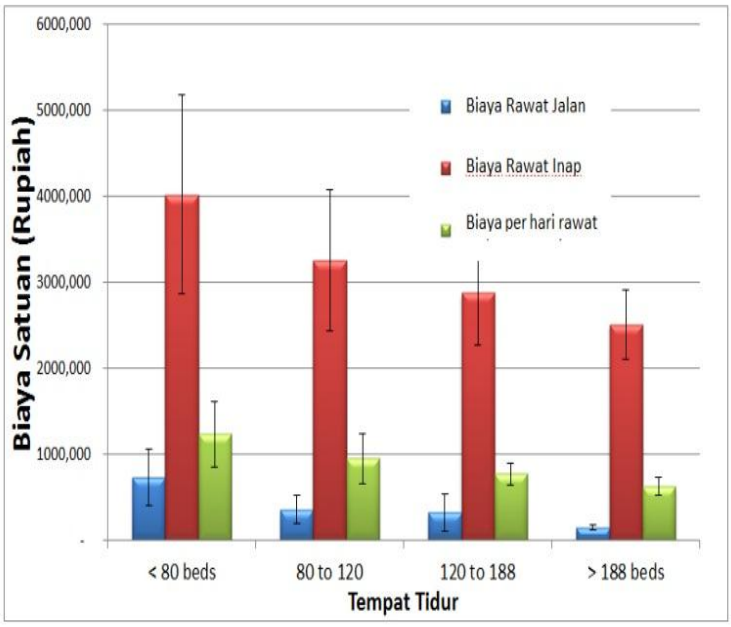
Studi ini difokuskan terutama pada rumah sakit kelas B dan C yang paling banyak ditemui di tingkat kabupaten/kota namun dengan tidak mengabaikan rumah sakit kelas A dan D. Ada empat kategori kepemilikan terhadap rumah sakit yaitu: rumah sakit pemerintah dengan status BLU (29%), rumah sakit pemerintah non-BLU (31%), rumah sakit swasta nirlaba (21%) rumah sakit swasta for profit (20%). Mayoritas rumah sakit (58%) telah memiliki akreditasi dari Komisi Akreditasi Indonesia walaupun di provinsi yang masuk dalam kelompok tiga proporsinya hanya sekitar 21%.

Berfungsinya rumah sakit dikaji dengan mengajukan pertanyaan tentang gangguan utilitas (air, listrik dll), keterlambatan penerimaan sumber daya, dan jumlah staf. Keterlambatan dalam pembayaran gaji terutama dilaporkan oleh institusi pemerintah. Dilaporkan juga adanya keterlambatan yang berarti dan bervariasi dalam penerimaan obat. Hanya sedikit perbedaan jumlah dokter per tempat tidur antara rumah sakit pemerintah dan swasta. Jumlah perawat pada umumnya lebih tinggi di rumah sakit pemerintah.

Ditemukan adanya variasi yang bermakna dalam produktivitas antar fasilitas kesehatan. *Bed Occupancy Rate* berkisar antara 41% sampai 76%, sedangkan throughput (jumlah pasien per tempat tidur per tahun) bervariasi antara 10 sampai 120. Rumah sakit dengan tingkat pemanfaatan (utilisasi) yang tinggi dengan biaya satuan yang relatif rendah, cenderung merupakan fasilitas kesehatan yang besar. Rumah sakit dengan jumlah pasien per tempat tidur yang rendah dan waktu rawat yang singkat cenderung merupakan rumah sakit kecil yang kurang berfungsi dan terutama merawat pasien penyakit menular.

Terdapat variasi yang besar dalam biaya untuk menjalankan rumah sakit yang sebagian besar dipengaruhi oleh ukuran dan tingkat pemanfaatan rumah sakit. Biaya total untuk rumah sakit kelas D adalah kurang dari 25% biaya total rumah sakit kelas A. Tidak ditemukan adanya variasi yang mencolok dari biaya per tempat tidur antar kelas RS. Sekitar 43% biaya penyelenggaraan rumah sakit pemerintah dan 32% biaya penyelenggaraan rumah sakit swasta digunakan untuk gaji dan insentif staf. 15% biaya di rumah sakit pemerintah dan 17% di rumah sakit swasta digunakan untuk obat dan bahan medis habis pakai. Biaya modal (peralatan dan bangunan) adalah sebesar 11% biaya total. Investasi terbesar terjadi di bagian radiografi dan kamar operasi. Analisa umur peralatan mengindikasikan bahwa rumah sakit pemerintah kelas B, C dan D lebih cenderung mempunyai peralatan yang lebih tua yang melampaui standar umur ekonomis dibandingkan rumah sakit pemerintah kelas A atau swasta.

Biaya satuan menurut ukuran RS (Jumlah TT)



Biaya rata-rata (mean) kunjungan rawat jalan di semua kelas rumah sakit adalah 415,453 (Rp. 368,174 tanpa biaya modal) dan biaya per admisi rawat inap adalah Rp. 3,5 juta (Rp. 3,1 juta tanpa biaya modal). Biaya satuan rawat inap dan rawat jalan menurun seiring dengan meningkatnya jumlah tempat tidur. Biaya terendah ditemukan di rumah sakit yang memiliki 160-200 tempat tidur. Hal ini sesuai dengan bukti internasional tentang ukuran rumah sakit. Biaya satuan untuk rumah sakit kecil (C/D) hampir sama dengan biaya satuan rumah sakit besar (A/B). Hal ini diakibatkan karena tingkat admisi pasien yang biasanya lebih tinggi di rumah sakit tipe A/B dan fasilitas dan peralatan yang mahal digunakan bersama oleh lebih banyak pasien. Untuk rumah sakit yang memiliki tingkat pemanfaatan yang hampir sama, biaya satuan rawat inap untuk rumah sakit kelas C/D lebih rendah daripada di rumah sakit kelas A/B.

Hasil perhitungan biaya satuan antara (*intermediate unit cost*) memungkinkan untuk menghitung biaya penyakit tertentu antar Rumah sakit. Biaya satuan sangat bervariasi di seluruh Indonesia yang mencerminkan perbedaan jumlah pasien yang dilayani. Biaya dokter per menit dihitung dengan membagi biaya gaji dan insentif dokter penuh waktu (*full time*) dengan waktu efektif per hari di sebuah fasilitas (rata-rata 3,5 jam/hari). Biaya satuan seringkali lebih tinggi di fasilitas yang kecil karena rendahnya beban kerja. Biaya ini dapat digunakan untuk mengembangkan penghitungan biaya kasus (*case costing*) berdasarkan pendekatan bottom up (*ingredients*) yaitu obat, bahan habis pakai dan uji laboratorium beserta biaya satuan antaranya (*intermediate unit cost*). Biaya satuan untuk beberapa kondisi/penyakit dihitung dan dibandingkan antara rumah sakit kecil dengan tingkat admisi pasien yang rendah (kurang dari 4.000 per tahun) dengan rumah sakit berukuran efisien (lebih dari 180 tempat tidur dan *throughput* yang tinggi). Hasil perhitungan mengindikasikan bahwa kondisi yang memerlukan tindakan bedah (appendectomy dan operasi Caesar) 30% lebih mahal dan kondisi non bedah (dengue, diare, gastritis) 25% lebih mahal di rumah sakit kecil dibandingkan dengan rumah sakit yang berukuran efisien.

Diskusi dan tindak lanjut

Dataset yang dikembangkan selama studi ini mempunyai banyak sekali variabel tentang pelayanan kesehatan primer dan sekunder di Indonesia yang dapat digunakan untuk menjawab sejumlah besar pertanyaan kebijakan termasuk pengembangan anggaran sektor kesehatan, pengembangan tarif dasar untuk sistem pembayaran pemberi layanan, dan alokasi sumber daya secara geografis.

Biaya satuan puskesmas dan jaringannya tergantung pada dua faktor utama. Pertama, biaya per kapita penyelenggaraan pelayanan yang lebih tinggi di daerah perdesaan dimana dibutuhkan jejaring

yang lebih besar untuk mempertahankan cakupan. Kedua, jelas bahwa biaya satuan sangat tergantung pada tingkat pemanfaatan. Saat ini, tingkat pemanfaatan masih rendah yaitu sekitar satu kunjungan/orang/tahun, namun dapat meningkat secara bermakna seiring dengan diperluasnya cakupan asuransi. Peningkatan pemanfaatan akan meningkatkan biaya total, tetapi biaya rata-rata akan menurun. Hal ini memungkinkan perluasan cakupan pelayanan dengan penambahan biaya yang relatif rendah.

Biaya pelayanan rawat inap di puskesmas sangat bervariasi. Bila angka pemanfaatan tinggi, survey ini mengindikasikan bahwa puskesmas rawat inap merupakan alternatif yang jauh lebih rendah biayanya dibanding dengan pelayanan di rumah sakit untuk kondisi/penyakit tertentu. Sebaliknya angka pemanfaatan yang rendah mengakibatkan biaya satuan yang sama tingginya atau bahkan lebih tinggi daripada biaya satuan di rumah sakit. Hal ini mengindikasikan bahwa kebijakan untuk mengembangkan puskesmas rawat inap merupakan pilihan yang efektif dalam masa transisi menuju ketersediaan pelayanan rawat inap. Namun hal ini harus dibarengi dengan perubahan dalam praktek klinis dan sistem insentif dalam pemberian perawatan di puskesmas. Kebijakan ini akan mendorong peningkatan pemanfaatan tempat tidur di puskesmas secara lebih efektif dan juga aman bagi keselamatan pasien

Di tingkat rumah sakit, biaya satuan sangat ditentukan oleh produktivitas dan besarnya rumah sakit. Survey ini mengindikasikan bahwa rumah sakit kecil (yang secara kasar dihitung dengan jumlah tempat tidur) memiliki biaya satuan yang secara substansial lebih tinggi. Hal ini sesuai dengan bukti-bukti internasional bahwa biaya terendah tercapai di rumah sakit yang memiliki 200 tempat tidur atau lebih. Biaya satuan yang relatif lebih kecil dimungkinkan di rumah sakit kecil (C/D) jika dilakukan upaya untuk meningkatkan tingkat pemanfaatan. Hal ini membutuhkan peningkatan mutu pelayanan, penambahan staf dan perubahan pola rujukan dan akses. Faktor-faktor ini sangat penting untuk dipertimbangkan dalam mempersiapkan pihak penyedia layanan (sisi supply) menuju cakupan universal.

Diencanakan dilakukan analisa lebih lanjut dengan menggunakan data ini:

1. Penyesuaian Case Mix
2. Pemodelan dengan ekonometrik lanjutan
3. Proyeksi biaya masa depan

Data telah dibersihkan dan dianalisis dengan STATA. File data yang berisi data yang telah dibersihkan tersedia di Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan. Data tersebut dapat dikonversi ke dalam format lain seperti SPSS dan Excel.

Abbreviations

APBD	Regional Budget
APBN	National Budget
ALOS	Average Length of Stay
BEOC or PONED	Basic Emergency Obstetric Care
BLU	public service agency
Dinas Kesehatan	District Health Office
ICD X	International Classification of Disease X
ICD IX - CM	International Classification of Disease X – Clinical Modification
ICU	Intensive Care Unit
ISO	International Organisation for Standardisation
GFK	District Drug Warehouse (Gudang Farmasi Kesehatan)
KARS	Komisi Akreditasi RS Indonesia
MCH	Mother and Child Health
MIMS	Indonesian Index of Medical Specialties
NCD	Non Communicable Diseases
NICU	Neonatal Intensive Care Unit
NTT	Nusa Tenggara Timur
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Square
PONED	Pelayanan Obstetri Neonatal Dasar
RS	Rumah Sakit - Hospital
SPM	Standard Pelayanan Minimal (Minimal Package of Services)

Glossary

Public hospital	A hospital run by government, it can be by central, provincial or district government
Private hospital	A hospital owned by private organization, it can be not-for profit hospital or profit hospital
Salary	Monthly payment for employees
Incentive	Payment for performance or output e.g. doing procedures
Teaching hospital	A hospital used for training of doctors. It does not include hospitals used for training of nurses and midwife

Section 1. Introduction

Background

The central objective of this study is to describe and better understand the determinants of cost differences across primary care facilities (puskesmas and network), public hospitals and private hospitals. The results will be used to inform policy that requires costing data particularly the development of the benefits package under the universal coverage policy and case based provider payment system. While there have been a number of cost studies undertaken in Indonesia, most of these have been relatively small in scope and do not permit comparison of facilities across different parts of the country.

The study has three specific objectives:

1. Investigate the main drivers of cost difference and examine how these might be used to develop a resource allocation methodology
2. Compare health facility performance across the country and in different contexts
3. Derive relative costs of facility activities to inform the development of payment systems and hospital global budgets

A first phase of this work was devoted to develop a normative model of costing that can be used to estimate the costs of the minimal service package (SPM) in different parts of Indonesia. The model relied on a number of assumptions underpinning the construction of system and overhead costs.

The scope of the current study is wider in that it looks more generally at the full range of services provided by each facility. The study draws upon a prospective costing of a stratified, representative sample of facilities from throughout the country collected between October 2010 and September 2011 (one full year). This report summarises the main methods and data collected and undertakes some preliminary analysis. The study has generated large datasets on facility productivity which will be of use for policy makers and health system researchers.

The report is structured as follows. In the next section the methods used to undertake costing and gather data are described. The second section describes the puskesmas sampled and resulting costing estimates. The third section describes the hospital sample and undertakes a number of analyses of the resulting costing data.

Methods

This section describes the approach to costing and the methods undertaken to sample facilities and collect data for the study.

1. Approaches to costing

Two main approaches are taken to costing of services. The first is an accounting approach to derive average intermediate and final unit costs following a step down costing. The second is a statistical (econometric) approach to modelling the relationship between overall costs, levels of production (number of patients treated) and other background characteristics.

Table 1: Cost centres used in the study

Hospital			**Puskesmas**		
Cost centres	Intermediate	Final	Cost centres	Intermediate	Final
1. Emergency room	*	*	1. General outpatients/ Pustu/poskedes	*	*
2. Outpatient	*	*	2. MCH clinics	*	*
3. Inpatient	*	*	3. Dentistry	*	*
4. Delivery rooms	*		4. Pharmacy	*	
5. Surgery	*		5. Laboratory	*	
6. ICU/NICU	*		6. Radiography	*	
7. Pharmacy	*		7. Delivery room	*	
8. Radiology	*		8. Inpatients	*	*
9. Laboratory	*		9. Counseling		
10. Other supporting clinical			10. Other		
11. Non clinical support					
12. Admin etc					

A step down accounting methodology was applied to both hospital and puskesmas costs. This approach has two main stages. The first is to assemble the full cost of providing services. For recurrent costs this had three main components: staff, medicines and medical supplies and other operational costs. Staffing costs were obtained directly from the monthly payroll which includes both salary paid to workers and incentives and other allowances. Spending on medical supplies were derived by valuing all received medicines both in kind and in cash. In order to take account of stocks and wastage the study valued stocks of medicines at the beginning and the end of the year. Any surplus of the stock at the end over stock at the beginning of the period was then deducted from drugs received in order to arrive at a figure for usage of medicines and supplies. Costs of operational items were based on reported expenditure but included also spending made in the previous period together with debts unpaid at the end of the accounting period. Costs of capital items were based on two main sources of information. The cost of the facility was based on the current cost of building (per square metres) multiplied by the floor area covered together with the amortised valuation of fixed equipment such as gas systems and air conditioning. The costs of equipment were obtained by completing an inventory of medical and non-medical equipment items and valuing at replacement cost using a standardised price list. This approach demonstrates the long run cost of maintaining services although arguably over-values the cost of some services where equipment has long since exceeded a standard depreciation period. The purchase date of more significant capital items was obtained so it is possible to generate alternative valuations of equipment where equipment that has gone beyond a reasonable useful life can be written off.

A standard annualising formula was applied to all equipment items as follows:

$$A_i = \frac{r\ V_i}{\left[1 - \frac{1}{(1+r)^{L_i}}\right]}$$

Where A_i is the annualised value of asset i, V_i is the replacement cost, L_i is the useful life and r is the rate of discount[1].

The second stage of the accounting approach is to allocate costs to cost-centres. This was undertaken in three stages. Departments were divided into three groups: overhead (administration, maintenance etc.), supporting departments (radiography, pharmacy, operating theatres and laboratory) and final (Table 1). For hospital the final departments were defined as outpatients, emergency and inpatients. For puskesmas they were general outpatients, mother and child health, dentistry and inpatients. Further disaggregation of cost by condition (a case mix approach) can be obtained by aggregating the individual cost of medicines and intermediate components of care. At the first stage direct items were allocated that were incurred clearly and exclusively by a particular cost-centre. Drugs, for example, were allocated to the pharmacy, radiography and dental staff to the radiography and dental department. Most equipment was also allocated directly. The second stage was to allocate facility based overheads, such as maintenance and utilities, to each intermediate department. This apportionment was done on the basis of the space used by the cost-centre as a proportion of the useful floor area (minus corridors and unused areas) of the facility. For hospitals this provides the standard costs by component. These are:

- Overhead cost of drug script
- Overhead cost of laboratory test
- Cost per minute in the operating theatre
- Cost per bed-day with nursing
- Cost per day in intensive care unit with nursing
- Cost per doctor minute

Intermediate unit costs do not include doctor time (on the ward or in the operating theatre) or pharmaceuticals. The costs of drugs and time spent with a patient by doctors can be added in to formulate the total cost of a specific episode of illness.

The second stage of costing is to allocate intermediate department costs to final cost centres. Available data were used to allocate shared cost items. This included for staff, a nested survey of doctors, nurses and midwives about how they allocate their time and for drugs a survey of the division of the value of items between final cost centres.

The second approach to costing used in the study is to model the total and component costs (staff, variable, overhead and capital cost) using econometric methods. The objective of this was to investigate the associations between costs, overall production and characteristics of the hospital. The analysis in this report is of a preliminary nature. Future work will explore these associations in more depth.

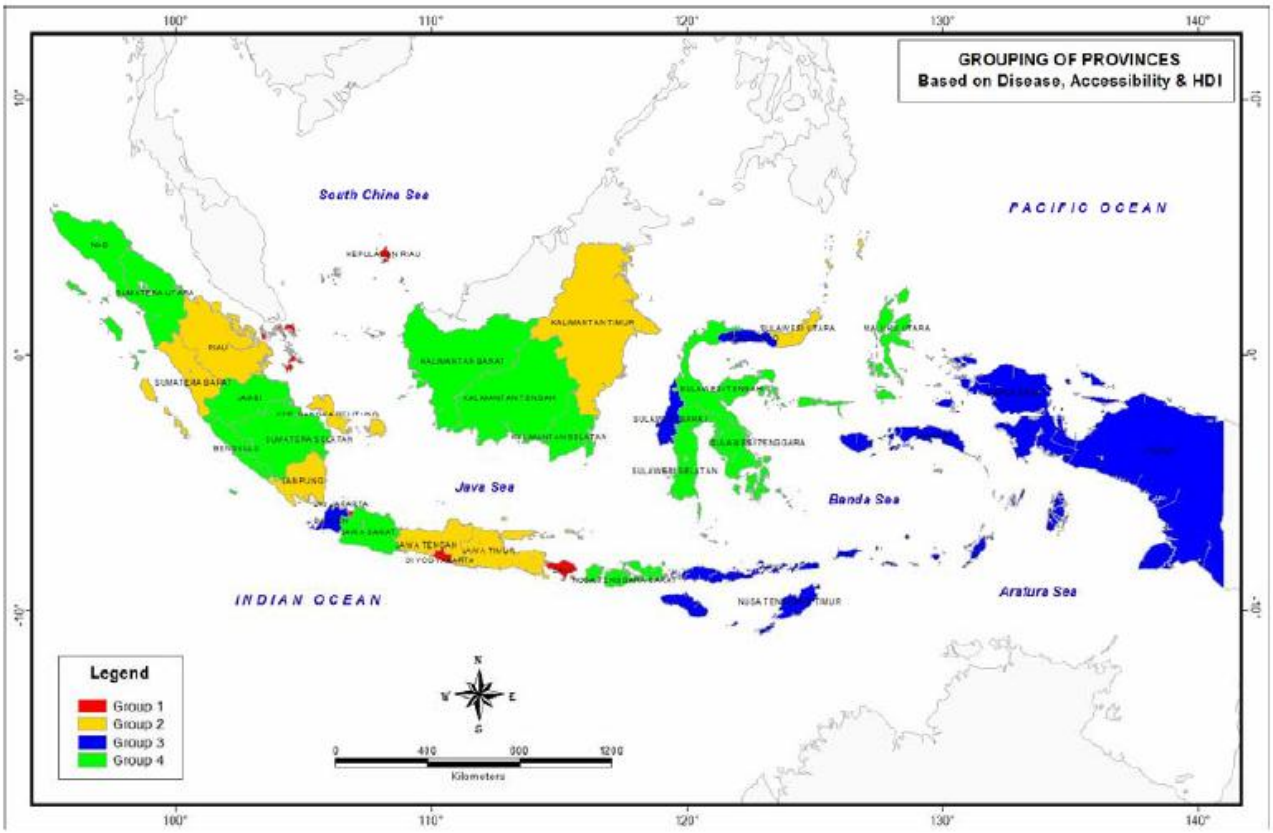
[1] A rate of 5.1% is used which reflects the return on Indonesian government bonds at the end of 2011 and reflects the opportunity cost of capital on a safe investment.

2. Sampling

Sampling was undertaken to ensure that as far as possible the survey is nationally representative of country context and sectors both government and non-government. It also attempted to overcome a problem with many retrospective studies that data when collected is either recorded inadequately or missing altogether. It did this by collecting prospectively over the course of a 10 month period, for the first 2 months the data were collected retrospectively. This method of data collection provided greater opportunity for data collectors to return to the sites to check up on and collect missing data.

