Chapter 28
The Costs of Healthcare-Associated Infections

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Key points

- Healthcare-associated infections delay patient discharge and increase costs.
- Healthcare-associated infections are accompanied by increasing numbers of laboratory and diagnostic investigations.
- Healthcare-associated infections increase infection prevention and control costs, including epidemiological investigations and medical, nursing and management time.

Introduction

Healthcare-associated infections (HAI) are an important cause of morbidity and mortality and therefore should be rigorously controlled as part of the general duty of safe patient care. HAIs also have considerable economic impact on health care services and the cost of national health care. The members of the infection control team (ICT) need to understand the financial burden of HAIs and how to evaluate the cost savings of any infection prevention intervention.

Economic Consequences

Measuring the cost of HAIs is difficult and the financial impact varies between different health care systems. Nevertheless, HAIs can have the following economic results (See Table 28.1):

1. HAIs delay patient discharge, resulting in increased 'hotel' costs. In addition, the patient suffers additional costs due to absence from work, and relatives suffer costs of time and travel to visit the patient;
2. Infections require increased treatment costs (for example, drug therapy and procedures, including repeat surgery). The patient may be discharged from hospital while infected and these costs then fall on General Practice or Community Services;
3. HAIs involve increasing numbers of laboratory and diagnostic investigations;
4. HAIs increase infection prevention and control (IPC) costs, including epidemiological investigations and medical, nursing, and management time;
5. An HAI is often the subject of litigation.

There may also be costs associated with blocked beds and closed wards or operating theatres, resulting in increased unit costs for admissions and procedures, lengthening waiting lists, and failure to complete contracts. Patient morbidity resulting from an HAI generates community and society costs that are difficult to quantify but may have considerable impact. Also difficult to measure in economic terms is loss of reputation – either for the facility or for individual units – which can have a significant impact on contracts and patient referral.

Table 28.1. Economic consequences of healthcare-associated infections[1]

Hospitalisation Costs	Use of antibiotics Increased length of hospitalisation Potential intensive care unit stay
Intervention Costs	Tests performed Barriers used (e.g., gown, gloves) Nurse/physician time Potential need for an isolation room
Outpatient/Community Care Costs	Physician visits Use of antibiotics Home health visits Rehabilitation center stay
Patient Costs/Outcomes	Mortality Morbidity Lost wages Travel expenses

Overall Cost Estimates

Many studies have focused on the severity of HAIs and their risk for patient safety, and have tried to analyse the economic impact of HAIs by different methods. These methods are often flawed by the failure to distinguish accurately between the type and amount of resources specifically associated with treating HAIs and those incurred by the original disease for which the patient was admitted.[2]

Although measuring the cost of HAIs is difficult, some studies have shown the probable magnitude of the problem. One study reviewed 4,000 adult patients in an English district general (community) hospital during 1994 - 1995.[3] In this study, 7.8% of patients had an HAI identified in hospital. These patients remained in hospital about 2.5 times longer than uninfected patients, an average of 11 additional days. They had increased hospital costs 2.8 times greater than uninfected patients, averaging about £3,000 (US $5,000) per case at that time. 13% of infected patients died compared

with 2% of those uninfected. Adjusted for age, sex, co-morbidity and other factors, the death rate was seven times higher for patients with an HAI. Estimated costs of HAIs to the hospital were £3.6m (US $5.8m).

The extrapolated national annual cost burden of HAIs for English hospitals was about £1b (US $1.6b), equivalent to about 1% of the total national hospital budget. The national annual post-discharge costs were estimated to be about £56m (US $90m). This included General Practice costs of £8.4m, hospital out-patients, £27m, and community nursing services, £21m. It was estimated that HAI was the direct cause of about 5,000 deaths per annum in England (more than those caused by suicides or traffic accidents) and contributed to an additional 15,000 deaths.

One study in the United States noted that the direct hospital-related financial burden of HAIs was estimated to be between 25.0 and 31.5 billion dollars per year.[5] Another US study found that each HAI adds $12,197 in incremental costs to hospitals.[5]

In Mexico, Navarrete-Navarro and Armengol-Sanchez[6] estimated costs associated with HAIs in paediatric intensive care. Infected children had an extra hospital stay of 9.6 days. This was the major factor contributing to an average cost per infection of nearly US $12,000.

