

An empirical analysis of Unit costs of public hospitals in Jordan

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Abstract

Background: Public providers in low-middle income countries face enormous pressures to meet complex needs of its population. This study aimed to benchmark unit costs of hospital services in public providers in Jordan to provide useful insight and readings of healthcare delivery and sustainability.

Methods: Unit costs of hospital services per admission, inpatient days, outpatient visits, emergency visits and surgical operations were estimated using standard average costing method. Unit costs per inpatient days was estimated relevant to nine specialities, staff and selected medical services too. Unit costs were estimated in Jordanian Dinars (exchange rate= US\$1.41).

Results: Average unit cost per admission was 782.3 JDs (US\$1101.8), per inpatient day was 236.6 JDs (US\$ 333.2), per bed day was 172.9 JDs (US\$244.9), per outpatient visit was 58.4 JDs (US\$ 82.3), per operation was 449.6 JDs (US\$ 633.2) and per emergency room visit was 31.8 JDs (US\$44.8). ICU/CCU and OB/GYN presented the highest unit costs per inpatient days across providers; US\$532.9 and US\$510.7 respectively. Unit costs varied depending on service utilization, type of service and organizational outset.

Conclusions: Countries in areas of political conflicts face enormous fiscal constraints, health policy makers, managers and stakeholders ought to understand these challenges and foster use of value based budgeting and performance analysis.

Background

The Hashemite Kingdom of Jordan is a middle-income country in an area of political instability. Jordan is located in the western Asia in the north of the Arabian Peninsula on the East Bank of the Jordan River and bordered by Saudi Arabia to the south, Iraq to the north-east, Syria to the north and Palestine to the west. The total population was around 9,5 million in 2015 (1, 2). The gross domestic product (GDP) in 2017 was about 27.4 billion Jordanian dinars (JDs) equal to \$38.65 billion United states (US) dollars (3). Total health expenditure estimated at 2,25 billion Jordanian dinars (JDs) in 2015 (US\$ 3.17 billion) accounting for 6.4 % of GDP (4). The total pharmaceutical expenditure accounts for 2.88% of the GDP and makes up 25.9% of the total health expenditures. These levels of expenditures are considerably high in comparison to countries in the surrounding region (4,5,6).

Healthcare system in Jordan is facing rapid changes over the past years due to human crisis in the neighboring countries leading to increase service demand and changes in demographics and disease patterns (7). The crises in Syria, Iraq, Libya, Yemen and the economic slowdown across the area of the Gulf Cooperation increased economic constraints. Jordanians have welcomed asylum seekers and refugees starting from Palestinians in 1970s up to the recent events in the area. In 2015, the total number of refugees in Jordan was estimated at 2.5 million (from Iraq, Libya, Yemen and Syria). Syrians account for almost half of the non- Jordanians (1.4 million) and 53% of the refugees are reported under the age of 18 years (4). For four years after the break of civil war in Syria, refugees received free health care in Jordan. This placed huge burdens on the health sector. Due to the lack of international support, health services currently provided only to Syrian refugees live inside campus who are estimated at 0.66 million. Those receive health care at the same rate of insured Jordanians by the Ministry of Health (MoH) facilities (4,8). Whilst, refugees lives outside campus pay fully out of pocket for healthcare (4,9). A recent report by the Central Bank of Ireland outlined that Jordan rely on creditors financial assistance to provide a significant portion of its public services. External aid fund in health are estimated at 6.7%, which leaves Jordan economy very sensitive to any changes in the level or terms of support or fund)4,8(. Therefore, Jordan economy is struggling to response to the complex and increased needs of its population.

Health systems in Jordan

The healthcare sector in Jordan is heavily subdivided to multiple providers including public, private and international charitable providers. The insured citizens are estimated at 68% of the total population)4,6(. The majority of healthcare fund is subsidized by public providers with only 7–8% of the population has private health insurance coverage either through health insurance companies or self-funds)7(. The public sector consists of three major providers; MoH, Military Royal Medical Services (RMS) and two University affiliated hospitals (UHs).

MoH operates 32 hospitals representing 37% of hospital beds in the country. RMS provides 24% of hospital beds through 14 hospitals, whilst UHs accounts for 3% of hospital beds)6, 7(. RMS provides healthcare services to 1.7 million military individuals

and their dependents accounting for 25% of the population. UHs insurance program covers 2.5% of the population)4,6(. Public health provider's beneficiaries receive services with subsidized fees and only pay a margin of health costs amounting only to 20% of health costs)7(. On the other hand, direct out-of-pocket health spending by citizens account for about 33% of total health spending in the country)6(. Such mix of healthcare financing plus the growing challenges in the area beset policy makers with ethical and financial strains to ensure sustainability and equity of healthcare)4,6,7(.