A simple random sample of all districts could have led to sampling that was impractical to implement. Instead, in order to ensure that sampling remained manageable but still representative a stratified cluster approach was adopted. Provinces were first stratified into groups based on characteristics thought likely to influence the cost of services (Annex 1). Cluster analysis was used to group provinces according to similar demographic and disease profile (e.g. malnutrition, malaria, TB, diarrhoea), access to health services (e.g. numbers of facilities, levels of immunisation, travel time to facilities), fiscal capacity, human development index and per capita spending on government services. A variety of models were tested which proved relatively stable in the way they assigned provinces to strata. Provinces were assigned to four strata (Figure 1). Further details is provided in the detailed sampling report (Prasetyo et al., 2009).

Figure 1: Strata used to group Indonesian provinces



Source: (Prasetyo et al., 2009)

Provinces were chosen randomly from each stratum. A total of 15 provinces were selected roughly in proportion to the number of facilities, population of each stratum as follows: Group 1, two provinces selected; Group 2, four provinces; Group 3, three provinces; Group 4 six provinces (Table 2). The

proportional representation in Group 4 is a little larger than in the other groups because provinces are large and it was difficult to be precisely representative of population. Sampling weights can be used at the analytical stage to adjust for the differences.

Table 2: Provinces sampled from each strata

Provincial group	Group 1	Group 2	Group 3	Group 4
Selected provinces (sampled)	1. Bali 2. DI Yogyakarta	3. Bangka Belitung 4. Riau 5. Jawa Timur 6. Sumatera Barat	7. Sulawesi Barat 8. Gorontalo 9. NTT	10. Sumatera Utara 11. Sulawesi Tengah 12. Kalimantan Selatan 13 Kalimantan Tengah 14 Jawa Barat 15 Sulawesi Selatan
Population size in sampled provinces	7,052,900	48,558,800	6,651,400	70,720,700
Population size in all provinces/group	17,791,200	94,309,000	20,618,500	98,654,300

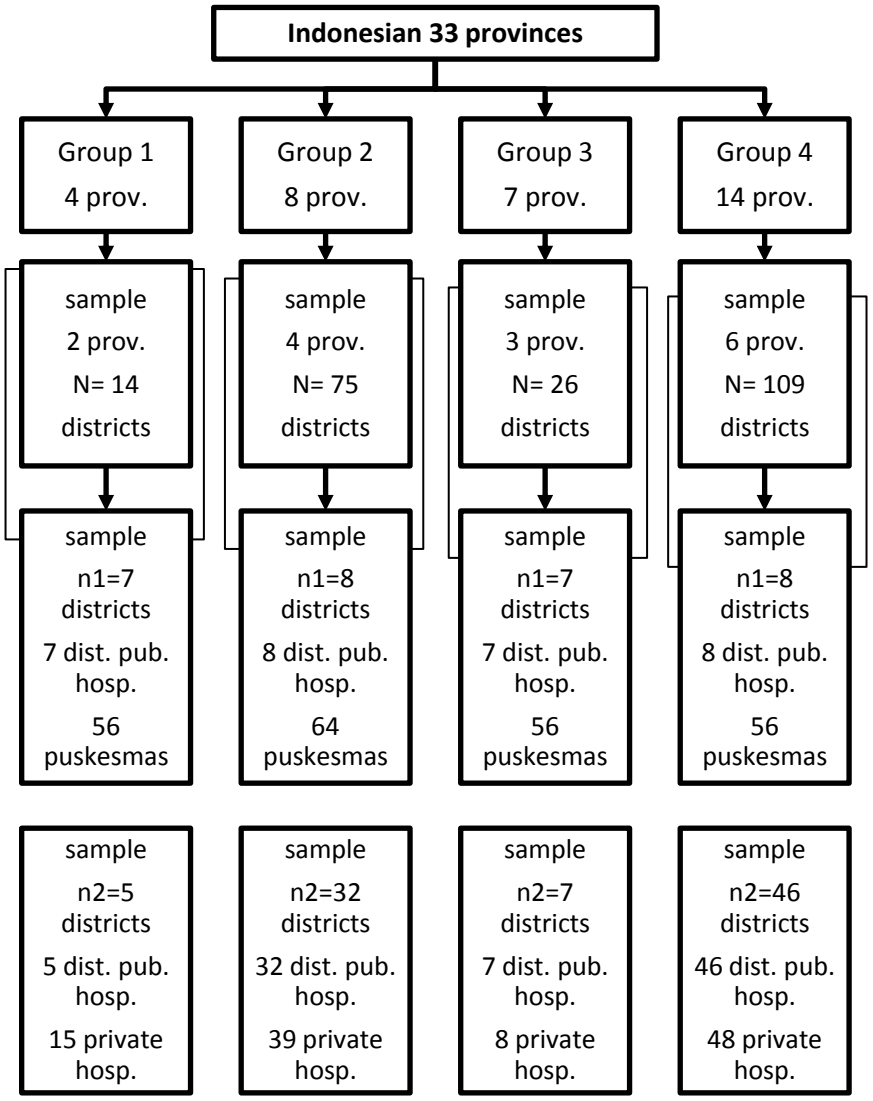
Source: (Prasetyo et al., 2009)

From the selected provinces, districts were then sampled again using a cluster process based on similar variables to those required for provincial selection. Each provincial stratum was grouped into four district level stratum (Annex 2). Finally, districts were selected at random from each district-provincial stratum in proportion to population. Sampling then proceeded in three phases.

- Two groups of districts (urban and rural) were selected. Thirty districts were initially selected across the country. From each of these districts, eight puskesmas (health centres), one public and two private hospitals were selected randomly.
- A further 90 districts were then selected across the strata at random and from each of these districts one public and two private hospitals were identified.
- In some districts, an insufficient number of private hospitals and in some cases public hospitals were identified. The sample was then topped up to the target sample from districts within the same strata.

A final sample of 119 public hospitals, 109 private hospitals and 235 puskesmas was identified to be included in the study (Figure 2).

Figure 2: Final sample identified through stratified, cluster sampling



Source: (Prasetyo et al., 2009)

Sub-surveys were conducted in a sample of facilities in each province (Table 3). These were

- The use of pharmaceuticals and laboratory tests by department (hospital and puskesmas)
- Patient exit interviews (hospital and puskesmas)
- Survey of working patterns of clinical staff (hospital and puskesmas)
- Discharge data for a sub-set of conditions (hospital)

These nested surveys were completed between April and October 2011 in a representative sample of facilities by class of hospital (Public A/B;, Public C/D, Private>=100 beds, Private<100 beds) and puskesmas (with bed, rural, urban).

Table 3: Sample for study nested surveys

	Group 1	Group 2	Group 3	Group 4	Total
Public A-B	1	4	0	4	9
Public C-D	2	7	1	10	20
Private>=100	1	7	1	6	15
Private<100	4	4	2	6	16
Total Hospital	8	22	4	26	60
Puskesmas with bed	7	14	5	12	38
Rural	10	6	7	8	31
Urban	4	7	7	3	21
Total Puskesmas	21	27	19	23	90

Questionnaire description

Three main instruments were developed for the study for hospitals, puskesmas and Dinas Kesehatan. The hospital questionnaire was developed for use in both public and private facilities. The questionnaire has 11 main sections (Table 4). Some of the data was collected once during the year. Other information was collected regularly during the year. As far as possible data collection was designed to fit with standard reporting patterns and formats. So, for example, data on utilisation of services (module 5) was collected on a quarterly basis to fit in with the three monthly reports by hospitals.

Table 4: Hospital instrument modules, description and timing

	Module	Type data collection	Frequency
1	Overview of Hospital	Identification data, numbers of beds, functionality of utilities (e.g. Water), accreditation status	Once, at beginning of study
2	Physical infrastructure	Book value of buildings, land etc.; local land and building prices and physical size of buildings (by cost centre)	Once, around end of second quarter
3	Funds Flow	Flow of funds to hospital by source of fund	End of each quarter
4	Hospital assets	Main medical and non-medical equipment owned by hospital by cost-centre	Once, mid-way through the study
5	Activity of hospital	Outpatient visits and inpatients by cost-centre, age group and disease	Monthly
6	Intermediate activity	Total prescriptions, surgery and other intermediate activity (e.g. X-rays)	Quarterly
		Sub-surveys of use of pharmacy and laboratories by cost centre	Once, towards end of the fieldwork
7	Human Resources	Numbers of staff, salary and incentives by type of staff	Monthly
		Sub-survey of doctor workload by cost centre	End of third quarter

	Module	Type data collection	Frequency
8	Consumable drugs and medical supplies	Inventory of drugs at beginning and end of study period; drugs received during study. Monthly drug and medical supplies expenditure. Physical stocks from own cash and other sources	Once at beginning and end for inventory; monthly for drugs and supplies received, and drugs and supplies spending.
9	Expenditure details	Expenditure by type of spending in cash from all sources and in-kind	Every quarter for in-kind receipts; every month for cash spending
10	Patient survey	Sub-survey of patients to obtain information on patient payments inside and outside the facility	Once towards the end of the fieldwork
11	Survey of costs of selected diagnoses	Detailed ingredients costing of selected diagnoses	Once towards the end of the fieldwork

The hospital instrument incorporated three nested surveys. These were all implemented in a sub-sample of facilities representing all provincial strata. These were a survey of drugs use by cost-centre, a survey of working patterns of doctors by cost-centre and a patient survey. The first two of these surveys were designed to permit allocation of total costs by cost-centre. The third survey was designed to obtain information on costs incurred by patients that would not show up in the records of facilities to ensure that an accurate picture of the full service cost can be presented.

The puskesmas instrument follows a similar pattern to that used in hospitals (Table 5). The main differences are that detailed information on staff was only collected once during the study due to the large volume of people that would need to be included and relative stability of the workforce although the total salary and incentive bill was collected on a monthly basis. During the study, the monthly salary bill was monitored and if it fluctuated substantially then the total payroll was collected again. The workload sub-survey also included midwives and nurses as well as doctors since at a puskesmas level they move between cost-centres. The puskesmas survey did not include an ingredient costing by diagnosis.

Table 5: Puskesmas instrument modules, description and timing

	Module	Type data collection	Frequency
1	Overview of Puskesmas	Identification data, size of catchment area, functionality of utilities (e.g. Water), number of beds and whether has BEOC capability	Once, at beginning of study
2	Physical infrastructure	Book value of buildings, land etc.; local land and building prices, number of network facilities and physical size of buildings (by cost centre)	Once, around end of second quarter
3	Funds Flow	Flow of funds to puskemas by source of fund; flow of funds retained by puskesmas and resubmitted to dinas kesehatan	End of each quarter

	Module	Type data collection	Frequency
4	Puskesmas assets	Main medical and non-medical equipment owned by puskesmas by cost-centre	Once, mid-way through the study
5	Activity of puskesmas	Outpatient visits and inpatients by cost-centre, age group and disease	Monthly
6	Intermediate activity	Sub-surveys of use of pharmacy and laboratories by cost centre	Once, towards end of the fieldwork
7	Human Resources	Numbers of staff, salary and incentives by type of staff	Once early in third quarter for complete payroll by type of staff; monthly for total payroll and incentives
		Sub-survey of doctor and midwife workload by cost centre	End of third quarter
8	Consumable drugs and medical supplies	Inventory of drugs at beginning and end of study period; drugs received during study. Physical stocks from own cash, dinas and other sources	Once at beginning and end for inventory; monthly for drugs and supplies received
9	Expenditure details	Expenditure by type of spending in cash from all sources (APBN, APBD I & II, Donor, other) and in-kind	Every quarter for in-kind receipts; every month for cash spending
10	Patient survey	Sub-survey of patients to obtain information on patient payments inside and outside the facility	Once towards the end of the fieldwork

The main focus of the Dinas Kesehatan instrument was collecting information on spending as a district overhead for public services although it was also used to identify information on spending on specific puskesmas included in the survey that was not held at the puskesmas level. The instrument included modules on information on district as a whole, assets held by the Dinas Kesehatan, spending and the Dinas Kesehatan workforce (Table 6).

Table 6: Dinas Kesehatan instrument modules, description and timing

	Module	Type data collection	Frequency
1	Overview of District Health Office	Identification data, size of catchment area and insurance beneficiaries	Once, at beginning of study
2	District Health Office infrastructure	Book value of buildings, land etc.; local land and building prices	Once, during the study
3	District Health Office expenditure	Details of receipts of funding in kind & cash; expenditure by line items	End of each quarter
4	District Health Office Assets	Main equipment owned by District Health Office	Once, mid-way through the study
5	Human Resources	Details of employees, salaries, incentives and training received.	Every month for payroll data; every quarter for training data

Data collection and drop outs

Data was collected by Saniplan and subcontracted to PT Wastu Cipta Selaras (PT WCS). PT WCS established a province office in each province. In each office a senior enumerator acted as the office manager. Data collection and initial verification was administered from each provincial office. The work was divided into 2 phases; preparation and implementation. During the preparation phase two main activities were carried out:

1. A workshop describing the study and demonstrating support from Ministry of Health was conducted for key stakeholders. In the national workshop representatives from the provinces and districts as well as the Indonesian Hospital Association were invited, together with other related ministries such as Ministry of Home Affairs and Ministry of Finance. The workshop was successful in gaining commitment and was repeated at the provinces with strong participation of facility staff.
2. Technical workshop with data collectors to ensure a common understanding of instruments, definitions and the time schedule. The contractor established provincial offices and hired enumerators for each provinces. Those enumerators who participated in the workshop were in charge for running the same workshop in each province. Altogether there were about 200 enumerators hired across the country. In a later stage, a further technical workshop was conducted for data entry staff.

A number of challenges were faced in undertaking data collection. These included:

1. Facility drop outs

A total of 28 facilities dropped out of the study for a variety of reasons (Table 7). Only one puskesmas dropped out by default because it did not provide adequate data. A total of 27 hospitals dropped out of the study. Three hospitals dropped out because they were busy with other activities such as obtaining new accreditation or being audited. A further four were dropped because they were closed down just before or during the study and two other hospitals did not get approval to participate. The remaining (19) hospitals agreed to participate but it gradually became apparent during the year that they were unwilling or unable to provide accurate data. The largest number of drop outs (10) was in North Sumatra[2]. Statistical analysis shows that the remaining facilities participating in this study are still representative for the country.

2. Collection of data

Despite efforts to design the instrument as close as possible to the field reality, basic information or data on expenditures were not properly recorded in some hospitals – particularly small private hospitals. Therefore, enumerators had to work closely together with the facility staff to generate this information. In a small number of cases activities were not properly recorded by the facility even though services were being provided. The study attempted to collect information on training of staff in order to impute the on-going cost of training but in most cases this information was not forthcoming or was not complete. In total, 92% of the variables that were due to be collected from the study sites were obtained, coded and entered on the database.

[2] 2 not operational, 1 because of financial audit, 1 no approval, 3 reporting activities that were too low, 3 unwilling to provide financial and drug data

Table 7: Original sample size and study drop outs

		DHO			Puskesmas			Public Hospital			Private Hospital			Total		
	PROVINSI	Sample	Collected	Drop-out	Sample	Collected	Drop-out	Sample	Collected	Drop-out	Sample	Collected	Drop-out	Sample	Collected	Drop-out
1	North Sumatra	1	1	0	8	8	0	16	15	1	17	8	9	42	32	10
2	Riau	1	1	0	8	7	1	7	7	0	6	6	0	22	21	1
3	West Sumatra	3	3	0	24	24	0	10	10	0	9	8	1	46	45	1
4	Bangka Belitung	1	1	0	7	7	0	3	3	0	3	3	0	14	14	0
5	West Java	2	2	0	16	16	0	11	11	0	12	9	3	41	38	3
6	Yogyakarta	3	3	0	24	24	0	5	5	0	7	7	0	39	39	0
7	East Java	3	3	0	24	24	0	20	20	0	20	14	6	67	61	6
8	Bali	4	4	0	30	30	0	7	7	0	7	6	1	48	47	1
9	Central Kalimantan	1	1	0	8	8	0	6	6	0	0	0	0	15	15	0
10	South Kalimantan	1	1	0	8	8	0	5	5	0	3	3	0	17	17	0
11	Central Sulawesi	1	1	0	8	8	0	4	4	0	4	2	2	17	15	2
12	South Sulawesi	2	2	0	16	16	0	14	13	1	11	8	3	43	39	4
13	West Sulawesi	1	1	0	9	9	0	3	3	0	0	0	0	13	13	0
14	Gorontalo	3	3	0	21	21	0	3	3	0	0	0	0	27	27	0
15	NTT	3	3	0	24	24	0	7	7	0	7	7	0	41	41	0
	TOTAL	30	30	0	235	234	1	121	119	2	106	81	25	492	464	28

Source: Health Facility Costing Study Team Phase 2 report

3. Loss of field staff

Some of the enumerators resigned/dropped out requiring additional technical workshops conducted to train new workers. Drop outs made it more difficult to ensure that data collection procedures were complied with.

4. Remoteness of facilities

Facilities were physically difficult to reach making it more difficult to obtain timely data.

During the year, data verification was conducted to ensure that data being collected was authentic and accurate. Initial data checks were conducted by the senior enumerator before being entered into the computer. Range checks were enabled at data entry stage to highlight obvious problems with the data and data were double entered.

Delays in obtaining necessary data meant that the data collection process was extended to the end of November 2011 and data entry completed in February 2012. The data cleaning process was undertaken from January to June 2012.

Data verification and data cleaning

A data verification team based at University of Gadjah Mada (UGM; Yogyakarta -Central Java) and composed of the University of Indonesia (Jakarta), University of Airlangga (Surabaya- East Java), University of Hasanudin (Makassar – South Sulawesi) undertook independent verification.

Spot checks enabled verifiers to visit facilities and compare data held by the facility with the responses on the questionnaires filled in by enumerators. The facility visited could be randomly or purposively selected if the data verifiers found doubtful data. This approach was done in the beginning of data collection and overall showed satisfactory results.

Analytical verification of the incoming data helped to scrutinise the plausibility of the data. Since this was a prospective data collection, data came in streams. Data verifiers scrutinised the incoming data and looking for doubtful data, comparing it with hard copy questionnaires. Their findings were communicated with the enumerator in charge at the province and corrections were made where necessary. This approach was not always successful in correcting the data, especially when the high turnover of enumerators and data entry staff occurred. Due to time pressure, the data verification process focused on 'strategic variables' that will be used for the current analysis. Follow up verification following data collection cleaned other data collected during the study.

Data cleaning represented a substantial task for the Data Management Team. There are several types of data errors that needed to be corrected after data collection was completed:

1. Data entry duplication. This is due to the change of data entry persons in the field. For some facilities the same data were entered several times.
2. Digit errors. Some of the data missed or added digits, e.g. 100 became 100,000.
3. Errors in selecting drug names and inputting supply names. The study collected information about drugs and medical supplies received and used for services which were then valued in rupiah using the MIMS database that contains most drugs available in the country. To do this, the data entry programme was linked to the database. However, if the drug was not available in the list the data entry person can choose independently from the available list. We found that some puskesmas reported to supply 'branded' drugs – a situation that is unlikely to occur. In addition, the way the drugs and supplies were written varied across facilities. Therefore, a lot of time was dedicated to standardize the drug and supplies names. Around 30% of supplies cannot be identified. In the puskesmas, all drugs were changed to 'generic drugs' if available; this is in line with the government policy to use generic drugs in puskesmas. For drugs that did not have the generic drug available, we kept the original. For hospitals, where branded drugs are common, names were left as reported by the facilities and linked to the MIMS pricelist. For supplies, if the size is not mentioned, we chose the most common size used.
4. Errors in categorizing type of expenditures. The instrument collected the name of activities. Sometimes it was difficult for the enumerators to categorize this expenditure – thus a significant portion was initially missing. Additional time was dedicated for re-categorization of these expenditures both for puskesmas and hospital.
5. Difficulties in using the ICD X and ICD IX-CM for Hospital Discharge data (module 11). Medical record practice appears to vary across hospitals. Therefore, there is a need to recode the diagnosis reported and also to choose the main diagnosis before assigning the ICD IX – CM for medical procedures.
6. Diagnostic procedures (radiology and laboratory) needed standardization. This is particularly important so that it can be linked to a standardized list for these procedures and its tariff. The tariff used was based on information from several hospitals.

Limitations of data collected by the study

The study collected a comprehensive set of physical, costing and activity data (intermediate and final) from a wide range of facilities. Despite the extent of the data collection the study has a number of limitations.

1. Some facilities did not completely report monthly expenditures for various reasons. Some assumptions, therefore, were used to estimate the annual expenditures. Different assumptions were used for different type of expenditures, taking into account the nature of expenditure. For instance, for salary estimation, missing months were filled simply by assuming those months were equivalent to the mean value of available months. This is appropriate for salaries since these are distributed monthly. For staff incentives, this assumption was not appropriate since incentives are distributed unevenly throughout the year. This may lead to some under- or over-valuation of incentives.
2. Puskesmas drugs are assumed to be generic drugs. In some areas, puskesmas also provided non generic drugs. This may under-estimate drug expenditures in those puskesmas where branded drug prescription is common.
3. It was hard to find drugs and medical supplies procurement value in each facility. In general puskesmas received drugs and supplies in-kind from the Dinas Kesehatan (via GFK), while in hospitals practices varied. Therefore, this study used a standardized list of value for drugs and supplies. The same approach was applied for assets. Values of drugs used the MIMS database and Ministry of Health regulation on the price of generic drugs by regions. For hospitals, the generic drug value used the ceiling price set by the MoH. Medical supplies price list used information from 3 major hospitals as the basis of valuation.
4. It was hard to find asset values and year of procurement for much equipment. We used information on values collected from 3 major hospitals in the country to develop an asset price database. Useful life used information provided internationally by American Hospital Association (Estimated Useful Lives of Depreciable Hospital Assets, revised 2008 edition). The analysis does not allow for differences in procurement efficiency across hospitals.

