Health Information and Quality Authority

An tÚdarás Um Fhaisnéis agus Cáilíocht Sláinte

Background document to support the revision of the National Standards for the prevention and control of healthcare-associated infections in acute healthcare services

May 2017

Safer Better Care

Background document to support the revision of the National Standards for the prevention and control of healthcare-associated infections in acute healthcare services

Health Information and Quality Authority

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Health Information and Quality Authority

About the Health Information and Quality Authority

The Health Information and Quality Authority (HIQA) is an independent authority established to drive high-quality and safe care for people using our health and social services in Ireland. HIQA's role is to develop standards, inspect and review health and social care services and support informed decisions on how services are delivered.

HIQA aims to safeguard people and improve the safety and quality of health and social care services across its full range of functions.

HIQA's mandate to date extends across a specified range of public, private and voluntary sector services. Reporting to the Minister for Health and the Minister for Children and Youth Affairs, HIQA has statutory responsibility for:

Setting Standards for Health and Social Services — Developing person-centred standards, based on evidence and best international practice, for health and social care services in Ireland.

Regulation — Registering and inspecting designated centres.

Monitoring Children's Services — Monitoring and inspecting children's social services.

Monitoring Healthcare Safety and Quality — Monitoring the safety and quality of health services and investigating as necessary serious concerns about the health and welfare of people who use these services.

Health Technology Assessment — Providing advice that enables the best outcome for people who use our health service and the best use of resources by evaluating the clinical effectiveness and cost effectiveness of drugs, equipment, diagnostic techniques and health promotion and protection activities.

Health Information — Advising on the efficient and secure collection and sharing of health information, setting standards, evaluating information resources and publishing information about the delivery and performance of Ireland's health and social care services.

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Section 1: Introduction

1.1 Overview

Preventing and controlling healthcare-associated infections continues to be a significant challenge to healthcare systems throughout the world. A point prevalence survey conducted across acute hospitals in Ireland in 2012 found that approximately 1 in 20 people in an acute healthcare service had a healthcare-associated infection.[1]

Antimicrobial resistance presents a serious threat to patients, with an increasing number of outbreaks related to multidrug-resistant organisms reported in Irish hospitals. In particular, strains of Enterobacteriaceae and Enterococci that are resistant to commonly used antimicrobials have emerged as important causes of healthcare-associated infection. In 2014, Ireland had the highest proportion of blood-stream infections due to vancomycin-resistant Enterococci in Europe.[2] Healthcare-associated infections can significantly impact on patients and their families as they may result in serious illness, long-term disability or death. Healthcare-associated infections lead to increased healthcare costs, prolonged patient stays and, therefore, decreased overall bed availability.

A significant proportion of healthcare-associated infection is known to be avoidable if effective structures, systems and processes are in place to manage the potential risks arising from the environment and activities within the hospital. This is best achieved through a well-organised, planned and managed infection prevention and control programme which is integrated with an antimicrobial stewardship programme to effectively coordinate efforts within an acute healthcare service.

The *National Standards for the Prevention and Control of Healthcare Associated Infections* were first published in 2009.[3] The general content of the 2009 standards is retained, updated and streamlined within the revised standards. Previously stated criteria, including incident identification and management, monitoring, occupational health service, externally contracted service providers, resources and information governance, have been developed into stand-alone standards. Certain standards have been strengthened, including communication with the patient; local, regional and national governance structures; and workforce training. New standards include cleaning and decontamination of patient equipment and reusable invasive medical devices, risk management, quality improvement, health and wellbeing of patients, procurement of medical devices and equipment and management of information.

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The revised national standards are designed to promote effective infection prevention and control and a safe environment within acute healthcare services. Importantly, they are designed to promote a culture of patient safety through the efforts of all staff working together to reduce healthcare-associated infections. In particular, the standards are intended to:

- create a person-centred approach to the prevention and control of healthcare-associated infection
- promote clinical practice that is up to date, effective and based on best practice
- enhance infection prevention and control efforts by regularly checking the service's performance and identifying strengths and highlighting areas for improvement
- encourage a multidisciplinary approach to preventing and controlling healthcare-associated infections within acute healthcare services.

1.2   Standards development process

The development of standards builds on current relevant best practice evidence. A focused horizon scanning review of international and national literature was undertaken and used to inform the development of the revised national standards. This review took account of international standards and guidelines, national guidelines, published HIQA guides and reports, recommendations from investigations, national surveys and expert opinion. The revised standards have taken into account this information where relevant.

The 2009 *National Standards for the Prevention and Control of Healthcare Associated Infections*[3] were mapped onto HIQA's standards development eight theme framework. The framework is comprised of four dimensions of safety and quality, namely:

- Person-centred Care and Support
- Effective Care and Support
- Safe Care and Support
- Better Health and Wellbeing.

Delivering improvements within these safety and quality dimensions depends on service providers having capacity and capability in the following four key areas:

- Leadership, Governance and Management
- Workforce
- Use of Resources
- Use of Information.

Findings from the literature and data reviewed informed the content of the standards and features within the eight themes. More information was available in relation to some themes than others, for example, the literature review identified most evidence in relation to Theme 2 (Effective Care and Support) and Theme 3 (Safe Care and Support), but less in relation to Theme 4 (Better Health and Wellbeing), Theme 5 (Leadership, Governance and Management) and Theme 8 (Use of Information).

Feedback was requested on this thematic resources list from the Standards Advisory Group, which was made up of a diverse range of interested and informed parties that advised HIQA, supported consultation and information exchange, and advised on further steps. The Standards Advisory Group was asked about any inadvertent omissions, any unnecessary inclusions and any new or revised guidelines pending publication. The Standards Advisory Group were also asked to identify any specific areas of infection prevention and control practice where there is uncertainty, variation, or new or emerging evidence that should be specifically addressed in a further focused systematic literature review. No specific areas were identified by the group.

To ensure that the standards development process was comprehensive, a series of focus groups and a public consultation process was conducted. This provided an opportunity to hear from a diverse range of people and to reflect on key infection prevention and control issues arising in acute healthcare settings. Focus group contributions and submissions made during the public consultation process were discussed with the Standards Advisory Group and incorporated as appropriate into the final standards document.

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1.3 Structure of this document

This document sets out the information used to inform the revision of the of the 2009 PCHCAI standards. It includes an overview of:

- the international context, including standards and relevant guidelines
- the Irish context, including relevant guidelines
- HIQA's prevention and control of healthcare-associated infections (PCHCAI) monitoring programme findings
- investigation reports into healthcare-associated infection-related deaths
- Irish surveys relating to healthcare-associated infection and antimicrobial resistance.

All documents were reviewed and assessed for inclusion in the evidence base to inform the revised *National Standards for the prevention and control of healthcare-associated infections in acute healthcare services*.