In assessing health efficiency, information about unit costs is pivotal)10(. Unit costs are established tools for health evaluation and policy decisions in many countries)11–13(. A unit cost is defined as the monetary value of the resources that is consumed to create goods or services)10(. Consequently, a unit cost is the collective costs related to the material, time, equipment and capital infrastructure used to carry out a service. Unit costs often developed by direct or model based estimations)12–14(. There are lack of estimates from developing economies due to data quality and scarcity; Jordan no exception)14–16(. Up to date, there is only one published study from Jordan relied on audit data from 2007)17(. Hammad and her colleagues estimated the direct cost of hospital services in a single public hospital affiliated to MoH in the capital Amman and therefore generalizability was not guaranteed. Hence, a larger-scale study scoping unit costs from the perspectives of different types of public providers was warranted of value.

Methods

The aim of this study was to estimate unit costs of hospital services in Jordan to benchmark costs of healthcare services in the public sector and inform future policies and initiatives to enhance performance and efficiency.

Cost analysis from healthcare public providers' perspective in Jordan was performed. Unit costs were defined as the cost of one unit of "output" including admission, inpatient days, outpatient visits, emergency visits and surgical operations (12, 18, 19). Unit costs per hospital output were estimated using standard average costing; top down approach (17, 18, 20–22). Total health expenditures of a provider was divided by the total output produced to determine the unit costs above.

The formula used was: Average cost = total expenditure ÷ total output units. Total expenditure = $\sum C_{\text{drugs}} + C_{\text{salaries}} + C_{\text{medical and non-medical supplies}} + C_{\text{food\&housekeeping}} + C_{\text{resource development and training}} + C_{\text{medical\&non-medical equipment}} + C_{\text{adminstarartion}} + C_{\text{utililites and overhead expenses. utililites}}$ (17, 19, 20, 21).

Total health expenditures was defined as the value of health goods consumption for the production of all provider's activities (10). Total expenditures were allocated based on the proportion of resource consumed from the provider budget in the delivery and production of services within inpatient, outpatient, emergency departments and surgical units (8, 19, 21). Data were collected and synthesized between September 2015 and January 2018.

Data sources and collection

Data were obtained through interviews, reviewing published as well as unpublished reports. Reports were obtained from the Health Economic Directorate, public affairs offices, planning and health insurance divisions and finance departments in each provider. Data were also extracted from the National Health Account technical report published in 2016 (most recent issue) and the annual statistical reports for 2016–2017 from each of the providers. Data were also extracted from the Department of Statistics reports on demographic and health indicators estimates, Ministry of Finance Budget Department reports and Central Bank of Jordan annual and monthly reports.

Unit costs of hospital services

Unit costs were calculated using the average cost method; the total cost of a care provider was divided by the output units (22–24). Unit costs per inpatient days included the day of admission with exclusion of the day of discharge or death. Total inpatient days were calculated by adding the daily patient census days relative to 365 days in all departments of the study providers. A bed day was defined as a day during which a patient is confined to bed and stays overnight in the hospital. Total bed days were obtained by multiplying the total number of beds by 365 (21, 24). Cost per surgical operations did not include pre or post-operative costs.

Unit costs per speciality were estimated relevant to nine specialities. Specialities require similar labor and capital inputs to treat patients with similar maladies were grouped together (17,18, 22).

Total expenditures were allocated to specialities based on the proportion of inpatient admissions relevant to the department. Unit cost per inpatient day per speciality was obtained using the following formula: $\text{Cost per inpatient day}_i = \frac{\text{Total expenditure}_{\text{inpatient}} * [\text{inpatient admission}_i / \text{Total inpatient admission}]}{\text{inpatient days}_i}$ (17,18, 22). Inpatient days_i is the number of inpatient days for a medical speciality _i.

Unit costs were estimated in JDs. The exchange rate was US\$1.41 based on quotation from the central bank of Jordan on 24 October 2018. Health expenditures were inflated to in 2018; the inflation rate was averaged as 5.1% from 2013 to 2018 as reported by the Hashemite Kingdom of Jordan Department of Statistics 2018.

Unit costs of medical and ancillary staff

Unit costs of staff in relation to salary based staff per hour were estimated. This includes basic salary, benefits, gratuities and social charges. The number of working hours for each profession subtracting annual, statutory and sickness leave days from week days per annum were estimated at 260 days. The unit cost per hour was estimated by dividing average salaries by working hours (13).

