

## Preventing healthcare associated infections: an essential component of patient safety

Robert J Pratt

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Acquiring new infections as a result of health care is a major patient safety issue associated with several contributing factors that include the use of indwelling medical devices and staff hand hygiene practices. In this article Robert Pratt summarises the available national and international evidence based guidance for preventing these infections, and emphasises the importance of clinical governance in the efforts of organisations like the National Patient Safety Agency to incorporate these guidelines into daily practice in the NHS.

Healthcare associated infections (HCAI) are those infections transmitted to patients (and sometimes to healthcare workers) usually as a result of healthcare interventions during periods of care in hospital or in primary and community healthcare services. HCAI is a major problem in hospitals and other healthcare systems throughout the world, ranging in estimated prevalence from 4% to 10% in a recent survey of nine countries.<sup>1</sup>

In National Health Service (NHS) hospitals in England, the prevalence of HCAI has hardly declined during the last 25 years, affecting an estimated 9% of hospital inpatients at any given point in time.<sup>2</sup> This means that at least 300 000 inpatients acquire an HCAI each year—that is, 1 in every 11 patients admitted to

hospital. The cost to the NHS is considerable—an estimated £1 billion annually.<sup>3</sup> HCAI often adversely affects the treatment of a patient's original medical condition and adds an average of an extra 11 days of hospitalisation for infected patients, causing further delays for admission.<sup>1</sup> In addition, these infections cause distress and discomfort, and can result in prolonged or permanent disability. HCAI are estimated to cause the deaths of 5000 patients and contribute to the deaths of a further 15 000 patients each year.<sup>2, 4</sup>

When patients are harmed as a result of healthcare interventions or lack of effective preventive measures, they lose confidence in the ability of the NHS to safely care for them. As society becomes more litigious, this loss of faith and sense of injury may

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Correspondence: Professor Robert J Pratt,  
Director, Richard Wells Research Centre,  
Institute of Health and Human Sciences  
Research, Thames Valley University London;  
and President, Infection Control Nurses  
Association (1999–2005).  
robert.pratt@tvu.ac.uk

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## Box 1: The commonest HCAI<sup>2, 5</sup>

Urinary tract infections	23%
Chest infections	23%
Surgical site infections	11%
Skin infections	10%
Bloodstream infections	6%

increasingly drive many to seek redress in the courts. Media reports and patients' experience of dirty hospitals, healthcare workers with poor hygiene practices, and hospital outbreaks of difficult to treat infections, often associated with poor clinical outcomes, are alarming the public. Today, more than ever, the reputation of the NHS is being damaged by our apparent inability to improve basic infection prevention practice and to protect patients better from the commonest of all adverse events in health care—infection.

### OVERVIEW

A diverse assortment of microorganisms can be transmitted in healthcare settings, causing in turn a wide spectrum of diseases. Many of these infections (Box 1) are associated with the use of medical devices, especially indwelling urinary catheters, central venous catheters,

and endotracheal tubes used in patients requiring mechanical ventilation.

### What determines the risk for HCAI

Often acting in synergy, multiple factors determine risk and influence individual vulnerability to infection (Box 2).<sup>6</sup> Adding to this conundrum is an escalating increase in the prevalence of HCAI caused by antimicrobial-resistant microorganisms, due to the widespread and inappropriate use of antibiotics in medicine and agriculture.

### Prevention and control of HCAI

Although not all HCAI are preventable, many are. It has been estimated (perhaps somewhat conservatively) that 15–30% of these infections could be prevented.<sup>2, 7</sup> In fact, if only 15% of these infections were prevented by achievable improvements in clinical practice, HCAI would be avoided in 45 000 patients each year and £150 million worth of NHS resources saved.<sup>1, 3</sup>

Prevention and control of HCAI is an essential element of patient safety. Reducing the risks of avoidable nosocomial infections requires a major change in culture, attitude, and approach to healthcare delivery. Among the most

