Health and Social Services Committee

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Title: Hospital Acquired Infections: The National Response

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1. Introduction

Healthcare associated infections (HCAIs) are an important cause of preventable morbidity and mortality in the population. This paper seeks to inform the Welsh Assembly Government Health and Social Services Committee of the nature of these infections, their impact in Wales, what we doing at a national level to reduce their occurrence and what might be done to improve the situation further.

2. Man and Microbes

Mankind shares its world, and lives in intimate proximity to, a vast population of micro-organisms comprising bacteria, viruses, fungi and parasites. Each human harbours around one thousand billion bacteria (there are about one million bacteria on the average human hand). The food we eat can contain up to a million bacteria per gram, the air we breathe has about ten organisms per millilitre, and the soil that surrounds us, about one billion bacteria per gram. Most of these micro-organisms are entirely harmless and some are highly beneficial. They can keep micro-organisms more likely to cause disease at bay, assist digestion of food, and provide a source of vitamins. A small percentage can cause infections if they can breach the body's normal barriers to entry (eg surfaces of the skin, gut, urinary and respiratory tracts), particularly in situations where an individual's resistance to infection is reduced by other factors such as age (the very young and very old), illness (eg cancer and diabetes), medication (eg steroids and cancer chemotherapy), and indwelling medical devices (eg implants, ventilatory support, and urinary and vascular catheters). There is a relatively limited range of micro-organisms that are capable of causing disease simply by being transferred to a new (and non immune) human host. These are the causes of the major infectious diseases of man (eg many viral infections, infectious diarrhoea, excepting *Clostridium difficile*, diphtheria, plague, typhoid, tuberculosis etc).

3. Healthcare Associated Infections

The treatment and care of patients in hospital is often complicated by the development of infection. This arises due to the impact of a variety of factors in this setting that render people especially susceptible to microbial challenge. These include the reduction of the effectiveness of the body's immune system by many illnesses, the presentation of disease in the very young and the very old who are particularly prone to infection, medical interventions which compromise normal protective mechanisms and the potential for transmission of pathogenic organisms from patient to patient when they are managed in close proximity.

Micro-organisms that cause HCAIs may be derived from patients' own flora or via transmission from others via person to person spread or from food and water or the environment. Transmission of new agents to susceptible patients can result in acquisition of micro-organisms that are more likely to produce disease (or to produce disease that is more difficult to treat because of resistance to antibiotics) than their own microbial flora. The majority of micro-organisms causing HCAIs in non-epidemic settings do not cause infections in healthy people but do so when the normal body defences are compromised in the ways described above.

The prevention and control of such infections has provided medical science with one of its major challenges and success in this area was a pre-requisite for the development of complex medical procedures in the Twentieth Century. The reduction of the occurrence and impact of infections has been achieved as a result of a multiplicity of approaches that have resulted from an increasing understanding of microbial disease. These have included the introduction of sound hygienic practices, effective methods for sterilisation, asepsis, antisepsis, environmental control, the discovery and use of antibiotics, the development of laboratory diagnostic methods and the application of epidemiological science. Their incorporation into clinical practice has been facilitated and supported by education and training at pre- and post registration levels, the employment of a range of management processes to ensure good practice and the training and employment of a cadre of specialist infection control specialists. Despite this, infections acquired in healthcare settings remain common. National surveys (1981 and 1992) have suggested that about nine per cent of inpatients have a hospital acquired infection at any one time. The major categories of infections that arise are illustrated in table 1(annex).

4. Healthcare Associated Infections: occurrence in Wales

Varying degrees of information are available on rates of infection from individual NHS Trusts. Prevalence studies, ie assessments of the percentage of patients being treated in a hospital who have acquired an infection as a result of the healthcare they have received, have been recently undertaken in 2 Welsh hospitals. Overall rates of infection were 5.6% and 5.5% respectively. Comparisons with international data are provided in table 2 (annex).

National data is also available in relation to *Staphylococcus aureus* bacteraemias, orthopaedic surgical site infections and outbreaks of healthcare associated infections. Reports on the these programmes are available on the NPHS website at http://www.wales.nhs.uk/sites/page.cfm?orgid=379&pid=2663

Staphylococcal bacteraemias

Information regarding laboratory reports of *S aureus* bacteraemia has been forwarded to the Communicable Disease Surveillance Centre Wales since 1991. Between 1991 and 2001 (figure1, annex), this was a voluntary reporting scheme. Reporting became mandatory for NHS Trusts in 2001 (figures 2 and 3, annex). Results show that:

- There was a steep rise in reports of bacteraemias caused by Methicillin resistant *S aureus* (MRSA) between 1991 and 1997.
- Despite increases in hospital activity over the period, the rates of staphylococcal (including MRSA) bacteraemias have changed little between 1997 and 2005.
- The mean rates for MRSA bacteraemias presenting in acute general hospitals in Wales in 2004/5 (0.11 per thousand bed days) are lower than the rates published for England (0.16). The mean rate for specialist trusts in Wales (0.13) is also lower than the rate published for England (0.21). The rates for individual Welsh hospitals

are provided in annex 1 figures 4 and 5, together with the corresponding data from England.