Unit costs of selected medical services

Charge master lists were used for unit cost estimation of procedures, imaging and laboratory tests. Charge master lists of all procedures, lab tests, diagnostic and interventional services with its official billed charges in JDs were obtained from providers. List of prices for MoH were extracted from the civil insurance guide published in 2016 (25). For RMS and UHs the charge master lists were dated 2011 and 2012 respectively. These were the official list of charges in effective use up to the date of the study; hence, inflation of unit price was not warranted (23).

Charges for procedures, imaging and laboratory tests were analysed descriptively by the observation of minimum and maximum values. To estimate costs of providing a service to the provider; top-down costing using cost-to-charge ratio (CCR) method was employed. CCR was investigated through expert elicitation discussions and interviews with financial managers in each provider (20, 24). CCR presented the ratio between a provider operating and capital costs and revenues for the fiscal year 2016–2017 (26,27). Thus, the cost of each service equalled the billing charge (unit price) multiplied by the overall CCR of a provider. Eventually, median cost and range was stipulated for a selection of medical services deemed mostly performed (26,28).

To analyze cost contributes to a medical services across providers, financial managers and clinical consultants who had current or previous administration duties relevant to allocate or manage budget in each provider were requested to complete a form independently after reviewing a set of medical services. They estimated the proportion of cost contributed by material, labor, equipment and overhead costs to the overall cost of the service. Discrepancies were discussed until agreement. Chi-square test was performed to assess significant variations between providers. P value <0.05 was considered statistically significant.

Results

Background information about the study providers are presented in Table 1. Total number of hospitals included in the study analysis were 48 with total number of beds 9235 and 26753 of salaried health staff including physicians, dentist, pharmacists, nursing staff and midwives. Total number of admissions and outpatient visits were 659424 and 8188631 respectively. Average occupancy rate was 71.3% and length of hospital stay 3.7 days. As the main public health provider, MoH represented 36% of expenditures of the total health care expenditures in Jordan. RMS and UHs accounted for almost 20%. The remainder accounted by private sector and non-governmental organizations or donors.

Unit costs of hospital services

Table 2 presents unit costs by provider and the average unit costs of public providers in Jordan respectively.

RMS hospital services were costed the highest compared to the rest of providers except for emergency visits. UHs had the highest costs per an emergency visit.

Table 3 estimates unit costs of inpatient days per specialty.

ICU/CCU and OB/GYN presented the highest unit costs per inpatient days across providers U\$532.9 and U\$510.70 respectively. This was followed by the unit costs of ophthalmology estimated at U\$ 496.62 and neonatal care estimated at U\$ 438.31.

Unit costs of medical and ancillary staff

Table 4 in supplementary file presents the average salary for each rank of staff per hour. With every year of employment, the paid wages increase by an estimate of 10–20%. This is married by moving up a band or structured ranking system; with the highest appointment level often granted after 15–20 years of full time employment. For MoH moving up bands/grade is mainly based on year of experience. RMS follows an in-house residency and training programs involving profession development and research publications. For teaching hospitals, university wages based mainly on teaching and academic roles. Roles involved direct patient care services are reimbursed by providers independently in proportion to number of patients or procedures and consultations performed. Physicians receive financial incentives in addition to their salaries linked to the fees obtained from uninsured patients too. Incentive and non-salary based payments vary seasonally and per speciality. Consultants wages however are heavily linked to year of practice; it is permissible to charge additional 20% compared to average fees; a medical consultation set at 20JDs (U\$ 28); if the consultant caring for the patient been in practice for over 20 years.

Costs of selected medical services

Figure 1 in supplementary file illustrates the average CCRs per provider across departments. CCR for MOH ranged between 1.09 and 2.3 with paediatric service estimated with the highest CCR indicating service costed almost two times what MoH charges for. CCR ranged between 0.31-.89 for RMS with paediatric service estimated the lowest ratio. For UHs, CCR ranged between 0.34–0.79 with dermatology and orthopaedic estimated to have the lowest ratio. A full list presenting estimated costs for 187 procedures, imaging and laboratory tests is available upon request. These represent procedural costs, including labor, material, equipment and overhead costs. Cost of drugs and supplies to be added on individual patient case, e.g. medical solutions, gloves, blood transfusion and others.

For surgical procedure, costs were linked to the complexity and level of anaesthesia. Consequently, surgical procedures classified as majors with invasive operative procedure in which a resection is performed including a body cavity or organs under general or local anaesthesia accounted for higher costs. Minor surgeries with only skin or mucus membranes or connective tissue resected often performed under local anaesthesia without admission to the operation theatre accounted for lower costs. Minor surgical procedures ranged 150–350 JDs (US\$211.4 –493.3) whilst major surgical procedures ranged 450–780 JDs (US\$ 634.3 –1099.4). For other elective day case procedures, the unit costs ranged between 10–660 JDs (US\$14.10–930.89). For radiology imaging services, costs varied depending on the technique and level of imagining ranging between 15–300 JDs (US\$21.16 –423.13). The use of contrast media and level of organ details were associated with higher costs. Laboratory tests unit costs mostly varied with the estimated processing time of the sample and the technology used. Microbiology and endocrine tests presented higher unit costs averaged at 15 JDs (US\$21.14) and 25 JDs (US\$35.23) respectively.

