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### Adoption and Use of New Medical Technology at the Hospital Level

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While innovative technologies drive modern healthcare and may dramatically improve patient outcomes, they also have been identified as the leading cause of increasing healthcare expenditures (2,3). Technology adoption decisions pose a challenge to decision-makers who are often forced to make timely decisions regarding new technologies, before there is definitive evidence on their clinical efficacy and economic merit. Hospitals, among other healthcare providers, have to develop their individual set of decision criteria for strategic technology planning with respect to their particular environment (5).

#### Hospital Decision-Making Systems for Technology Adoption

A number of theories have been suggested to describe hospital behaviour and adoption of new technology, yet these theories are not mutually exclusive and none of these perspectives alone has been able to satisfactorily explain technology adoption decisions (8). The first set of models known as the profit-maximization model (15), or the price competition model (16), or the fiscal-managerial system (17) uses traditional economic theory to explain hospital behaviour. This approach assumes that hospitals evaluate new technologies from the perspective of hospital profitability.

The second perspective known as the technology competition model (16), or technological preeminence (8) or the strategic institutional approach (17), derives from three different theories of hospital behaviour: the sales maximization theory (hospitals want to be the largest), the conspicuous consumption theory (hospitals want to show that they are the most technologically advanced) and the physician cooperative theory (hospitals will acquire technology that maximizes physician income) (16). According to the utility-maximization model, hospital managers invest in technology, subject to budget constraint, to enhance the quality and quantity of services the hospital provides (16). The medical-individualistic perspective (17) focuses on delivery of services according to the definition and demands of physicians and hospital medical administrations.

#### Strategic considerations

Regardless the decision-making structures, the considerations that go into such decisions are similar across different healthcare systems and different insurers and health services providers within a healthcare system. Cohen (4) has recently explored some of these considerations:

- a) Availability of information (many decision makers emphasise that the most important barriers to optimal decision-making relate to timely data on safety, cost effectiveness and efficacy for the considered technology);
- b) Clinical needs (hospitals will often act as their customers' agents and adopt technologies based on the clinical needs of the population they serve, supporting the medical-individualistic approach);
- c) Estimation of costs and benefits (decision makers should consider the cost savings relative to alternative treatments already existing in the hospital and the averted costs of future treatment);
- d) Appropriate staffing and site requirements (adopting a technology with the lack of appropriate additional training may result in serious complication rates and harmful consequences to the patient and the hospital. The potential adopter has to consider the trade-off between early adoption and potential profits and waiting upon expected profit later when additional scientific advances and increased experience emerge);
- e) Regulatory controls
- f) Reimbursement policies (the introduction of prospective payment systems, such as capitation, global budget, and diagnosis-related groups (DRGs) in many healthcare systems created disincentives to the adoption of technologies that are cost-increasing);
- g) Timing of adoption (in many cases, early adoption occurs in periods where the technology is flux, its acquisition costs are high, the evidence on the capabilities, clinical use and outcomes associated with the use of the technology are incomplete and third-party payer reimbursement does not exist).

#### The Decision-Making Process

Many hospitals have decision-making structures for the adoption of new technologies, but the nature of the structure and the adoption process may vary depending on the type of technology considered. For therapeutic agents, a recent observational study of two general hospitals in the UK, Jenkins and Barber (23) found that the issues that affected the decision-making process were the availability of clinical trial data, cost, pre-existing prescription of the drug considered, pharmaceutical companies activities, decisions in other medical centres, patient demand and physician excitement. These factors were supplemented by local knowledge in the hospital.

The adoption decision is different when high-ticket technologies or new specialised services are involved. Cohen (4) states that since new technologies are becoming increasingly specialised and complex, the decision-making structures and processes for equipment purchases and service expansion are also becoming more complex and involve decision makers from different specialisation fields. An illustration of the decision-making process can be found in our recent study of medical centres in Israel (12). We found that the first initiative to use new technology comes, in most cases, from the chiefs of medical wards or other senior physicians, but the responsibility for the final decision to implement a new technology varies by its nature. The final decision may also be made by ad-hoc committees comprised, in addition to the medical director, of representatives of the non-clinical management, and the chief of the relevant medical division.

In recent years, several scholars have suggested that when making priority-setting decisions, decision-makers must ensure that they achieve two goals: legitimacy, defined as the moral authority to make resource allocation decisions, and fairness, which may be achieved when an individual has a sufficient reason to accept a priority-setting decision, because of the acceptability of the decision-making process (24). Accountability for Reasonableness, a framework developed by Daniels and Sabin (24), has been used to examine priority-setting decisions at the hospital level (13,25,26). According to this framework, an institution's priority setting decision may be considered fair if it satisfies for conditions of publicity, relevance, appeals and enforcement. The publicity criterion suggests that decisions and their rationales must be publicly accessible. The relevance condition should ensure that these rationales are based on evidence-based reasons and principles that fair-minded parties agree are relevant to meet the disease and population needs under resource constraints. The appeals condition suggests that there should be a mechanism for challenge and dispute resolutions regarding priority-setting decisions, including the opportunity for revision of decisions when new evidence becomes available. Finally, the enforcement condition ensures public regulation of the process to ensure that the first three conditions are met.

More recently, Gibson et al (27) proposed a transdisciplinary, practical, four-step model (reasonableness, transparency, responsiveness, and accountability) to offer guidance to ensure that healthcare institutions achieve the goals of legitimacy and fairness in their decision-making process.

## **Conclusions**

Several surveys suggest that decision makers have only limited training in areas of health economics, health technology assessment, and decision-making. These may limit their ability to truly understand the nature of the technology and the immediate and future implications of their adoption decisions. We therefore strongly recommend that hospital executives who may be involved in technology policy undergo some formal training in the above-mentioned fields.

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