RESEARCH ARTICLE

National Reference Unit Cost of Health-care Services: International Experiences

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Abstract

Introduction: Costing information is vitally important for public health management. It is applied in relation to priority setting concerning health problems, cost control, health economic evaluation, and health-care financing. When calculating the cost of illness as well as the cost of the health-care program, the cost of the same quantity of utilized services can be different if their unit costs are different. Many countries have attempted to alleviate such difficulties by developing a standard or reference list of the unit cost of health-care services. **Aims:** This review aimed to explore the situation of the national reference unit cost (NRUC) of health-care services in various countries. **Materials and Methods:** The study was designed as a systematic review. We searched articles from the PubMed and Google Scholar databases in November 2015 using a combination of keywords, MeSH terms, and other free text terms considered suitable for the purpose. The study only included complete peer-reviewed publications that were reported in the English language. Editorial, reviewed, or methodological articles were excluded. **Results:** Of the 437 identified citations, seven articles related to the unit cost of medical services studies met the selection criteria. These studies were conducted in Canada, the Netherlands, Australia, Thailand, the Philippine, the United Kingdom, and India. The NRUC has been introduced into economic evaluation analysis or reimbursement. Australia was the first country to publish a standard unit cost study in 1992, while the standard costs list for health economic evaluation in Thailand, which was published in 2014, is the newest available list. The standard unit cost list in England is updated annually and provided to all hospitals. Both top-down and bottom-up costing methodologies were used to validate the accuracy of the results. **Conclusion:** This first systematic review concerning the NRUC of medical services clearly showed that the current situation, as well as the international methodological guidelines for conducting and reporting the NRUC of health-care services, should be developed as soon as possible.

Key words: Health-care service, price, reference cost, standard cost, unit cost

INTRODUCTION

The methodologies associated with health economics do not replace socio-political decision-making; however, they do play an important role in rational decision-making regarding necessary changes to the social and health system.[1] For instance, unit costs help managers to improve budgeting by monitoring costs as well as the efficiency of the intervention by identifying potential cost savings. Unit costs are also used to estimate the resources required to sustain the intervention by seeking an accurate estimate of the budget necessary to maintain it and the resources required to expand the intervention.[2] In developed countries, unit costs help economic evaluation experts to establish repayment rates and determine reimbursement by social security systems. Recently, standard unit costs have been introduced into economic evaluation analyses to measure

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the potential differences in resource use that result from the selection of one intervention over another.[3] For instance, analyzing the cost-effectiveness of new drugs to be added to the list of national essential drugs, new vaccines for national immunization programs, and new medical procedures in the package of health insurance benefits. Standard costs are deemed to be desirable in evaluation studies because they serve to ensure that the study results will not vary based on the utilized costing methods.

Nowadays, the prices of medicine and health-care services are often high and unaffordable, not only for large sectors of the population in low- and middle-income countries but also for sizeable segments of the population who are without adequate social protection or insurance in high-income countries.[4,5] When seeking to increase the quality and efficiency of health-care resources, health economics should be a special concern. It uses models to estimate the comparative costs and usage of interventions within the health-care field. Cost, according to the economic definition, refers to the opportunity cost (which is equal to the value of a resource in its best alternative use).[6] Costing information is, therefore, important for public health management. It is applied in relation to priority setting concerning health problems, cost control, health economic evaluation, and health-care financing. When calculating the cost of illness as well as the cost of the health-care program, the cost of the same quantity of utilized services can be different if their unit costs are different. Many countries (the most well-known being Australia,[7] Canada,[8,9] the Netherlands,[10-12] and the United Kingdom [UK])[13] have tried to alleviate such difficulties by developing a standard or reference list of the unit cost of health-care services.