Section 2: Review of international standards

2.1 Overview

It is recognised internationally that the setting and implementation of quality standards are important levers to improve care. Standards help to set public, provider and professional expectations and enable services to safeguard people using their services and to improve the quality of care they provide. A desktop search for international standards related to infection prevention and control was conducted. The most relevant standards developed or revised since 2009 are summarised in the following sections. These documents helped identify key areas for consideration in the standards development process. Standards published before 2009 and standards not available in the English language or where there are no overarching national standards related to infection prevention and control were not included here for discussion.

2.2 Scottish standards

The Scottish *Healthcare Associated Infection Standards* were revised by Healthcare Improvement Scotland in 2015.[4] These standards supersede the National Health Service (NHS) Scotland Code of Practice for the local management of hygiene and healthcare-associated infection and all previous healthcare-associated infection standards produced by Healthcare Improvement Scotland's predecessor organisations. The revised standards were developed to ensure clarity around infection prevention and control of healthcare-associated infection, at the point of patient care. There are a total of nine standard statements followed by a rationale and a criteria list. All criteria are considered essential or required in order to demonstrate the standard has been met. This is followed by an explanatory box with practical examples of what the standard means and how the organisation can show that the standard was achieved. The standards document is closely aligned with the *National Infection Prevention and Control Manual*.[5] It is expected that all healthcare organisations and practitioners adhere to the standards according to their infection prevention and control risks and needs.

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The nine standards prioritise key areas that are considered important to infection prevention and control efforts. The standards are listed below:

1. Leadership in the prevention and control of infection
2. Education to support the prevention and control of infection
3. Communication between organisations and with the patient or their representative
4. Healthcare-associated infection surveillance
5. Antimicrobial stewardship
6. Infection prevention and control policies, procedures and guidance
7. Insertion and maintenance of invasive devices
8. Decontamination
9. Acquisition of equipment.

In Standard 1, effective leadership means having an accountable board of management that leads its organisation in maintaining a safe care environment through risk assessment, performance assurance, outbreak management and continuous improvement in infection prevention and control practice.

In relation to Standard 2, the provision of education to all staff enables them to apply the necessary knowledge and skills to minimise infection risks and ensure care is safe, effective and person-centred.

In Standard 3, the importance of effective care provider communications during the patient's journey is outlined, especially where infection risks to and from the patient are identified. This also extends to people receiving treatment in, or visiting, one or more care settings being involved in care decisions taken to mitigate these risks.

In relation to Standard 4, a surveillance system is essential to ensure rapid recognition of new, emerging or re-emerging infection-related risks.

Standard 5 notes that the organisation's antimicrobial stewardship programme needs to align with the infection prevention and control work programme to ensure a coordinated effort for safe antimicrobial prescribing.

The importance of adhering to evidence-based best practice guidance, including standard infection control precautions, as set out in the *National Infection Prevention and Control Manual*[5] is highlighted in Standard 6.

Standard 7 on insertion and maintenance of invasive medical devices outlines how to minimise infection risk to patients, including involving patients in the decision-making process.

Standard 8 notes that decontamination is critical in the provision of a safe, clean environment and equipment, underpinned by regular risk assessments and audits by the organisation to identify and address any deficiencies detected in cleanliness.

In relation to Standard 9, an acquisition process ensures that all equipment is safe for its intended use and the risk of transmission of infection is minimal.

2.3 Australian standards

National Safety and Quality Health Service Standards

The 2012 *National Safety and Quality Health Service Standards* were developed by the Australian Commission on Safety and Quality in Health Care.[6] Standard 3 outlines the prevention and control of healthcare-associated infections. The intention of this overarching standard is to prevent patients from acquiring preventable healthcare-associated infections and effectively manage infections when they occur by using evidence-based strategies. Each standard contains:

- the standard, which outlines the intended actions and strategies to be achieved
- a statement of intent, which describes the intended outcome for the standard
- a statement on the context in which the standard must be applied
- a list of key criteria: each criterion has a series of items and actions that are required in order to meet the standard.

A guide for each of the 10 National Safety and Quality Health Service Standards was designed to assist health service organisations achieve the standards by listing key tasks, implementation strategies and examples of the outputs of improvement processes.[7]

Standard 3 was developed in line with the recommendations and evidence found in the *Australian Guidelines for the Prevention and Control of Infections in Health Care 2010*.[8] This guideline also provided detailed information about risk assessment processes for infection prevention and control. The National Safety and Quality Health Service Standards apply to a wide variety of health service organisations; however, a degree of flexibility is expected in the application of the standards to fit the context of the organisation, including varying patient and staffing profiles.

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The six standards to prevent and control healthcare-associated infections are:

1. Governance and systems for infection prevention, control and surveillance
2. Infection prevention and control strategies
3. Managing patients with infections or colonisations
4. Antimicrobial stewardship
5. Cleaning, disinfection and sterilisation
6. Communicating with patients and carers.

The governance standard outlines how current governance arrangements, systems, processes and practices should be implemented and maintained. This includes endorsing policies, procedures and protocols, oversight of surveillance, reporting, investigating and analysing healthcare-associated infections and undertaking quality improvement activities.

Successful infection prevention and control measures involve implementing work practices that prevent the transmission of infectious agents. The listed strategies include hand hygiene, immunisation, occupational health and safety programmes, protocols for invasive device procedures and aseptic technique.

In terms of managing patients with infections or colonisations, it is imperative that they receive the necessary management and treatment. This includes appropriate patient placement and communication of a patient's infectious status at key times during points of transition of care.

Antimicrobial stewardship needs to be part of the organisation's broader strategy to reduce the development of resistant pathogens, prevent and manage healthcare-associated infections and improve patient safety and quality.

The requirement for healthcare facilities and the associated environment to be clean and hygienic is outlined. Reprocessing of equipment and instrumentation needs to meet current best practice guidelines.

The final standard outlines the importance of ensuring information for patients and carers on the management and reduction of healthcare-associated infections is available at the point of care.

Antimicrobial Stewardship Clinical Care Standard

The Australian Commission on Safety and Quality in Health Care published the *Antimicrobial Stewardship Clinical Care Standard* in 2014.[9] It complements existing efforts that support national antimicrobial stewardship. The antimicrobial stewardship

clinical care standard aims to ensure that a patient with a bacterial infection receives optimal treatment with antimicrobials. The quality statements in relation to each of the following headings relate to the care that a patient should receive when they have, or are suspected of having, a bacterial infection:

1. Life-threatening conditions
2. Microbiological testing
3. Information on treatment options
4. Use of guidelines and clinical condition
5. Taking antibiotics as prescribed
6. Documentation
7. Use of broad-spectrum antibiotics
8. Review of treatment
9. Surgical prophylaxis

Every statement is followed by a pragmatic explanation for patients, clinicians and health services of what the quality statement means for them.

2.4   UK Standards

The National Institute for Health and Care Excellence (NICE) have developed a number of quality standards related to infection prevention and control. These quality standards are a concise set of prioritised statements designed to drive measurable improvements in three dimensions of quality, namely, patient safety, patient experience and clinical effectiveness. The statements are followed by a rationale, expected quality measures, outcomes, and an explanation of what the quality statement means for service providers, health and social care practitioners, and commissioners. Infection prevention and control is a key priority for the National Health Service (NHS) given the significant morbidity in those infected and costs to the healthcare service.

