

Chapter 23

The Costs of Healthcare-Associated Infection

Gary French

Key points

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

Introduction

Healthcare-associated infections (HAI) are common: at any one time about 1 in 10 patients in acute care hospitals have an HAI and an additional 10-60% of infections may present after discharge.

HAI is an important cause of morbidity and mortality and therefore should be rigorously controlled as part of the general duty of patient care. But HAI also has considerable 'economic' impact on health care services and on the costs of national health care.

Economic consequences of HAI

Measuring the cost of HAI is difficult and the financial impact varies between different health care systems. Nevertheless, in simple terms, HAI can have the following economic results:

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

Increased rates of HAI, associated with blocked beds and closed wards and theatres, result in increased unit costs for admissions and procedures, lengthening waiting lists and failure to complete contracts. All these issues have financial penalties. Patient morbidity resulting from 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 hospital or for individual units – which has significant impact on contracts and patient referral.

Overall cost estimates

Although measuring the cost of HAI is difficult, a number of studies have shown the probable magnitude of the problem. A study in the UK reviewed 4,000 adult patients in an English district general (community) hospital during 1994 - 1995.¹ In this study, 7.8% of patients had HAI identified in hospital. In addition, 19% of patients who were not diagnosed in hospital reported symptoms of HAI after discharge. Patients with HAI diagnosed in hospital remained in hospital about 2.5 times longer than uninfected patients, an average of 11 additional days. (Figure 23.1) They had increased hospital costs 2.8 times greater than uninfected patients, averaging about £3,000 (\$5,000) per case. (Figure 23.2) 13% of infected patients died compared with 2% of those uninfected. Adjusted for age, sex, co-morbidity and other factors, the death rate was 7 times higher for patients with HAI. Estimated costs of HAI to the hospital were £3.6m (\$5.8m).

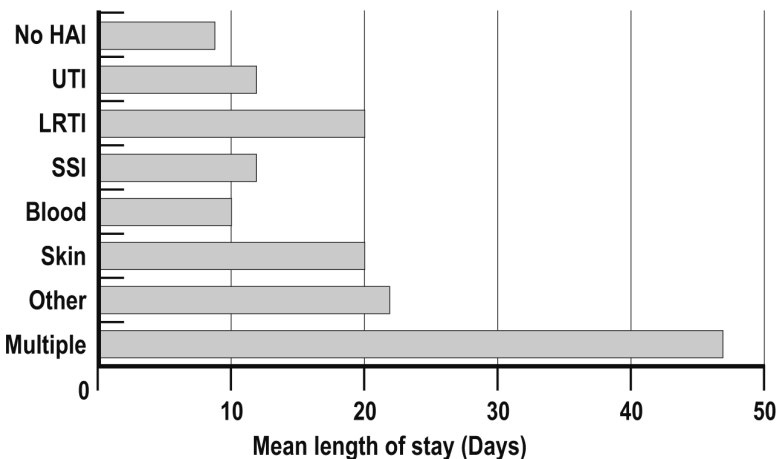


Figure 23.1. Extra length of stay due to healthcare-associated infection by type [R Plowman, et al. *The socio-economic burden of hospital acquired infection*. Public Health Laboratory Service, Health Protection Agency, UK] ¹