Yet, hospitals consume the largest share of health resources in most countries. They received 50% or more of the government's health resources in 19 out of 29 developing countries for which data were available[14] (in Vietnam, the figure was 54.3% in 1996).[15] This suggests that hospitals' resources should be managed for the benefit of the community in both developing and developed countries. Information regarding hospital costs is also needed to inform many types of policy decisions. It can help health planners to allocate resources, determine budgets for facilities and services,[16] and assess the comparative efficiency of health-care services across settings.[17] Therefore, the cost of health-care services in hospitals should be explored with the purpose of helping not only to manage finances and budgets but also to improve both performance and the health economics research.[18,19] In general, identifying and valuing, all costs from a societal perspective are likely to prove challenging (e.g. not available and/or difficult to measure), although analysts should do their best to identify, measure, and value resource use wherever possible in an economically feasible way.[16,20]

In recent years, many countries worldwide (with the most well-known being Australia,[7] Canada,[8,9] the Netherlands,[10-12] and the UK)[13] have implemented the calculation of the standard unit cost using many different methods, perspectives, discount rates, and so on. This review, therefore, aimed to explore the situation of the national reference unit cost (NRUC) of health-care services in various countries, which could express an overview to manage the policy of the government.

MATERIALS AND METHODS

The present study, which was updated in November 2016, was designed to be a systematic review. Publications were searched in the PubMed and Google Scholar databases using the following keywords: (standard* OR reference*) AND (cost* OR price*) AND (national*) AND (list*) with the following filter criteria 20 years ago; (standard* or reference*) AND (cost* OR price*) AND (national*) AND (list*). We also hand searched the reference lists of relevant papers and reviews. This study aimed to identify and include all published articles that included a reference or standard unit cost of health-care service study. We considered studies conducted from 1995 to the present. We limited our search to studies published in English language. All the identified titles, abstracts, and full-text articles were reviewed. Studies were rejected, if they were editorial, reviewed, or methodological articles.

RESULTS

A total of 437 abstracts were identified during the search performed in November 2016. Two reviewers then individually screened the abstracts and excluded 408 titles and/or abstracts. At this stage, 17 full-text articles were found to be eligible for inclusion in the study. After the second round of double screening, seven articles were judged to be eligible for inclusion in the review; however, ten reviewed or methodological articles were excluded . Two reviewers then performed the data abstraction. Figure 1 presents a flow diagram of the selection process for this systematic literature study.

Of the 437 citations identified, seven articles were found to be related to studies concerning the unit cost of medical services; hence, they met the selection criteria. These studies were conducted in Canada, the Netherlands, Australia, Thailand, the Philippines, the UK, and India whose details were shown in Table 1. The NRUC has been introduced into economic evaluation analysis or reimbursement. Australia was the first country to publish a standard unit costs study in 1992, while the standard costs list for health economic evaluation in Thailand, which was published in 2014, is the newest available list. The standard unit cost list in England is updated annually and provided to all hospitals.

In particular, in Asia, three countries have estimated the standard unit costs (42.8%), which render it the continent with the most relevant studies. In addition, Europe has two

studies from two countries (28.6%), while America and Australia have the least papers, with just one paper being found for each continent.

Australia was the first country to publish a standard unit costs study in 1992. The study has been updated fairly regularly, with four versions having been published so far. Despite having the most studies concerning standard unit costs, the first paper in Asia was published just 6 years ago. Europe has seen the most versions published despite the continent only having two studies, since the standard unit cost list of the UK, which is known as National Health Service (NHS) Costing Manual, is updated annually and provided to all hospitals.

Hospital unit costs are essential ingredients of many policy decision-making processes in the health-care sector. They can be used to assess the efficiency of units, treatments, and facilities, as well as for budgeting and resource allocation. They may also serve as inputs to further analysis, such as benefit incidence analysis and economic evaluation of health-care programs. Moreover, standard costs have been introduced into economic evaluation analyses so as to measure the potential differences in resource use that result from the selection of one intervention over another. Therefore, studies concerning unit costs are vitally important. However, only a small group of countries is presently concerned with this issue. The developed countries, with access to modern science and technology, first realized the importance of this issue within the health-care sector and hence became pioneers with regard to the researching of unit costs. The first article was published in Australia, followed by the UK, the Netherlands, and Canada. While it is true that the number of research studies published in Asia is higher than the number published in other continents, these studies have not been updated and edited over the years. This is one of the reasons why Asian health-care systems struggle to deal with many troubles and ultimately achieve less success than those in developing countries.

