Health economics

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Health production faces two forever growing challenges, the increasing demands on limited resources on one side and the increasing cost of healthcare on the other side. Effective and efficient health resources allocation is required for a safe and distributive health. Health economic analysis facilitates decision-making by offering a decision-making framework assessing which health intervention provides the maximum clinical benefits at an economic cost.

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Introduction

The South African healthcare system, like any other healthcare system in the world, faces a constantly increasing demand for health services.[1,2] Health represents a good that needs to be produced and distributed for human consumption.[3] The production of health like any other good requires the transformation of limited resources. After production, health must be distributed to humans who have endless health needs. Health production and health distribution cost both the healthcare payer and the patient.[3] The healthcare payer incur the costs linked to production and distribution while patients can suffer consequences of ill health due to poor production and distribution of health. Therefore, policymakers have to carefully balance the cost and health outcome or benefits before implementing any health intervention or decision.[3] The application of these economic principles in health science is important for equitable use of scarce resources needed for the production and distribution of quality health.[4] The scarcity of health resources and the need for an equitable distribution of health represent the basis for the introduction of health economics, which represents a branch of economic science that applies economic principles to the practice of healthcare.[4]

Health economics has evolved and its origin was many years ago. The first pioneering works can be found in Milton Friedman's publications in 1930. After World War I, the RAND corporation was established in 1945 in the United States of America to help build a welfare state in liberal capitalism, to manage social affairs and, ultimately, to establish the economics of healthcare.[5,6] In 1958, Selma Mushkin published a paper titled "Towards the definitions of health economics".[7] In 1963, Kenneth Arrow released a paper titled "Uncertainty and welfare economics of Medicare", which paved the way for health economists' thoughts on how the healthcare market is structured.[8] In 1972, Michael Grossman published a paper on the health capital concept and the demand for health, laying the foundation for the influential health capital model.[9]

What is health economics?

Economics is a science that explains the production of goods using scarce resources. It allows for the collection and structuring of data, and the prioritisation of choices to maximise welfare within a constrained resource.[10]

Health economics is thus a subspecialty of economic science that studies the allocation of resources to and within the healthcare domain; serving as a connection between health and the resources which are consumed for its promotion.[11]

Health economics addresses questions related to the efficiency and equity of scarce resources within the healthcare sector. The efficiency relates to various options of maximising the benefits from available resources by ensuring that the benefits gained exceed opportunities forgone; the equity aspect of health economics addresses the fair distribution of resources. Hence, health economics provides a systematic framework that allows the comparison of costs and benefits arising from each therapeutic option for the patients.[11]

Why health economics?

The decision-making process concerning treatment choices has evolved. In the past, patients' therapeutic options were often chosen by healthcare practitioners while the patients' views or opinions had little to no impact on the decision-making process. Recent progress made in both medicine and technology have resulted in improving patients' awareness on their health and the type of healthcare services they want. More and more patients are demanding quality healthcare based on the strongest available evidence that can justify the choice of one therapeutic modality over another.[6]

Evidence-based medicine helps ease the decision-making process by showing the scientific foundation for the selection of the best health interventions using available scarce health resources. The choice of the best health intervention will be guided by a careful analysis of the costs and benefits of different
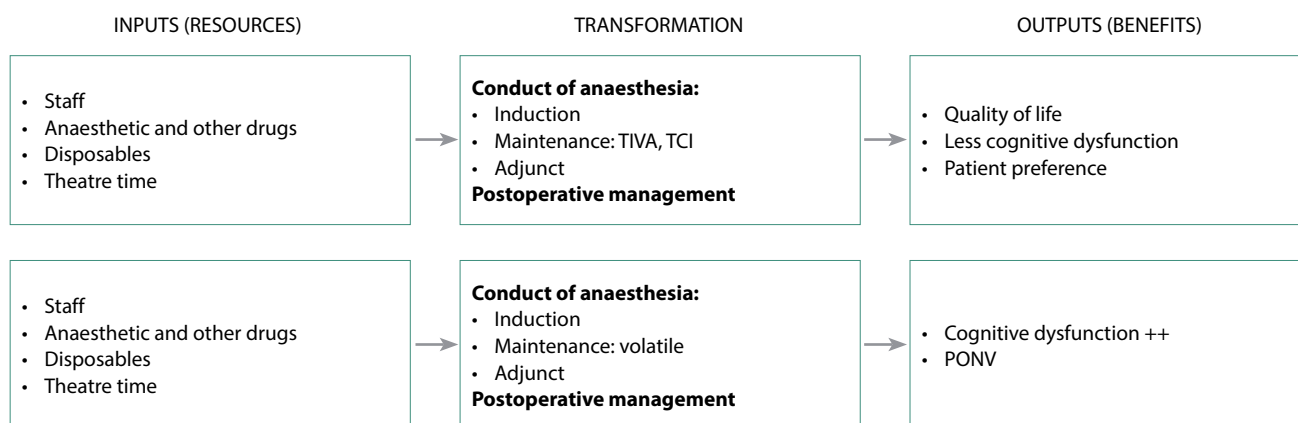
INPUTS (RESOURCES) TRANSFORMATION OUTPUTS (BENEFITS)

