

# English National Point Prevalence Survey on Healthcare-Associated Infections and Antimicrobial Use, 2011: Preliminary data

## Frequently asked questions

### 1.0 Overview

#### 1.1 What is a healthcare-associated infection?

A healthcare-associated infection (HCAI) is any infection that occurs related to a healthcare setting.

In this survey a HCAI was defined as any infection that occurred:

- Two days or more after admission to hospital or
- Present on admission from another hospital or
- Readmitted with HCAI within two days of discharge from any acute hospital or
- Presented with *C. difficile* infection within 28 days of discharge from any hospital
- Had recent surgery – within 30 days without foreign material or within 1 year with foreign material
- Or had an infection on day 1 or day 2 of admission after a device (urinary catheter, vascular access device) was inserted.

A prevalent HCAI is one where the patient has symptoms of a HCAI or is being treated for a HCAI on the day of the survey.

#### 1.2 What is an antimicrobial?

An antimicrobial is a drug that selectively destroys or inhibits microbes. Both antibiotics (against bacteria) and anti-fungals (against fungi) were included in this survey. Antivirals (against viruses) were not included.

#### 1.3 What is a prevalence survey?

A prevalence survey is a count of the number of patients with a particular condition/treatment (in this case either a HCAI or an antimicrobial) at a particular time as a proportion of the total number of patients who were being treated in hospital. This survey gives a snap-shot picture of the number of patients with HCAI in English hospitals. The report contains information on the prevalence of HCAI at the time of survey only, and not for all times.



#### **1.4 Why was this survey undertaken?**

It is important to know the prevalence of HCAI and antimicrobial use (AMU) in English hospitals to allow the government and local hospitals to plan effective ways to reduce HCAI.

With this information both national and local infection prevention and control AND antimicrobial stewardship priorities can be targeted most effectively.

#### **1.5 Who undertook the survey?**

The Health Protection Agency (HPA) undertook the survey in collaboration with the British Infection Association (BIA), British Society for Antimicrobial Chemotherapy (BSAC), Infection Prevention Society (IPS) and Healthcare Infection Society (HIS). Hospitals participated voluntarily and local hospital survey teams included data collectors trained by HPA in the data collection.

Within each hospital a named contact point acted as coordinator for the survey team. Infection prevention and control staff, antimicrobial teams and clinicians collected the data, which were then sent to HPA quality assurance and analysis. HPA is indebted to the local Infection Prevention and Control Teams (IPCTs), Antimicrobial Stewardship Teams (AST), clinicians and ward staff in all of the participating hospitals. Their collaboration is gratefully acknowledged.

#### **1.6 When was the survey undertaken?**

Hospitals performed the survey between September and November 2011.

#### **1.7 Where was the survey undertaken?**

The survey was voluntary and undertaken in 99 NHS acute trusts (one hospital submitted incomplete data and was not included in the analysis) and five independent sector organisations (114 hospital sites).

The mean size of the NHS trusts included in this survey was 518 beds compared with 15 beds per hospital site from independent organisations.

#### **1.8 Which patients were surveyed?**

The data collectors visited all inpatients in the surveyed hospitals. Day patients who did not stay overnight were not included in the survey. All patients who were admitted to the ward at 8am on the morning of the survey were eligible for inclusion in the survey. Patients admitted to or transferred into the ward after 8am were

excluded. Patients who left the ward before they were surveyed were not followed up and were, therefore, excluded from the survey.

### **1.9 What were the objectives of the survey?**

The aims of this survey were to determine the burden of HCAI and AMU and to identify priority areas for the future. The specific objectives were:

- To estimate the total burden (prevalence) of HCAI and AMU in acute care hospitals in England.
- To describe patients, invasive devices, HCAI and AMU by types of patients, specialties, and healthcare facilities.
- To describe the HCAI sites, micro-organisms and markers of resistance.
- To describe the AM compounds prescribed, their indications and AMU quality indicators.
- To disseminate the results to those who need to know at local, regional and national level to raise awareness.
- To train and reinforce surveillance structures and skills, by developing a comprehensive training programme on the protocol and definitions.
- To identify areas of concern and develop appropriate national priorities for incidence surveillance, research and policy interventions.
- To identify and develop priority areas for AMU quality indicators in line with the national AM stewardship programme.

### **1.10 Were these objectives met?**

Yes, the report contains results and discussion on each of these topics.