## Box 2: Risk factors for HCAI

Factors	Examples
Patient risk factors	Severity of underlying illnesses and immunosuppression
Therapeutic factors	Need for indwelling medical devices that breach normal immune defences Necessity for placing patients in immunocompromised convergent areas such as intensive care units
Organisational factors	High bed occupancy Increased movement of patients Poor staff-to-patient ratios Admitting patients from a large geographical area so that different pools of patients are mixing within a healthcare environment
Management factors	Ineffective leadership Lack of insight into available best evidence for infection prevention Inadequate resource allocation
Behavioural factors	Poor staff adherence to safe standards of infection prevention practice such as hand hygiene, aseptic technique
Structural factors	Number of single rooms Facilities for hand washing
Environmental factors	Dirty instruments and healthcare environment

## Box 3: UK national guidelines for evidence based infection prevention and control practice

The guidelines describe standard principles for preventing infections which can be used in all general care settings. They also provide guidance for preventing infections associated with the use of select medical devices, such as urinary catheters, central venous catheters, and enteral feeding systems. The evidence base is reviewed on a regular basis and the guidelines are updated when necessary.<sup>12</sup>

important cultural changes to take place in the NHS was the introduction of clinical governance during the mid-1990s, designed to facilitate continuous quality improvements in clinical care. This has accelerated an increasing emphasis on patient safety which includes renewed efforts to minimise the risk to patients of acquiring HCAI.<sup>8</sup> However, the real impetus for prioritising strategic initiatives for infection prevention in the NHS was the publication of a National Audit Office report in 2000 on hospital acquired infections.<sup>2</sup> This prompted new Department of Health (DoH) strategies for combating infectious diseases in general,<sup>9</sup> and HCAI in particular,<sup>6</sup> that provide the current framework for prevention initiatives.

### **The role of clinical governance**

Clinical effectiveness is a core feature of clinical governance. It requires that clinical care and the delivery of services is based on the best available evidence of clinical and cost effectiveness. The need for evidence based infection control practice prompted the commissioning of national evidence based guidelines for preventing HCAI, which were developed and subsequently issued by the DoH<sup>10</sup> and the National Institute for Clinical Excellence.<sup>11</sup> These guidelines, designed to influence more detailed local protocols, are systematically developed broad statements of good practice based on the best available evidence (Box 3).

Evidence based guidelines for prevention of healthcare associated pneumonia have recently been produced by the Healthcare Infection Control Practices Advisory

Committee (HICPAC) at the Centers for Disease Control and Prevention in the USA.<sup>13</sup> Updated evidence based guidelines for the prevention of methicillin resistant *Staphylococcus aureus* (MRSA) colonisation and infection will be issued by the DoH (early 2006), and additional HICPAC evidence based guidance is available which focuses on environmental infection control,<sup>14</sup> hand hygiene,<sup>15</sup> and intravascular device related infection.<sup>16</sup>

Other key initiatives for lessening the risk of HCAI were outlined in December 2003 in a seminal report by the Chief Medical Officer (CMO) for England, clearly describing the activities that were needed to reduce the rate of HCAI and to decrease the proliferation of antimicrobial resistant microorganisms.<sup>6</sup> These activities are grouped within seven 'action areas' (Box 4).

We clearly understand those factors that increase the risk to patients of HCAI and we also clearly comprehend where improvements in structure, organisation, and practice can reduce this threat and increase patient safety. Clinical governance is providing the NHS with the framework for continuous quality improvements in practice. The evidence base for infection prevention and control is being made available in national guidelines, the policy foundation has been developed by the DoH, and political, professional, and public support for improvements in patient safety, especially in preventing infection, has never been greater. The challenge is to use these advantages and momentum to skilfully implement the activities in each of the action areas of the CMO's report to bring about sustainable improvements in practice.

