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Health Enterprise East

TO OPERATE OR NOT TO OPERATE – THE ECONOMICS OF SURGERY

TRENDS, INSIGHTS & OPPORTUNITIES

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HEALTH ENTERPRISE EAST LTD.

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Medtech Navigator

The Medtech Navigator, part-funded by the European Regional Development Fund (ERDF), is a three-year programme, delivered by Health Enterprise East Ltd., to facilitate knowledge exchange between the medtech industry, many of whom are small and medium sized enterprises (SMEs), the NHS, and academia. The programme seeks to enable companies to identify potential market opportunities in a variety of specific disease areas and apply for Innovation Grant funding through the programme, thereby engaging SMEs in new R&D projects that are both customer-focussed and collaborative in nature. This will allow the creation of partnerships between clinicians, academics and industry to develop novel medical technologies which will improve healthcare and quality of life for patients and the healthcare market of the future.

Health Enterprise East Ltd.

At Health Enterprise East believe in improving healthcare through technology and innovation.

We work with the NHS, medical technology industry and government organisations to help turn innovative ideas into products and services that will benefit patients.

Our experienced team offers clients a diverse range of business and innovation management services. Our strengths include IP management, technology commercialisation, health economics and strategic market access advice.

Based in Cambridge, we work with over 25 NHS organisations nationally and medtech companies globally. Our aim is to help our clients address the challenges faced along the product development pathway, connecting them with relevant healthcare experts and funding opportunities.

Report Summary

The best surgeons know when not to perform a surgical procedure if the benefit of the treatment is too small to outweigh the potential harm which could be done. If we elevate this principle from the individual patient to all patients in the NHS, knowing the sacrifices to be made, by deciding to undertake a specific surgical intervention, is crucial to ensure the fair and equitable allocation of healthcare resources.

Health economic evaluation provides a vehicle for understanding these opportunity costs and weighing them up against the benefits to be generated for the health of all citizens.

While we cannot expect surgeons to perform a health economic evaluation every time, having an understanding of the consequences of their professional choices will contribute to better decision making and knowing when *not* to operate.

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1. Introduction

Modern surgical care has an impressive armamentarium of surgical procedures – everything from the drainage of a simple abscess, to the repair of complex congenital heart anomalies. Surgical care encompasses the surgical procedure itself, as well as the preoperative treatment of patients, including deciding whether to operate; intraoperative anaesthetic management and postoperative care[14].

It is estimated that the total expenditure on surgery in the NHS in England accounts for over 4% of the total NHS budget, with individual theatres costing an average of GBP 1.5 million a year to run[1]. Unconstrained, national spending on surgical procedures and care can quickly balloon to account for over 50% of spending as a recent evaluation of Medicare spending in the USA revealed[2].

The efficiency of surgical care and the running costs of operating rooms is coming under increasing scrutiny; cost-transparency and cost-containment measures seek to identify cost-savings without impacting on health outcomes. A cornerstone of many of these measures is making surgeons more aware of the cost implications of their treatment decisions. Furthermore, suppliers of surgical technologies need to recognise that cost is becoming an increasingly important factor in the operating room.

2. Why should surgeons worry about health economics?

A BMJ editorial from 1999 stated that "*Good Surgeons know how to operate, better ones when to operate, and the best when not to operate*"[3]. The very best surgeons sometimes do not perform a surgical procedure if the benefit of the treatment to the patient is too small to outweigh the potential harm which could be done. This can be a difficult decision to take for a surgeon who would like to "test their mettle" by performing ground-breaking and challenging procedures. It takes strength of character, wisdom, experience and courage not to intervene, even though one could.

This decision does not only impact the patient at hand, but the health of other patients. The decision to operate on one patient necessarily means that this surgeon and the surgical support team is not available to tend to other patients. Furthermore, the cost of performing the surgery has budgetary implications which translate into a sacrifice that has to be made in denying healthcare services to other patients, whom we may never know. This sacrifice is known in economics as the "opportunity cost". But is the value of their health necessarily less just because we don't know them?[4] A public healthcare system such as the NHS has equity concerns that mandate that there should be no discrimination between healthcare recipients[5]. Consequentially, deciding whether, or not, to operate comes with opportunity costs to other patients, who we may not know, but whose lives are nevertheless worth the same.