The quality standards build on the code of practice on the prevention and control of infections that applies to all providers of healthcare and adult social care under the *Health and Social Care Act 2008*.[10] NICE standards apply to NHS services in England and in certain cases also apply to Wales, Scotland and Northern Ireland. The quality standards also recognise the important role families and carers have in infection prevention and control. The quality standards are incorporated into the NICE pathway on prevention and control of healthcare-associated infections, which links the relevant quality standards, and guidance.

Healthcare-associated infections quality standard 113

This quality standard published in 2016 covers the organisational factors in preventing and controlling healthcare-associated infections in secondary care settings.[11] The quality statements cover the following areas:

1. Surveillance
2. Collaborative action
3. Responsibilities of hospital staff
4. Planning, design and management of hospital facilities
5. Admission, discharge and transfer.

The surveillance quality statement outlines the need to monitor healthcare-associated infections of local relevance which are then used to reliably inform and review objectives for quality improvement.

The quality statement on collaborative action highlights the need for joint working initiatives between hospitals and other local health and social care organisations to investigate and manage the risk of healthcare-associated infection from incidents and outbreaks in the community.

The responsibilities of hospital staff quality statement notes that hospital staff have individual responsibilities in relation to infection prevention and control that are linked to organisational objectives and strategies.

The importance of involvement of the infection prevention and control team in the building, refurbishment and maintenance of facilities is outlined in the planning, design and management of hospital facilities quality statement.

The admission, discharge and transfer quality statement states that a consistent approach to sharing information between health and social care practitioners involved in a patient's care pathway is critical to preventing potentially avoidable healthcare-associated infections.

Infection prevention and control quality standard 61

This quality standard, published in 2014, covers the prevention and control of infection for people receiving healthcare in primary, community and secondary care settings.[12] The quality statements cover the following areas:

1. Antimicrobial stewardship
2. Organisational responsibility
3. Hand decontamination
4. Urinary catheters
5. Vascular access devices
6. Educating people about infection prevention and control.

The quality statement on antimicrobial stewardship addresses the issue of the appropriateness of antimicrobial prescribing, particularly given that antimicrobials underpin routine medical practice in both primary and community care.

The organisational responsibility quality statement highlights the importance of all organisations working together to coordinate strategies for infection prevention and control across a local area.

Hand hygiene is covered in the hand decontamination quality statement, given the remaining misconceptions about this fundamental principle of infection control and the fact that good practice is not universal.

The correct procedure for urinary catheter insertion and maintenance is covered in the urinary catheters quality statement, given that catheter-associated urinary tract infections comprise a large proportion of healthcare-associated infections.

Similarly, the need for the correct procedure for vascular access device insertion and maintenance is discussed in the vascular access devices quality statement.

The final quality statement outlines the importance of education for patients and or their family members or carers, as appropriate, about the safe management of their device or equipment, including techniques to prevent infection.

Surgical site infection quality standard 49

This quality standard covers the prevention and treatment of surgical site infection for adults, children and young people undergoing surgical incisions through the skin, in all healthcare settings.[13] Surgical site infections can often be prevented with

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appropriate care before, during and after surgery, as outlined in the following quality statements:

1. Personal preparation for surgery
2. Antibiotic prophylaxis
3. Patient temperature
4. Intraoperative staff practices
5. Information and advice on wound care
6. Treatment of surgical site infection
7. Surveillance.

Care should be focused on implementing evidence-based practice in the period prior to surgery to reduce the risk of developing a healthcare-associated infection. Where an infection does develop, appropriate treatment will reduce morbidity arising from such infection. Surveillance systems that capture in-patient and post-discharge surgical site infections allow the service to learn from the true infection rate and improve clinical practice accordingly.

Health Protection Agency standards for health protection units 2012

These Health Protection Agency (HPA) healthcare-associated infection standards outline the responsibility that the UK public health authorities have in supporting service providers, including acute hospitals, in collectively targeting healthcare-associated infection risks.[14] Health protection units provide specialist public health advice and operational support to the National Health Service (NHS), local authorities and other agencies. They play a key part in supporting service providers in the detection, investigation and management of a wide range of healthcare-associated infection-related situations which might come to light through local, regional or national surveillance systems.

This document for health protection units and other regional and national HPA staff, outline 16 standards for best practice that cover:

- the actions that health protection units and others need to undertake to help reduce the risks of healthcare-associated infections in local health and social care settings (identified in the document as core responsibilities)

- the HPA governance framework required to underpin these responsibilities in partnership with their local health and social care economy (health and social care providers, commissioners, regulators and performance managers).

It is expected that the standards should enable health protection units, through a more risk-based approach, provide consistent and targeted advice and support to service providers and escalate any concerns to commissioners, regulators and performance managers when required. This is underpinned by fit-for-purpose agreed data from validated surveillance systems so that progress on healthcare-associated infection and antimicrobial resistance can be reliably monitored.

2.5　Welsh Standards

The *Health and Care Standards*[15] for healthcare services in Wales were published in 2015, replacing the 2010 *Doing Well, Doing Better* standards. The standards have been designed so they can be implemented in all health and social care services, settings and locations. The infection prevention and control standard is outlined under the theme of 'safe care'.

Health and Care Standard 2.4 states that infection prevention and control needs to be everybody's business, part of everyday healthcare practice and based on the best available evidence, as outlined in the text boxes on the next page.

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Standard 2.4 Infection Prevention and Control (IPC) and Decontamination

Effective infection prevention and control needs to be everybody's business and must be part of everyday healthcare practice and based on the best available evidence so that people are protected from preventable healthcare associated infections.

The health service will need to consider the following criteria for meeting the standard:

Criteria

- There are appropriate organisational structures and management systems for infection prevention, control and decontamination in place.

- Physical environments are maintained and cleaned to a standard that facilitates infection prevention and control minimises the risk of infection.

- Suitable and accurate information on infections is available.

- Suitable, timely and accurate information on infections is provided to any person concerned with providing further support or nursing/medical care when a person is moved from one organisation to another or within the same organisation.

- Staff employed the provide care in all settings are fully engaged in the process of infection prevention and control.

- Adequate isolation facilities are provided to support effective infection prevention and control.

- Policies on infection prevention and control are in place and made readily accessible to all staff.

- So far as is reasonable practicable staff are free of and are protected from exposure to infections that can be acquired or transmitted at work.

- Staff are suitable trained and educated in infection prevention and control associated with the provision of healthcare.

- Suitable and sustainable systems, policies and procedures are in place for medical device decontamination by competent staff in an appropriate environment.

- Patients and visitors are supported to achieve and maintain high standards of hygiene.

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In addition, Health and Care standard 2.9 covers the procurement and maintenance of medical devices, equipment and diagnostic systems.