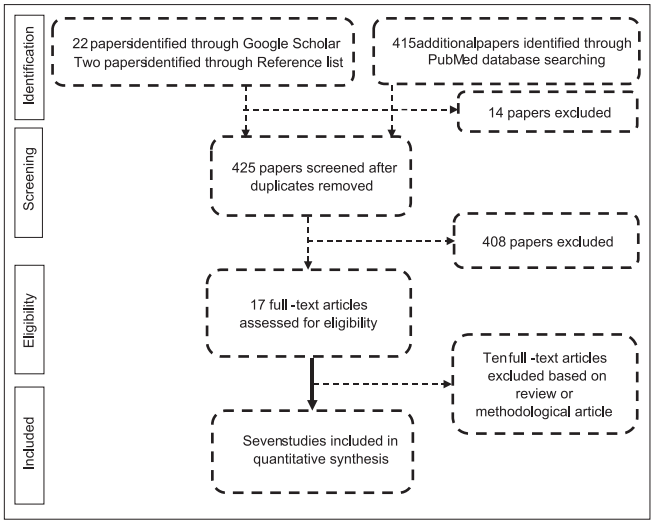

Figure 1: Flow diagram of the systematic literature study selection process

The nine identified countries have all implemented the estimated unit costs in many different ways due to having different objectives. In general, the most common objective is to conduct economic evaluations, which was the case in the Netherlands, Australia, and Thailand. Economic evaluations should include long-term costs, and the results of these studies are occasionally used to support decision-making at a national level. The main problem with economic evaluations conducted to date concerns the quality and consistency of studies as well as the degree to which the results can be compared among studies. The lack of a uniform methodology is often considered to be a weakness of these studies since it prevents the use of such assessments in practice. Therefore, some authors have encouraged the standardization of the methods used in economic evaluations "promoting high standards of conduct, scientific credibility and for explaining and comparing the results of studies in similar and different settings."

Another popular objective is the estimation of the unit cost for a regional hospital or several hospitals, as seen in the Philippines and India. Canada had assessed two provincial cost lists from two viewpoints and compared them. The objectives of UK in this regard are particularly detailed. The choice of a specific

Table 1: Characteristics of the NRUC studies

Countries	NRUC studies	Country	Number of versions	Published year
	n (%)			
America	1 (14.3)	Canada	1	2000
Europe	2 (28.6)	Netherlands	3	2000, 2004, 2010
		UK	19	Since 1997–1998 (updated annually)
Australia	1 (14.3)	Australia	4	1992, 1993, 2002, 2009
Asia	3 (42.8)	India	1	2013
		Thailand	1	2014
		Philippines	1	2009
Total	7 (100)			

NRUC: National reference unit cost

setting for the calculation of unit costs is thus very important. Some authors have argued that unit costs can differ considerably between health-care providers, so that the selection of a center(s) may seriously affect the cost calculations. It has been recommended that we should collect unit costs in more than one center and, further, that we should change the unit costs in a sensitivity analysis based on differences in unit costs that were discovered or according to estimates taken from other studies.[11]

In Table 2, the majority of studies were conducted by specific government health departments or institutes. This was the case in Canada, the Netherlands, the UK, Thailand, and Australia. This suggests the important role and concern of governments and institutes in monitoring, inspecting, and systematizing unit costs. They are certainly the first entities to introduce lists of unit costs and relative guidelines. The identified studies allow us an overview of the financial situation in the health-care sector. Hence, orientations and appropriate solutions intended to improve the quality as well as the performance of this sector can be identified based clear guidance concerning unit costing processes. Focusing on research regarding unit costs will help to improve health-care systems through both balancing budgets and achieving expenditure efficiency.