## Box 4: The seven action areas (Chief Medical Officer, 2003<sup>6</sup>)

- (1) Active surveillance and investigation
- (2) Reducing infection risk from the use of catheters, tubes, cannulas, instruments, and other devices
- (3) Reducing reservoirs of infection
- (4) High standards of hygiene in clinical practice
- (5) Prudent use of antibiotics
- (6) Management and organisations
- (7) Research and development

## Key Points

- Healthcare associated infection (HCAI) is a major problem in hospitals and other healthcare systems, and in NHS hospitals in England it affects an estimated 9% of hospital inpatients at any given point in time
- Many of these infections are associated with the use of indwelling medical devices and contaminated hands of healthcare providers are the commonest cause of transmission of infections to patients
- If only 15% of these infections were prevented by achievable improvements in clinical practice, HCAI would be avoided in 45 000 patients each year and £150 million worth of NHS resources saved
- Clinical governance is providing the NHS with the framework for continuous quality improvements in practice, and the evidence base for infection prevention and control is being made available in national guidelines
- Staff education is central to the successful implementation of new strategies, interventions, and campaigns
- We need to develop a better understanding of the factors that influence NHS organisations to successfully and effectively translate evolving best evidence for efficacy into local clinical practice

## INTERVENTIONS

Key interventions to reduce the risk of infection include:

- Effective hand hygiene
- Active HCAI surveillance
- Safe use of medical devices
- Environmental hygiene
- Education
- Research

Improvements in these areas are achievable through innovative campaigns and interventions.

### **Hand hygiene**

The evidence that contaminated hands of healthcare providers are the commonest cause of transmission of infections to patients has been extensively described.<sup>15</sup> It follows then that effective hand hygiene is the single most important measure for controlling the transmission of

infection in healthcare settings. However, evidence from practice and from staff and patients' experience of health care indicate that adherence to consistently good standards of hand hygiene is generally poor.<sup>1, 2</sup> More recently, the effectiveness of alcohol based handrubs has been shown to be significantly more efficient in reducing hand contamination than handwashing with antiseptic soap.<sup>17</sup> An important campaign at the University of Geneva Hospitals to improve adherence to hand hygiene demonstrated that the promotion of bedside alcohol based antiseptic handrubs was a critical component in achieving a sustained improvement in adherence to hand hygiene, coinciding with a reduction in HCAI and MRSA transmission.<sup>18</sup>

The National Patient Safety Agency is now implementing a more sophisticated hand hygiene intervention in the NHS acute care sector throughout England, known as the '*cleanyourhands*' campaign. This intervention focuses on placing disinfectant handrubs near to where staff have patient contact, displaying posters and promotional materials where they will influence staff and patients, and involving patients in improving hand hygiene. More detailed information is available from the campaign website ([www.npsa.nhs.uk/cleanyourhands](http://www.npsa.nhs.uk/cleanyourhands)).

### **Safe use of medical devices**

New technologies and products that may help minimise the risks to patients of acquiring infections during periods of health care are constantly emerging. Some, like alcohol hand decontamination preparations, have already been tested in large trials, have been found to be effective, and have now entered clinical practice. Others such as silver alloy coated urinary catheters for prevention of catheter related urinary tract infections and antiseptic or antimicrobial impregnated central venous catheters for preventing catheter related bloodstream infections have been shown to be effective in some circumstances.<sup>19, 20</sup>

Engineering out the potential for human error remains a prime goal of commercial innovation and undoubtedly more products and devices will come forward which will require careful appraisal for both clinical efficacy and cost effectiveness. But when that appraisal reliably demonstrates their value, they should be quickly introduced into the service.

## Education

Education is central to the successful implementation of new strategies, interventions, and campaigns. The DoH has launched a blended e-learning infection prevention and control education and training initiative for both clinical and non-clinical NHS staff.<sup>21</sup> This national evidence based programme aims to support infection prevention and control practice by providing both e-learning material that learners can access independently and face to face sessions that can be delivered through the organisation by a broad range of trainers ([www.infectioncontrol.nhs.uk](http://www.infectioncontrol.nhs.uk)).

NHS Education in Scotland has developed an e-learning programme to train 'Cleanliness Champions' who are key infection and prevention resource staff ([www.rcn.org.uk/resources/mrsa/healthcarestaff/goodpractice/cleanlinesschampions.php](http://www.rcn.org.uk/resources/mrsa/healthcarestaff/goodpractice/cleanlinesschampions.php)).