Orthopaedic surgical site infection surveillance

NHS Trusts providing orthopaedic services are required by the Welsh Assembly Government to monitor the infection rates associated with surgery involving the insertion of hip and knee prostheses. The methodology was developed by a Department of Health working party and provides information that can be used to compare infection rates across the UK and internationally. There is an active collaboration with Scotland and Northern Ireland in relation to this surveillance programme (reports are available on http://howis.wales.nhs.uk/sites/page.cfm?orgid=379&pid=7702 and Wales is contributing to the European data base established by HELICS (Hospitals in Europe Link for Infection Control through Surveillance).

Data collection became mandatory for NHS Trusts in Wales in 01/09/03. To date (02/09/05), data from has been submitted from 9/12 Trusts. For the 4 mandatory procedures, the rates are as follows: Hip prosthesis 3.2% (2187 procedures); Knee prosthesis 3.3% (1828 procedures); Open reduction of fracture 2.5% (972 procedures); Hemiarthroplasty 4.4% (340 procedures).

Outbreaks of Healthcare Associated Infections

A surveillance scheme for outbreaks/incidents of healthcare associated infections (HAI) has been operational in Wales since 1997. This was initially a voluntary surveillance scheme using paper questionnaires. To strengthen this surveillance, using an amended data set and new definitions, the reporting of outbreaks/incidents of HAI in Wales was made mandatory by the Welsh Assembly Government from July 2003. To facilitate the scheme a web site was developed enabling authorised users to report outbreaks, run standardised reports and export data. (http://howis.wales.nhs.uk/whaip .

A report is currently in preparation regarding outbreaks of healthcare associated infections that occurred in 2004. This shows that the majority involved enteric disease, most of which were viral in origin. These affected 2430 patients, involved 227 wards and resulted in 5 hospital closures.

5. Healthcare Associated Infections: costs

Table 3 (annex) illustrates the costs incurred as a result of acquiring healthcare associated infections in an NHS Trust examined in England as part of a Department of Health sponsored study (http://www.dh.gov.uk/assetRoot/04/08/97/25/04089725.pdf . It shows that in the year 2000 the average cost per infection acquired amounted to some £3154. This would equate to an annual cost to the NHS in Wales of approximately £50million. Hospital overheads, capital charges and the cost of management time accounted for 33% of the additional costs incurred, while nursing care accounted for 42%, medical care 6%, operations and consumables 6%, paramedics and specialist nurses 4%, antimicrobials 2%, other drugs 3%, microbiology tests 1%, and other tests and investigations 3%. The infections were shown to result in lengths of stay for patients 2.5 times longer than for patients who remain uninfected. This is, on average, an extra 11 days of stay.

6. Healthcare associated infections: scope for reduction

The current burden of infection is discussed above. Not all of these healthcare associated infections are preventable. Medical science has not yet advanced to the point where micro-organisms from a patients' own flora can always be excluded from situations that might give rise to infections. Preventative measures, such as the use of prophylactic antibiotics will not always be effective. Practical mechanisms that completely prevent acquisition of new organisms from external sources also do not exist. In addition, the risk of infection for individual patients will be highly dependant on their underlying disease, their general condition, the medical procedures they are subjected to, and the drugs they receive. However, there is a general consensus that current levels of infection can be reduced further. The National Audit Office report in 2000 (http://www.nao.org.uk/publications/nao_reports/9900230.pdf) suggested that 15-30% might be a realistic target. The Department of Health has set a target for NHS Trusts to reduce their MRSA bacteraemia rates by 50% by 2008.