Interestingly, the study from the Philippines was the result of a program financed by the European Commission. It, therefore, represents a positive example of developed countries being interested in supporting developing countries in terms of organizing and developing many fields, including the health-care system.

Table 3 represents the sample characteristics of the NRUC studies. The sample sizes differ between the studies. The studies from the Philippines, Thailand, and India clearly listed the number of hospitals that participated in the research. In particular, the size of the sample involved in the study from the Philippines was the largest, comprising six tertiaries and two secondary hospitals. The use of a large

Table 2: The objectives and the organizations that conduct NRUC studies

Country	Objective	Organization
Canada	Provide a summary of the two provincial cost lists. Assess them from two viewpoints. Use in pharmacoeconomic submissions for listings on the drug formulary.	MCHPE CIHI
Netherlands	Conduct EE Provide a cost study action plan to researchers and policymakers to facilitate the implementation and assessment of costing studies in EE.	Issued by the Dutch Health-care Insurance Board and approved by the Ministry of Public Health, Welfare, and Sports.
UK	Used to support Development of the national tariff; Monitoring of performance and service delivery; Efficiency targets; Benchmarking of services across all sectors; Consideration of investment decisions; Commissioning to meet health needs; and Negotiation of revised levels of funding.	Department of Health (NHS Reference Costs)
Australia	Conduct EE and financial analyses. Strike a balance between comparability and accuracy in the determination of unit costs.	Pharmaceutical Benefits Advisory Committee
India	Estimate unit costs of the most basic services provided at different levels or types of hospitals in India.	Individual (*)
Thailand	Use in HEE. Increase the efficiency of study implementation, improve the reliability of data, and allow more accurate cross-study comparisons.	HITAP of the Ministry of Public Health
Philippines	Estimate unit costs of some key hospital services at selected hospitals in the Philippines. Support current hospital payment system reform efforts	PhilHealth European Commission-funded technical assistance for Health Sector Policy Support Reform program

The UK: The United Kingdom. *Susmita Chatterjee, Researcher, Research and Policy, Public Health Foundation of India, New Delhi, India. MCHPE: Manitoba Centre for Health Policy and Evaluation, CIHI: Canadian Institute for Health Information, EE: Economic evaluations, HITAP: Health Intervention and Technology Assessment Program, HEE: Health economic evaluation, NHS: National Health Service

Table 3: The samples of the NRUC studies

Country	Sample size	Sample methods
Canada	Two provinces Manitoba Alberta	N/A
Netherlands	N/A	N/A
The UK	N/A	N/A
Australia	N/A	Casemix Classification for Hospital-Based Ambulatory Services
India	Charitable hospital District hospital Tertiary care hospital Private hospital Private teaching hospital	Five hospitals of different types were chosen for this study based on their willingness to cooperate and the accessibility of hospital data The district and tertiary care teaching hospitals are government hospitals, while the charitable hospital is funded by a charitable trust Five hospitals (two in the north and three in the south) were located in four states in India
Thailand	Three regional/provincial hospitals and two district hospitals Regional (>500 beds), provincial (120–500 beds), district (10–120 beds).	Ref: Efficiency of hospital costs management (MOH: Ministry of Health)
Philippines	Six tertiary and two secondary hospitals in five provinces located in three island groups	15 hospitals were selected based on a predefined set of criteria followed by testing of the survey instruments at Quirino Memorial Medical Center and Mother Regina Hospital

The UK: The United Kingdom, N/A: Not available, MOH: Ministry of Health. NRUC: National reference unit cost

sample size in combination with an appropriate research method should lead to highly accurate results. The studies from India and Thailand both included five participating hospitals. Although the study from Canada listed the location of the sampling, it did not mention the number of hospitals involved. The studies from the Netherlands, the UK, and Australia failed to mention the sample size, which represents a major shortcoming in the eyes of readers who hope to refer to the utilized research methods as well as when evaluating the accuracy of the results.