Standard 2.9 Medical Devices

Health services ensure the safe and effective procurement, use and disposal of medical equipment, devices and diagnostic systems.

The health service will need to consider the following criteria for meeting the standard:

- There is compliance with health, safety and environmental legislation, regulation and guidance.

- Processes ensure that equipment, and devices are maintained, cleaned and calibrated in accordance with manufacturer's guidelines, ensuring they are appropriate for their intended use and for the environment in which they are used.

- An ongoing programme of training and competence assessment covers staff and users.

- Timely reporting and management arrangements exist to address any device, equipment or system faults in use or in stock, including any alert or warning notices issued by appropriate agencies such as MHRA.

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2.6 Joint Commission International Standards

One third of all Irish acute hospitals are in the private sector and are accredited by an internationally recognised body. In most cases, this is the Joint Commission International (JCI), which has developed a generalised set of healthcare standards.[16] These standards are organised around the important functions common to all healthcare organisations and apply to those organisations that are accredited to JCI.

The prevention and control of infections chapter is addressed under JCI's: healthcare organisation management standards. These comprise 11 standards which are accompanied by an 'intent' to help explain the full meaning of the standard and 'measurable elements' that identify the requirements for full compliance with the standard.

The 11 standards focus on the following areas:

1. oversight of the infection prevention and control programme
2. a coordination mechanism for all infection prevention and control activities
3. an infection prevention and control programme that is based on best practice
4. hospital leadership that provides adequate resources
5. a comprehensive programme that addresses the service's infection issues across all levels of the hospital
6. a risk-based approach, including surveillance activities, to focus efforts to reduce healthcare-associated infections
7. implements strategies to reduce infection risk including cleaning, laundry management, disposal of expired supplies, waste management, safer sharps handling, food services and demolition, construction and renovation activities
8. isolation procedures and arrangements
9. personal protective equipment
10. integration with the quality improvement and patient safety programme
11. education on infection prevention and control practices.

Standard 1 describes the required oversight for the infection prevention and control programme by individuals who are qualified in infection prevention and control practices.

Standard 2 discusses a designated mechanism is required to coordinate the overall programme and involve individuals in multiple departments and services.

Standard 3 notes that information is essential to the programme's implementation, including evidence-based practices, guidelines, applicable laws and regulations.

Standard 4 states that hospital leadership needs to provide resources, including staff, supplies and information management systems, to support infection prevention and control efforts.

Standard 5 notes that a comprehensive programme should address the infection issues that are epidemiologically important to the hospital, encompassing both patient care and employee health. This applies to all areas of the hospital and everyone who enters a hospital.

Standard 6 discusses a risk-based approach helps hospitals identify those practices and infections on which they should focus their programmes. A hospital that identifies and tracks risks, rates and trends in healthcare-associated infections through surveillance can more effectively improve infection prevention and control activities.

Standard 7 contends that the implementation of specific strategies to reduce infection risk is essential, especially those relating to cleaning, laundry management, disposal of expired supplies, waste management, safer sharps handling, food services and demolition, construction, and renovation activities.

Standard 8 discusses the need for hospitals to have isolation procedures and arrangements in place to protect infections to and from patients, visitors and staff.

Standard 9 discusses identifying those situations in which personal protective equipment (PPE) such as masks, eye protection, gowns, or gloves are required and providing training in their correct use.

Standard 10 considers integration with the quality improvement and patient safety programme to ensure that the hospital uses collective measurement information to select the priorities for the infection prevention and control programme.

Standard 11 details how hospitals need to educate staff members on infection prevention and control practices when they begin work in the hospital and regularly thereafter.

2.7 Summary

This review of international standards demonstrates the many different components that are necessary to implement an effective infection prevention and control programme. The international standards helped identify and prioritise key areas for consideration in the standards development process. Most standards advocate a person-centred approach to managing healthcare-associated infections, especially with regard to effective communication. The importance of adhering to multi-targeted best practice infection prevention control measures is highlighted.

Surveillance of healthcare-associated infection is a key requirement of an infection prevention and control programme and can provide valuable information for monitoring and quality improvement activities. Management of invasive medical devices is well covered in order to reflect the significant association of medical devices with healthcare-associated infections. Antimicrobial stewardship is a reoccurring theme in the context of the global antimicrobial resistance threat.

As is often stated in the standards, defined leadership and coordinated multi-disciplinary team approach is essential for the successful implementation of any infection prevention and control or antimicrobial stewardship programme. Overall, the international standards discussed are very clear, concise and reflective of current infection prevention control-related issues.

Section 3: Review of international guidelines

3.1 Overview

A number of countries have developed national guidelines on the prevention and control of healthcare-associated infections which are aligned with their national standards. This includes the Scottish national standards aligning with their infection prevention and control manual, the National Institute for Health and Care Excellence (NICE) pathway model linking the relevant quality standards, guidelines and guidance, and the Australian standards supporting a suite of documents, including a guideline, toolkit and educators guide.

The Welsh government has supported the development of a guide to support the S.T.O.P (stop, think, options, prevent) campaign to reduce invasive device-related infections. In addition, the World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) have produced a number of substantive guidelines covering key areas such as core components of infection prevention and antimicrobial stewardship programmes, hand hygiene, surgical site infection prevention, and isolation precautions.

An overview is presented on the international guidelines which helped to provide clarity and detail on current infection prevention and control evidence-based best practice. A number of the key recommendations from international guidelines on established good practice were integrated into the revised Standards.

3.2 Scottish guidelines

National Infection Prevention and Control Manual 2012

The revised 2012 *National Infection Prevention and Control Manual* contains best practice guidance on standard infection control precautions and transmission-based precautions that should be adopted locally for infection prevention and control practices and procedures.[5] Health Protection Scotland (HPS) has also published the associated literature reviews that underpin and inform the practical application of the national manual.

The responsibilities for the adoption and implementation of the manual for organisations, managers, staff and the infection prevention and control team are outlined in the manual. Chapter 1 covers the 10 elements of standard infection

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control precautions that are to be used by all staff, in all care settings, at all times, for all patients whether infection is known to be present or not. These are:

1. patient placement/assessment for infection risk
2. hand hygiene
3. respiratory and cough hygiene
4. personal protective equipment
5. safe management of care equipment
6. safe management of the care environment
7. safe management of linen
8. safe management of blood and body fluid spillages
9. safe disposal of waste (including sharps)
10. occupational safety: prevention and exposure management (including sharps)

Patient placement depends on accurate assessment of a patient's infection risk on arrival to the care area, especially for those with symptoms of infection, previous identification of a multidrug-resistant micro-organism and hospitalisation outside Scotland in the previous 12 months. The associated literature review outlines the minimum ergonomic standard requirements for single- and multi-bed rooms and sanitary facilities.[17]

The specific technique and timings recommended for hand hygiene are also outlined in the manual. Staff should promote respiratory and cough hygiene for those patients who need assistance, including the elderly and children. Personal protective equipment needs to be correctly used in order to provide adequate protection against the risks associated with tasks or procedures associated with exposure to blood or other body fluids.