Sampling weights

The process of cluster sampling means that while facilities are drawn randomly from each cluster clusters themselves have different probabilities of being selected. For analytical purposes, it is necessary to construct sampling weights to readjust the sample so that it is representative of the population of facilities. The appropriate sampling weight is equivalent to the reciprocal of the probability of a facility being selected. In turn the probability is the product of the probability of selecting a province (p_r), district (p_d) and hospital (p_h) or puskesmas (p_p).

This gives sampling weights of:

$$Hospital\ weight = \frac{1}{p_r \times p_d \times p_h} \qquad Puskesmas\ weight\ = \frac{1}{p_r \times p_d \times p_p}$$

These weights were merged with the hospital and puskesmas datasets by district and the datasets declared as a stratified dataset using the STATA svyset command. This ensures that the observations are weighted to reflect the relative number of facilities in each area. Throughout the report weighted averages are given across strata to give an idea of the national figure for each variable. These are based on population weights since we wished to present an idea of the costs required for delivering health services related to the size of population. It would also be possible to present weights in terms of the facility share of each stratum. This would provide a different average since facilities are not evenly spread across the population.

Section 2. Costs and functioning of puskesmas network

Characteristics of puskesmas sample

In this section we summarise the results of the costs of providing primary care services through the puskesmas and network. Throughout this section references to puskesmas or puskesmas network refers to the inputs, activities and costs of running the public sector primary care network in a sub-district. This is overseen by the puskesmas and incorporates sub-centres (pustu), maternity (polindes), health posts (poskesdes) and integrated health posts (posyandu).

Data were obtained from a total of 234 puskesmas (Table 8). Overall 34% of these had beds while 33% were recorded as having functionality for basic essential obstetric care (PONED).

Table 8: Puskesmas sampled by province, % with beds and PONED

Province	Number of Puskesmas	Catchment population	Proportion with beds	Proportion with PONED	% with 24 hour emergency	% open in afternoon	% urban
Group One							
Bali	30	30,200	27%	43%	26%	22%	17%
Yogyakarta	24	22,708	42%	37%	53%	5%	32%
Total	54	26,641	33%	40%	40%	13%	25%
Group Two							
Bangka Belitung	7	19,528	29%	14%	43%	29%	57%
Jawa Timur	24	41,286	50%	35%	45%	10%	30%
Riau	7	28,698	29%	50%	20%	0%	14%
Sumatra Barat	24	18,033	63%	45%	84%	67%	6%
Total	62	27,700	50%	38%	49%	20%	25%
Group Three							
Nusa Tenggara Timur	24	14,155	25%	10%	57%	9%	4%
Sulawesi Barat	9	18,152	44%	63%	67%	50%	25%
Total	33	15,191	30%	24%	59%	17%	9%
Group Four							
Gorontalo	21	22,834	29%	43%	57%	36%	38%
Jawa Barat	16	41,875	31%	7%	22%	11%	30%
Kalimantan Selatan	8	22,400	0%	13%	14%	0%	0%
Kalimantan Tengah	8	10,362	75%	13%	25%	0%	13%
Sulawesi Selatan	16	24,673	81%	44%	74%	6%	32%
Sulawesi Tengah	8	13,784	38%	25%	38%	13%	13%
Sumatra Utara	8	71,512	38%	29%	17%	100%	86%
Total	85	28,680	42%	28%	29%	41%	46%
Weighted average	234	26,922	43%	33%	41%	28%	33%

The study included data from the main puskesmas in each sub-district and also from all the network facilities in the catchment area. On average there are 3 pustu, 2.6 polindes, 2.8 poskesdes and 39 posyandu in each catchment area (Table 9).

Table 9: Average number of network facilities in each puskesmas catchment area

Cluster\province	Pustu	Polindes	Poskesdes	Posyandu	Poskestren
Group One					
Bali	3.70	0.42	3.00	36.00	-
Yogyakarta	2.90	0.22	1.20	50.00	0.26
Total	3.30	0.32	2.00	43.00	0.14
Group Two					
Bangka Belitung	3.40	1.10	3.60	19.00	0.29
Jawa Timur	2.50	5.80	5.90	49.00	0.49
Riau	4.40	1.30	0.86	17.00	-
Sumatra Barat	3.40	6.90	1.10	23.00	0.21
Total	3.00	5.10	4.20	39.00	0.36
Group Three					
Nusa Tenggara Timur	5.80	1.20	0.39	27.00	-
Sulawesi Barat	3.30	0.63	3.80	20.00	-
Total	5.20	1.10	1.20	26.00	-
Group Four					
Gorontalo	5.20	2.20	3.00	18.00	0.07
Jawa Barat	1.30	1.50	2.40	53.00	0.17
Kalimantan Selatan	4.30	3.30	4.10	18.00	-
Kalimantan Tengah	8.40	0.50	-	15.00	-
Sulawesi Selatan	3.50	1.60	2.10	27.00	0.13
Sulawesi Tengah	5.90	1.10	4.10	13.00	0.13
Sumatra Utara	1.90	-	0.86	38.00	-
Total	2.40	1.10	1.90	39.00	0.09
Weighted average	2.96	2.67	2.78	38.15	0.20

As with hospitals, a substantial proportion of puskesmas report problems with water and electricity availability although with substantial variation across the country (Table 10). Availability of medicines is extremely variable with some puskesmas reporting few or no problems while in other areas delays are reported by more than 40% of facilities. Puskesmas in cluster three reported the most problems across the five areas of functionality measured.

Table 10: Functionality of puskesmas by province

Cluster/province	Water disrupted at least once a month	Electricity disrupted at least once a month	Medicines supplied disrupted at least once a month	Salaries disrupted at least once a year	Incentives disrupted at least once a year
Group One					
Bali	15.0%	17.0%	6.0%	0.0%	25.0%
Yogyakarta	5.4%	38.0%	0.0%	0.0%	32.0%
Total	9.8%	28.0%	2.8%	0.0%	29.0%
Group Two					
Bangka Belitung	14.0%	29.0%	0.0%	0.0%	43.0%
Jawa Timur	9.5%	9.5%	3.7%	4.3%	15.0%
Riau	57.0%	57.0%	0.0%	29.0%	43.0%
Sumatra Barat	58.0%	73.0%	24.0%	0.0%	57.0%
Total	24.0%	27.0%	5.6%	7.7%	26.0%
Group Three					
Nusa Tenggara Timur	55.0%	57.0%	10.0%	52.0%	64.0%
Sulawesi Barat	25.0%	38.0%	25.0%	25.0%	38.0%
Total	48.0%	53.0%	14.0%	46.0%	59.0%
Group Four					
Gorontalo	64.0%	83.0%	42.0%	7.2%	60.0%
Jawa Barat	17.0%	22.0%	7.9%	0.0%	33.0%
Kalimantan Selatan	0.0%	86.0%	29.0%	14.0%	57.0%
Kalimantan Tengah	88.0%	75.0%	13.0%	13.0%	100.0%
Sulawesi Selatan	45.0%	25.0%	13.0%	18.0%	30.0%
Sulawesi Tengah	50.0%	75.0%	50.0%	100.0%	100.0%
Sumatra Utara	14.0%	14.0%	0.0%	14.0%	29.0%
Total	**23.0%**	**28.0%**	**9.3%**	**12.0%**	**38.0%**

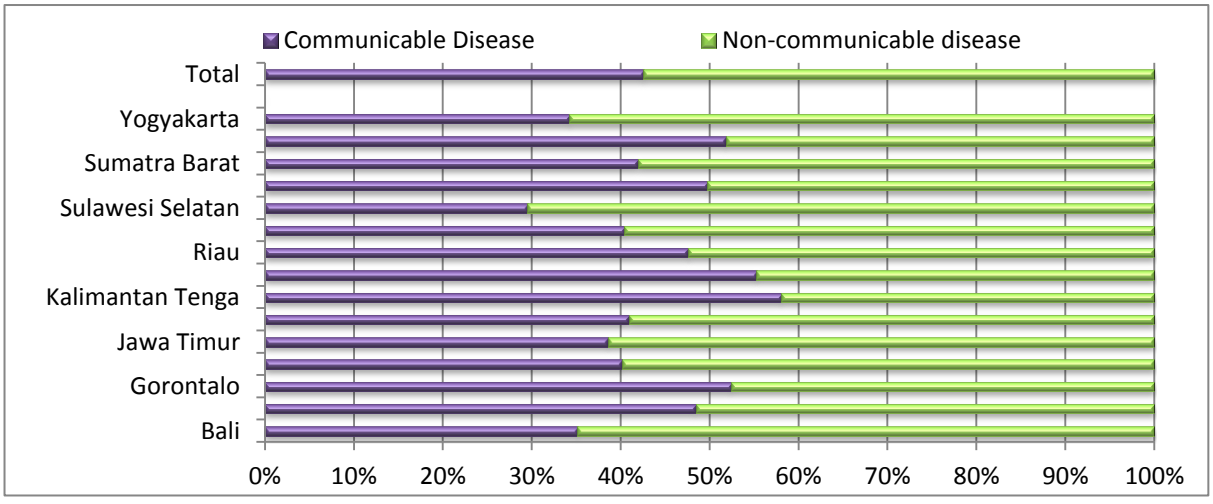
Each puskesmas-network provides services to just below 27,600 patients per year, 73% general outpatient, 19% MCH, 6% dental and 1% inpatients (Table 11).

Table 11: Patients per 1000 population by service and province

	Patient per 1000 population			
Cluster/province	**General patients**	**MCH**	**Dentistry**	**Inpatients**
Group One				
Bali	739	114	64	**9**
Yogyakarta	1,053	167	94	**7**
Total	896	141	79	**8**
Group Two				
Bangka Belitung	938	108	107	**14**
Jawa Timur	781	291	106	**10**
Riau	346	102	35	**10**
Sumatra Barat	691	398	70	**28**
Total	716	285	83	**18**
Group Three				
Nusa Tenggara Timur	1,100	170	23	**12**
Sulawesi Barat	809	191	30	**7**
Total	1,041	174	25	**11**
Group Four				
Gorontalo	875	135	21	**15**
Jawa Barat	833	257	71	**4**
Kalimantan Selatan	667	184	55	**16**
Kalimantan Tengah	428	110	9	**19**
Sulawesi Selatan	875	122	51	**26**
Sulawesi Tengah	780	117	16	**25**
Sumatra Utara	321	41	55	**0**
Total	758	147	40	**16**
Weighted Average	777	205	59	**16**
	73%	**19%**	**6%**	**1%**

Communicable diseases predominate in some provinces such as East Kalimantan and NTT while the treated disease burden has shifted towards non-communicable diseases in provinces such as Bali, Jawa Barat and Yogyakarta (Figure 3).

Figure 3: Top 30 conditions by communicable and non-communicable diseases



Characteristics of puskesmas staffing

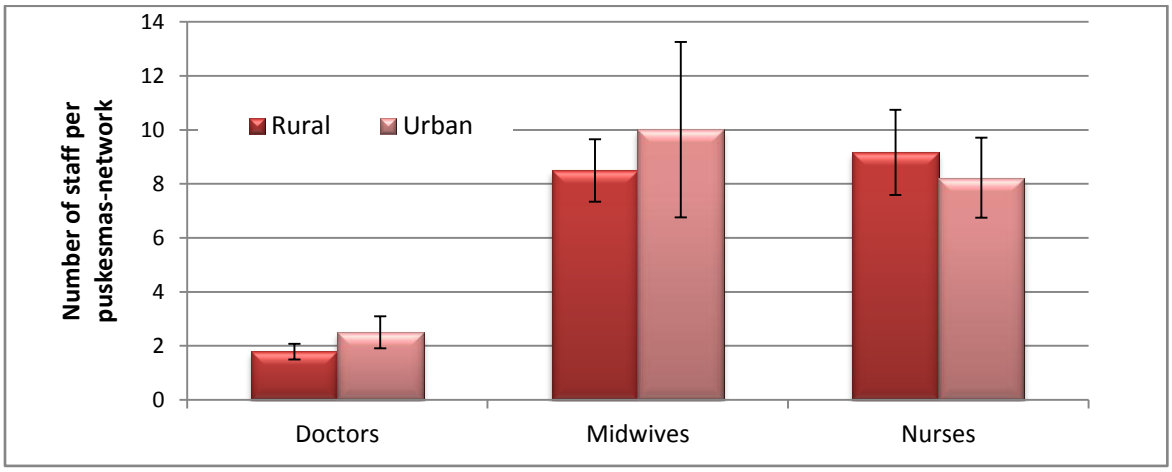
The number of doctors in each puskesmas ranges from less than one in NTT (some puskesmas have no doctors) to a high of 3.5 in Yogyakarta (Table 12). The number of doctors per puskesmas is higher in urban areas. The number of midwives is higher and nurses are lower in urban areas although the confidence intervals overlap. (Doctors, midwives and nurses by area (average number per puskesmas & network)

There is wide variation in the number of patients per member of the medical staff (doctors, nurses and midwives) during the course of a year ranging from just a few hundred to many thousands. In practice, of course, not all of these patients will have contact with medical staff but will see instead a community worker, paramedic and or other staff member. The ratios give some indication of the wide ranging workload apparent across sub-districts.

Table 12: Staffing per puskesmas and per 10,000 population

	Doctors		**Midwives**		**Nurses**		**Total staff**	
Cluster/province	Total	/10,000	Total	/10,000	Total	/10,000	Total	/10,000
Group 1								
Bali	2.9	1.1	8.0	3.2	8.6	3.3	38.0	14.0
Yogyakarta	3.5	1.7	5.6	2.4	7.5	3.1	37.0	16.0
Total	3.2	1.4	6.7	2.7	8.0	3.2	37.0	15.0
Group 2								
Bangka Belitung	1.9	1.2	7.3	4.8	18.0	13.0	40.0	27.0
Jawa Timur	1.9	0.7	13.0	4.4	9.4	3.7	37.0	14.0
Riau	1.4	0.6	13.0	4.9	15.0	5.5	38.0	14.0
Sumatra Barat	1.7	1.4	10.0	9.6	8.6	8.2	32.0	29.0
Total	1.8	0.8	12.0	5.1	11.0	5.0	37.0	16.0
Group 3								
Nusa Tenggara Timur	0.6	0.6	6.9	5.4	8.0	7.6	27.0	25.0
Sulawesi Barat	1.6	0.8	6.2	3.0	8.3	4.0	25.0	12.0
Total	0.8	0.7	6.7	4.9	8.1	6.8	26.0	23.0
Group 4								
Gorontalo	2.2	1.1	7.0	3.4	9.7	4.7	40.0	20.0
Jawa Barat	1.8	0.6	8.4	3.4	7.5	2.4	27.0	9.8
Kalimantan Selatan	2.7	1.7	12.0	6.7	9.0	4.8	37.0	21.0
Kalimantan Tengah	1.8	1.5	9.1	11.0	14.0	17.0	34.0	39.0
Sulawesi Selatan	1.9	0.9	7.5	3.5	9.1	4.6	31.0	15.0
Sulawesi Tengah	1.5	1.2	5.9	4.4	17.0	14.0	35.0	28.0
Sumatra Utara	1.1	0.2	9.3	1.0	6.7	0.8	27.0	3.2
Total	**1.6**	**0.6**	**8.6**	**3.6**	**8.4**	**3.8**	**29.0**	**13.0**

Figure 4: Doctors, midwives and nurses by area (average number per puskesmas & network)



Note: 95% confidence intervals indicated by error bars

Costs of puskesmas services

It costs on average Rp. 2.16 billion (Median Rp. 1.9 billion) per year to provide care through the puskesmas and network (typically composed of 3 pustu, 2-3 polindes & poskesdes and 38 posyandu) for an average population of 26,922 (Mean Rp. 93,101 per capita/year; median Rp. 51,175). In urban areas the cost is estimated at Rp. 2.5 billion (median Rp. 2.3 billion) or Rp. 77,717 per capita/year (median Rp. 36,816). In rural areas the total cost is Rp. 2.0 billion (median 1.6 billion) or Rp. 99,180 per capita/year (median Rp. 57,406).

The structure of costs varies substantially across the provinces surveyed (Figure 5). A sample weighted average shows that around 52% of the cost are staff including both salaries and incentive payments (incentives account for 12% of income) while medicines and medical supplies account for 27% of the costs. Capital costs account for around 17% of the costs. Part of this cost (5%) is the annualised cost of buildings and fixed equipment (e.g. air conditioning) while 12% is the annual cost of medical and non-medical equipment. The value of land is not included in the costs although information on land area and reported values was collected. Reported information on the value of land was extremely patchy and variable and based on possibly outdated valuations. Standardised land values could be incorporated at a later stage based on region specific standard valuations.

The largest share of costs is staffing. Most of the staffing costs are for nurses and midwives who provide the majority of care in the puskesmas, network facilities and community. Average remuneration (salary, allowances and incentives) are generally higher for medical workers in provinces in the fourth group although there is variation and the confidence intervals overlap (Figure 6). Similarly, remuneration of urban workers is higher than in rural areas but the difference is not statistically significant (5% level). Doctors on average receive more of their income (13%) from incentives than do nurses (12%) or midwives (11%). A large proportion of puskesmas staff report maintaining a private medical practice; 51% of doctors, 15% of nurses and 37% of midwives. On average doctors report devoting 9, nurses 6 ½ and midwives 8 ½ hours a week to this practice. Even those not stating that they have a private clinic report spending around one hour a week on practice outside their public duties.

Figure 5: Structure of costs by puskesmas

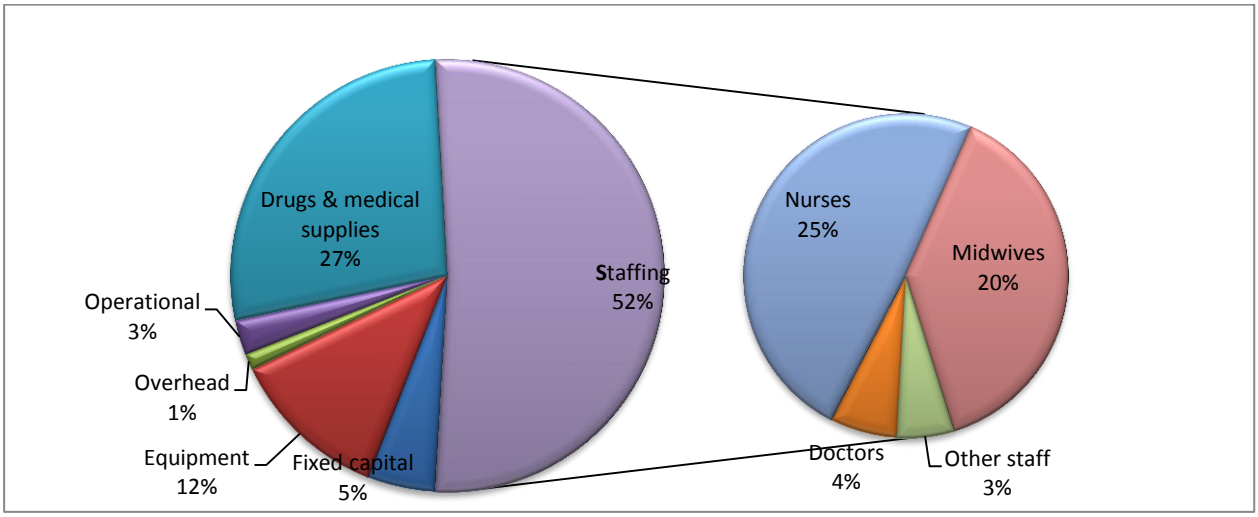
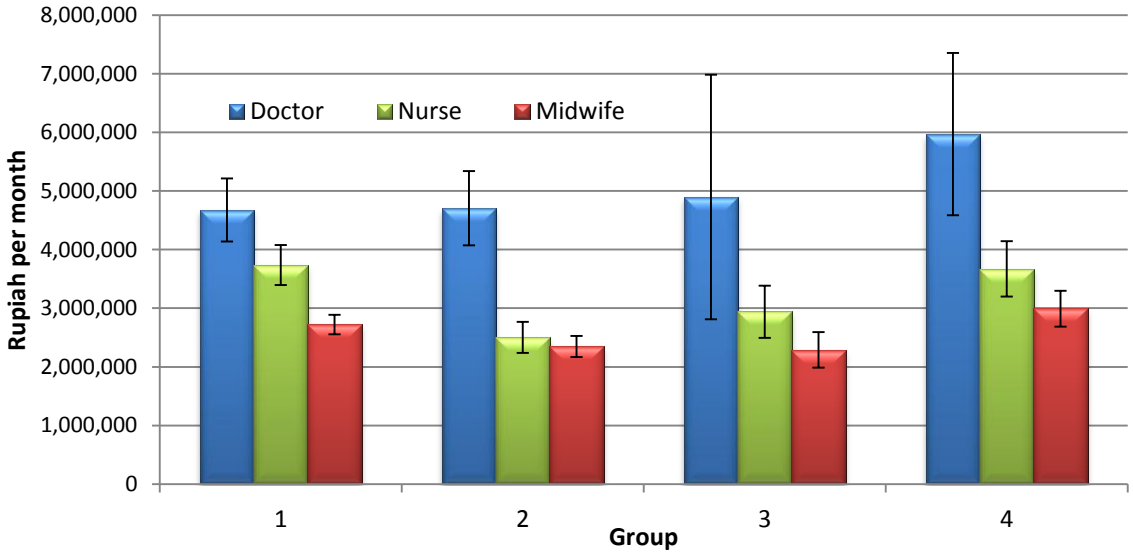


Figure 6: Monthly income of medical staff by Group (salary plus incentive),



The costs of drugs and medical supplies include both medicines provided by the puskesmas or pustu pharmacies, whether they are financed by the patient or from other source and also patient spending on medicines outside the puskesmas. The weighted cost of medicines was found to be Rp. 26,478 per capita and Rp. 31,520 per patient (combined outpatient and inpatients) although there are some notable variations across the country (Table 13). There is substantial variation across the country with an eight fold difference between the highest and lowest province in terms of cost per capita. Further analysis of these differences is recommended.