The study from the Philippines initially selected 15 hospitals and then tested the survey instruments. Finally, the study was implemented in eight hospitals. In India, the participant hospitals were chosen based on their willingness to cooperate as well as the accessibility of hospital data. Five hospitals from four states (two in the north and three in the south) were included in the study from India. The sample of the study from Thailand comprised three regional/provincial hospitals and two district hospitals, while the Canadian study involved two hospitals from two provinces.

In Table 4, each country to have conducted a study chose or combined different methods in different steps based on both the objectives and the availability of data. Canada used four methods, while the UK applied a mixed approach. The Netherlands, India, and Thailand all employed three methods in their studies. Top-down and bottom-up costing methodologies were typically used to validate the accuracy of the results. Depending on the purpose of study, quantities of resources can be measured for individual patients ("bottom-up" approach) or the average number of patients ("top-down" approach) (10-12). The top-down methodology is more feasible and can be applied in the case of departments characterized by relatively homogeneous production. It is less costly, less time-consuming, and more accurate than the bottom-up approach, although it fails to collect cost data directly for specific patients who incur costs. Conversely, the bottom-up costing approach provides more detailed and precise cost data for each disease and patient treated at a hospital, which means that it allows for the identification of costs directly accrued for a particular patient as well as for insight into patient subgroups. However, it has not been widely used in economic evaluations, since it takes more time and requires more resources than the top-down approach. It is commonly used to determine case-specific costs for selected common diseases as well as to validate the estimates produced using the top-down costing methodology.

In Australia, six categories of health care were identified, including drugs, medical services, hospital services, diagnostic services, investigational services, and community-based services. The services included in the manual are based on economic evaluations and financial analyses conducted in both Australia and overseas, and they have been refined through discussions with sponsors and medical professionals involved in the clinical trials of drugs. In India, other medical services were identified, such as the cost per laboratory test,

Table 4: Cost methodology and scope of medical services in the NRUC studies

Country	Cost methodology	Scope of medical services	Cost component scope of medical services
Canada	Four methods 1. Top-down costing. 2. Bottom-up or micro-costing. 3. Activity-based costing. 4. To use prices, charges, or rates as an approximation of the costs of services.	Inpatient hospital. Outpatient hospital services (outpatient surgery, emergency care, outpatient clinics). Home care. Nursing home. Physician services. Outpatient diagnostic services.	N/A
Netherlands	Three methods 1. Top-down costing. 2. Bottom-up or micro-costing. 3. Allocation methods.	Direct, inside health care. Indirect, outside healthcare. Indirect, inside health care. Direct outside recommended self-report. In 2009, the replacement costs amounted to €12.50 per hour.	Inpatient days. Laboratory tests. GP visits. Hours of home care. Travel expenses, Time costs. Productivity costs. Special education. Juridical costs.
The UK	Mixed approach (bottom-up and top-down)	N/A	N/A
Australia	N/A	Six categories of health care are classified into: admitted patient services and non-admitted patient services	N/A
India	Three methods 1. Standard costing method. 2. Simultaneous equation method. 3. Average cost method.	Unit cost of OPD visit, stay, emergency room visit, IPD, and surgery. Costs of some other medical services for individual hospitals.	Human resources costs. Capital costs. Materials costs.
Thailand	Three methods 1. Development of standard RVUs of health services. 2. Unit cost analysis of hospital medical services. 3. Direct non-medical costs for outpatients.	3091 items in 12 groups.	Labor. Materials. Capital costs but excluding pharmacy costs.
Philippines	Two methods 1. Top-down or step-down costing. 2. Bottom-up or resource costing.	Unit cost of bed-day, discharge, outpatient visit, and ancillary services of hospitals.	Capital cost. Cost of personnel services. Drugs/medicines and medical supplies costs. Other recurrent costs.