### **1.11 What does the report tell us?**

The final report contains information on how many patients in the hospitals who participated in the survey had a HCAI during the period of the survey, what type of HCAI those patients had and what specialty they were being treated for. It also reports how many invasive devices, such as catheters, patients were being treated with and which antibiotics and the indication for the antibiotics they were prescribed on the day of survey.

### **1.12 What does the report not tell us?**

The report does not provide details of how the patient acquired their HCAI and does not report on the cleanliness of the hospitals or the overall infection prevention and control practices of healthcare staff within the hospitals.

## **2.0 Methodology of survey**

### **2.1 How many patients were included in the analysis?**

The analysis included 52,443 patients from 103 organisations. One hospital did not collect detailed information on all patients and could not be included. A total of 50,778 (96.8%) patients were surveyed from NHS organisations. The independent sector organisations contributed 1,665 (3.2%) patients to the survey.

### **2.2 How was HCAI and AMU prevalence calculated?**

HCAI prevalence was calculated by dividing the total number of inpatients diagnosed with a HCAI by the total number of inpatients.

AMU prevalence was calculated by dividing the total number of inpatients on an antimicrobial by the total number of inpatients.

### **2.3 What definitions of HCAI were used?**

The European Centre for Disease Control and Prevention (ECDC) has defined specific types of infection for use in surveillance. These definitions have been internationally recognised as standard definitions for HCAI types. The ECDC definitions of HCAI were used in this survey.

### **2.4 What types of HCAI were included in the survey?**

This survey included every type of HCAI defined by the ECDC in patients. Therefore the full range of HCAI types found in hospital inpatients which met the survey definitions were examined. HCAI are grouped into 13 broad categories by the ECDC based on the main physiological systems and surgical interventions. These are:

- Bloodstream infections.
- Bone and joint infections.
- Cardiovascular system infections.
- Central nervous system infections.
- Clinical sepsis.
- Eye, ear, nose, throat and mouth infections.
- Gastrointestinal infections.
- Lower respiratory tract infections other than pneumonia.
- Pneumonia.
- Reproductive system infections.
- Skin and soft tissue infections.
- Surgical site infections.
- Urinary tract infections.

## **2.5 How was the study designed?**

The ECDC protocol for PPS studies in Europe was used. This was designed by European experts and ECDC between 2008 and 2011 and adapted for use in England.

## **2.6 How was the data collected?**

A team of data collectors were trained to diagnose HCAI in inpatients and record their information on specifically designed data collection forms. All the data collectors were trained by HPA, using the ECDC accredited course, prior to collecting the data. Data collection was undertaken on each ward within a single day however the whole hospital surveillance could take place over a two to three week period depending on the size of the hospital.

## **2.7 What is the difference between number of infections and number of patients with HCAI?**

Some patients were found to have more than one HCAI. Prevalence was calculated using the number of inpatients with infections compared to the total number of inpatients.

In some instances within the report the total number of infections is reported, this number is always greater than the total number of patients who have HCAI. It is important to consider the total number of infections because this gives a clearer picture of what type of HCAI patients have.

## **2.8 What is the difference between colonisation and infection and what implications did this have for the survey?**

A patient may have an organism living on or in their body without any clinical signs or symptoms of disease. These patients are colonised with the organism. An example of this is the presence of MRSA in a patient's nasal passage which is detected by screening. An infection occurs when the organism enters the body and causes disease.

The survey collected information on patients that showed clinical signs and symptoms of infection and not those that were colonised with an organism.

## **2.9 What is an acute hospital?**

Acute hospitals are hospitals that provide a wide range of specialist care and treatment for patients. They include consultation with specialist clinicians, emergency treatment following accidents, routine, complex and life saving surgery, specialist diagnostic procedures and close observation and short-term care of patients with

health symptoms of concern. Acute hospitals included in this survey were both NHS acute trusts and independent sector organisations.

### **2.10 What are the differences between independent sector organisations and NHS acute trusts?**

Independent sector organisations participated in this survey for the first time and there are some important issues to highlight between these organisations and NHS trusts. The independent sector organisations are large privately owned organisations with many separate hospital sites. Each independent sector hospital has a much smaller inpatient bed base with a primarily elective patient mix; and much of their activity is conducted as day cases compared to NHS acute trusts. These independent sector organisations have many hospitals that are geographically diverse with a constantly changing list of facilities and sites. Many of the sicker patients may be transferred to NHS organisations for further care in NHS intensive care facilities.