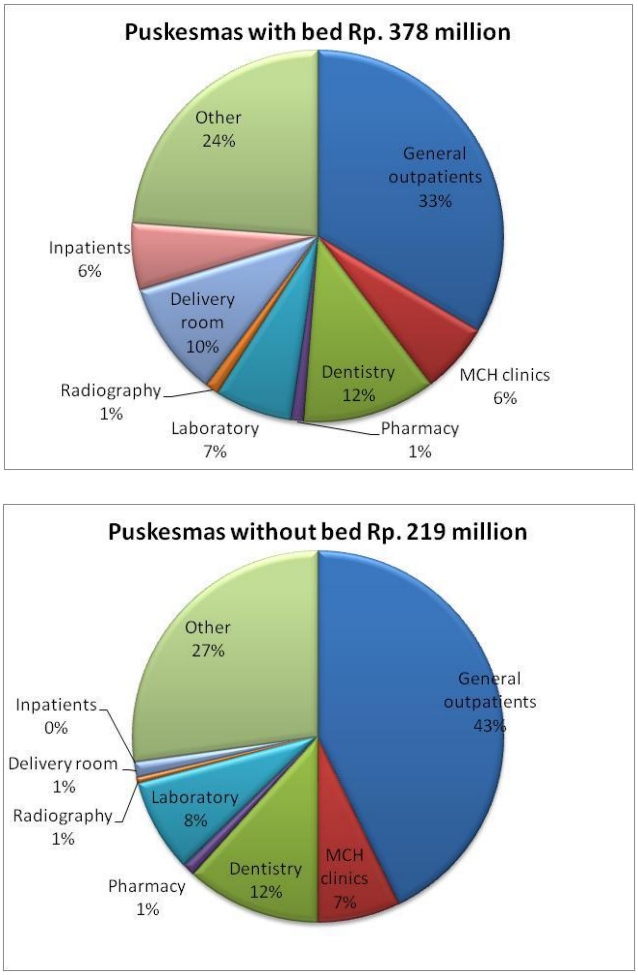
Table 13: Per capita and per patient costs of medicines and supplies (by province, Rp.)

	Drug cost per capita	Drug cost per patient
Group One		
Bali	15,011	**14,970**
Yogyakarta	12,543	**10,476**
Total	13,777	**12,813**
Group Two		
Bangka Belitung	34,920	**29,058**
Jawa Timur	14,367	**14,140**
Riau	11,459	**25,143**
Sumatra Barat	25,825	**43,267**
Total	21,390	**28,570**
Group Three		
Nusa Tenggara Timur	56,936	**41,049**
Sulawesi Barat	40,481	**60,713**
Total	53,508	**46,293**
Group Four		
Gorontalo	18,411	**25,011**
Jawa Barat	25,597	**26,442**
Kalimantan Selatan	7,378	**8,256**
Kalimantan Tengah	40,797	**75,999**
Sulawesi Selatan	50,161	**46,296**
Sulawesi Tengah	26,654	**33,573**
Sumatra Utara	18,791	**35,785**
Total	27,984	**34,625**
Weighted average	**26,478**	**31,520**

Equipment spending

Equipment spending represents 12% of the annualised costs of puskesmas operation. Equipment valuation was based on an inventory of items in each cost centre and a valuation at replacement cost. The cost thus represents the cost of sustaining the function of puskesmas. The costs of medical equipment is based on the replacement cost of equipment annualised using standard years of useful life (Arges, 2008) and an opportunity cost of capital of 5%. The annualised cost of medical equipment in a puskesmas network with beds is Rp.378 million and without beds Rp.219 million; the difference largely accounted for in the cost of equipping the inpatient wards and maintaining a larger delivery capability (Figure 7). There was remarkably little difference in the valuation across the country.

Figure 7: Distribution of annualised cost of medical equipment



The unit costs of puskesmas care

Step-down costing was used to allocate costs to intermediate and final cost-centres based for four cost-centres: general outpatients, mother and child visits, dentistry and inpatients (for those puskesmas with beds). Around 73% of the workload of a puskesmas network is general outpatients treated in the puskesmas itself, pustu or in outreach centres. The average cost of each general patient visit across the country is Rp. 88,240 (Rp. 68,776 without capital costs), ranging from Rp. 41,000 to more than Rp. 300,000 (Table 14 and Annex 3: Unit costs of puskesmas services by province and group).

Median unit costs are somewhat lower Rp. 51,109 for general outpatients and Rp. 81,435 for MCH services. The cost of an MCH visit is around 30% higher than for general outpatients which largely reflect the relatively higher staff commitment to these services. Midwives and nurses suggested that they spend only a slightly larger proportion of their time in general outpatient compared to MCH clinics (midwives 32% compared to 28% and nurses 39% compared to 20%) even though the puskesmas provides care for more than three times as many general relative to MCH patients. Midwifery services are more time consuming since they are more likely to necessitate outreach clinic or community visits.

Table 14: Unit cost of puskesmas services (Rp.) by group

	General outpatients	Mother & Child	Dentistry	Inpatient admissions
Mean unit costs				
Recurrent and capital)				
Group 1	58,301	160,829	218,608	**2,850,644**
Group 2	71,320	85,550	237,948	**1,274,236**
Group 3	111,503	110,056	298,987	**1,390,541**
Group 4	104,953	129,550	477,801	**1,643,845**
Average	*88,240*	*112,283*	*344,170*	***1,563,413***
Recurrent only				
Group 1	40,573	129,870	182,964	**2,468,783**
Group 2	53,089	74,090	173,899	**1,109,112**
Group 3	79,163	95,615	208,771	**1,215,229**
Group 4	86,688	117,245	367,369	**1,503,224**
Average	68,776	98,698	260,197	**1,391,163**
Median unit costs				
Recurrent and capital				
Group 1	45,489	94,188	197,062	**1,360,570**
Group 2	53,241	70,781	184,561	**1,016,034**
Group 3	79,851	105,727	283,208	**1,115,331**
Group 4	60,766	106,339	61,197	**1,357,642**
Average	*51,109*	*81,435*	*201,752*	***1,097,641***
Recurrent only				
Group 1	32,851	67,893	166,899	**1,241,865**
Group 2	33,618	63,481	145,256	**856,369**
Group 3	65,640	97,036	189,031	**947,186**
Group 4	51,362	99,142	211,931	**1,231,535**
Average	***43,978***	***82,016***	***179,250***	***1,054,070***

Note 1: Inpatient admissions include delivery care which does not necessarily require an overnight stay and so can be done in puskesmas without beds.

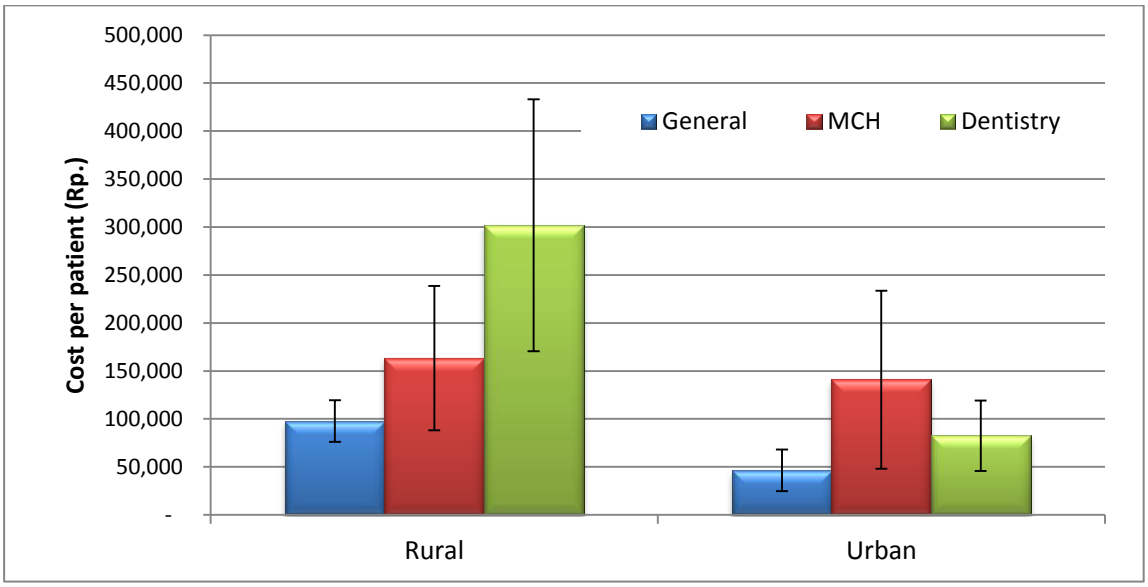
The unit costs of inpatients exhibit the greatest variation across sub-districts. This is unsurprising since the numbers of patients tends to be small and variable. On average, puskesmas with beds devote around 12% of their floor space (Table 15) to inpatients while inpatients account for around 2% of total patients. In a number of cases (13 sub-districts) the unit cost of treating an inpatient is higher than in the neighbouring district hospital.

Table 15: Distribution of space across puskesmas with and without beds

Type	Outpatients	MCH	Dentistry	Clinical support	Delivery	Inpatient	Other
Without beds	63%	5%	3%	5%	1%	0%	24%
With beds	56%	3%	2%	4%	3%	12%	19%
Total	**60%**	**4%**	**3%**	**5%**	**2%**	**5%**	**22%**

Cost of puskesmas care is generally lower in urban compared to rural areas. The differences are significant for both general visits and dentistry (Figure 8). This reflects a combination of lower workload and higher fixed costs in rural areas which lead to higher per patient capital and staffing costs.

Figure 8: Unit costs of outpatient care at urban and rural puskesmas network (Rp.)



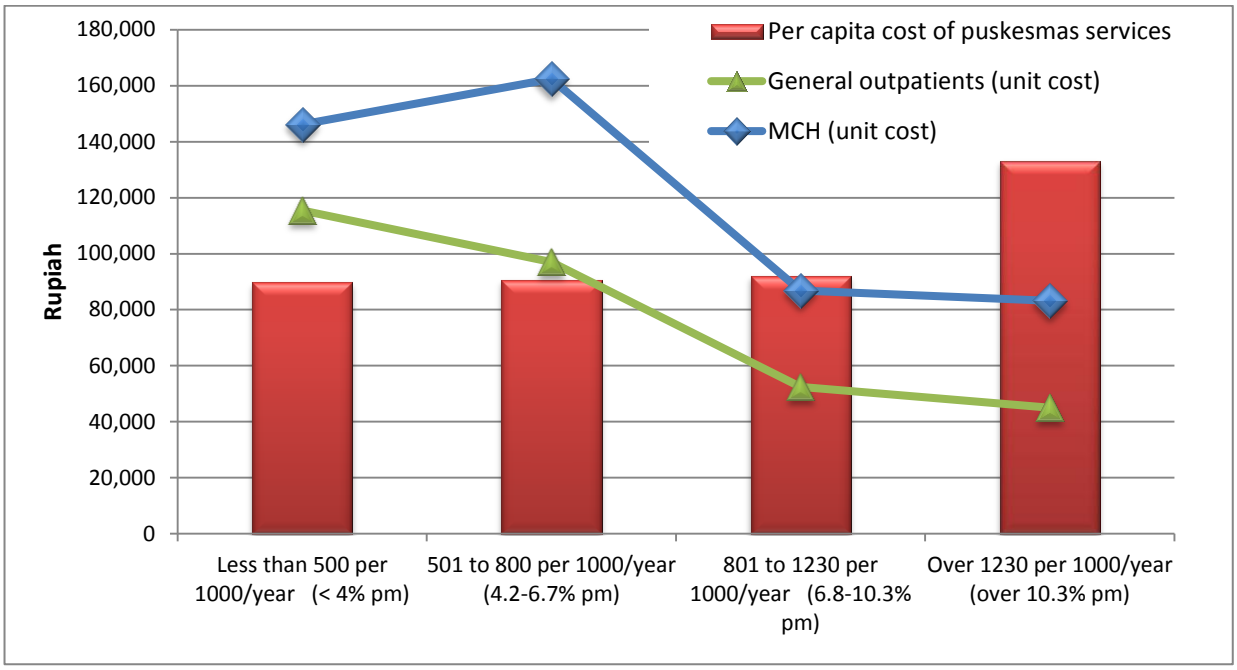
Note: bars indicate 95% confidence interval

Unit costs are sensitive to changes in utilisation of the puskesmas network. For an average sized sub-district (26,900 populations) the unit cost of general outpatient care falls from around Rp. 110,000 per visit where total outpatient utilisation is less than 500 visits per 1000 population to less than Rp. 60,000 for sub-districts with more than 800 visits (Figure 9).

Unit costs of other services exhibit similar trends. The sharp decline in unit cost is the consequence of the fixed (e.g. capital, utilities, administration) and semi-fixed costs (staffing) being shared across a larger number of patients. This has an impact on the per capita cost (annual cost per person in the sub-district) of primary care services which shows little total increase as visit rates increase[3].

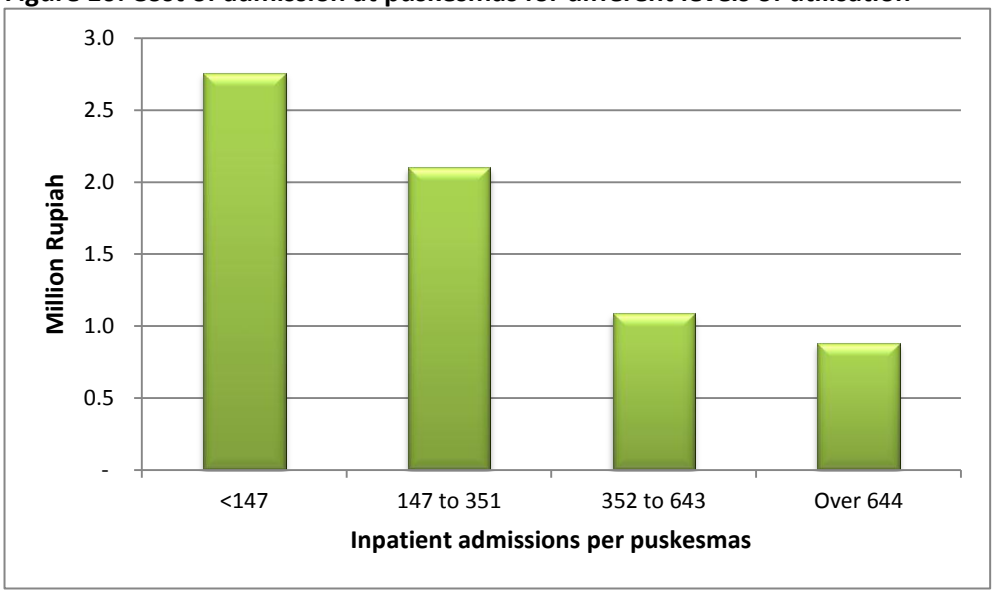
[3] Note that the figures are not adjusted for other factors. The total impact holding other factors constant shows that costs do rise but the increase is relatively small (see Annex 5).

Figure 9: Per capita cost of primary care by patient workload



The cost of inpatient services shows wide variability across sub-districts. As with outpatient services utilisation is an important driver of costs (Figure 10). In puskesmas with less than 147 patients per year (less than one every two days) the cost per admission exceeds Rp. 2.5 million, not much less than the average cost of an inpatient treated at the hospital level (see next section). It should be noted also that not only is such care relatively expensive it is likely to be of lower clinical quality since a small number of patients will probably mean that staff are less practised at providing treatment and staff diverted into other activities. In contrast, sub-districts where the number of inpatients treated exceeds 640 per year (almost two a day) have a cost per inpatient of less than Rp. 1 million, a third of the cost of hospital services. Although puskesmas care is much more limited than hospitals, it suggests that for a limited range of conditions providing inpatient care in enhanced puskesmas can be low cost.

Figure 10: Cost of admission at puskesmas for different levels of utilisation

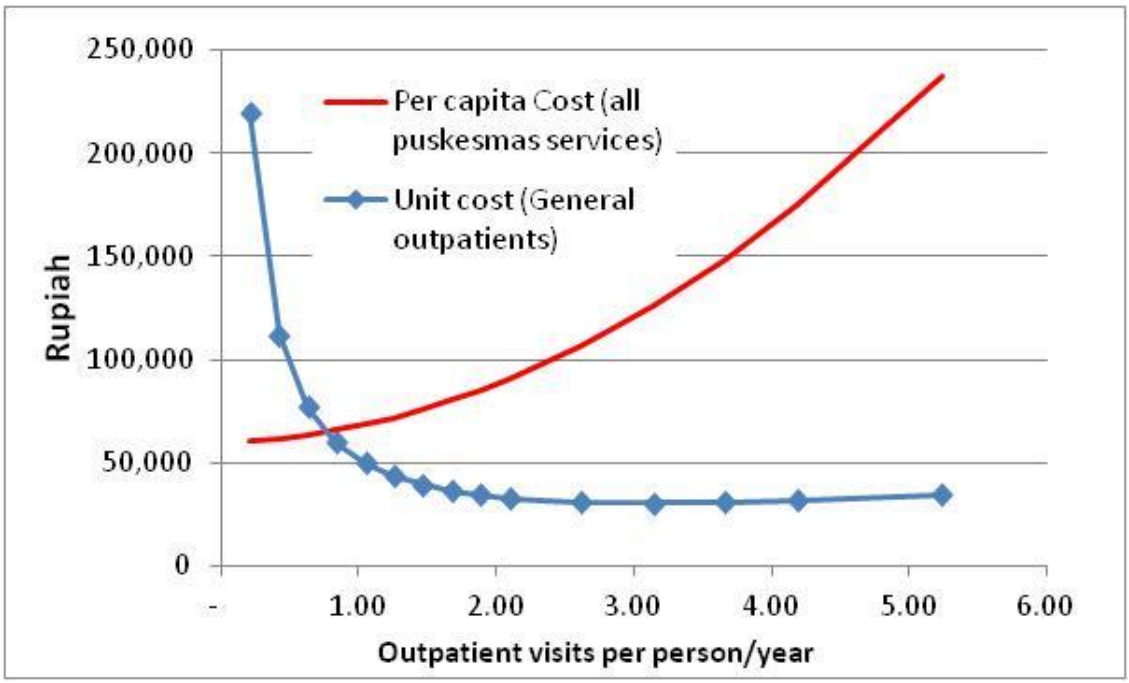


Summary: Puskesmas Costing

The study suggests that the costs of puskesmas are strongly dependent on overall levels of utilisation. The results have implications for the expansion of services under the universal coverage plans. In rural sub-districts, the data suggests that the population currently makes about 1.1 visits (general, MCH, dental and puskesmas inpatient) per capita. This contact rate is low by the standards of most systems that provide universal coverage. Indeed it is considerably lower that the estimates used by ASKES for people currently insured.

The data were modelled using multivariate regression analysis. This permits predictions to be made about the effects of changing workload on total costs. We assume that all services expand evenly and model the effect in a rural area with an average number of pustu (just under 4). The simulations suggest that doubling the patient contact visits per capita (from 1.06 to 2.12 a 100% increase) would result in an increase of total and per capita costs of around 30% to Rp. 99,690 per capita (Annex 5). An increase to 3 visits is expected to increase costs by a total of 64% to around Rp. 135,000 per capita.

Figure 11: Estimated impact of a change patient contacts on total costs of primary care



The large variation in the costs of inpatient care in puskesmas suggests the need to look carefully at how best to provide these services. In sub-districts with high patient loads these facilities appear to operate productively providing a service that is far cheaper than in a hospital. In contrast, inpatient puskesmas services can be very expensive, comparable to hospital services, in some areas. In addition, low utilization also relates to low quality services that lead to patient safety.

Development of universal coverage provides an opportunity to consider on how best to use these services. An issue in extending coverage is that hospital admission rates will increase rapidly with the possibility of patients self-referring to higher level facilities perhaps with tacit support of primary care staff who wish to reduce the difficulty of their caseload. A rapid increase in admission rates runs the danger of becoming unaffordable. A vital part of a universal coverage strategy is to develop the

referral system and gatekeeper role of primary care recognising that perhaps 90% of cases can be treated safely and effectively at this level. In addition, the continued practice of home delivery, even with skilled attendance, is thought to contribute to persistently high maternal mortality. Strategically strengthening some puskesmas to provide basic inpatient services could help to increase the facility delivery rate while also helping to mitigate the escalating costs of hospital services.

Section 3. Costs of providing hospital services

This section describes the characteristics of the public and private hospitals, examines the overall productivity of facilities and then presents estimates of final and intermediate unit costs.

Characteristics of hospital sample

There are four classes of hospitals in Indonesia designated according to criteria related to (bed) size and services provided (Table 16).