The UK: The United Kingdom, N/A: Not available. NRUC: National reference unit cost, OPD: Outpatient department, IPD: inpatient department

cost per admission or bed-day at the intensive care unit, cost per surgery in the orthopedic, ophthalmic, and gynecology operating theaters, and cost per visit to the physiotherapy, and other units. The 12 categories identified in Thailand are routine services at outpatient and inpatient departments, blood transfusion services, diagnostic and clinical pathology services, diagnostic and therapeutic radiology services, special investigations, medical supplies and services, medical procedures and anesthesia, nursing care services, dentistry services, physical therapy and medical rehabilitation, acupuncture and other alternative medicine, and health promotion and disease prevention and control.

The cost component scope of medical services consisted of the capital cost, materials cost, and labor cost. In general, the various cost components are carefully calculated (e.g. in the Netherlands, India, Thailand, and the Philippines). Based on the provider's perspective, the capital costs are frequently estimated, while variable costs such as drugs and medical supply costs only appear when assessing the unit cost of the medical service in the Philippines. Yet, the Netherlands is the country that has the largest range of costs, including direct costs (e.g. inpatient days, laboratory tests, and general practitioner visits) and non-direct costs (e.g. travel expense and hours of home care). These medical costs, which are both usually calculated based on the perspective of the payer, are also present in other countries, such as Thailand and the Philippines.

Very few countries mentioned the discount rate in their studies. The discount rate, as recommended by the WHO guide,[21] was 3% for a base case. However, the Netherlands used 1.5% based on the assumption that the value of health gains increases over time, while this increasing value is not accounted for in economic evaluations. This explains why the discount rate is not an important variable and has little effect on the results of the economic evaluations in countries uch as Canada, the UK, Australia, India, and the Philippines. The results and limitations of each study were showed in Table 5.

DISCUSSION

Costing methodology

There exist a variety of approaches to resource measurement, and the choice of approach may be determined by the problem needing to be decided on, the perspective of the study, and the availability of data. Based on the main methodological issues identified in costing health-care services by the University of York, there are five general costing approaches found in almost all projects: Direct measurement (including top-down [gross-costing] and bottom-up [micro-costing or activity-based] costing); using standard unit costs; using cost accounting methods; use of fees; and market prices and estimates based on information derived from previous studies.[22] Applying direct measurement at a study site to ascertain the unit cost is appropriate when the results are to be used for organizational management, while the standard unit cost is used when the results are needed for national-level management.

In Thailand, the majority of studies have used the accounting-based approach due to its relative simplicity. It ignores the concept of opportunity cost and costs in time difference. The notion of the "effect of costing methods on unit cost of hospital medical services" argues that the capital cost of buildings and capital items as calculated using the accounting-based

Table 5: The outcomes of the NRUC studies

Countries	Results	Limitations
Canada	The classification of patient care by diagnosis and procedure as well as the assignment of first principal diagnosis. Both provinces use the CIHI DPG classification system and weights. Both Alberta and Manitoba use fees to place a value on nursing home care, which can be consolidated into a cross-provincial fee rate.	While Alberta and Manitoba were the first provinces to develop formal cost lists, it is desirable to develop cost lists for other provinces as well, since the current lists do not represent health-care expenditures in all of Canada. A truly representative national cost list for Canada would have to include data from both Quebec and Ontario.
Netherlands	N/A	Lacked topics on (1) medical costs in life-years gained, (2) the database of the DBC Casemix System, (3) reference prices for the mental health-care sector, and (4) the costs borne by informal caregivers. New insights and developments necessitated the updating of existing topics, such as (5) the friction cost method to account for absence from paid work, (6) discounting future effects, and (7) options for transferring cost results from international studies to the Dutch situation
The UK, Australia, Philippines	N/A	N/A

(Contd...)