Care equipment can also easily be contaminated with blood, other body fluids, secretions, excretions and infectious agents. As outlined in the associated literature review, transmission of healthcare-associated infection from care equipment depends on staff factors, patient factors and the type of exposure.[18] Adherence to manufacturers' guidance for use and decontamination of all care equipment is advised. It is recommended that a local decontamination policy should be in place to determine which groups of staff are responsible for the regular decontamination of care equipment. The moments for appropriate decontamination of reusable non-invasive communal patient care equipment are clearly outlined. It is acknowledged that the methods for decontamination of such care equipment are mostly based on expert opinion due to a lack of available scientific evidence.

The care environment needs to be safe for practice including the requirement for both cleanliness and maintenance. In the associated literature review on this section, further information is given on patient accommodation categories, which prioritises the sites closest to the patient, frequently touched surfaces and high risk areas such as operating theatres, transplant and intensive care units.[19] In general, cleaning staff are responsible for cleaning the built environment and fixtures and fittings, while nursing staff are responsible for cleaning patient care equipment. It is advised that any new technologies that are adopted for cleaning should be considered in consultation with local infection control teams and used in accordance with manufacturer's instructions, after risk assessment and training for users. While visual inspections can identify damage to surfaces and accumulations of dust, it is accepted that this is a subjective method that may over-estimate the effects of cleaning.

An outline is given in the manual for managing all used and contaminated linen in the hospital environment. The associated literature review further discusses how linen should be sorted, labelled, handled, washed, transported and stored.[20] However, an acknowledgement is made of the limited evidence base relating to safe management of linen. Spillages of blood and other body fluids must be decontaminated by staff trained to undertake this safely. NHS Scotland's regulatory waste management guidance is reiterated in the manual and emphasises the importance of disposing of waste as close to the point of use as possible and into the correct waste stream. The regulatory health and safety requirements for employers and contractors in the healthcare sector is noted, particularly with regard to sharps handling.

Chapter 2 outlines the additional precautions, known as transmission-based precautions, which staff are required to use when standard precautions may be insufficient to prevent cross transmission of specific infectious agents. The elements outlined are:

1. patient placement/assessment for infection risk
2. safe management of patient care equipment in an isolation room/cohort area
3. safe management of the care environment
4. personal protective equipment: respiratory protective equipment
5. infection prevention and control during care of the deceased.

The prioritisation criteria for patient placement in suitable areas to minimise cross contamination is outlined. As stated in the associated literature review, patient placement decisions should be based on a risk assessment which considers the route of transmission and patient factors.[21] The clinical judgement and expertise of the

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staff involved in a patient's care and the infection prevention and control team should be sought when single rooms are in short supply. Use of an isolation priority tool that assists decision-making on the hierarchy of patient placement is advised in the literature.

Preferentially, isolation rooms are used for patients known or suspected to have infections spread by the airborne route, such as chicken pox and measles. Single room isolation has been shown to be effective for transmissible micro-organisms that cause extensive environmental contamination (such as *Clostridium difficile*) and those which are resistant to antimicrobials. Cohorting of patients is mostly used during outbreaks of infection or if single rooms are in short supply. It is important to ensure adequate physical space between patients and designated staffing arrangements during these situations.

Ideally single-use items should be used in an isolation room or cohort area, otherwise dedicated reusable non-invasive care equipment is used where this is not practical. Isolation rooms or cohort areas must also be decontaminated at least daily. Instruction is given in the manual on the decontamination procedures recommended following a patient transfer, discharge or once the patient is no longer considered infectious. As outlined in the associated literature review, isolation rooms and cohort areas should be decontaminated by starting from the highest to the lowest point, and from the least contaminated to the most contaminated, changing equipment and solutions when they become soiled.[22] A number of considerations need to be taken into account regarding the method of disinfection used, such as the time required, efficacy, cost, potential hazards, and user safety. Respiratory protective equipment must be considered by staff when caring for patients with suspected or known airborne infection. Finally, it is recommended that the principles of good infection prevention and control precautions continue to apply during care of the deceased.

HPS Norovirus Outbreak Guidance 2013

The focus of this guidance document on norovirus outbreaks is on the preparedness of the healthcare facility and having optimal systems in place to reduce impact on normal healthcare services.[23] Norovirus outbreaks happen frequently in hospitals, mostly over the winter period. Norovirus causes gastrointestinal infection which predominantly causes sudden onset vomiting or diarrhoea. Some strains or serotypes are more virulent and likely to lead to more severe illness, particularly in elderly patients with co-morbidities.

As stated in this guideline, the management of norovirus is challenging given its predisposition to spread easily. Therefore, preventing all outbreaks is impossible, but what is within the remit of healthcare facilities is to minimise the incidence of outbreaks and limit the disruption of normal healthcare services. This document outlines the key steps to achieve this.

An outbreak schematic is outlined in the guideline as an aid memoire for the treating clinical teams. This includes the following ABC actions:

- **A**lert the infection prevention and control team promptly
- **B**e up-to-date with the details of patients that meet the suspect norovirus case definition
- **C**ontact precautions for symptomatic patients.

Clear comprehensive guidance is outlined in 17 outbreak control measures that should be adhered to during a norovirus outbreak, including decontamination, patient placement and advice for visitors. The document also outlines the components of an escalation plan in those circumstances where these control measures have failed to stop an outbreak.

3.3 Australian guidelines

Australian Guidelines for the Prevention of Infection in Healthcare 2010

The *Australian Guidelines for the Prevention and Control of Infection in Healthcare 2010* cover a comprehensive range of topics.[8] This revised guidelines aim to provide a coordinated approach to the management of healthcare-associated infection in Australia by supporting the Australian Commission on Safety and Quality in Health Care's other healthcare-associated infection priority programme initiatives, including the:

- National Surveillance Initiative
- National Hand Hygiene Initiative
- Antimicrobial Stewardship Initiative.

The guidelines provide a basis for healthcare workers and healthcare facilities to develop detailed protocols and processes for infection prevention and control specific to local settings.

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The guideline is divided into three parts:

Part A: Basics of infection prevention and control

Part B: Standard and transmission-based precautions

Part C: Organisational support

An overview of risk management in infection prevention and control is presented in Part A. A patient-centred approach is advocated in order to facilitate a two-way approach to infection prevention and control and encourage the patient participation required to minimise cross-infection or transmission.

Part B details standard and transmission-based precautions with the use of standard precautions being the primary strategy for minimising the transmission of healthcare-associated infections. Transmission-based precautions are used in addition to standard precautions where the suspected or confirmed presence of infectious agents represents an increased risk of transmission. The use of standard and transmission-based precautions is particularly important in containing multi-resistant organisms and in outbreak management. Part C describes the organisational components required to support effective infection prevention and control within a healthcare facility. It outlines the responsibilities of managers of healthcare facilities and the governance structures that support the implementation, monitoring and reporting of effective infection control work practices. This covers a number of key areas, including staff health and safety, education and training, surveillance, antimicrobial stewardship and facility design. While the management structure and processes associated with infection control will differ depending on the size of the organisation and the types of healthcare services it delivers, the principles of clinical governance apply regardless of the setting and all essential roles and responsibilities should be fulfilled.