## SUMMARY

It seems so simple: healthcare workers need to always use good standards of hand hygiene and consistently adhere to the infection prevention and control recommendations in national and local guidelines. If they do this, HCAI rates will decrease—end of story.

But it's not the 'end of story'—it's more complex than this. We often don't fully comprehend the organisational and individual behavioural factors involved with understanding evidence and consistently using it in clinical practice to protect patients.

We need to develop a better understanding of the factors that influence NHS organisations to successfully and effectively translate evolving best evidence for efficacy into local clinical practice. We also need to know how those factors operate or don't operate in organisations that lack success in consistently using evidence to continuously improve the quality of their infection prevention and control practices and service. We need to learn the characteristics of 'winning' and 'failing' healthcare organisations, so that we can adapt and support those positive characteristics and organisational traits throughout the NHS so that more healthcare organisations become 'infection aware'—enthusiastically and consistently using best evidence to prevent HCAI and enhancing patient safety.

Time is moving on and we've long past that previous point of tolerating cases of patients developing preventable infection as a result of our care (or lack of). We understand the evidence that underpins effective measures to prevent HCAI; we just don't understand the complex dynamics of why evidence in guideline recommendations is not universally incorporated into clinical practice. It's time we did.

## REFERENCES

1. National Audit Office. *Improving patient care by reducing the risk of hospital acquired infection: A progress report*. Report by the Comptroller and Auditor General. HC 876 Session 2003–2004. London: The Stationery Office, 2004. Available at: [http://www.nao.org.uk/publications/nao\\_reports/03-04/0304876.pdf](http://www.nao.org.uk/publications/nao_reports/03-04/0304876.pdf) (accessed 21 November 2005).
2. National Audit Office. *The Management and Control of Hospital Acquired Infection in Acute NHS Trusts in England*. Report by the Comptroller and Auditor General. HC 230 Session 1999–00. London: The Stationery Office, 2000. Available at: [http://www.nao.org.uk/publications/nao\\_reports/9900230.pdf](http://www.nao.org.uk/publications/nao_reports/9900230.pdf) (accessed 21 November 2005).
3. Plowman R, Graves N, Griffin M, Roberts JA, Swan AV, Cookson B, et al. *The Socio-economic Burden of Hospital-acquired Infection*. London: Public Health Laboratory Service and London School of Hygiene and Tropical Medicine, 1999:12. Available at: <http://www.dh.gov.uk/assetRoot/04/08/97/25/04089725.pdf> (accessed 21 November 2005).
4. Department of Health. HSG(95)10. *Health Service Guidelines. Hospital Infection Control* London: Department of Health, 1995. Available at: <http://www.dh.gov.uk/assetRoot/04/01/23/29/04012329.pdf> (accessed 21 November 2005).
5. Emmerson AM, Enstone JE, Griffin M, Kelsey MC, Smyth ETM. The second national prevalence survey of infection in hospitals—an overview of results. *J Hosp Infect* 1996;32:175–90.
6. Department of Health. *Winning Ways: Working Together to Reduce Healthcare Associated Infection in England*. Report from the Chief Medical Officer. London: Department of Health (England), 2002. Available at: <http://www.dh.gov.uk/assetRoot/04/06/46/89/04064689.pdf> (accessed 21 November 2005).
7. House of Commons. Committee of Public Accounts Session 1999–2000. Forty-second report: the management and control of hospital acquired infections in acute NHS trusts in England, together with the proceedings of the Committee relating to the report, the minutes of evidence and appendices. London: The Stationery Office, 2000. Available at: <http://www.publications.parliament.uk/pa/cm199900/cmselect/cmpub acc/306/30602.htm> (accessed 21 November 2005).