A study in Turkey suggested that a patient with an HAI spent an additional 23 days in the hospital compared with a patient not affected with an HAI. The extra cost for an infected patient was calculated as US $2,026.[7]

Costs might be expected to be higher in tertiary referral hospitals. Costs will be different for various countries and will change with time; however the relative magnitudes will be similar.[2]

Types of Economic Evaluations

Several types of economic analyses can be employed, including: cost minimisation, cost effectiveness, cost benefit, and cost utility. The most preferred analyses are cost-effectiveness and cost utility.

A cost-effectiveness analysis compares interventions or products with different costs and different effectiveness. A cost utility analysis is similar,

except the benefits of a specific intervention are adjusted by health preference scores. Cost utility analyses are useful when there are no expected mortality differences between interventions, only differences in physical well-being which can be expressed as quality adjusted life years (QALY).[1]

When data on costs used in analyses are from different years, they should be brought into current year values. A typical method is to inflate the amounts using a standard price index for the country.[1] The World Health Organization recommends that a threshold for calling an intervention cost-effective be three times the country's gross domestic product per capita.[8]

Costs that can be measured include the health care facility costs, health care facility charges, resources used, and actual reimbursed charges. Hospital costs are a useful measure; they best reflect the actual economic burden to the institution. If the only information available is charges, the data can be adjusted using cost-to-charge ratios.[9]

Costs of Outbreaks

Several investigators have attempted to measure the costs associated with outbreaks of infection. Again, the costs are tentative and must be considered in relation to the health care system studied and the year of study. Nevertheless, costs are considerable.

For example, a 4-month outbreak of *Klebsiella pneumoniae* infection in a neonatal intensive care unit was estimated to cost a hospital more than US $300,000 in 2001.[10] Kim et al[11] measured the costs of MRSA in their hospital and calculated that it cost all Canadian hospitals $42m - $59m annually.

Cost-benefit of Infection Prevention and Control

In the Study on the Efficacy of Nosocomial Infection Control (SENIC) of 1974-1983, US hospitals with one full-time infection control nurse (ICN) per 250 beds, an infection control doctor (ICD), moderately intense surveillance, and systems for reporting wound infection rates to surgeons reduced their HAI rates by 32%. In other hospitals the HAI rate increased by 18%.

The SENIC study estimated the annual cost of HAIs in US hospitals was $1b (in 1975 dollars). The cost of IPC teams (0.2 ICD and 1 ICN per 250 beds) was $72m per annum, only 7% of the infection costs. Therefore, if IPC programmes were effective in preventing only 7% of HAIs (normally distributed), the costs of the programmes would be covered. A 20% effectiveness would save $200m and 50% would save $0.5b (1975 US dollars).

The Association for Professionals in Infection Control & Epidemiology documented the business case for reducing HAIs from the perspective of the health care executive in 2007. Case studies of significant cost savings were presented along with a methodology for determining the cost of various categories of HAIs.[12]

Similarly, guidelines on how to develop a business case for infection prevention were developed by the Society for Healthcare Epidemiology of America. This publication also explains economic concepts.[13]

Decreasing organisational revenues and efforts to reduce overall operating costs have had a direct impact on IPC programmes. Senior managers in health care organisations are focusing on achieving and maintaining revenues while controlling costs. IPC professionals must align themselves and their programs with these organisational goals by: (1) identifying areas in which the IPC program can support and enhances revenues, (2) avoiding excess costs for care, especially those related to HAIs, (3) identifying opportunities for cost reduction through value analysis, and (4) participating in efforts to measure and prevent other adverse outcomes of care.[14]

Low Resource Issues

Improved data collection efforts would help estimate the burden of HAIs in low resource countries; drug resistance is a significant area where data are needed.[9] Computer-assisted epidemiological surveillance may be an important aspect of monitoring IPC programmes.

Summary

The costs of HAIs are huge and include patient morbidity and mortality, hospital and community medical costs, the impact of blocked beds, and wider socio-economic costs. The costs of IPC programmes and staffing are relatively minor and with only a small degree of effectiveness they can pay for themselves. Investment in IPC is therefore highly cost-effective.

The constantly changing external environment, advancing technology, legislation, the introduction of government mandates, and a drive to maximise health care resources have made costing of IPC a management priority.[15]

Economic evaluations play an increasingly important role in IPC. It is important for IPC advocates to partner with individuals from many different fields to give decision-makers the information they need to make choices.

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Further Reading

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