Australian guidelines for the prevention of infection in healthcare toolkit 2010

The OSSIE Toolkit for the implementation of the Australian Guidelines for the Prevention of Infection in Health Care 2010 accompanies the guideline.[24] The purpose of this OSSIE toolkit is to provide clinicians and managers with practical tools, resources and information that can be used in a range of healthcare settings to help facilitate their uptake and use in clinical practice.

OSSIE represents a five phase approach to change management to help deal with the challenges of implementation:

O: organisational leadership

S: solutions and strategies for implementation

S: stakeholder engagement

I: implementation

E: evaluation and maintenance

The organisational leadership phase of OSSIE requires both clear leadership and appropriate resource allocation to enable the project team to plan implementation strategies. The project team need to consider and choose tools that will support implementation and help staff to change and improve practice to enhance infection prevention and control in the facility. This includes an assessment of readiness for change as well as barriers to change. The stakeholder engagement phase provides specific guidance on ways to identify, communicate with and maintain the involvement of stakeholders. The implementation phase of OSSIE is set out in the project action plan, which describes who will be responsible for what actions, when each of the actions will be put into place, the resources required and what measures will be used to monitor progress. Following this, an evaluation plan needs to be developed to enable the project team to measure the progress and impact of the guideline implementation strategies.

Throughout the document, some practical tools and ideas for implementing the guidelines are provided, including:

- tools to undertake an analysis of current practice against the key guideline recommendations
- an outline of how to identify barriers and links to tools to do this
- tools to identify and engage stakeholders
- a suggested framework and strategies to aid guideline implementation
- stories and hints from real life practice in infection control
- resources to assist implementation.

Clinical Educators Guide for the prevention and control of infection in healthcare 2010

The *Clinical Educators Guide for the prevention and control of infection in healthcare 2010*[25] was developed to provide strategies for clinical educators and supervisors to assist students and graduate healthcare workers integrate a risk management approach into their daily tasks that involve infection control. Risk management decisions are based on understanding the chain of infection, including the susceptible person at risk, the potential source of the infectious agent and mode of transmission.

Adherence by staff to the risk management steps outlined in the document supports better decision making by providing greater insight into potential infection risks and perhaps avoiding them in the first instance where possible. The guide acknowledges that a 'one size fits all' approach to risk management is not possible given the varying levels of complexity of care delivered by staff. However, the core principles can be applied by staff to determine risks in their own context and select the most suitable action.

3.4   UK guidelines

Healthcare-associated infections: prevention and control 2011

This public health guideline, published by National Institute for Health and Care Excellence (NICE) in partnership with the Health Protection Agency (HPA), offers advice on the organisational and management actions to prevent and control healthcare-associated infections in secondary care settings.[26] Of note, the guide is particularly aimed at board of management members, so they can assess current practice, identify areas for improvement, monitor progress and provide leadership and support to infection prevention and control teams and other staff. It builds on the advice set out in the code of practice on preventing and controlling infections.[10]

The guide contains 11 quality improvement statements, followed by examples of evidence to demonstrate progress against each statement. Senior management should consider the applicability of each statement to their setting and select the most appropriate measures as evidence of achievement for their setting. The 11 quality improvement statements are:

1. Board-level leadership to prevent healthcare-associated infections
2. Be a learning organisation
3. Healthcare-associated infection surveillance
4. Workforce capacity and capability
5. Environmental cleanliness
6. Multi-agency working to reduce healthcare-associated infections
7. Communication
8. Admission, discharge and transfer
9. Patient and public involvement
10. Trust estate management
11. New technology and innovation.

Boards of management need to be proactive in ensuring quality improvement by leading on and checking compliance of their organisation with relevant infection prevention and control objectives, policies and procedures. The board of management should also use and learn from information from a wide range of sources, including its own and other healthcare providers' experience, to minimise the risk of infection to patients, staff and visitors. This information can vary from surveillance data to recommendations and actions identified from significant incidents and outbreaks.

A fully resourced and flexible surveillance system is essential for the organisation to define their local objectives and priorities. It is also imperative that staff have the necessary skills, knowledge and time to undertake infection prevention and control procedures in their area of work. Boards of management need to ensure that policies, procedures and resources are in place to maintain and continuously raise the level of cleanliness. The importance of multi-agency collaborative working by hospital trusts with other local health and social care providers to reduce healthcare-associated infections is outlined, especially for incidents which may impact on the health of the wider community.

Boards of management need to support and promote clear communication among all staff in the organisation. This includes communicating with patients and carers throughout the care pathway about healthcare-associated infections in order to help

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minimise risk in the first instance. The organisation requires a multi-agency patient admission, discharge and transfer policy to facilitate seamless sharing of relevant information between local health and social care providers. Boards of management need to make certain that mechanisms are in place to seek patient and public views and involve them in decisions related to quality improvement for infection prevention and control.

It is also important that boards of management ensure that infection prevention and control needs are met when procuring, commissioning, planning, designing and completing new and refurbished hospital services and facilities. Finally, boards of management should routinely identify technology needs relevant to healthcare-associated infection prevention and control and assess the potential of new technologies and innovation to meet those needs.

Antimicrobial stewardship: systems and processes for effective antimicrobial medicine use 2015

The purpose of this National Institute for Health and Care Excellence (NICE) guideline is to provide good practice recommendations on systems and processes for the effective use of antimicrobials.[27] The guideline applies to commissioners and providers of all health or social care services. It focuses on three broad areas:

1. Recommendations for organisations
2. Implementation: getting started
3. Research recommendations.

The importance of a comprehensive antimicrobial stewardship programme is outlined. Core components include defined roles, responsibilities and accountabilities, education and training, monitoring and evaluating antimicrobial prescribing and providing regular feedback to individual prescribers in all care settings. Organisations should ensure that the antimicrobial stewardship team has core members and can co-opt additional members as required. The team needs to be supported to educate prescribers, input into local formulary and guideline development, review prescribing and antimicrobial resistance data and feedback this information to prescribers.

A set of antimicrobial stewardship interventions needs to be in place, including such measures as review of very high or low volumes of prescribing, promotion of recommended antimicrobials at local and national level and information and communication technology or decision support systems. Communicating and sharing learning and experiences about antimicrobial resistance and antimicrobial stewardship should be promoted. Laboratory susceptibility testing should be in line

with the local formulary and treatment guidelines. Some specific recommendations are also outlined for prescribers, including intravenous antimicrobials. Recommendations are also set out for integrating any new antimicrobials into the local organisation.