7. Healthcare Infections in Wales: development of a national strategy

The Welsh Assembly Government issued in September 2004 a strategy aimed at supporting acute hospitals achieve further reductions in healthcare associated infections (http://www.cmo.wales.gov.uk/content/work/communicable-disease/healthcare-associated-infections-strategy-e.pdf . This strategy had been developed by the Welsh Healthcare Associated Infection sub-group (WHAISG) of the Committee for the Control of Communicable Disease. It highlights the potential to make further progress in this area, notes that careful attention to infection control practice is the key to success and emphasises the crucial need for all healthcare staff to understand their responsibilities in this area. To assist in achieving the latter, the strategy emphases the need for clinical directorates to be held accountable for their performance in this area of activity and to have systems of management in place that can underpin this. It recommends:

- Appointment of trust directorate (or equivalent unit of management) leads.
- Development of directorate action plans within the overall trust infection control programme.
- Leadership at Trust management executive/board level.
- That Trusts deploy sufficient specialists in infection prevention and control to provide adequate support to clinical services

In addition the strategy outlines a wide range of further recommendations to reinforce the infrastructure in the NHS to deal with this problem. These areas cover:

National standards
Currently these are largely encapsulated within the Welsh Risk Pool standards and National Standards of Cleanliness for NHS Trusts in Wales. The recommendations seek to develop these to ensure that they relate appropriately to outcomes.

National expert and epidemiological support
The National Public Health of Wales to ensure availability of specialist epidemiological expertise to support local services.

Training and education
A new training programme to be developed that builds on the current training and education infrastructure to ensure consistent and universal multi-disciplinary infection control training for all healthcare staff. Enhanced training for specialist staff also to be addressed.

Surveillance and audit programmes
Trusts to adopt comprehensive surveillance and audit programmes to monitor and direct their infection control programmes. Existing national schemes to be extended to wider range of surgical specialties, infections in ITU and laboratory confirmed infections due to *Clostridium difficile*. Trusts to ensure that infection control audit is included as part of Trust wide programme of clinical audit and the use of the UK audit tool encouraged.

Infection reduction programmes
Reduction in infection rates to form part of Trust programmes and strategies. Each Trust to set and register annually with WHAISG local targets for measurable infection reduction. Progress to be monitored via NHS Regional Offices through the Balanced Scorecard and the WHAISG project team. The aim of these programmes is to define high priority areas for Trust action, introduce appropriate interventions to reduce infection rates, share best practice with trusts across Wales and develop the evidence base for future performance management and target setting.

Information technology and communications
A need highlighted for the needs of infection control to be taken account of in the development and implementation of future IM&T programmes

8. Development of a national strategy: progress to date

Trust infection control programmes
Trust action plans that take account of the Welsh Assembly Government strategy have been prepared and submitted to WAG Regional Offices. Feedback and guidance on future format and contents has been issued to trusts by Public Health Protection Division, Welsh Assembly Government.

National standards
Discussions taking place on future approaches.

National expert and epidemiological support
This is available to trusts if support required.

Training and education
It is planned to make available to Trusts an e learning package that has been developed, evaluated and implemented in Scotland. Additional training for specialist staff has been provided and consideration is being given to future programmes.

National surveillance and audit programmes
Mandatory surveillance of Clostridium difficile infections was implemented by all Trusts in January 2005 and the first report will be available shortly.
Surgical site infection is shortly to be extended to incorporate caesarean sections and pilots have been run in 5 Trusts. The overall infection rate for the Trusts involved in these preliminary studies has been 12%.
Discussions have begun in relation to developing surveillance programmes for vascular surgery and ITU infections.

Infection reduction programmes
Trusts are now in the second year of this process. Results from the first year were presented and shared by Trusts in seminars held in North and South Wales venues in March 2005. The areas addressed were: bacteraemias (8 Trusts), infections post caesarean section (2 Trusts), Clostridium difficile infections (1 Trust) and outbreaks of diarrhoea and vomiting (1 trust). Overall:

- Reduction in infection rates achieved in 4 Trusts. Sustainability to be assessed.
- In 6 trusts, most of year spent establishing programme.
- 2 Trusts failed to make progress.

Information technology and communications
A system, DataStore, that was developed by the PHLS in Wales/NPHS that facilitates laboratory data management has been installed into all microbiology laboratories in Wales. This is being used for local retrieval of laboratory data to facilitate infection monitoring and provides the national data for the *Clostridium difficile* surveillance programme. It will be used for developing bacteraemia surveillance more broadly than the current focus on *Staphylococcus aureus*.

Promotion of the strategy
The strategy has been promoted via seminars and symposia throughout Wales. These have included work shops that have examined the processes required to develop a greater focus on infection control at clinical directorate level. Following these discussions the Public Health Protection Division, WAG has issued guidance to trusts in relation to the role of directorate leads for infection control.
The national "clean your hands" campaign to increase awareness in relation to hand hygiene practice has been promoted by WHAISG and adopted by Trusts.

9. Further action required

Infection control management at clinical directorate level
The Welsh strategy for the control of healthcare associated infections emphasises that it is front-line healthcare workers, conducting their routine day to day activities, who have responsibility for ensuring that they incorporate sound infection control practice into all aspects of the patient care they deliver. It is for this reason that clear management responsibility for infection control at clinical directorate (or equivalent) level is the driving principle underpinning the Welsh strategy. It is considered vital that staff recognise their personal responsibilities in this area and their management and leadership responsibilities in relation to others. In addition it is viewed as essential that clinical directorates work with infection control specialists to monitor performance, identify potential areas of concern and implement remedial action or new interventions when necessary.