Table 16: Hospital Class in Indonesia

Hospital	No. of bed	Clinical services
A	Not specifically stated	Have a broad range of facilities providing specialized and subspecialized clinical services
B	Minimum of 200 beds	Provide at least eleven (11) specialized clinical service and limited sub-specialized care facilities in the range of clinical services offered teaching and non-teaching hospital
C	Minimum of 100 beds	Provide at least four (4) basic specialized clinical services and facilities in the range of clinical services offered
D	Minimum of 50 beds	Other basic medical services and facilities in the range of clinical services offered

Hospitals included in the sample are of four main types: autonomous hospitals (BLU or public service agency), public hospitals without autonomy, private not-for-profit and private for-profit (Table17). It was intended to collect information on approximately the same number of public and private hospitals. In the event fewer private facilities were included for two reasons: firstly, in some areas it was difficult to find private facilities; secondly, some facilities refused to join the study. Since the study was sanctioned by the Ministry of Health, the level of public hospital compliance was high with only 2 public hospitals together with 25 private hospitals dropping out of the original sample. However, statistical analysis shows that the remaining facilities participating in this study is still representative for the country.

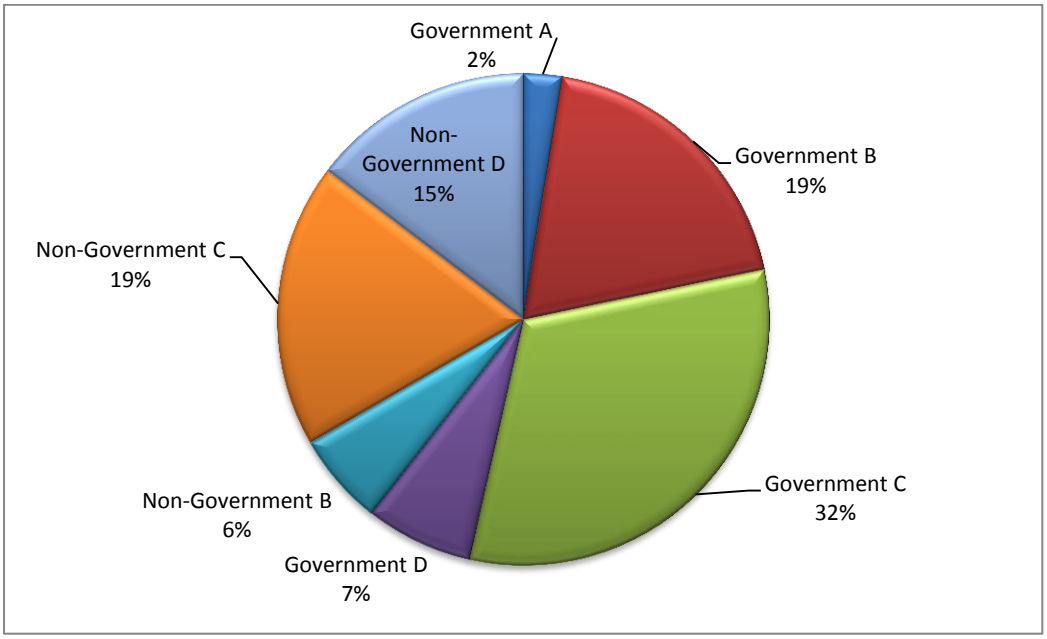
Table17: Numbers of hospitals included by ownership and mean number of beds

	Government Autonomous	Government Non-Autonomous	Private not-for profit	Private for-profit	Total
Group 1	9	3	8	5	25
Group 2	21	20	18	12	71
Group 3	3	7	5	2	17
Group 4	25	31	11	20	87
Grand total	58	61	42	39	200
	29%	**31%**	**21%**	**20%**	**100%**

The study focused on the hospitals most common at the district level which are mostly class B and C hospitals in the public sector which accounted for 51% of the sample (Figure 12). Class D hospitals in

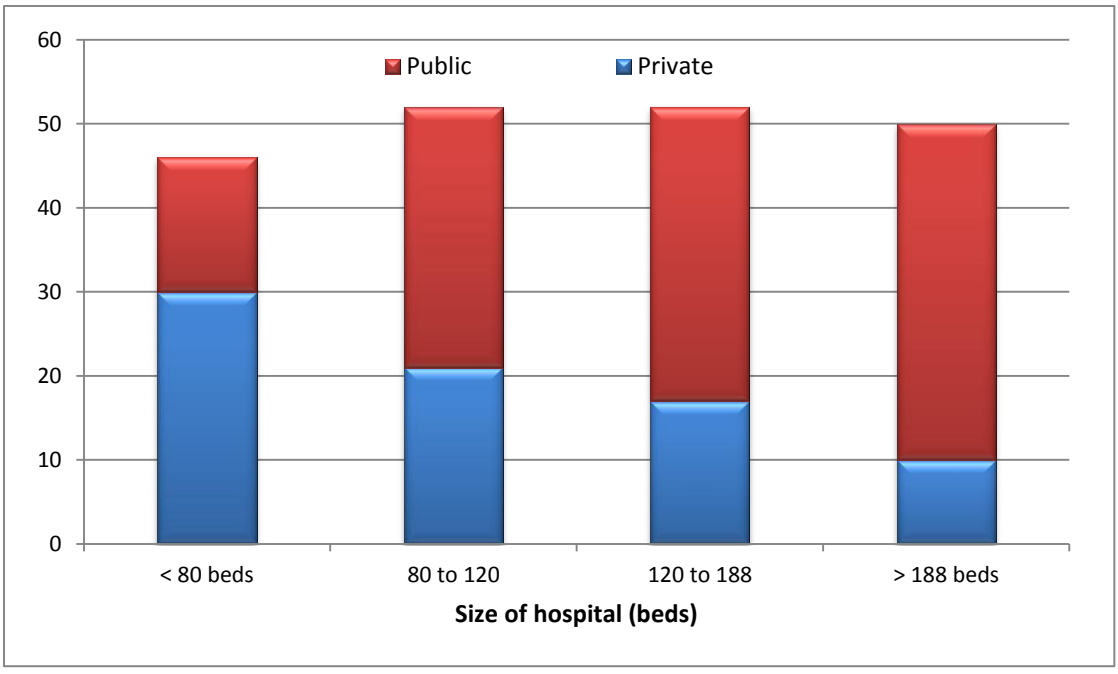
the public sector are gradually being upgraded to higher level hospitals. In the private sector, 34% of hospitals were classified as class C and D.

Figure 12: Share of hospitals in the sample by class (public and private)



On average, public autonomous hospitals are larger in terms of bed capacity than other public or private hospitals. The smallest public hospitals are recorded in cluster three which are relatively poor areas delivering services for a scattered population. Two thirds of the smallest facilities (less than 80 beds) are in the non-government sector.

Figure 13: Hospital size (weighted sub-totals)



Just 60% of hospitals have been accredited by the commission on accreditation (Komisi Akreditasi RS Indonesia or KARS). Compliance is highest in the public sector (Table 18). About 11% have additional accreditation from a number of organisations including ISO 9001, SAI Global and World Quality Assurance.

Table 18: Accreditation status of hospitals by province and ownership (weighted sub-totals)

	KARS accreditation	Other Accreditation	All accreditation
Group One			
Bali	40%	5%	40%
Yogyakarta	63%	27%	63%
Total	52%	17%	52%
Group Two			
Bangka Belitung	45%	22%	45%
Jawa Timur	77%	13%	77%
Riau	63%	28%	63%
Sumatra Barat	77%	25%	77%
Total	72%	19%	72%
Group Three			
Nusa Tenggara Timur	15%	8%	23%
Sulawesi Barat	67%	33%	67%
Total	21%	11%	28%
Group Four			
Gorontalo	0%	0%	0%
Jawa Barat	53%	0%	53%
Kalimantan Selatan	64%	9%	64%
Kalimantan Tengah	50%	0%	50%
Sulawesi Selatan	67%	4%	67%
Sulawesi Tengah	29%	0%	29%
Sumatra Utara	52%	0%	52%
Total	53%	2%	53%
Weighted average	**58%**	**11%**	**58%**

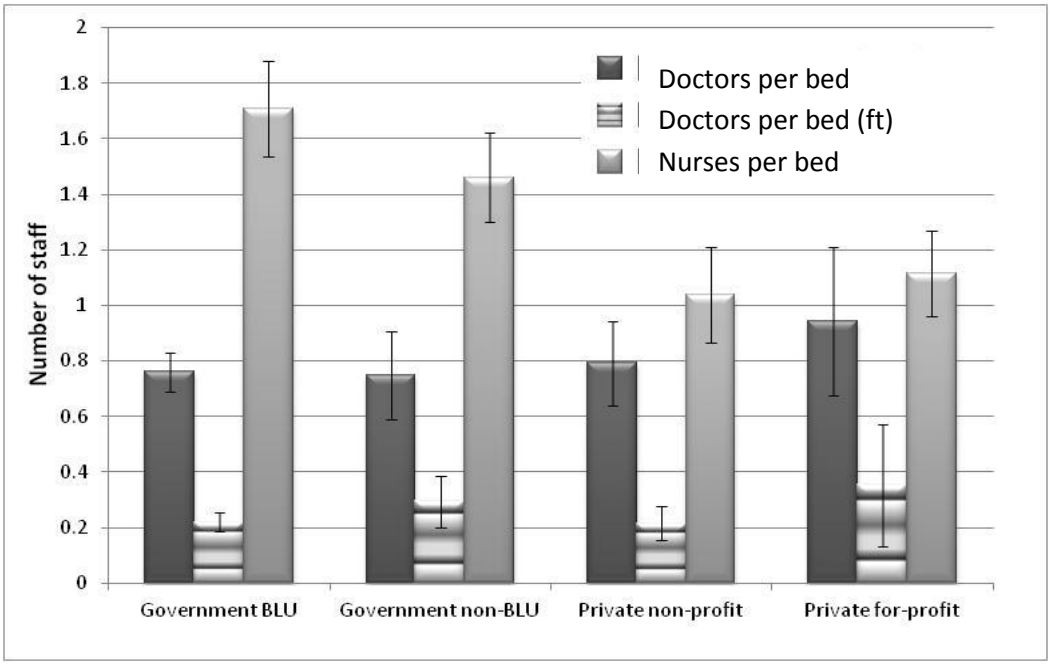
A basic understanding of the functionality of hospital services was obtained by finding out how often water and electricity were disrupted and how often medical supplies and salary and incentive payments were delayed (Table 19). High levels of electricity disruption were reported across the sampled in almost all provinces. Unsurprisingly, all types of facility (by ownership) are affected. Water supplies are also regularly disrupted. Delays in payment of salaries are mostly confined to the public sector although a few private facilities also reported problems. Delays in supply of medicines vary enormously across the country from negligible problems reported in Kalimantan Tengah and Sumatra Barat to 67% reporting monthly problems in Gorontalo.

Table 19: Functionality of hospitals by province and ownership

	Water disrupted at least once a month	Electricity disrupted at least once a month	Medicines supplied disrupted at least once a month	Salaries disrupted at least once a year	Incentives disrupted at least once a year
Group One					
Bali	12%	12%	24%	12%	32%
Yogyakarta	15%	58%	8%	0%	6%
Total	14%	36%	16%	6%	18%
Group Two					
Bangka Belitung	33%	33%	11%	0%	11%
Jawa Timur	13%	13%	20%	7%	29%
Riau	17%	33%	13%	9%	35%
Sumatra Barat	42%	50%	4%	4%	39%
Total	23%	27%	14%	6%	31%
Group Three					
Nusa Tenggara Timur	29%	50%	29%	21%	21%
Sulawesi Barat	0%	0%	33%	0%	33%
Total	26%	45%	29%	19%	23%
Group Four					
Gorontalo	33%	33%	67%	0%	67%
Jawa Barat	14%	38%	18%	0%	6%
Kalimantan Selatan	9%	36%	18%	0%	36%
Kalimantan Tengah	0%	50%	0%	17%	67%
Sulawesi Selatan	27%	40%	22%	16%	51%
Sulawesi Tengah	14%	58%	50%	29%	64%
Sumatra Utara	42%	22%	21%	16%	21%
Total	21%	38%	22%	9%	30%
Weighted average	**22%**	**34%**	**19%**	**8%**	**29%**

There is little difference in the number of doctors per bed across public and private hospitals (Figure 14). Private for profit facilities appear to have a higher ratio of doctors to beds. The number of nurses does, however, appear to be higher in public facilities although there is substantial variation and confidence intervals overlap.

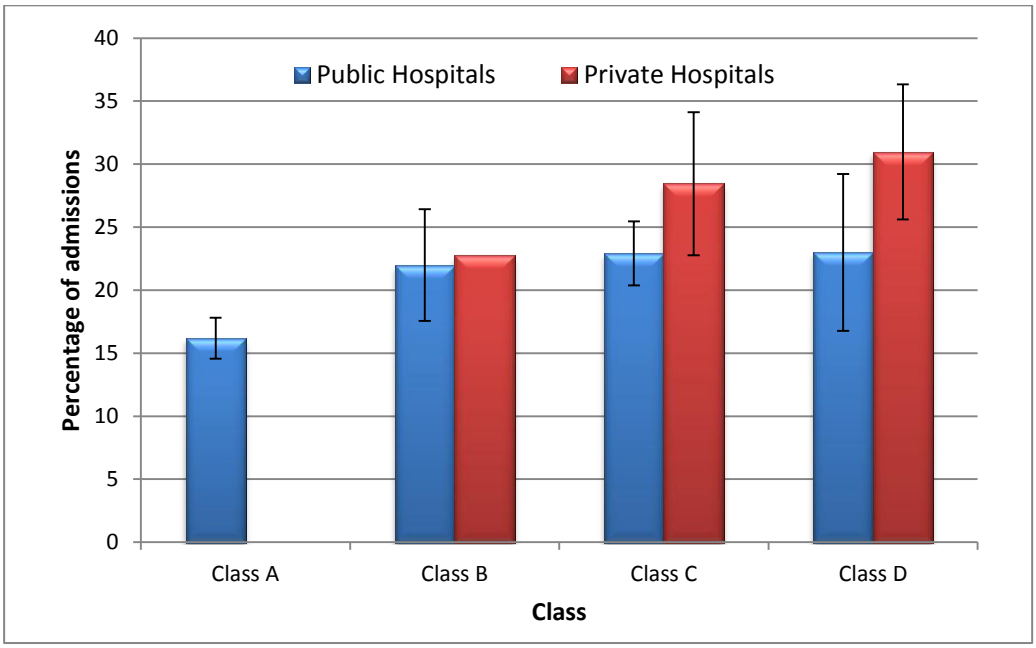
Figure 14: Doctors and Nurses (total and per bed) by hospital ownership



Note: 95% confidence intervals indicated by error bars

The proportion of inpatients with communicable diseases is higher for lower level hospitals in both public and private sector (Figure 15). Variation in disease mix is evident across provinces. Conditions in the minimal package (SPM) represent a larger proportion of admissions in provinces such as Kalimantan Tengah (52%, +/- 9.7%) compared to Kalimantan Selatan (34%, +/- 7.3%).

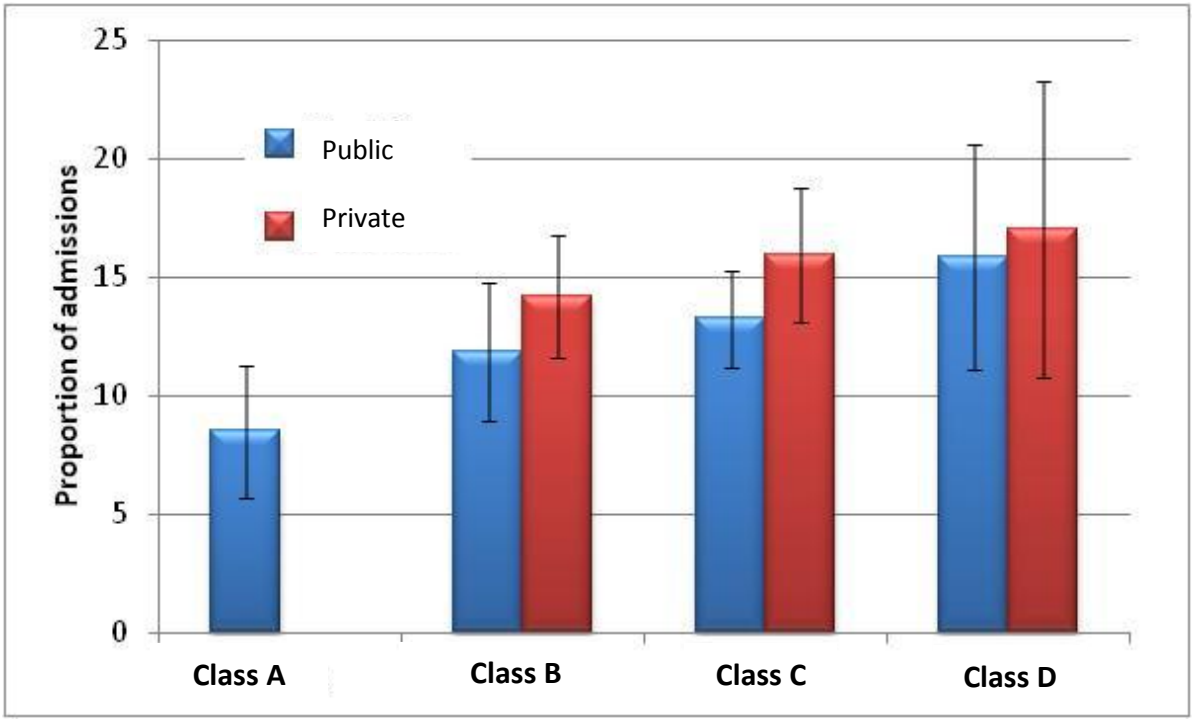
Figure 15: Priority communicable diseases as proportion of admissions (by hospital class)



Note: includes malaria, typhoid, tuberculosis, dengue, respiratory infections/pneumonia, diarrhoeal disease; 95% confidence intervals indicated by error bars

There is some variation in the number of child admissions (under 5) as a proportion of the total by class of hospital although the numbers are extremely variable (Figure 16). Children make up a larger proportion of lower class hospitals, particularly class D public hospitals. This is likely to be partly associated with the use of these facilities for treating common communicable diseases such as diarrhoea whose incidence is high amongst the young[4].

Figure 16: Child hospital admissions by class of hospital



Note: 95% confidence intervals indicated by error bars

[4] Note, for example, that there is a significant association between admissions for communicable diseases and children, p value<0.001

Hospital productivity

Occupancy rate[5]s across areas vary considerably from 41% (group 4) to 76% (group 3) (Table 20). Average lengths of stay are remarkably similar across the country and between hospital classes.

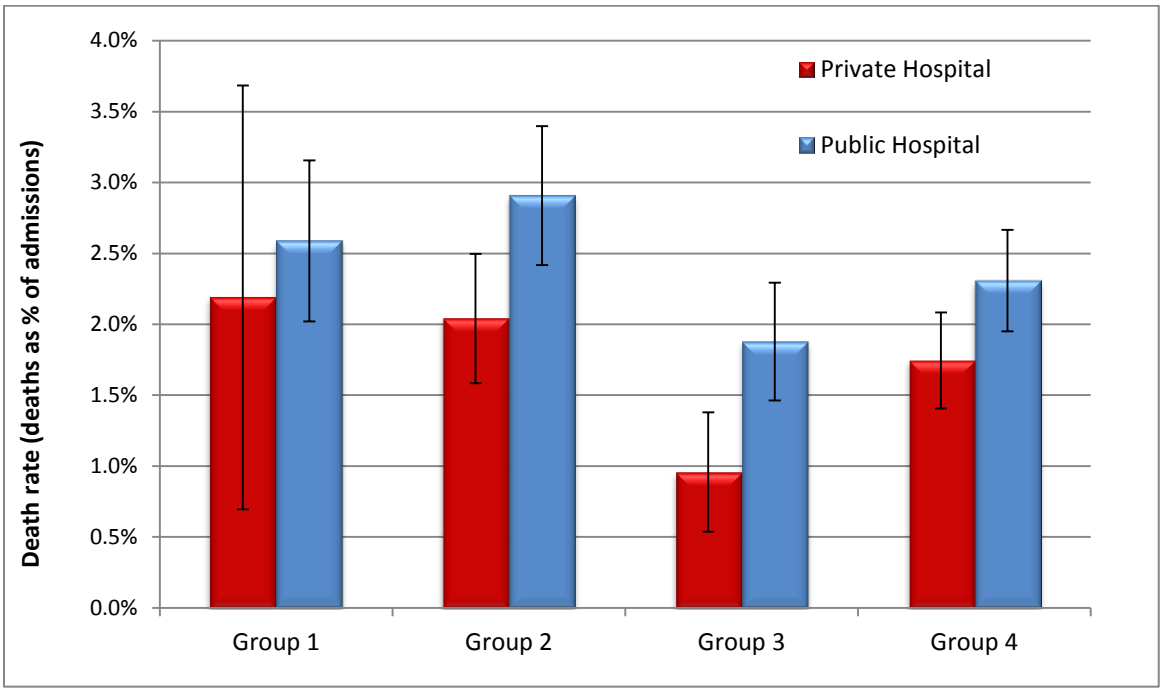
Table 20: Hospital productivity statistics

Cluster/province	Bed Occupancy	Throughput (patients per bed/year)	Average Length of Stay	Death rate
Group One				
Bali	54%	56	3.6	1.6%
Yogyakarta	66%	68	3.9	2.8%
Total	61%	63	3.8	2.3%
Group Two				
Bangka Belitung	53%	71	3.2	1.4%
Jawa Timur	60%	63	3.8	2.9%
Riau	74%	66	4.1	2.0%
Sumatra Barat	58%	59	3.9	1.9%
Total	61%	63	3.8	2.4%
Group Three				
Nusa Tenggara Timur	58%	62	3.8	1.4%
Sulawesi Barat	76%	65	4.4	2.4%
Total	60%	62	3.8	1.5%
Group Four				
Gorontalo	51%	49	3.9	1.4%
Jawa Barat	65%	77	3.8	2.1%
Kalimantan Selatan	63%	67	3.5	2.0%
Kalimantan Tengah	60%	63	3.5	1.8%
Sulawesi Selatan	63%	57	4.3	1.8%
Sulawesi Tengah	64%	60	4	1.8%
Sumatra Utara	41%	43	3.8	2.6%
Total	60%	63	3.9	2.0%
Weighted average	**60%**	**63**	**3.8**	**2.1%**

Average deaths rates (deaths as a proportion of admissions) appear to be higher in public compared to private hospitals (Figure 17). Further work will be required to understand whether this variation is associated with differences in the standards of care or differences in case mix. It may also be partly due to an often observed practice that very severe cases are referred from private to public hospitals. No investigation concerning death and referral was done for public hospitals.