They often have infection prevention and control input though usually have very little infection control doctor input and rarely have antimicrobial pharmacist employed.

## **3.0 Results**

### **3.1 What is the overall prevalence of HCAI in English hospitals?**

The overall prevalence of HCAI in acute hospitals was 6.4%.

The prevalence in NHS acute trusts was 6.5%

Independent sector organisation had a lower prevalence of HCAI of 2.2%

It is not appropriate to compare the prevalence between these hospital types because they represent distinct case mixes, patient populations and specialties. Further the numbers included were very small in paediatric and independent hospitals and these results should be interpreted with caution.

### **3.2 Does a prevalence of 6.4% mean that if I go in to hospital I have a one in sixteen chance of getting a HCAI?**

No. This means that at any time one in sixteen inpatients in hospital will have a HCAI. A prevalence survey counts the number of patients with HCAI at any point in time. People with HCAI tend to stay in hospital longer and those patients who stay in hospital for longer periods of treatment tend to be more seriously ill and therefore

more at risk of contracting HCAI. The large majority of patients are successfully treated in hospital and go home without acquiring a HCAI.

### **3.3 Can you tell me what my chance is of contracting HCAI during my hospital stay?**

No. This is not shown by the current prevalence survey. In order to calculate how likely a person is to get a HCAI an incidence study would be required. This would look at all patients who were treated within the hospital on a regular basis over a defined time period.

### **3.4 What are the most common types of infections?**

The six most common types of HCAI which accounted for more than 80% of all HCAI were respiratory tract infections (22.8%), urinary tract infections (UTI) (17.2%), surgical site infections (SSI) (15.7%), clinical sepsis (10.5%), gastrointestinal infections (8.8%) and bloodstream infections (BSI) (7.3%). In the paediatric survey population, the most common HCAI were clinical sepsis (40.2%), respiratory tract infections (15.9%) and BSI (15.1%).

Enterobacteriaceae were the most frequently reported organisms associated with HCAI (0.9% of the survey population) – 12.4% were reported as resistant to third generation cephalosporins. Less than 0.1% of the survey population had a HCAI caused by meticillin resistant *Staphylococcus aureus* (MRSA) and 0.4% had *Clostridium difficile* infection (CDI).

### **3.5 Why is the prevalence of HCAI higher in ICU?**

This is where the most vulnerable patients are cared for often with devices required for their management. People in this group continue to be at higher risk even when they are discharged to the general wards owing to the continued use of devices.

### **3.6 What are the most serious types of infection?**

HCAI is a term for a group of conditions. Some HCAI can be treated easily and while they can be unpleasant they do not have a lasting impact on patients' health. Some of these infections, if they remain untreated can progress to more serious conditions. Other types of HCAI initially have a very serious effect on a patient's health, increasing their hospital stay, requiring further surgery, prolonged treatment with antibiotics and considerable distress to the patient e.g. surgical site infections.

### **3.8 What was the prevalence of antimicrobial use?**

The prevalence of antibiotics was 34.7 per cent and prevalence of use was highest in the independent sector (46.7 per cent compared to NHS organisations at 34.3 percent).

### **3.9 Why is antibiotic use higher in the independent sector?**

This may be due to a range of potential factors such as there is likely to be less antibiotic stewardship in the independent sector and independent hospitals are less likely to have an antimicrobial pharmacist, there may not be so many ward rounds or other measures to reduce antibiotic use. It may also be that these patients spend shorter times in hospital, getting discharged before their treatment has been completed.

### **3.10 How does the antimicrobial use data compare to other data in England?**

This is not possible as there is no nationally reported antibiotic use available for NHS acute trusts in England. A commercial company (IMS Health) collect antimicrobial consumption data but it is not available for feedback or for comparison.

### **3.11 Why does it matter if people are receiving antibiotic treatment for surgical prophylaxis longer than one day?**

Multiple studies have shown that there is no benefit after one day but there are more risks. Antibiotic use has been implicated in the selection and spread of multidrug resistant bacteria around healthcare institutions and also is implicated in causing *C. difficile* infection.