Discussions with infection control practitioners has suggested that adoption of these principles has been variable to date across Trusts and across directorates. They have also reported that engagement and leadership from senior staff (especially medical) has at times been suboptimal. Leadership at Trust Executive and Board levels will be required to address this when such situations arise.

Resources
Implementation of the Welsh strategy requires further resource to be directed towards infection control. In particular, the following are required: adequate staffing so that infection control requirements can be accommodated in the face of varying patient throughputs; an infrastructure for directorate engagement; improved systems for in-service training; and mechanisms for undertaking comprehensive surveillance.
The potential gains in real and opportunity costs far outweigh the costs of maintaining comprehensive infection control programmes. Unfortunately the introduction of improved infection control practice is often regarded as a service development which consequently is seen as requiring new funding for implementation. Putting this in the context of current financial restraints is resulting in reluctance by some Trusts to implement key aspects of the strategy. It is suggested that instead of service development, infection control should be clearly designated as a core element of

patient care and that commissioners require that healthcare providers must ensure that all patients receive treatment that incorporates a specified level of infection control practice. This should at least accommodate all elements of the Welsh strategy. Negotiations between providers and commissioners would then centre around activity levels rather than an implied trade off of activity against quality of care.

Legislation
In view of the issues raised above regarding management accountabilities and resource allocations it is suggested that the potential value of enacting relevant legislation in relation to healthcare associated infections should be examined. This has been successful in contributing to improved practice in other areas involving Health and Safety.

Facilities
The Welsh strategy highlights the need for Trusts to provide appropriate isolation facilities to meet their needs. Assessment is required of the numbers needed and how well facilities conform to current NHS Estates guidelines. It is likely that facilities will be shown to be inadequate for needs with significant resource implications.

Surveillance
Routine monitoring of infection rates with regular feed-back of results to clinical staff to provide: an understanding of performance and outcomes; identification of potential problems; and targeting of remedial actions, has been shown to be essential to achieve significant and sustained reductions in infection rates. Progress in developing surveillance programmes has been impeded by the resource issues described above. Short term funding was provided by WAG to "pump-prime" the implementation of mandatory national surveillance programmes; however, this has now come to an end and many Trusts are discontinuing the co-ordinator posts that this supported

Information technology
The following can provide important information for surveillance and control of HCAIs:

- linkage between patient administration systems and pathology (microbiology) systems so that organisms of concern, e.g. MRSA, *C. difficile*, ESBL producers etc, can be flagged to users logging into the patient record.
- linkage between pharmacy systems and pathology (microbiology) results so that microbiology and infection control staff can monitor with pharmacists that appropriate antibiotics are being prescribed with respect to individual patient need and local antibiotic resistance patterns
- linkage between the theatre operating list programme, pathology (microbiology) results, pharmacy, and the electronic patient record to enable automatic data entry to facilitate surgical site surveillance.
- Information regarding patient movement to facilitate accurate definition of outbreaks and analysis of cross-infection.
- Automated reporting to national databases.

The use of the electronic patient record together with real time linkages to the appropriate healthcare databases would greatly facilitate these processes. Incorporation of healthcare associated infection control requirements into the Informing Healthcare programme would be of immense clinical value. It could also substantially reduce the costs of undertaking surveillance.

Communications to the general public
In recent times there has been much misinformation provided to the general public in relation to HCAIs. Many have the mistaken impression that all HCAIs are preventable,

that MRSA causes all the infections, that MRSA is a highly virulent “super-bug”, and that HCAIs are spiralling out of control. It is important that patients properly understand all the risks they face when they are admitted to hospital, including the risks of infection. Therefore careful thought needs to be given as to how and what information is provided. One of the key issues that needs to be explained is the relationship of risk to a given patient’s underlying condition and the likely treatment they will receive. For example, patients admitted simply for investigation will be at negligible risk of acquiring an infection whereas a patient admitted as an emergency requiring large bowel surgery will be at very high risk of infection which will be further influenced by general condition and underlying disease. Hospital “league tables” do not help in this regard. It is proposed to introduce an information “package” that covers a range of infection information provided by Trusts together with easily understandable explanations regarding their interpretation. It is recommended that this be done clearly in the context of providing background information to assist discussions with general practitioner or hospital consultant regarding the individual risk that a patient will face in relation to their particular condition. To facilitate such a process, health professionals will also need ready access to such information so they are in a position to provide informed advice.