[5] Defined as the number of occupied bed days (admissions multiplied by average length of stay) divided by available bed days (beds multiplied by 365).

Figure 17: Deaths in hospital as a proportion of total admissions (by stratum and ownership)



Note: 95% confidence intervals indicated by error bars

A popular way to visualise non-financial productivity of hospitals is the Lasso diagram (Lasso, 1986). This plots hospital activity according to two measures of productivity, throughput (number of patients admitted per bed) and bed occupancy. Arithmetically the slope of a ray through the origin to any point represents the average length of stay[6]. Averages of each variable divide the figure into zones representing different levels of productivity: hospitals in zone III treat patients quickly (high throughput) and utilise beds fully (high occupancy), hospitals in zone I have low throughput of patients and long periods where beds are left empty. Hospitals in zone IV keep their beds full but have a low throughput so that it may be that patients are kept in hospital longer than necessary or they treat more chronic diseases. Hospitals in zone II treat a large number of patients per bed but still have long periods when beds are left unoccupied whether because bed capacity is too high or because demand-factors constrain the use of beds. The Lasso diagnostic is suggestive only and further investigation of case-mix and demand-side factors is required to draw definitive conclusions.

Hospitals in each quadrant are diverse but the data allow general characterisation of facilities based on the main features of the facilities and unit costing (Table 21). Hospitals in quadrant III are generally larger hospitals with low relative unit cost for both admissions and emergency care. In contrast, facilities in quadrant I tend to be smaller facilities with low functionality and higher unit cost. Hospitals in quadrant II, characterised by short length of stay and low occupancy, are more likely to be public hospitals. Finally, hospitals in quadrant IV, with longer than average length of stays, tend to provide care for adults suffering from non-communicable diseases.

[6] Numerically, the slope is equal to 365 divided by the average length of stay.

Figure 18: Lasso diagram by hospital ownership

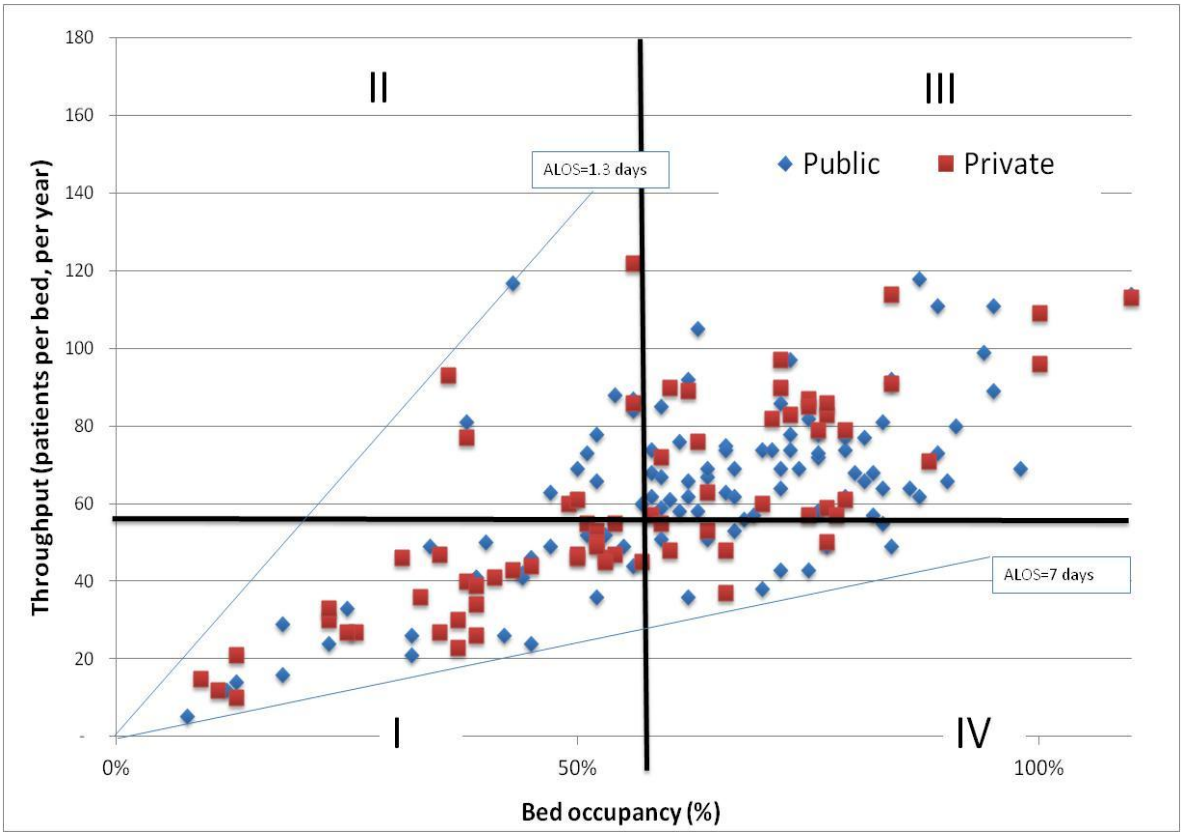


Table 21: Characterising hospitals by Lasso quadrant

Quadrant II: High Throughput & Low bed occupancy (short ALOS) • Mainly public • Lower death rates • Low unit cost	**Quadrant III: High Throughput & High bed occupancy** • Low unit cost (admission, emergency) • High function, larger hospitals
Quadrant I: Low Throughput & Low bed occupancy • Low function • High unit cost (admission, emergency • Smaller number of beds	**Quadrant IV: Low throughput & High bed occupancy (long ALOS)** • Adult non-communicable diseases • Higher death rates

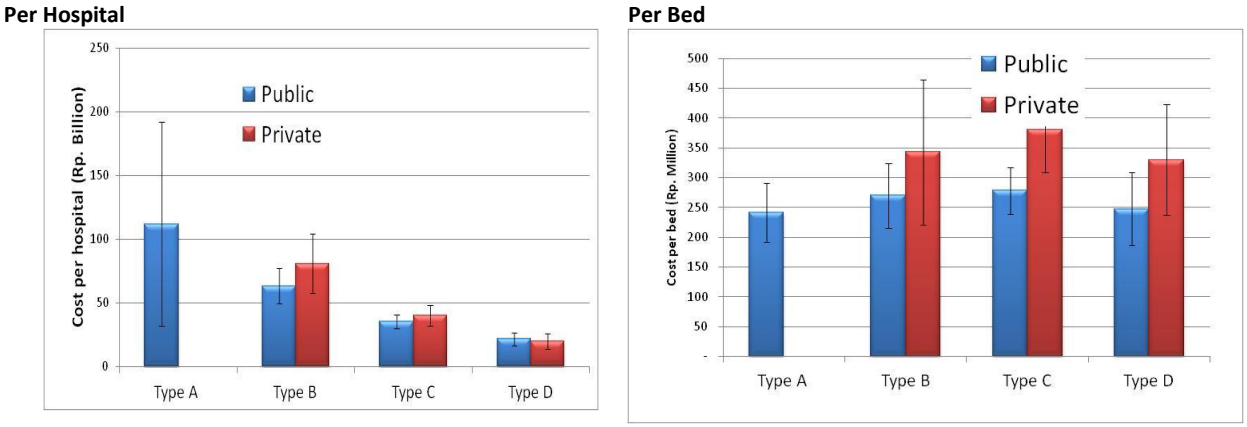
Source: based on costing study estimates

Costs of hospital services

The annual cost of running a hospital varies enormously; from less than Rp. 4 billion in one class C 50 bedded private hospital in region three to Rp. 231 billion in a large 740 bedded class A public hospital.

There is some variation in the costs by class of hospital (Figure 19). In both the public and private sector the total cost per hospital declines for lower class hospitals; class A hospitals cost on average four times as much to run as class D hospitals. There is no significant difference in costs by ownership and the cost per bed also exhibits no clear pattern by class. The average cost per bed in the private sector is higher for more sophisticated hospitals but the difference is not statistically significant.

Figure 19: Cost per hospital and per bed by class and ownership



Note: 95% confidence intervals indicated by error bars

Staffing is the main expenditure item in all hospitals; 43% in government and 32% in non-government facilities (Figure 20). The lower proportion in non-government hospitals may be due to the greater dependence on part time contracted staff that also have a position in a public facility. This may permit non-government facilities to utilise staffing more flexible although it also makes them dependent on proximity to public facilities. In some private hospitals, it has become common to contract out (out-source) some staff functions and this may reduce the proportion of staff costs. These costs are included instead in the overhead but most hospitals do not account for these costs separately so it is not possible to provide a detailed disaggregation. Drugs, medical supplies and operational costs represent the other main component of costs. The majority of the supplies costs are drugs and other medical supplies which account for 15% of costs in the government sector and 17% in the public sector.

Staff costs represent a major proportion of total costs of a hospital although this share is substantially lower than found in hospitals in high income countries. A full time general doctor earns around Rp. 6 million per month while nurses earn Rp 3 million and the average for all staff is just under Rp. 3 million. The majority (80%) of a nurse's income is in the form of salary and allowances in both public and private sector. Specialist doctors in the government and non-government sector earn many times the average for health facility staff, much of their income from incentives. The average for a surgeon is around 20 million per month but it is strongly related to the level of activity in the facility (Figure 21).

Figure 20: Distribution of costs by ownership

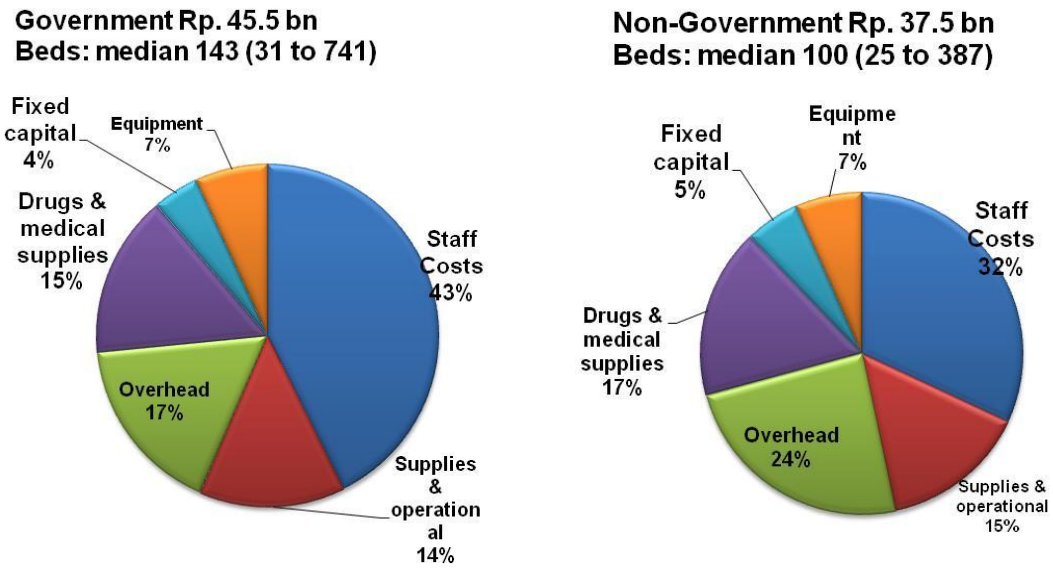
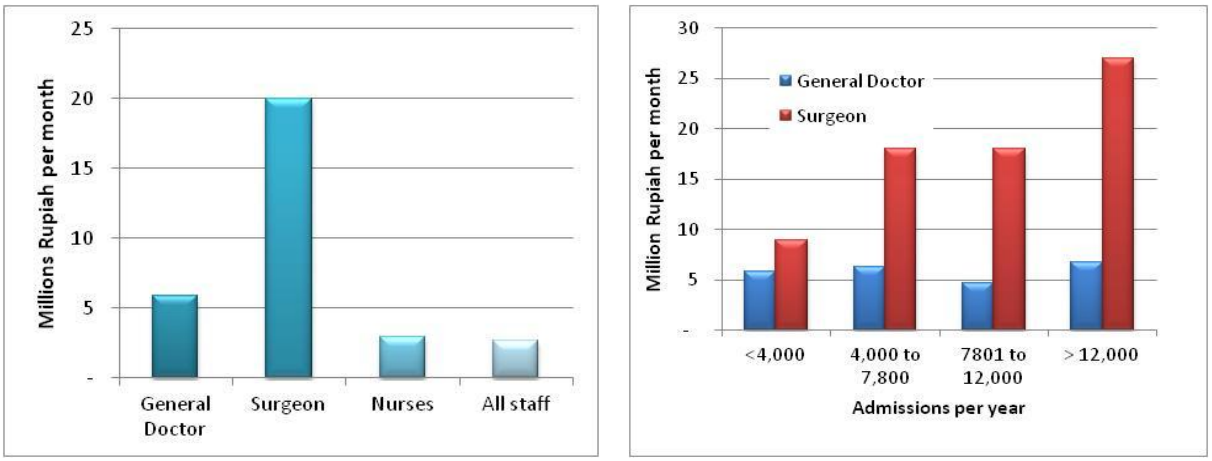


Figure 21: Staff income and composition by cadre

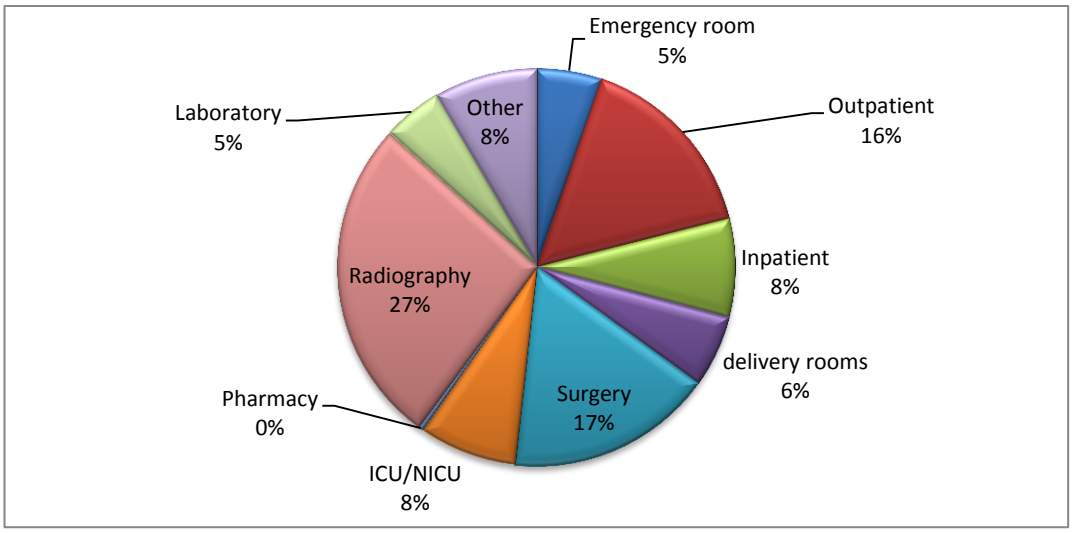


A sub-survey of 639 doctors was undertaken to understand how doctors allocate their time between cost-centres and how much income they receive from private individual medical practice. The majority, 60% of full time and 80% of part time, report undertaking private practice separately from their main employment. Full time doctors report around 13 hours of private practice per week while part time doctors report 18 hours. More than 50% of all doctors report receiving Rp.10 million or more from their private practices each month suggesting that this income dominates earnings from working for a public or private organisation. It should be noted, however, that the ability to earn income from private practice is often strongly associated with their position at a medical facility.

The valuation of the annual costs of medical and other equipment is Rp. 2.75 billion per year. Much of the cost is shared between three departments; radiography (27%), surgery (17%) and outpatient (16%) (Figure 22). The large share for radiography reflects the capital intensive nature of this sophisticated department. The cost of equipment changes sharply with class of hospital: in Class A

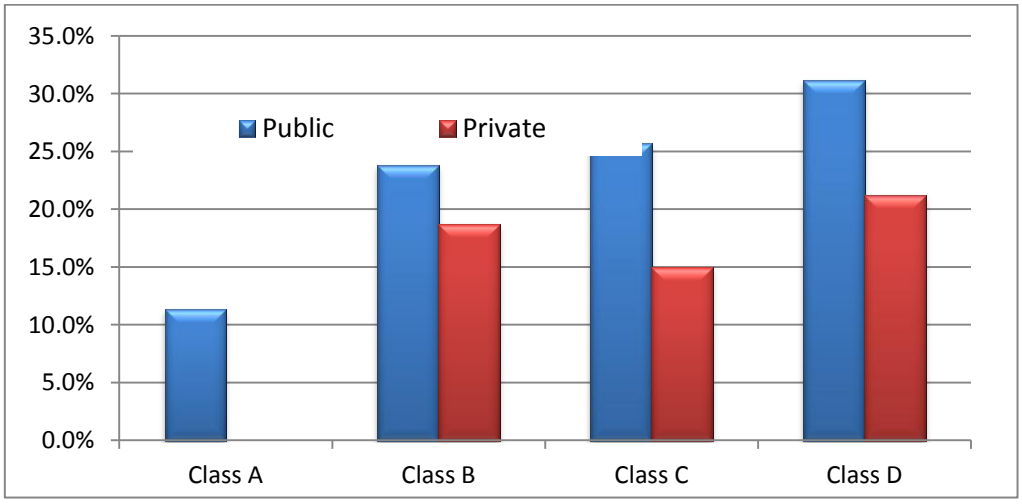
hospitals the cost is more than Rp. 6.2 billion while in class D hospitals the cost is only Rp. 1.8 billion. Class D hospitals have a rather different distribution of cost with only 6% in the much less sophisticated radiography departments.

Figure 22: Allocation of annual equipment costs by cost centre



A second measure of equipment cost was constructed by writing off assets (zero valuation) where their age exceeded their expected useful life. This provides an accounting valuation of costs and also an indicator of the relative age of equipment across the country. It should be noted that this information was not available for all equipment items but was provided for most of the larger items (accounting for around 50% of the value of all items) and extrapolated to the total value of items. This valuation suggests that around 25% of items have already exceeded their useful life (Figure 23). For class A hospitals this value is around 12% but increases to more than 30% for lower class hospitals.

Figure 23: Estimated proportion of equipment value exceeding useful life (%)



Unit costs of outpatient and inpatient care

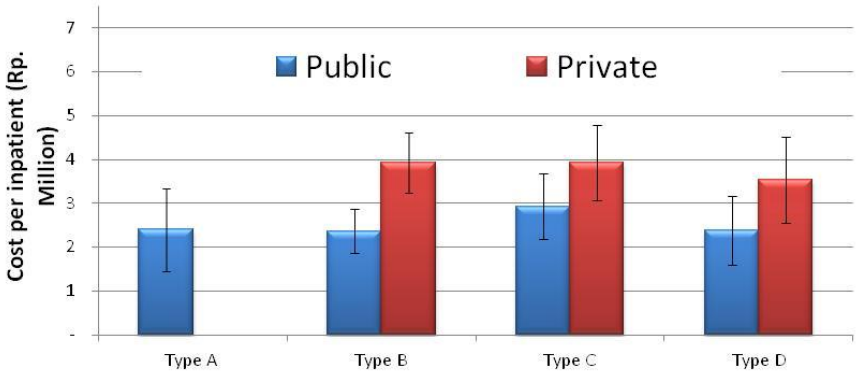
Lowest costs for outpatients and inpatients are found in Yogyakarta while the highest costs are found in Kalimantan Selatan (Annex 4: Unit costs of hospital services by province and group). Cost data, particularly in hospitals, tends to be skewed and median costs are below the means. This is particularly the case with emergency inpatient, where the median total is less than half the mean. This demonstrates how sensitive costs are to overall workload since the hospitals with high costs are largely those with low throughput of patients. It is also noticeable that the median outpatient costs in group three are the lowest across the country. This accounted for by a small group of Class D hospitals with low workloads and high unit costs that inflate the group mean.