The section on implementation highlights the interventions for changing prescribing practice. This includes commissioners and managers of services supporting antimicrobial stewardship and changing prescribers' attitudes. The recommendations for research include suggestions for randomised controlled trials, such as short versus longer courses of antimicrobials.

Guidelines for National Health Service (NHS) hospitals in England 2013

These Department of Health national evidence-based guidelines for preventing healthcare-associated infection were originally published by the Department of Health in 2001 and were reviewed and updated in 2007 and 2013.[28] The guidelines provide comprehensive recommendations for preventing healthcare-associated infection in hospital and other acute care settings based on the best currently available evidence.

The intention of the guidelines is to inform the development of more detailed local protocols and ensure that important standard principles for infection prevention are incorporated. As stated, they can also be used as a benchmark for determining appropriate infection prevention decisions, assessing clinical effectiveness, providing a baseline for clinical audit and facilitating on-going quality improvements.

As outlined in the document, prevention measures are a core component of an effective strategy designed to protect patients from the risk of healthcare-associated infection. The scope of the guidelines includes:

- standard infection control principles, including best practice recommendations for hospital environmental hygiene, effective hand hygiene, the appropriate use of personal protective equipment, the safe use and disposal of sharps and the principles of asepsis
- preventing infections associated with the use of short-term indwelling urethral catheters
- preventing infections associated with the use of intravascular access devices.

Hospital environmental hygiene is considered an essential part of good infection prevention and control best practice. The supportive evidence, however, is quite limited given that the research has primarily consisted of ecological, weak quasi-experimental and observational study design. The guidelines acknowledge that

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creating a culture of responsibility for maintaining a clean environment and increasing knowledge about how to decontaminate equipment and high-touch surfaces effectively requires education and training of both healthcare cleaning professionals and clinical staff.

Hand hygiene is another fundamental infection prevention and control principle as epidemiological evidence indicates that hand-mediated transmission is a major contributing factor in the acquisition and spread of infection in hospitals. Improved hand hygiene compliance has been reported in observational studies that have looked at multi-modal interventions involving the introduction of near-patient alcohol-based hand rubs, audit and feedback, reminders and education.

As stated, the decision to use or wear personal protective equipment must be based upon an assessment of the level of risk associated with a specific patient care activity or intervention and take account of current health and safety legislation. There is no evidence that uniforms or work clothing are associated with healthcare-associated infection. This document is consistent with other national and international guidelines in its recommendations for the safe use and disposal of sharp instruments and needles and the management of healthcare workers who are exposed to potential infection from blood borne viruses. While an aseptic technique is an essential element of the prevention of healthcare-associated infection, no clinical or economic evidence identified that any one approach to the aseptic technique is more clinically or cost-effective than another.

The management of catheter-associated urinary tract infection has been prioritised given the fact that it is one of the most common infections acquired as a result of healthcare. The recommendations for preventing infections associated with the use of short-term indwelling urethral catheters cover six distinct interventions:

- assessing the need for catheterisation
- selection of catheter type and system
- catheter insertion
- catheter maintenance
- education of patients, relatives and healthcare workers
- system interventions for reducing the risk of infection.

As outlined in the guidelines, catheter-related bloodstream infections arising from the insertion and maintenance of central venous catheters are potentially among the most dangerous complications associated with healthcare. The recommendations preventing infections associated with the use of intravascular access devices cover nine distinct interventions:

- education of healthcare workers and patients
- general asepsis
- selection of type of intravascular catheter
- selection of intravascular catheter insertion site
- maximal sterile barrier precautions during insertion
- cutaneous antisepsis
- catheter and catheter site care
- replacement strategies
- general principles for catheter management.

3.5 Welsh guidelines

Reducing Healthcare Associated Infections: Appropriate and timely use of invasive medical devices guide 2012

This guide was developed as part of an overall national quality improvement initiative across National Health Service (NHS) Wales to improve the safety and quality of care that patients receive.[29] The guide aims to support healthcare teams to successfully implement a series of interventions that underpin appropriate and timely use of peripheral venous cannulas and urinary catheters. These devices can bypass the natural defences to cause a healthcare-associated infection. The most important risk factor for infection related to such devices is the duration of cannulisation or catheterisation. Implementation of a successful intervention requires a teamwork approach with the correct organisational, technical and frontline leadership and support.

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The four components of care required to reduce the risk of peripheral vascular device-related infections are:

- avoid unnecessary use of peripheral vascular cannula
- insert peripheral vascular cannulas only if needed and follow evidence-based best practice
- maintain peripheral vascular cannulas based on recommended guidelines
- review peripheral vascular cannula necessity daily and remove promptly when no longer needed.

The S.T.O.P (stop, think, options, prevent) algorithm is presented in the guide. The challenge for healthcare staff is to reliably and sustainably deliver this process for every patient, every day and on every shift. Measurement of results and interpretation of improvement data is essential for this type of initiative to work.

Similar to peripheral vascular cannulas, the four components of care required to reduce the risk of catheter-associated urinary tract infections are:

- avoid unnecessary urinary catheters
- insert urinary catheters only when clinically necessary and follow evidenced best practice for insertion
- maintain urinary catheters based on recommended guidelines
- review urinary catheter necessity daily and remove promptly when no longer needed.

The guide advises that a healthcare organisation needs to initially test these interventions and achieve a reliable change in order to effectively integrate it into service-wide daily work routine. A description is given of the technical and human factors that are required, including pragmatic advice to overcome some of the potential cultural barriers to change.

3.6   World Health Organization guidelines

Core components for infection prevention and control programmes 2008

The World Health Organization (WHO) convened an expert group to agree on the basic components that are necessary to an infection prevention and control programme at a national level and in health-care facilities.[30] As this document states, a considerable proportion of the burden of disease attributable to healthcare-associated infection is preventable and many interventions that have been proven to

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be effective are low cost. Infection prevention and control activities and programmes have been successful in controlling healthcare-associated infections in various settings in a sustainable way and with a favourable cost–benefit ratio. It is important that countries address the necessary components for national programmes and integrate the efforts of both national and local programmes.

As described in the document, a national infection prevention and control programme is intended to regulate, provide guidance, promote and supervise compliance with regulations, whereas a programme at local level is focused on providing care in a safe and efficient manner for patients, health-care workers and others.

The WHO has identified that one of the main obstacles to the timely response to emergencies involving communicable diseases is the lack of established infection prevention and control capacities in healthcare facilities and the weakness of many national infection prevention and control programmes. An infection prevention and control programme should contribute to the prevention of endemic infections associated with healthcare and to the better management of outbreaks of these infections that cause a high morbidity, mortality and economic burden to patients and healthcare facilities.

Table 1 outlines the proposed components identified as essential or 'core' elements of infection prevention and control programmes considered by the expert group to be of the 'utmost importance, being basic, indispensable and necessary' for any programme to meet its objectives.

The WHO infection prevention and control core components assessment tools are based on the above document.[31] The purpose of the tools are to help plan, organise and implement an infection prevention and control programme.