## **4.0 Discussion**

### **4.1 Is there any evidence to show that HCAI is rising or falling?**

Comparing prevalence surveys is not without difficulty and has been well described in the report.

The overall prevalence of HCAI has reduced from 8.2% (95% confidence intervals (CI) 8.0-8.4) in 2006 to 6.4% (95% CI 4.7 – 8.7%) in 2011.

The confidence intervals overlap in the two surveys. This means that if we did the survey 100 times, 95 times out of 100 the current survey would result in a HCAI prevalence of between 4.7 and 8.7%. This suggests that while this survey has an

overall reduced prevalence compared to 2006, there is no statistical difference in HCAI prevalence between the two surveys.

Since this was the first survey of its kind in paediatric and independent hospitals there is no baseline against which to measure whether HCAI is rising or falling in these populations.

When considering HCAI prevalence comparisons over time it is important to consider a number of factors before making any comparisons.

- The complexity of high-risk procedures increases with time.
- The underlying health of the population is not constant.
- The specialty mix will alter over time.
- New therapies will increase the life expectancy of very ill patients who are more susceptible to infection.
- The age of patients is increasing with time since people are living for longer.
- Many procedures that were undertaken in hospital are now day procedures and therefore the hospital population are undergoing more complex procedures.

#### **4.2 Can the results be directly compared to the rest of Europe and the UK?**

Comparisons of the results of prevalence surveys undertaken in different locations or in the same location at different times are difficult.

This survey used the same definitions as surveys performed at the same time in Wales and Scotland. These definitions are also being used throughout Europe. Comparisons with other countries in Europe will be available in late 2012.

However, the prevalence of HCAI is dependent on a number of factors that reflect differing patient vulnerability to infection and differences in admission policies and inpatient management policies and practices at the time of the survey. The Length of Stay (LOS) of hospital inpatients will also affect the likelihood of diagnosing HCAI and/or the risk of HCAI in inpatients. Hospital size is an important factor known to affect prevalence and probably reflects variation in some or all of the factors listed above.

Personnel collecting the data can vary between surveys and it is often not clear how well data collectors have been trained. In addition, age and gender distribution,

length of stay, case mix and underlying health of the population vary greatly across Europe. This limits the comparability of results from different surveys.

A pilot study from Europe published in the last year using the same protocol as this survey indicated an overall prevalence of 7.1%. These results in England compare favourably with that- a full report from ECDC is expected later this year and further comparison, adjusting for important variables can be made at that point.

#### **4.3 How do the results compare to previous prevalence surveys?**

In all four HCAI prevalence surveys carried out in England, the hospitals have participated voluntarily. However, on this occasion, all hospital sizes, all patients residing in acute care hospitals including psychiatric and paediatric patients, and hospitals from the independent sector were included. In comparison, the 2006 survey included NHS hospitals with greater than 50 adult acute care inpatient beds only. The independent sector contributed 3.2% of survey patients and the paediatric survey population was a further 8.3%, excluding these populations, who were not surveyed previously, does not significantly alter the overall HCAI prevalence detected.

Over five years considerable changes have occurred in NHS organisations in England. Mergers of organisations are more frequent, resulting in larger more complex organisations, with multiple hospital sites. Nationally reported data[28] show reduced hospital lengths of stay (LOS) over the last five years.

The prevalence of devices is lower in this survey compared with the 2006 PPS: peripheral vascular catheter 38.6% compared with 61.7%, central vascular catheter 5.9% versus 7.3%, urinary catheter 18.8% versus 31.6% and mechanical ventilation 5.6% versus intubation 1.7% (a proportion of intubated patients will not be mechanically ventilated). While this may be related to progress related to improving device use and the impact of the High Impact Interventions (HII), it may also be related to differences in patients included in the two surveys. As device use is a recognised risk factor for HCAI, the reduction in device use may have reduced the number of HCAI detected.

No previous national AMU prevalence surveys have been carried out.

#### **4.4 How do the results compare to recent studies in the UK and Europe?**

Other UK countries (Scotland and Wales) carried out similar surveys during the same time as this survey. Scotland reported their results in 4 April 2012 and reported

a HCAI prevalence of 4.4%. ECDC will publish all the data from European countries participating later this year.