8. Pratt RJ, Morgan S, Hughes J, Mulhall A, Fry C, Perry C, *et al*. Healthcare governance and the modernisation of the NHS: infection prevention and control. *Br J Infect Control* 2002;3:16–25. Available at: <http://www.richardwellsresearch.com/richardwells/pdfs%20and%20documents/Healthcare%20governance%20and%20the%20modernisation%20of%20the%20NHS.pdf> (accessed 21 November 2005).
9. Department of Health. *Getting ahead of the curve: a strategy for combating infectious diseases (including other aspects of health protection)*. A report by the Chief Medical Officer. London: Department of Health, 2002. Available at: <http://www.dh.gov.uk/assetRoot/04/06/08/75/04060875.pdf> (accessed 21 November 2005).
10. Pratt RJ, Pellowe CM, Loveday HP, Robinson N, Smith GW, and the epic guideline development team. The epic Project: developing national evidence-based guidelines for preventing healthcare associated infections. Phase 1: Guidelines for Preventing Hospital-acquired Infections. *J Hosp Infect* 2001;47(suppl):S1–S82. Available at: <http://www.epic.tvu.ac.uk/epicphase/1.html> (accessed 21 November 2005).
11. Pellowe CM, Pratt RJ, Harper P, Loveday HP, Robinson N, Jones SRLJ, MacRae ED, and the Guideline Development Group. Infection control: prevention of healthcare-associated infection in primary and community care. *J Hosp Infect* 2003;55(suppl 2):1–127. Available at: <http://www.epic.tvu.ac.uk/epicphase/2a.html> (accessed 21 November 2005).
12. Pellowe CM, Pratt RJ, Loveday HP, Harper P, Robinson N, Jones SRLJ. The epic project. Updating the evidence-base for national evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England: a report with recommendations. *Br J Infect Control* 2004;5:10–15. Available at: <http://www.richardwellsresearch.com/richardwells/pdfs%20and%20documents/epic%20-%20updating%20the%20evidence%20base%20BJIC%20Dec%202004.pdf> (accessed 21 November 2005).
13. Centers for Disease Control and Prevention. Guidelines for the Prevention of Health-Care-Associated Pneumonia, 2003. *MMWR Recomm Rep* 2004;53(RR-03):1–36. Available at: <http://www.cdc.gov/ncidod/hip/pneumonia/default.htm> (accessed 21 November 2005).
14. Centers for Disease Control and Prevention. Guidelines for environmental infection control in health-care facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). *MMWR Recomm Rep* 2003;52(No. RR-10):1–48. Available at: [http://www.cdc.gov/ncidod/hip/enviro/Enviro\\_guide\\_03.pdf](http://www.cdc.gov/ncidod/hip/enviro/Enviro_guide_03.pdf) (accessed 21 November 2005).
15. Centers for Disease Control and Prevention. Guideline for Hand Hygiene in Health-Care Settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *MMWR Recomm Rep* 2002;51(No. RR-16):1–48. Available at: <http://www.cdc.gov/handhygiene/> (accessed 21 November 2005).
16. Centers for Disease Control and Prevention. Guidelines for the Prevention of Intravascular Catheter-Related Infections. *MMWR Recomm Rep* 2002;51(No. RR-10):1–34. Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr5110.pdf> (accessed 21 November 2005).
17. Girou E, Loyeau S, Legrand P, Oppein F, Brun-Buisson C. Efficacy of handrubbing with alcohol based solution versus standard handwashing with antiseptic soap: randomised clinical trial. *BMJ* 2002;325:362–6.
18. Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, *et al*. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Lancet* 2000;356:1307–12.
19. Saint S, Elmore JG, Sullivan SD, Emerson SS, Koepsell TD. The efficacy of silver alloy-coated urinary catheters in preventing urinary tract infection: a meta-analysis. *Am J Med* 1998;105:236–41.
20. Veenstra DL, Saint S, Saha S, Lumley T, Sullivan S. Efficacy of antiseptic-impregnated central venous catheters in preventing catheter-related bloodstream infections: a meta-analysis. *JAMA* 1999;281:261–7.
21. Pratt RJ, Pellowe CM, Shelley J, Adams J, Loveday HP, King D, *et al*. Using a blended e-learning model to provide accessible infection prevention and control training for NHS staff: The NHSU/TVU/Intuition approach. *Br J Infect Control* 2005;6:16–18. Available at: <http://www.richardwellsresearch.com/richardwells/pdfs%20and%20documents/Pratt.pdf> (accessed 21 November 2005).