28 September 2005

Annex

Table 1. Categories of healthcare associated infections (from Emmerson et al, 1996, quoted in The Management and Control of Hospital Acquired Infection in Acute NHS Trusts in England, National Audit Office, 2000. http://www.nao.org.uk/publications/nao_reports/9900230.pdf

Site of infection	% of HAIs
Urinary	23
Respiratory	23
Surgical wound	11
Blood	6
Skin	10
Other	25

Table 2 Prevalence of healthcare associated infections: international data. From, Improving patient care by reducing the risk of hospital acquired infection: A progress report, National Audit Office, 2004. http://www.nao.org.uk/publications/nao_reports/03-04/0304876.pdf

Germany	**4%**
France	**6-10%**
Spain	**8%**
Denmark	**8%**
England	**9%**
USA	**5-10%**
Australia	**6%**
Norway	**7%**
Netherlands	**7%**

Source: Richard Wells Research Centre. Thames Valley University and other expert sources.

Figure 1

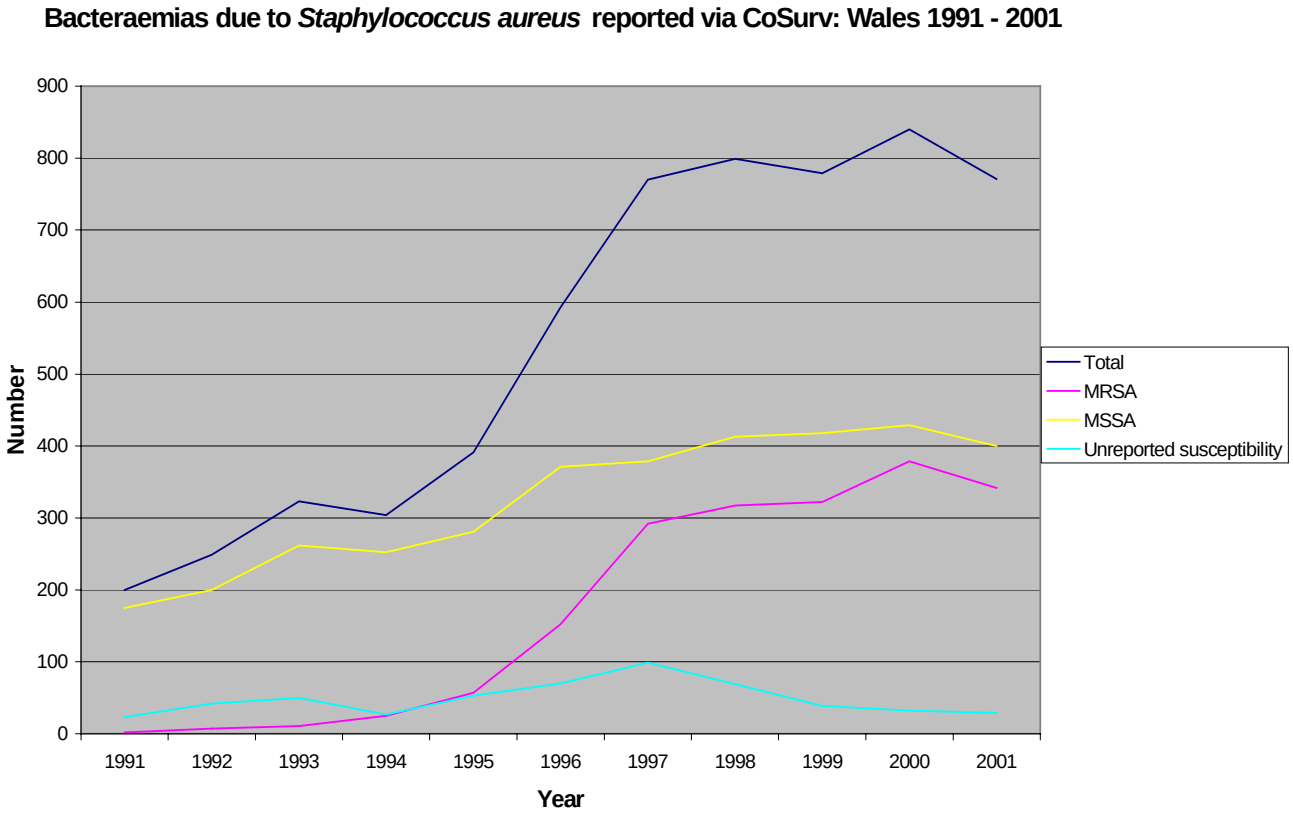

Figure 2. Process control chart illustrating overall S aureus data from mandatory bacteraemia reporting scheme. Wales 01/04/01 - 31/03/05