To account for the harm which could potentially be done to these unknown patients, by operating on the known patient at hand, we need an evaluation of the cost and health outcomes to make an informed decision, based on the overall improvement in health achievable against the resources and cost it requires.

Surgeons who care about all patients, known and unknown, should also consider the cost and benefits of a surgical intervention before taking that decision. While we cannot expect surgeons to perform a health economic evaluation every time, having an understanding of the consequences of their professional choices will contribute to better decision making and knowing when *not* to operate.

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3. What is a health economic evaluation?

A health economic evaluation compares the cost and consequences of a new surgical intervention ("the innovation") against a relevant alternative, which could either be another surgery or a non-surgical alternative, or indeed a "do nothing" option. This evaluation can yield four possible scenarios; the innovation can either;

A. Cost money and improve health
B. Save money and improve health
C. Save money and worsen health
D. Costs money and worsen health

Each of these scenarios is represented by a quadrant on the cost-effectiveness plane[6] shown in Figure 1 below, which represents the incremental costs and benefits of the innovation as compared against the alternative treatment placed at the origin on the graph.

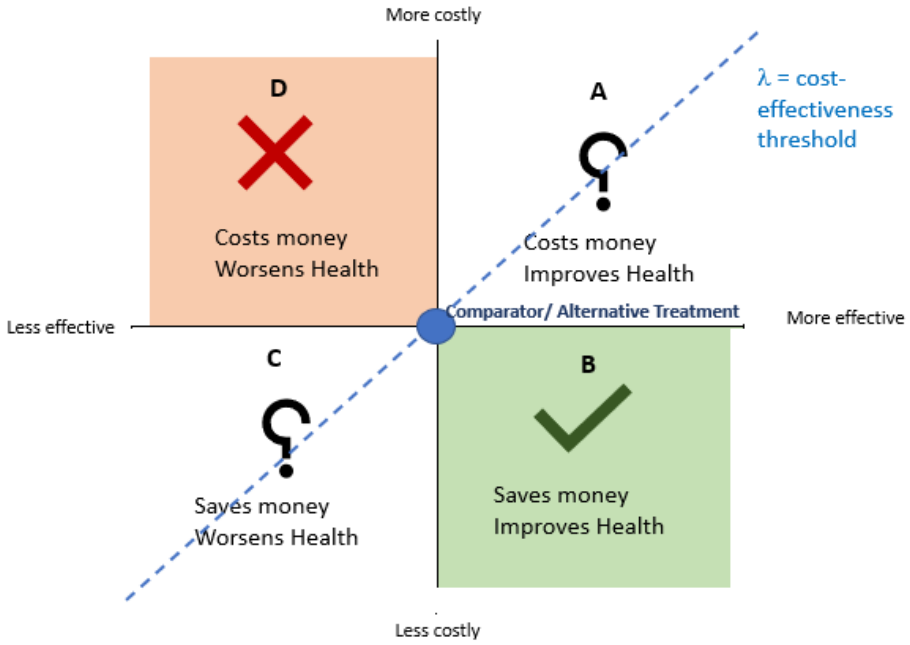

Figure 1 - Cost-effectiveness plane. Adapted from Drummond et al[6]

Scenario B (South-east quadrant) and scenario D (North-west quadrant) yield clear answers in terms of cost-effectiveness with B being cost-effective but scenario D not. However, scenarios A (North-east quadrant) and C (South-west quadrant) are not so clear. Scenario A is encountered most frequently in health economic evaluations and involves making a trade-off between the additional benefits on the one hand and increased cost on the other. We can get a sense of this trade-off by dividing the additional costs by the additional benefit of the innovation, giving the additional cost per additional unit of health benefit; this is known as the incremental cost-effectiveness ratio (ICER).