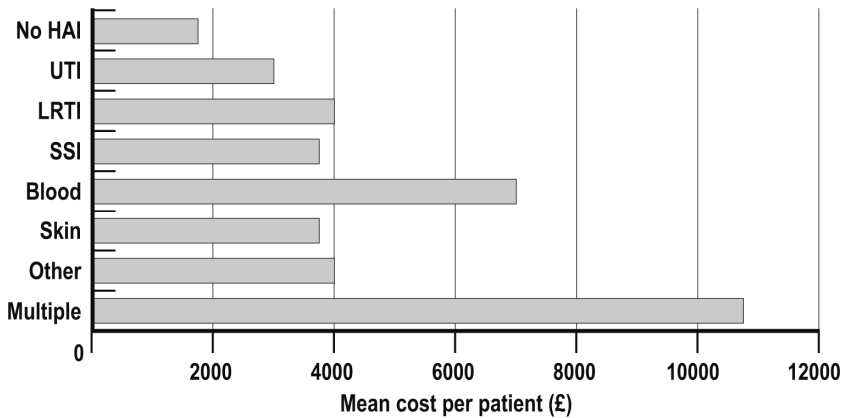


Figure 23.2. Extra cost due to healthcare-associated infection by type [R Plowman et al. *The socio-economic burden of hospital acquired infection*. Public Health Laboratory Service, Health Protection Agency, UK] ¹

Costs might be expected to be higher in tertiary referral hospitals. Costs will be different for other countries and will change with time; however the relative magnitudes will be similar. Table 23.1 shows the additional length of hospital stay associated with HAI in other studies.

The extrapolated national annual cost burden of HAI for English hospitals was about £1b (\$1.6b), equivalent to about 1% of the total national hospital budget or the resources of twenty-seven 400-bed general hospitals. The national annual post discharge costs were estimated to be about £56m (\$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.

In the USA, HAI is amongst the top ten causes of death.^{3,4} The US Institute of Medicine estimates that preventable adverse patient events, including healthcare-associated infections, are responsible for 44,000-98,000 deaths annually in the US at a cost of \$17-\$29 billion.⁵ The US National Nosocomial Infection Surveillance system reported a positive impact on reducing HAI rates in participating hospitals.⁶

Table 23.1. Studies of cost and increased hospital length of stay (LOS) associated with HAI. From Wilcox & Dave²

Date of Study (Author)	Country	Type of HAI (Number in study)	Increased LOS (days)	Cost/case (£)
1981 (Haley)	USA	All (177)	1	891
1983 (Girady)	France	Neonatal (61)	6.7	1118
1989 (Mugford)	UK	Caesarean (41)	2.1	1011
1992 (Kappstein)	Germany	ICU Pneumonia (34)	10.1	5533
1993 (Coello)	UK	UTI (36)	3.6	498
1993 (Coello)	UK	Wound (12)	10.2	1553
1996 (Wilcox)	UK	<i>C. difficile</i>	21	4107
1998 (Zoutman)	Canada	Wound (108)	10.2	1780
1999 (Plowman)	UK	All (309)	11	3000

In Mexico, Navarrete-Navarro and Armengol-Sanchez⁷ estimated costs associated with HAI 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 \$12,000.

Costs of outbreaks

Several investigators have attempted to measure the costs associated with hospital 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 were considerable.

Cox et al.⁸, estimated the additional costs generated by a large outbreak of methicillin-resistant *S. aureus* (MRSA) over three years in an English

district general hospital as £400,000 (\$640,000). A smaller MRSA outbreak cost £7000, however an outbreak of multidrug resistant Gram-negative infection increased costs by about £35,000 (\$56,000) (1990 prices).⁹ Kim et al¹⁰ measured the costs of MRSA in their hospital and calculated that it cost all Canadian hospitals \$42m - \$59m annually in 1997 dollars.

Cost benefit of infection prevention and control (IC)

In the Study on the Efficiency of Nosocomial Infection Control (SENIC)³ 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 HAI in US hospitals was \$1b (in 1975 \$). The cost of infection control teams (0.2 ICD, 1 ICN, 1 clerk per 250 beds) was \$72m per annum, only 7% of the infection costs. Therefore, if IC 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 prices).

The Association for Professionals in Infection Control & Epidemiology published a paper on the business case for reducing HAIs from the perspective of the healthcare executive in 2007. Case studies of significant cost savings are presented along with a methodology for determining the cost of various categories of HAIs.¹¹

Conclusions

The costs of HAI 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 IC programmes and staffing are relatively small and with only a small degree of effectiveness they can pay for themselves. Investment in IC is therefore highly cost effective.

References and Further Reading

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