Figure 1: The transformation process of anesthesia

available choices. The best choice in health economics is the one that provides the maximum value for money spent by offering both clinical and cost effectiveness. The selection of the best choice is guided by health economic evidence which can be produced using economic evaluation.[6]

Economic evaluation

The scarcity of resources (human, equipment, facilities and time) required for health production obliges health policymakers to objectively evaluate different health interventions before deciding on their implementation. Their selection should be based on the best available objective evidence rather than on subjective individual opinions. The collection of objective evidence can be done through economic evaluation.[11,12]

Economic evaluation is the process of comparing the costs (inputs) and benefits (outcomes) of more than one health intervention. Health intervention requires the transformation of inputs (resource incurring costs) to produce outputs (benefits or outcomes)[3] as illustrated in Figure 1.

The implementation of all health interventions and decisions need to have a careful balance between the costs and the health outcomes. Although the costs of health interventions can be

Table I: Definition of different types of cost

Type of cost	Definition
Direct costs	Cost of resource and labour used in the production (costs of wasted drugs, disposable, dispensing costs as well as costs of managing drug side effects)
Indirect costs	Costs related to the consequences of an event on society or an individual
Marginal costs	Change in costs for producing one additional unit of output
Intangible costs	Expenses involving items that lack physical substance (i.e. time)
Fixed costs	Costs that remain the same regardless of the number of goods or services provided (e.g. rent and salaries)
Semi-fixed costs	Expenses that remain unchanged only over a certain range of output
Variable costs	Costs that change with the number of services provided

difficult to measure, it is important to determine which costs that are either included or excluded during the economic evaluation of the intervention.[3]

Cost can be defined as the sacrifice measured as the price paid for the irreversible use of a resource.[11] The different types of cost are illustrated in Table I.

The benefits of health interventions can have an impact on society, healthcare providers, the patient or the healthcare payer. These benefits can be direct medical, direct non-medical, indirect or intangible. The decision-making process for healthcare policy looks at the benefits of the entire society which can be difficult to measure with accuracy.[11] The expression of benefits resulting from health interventions can be different depending on the medical discipline, as illustrated in Table II.

Table II: Benefits of health interventions

Benefits from the anaesthesiologist's medical intervention
• Episodes of nausea and vomiting
• Duration of post-anaesthetic care unit stay
• Return to normal functioning
• Improvement in pain scores
Benefits from surgical or medical intervention
• Healthy days
• Life years gained
• Quality-adjusted life years (QALYs)

Economic evaluation represents a tool that allows for the identification as well as objective quantification of inputs and outputs which in turn will define the criteria on which choices can be made using a systematic analysis of different health interventions. It provides a systematic and objective framework by relating the benefits (outcomes) of alternative interventions to the costs (inputs) used for their production; therefore, assisting decision-makers to make more informed choices.[4]

Three principles are used during an economic evaluation: opportunity cost, marginal analysis and perspective. The opportunity cost represents the benefit lost when one alternative is chosen over another.[13] Marginal analysis is the process of comparing the additional benefits derived from an activity to the extra cost incurred by the same activity.[14] Perspective represents the point of view used while deciding on the types of cost and health outcomes that have to be included during an economic

evaluation.[15] The basis for decision-making can differ depending on different perspectives (healthcare sector, societal and governmental).[1] Therefore, it is important for the decision-maker to clearly specify the viewpoint on which the choice of health intervention was based.

There are four main types of economic evaluation: cost-minimisation or cost-identification analysis, cost-benefit analysis, cost-effectiveness analysis and cost-utility analysis.[1,16] (Also see Table III.)

Table III: Types of economic evaluation

Type of economic evaluation	Measurement and valuation of outcomes
Cost-minimisation analysis	Outcomes are equivalent Measurement is focused on costs
Cost-benefit analysis	Outcomes are measured in monetary value
Cost-effectiveness analysis	Outcomes measured by natural units unidimensional index
Cost-utility analysis	Outcomes are measured by QALYs

Cost-effectiveness analysis

This is one method of economic evaluation that compares the opportunity costs and benefits of different health interventions in order to assess the most suitable alternative courses of action to implement, having similar benefits or health outcomes.[3,4] A cost-effectiveness analysis is used when the health benefits are difficult to value in monetary terms. These health benefits can be represented as life-years gained, symptom-free days and decreased episodes of postoperative nausea and vomiting (PONV). The process of a cost-effectiveness analysis begins with the determination of health interventions subject to comparison. This step is usually followed by the determination of the costs of health interventions. The outcomes from these interventions will then be converted to the same measurement unit; therefore, each health intervention will have its own ratio.[3] This ratio is called the cost-effectiveness ratio (CER) and is directly proportional to the costs of intervention and inversely proportional to the health benefits produced (CER = costs of intervention/health benefits produced). The incremental cost-effectiveness ratios (ICERs) are used for mutually exclusive health interventions: ICER = (costs of intervention 1 – costs of intervention 2)/(health benefits intervention 1 – health benefits intervention 2).[4]

Finally, each health intervention will have a ratio consisting of the amount of money spent and the health benefits gained from the intervention (for example, Rands per decreased episode of PONV).[3,4] Therefore, these ratios can be used to show which intervention is more beneficial.