Figure 2 presents cost components analysis of selected services per providers. The large component of costs was often estimated to labor costs. Yet, for the same services, providers vary significantly in the weight each cost component contributed to a service cost, all Chi square test p values were <0.001.

Discussion

This is the first exploratory study in the region attempted to explore unit costs of hospital services, staff, procedures, imaging and laboratory tests in public providers and pinned out financing characteristics of different type of providers. In recent report, WHO outlined that health system performance vary considerably between countries of the region but highlighted that the main challenges facing health systems is the raised health costs and inequity of health care services particularly in areas affected by acute and chronic conflicts⁴(. The complexity of the health outlook is increasing in Jordan and the refugees crisis have contributed to increased demand for health services at MoH and thus referrals to other providers. Thus, it is important for local health policy makers and managers to understand financing characteristics of the key providers in the country and how costs vary across settings. On the other hand, it is also important for international policy makers and funding organizations to recognize the complexity of healthcare delivery for when terms of financial assistance are set to support refugees and hosting communities⁸(.

Unit costs varied across providers depending on service utilization, type of service and provider organizational outset. This is in agreement to previous studies explored cost drivers in hospital budgeting decisions in middle to low income countries^{16, 19, 21, 22}(. Unit costs of hospital services in military health services were found highest when compared to other providers. RMS services predominantly as a tertiary provider and oriented mainly to inpatient care treating complex referrals from other providers⁷(. Hence, higher costs can be potentially due to complexity of care. The cost per outpatient attendance in RMS was the highest too; where services utilization is relatively low though. Higher density of services where most expensive procedures often performed presumably contribute to higher costs (6,7). Thus, information on service utilization and type of service are essential to inform patient co-payment and reimbursement policies (14, 23). In addition to the above, type of provider might be an influential factor too. Cost per operation in UHs was the lowest. UHs are teaching facilities and potentially perform greater number of operations by residents or fellows. This has been highlighted previously where labor costs in teaching hospitals found lower when compared to tertiary settings (19,21). Of note, UHs had the highest cost per emergency room visit. UHs services heavily focused on outpatient services that are not available during weekends, holidays and out of working hours. Effective referral system and standard treatment protocols across public provider should be promoted to enhance service delivery and minimized avoidable costs (4).

Unit costs of inpatient days per medical specialty showed highest unit costs for ICU/CCU, gynecology, ophthalmology and neonatal care. This is consistent with previous reports outlining these units as specialized with fewer patients and expensive equipments (11, 17–19, 22). In depth evaluation is needed in future studies to understand cost drivers across departments and disease mix.

The variation across providers in cost components analysis for the same or similar medical services and CCRs was high. This outlines high heterogeneity in the delivery and performance of the public health sector in Jordan. Mostly the existing charges used for patients or payers billing are out dated and ultimately doesn't relate to overall organizational sustainability or profitability. For instance, MoH costs were extremely underestimated compared to the other providers. Despite the fact that almost 92% of MoH budget is financed by Ministry of Finance and the remaining left by donors and households (4,6), the premium paid and co-payment by patients are the main revenues source for MoH. MoH beneficiaries for instances can receive health care services by other public providers without referral or treatment algorithms. MoH eventually would reimburse other public providers on fee for service base. Herein, health authorities should understand that sustainability might be jeopardized in future times without outlining the true health costs for caring for both Jordanians and non-Jordanians. Extensive review of the financing structure and reimbursement strategies across different settings is recommended. Therefore, manager should be opt to adapt evidence based assessment of performance to identify areas where cost savings and profitability can be maximized.

Future Implications

Understanding costs incurred for a patient care is valuable to health decision makers, payers as well as care providers. Adaption of national training and education programs on health economics and pharmacoeconomics is essential. Public providers in Jordan are mostly onus on providing an acceptable level of care within a defined budget rather than generating profit (7, 29). Organizational profitability can produce considerable investments to human and capital development. Therefore, health managers must equip staff with skills and knowledge on cost estimation and efficiency assessment.