Whether the innovation is considered worthwhile depends on how much the decision-maker or budget holder is willing to sacrifice for that additional unit of health benefit; this is known as the "cost-effectiveness threshold", represented by the dotted line in Figure 1. Beyond the pure monetary cost, this threshold represents the opportunity cost of the health expected to be given up, as a consequence of the incremental cost required to acquire the innovation.

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4. What outcomes matter?

Healthcare systems, such as the NHS and others, have, as their objective, the improvement of the health and well-being of all patients[7]. With this objective comes a need to measure this improvement. To know whether an innovation does more good than harm, health outcomes need to be measured in a way that is comparable across conditions using a generic, single index measure such as, for example, lives saved. However, while this accounts for mortality, it does not indicate morbidity; how much the patient's quality of life is impacted by a condition. To weigh a patient's years of life saved by the quality of that life, one needs to apply a health-related quality of life (HRQoL) weighting to establish Quality-Adjusted Life Years (QALYs). QALYs offer a generic, single-index preference-based measure of health outcomes that combines gains from reduced mortality (quantity gains) and reduced morbidity (quality gains)[6].

An alternative to the QALY is the disability-adjusted life year (DALY), which measures the sum of life-years lost due to premature mortality and the years lived with a disability. DALYs are preferred by the World Health Organisation (WHO)[8] as a way of measuring the burden of diseases on countries.

5. What costs matter?

Costing in an economic evaluation involves the identification, measurement and valuation of resources consumed as a result of an intervention. This typically includes resource cost in terms of time spent, use of a facility, use of equipment, use of consumables. Sometimes, the costs incurred may not be confined to the health care sector, such as, for example, the patient-incurred cost of needing to travel to a hospital where their surgery is scheduled, or the cost to a relative who may accompany them to the hospital and care for them after they are discharged.

Which costs should be included depends on the study's perspective; what is relevant to a budget-holder at the local level may be different to what matters to a decision-maker at the national level. In England, the National Institute of Health and Clinical Excellence (NICE) requires that all NHS and social services resource use be included in any submission it receives. Furthermore, any non-health resources differing significantly between interventions being compared should also be included, albeit reported separately[9].

6. Keeping it dynamic

The costs and benefits associated with a healthcare intervention may occur at different times; a heart transplant, for example, may require an investment in the present, but the effects in terms of improved quantity and quality of life accrue for many years in the future. Costs and benefits occurring in the future are typically given less weight than those happening today; this is based on economic theory which postulates that individuals and society prefer to receive something today rather than in the future (a.k.a. the "positive rate of time preference")[10]. To compare the investment made today with a criterion that considers the timing of when the returns will accrue is considered essential in economic analysis.

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7. What contributes to the cost-effectiveness of surgical interventions?

7.1 The cost-effectiveness threshold

In a budget-constrained system such as the NHS, every decision made comes with an opportunity cost, which represents the benefits foregone as a result of making the decision. Is the sacrifice to be made justified by the incremental improvement in health achievable by a certain surgical intervention? What sacrifices are we prepared to make to approve a certain surgical intervention and improve the life of the recipient? Whichever decision is taken needs to be accountable to the patients who bear the opportunity cost and may be denied access to another intervention.

The answer to this lies in the "cost-effectiveness threshold", which is the price at which the amount of health expected to be lost, as a consequence of the additional cost, is just offset by the health expected to be gained. This threshold is different for each society, as it depends on the relative value people put on health. In England, the threshold applied by NICE is £20,000 to £30,000 per quality-adjusted life-year (QALY)[11]. Consequently, for every £20,000 to £30,000 spent, we would hope to gain more than one QALY for the investment to be considered cost-effective.

7.2 Type of patients

The impact of an intervention may well differ with patient characteristics; effects can differ between males and females, between different sub-groups of patients based on co-morbidities and even genetic makeup. Furthermore, the benefits gained may decline with age. All these variables need to be accounted for in a health economic evaluation.