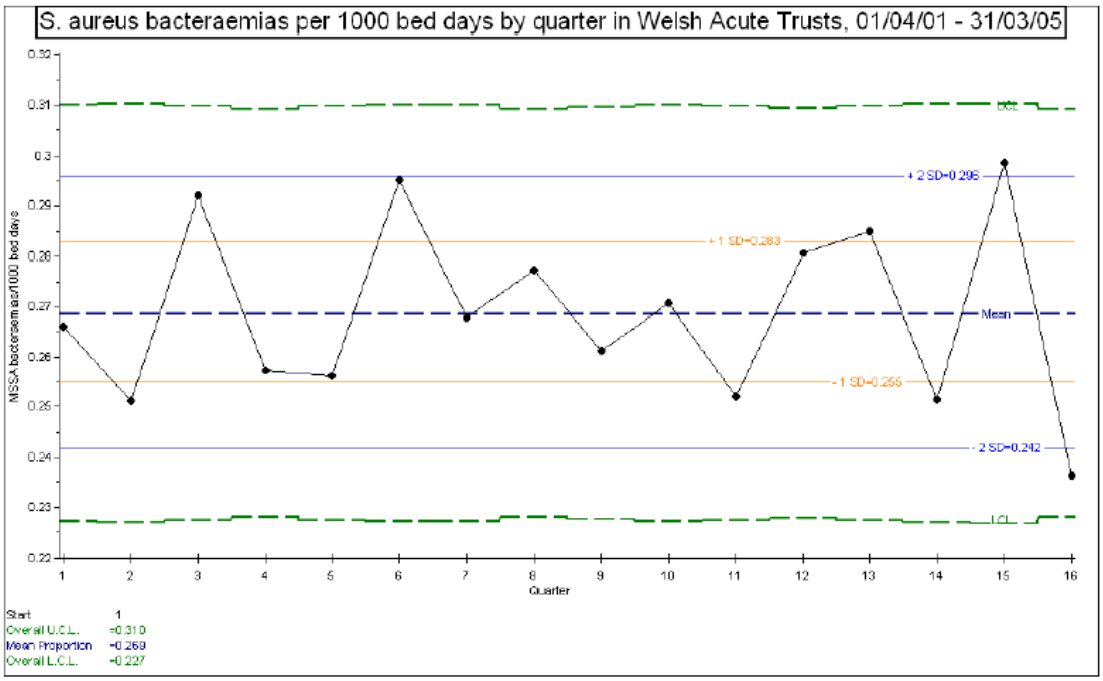

Figure 3. Process control chart illustrating overall MRSA data from mandatory bacteraemia reporting scheme. Wales 01/04/01 - 31/03/05