#### **4.5 What does the survey tell us about organisms which cause infection (e.g. MRSA, *C. difficile* and *Enterobacteriaceae*)?**

Not every HCAI identified in the survey had microbiology results available. Often the results from samples sent to microbiology were not available at the time of survey. The percentages of organisms reported are therefore based on a subset of infections where the microbiology test results were available. This survey did not collect any information on the prevalence of microorganisms colonising patients who did not have a HCAI.

Microbiology data indicated in acute care that *Enterobacteriaceae* were the most commonly identified organism group; accounting for 32.4% where microbiology was reported.

##### *Further notes on emerging organisms causing HCAI:*

*Enterobacteriaceae* are a family of bacteria which includes *E. coli*, *Klebsiella* spp., *Enterobacter* spp. and other Gram negative organisms. They are widely dispersed in the environment and are often found in the gut of humans and animals. They can cause a range of infections in humans such as urinary tract infections and blood stream infections.

*E. coli* is an organism that colonises the gut of both humans and animals. It is a common cause of urinary tract infections but can also cause more serious conditions such as blood stream infections.

#### **4.6 Where does the work go from here?**

The findings of this survey enable the identification of priorities for IPC and AM stewardship measures in England in the coming years.

This survey has developed a standardised prevalence surveillance method allowing the collection of robust data for this survey. This can be used in the future for HCAI surveillance at international, national and local level. There are two key aspects to future prevalence surveillance. The first is continued surveillance of HCAI at a national level. The second is to use prevalence surveillance to undertake smaller local investigations more frequently as part of local hospitals infection prevention and control programmes targeting areas of concern.

#### **4.3. Who will take the priorities forward?**

Priorities will need to be discussed by individual organisations and the Department of Health. Some of the priorities may be taken forward by professional organisations for example HIS, BSAC, IPS; others may be taken forward by professional bodies e.g. Royal College of Physicians. Those that require policy decisions will need to be discussed at the Department of Health Advisory Committee on Antimicrobial Resistance and Healthcare Associated Infections (ARHAI).

### **5.0 HCAI Prevention**

#### **5.1 What is currently being done in England to reduce HCAI?**

Reducing MRSA bacteraemia and *C. difficile* infections has been a top priority for hospitals. There has been a cultural change so that senior management and the trust Board are responsible and that infection prevention and control is 'everybody's responsibility'. Strong board leadership and ward management along with robust infection prevention and control by all staff in the hospital is integral to the management of HCAI in all hospitals.

Specific areas that are essential for hospitals to include are as follows:

- Hand hygiene.
- Environmental cleaning.
- Surveillance/ screening.
- Training and education.
- Decontamination of instruments and patient care equipment.

Specific Department of Health initiatives are

- Saving Lives (2006) provides the tools and resources for hospital trusts to embed robust infection prevention and control across their organisation.
- The Code of Practice (part of the Health Act).
- Improvement Teams (2006).
- The Deep Clean (2008) The deep clean has contributed to on-going improvements in cleanliness and helped improve patient and staff confidence.
- The Technology Programme (2008) To speed up the assessment and adoption of technologies to improve patient safety.
- National Clean Your Hands Campaign materials.
- MRSA screening (2009).
- Revised guidance e.g. norovirus, *C.difficile*,

- HCAI improvement programme published a compendium of tools and guidance which are available on the Department of Health website (January 2011).
- 'Start Smart – Then Focus' related to antimicrobial prescribing (2011).

## **5.2 What other surveillance programmes are undertaken in England?**

In England, HCAI and AM resistance (AMR) surveillance is collated and fed back to hospitals by the HPA.

Mandatory surveillance schemes include:

- *Staphylococcus aureus* - meticillin-resistant *S. aureus* (MRSA) and meticillin-sensitive *S. aureus* (MSSA) bacteraemias.
- *Escherichia coli* (*E. coli*) bacteraemias.
- Glycopeptide-resistant *Enterococcus* (GRE) bacteraemias.
- *Clostridium difficile* infection (CDI).
- Orthopaedic surgical site infection (SSI).
- Voluntary surveillance schemes also exist for other SSI from NHS trusts and independent sector reports of MRSA bacteraemia, CDI and SSI.
- Micro-organisms and their resistance profiles are monitored via a voluntary microbiology laboratory reporting system.

## **5.3 How will the results of this survey be used to reduce HCAI?**

Each participating organisation was provided with their individual results. The purpose of providing individual reports was for hospital teams to identify priorities for local HCAI surveillance, ward and clinical specialties for focused infection prevention and control and AM stewardship interventions in their own organisation.