An example is shown in Figure 2, which shows the probability of total hip replacement being cost-effective for women and men of different ages[12,13] ; at the NHS threshold of £20,000 to £30,000 per QALY, hip replacements become less cost-effective at 80 years of age, particularly for women.

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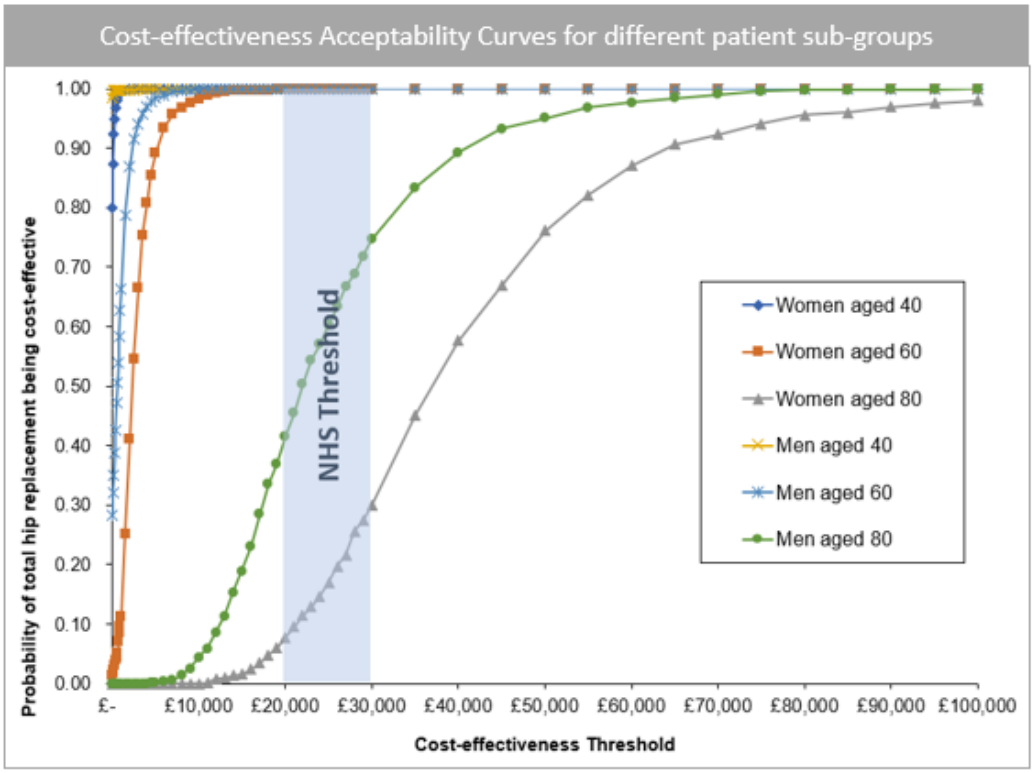

Figure 2 - Cost-effectiveness acceptability curve for total hip replacement

7.3 Type of hospital

The total cost of surgical care also depends on the type of hospital; whether it is public or privately operated, the surgical platform used for delivering services, bed occupancy, length-of-stay and differences in salary structures[14].

7.4 Organisation of surgical services & volume of operations

The volume of surgeries undertaken by a hospital is also an important factor; surgical outcomes tend to be better, and mortality rates lower, for surgeons who undertake the same operation over and over again[15]; the same holds for facilities and hospitals[16, 17]. In many cases, cost per operation will be lower at higher volumes because standardisation can reduce cost and allow the cost of any specialist equipment to be spread over a larger number of patients. However, while concentrating surgical services to a smaller number of high-volume hospitals may achieve some economies of scale, the labour intensity of hospital care may limit this. Furthermore, geographical equity in the provision of services and access to care needs to be taken into consideration[18].

7.5 Types of surgery

Though types of surgical interventions do differ in their cost-effectiveness, a comparative evaluation is challenging as other determinants, such as underlying healthcare infrastructure, available equipment and resources, medical staffing (and levels of experience), organisation of care, as well as patient factors all play into the equation. A large number of surgical procedures and variability in operative outcomes, as well as what a society considers to be an acceptable cost-effectiveness threshold, make a listing of procedures by cost-effectiveness difficult.