Table 5: *(Continued)*

Countries	Results	Limitations
India	The tertiary care hospital had the highest caseload (average of 1045 visits per day), and the charitable hospital, the lowest (average 84 visits per day). One of the efficiency indicators of hospitals is the bed occupancy rate. The major cost component for the district and tertiary care hospitals was human resources, while for the charitable and private hospitals it was the capital cost, but for the private teaching hospital, it was the materials cost. The land cost was the largest component for the charitable hospital, the equipment and building costs shared almost the same percentages for the district hospital, the equipment cost was the biggest item for both teaching hospitals, and the building cost was the highest component for the private hospital. The human resources cost was the main component of the total operating cost for the government hospitals, but the materials cost became the main component for all the other hospitals when the land cost was excluded. Within an individual cost center, human resources accounted for the highest cost share, followed by the materials cost, in both the district and tertiary care hospitals.	As the tertiary care hospital was unable to indicate the distribution of drugs and medical supplies among its cost centers, we used the number of visits and admissions to distribute this cost. Based on the hospital physicians' opinions, we assumed that patients in the wards consumed 3 times more drugs and medical supplies than patients seen at the OPD or emergency room. Although expert opinion is an accepted method for resource allocation, the resulting figures are not exact. Hence, the unit costs of different departments at the tertiary care hospital might be either under- or over-estimated. As we did not have access to price data for certain equipment and instruments in the ophthalmic operating theater of the tertiary care hospital, the equipment cost of this department is an estimate. This might affect the unit cost estimate of the ophthalmic department of this hospital. Donated items have not been considered in the cost calculation. Shepard *et al.* argued for the inclusion of donated items in cost analyses, since hospitals or wards with more donated items may appear more efficient than their peers, even though their actual efficiency may be the same. Such items can account for a substantial share of hospital resources.[4] However, as the study hospitals did not keep any record of donated items, we excluded them from our calculation, although the unit cost estimates of the study hospitals would have been different had they been included. The quality of services could clearly explain some of the variations in costs, but it was beyond the scope of this study. Using duty rosters to allocate nursing and ground level staff time provides only estimates of time allocation. However, it was impossible to obtain exact time allocations for these staff categories. As one goal of this study was to determine the feasibility of conducting cost estimates in the Indian health-care sector, we chose five hospitals of different types whose administrators would agree to cooperate and provide data. Given the diversity of hospitals in India, our study hospitals might not be representative.
Thailand	The costs per RVU for regional/provincial hospitals and district hospitals were found to be 134.95 THB and 128.67 THB, respectively. The cost to charge ratios is 1.63 and 1.45 for regional/provincial hospitals and district hospitals, respectively.	The CSMBS reimbursement rate used for the standard RVU development was established several years ago, which may mean that some of the methods may be slightly out of date. The small sample size of health facilities used for the calculation. Did not include services at a super tertiary level or at a university hospital level.

The UK: The United Kingdom, N/A: Not available. DTC: Diagnosis treatment combination, OPD: Outpatient department, CIHI: Canadian Institute for Health Information, RVU: Relative value unit

approach was 13% lower than that calculated using the economic-based approach. If the results were used for price setting or financial planning, then the hospital would lose approximately US$24,596 per year. These results reflect the WHO's guidelines, which state that the economic-based approach is appropriate for calculating the capital costs of hospital cost analysis.[23]

Prior studies have shown that the top-down approach is simple, transparent, and able to tackle regional or institutional variability. Due to the lack of detailed data, it is often the only feasible option. Moreover, it is retrospective, and standard costs cannot be calculated this way. The managers of health-care institutions frequently use the top-down approach to calculate hospital treatment costs in several countries, including Australia, Belgium, Sweden, the UK, and the USA.[24-26] The results of the bottom-up approach are more reliable and precise although such an approach can prove expensive, may not always be practical, and requires a very detailed service delivery process.[27]

In Thailand, a special form of the bottom-up approach known as the relative value unit (RVU) system is used to establish the standard unit cost based on existing prices lists. The RVU system is a weighted procedure method calculated based on the detail of the consumption of supplies, equipment, or personnel as cost drivers. A study from Thailand argued that the RVU method is suitable for calculating the unit costs if the standard relative weight units have already been established.[2]