Institutionalizing health policy and service research in Jordan is essential too. The Jordan response plan for 2017–2019 has specified needs to strengthen and increase the capacity of the healthcare system in Jordan [8], this can be achieved by sharing and exchange expertise on evidence based decision making between local and international experts. Political support to generate laws

legitimizing the role of economic evidence is also needed. These are essential factors to promote the use of economic evidence in service delivery and international donors can help to promote political support by funding new or existing projects enforcing use of economic research in health policy planning (30–32).

Challenges to pharmacoeconomics research

The biggest challenge faced this study was willingness for data access. Being the first exploratory study that acquired monetary information across various providers, managers were resistance to share information openly. They perceived this as uncommon practice with unpredicted consequences. The study was granted approvals but with limited access to hospital records and accounting archives. Consequently, immense efforts were made to validate each estimate reported empirically in this study matrices through triangulation and expert elicitation.

The Jordan General Secretariat of the Higher Health Council institutionalized the National Health Account in 2007. The Jordan National Health Account provides specialized data and information in the field of health and issued periodically every three years following global methodologies (6,7). The Jordan General Secretariat of the Higher Health Council should be invited to host future initiative of cost information system in Jordan. International donors and project funders such as World Bank, the International Monetary Fund, the United Nation and United States acting through USAID who are constantly supporting constrained economies across the world can play a key role in fostering such initiative (8).

Nevertheless, these challenges faced with data collection are in line with challenges reported previously highlighting similar barriers exist to economic research in health across countries (33–35). Therefore, knowledge exchange and discussions with experts, managers, decision makers across countries is valuable to increase understanding of policy and similarity or varices in the economic context across the world.

Strengths and Limitations

The merit of this study is to establish a benchmark for hospital unit costs in Jordan to draw lessons to share with health policy makers, managers and researchers. It also highlights financing issues that might influence budgeting and reimbursement analysis by donors locally as well in the area.

However, the unit cost calculation of hospital services was based on the average method, which might be different from per patient or per disease estimates (23). Therefore, this study serves as a proxy benchmark and future research attempts to assess costs per patient or disease mix should be pursued.

Unit costs per specialty were calculated by dividing the total cost of each provider or a department by a proxy measure of output. This carry the risk of underestimating units with high capital investments, fewer patients and high maintenance costs (36, 21). The study providers had centralized management systems for allocating resources to their individual health facilities. Facilities do not have their own budgets and had limited autonomy. They receive allocations of equipment, supplies and pharmaceuticals as per their needs. This means that transactions are only recorded if they result in payments or receipts of cash.

In this study, charges were used as a proxy to estimate costs of medical services. RCC methodology is considered a less complicated method in practice, since it requires only data concerning the charges for medical services (28). Employing micro-costing method often produce most accurate estimates (23). However, it was not possible to employ this approach due to data quality and accessibility. Future attempts to draw unit costs estimates derived from micro-costing method must be pursued if institutional and political support can be warranted.

Conclusions

With the political conflicts and the fiscal constrains faced by many low and middle income countries in unrested regions, local and international health policy makers, managers, researchers and donors should understands the complexity and challenges faced by

individuals and health care managers. Efforts and knowledge exchange is advocated to promote resources and tools to improve capacity and health care system performance.

List Of Abbreviations

Cost-to-charge ratio (CCR)

Ear, Nose and Throat (ENT)

Gross domestic product (GDP)

Intensive Care Unit/Cardiac Care Unit (ICU/CCU)

Jordanian dinars (JDs)

Ministry of Health (MoH)

Military Royal Medical Services (RMS)

Obstetrics and Gynecology (OB/GYN)

University affiliated hospitals (UHs).

United states (US)

Declarations

Ethics approval and consent to participate

Approvals were obtained from the Institutional Review Boards and administration office in each of the study sites.

Consent for publication

All authors are aware of the submission and agree with it.

Competing interests

There is no direct or indirect financial relationship for the authors with any official or non-official body.

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Authors' contributions

All authors have contributed significantly to the preparation and production of the manuscript

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Data and material availability

Data related to the production of manuscript will be available upon request

Authors' information (optional)

The authors of the study are part of a multidisciplinary research team aims to promote use of health/pharmacoeconomics in health policy and planning in Jordan. They are members in number of national committees and councils in Jordan acting as advocates for policies that aim to ensure availability and equity of health services to the population of Jordan. Thus, they poses unique insights on the urging quests of local and international decision makers for optimizing resource use and maximise efficiency. From this standpoint, they have contributed to a number of publications to share insights and exchange knowledge with international researchers and policy makers around the world to pinout challenges in low to middle income countries and ways to improve health system performance.