Table 22: Unit costs for final cost-centres by group

	Outpatient	Emergency outpatient	Inpatient admission	Inpatient day
Mean unit costs				
Capital and recurrent costs				
Group 1	256,847	273,444	3,278,290	888,636
Group 2	296,771	456,139	3,297,613	951,340
Group 3	648,375	1,898,843	3,707,288	1,067,598
Group 4	508,831	2,174,855	3,793,779	1,080,483
Average	415,453	1,303,493	3,544,193	1,011,943
Recurrent costs				
Group 1	224,967	228,970	2,880,982	780,232
Group 2	271,701	402,954	3,013,826	869,168
Group 3	583,373	1,703,502	3,289,126	948,509
Group 4	441,248	1,932,001	3,342,479	950,046
Average	368,174	1,157,437	3,168,277	903,885
Median unit costs				
Capital and recurrent costs				
Group 1	162,288	260,475	3,243,621	888,466
Group 2	200,023	379,754	2,808,722	754,041
Group 3	152,742	267,181	2,310,687	756,029
Group 4	299,377	603,218	3,201,342	872,017
Average	235,271	455,832	2,965,189	814,858
Recurrent costs				
Group 1	108,799	219,570	2,630,313	737,554
Group 2	182,452	312,861	2,412,579	704,114
Group 3	98,967	265,785	1,809,829	594,795
Group 4	276,073	533,281	2,952,595	805,710
Average	209,268	395,476	2,605,864	740,263

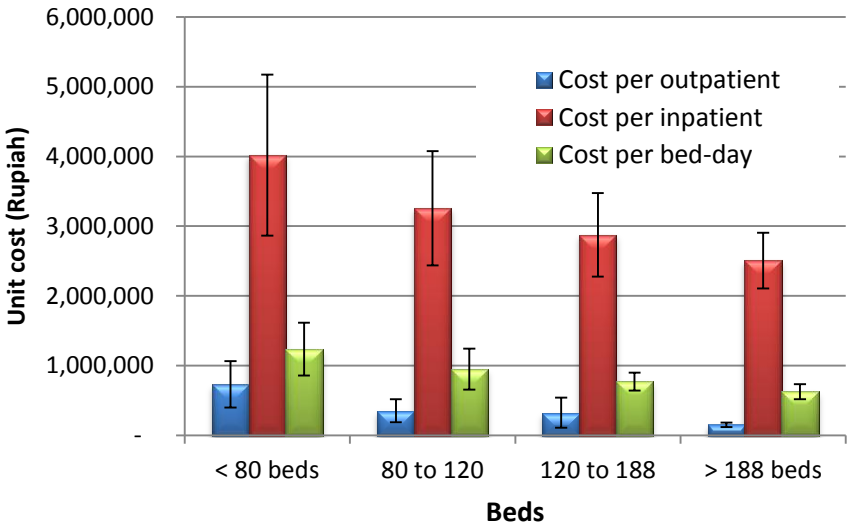
Across the public sector, there is no significant difference in the cost per inpatient by class of hospital despite the generally greater case complexity in higher class hospitals (Figure 24). This is supported by the multivariate analysis (see Annex 5: Multivariate analysis (preliminary results). Unit costs in lower level private hospitals do fall for smaller, less sophisticated hospitals but, as with cost per bed, the confidence intervals overlap.

Figure 24: Cost per inpatient by hospital ownership and class



There is an association between the number of hospital's bed and the unit cost of inpatients and to a lesser extent the cost of outpatients (Figure 25). Relatively small hospitals (less than 80 beds) have higher costs than those over 180 beds. This is in line with international experience which suggests that the optimum size of a hospital to ensure that economies of scale are fully exploited is between 200 and 400 beds (Posnett, 2002)[7]. The size effect is likely to work in a number of ways. Larger facilities permit expensive central facilities such as laboratories and imaging to be shared between a larger number of patients and beds. This in turns permits greater investment in the services while still maintaining relatively low average cost. Better facilities also tend to attract more patients who bypass lower level facilities. This in turn makes it harder for smaller facilities to compete, their throughput falls, unit costs rise and they have less resources to invest in the facility in order to attract patients.

Figure 25: Unit costs by size of hospital



The finding that class makes little difference to unit costs is at odds with some other studies. In fact there is some evidence that the level of facility is associated with unit cost but only if other factors are held constant. Across facilities with a similar number of admissions, for example, class C/D hospitals

[7] Conversely, there are no strong economic advantages in having hospitals much bigger that 400 beds except possibly for super specialist teaching hospitals.

have lower unit costs than B or A (Table 23). This is perhaps because their case mix is less complex or possibly because their facilities are less sophisticated and their staff less well paid.

Table 23: Variation in cost per admission by class and admissions

Class	Number of admissions per year			
	<4,000	4,000 to 7,800	7801 to 12,000	> 12,000
Class A				2,897,868[1]
Class B		4,797,919	3,678,260	2,557,641
Class C	6,709,956	3,743,326	2,586,545	2,650,701
Class D	4,728,359	2,357,884	1,971,299	

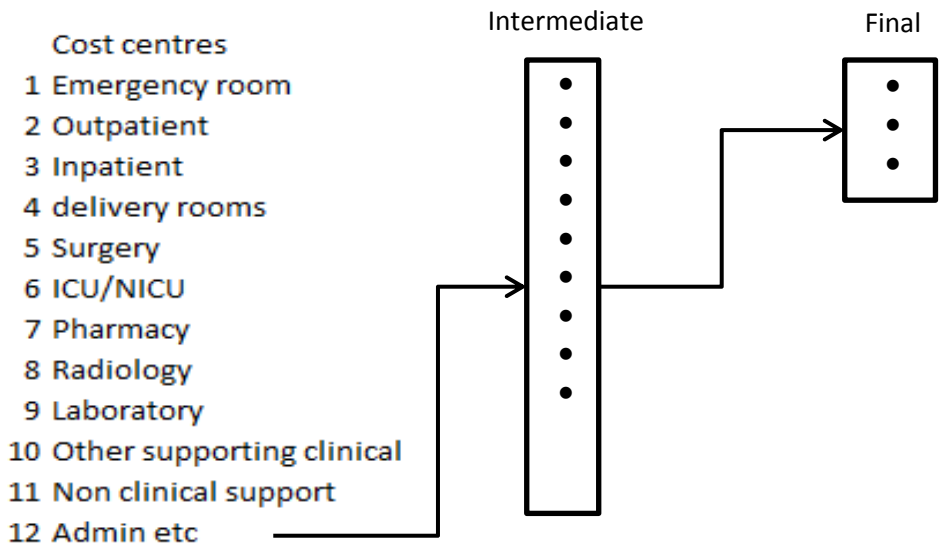
[1] only 2 observations

Intermediate cost components

The allocation of costs to final cost-centres produces unit costs of broad categories of output described in the last section. These provide an overall guide to the cost of services. They are, however, unadjusted for case mix and so cannot be used on their own as a basis for reimbursing facilities. Case based payment is becoming the accepted standard for payment and indeed measurement of a hospital's workload in most OECD countries and now increasingly in middle income countries. Indonesia is developing a system of case based categories for payment. These systems typically require detailed information on patients across a number of diagnostic and resource categories together with costs of intermediate outputs. The current study provides information that enable the computation of intermediate costs that can be combined with patient data to compute the cost of individual payments.

Intermediate costs are the costs of the intermediate outputs of a facility; those activities, such as minutes of operating time, day on the ward and minute of doctor time, that are used in turn as an input into the complete treatment of a patient. The step down costing methodology adopted in the study computed intermediate costs of departments as an interim stage in obtaining final costs (). These can be used to derive intermediate unit costs.

Figure 26: Step down costing schematic



Intermediate costs reflect all those associated with the intermediate output excluding the costs of medicines and medical supplies and the time of a doctor. So, therefore, the cost of an image includes the amortised cost of the imaging equipment and staff cost of the radiographer but not the x-ray film or other supplies. The cost of a drugs script is the administrative cost including pharmacy equipment and staff but not the medicines. The cost per minute of doctor time is also derived. This is based on a survey of working practices over a typical week and reflects the time reported by doctors undertaking clinical duties in the hospital excluding time on-call and attending to administrative duties such as meetings and training. Full time doctors reported a median 3.5 hours per day undertaking normal clinical duties across various cost-centres (inter-quartile range 1.8 to 6 hours).

As with final unit costs, the intermediate costs are dependent on a number of variables particularly size of hospital and admission rate. To illustrate the effect of these variables we compute intermediate costs for two types of hospital; a small hospital (less than 80 beds) with less than 4,000 admissions per year (implying a bed occupancy of 50% or less) and a size efficient hospital of more than 180 beds with high throughput, 12,000 admissions or more (at least 60% bed occupancy). Intermediate costs are estimated to be lower in the size efficient hospital for most of the outputs, in some cases 50% or less the cost in the small hospitals (Table 24). The exception is the cost per specialist time, particularly the surgeon. The intuition here is that specialists in larger hospitals will have a higher workload and so receive more incentives.

Table 24: Intermediate cost components

	Small hospital	Size efficient hospital
Emergency visit	88,344	44,213
Outpatient visit	23,028	13,045
Inpatient day	197,106	79,707
Minute in operating theatre (overhead cost)	16,470	6,284
Day in intensive care	521,370	433,871
Drug script (not drugs)	7,600	2,401
Radiography (test not consumables)	170,313	52,018
Lab tests (not consumables)	8,992	2,037
GP cost per minute	2,064	1,524
Surgeon's cost per minute	3,884	5,198
Anaesthetist's cost per minute	2,160	3,075

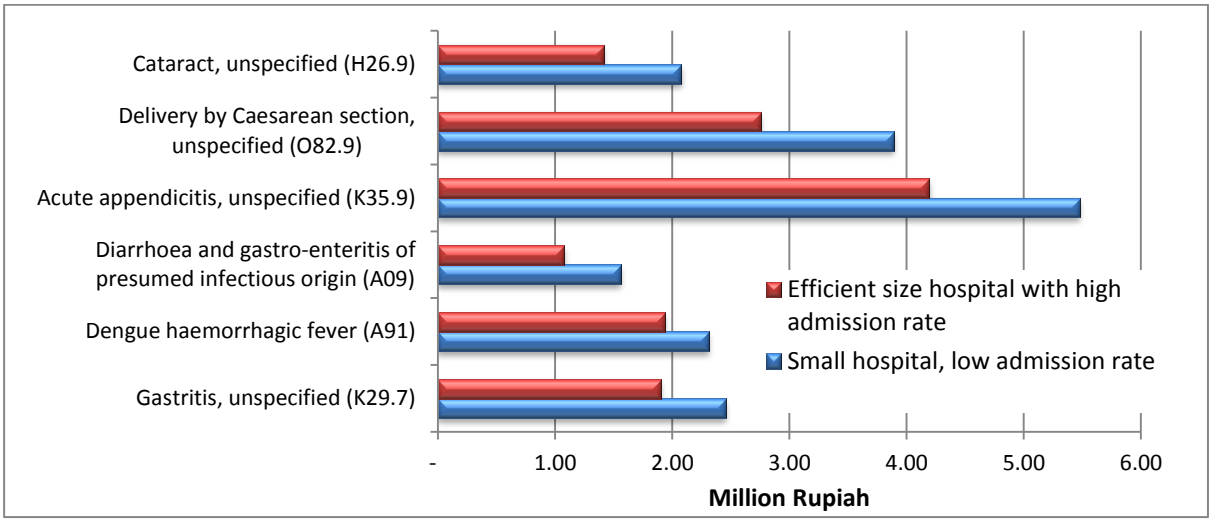
Note: These costs are the median across each sub-sample

Using these intermediate cost components, the cost per case for a particular diagnosis or condition can be derived as:

Cost per case =
Inpatient days x cost per day +
ICU *days* x cost per ICU day +
Surgical minutes x cost per OT minute +
Doctor time (surgery & ward) x doctor cost per minute +
Drugs costs + medical supplies + diagnostic procedures

The cost of drugs, medical supplies and diagnostic procedures are obtained from patient records or special discharged notes as are the units such as length of stay and operations. Although case mix was not a central focus of the study, a small discharge survey was undertaken in around 70 hospitals collecting information on a range of common conditions. This permitted the computation of case costs across a number of conditions. The costing demonstrates the differences in costs estimated in a small compared to a size efficient hospital. Across three medical conditions the average difference in cost between efficiency and small hospital was 23% and for three surgical conditions 28% (Figure 27).

Figure 27: Cost per case (selected conditions) for small and efficient size hospital



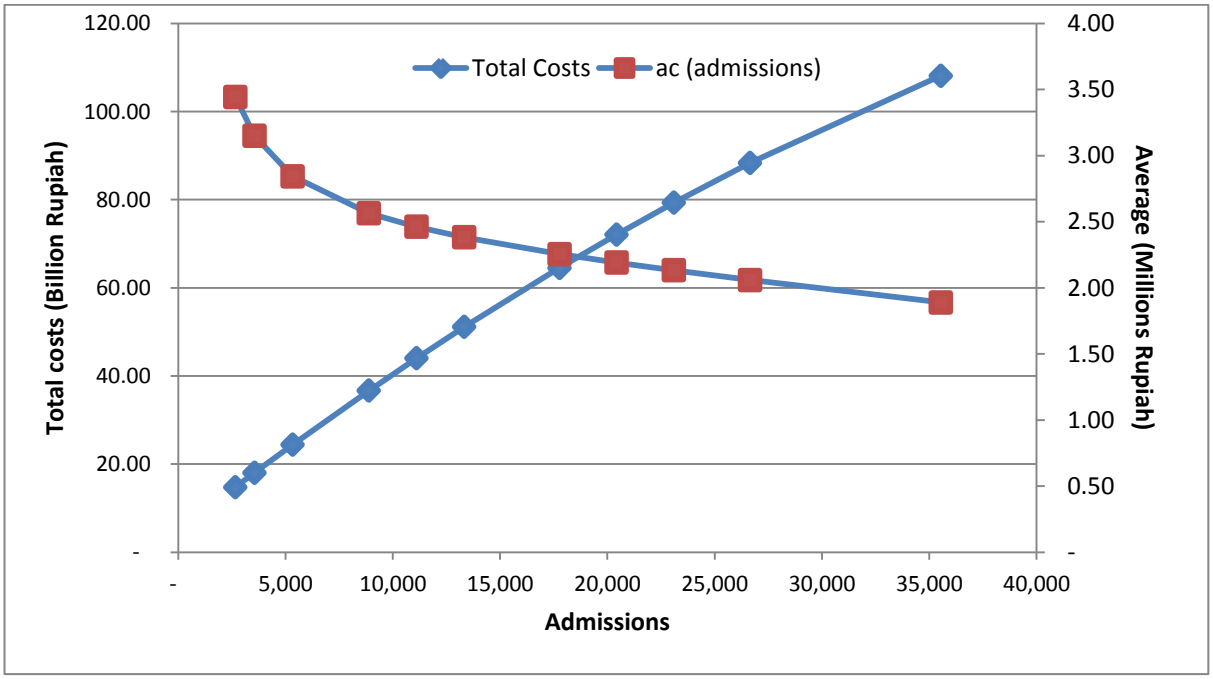
Summary: Hospital Costing

The analysis suggests that three factors are most important in determining unit costs in hospitals: size of hospital (using bed numbers as a proxy), admissions and ownership. The effect of bed numbers and admissions are interconnected since larger hospitals have greater scope to improve productivity by sharing good quality central facilities across a larger number of beds and patients. The bi-variate analysis consistently shows that non-government hospitals are more costly than government hospitals and this is confirmed by the multivariate analysis which controls for the effect of workload. There is relatively little variation in costs between provincial groupings for inpatient care although the unit costs of outpatient care, general and emergency is substantially lower in groups one and two. Relatively low unit costs are possible in lower class hospitals (C/D) provided that efforts are taken to increase utilisation rates. The study found particularly high variation in the costs of class D hospitals. For outpatients, for example, the median cost for class D was only 28% of the mean for all class D facilities suggesting highly skewed data with the hospitals with higher unit costs having very low utilisation.

Regression analysis was used to model the effect of utilisation of facilities on unit costs. As with the puskesmas data, the simulation was undertaken to look at the effect of expanding all outputs – inpatient admissions, outpatients and emergency outpatients on total and average costs. The modelling demonstrates the impact of increasing utilisation while holding other factors constant. For example, a median public hospital in the sample provides care for around 8,800 inpatient admissions, 53,000 general outpatient visits a year and 7,700 emergency outpatients. If the rates of outpatient and inpatient admissions are doubled (100% increase), total costs are estimated to rise by 76% as

average costs of each service decline (Figure 28 and details in Annex 5: Multivariate analysis (preliminary results)).

Figure 28: Modelled effect on total and average costs as hospital activity increases



Increasing utilisation of smaller hospitals may require improvements in the quality of the service, deployment of staff and changes in referral patterns and access. Consideration of these factors will be vital in preparing the supply side for universal coverage.

The finding that smaller hospitals often have high unit costs despite in most cases having a simpler case mix, raises important policy questions. It would be inequitable to pursue a general policy of reducing the number of small hospitals since this is likely to make hospital services even more inaccessible for populations in sparsely populated and hard to reach areas. Nevertheless, it does raise the challenge of how best to provide accessible care to the population. International evidence and this survey show that low costs can be obtained in moderately sized facilities (150 beds or more). Hospitals of this size are likely to be best positioned to provide specialist care at district level for emerging non communicable diseases that will form the majority of the disease burden in the future. At the same time technologies are being developed to deal with non-communicable diseases at the primary care level and are increasingly advocated by public health professionals and international agencies (Walley et al., 2012). There is also likely to be a need for an intermediate level of inpatient care between primary and sophisticated acute care for basic inpatient services such as delivery, monitoring of potentially severe conditions (such as childhood acute respiratory infections) and possibly providing largely nursing care for patients discharged from acute facilities. The precise mix of small hospitals and beds in puskesmas requires further discussion in the context of the changes in admission rates and referral patterns that are expected to arise from measures to increase coverage. Data from this study can be used to provide information on the financial implications of alternative reform scenarios.

Section 4. Next steps

The report summarises the main descriptive findings from a large study. The dataset contains a large number of variables on primary and secondary care in Indonesia that can be used to inform a wide selection of policy questions including the development of health sector budgets, development of base rates for provider payment systems and geographic resource allocation.

A number of further analyses are planned:

- Combining study data with data or information from other surveys
- Using available data from existing dataset
- Combining result from phase 1 and phase 2 of the Costing Study

1. Adjusting for case Mix

The incorporation of case-mix data into the costing analysis would facilitate the further exploration of differences in costs and productivity and also assist in the use of the data for provider payment purposes. Some case-based data were collected in the current study on a small number of conditions.

A more extensive analysis of case-mix should be possible by linking the data to the large case-mix database being developed by the Ministry of Health from insurance data. This should permit the adjustment of costs and outcomes such as death rates.

2. Further econometric modelling

The econometric modelling presented in this report is a first attempt to model the costs of care. A more in-depth analysis could be undertaken by using more complex functional forms. Further analysis of efficiency could be undertaken using stochastic frontier and data envelopment analysis to provide an understanding of the determinants of productivity.

3. Cost projections

Earlier analysis undertaken during phase one of the project developed normative cost estimates of the costs of essential services. The new data collected on actual costs can be used to update the projections of resource requirements to provide priority services to different parts of the country.

The data were cleaned and analysed in STATA. Data files with cleaned data are available by module. Two “do- files” were written to convert the module specific files to large summary flat files with all the main data variables for hospitals and puskesmas. The data can easily be converted to other formats such as SPSS and excel.