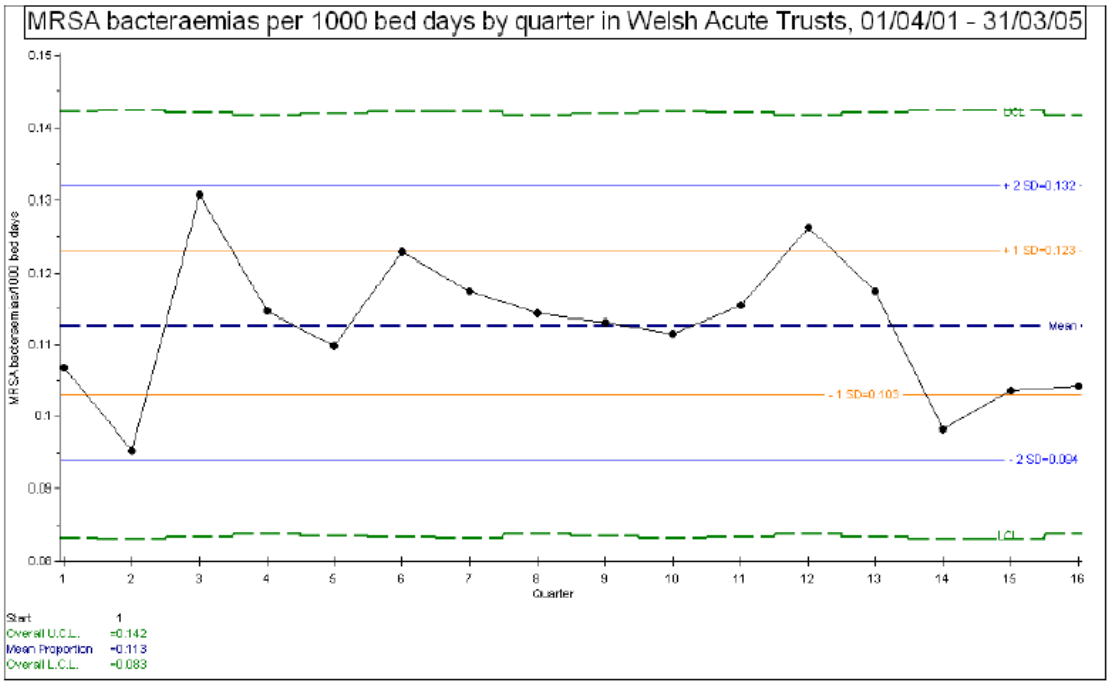

Figure 4. Process control chart illustrating overall MSSA data from mandatory bacteraemia reporting scheme. Wales 01/04/01 - 31/03/05

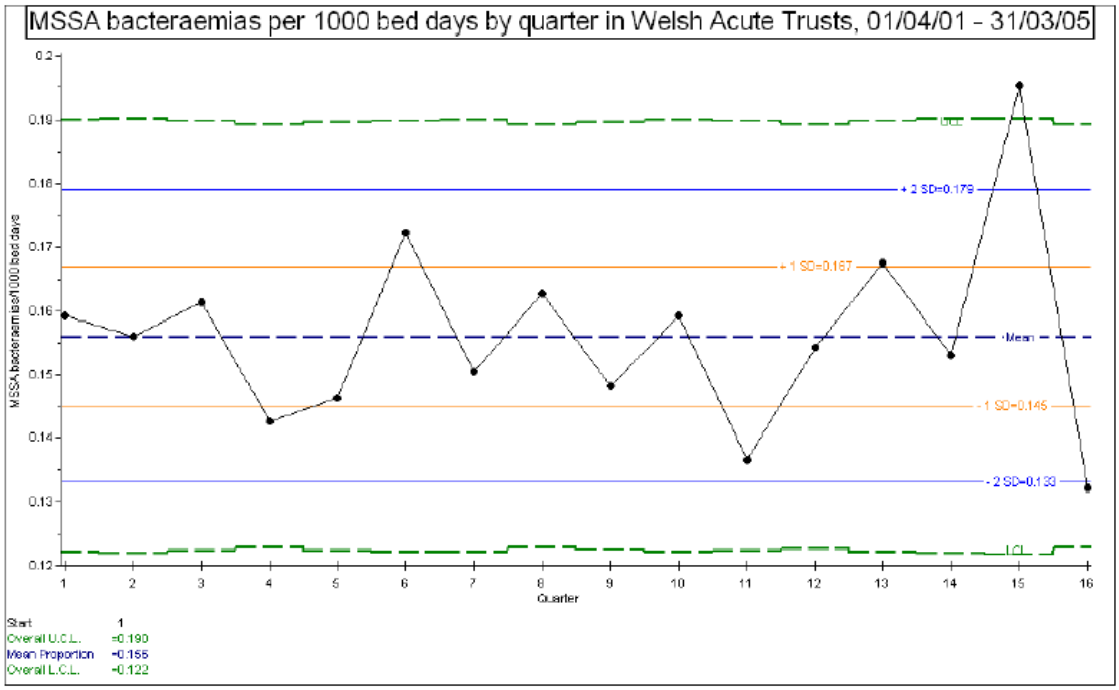

Figure 5. MRSA bacteraemias per 1000 bed days in General Acute Trusts in England and Wales, April 2004 - March 2005. Red points indicate a Welsh Trust.