References

1. World Health Organization: Global health expenditure database. <http://apps.who.int/nha/database/> (2019). Accessed 6 Mar 2019.
2. Hashemite Kingdom of Jordan Department of Statistics. <http://dosweb.dos.gov.jo/category/cpi> (2019). Accessed 6 Mar 2019.
3. World Bank in Jordan: Jordan home. <http://www.worldbank.org/en/country/jordan/overview> (2018). Accessed 6 Mar 2019.
4. World Health Organization, Regional Office for the Eastern Mediterranean. Strengthening health systems towards universal health coverage: an introduction to the department of health system development. License: CC BY-NC-SA 3.0 IGO. 2017. <http://www.who.int/iris/handle/10665/260169>. Accessed 6 Mar 2019.
5. Organisation for Economic Co-operation and Development (OECD). OECD health statistics 2018. <http://www.oecd.org/els/health-systems/health-data.htm>. Accessed 6 Mar 2019.
6. Jordan National Health Account. <http://www.hhc.gov.jo/uploadedimages/NHA%202013.pdf>. 2016. Accessed 6 Mar 2019.
7. Jordan High Health Council. National strategy for health sector in Jordan 2015- 2019. <http://www.hhc.gov.jo/uploadedimages/The%20National%20Strategy%20for%20Health%20Sector%20in%20Jordan%202015-2019.pdf>. 2016. Accessed 6 Mar 2019.
8. Central Bank of Ireland. The Hashemite Kingdom of Jordan - U.S.\$1,000,000,000 7.375% Notes Due 2047 (04 October 2017). <https://www.centralbank.ie/regulation/industry-market-sectors/securities-markets/prospectus-regulation/prospectuses/the-hashemite-kingdom-of-jordan>. Accessed 6 Mar 2019.
9. Daher A, Alabbadi I. Investigating the effect of syrian refugees on the pharmaceutical sector in Jordan. *Arch Iran Med*. 2017;20(8):538–546.
10. Berger ML, Bingefors K, Hedblom E, Pashos C, Torrance G. Health care cost, quality, and outcomes- ISPOR Book of Terms. 1st ed. Lawrenceville NJ: International Society for Pharmacoeconomics and Outcomes Research; 2003.
11. Sangwan A, Prinja S, Aggarwal S, Jagnoor J, Bahuguna P, Ivers R. Cost of trauma care in secondary- and tertiary-care public sector hospitals in north india. *Appl Health Econ Health Policy*. 2017;15:681.
12. Tan SS1, Van Gils CW, Franken MG, Hakkaart-van Roijen L, Uyl-de Groot CA. The unit costs of inpatient hospital days, outpatient visits, and daycare treatments in the fields of oncology and hematology. *Value Health*. 2010;13(6):712–719.
13. Curtis L, Netten A. Unit costs of health and social care. Unit Costs of Health and Social Care. Personal Social Services Research Unit, University of Kent, Canterbury. 2017. <https://www.pssru.ac.uk/project-pages/unit-costs/unit-costs-2017/>. Accessed 6 Mar 2019.