An evaluation of surgical intervention in low- and middle-income countries (LMIC) by the World Bank[14] using data from Prinja et al[19] shows an overview of the cost-effectiveness of some of the

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more basic interventions when compared against a non-surgical alternative by using disability-adjusted life-years (DALYs) as the measure of health outcome (see Figure 3).

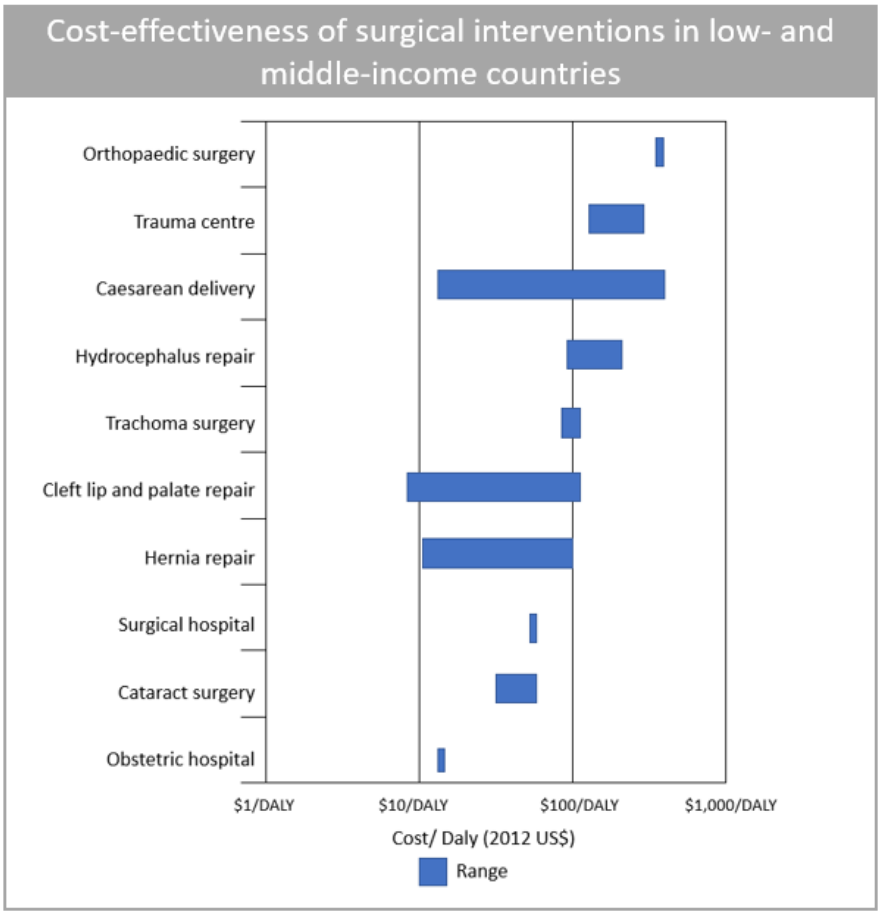

Figure 3 - Cost-effectiveness of surgical interventions in low-and middle-income countries

8. Conclusions

The NHS is committed to providing the best value for taxpayers' money and the most effective, fair and sustainable use of finite resources. Given the pressures on our health care systems, health economic evaluations are crucial if we are to allocate scarce resources efficiently and equitably.

Though a full-scale health economic analysis may not be available to a surgeon when faced with an innovative new way of doing surgery, having an appreciation of the opportunity cost can equip a surgeon to make the best decision, not only for the patient in front of him, but for all patients in the national healthcare system. For suppliers of MedTech innovations, proving that their technology not only improves health outcomes but does so at an opportunity cost that is deemed acceptable by the decision makers in the jurisdiction they would like to sell into remains crucial to ensuring successful market uptake.

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