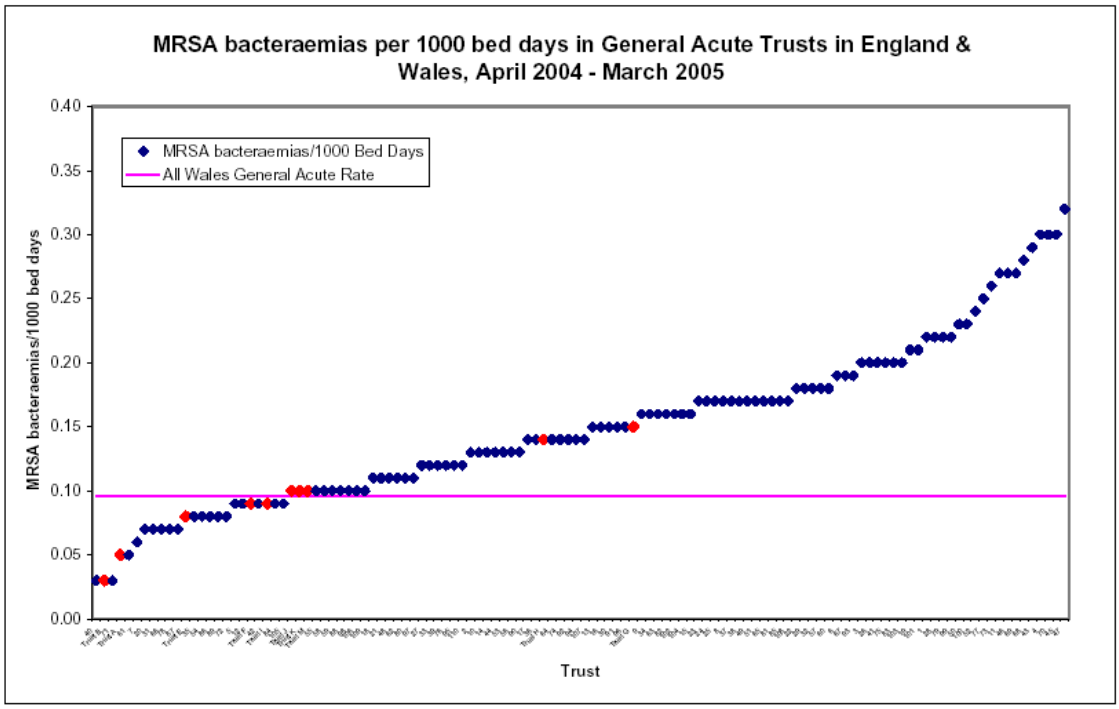

Figure 5. MRSA bacteraemias per 1000 bed days in Specialist and Single Specialty Trusts in England and Wales, April 2004 - March 2005. Red points indicate a Welsh Trust.

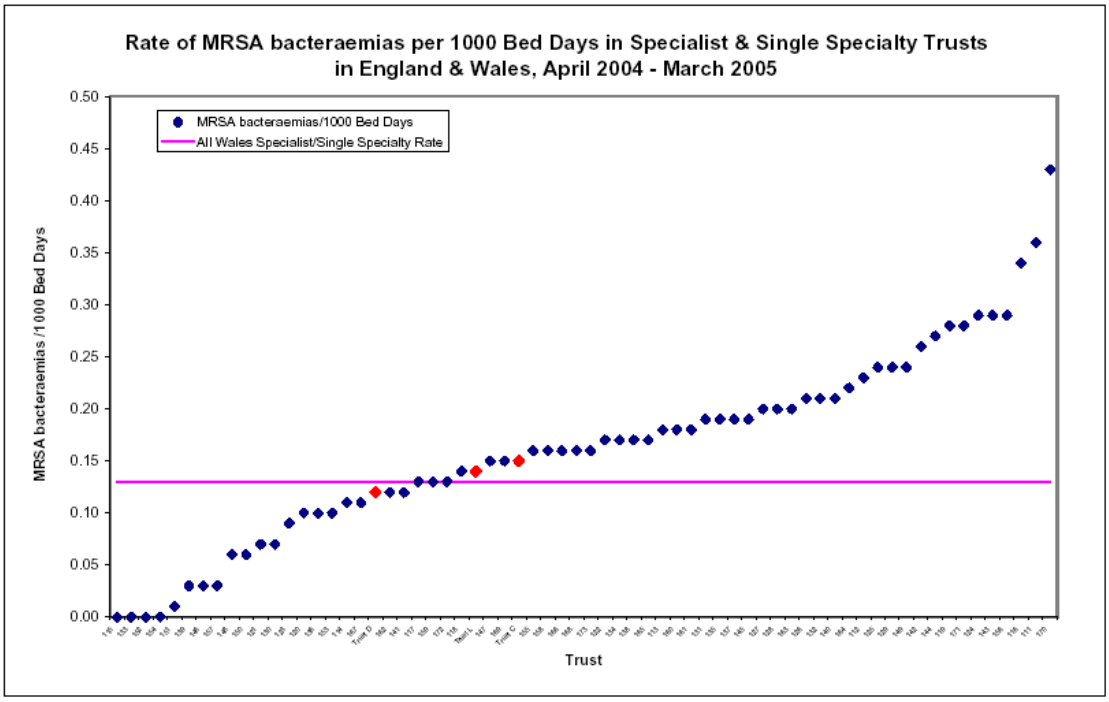

Table 3. Mean costs incurred during in-patient phase for patients with Healthcare Associated Infections (3980 studied). Plowman et al, Department of Health, 2000. http://www.dh.gov.uk/assetRoot/04/08/97/25/04089725.pdf

Site of infection	**Number cases investigated**	**Additional costs (£)**
Urinary tract	107	1327
Lower respiratory tract	48	2398
Surgical wound	38	1618
Blood stream	4	5397
Skin	25	1790
Other	30	2263
Multiple	57	9152
Any infection	309	3154