14. Stenberg K, Lauer JA, Gkountouras G, Fitzpatrick C, Stanciole A. Econometric estimation of country-specific hospital costs. *Cost Eff Resour Alloc.* 2018;16:11.
15. Alefan Q, Rascati K. Pharmaco-economic studies in world health organization eastern mediterranean countries: reporting completeness. *Int J Technol Assess Health Care.* 2017; 33(2):215–221.
16. Zeng W, Halasa Y, Cros M, Akhter H, Nandakumar AK, Shepard D. Costing essential services package provided by a non-governmental organization network in Bangladesh. *Health Policy Plan.* 2017;32: 1375–1385
17. Hammad EA, Fardous T, Abbadi I. Costs of hospital services in Jordan. 2017. *Int J Health Plann Manage.* 2017;32(4):388–399.
18. Younis MZ, Jaber S, Mawson AR, Hartmann M. Estimating the unit costs of public hospitals and primary healthcare centers. *Int J Health Plann Manage.* 2013;28:320–332.
19. Than TM, Saw YM, Khaing M, Win EM, Cho S, Kariya T, et al. Unit cost of healthcare services at 200-bed public hospitals in Myanmar: what plays an important role of hospital budgeting?. *BMC Health Serv Res.* 2017;17(1):669.
20. Conteh L, Walk D. Cost and unit cost calculations using step-down accounting. *Health Policy Plan.* 2004;19: 27–135.
21. Chatterjee S, Laxminarayan R. Costs of surgical procedures in Indian hospitals. *BMJ Open.* 2013;3(6):e002844.
22. Chatterjee S, Levin C, Laxminarayan R. Unit cost of medical services at different hospitals in India. *PLoS One.* 2013;8(7):69728
23. Flessa S, Dung NT. Costing of services of vietnamese hospitals: identifying costs in one central, two provincial and two district hospitals using a standard methodology. *Int J Health Plann Manage.* 2004;19(1): 63–77.
24. Langenbrunner JC, O'Duagherty S, Cashin CS. Designing and implementing health care provider payment systems: how to manuals. Washington, DC: World Bank. © World Bank. 2009. <https://openknowledge.worldbank.org/handle/10986/13806>. Accessed 6 Mar 2019.
25. Jordan Ministry of Health Official Guides on Civil Insurance. 2016. http://www.hia.gov.jo/Docs/Systems/InsuranceSystem_2016.pdf. Accessed 6 Mar 2019.
26. Nguyen HT, Riewpaiboon A. hospital cost analysis in developing countries: a methodological comparison in vietnam. *Asian Journal of Pharmaceutics.* 2018;12:S8-S18.
27. Mercier G, Naro G. Costing hospital surgery services: the method matters. *PLoS One.* 2014;9:97290.
28. Macario A. What does one minute of operating room time cost?. *J Clin Anesth.* 2010;22(4): 233–236.
29. Rawabdeh A. Health care cost containment strategies: the Jordanian experience. *Int J Health Plann Manage.* 2005;20(1):53–66.
30. Allin S, Mossialos E, McKee M, Holland W. Making Decisions on Public Health: a Review of Eight Countries. Copenhagen: WHO Regional Office for Europe. 2004. <http://www.who.int/iris/handle/10665/107600>. Accessed 6 Mar 2019.
31. Lafi R, Robinson S, Williams I. Economic evaluation and the jordan rational drug list: an exploratory study of national-level priority setting. *Value Health.* 2012;15:771–776.
32. Hammad EA. The use of economic evidence to inform drug pricing decisions in Jordan. *Value Health.* 2016;19: 233–238.
33. Gavaza P, Rascati KL, Oladapo AO, Khoza S. The state of health economic research in South Africa. *Pharmacoeconomics.* 2012;30: 925–940.
34. Gavaza P, Shepherd M, Shcherbakova N, Khoza S. The state of health economics and pharmaco-economic research in Russia: a systematic review. *J Pharm Health Serv Res* 2010;1(3):113–121.
35. Jiang S, Ma X, Desai P, Yang L, Rascati K. A systematic review on the extent and quality of pharmaco-economic publications for China. *Value Health Reg Issues.* 2014;3:79–86.
36. Van Meter MM, Adam RA. 2016. Costs associated with instrument sterilization in gynecologic surgery. *Am J Obstet Gynecol.* 2016; 215(5):652.

Tables

Table 1 Background information on public health providers in Jordan			
	MoH	RMS	UHs
Hospitals	32	14	2
Beds	5177	2917	1141
Admissions	374818	190364	91242
Death rate	1.8%	3.3%	1.4%
Out-patient visits	2978989	442911	772970
Occupancy rate	65.8%	78.6%	72.8%
Average length of stay (days)	3.2	4.3	3.7
Surgical operations	88305	102489	41339
Emergency room visits	2933928	1081635	193110
Inpatient days	1187236	796861	293065
Healthcare Personnel*	16464	9491	2374
Health expenditures	36.1%	14.6%	6.2%

*includes physicians, dentists, pharmacists, nurses and midwives. Source: Annual statistical reports in each provider 2016-2017 and Jordan National Health Accounts 2016, Technical Report No. 6

Table 2 Unit costs of hospital services per provider and average unit costs of public providers in Jordan

Unit costs (JDs)	MoH	RMS	UHs	Average
Cost per admission	557	914	740	782.3
Cost per inpatient day	175	277	230	236.6
Cost per bed day	119	207	162	172.9
Cost per outpatient visit	24	71	62	58.4
Cost per operation	402	548	399	449.6
Cost per emergency room visit	22	26	47	31.8

Table 3 unit costs of inpatient hospital days per speciality				
Speciality	Cost per inpatient day (JDs)			
	MoH	RMS	UHs	Average
Orthopaedic	169.8	161.1	168.1	163.7
General and specialized surgery	282.3	217.5	215.4	242.7
Internal Medicine	238.4	265.1	245.1	253.8
Paediatrics	240.8	280.1	286.4	265.9
ENT	220.3	392.1	359.5	328.4
Neonatal care	365.1	417.8	235.1	342.2
Ophthalmology	322.2	340.0	384.2	352.6
OB/GYN	320.3	419.1	342.1	362.6
ICU/CCU	327.8	413.9	398.7	377.8

ENT: Ear, Nose and Throat, ICU/CCU: Intensive Care Unit/Cardiac Care Unit, OB/GYN: Obstetrics and Gynecology,