Identification of future national targets should be based on the ability to prevent particular HCAI and the costs associated with their prevention. The results of this survey will need detailed consideration by the Department of Health and the Department of Health Advisory Committee on Antimicrobial Resistance and HCAI (ARHCAI) to determine national policy in the coming years. This section serves to highlight some potential implications that may be considered at both hospital and national level.

The methodology developed during this survey can be used repeatedly at intervals to allow the impact of measures taken nationally to reduce the burden of HCAI to be evaluated through an analysis of trends. Hospital prevalence results will allow local

infection control teams to develop local policies on HCAI reduction. It also allows local antimicrobial pharmacy teams to target antimicrobial practice within their organisation and determine which particular quality indicators and clinical areas to focus on.

#### **5.4 What can I do as a patient or visitor to prevent HCAI?**

The HPA website has some useful tips for patients and their visitors

<http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/HCAI/GeneralInformationOnHCAI/#general>

#### **5.5 What the staff may do to help prevent infections?**

Preventing spread between patients by cleaning hands either with soap and water or in some cases alcohol hand gel.

Understand that staff may use 'personal protective equipment', where necessary, for example, disposable gloves and aprons to prevent contamination of clothing and skin.

Staff will also ensure that, through regular cleaning, micro-organisms do not build up in the hospital environment.

Isolating patients known to be colonised with a resistant micro-organism to reduce risk of spread.

Careful use of antibiotics to minimise the spread of resistant strains and reduce the risk of patients contracting *C. difficile* infection.

#### **5.6 Is there anything I can do about antibiotic resistance?**

Yes, there is a lot you can do to help prevent the spread of antibiotic resistant micro-organisms.

Do not ask your doctor for antibiotics for illnesses like coughs, colds, or flu. These are caused by viruses, not bacteria, therefore antibiotics will not help, but may cause other bacteria in your body to become resistant.

Expect to be given antibiotics only when they are really necessary, for a severe infection.

Antibiotic resistance is most likely to develop when bacteria are exposed to antibiotics at levels too low to kill them outright.

So if you are prescribed an antibiotic:

- Take it exactly as prescribed and make sure you do not miss out any doses.
- Do not save any of your antibiotic treatment for the next time you get ill. (different antibiotics are used for different infections, so they may not work anyway).
- Never take out-of-date antibiotics. These lose their potency over time.
- Do not take antibiotics prescribed for someone else, as they may not be suitable for your infection and could even be dangerous.

### **5.7 What is the role of the HPA in HCAI and AMR?**

The HPA is an independent organisation, set up by the government to protect and public from the health effects of infectious diseases and other hazards to health. The HPA identifies, researches and responds to these threats. It gives advice to the public, provides data and information to government, and advises people working in healthcare.

The HPA monitors antibiotic resistance across England, Wales and Northern Ireland (surveillance in Scotland is undertaken by Health Protection Scotland, the Scottish counterpart of the HPA).

In England it is mandatory for health trusts to report all cases of blood stream infection caused by *meticillin-resistant Staphylococcus aureus* (MRSA) and glycopeptide-resistant *Enterococci* (GRE) and infections with *C. difficile* (CDI) to the HPA. Other infections (which make up the majority) are reported on a voluntary basis. Hospital microbiology laboratories also end off resistant micro-organisms that they are concerned about to the HPA so they can be studied in more detail. The results of the surveillance are published regularly on the HPA website so that healthcare professionals can be made aware of changes in rates of infection and resistance. Additionally the HPA, in collaboration with the Department of Health, runs the Resistance Alert System, which tells microbiologists in the NHS about new and emerging resistance problems and how far they have spread.

Another HPA scheme is the Surgical Site Infection Surveillance Scheme, which helps hospitals monitor their own rates of post-surgical infection and compare themselves with similar organisations.



## **5.8 Where can I get more information on HCAI?**

The HPA website

<http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/HCAI>

Department of Health

<https://hcai.dh.gov.uk>

Royal College of Physicians

<http://www.rcplondon.ac.uk/resource/top-ten-tips-series>

Infection Prevention Society

<http://www.ips.uk.net>

Healthcare Infection Society

<http://www.his.org.uk>

British Society for Antimicrobial Chemotherapy

<http://www.bsac.org.uk>