The general anaesthesia versus local anaesthesia (GALA) for carotid surgery trial can be used as an example of cost-effective intervention. The GALA trial was a large, multinational and randomised study which was conducted on 3 526 patients undergoing carotid endarterectomy either under general anaesthesia or local anaesthesia (LA). This trial showed that carotid endarterectomy under LA was cost-effective due to the fact that a patient who had carotid endarterectomy done under LA incurred fewer costs (mean difference 178 pounds) and had a slightly longer event-free survival (difference of 0.16 days) compared to the patient who had the procedure done under general anaesthesia.[17]

Cost-benefit analysis

Another type of economic evaluation similar to the cost-effectiveness analysis is the cost-benefit analysis, except that it is used when the benefits or outcomes of the health interventions can be converted to a monetary value. Hence, it allows for the comparison of health interventions by quantifying costs and benefits using the same units.

A cost-benefit analysis entails a systematic comparison of all the relevant costs and benefits of proposed health interventions. The benefits of health interventions must be converted to a monetary equivalent. This conversion is often laborious, difficult to achieve and yield different results from different individuals.[3] Waters et al.[16] have shown the costs and benefits in the implementation of the Michigan Keystone Patient Safety Programme in the intensive care units in the USA. Approximately 29.9 catheter-related bloodstream infections and 18 cases of ventilator-associated pneumonia were avoided annually per hospital. The implementation of this programme cost $3 375 per infection avoided and prevented additional costs of between $12 208 and $56 167 per infection related to treatment. This intervention yielded a net benefit of $8 833–$52 792. This analysis facilitated the decision-making process by indicating that the net benefit of the programme far exceeded the implementation cost of the programme.[16]

The ENIGMA trial is another example of a cost-benefit analysis. The ENIGMA trial was a prospective, randomised, multicentre study on 2 050 patients and showed that the use of more expensive potent inhalational anaesthetics is not associated with higher overall costs. It further showed that the total costs in the N_2O-oxide group were significantly higher compared to the costs of the N_2O-free group.[18]

Cost-minimisation analysis or cost-identification analysis

This type of evaluation is a primitive form of the cost-effectiveness analysis in which all the benefits are considered equal and the costs are the dominant determining factor in a choice between health interventions. It is the most common economic evaluation used in anaesthesia due to the fact that most of the time, the choice of intervention is not determined by the outcome (as this remains the same) while the costs of the intervention play a major role in the decision-making process.[3] Therefore, cost-minimisation analysis provides a systematic approach of selecting an intervention that produces the same health benefits at less cost.[3]

The simplest example of a cost-minimisation analysis is the choice between the use of sevoflurane and desflurane for the

maintenance of anaesthesia. Owing to the fact that sevoflurane and desflurane are equally effective for the maintenance of general anaesthesia, sevoflurane is the least expensive and will be chosen during cost-identification analysis in South African settings.

Cost-utility analysis

This type of evaluation is closely related to the cost-benefit and cost-effectiveness analyses, but benefits are not measured in monetary terms or natural units. This analysis considers different procedures and outcomes relative to an individual's quality of life. Many instruments are used to measure the quality of life and the most commonly used metric is the quality-adjusted life years (QALYs).[2,3]

The QALYs combine quantity and quality of health to derive the outcomes based on a health intervention or other activities that impact health. It provides a tool that helps to quantify the impact of an illness or health intervention on people's ability to function, which can then be extrapolated to an economic scale. The QALYs metric describes the cost of producing one year of quality living life.[2]

When health benefits are reported as QALYs, there is a numeric weight that is assigned to each possible health state starting from 0 as an equivalent to death and 1 as a perfect health state. People living an extremely low quality of life can be given negative weights. These weights are reflective of the population health and can be determined in many ways.[3] The sum of all weights given to each health state times the duration equals QALYs. For example, a person in perfect health who is expected to live 50 years would have 50 years × 1.0 utility = 50 QALYs.

Stroupe et al.[19] used the clinical outcome data of procedural and follow-up medical treatment costs from the randomised Open Versus Endovascular Repair (OVER) trial to estimate the cost-utility of endovascular versus open repair of an abdominal aortic aneurysm. Their cost-utility analysis suggested that endo-vascular repair is a lifesaving, life quality-enhancing procedure as well as cost-saving due to the fact that endovascular repair yielded 0.04 incremental life years compared to 0.006 QALYs gained from an open abdominal aortic repair. They further reported that in-hospital costs were lower in the endovascular repair group than in the open abdominal aortic repair group. Therefore, the endovascular abdominal aortic repair brought more resources to the healthcare system than the open aortic repair.

Conclusion

The scarcity of healthcare resources, together with the growing need for quality healthcare, are pressurising healthcare systems worldwide. The application of economic analysis in anaesthesia can be useful in assisting clinicians and managers with critical decision-making.

Conflict of interest

The author declares no conflict of interest.

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