In practice, analysts prefer a mixed approach in their studies, for instance, the NHS Costing Manual guidelines and the situation in the Netherlands (which uses a step-down approach, that is, a special form of mixed approach). The mixed model allowed analysts to tailor the cost measurement to the particular study objectives and decide when they will rely on direct cost measurement (micro-costing) and when they will use computer-based databases (macro-costing).[27-29]

Perspectives

The unit cost perspective is different in every country. While the costing perspective in the Netherlands focuses on society, in India, it focuses on the provider. The determination of the perspective could affect the question/decision problem to be addressed, the inclusion and exclusion of resource items (costs), the methodology selected, the statistical analysis completed, and a decision or recommendation. Analysts should, therefore, be clear and explicit about whether the costing exercise is performed from a: (a) patient (first party), (b) provider (second party), (c) purchaser (payer, third party), (d) employer or other sponsor (fourth party), (e) government, or (f) societal perspective.

The perspective determines the types of costs that should be taken into account. For instance, it can have an impact on whether direct non-medical costs (e.g., travel) should be taken into account as well as whether or not they should be reimbursed. Further challenges include the partial inclusion or exclusion of multidisciplinary care costs (e.g., early intervention for schizophrenia). In addition, the perspective will determine whether productivity costs should or should not be taken into account, as well as whether (service providers') overheads should be added to the direct medical costs.[27,30,31]

In Africa, the costs were calculated from the perspective of the health-care facility, while in Australia, the financial analysis in a submission prepared according to subsections E.2–E.4 of the PBAC Guidelines adopts the perspective of the PBS/Repatriation Pharmaceutical Benefits Scheme (RPBS). This means that cost components borne by payers other than the Australian Government are excluded from the financial analysis. In practice, this means that non-PBS/RPBS drugs, over-the-counter drugs, or drug delivery systems are excluded from the financial analysis because they incur no direct financial cost to the PBS/RPBS. This also means that the range of patient copayments is subtracted from each PBS/RPBS drug's unit cost.

In summary, the perspective of an economic evaluation study is the objective of the individual study as deemed appropriate for each country. It is crucial in relation to both the definition of the costs and the criteria for inclusion in the study.

Discount rate

Discounting is the process of converting future costs into their present value to reflect the fact that, in general, individuals and society have a positive rate of time preference for consumption now overconsumption in the future. The allocation of overhead costs is a common problem when estimating the unit cost, especially in multi-cost centers. Moreover, health economic methodological guidelines frequently fail to provide sufficient details regarding the recommended cost allocation methods.[32] Analysts should be aware of the value of the fixed asset, the working life of each particular asset, and either the acquisition costs or the replacement costs of the assets.

The discount rate, as recommended by the WHO guidelines,[21] was 3% for a base case and 6% for a sensitivity analysis. The sensitivity analysis of the discount rate was tested using a 6% discount rate in the calculation rather than the 3% of the base case. This resulted in an increase in the total annualized capital cost of 4.76%.

The discount rate in Thailand and India is determined to be 3%, while in the Netherlands it is 1.5%. The latter is based on the assumption that the value of health gains increases over time, while this increasing value is not accounted for in economic evaluations.[33]

Scope of services - sample size

The hospital data from Canada were collected in two hospitals from two provinces though they combined lost of terms of services. The study from the Philippines included data from eight hospitals, while the studies from India and Thailand were both conducted in five hospitals. India exported the unit costs of inpatient and outpatient care (One of the most popular approaches), emergency visits, surgery, for instance, Canada, and the Philippines. While Thailand classified 3,091 services into 12 groups.

CONCLUSION

This first systematic review of studies concerning the NRUC for medical services clearly showed that based on the current situation, the international methodological guidelines for conducting and reporting the NRUC of health-care services should be amended and developed as soon as possible.

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