Figures

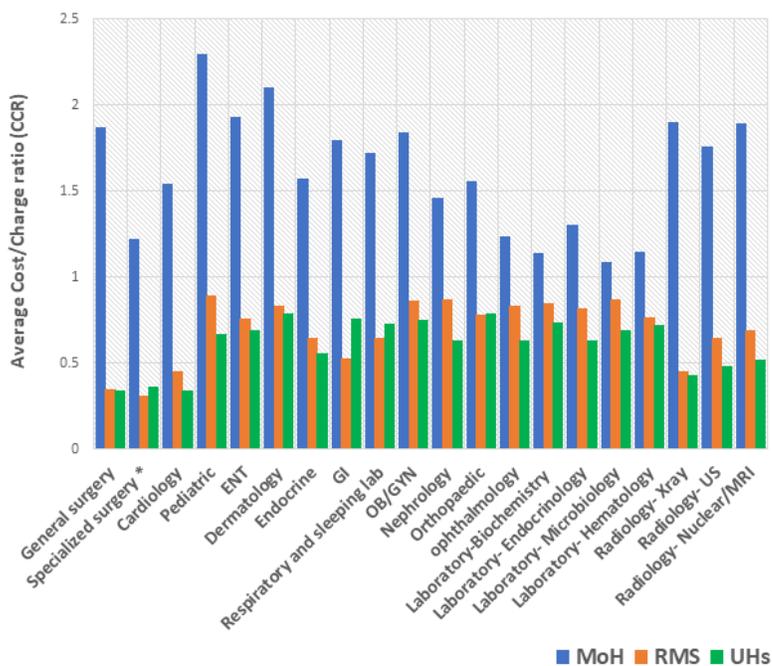


Figure 1

CCRs per providers across specialities. *includes neurosurgery, plastic and constructive surgery, paediatric and vascular surgery. ENT: Ear, Nose and Throat, GI: gastroenterology, MRI: Magnetic resonance imaging, OB/ GYN: Obstetrics and gynaecology, US: Ultrasound,

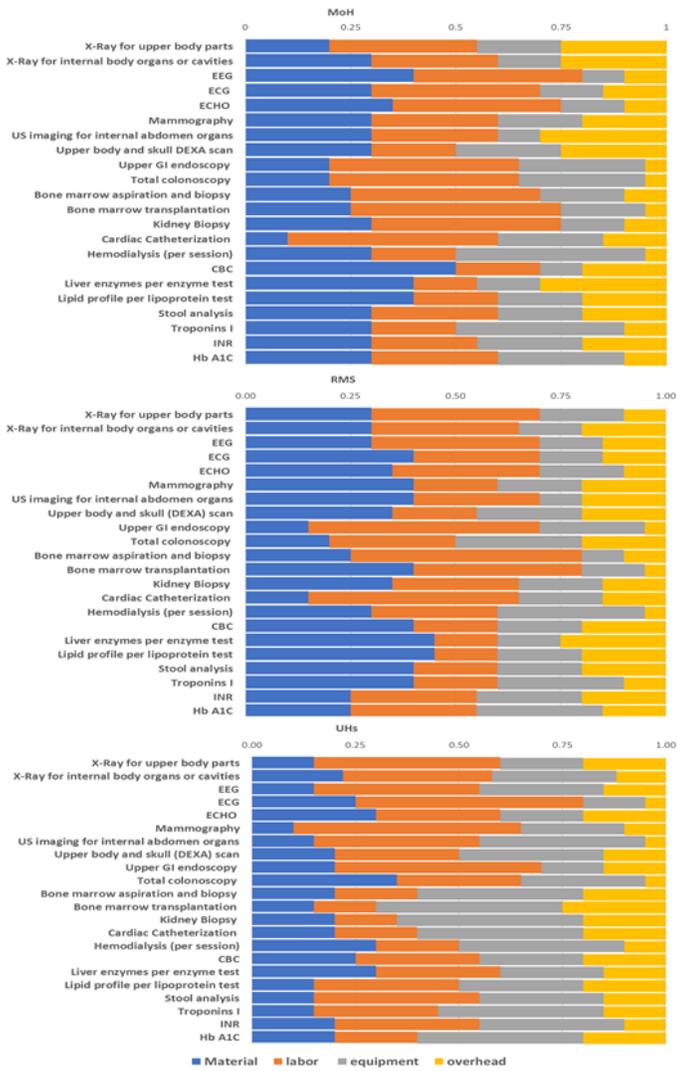


Figure 2

Cost components analysis of selected services across providers

Supplementary Files

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

- [Table4supplementaryfiles.docx](#)