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Annex 1: Variables used for provincial cluster analysis

Group of variables	Variables	Source of data
Demographic variables	Population size	BPS, 2008
	Population density	BPS, 2008
Disease	Malnutrition (Wt/Age)	Riskesdas, 2007
	Malnutrition (Ht/Age)	Riskesdas, 2008
	Malnutrition (Wt/Ht)	Riskesdas, 2009
	Malaria prevalence	Riskesdas, 2010
	Pneumonia prevalence	Riskesdas, 2011
	TB prevalence	Riskesdas, 2012
	Diarrhoea prevalence (Riskesdas)	Riskesdas, 2013
	Diarrhoea prevalence	Riskesdas, 2014
	Prevalensi Diare	IDHS, 2007
	Infant Mortality Rate	BPS, 2008
Access and services	Full immunization	Riskesdas, 2007
	Neonatal visit	Riskesdas, 2008
	Distance to health facility	Riskesdas, 2007
	Travel time to health facility	Riskesdas, 2008
	Distance to community health activities	Riskesdas, 2009
	Travel time to community health activities	Riskesdas, 2010
	Deliveries at health facility	IDHS, 2007
	Deliveries by health workers	IDHS, 2008
	Number of Class A hospital	MoH-yanmed, 2006
	Number of Class B hospital	MoH-yanmed, 2007
	Number of Class Chospital	MoH-yanmed, 2008
	Number of Class D hospital	MoH-yanmed, 2009
	Access 1 (new variable): Ratio of hospital total number to population size	
	Access 2 (new variable): Ratio of C&D hospital number to population size	
Financial report	Fiscal Capacity	Min.of Finance, 2009
	General block grant (DAU) province per capita	Min.of Finance, 2009
	Human Development Index	Bappenas, 2007

Annex 2: Cluster analysis of districts by provincial strata

Group/Cluster	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Provincial Group 1 **14 Districts**	1. Sleman 2. Bantul 3. Gunung Kidul 4. Buleleng	1. Denpasar 2. Karang Asem 3. Gianyar 4. Kota Yogyakarta 5. Kulonprogo 6. Tabanan	1. Bangli 2. Klungkung 3. Badung 4. Jembrana	
Provincial Group 2 **75 District**	1. Jember 2. Malang 3. Kota Surabaya 4. Banyuwangi 5. Sidoarjo 6. Kediri	1. Lamongan 2. Bojonegoro 3. Nganjuk 4. \Jombang 5. Pasuruan 6. Kota Padang 7. Blitar 8. Tulung Agung 9. Gresik 10. Tuban 11. Probolinggo 12. Lumajang 13. Sumenep 14. Ngawi 15. Ponorogo 16. Magetan 17. Kota Malang 18. Bangkalan 19. Pamekasan 20. Bondowoso 21. Madiun 22. Trenggalek 23. Agam 24. Padang Pariaman 25. Kota Kediri 26. Pesisir Selatan 27. Situbondo 28. Sampang 29. Pacitan 30. Tanah Datar 31. Solok 32. Lima Puluh Koto 33. Indragiri Ilir	1. Kota Dumai 2. Rokan Hilir 3. Bengkalis 4. Siak 5. Pasaman Barat 6. Pasaman 7. Kota Pekanbaru 8. Kota Solok 9. Kota Sawah lunto 10. Kota Padang Panjang 11. Bangka Tengah 12. Kota Pariaman 13. Kota Blitar 14. Pelalawan 15. Kampar 16. Solok Selatan 17. Kota Batu 18. Belitung Timur 19. Bangka Selatan 20. Bangka Barat 21. Kota Pasuruan 22. Kota Payakumbuh 23. Kota Mojokerto 24. Rokan Hulu 25. Kota Bukittinggi 26. Pangkal Pinang 27. Belitung 28. Dharmas Raya 29. Kota	

Group/Cluster	Cluster 1	Cluster 2	Cluster 3	Cluster 4
	7.	34.	30. Probolinggo 31. Indragiri Hulu 32. Kota Madiun 33. Kuantan Singingi 34. Kep. Mentawai 35. Sawah Lunto 36. Sijunjung 37. Bangka	
Provincial Group 3 **26 Dsitricts**	1. Belu 2. Timor Tengah Selatan 3. Kupang	1. Alor 2. Timor tengah Utara	1. Sikka 2. Kota upang 3. Ende 4. Flores Timur 5. Mamuju 6. Polewali Mandar 7. Gorontalo 8. Sumba Timur	1. Mamuju Utara 2. Boalemo 3. Rote Ndao 4. Kota Gorontalo 5. Majene 6. Manggarai Barat 7. Pahuwato 8. Ngada 9. Mamasa 10. Bone Bolango 11. Manggarai 12. Lembata 13. Sumba Barat
Provincial Group 4 **110 Districts**	1. Pak-pak Bharat 2. Balangan 3. Humbang Hasundutan 4. Buol 5. Tana Toraja 6. Tojo Una 7. Enrekang 8. Nias Selatan 9. Barito Timur 10. Kota Palopo 11. Labuan Batu 12. Hulu Sungai Utara 13. Barru 14. Selayar 15. Tanah Bumbu 16. Banggai Kepulauan 17. Lamandau 18. Sukamara 19. Tabalong 20. Kota Padang Sidempuan 21. Tapin 22. Samosir	1. Kab. Karawang 2. Kab. Indramayu 3. Langkat 4. Kab. Subang 5. Kab Bekasi 6. Simalungun 7. Kota Bekasi 8. Kab. Sumedang 9. Kota Makassar 10. Kab. Majalengka 11. Kab. Kuningan	1. Deli Serdang 2. Kab. Tasikmalaya 3. Kab. Cirebon 4. Kab. Cianjur 5. Kab. Ciamis 6. Kota Medan 7. Kab. Sukabumi	1. Kota Bandung 2. Kab. Garut 3. Kab. Bandung 4. Kab. Bogor

Group/Cluster	Cluster 1	Cluster 2	Cluster 3	Cluster 4
	23. Kota Pare-pare 24. Kota Tanjung Balai 25. Luwu Timur 26. Bantaeng 27. Kota Tebing Tinggi 28. Banjar baru 29. Kota Sibolga 30. Kota Banjar 31. Dairi 32. Luwu Utara 33. Soppeng 34. Maros 35. Pinrang 36. Seruyan 37. Palangkaraya 38. Pangkajene Kepulauan 39. Barito Selatan 40. Luwu 41. Kota Cimahi 42. Gunung Mas 43. Sidendreng rappang 44. Pematang Siantar 45. Toli-toli 46. Barito Utara 47. Pulang Pisau			

Annex 3: Unit costs of puskesmas services by province and group

Capital and recurrent

Group/province	General outpatients	Mother & Child	Dentistry	Inpatient admissions	Average beds
Group 1					
Bali	61,761	232,168	253,444	3,873,168	2.2
Yogyakarta	54,265	77,601	177,967	1,246,835	5.8
Total	58,301	160,829	218,608	2,876,973	3.9
Group 2					
Bangka Belitung	78,936	121,195	263,822	1,596,039	2.5
Jawa Timur	48,280	58,518	147,877	895,390	6.3
Riau	115,494	120,482	604,026	2,132,426	0.8
Sumatra Barat	79,600	91,998	212,645	1,322,326	6.3
Total	71,320	85,550	237,948	1,281,463	5.0
Group 3					
Nusa Tenggara	130,305	111,024	300,138	1,532,556	3.9
Sulawesi Barat	69,720	107,905	296,684	935,767	
Total	111,503	110,056	298,987	1,392,135	3.9
Group 4					
Gorontalo	69,850	165,417	839,279	2,227,684	5.6
Jawa Barat	95,952	94,540	202,475	1,314,518	3.3
Kalimantan	76,543	75,259	226,233	1,112,818	-
Kalimantan	371,973	230,923	1,177,766	2,438,561	3.3
Sulawesi Selatan	74,768	101,038	235,906	933,491	6.4
Sulawesi Tengah	100,937	128,870	391,064	1,695,537	4.9
Sumatra Utara	40,874	111,664	235,976	2,516,984	5.0
Total	104,953	129,550	477,801	1,647,271	4.1
Weighted average	88,240	112,283	344,170	1,569,986	4.4

Recurrent only

Group/province	General outpatients	Mother & Child	Dentistry	Inpatient admissions	Average beds
Group 1					
Bali	39,526	184,531	211,762	3,342,028	2.2
Yogyakarta	41,794	66,098	149,365	1,043,991	5.8
Total	40,573	129,870	182,964	2,470,359	3.9
Group 2					
Bangka Belitung	60,707	107,481	215,716	1,506,333	2.5
Jawa Timur	30,911	45,843	103,004	618,538	6.3
Riau	99,863	115,631	415,385	2,131,067	0.8
Sumatra Barat	59,677	80,482	161,653	1,182,415	6.3
Total	53,089	74,090	173,899	1,110,791	5
Group 3					
Nusa Tenggara Timur	85,740	93,462	212,536	1,329,415	3.9
Sulawesi Barat	64,546	100,400	201,241	845,059	
Total	79,163	95,615	208,771	1,215,449	3.9
Group 4					
Gorontalo	56,920	148,656	664,370	1,916,355	5.6
Jawa Barat	51,569	81,057	170,852	1,040,066	3.3
Kalimantan Selatan	51,582	63,925	163,788	1,111,960	-
Kalimantan Tengah	344,889	217,587	772,341	2,309,656	3.3
Sulawesi Selatan	71,462	97,703	208,194	910,319	6.4
Sulawesi Tengah	89,063	112,415	256,307	1,648,416	4.9
Sumatra Utara	40,051	99,533	230,713	2,293,558	5
Total	86,688	117,245	367,369	1,504,905	4.1
Weighted average	**68,776**	**98,698**	**260,197**	**1,392,705**	**4.4**

Annex 4: Unit costs of hospital services by province and group

Capital and recurrent

Group\province	Outpatient	Emergency outpatient	Inpatient admission	Inpatient day
Group One				
Bali	403,275	250,285	3,587,947	1,002,607
Yogyakarta	142,929	284,256	3,066,991	810,866
Total	256,847	273,444	3,278,290	888,636
Group Two				
Bangka Belitung	211,712	360,736	2,769,776	993,624
Jawa Timur	375,783	478,742	2,888,630	861,124
Riau	284,035	423,111	4,278,315	1,119,362
Sumatra Barat	211,712	360,736	2,769,776	993,624
Total	296,771	456,139	3,297,613	951,340
Group Three				
Nusa Tenggara Timur	677,783	1,569,985	3,694,118	1,097,469
Sulawesi Barat	401,354	3,674,679	3,817,913	816,679
Total	648,375	1,898,843	3,707,288	1,067,598
Group Four				
Gorontalo	653,901	4,247,822	4,285,529	1,162,218
Jawa Barat	372,845	3,220,880	3,281,496	1,028,657
Kalimantan Selatan	1,247,794	1,309,733	6,468,389	1,936,149
Kalimantan Tengah	430,101	676,216	4,492,361	1,315,262
Sulawesi Selatan	435,037	600,634	3,399,195	814,728
Sulawesi Tengah	415,984	3,163,793	2,892,510	733,976
Sumatra Utara	395,889	1,343,179	3,555,052	934,649
Total	508,831	2,174,855	3,793,779	1,080,483
Weighted average	415,453	1,303,493	3,544,193	1,011,943

Recurrent only

Group\province	Outpatient	Emergency outpatient	Inpatient admission	Inpatient day
Group One				
Bali	363,895	231,408	3,291,937	918,081
Yogyakarta	116,885	227,832	2,600,562	686,168
Total	224,967	228,970	2,880,982	780,232
Group Two				
Bangka Belitung	190,174	327,851	2,618,587	937,249
Jawa Timur	352,358	436,636	2,589,113	773,941
Riau	241,709	357,787	3,865,988	1,006,850
Sumatra Barat	168,363	398,164	3,551,165	949,566
Total	271,701	402,954	3,013,826	869,168
Group Three				
Nusa Tenggara Timur	611,193	1,502,200	3,273,433	974,743
Sulawesi Barat	349,690	2,790,533	3,420,952	728,146
Total	583,373	1,703,502	3,289,126	948,509
Group Four				
Gorontalo	470,634	3,685,562	3,464,992	922,997
Jawa Barat	311,332	2,878,076	2,915,707	906,078
Kalimantan Selatan	1,179,332	1,133,167	5,962,844	1,778,523
Kalimantan Tengah	390,689	626,067	4,070,399	1,188,541
Sulawesi Selatan	368,113	495,867	2,939,924	708,527
Sulawesi Tengah	366,616	2,966,967	2,666,668	676,047
Sumatra Utara	308,392	1,123,701	2,833,390	743,608
Total	441,248	1,932,001	3,342,479	950,046
Weighted average	**368,174**	**1,157,437**	**3,168,277**	**903,885**

Annex 5: Multivariate analysis (preliminary results)

Multivariate analysis was undertaken in order to provide estimates of the change in total costs of providing puskesmas and network primary care services as utilisation rates change but holding other factors constant. Following Mayo a functional form was specified that regresses total costs (dependent variable) on the main outputs (general outpatients, MCH outpatients, dental outpatients and admissions) and their interaction and squared terms (Mayo, 1984). This provides flexibility for economies and diseconomies of scope (provision of one service may reduce or increase the cost of providing other services) and the possibility of economies and diseconomies of scale. Specific fixed constants for inpatients and dentistry were also included to allow, for example, a change in fixed costs as a result of providing or not providing these services (all puskesmas provide MCH and general outpatient services) so the fixed costs are captured in the constant). The number of pustu in the network was included as was a dummy variable for whether the sub-district is classified as urban or rural. Variables for other network facilities were included in an early specification but these provided no improvement in the explanatory power.

Ordinary Least Squares (OLS) regression was estimated initially and tested for omitted variable bias (Ramsey RESET test) and heteroscedasticity (Breusch Pagan). The RESET test was not significant (Prob > F = 0.19) but the Breusch Pagan test was not rejected indicating that residuals were heteroscedastic. Robust standard errors were specified to adjust for this variation.

In addition to the regression, a stochastic frontier was also estimated. This estimates a cost function frontier for different levels of output for the most efficient facilities. A likelihood ratio test rejected the null hypothesis that the estimates were no different from the robust OLS estimates suggesting that there is a genuine difference in the frontier and the regression cost function.

Estimates from the regression and frontier can be used to project the costs of services as utilisation changes (estimates in Table 25). This can be done either by varying one output and holding others constant or varying all outputs in some fixed proportion. The latter approach was taken to provide an idea of the economies or diseconomies of scale of primary care production.

Simulating an impact on costs requires establishing the profile of a typical puskesmas. A rural sub-district was taken as the example with an average of 3.7 pustu and a population of round 21,500. The puskesmas was assumed to have beds and deliver all four main outputs. Average utilisation of 800 general, 200 MCH visits per capita, 46 dental visits and 20 puskesmas admissions per 1,000 population was assumed initially which equates to about 1.06 visits per capita per year (Table 26).

Table 25: Regression and frontier estimates for puskesmas total costs

	Coefficient.	t		Coefficient	z	
Robust regression				**Frontier Model**		
General outpatients	-15396.92	-1.01		-19080.04	- 1.65	*
MCH outpatients	-26269.87	-0.58		-34809.74	- 0.90	*
Dental Outpatients	382771.7	3.16	*	358084.7	3.26	*
Inpatients	573613.5	2.06	*	664090.5	2.17	*
General-MCH interaction	1.593722	0.63		0.666178	0.40	
General-dental interaction	-6.627926	-1.48		-6.627022	- 1.64	*
General-inpatient interaction	-37.8033	-2.67	*	-35.96492	- 3.04	*
MCH-Dental interaction	-23.91098	-1.66		-14.88286	- 1.36	*
MCH-inpatient interaction	-66.55604	-1.84		-57.31319	- 2.68	*
Dental-Inpatient interaction	210.5446	1.91		252.0175	2.73	*
General Squared	0.8476672	2.32	*	0.9747294	3.43	
MCH squared	5.124966	1.98		4.932693	2.08	*
Dental squared	2	0.13		-1.914732	- 0.10	
Inpatient squared	422	1.42		227.384	1.05	*
Dental fixed	- 34,300,000	-0.13		1.78E+07	0.09	*
Inpatient fixed	267,000,000	2.49	*	2.12E+08	1.85	*
Number of pustu	50,300,000	2.51	*	4.25E+07	2.34	*
Urban	237,000,000	1.75		2.44E+08	2.17	*
Constant	1,100,000,000	3.55	*	6.20E+08	3.16	*
Adjusted R square	0.57					

Note: * = significant at least at 5% level.

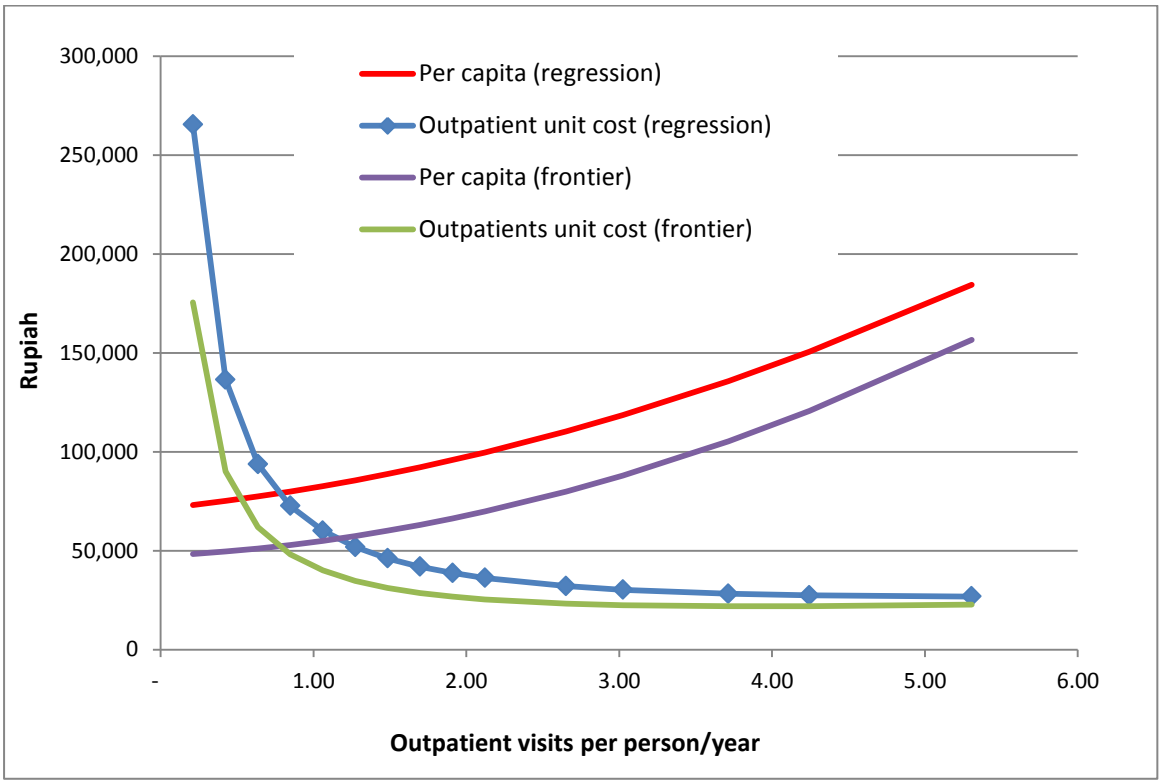
Table 26: Simulations using regression model

	Regression				Frontier				
Outpatient visits per capita	**Total Costs - (billion)**	**Per capita (Rp.)**	**Outpatient unit cost (Rp.)**	**% Change in Costs**	**Total Costs - (billion)**	**Per capita (Rp.)**	**Outpatient unit cost (Rp.)**	**% Change in Costs**	**Difference in frontier and regression costs**
0.21	1.57	73,037	265,448	-12%	1.04	48,275	175,453	-12%	34%
0.42	1.61	75,101	136,476	-9%	1.06	49,540	90,025	-10%	34%
0.64	1.66	77,390	93,756	-6%	1.10	51,087	61,892	-7%	34%
0.85	1.72	79,903	72,601	-3%	1.14	52,917	48,082	-4%	34%
1.06*	1.77	82,640	60,070	0%	1.18	55,030	40,001	0%	33%
1.27	1.84	85,601	51,852	4%	1.23	57,425	34,785	4%	33%
1.49	1.91	88,787	46,099	7%	1.29	60,102	31,206	9%	32%
1.70	1.98	92,197	41,886	12%	1.35	63,062	28,649	15%	32%
1.91	2.06	95,832	38,700	16%	1.42	66,304	26,775	20%	31%
2.12	2.14	99,690	36,232	21%	1.50	69,829	25,379	27%	30%
2.65	2.37	110,318	32,076	33%	1.72	79,876	23,224	45%	28%
3.02	2.55	118,591	30,247	44%	1.89	87,960	22,434	60%	26%
3.71	2.92	135,778	28,199	64%	2.26	105,267	21,862	91%	22%
4.24	3.23	150,611	27,369	82%	2.59	120,610	21,918	119%	20%
5.31	3.96	184,482	26,820	123%	3.36	156,592	22,765	185%	15%

*(Baseline average)

The scenarios reinforce the bi-variate analysis in the main report. As the number of visits per capita increases costs rise but not as fast as the changes in output (at least initially). A doubling in utilisation is estimated to lead to a cost increase of around 33% for the average facility (regression estimates). The cost increase is slightly higher (41%) for the frontier model because these facilities are already operating at a higher level of efficiency and are likely to have less spare capacity. Up to 5 visits per capita the models suggest that scale economies are still possible although beyond this point costs escalate more quickly as further capacity must be developed to accommodate more patients. The frontier model estimates the costs for the most efficient facilities for each level of utilisation. This suggests that the most efficient facilities at each level of output are operating at costs that are around 33% below the regression estimates at current levels of utilisation (Figure 29).

Figure 29: Per capita and unit costs (general outpatients) for regression and frontier model



A similar approach can be taken to the modelling of hospital costs. The same quadratic form with interaction terms was used with admissions, outpatients and emergency outpatients as the main independent variables with associated interaction and quadratic terms. Neither the strata or class was found to have any strong effect although more complex modelling may be required to properly capture their influences. As with the puskesmas model, the Breusch Pagan test was significant ($P<0.001$) and robust regression was used (Table 27). A dummy variable for government hospitals was included to examine the difference in total costs between public and private hospitals and was significant ($P<0.001$) suggesting that controlling for other factors government have lower costs than non-government hospitals (for similar levels activity).

Table 27: Hospital total cost model

Variable	Coefficient	t	
Admissions	3351218	4.71	*
Outpatients	67550.93	1.15	
Emergency outpatients	72271.62	0.1	
Admission-outpatient interaction	8.958755	2.7	*
Admission-emergency interaction	25.04427	0.92	
Outpatients-emergency interaction	-3.98245	-2.57	*
Admissions squared	-87.6527	-4.07	*
Outpatients squared	-0.02317	-1.81	
Emergency squared	9.88322	0.79	
Emergency fixed	1010000000	0.22	
Public hospital	-7530000000	-2.51	*
Constant	**11.300.000.000**	**2.69**	*****

Note: * = significant at least at 5% level.

The modelling demonstrates the impact of increasing utilisation while holding other factors constant. For example, a median public hospital in the sample provides care for around 8,800 inpatient admissions, 53,000 general outpatient visits a year and 7,700 emergency outpatients. If the rates of outpatient and inpatient admissions are doubled (100% increase), total costs are estimated to rise by 76% as average costs of each service decline (Table 28).

Table 28: Simulations of total hospital costs resulting for changes in patient numbers

Change in patient numbers (%)	Admissions	General outpatients	Emergency outpatients	Total Costs (Rp. Billion)	Change in costs (%)	Average cost of inpatient admission (Rp. million)
-70%	2,666	15,900	2,321	15	-60%	3.44
-60%	3,554	21,200	3,095	18	-51%	3.15
-40%	5,332	31,800	4,643	24	-33%	2.84
0%*	8,886	53,000	7,738	37	0%	2.56
25%	11,108	66,250	9,673	44	20%	2.46
50%	13,329	79,500	11,607	51	39%	2.38
100%	17,772	106,000	15,476	65	76%	2.26
130%	20,438	121,900	17,797	72	97%	2.19
160%	23,104	137,800	20,119	79	116%	2.13
200%	26,658	159,000	23,214	88	141%	2.06
300%	35,544	212,000	30,952	108	195%	1.89

***baseline average**

This annex describes only a preliminary regression analysis. It is intended that more complex models be used and compared to analyse the cost structures of hospitals and puskesmas in order to simulate the impact of health system reform scenarios (e.g. universal coverage) on the costs of services.