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Table 1. Summary of core components of infection prevention and control programmes

Category	Components
Organization of IPC programmes	A structure responsible for policies, goals, strategies, legal, technical framework and monitoring. Existence of qualified dedicated technical staff with defined responsibilities, scope and functions. A budget adequate to meet programmed activities.
Technical guidelines	Development, dissemination and implementation of technical evidence-based guidelines for prevention of the relevant risks and/or infections, adapted to local conditions.
Human resources	Training for all health-care personnel in IPC and specialized training of infection-control professionals. Adequate staff responsible for IPC activities. Address biological risks and implement preventive measures.
Surveillance of infections and assessment of compliance with IPC practices	Established priorities for surveillance of infections and pathogens, standardized case definitions and active methods of surveillance. Systematic assessment of compliance with IPC practices. Detection of outbreaks and prompt response. Documentation of the situation of HAI and IPC practices.
Microbiology laboratory	Standardization of microbiology laboratory techniques. Promotion of the interaction between IPC activities and the microbiology laboratory. Use microbiology data for surveillance and IPC activities. Establish laboratory biosafety standards.
Environment	Minimum requirements for IPC: clean water, ventilation, hand-washing facilities, patient placement and isolation facilities, storage of sterile supply, conditions for building and/or renovation.

Monitor and evaluation of programmes	Regular monitoring, evaluation and reporting of IPC outcomes, processes and strategies at national level and in health-care facilities.
	Promotion of evaluation in a non-punitive culture.
Links with public health or other services	Links between public health services and the facilities for events of mandatory reporting. Permanent coordination with activities related to waste management and sanitation, biosafety, antimicrobial pharmacy, occupational health, patients and consumers and quality of health care.

Source: World Health Organization. *Core components for infection prevention and control programmes.* Geneva: World Health Organization; 2008.

Guidelines on Hand Hygiene in Health Care 2009

The WHO *Guidelines on Hand Hygiene in Health Care* focuses on one of the simplest, low cost but least accepted forms of infection prevention.[32] It provides healthcare workers, hospital administrators and health authorities with a thorough review of the evidence on hand hygiene in healthcare and specific recommendations to improve practices and reduce transmission of micro-organisms to patients and healthcare workers. The Clean Care is Safer Care agenda is an important component of the overall WHO global initiative on patient safety.

The guidelines are intended to be implemented in any situation in which healthcare is delivered either to a patient or to a specific group in a population. This comprehensive set of guidelines covers a number of key areas including:

- review of the scientific data related to hand hygiene
- consensus recommendations
- process and outcome measurement
- national approaches to hand hygiene improvement
- patient involvement in hand hygiene promotion

The guidelines reinforce the 'My 5 Moments for Hand Hygiene' approach as key to protecting patients, healthcare workers and the healthcare environment against the spread of micro-organisms. This approach encourages healthcare workers to clean their hands before touching a patient, before clean/aseptic procedures, after body fluid exposure/risk, after touching a patient and after touching patient surroundings.

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In addition to the guidelines, the WHO developed a multimodal hand hygiene improvement strategy consisting of a guide to implementation and a range of tools constructed to facilitate implementation of each component.[33] Multimodal strategies have been shown to be more successful in improving rates of adherence to hand hygiene in healthcare workers than single interventions. Targeted, multi-faceted approaches focusing on system change, administrative support, motivation, availability of alcohol-based hand rubs, training and intensive education of healthcare workers and reminders in the workplace have been recommended to improve hand hygiene practice.

Guidelines on surgical site infections 2016

The WHO launched its *Global Guidelines for the Prevention of Surgical Site Infection* in November 2016.[34] The aim of these new guidelines is to provide a comprehensive range of evidence-based recommendations for interventions to be applied during the preoperative, intraoperative and postoperative periods for the prevention of surgical site infections. Recent work by the WHO Clean Care is Safer Care programme has demonstrated that surgical site infection is the most surveyed and frequent type of healthcare-associated infection in low- and middle-income countries and affects up to one third of patients who have undergone a surgical procedure.

The guidelines include a list of 29 concrete recommendations distilled by 20 of the world's leading experts from 26 reviews of the latest evidence. These new WHO guidelines are valid for any country and suitable for local adaptation, and they take account of the strength of available scientific evidence, cost and resource implications, and patient values and preferences.

The guidelines include 13 recommendations for the period before surgery and 16 for preventing infections during and after surgery. They range from simple precautions such as ensuring that patients bathe or shower before surgery and the best way for surgical teams to clean their hands, to guidance on when to use antimicrobials to prevent infections, what disinfectants to use before incision, and which sutures to use. The highest level of evidence was found in relation to recommendations on avoiding prolongation of surgical prophylactic antimicrobial use after an operation and the use of perioperative oxygenation.

3.7 Centers for Disease Control and Prevention guidelines

Core Elements of Hospital Antibiotic Stewardship Programs 2014

This document summarises the core elements of successful hospital antimicrobial stewardship programmes.[35] It acknowledges that there is a need for a flexible approach to the implementation of such programmes given the complexity of medical decision-making regarding antimicrobial use and variability in the types of care delivered in different hospitals. Success is determined by a defined leadership and a coordinated multidisciplinary approach. These core elements are as summarised as follows:

- leadership commitment
- accountability
- drug expertise
- action
- tracking
- reporting
- education.

Strong leadership ensures that financial, education and training supports are in place to enable staff to participate in antimicrobial stewardship activities. Both an antimicrobial stewardship programme leader and a pharmacy leader need to be accountable and responsible for the antimicrobial stewardship programme outcomes. This work can also be enhanced by other key groups including prescribers, laboratory staff, information technology staff, quality improvement staff and epidemiologists. This expertise can help prioritise the most suitable interventions based on the hospital's needs and availability of resources. The three categories of intervention outlined are broad, pharmacy-driven and infection and syndrome specific. It is advised not to implement too many interventions or policies at the same time.

Broad interventions include a wide range of activities varying from antimicrobial reviews after 48 hours, restrictive prescribing and external expert reviews conducted by staff other than the treating team. Pharmacy-driven interventions include initiating changes from intravenous to oral antimicrobial therapy, adjusting and optimising doses based on laboratory monitoring and detecting and preventing antimicrobial-related drug-drug interactions. Specific interventions that target a certain type of infection or syndrome, such as urinary tract infection, can improve diagnostic accuracy and tailor appropriate therapy. Tracking and reporting antimicrobial use and outcomes is an important opportunity to assess the impact of improvement efforts. An outline is given of some of the process and outcome measures that can be used.

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Process measures can include checking if microbiological cultures and relevant tests were obtained prior to commencing antimicrobial therapy, the indication and duration of therapy documented and recommended agents adhered to. In terms of outcome measures, the advantages and limitations of measuring antimicrobial use as either days of therapy or defined daily doses are outlined. Finally, the educational component should provide regular updates on antimicrobial prescribing, antimicrobial resistance and infectious disease management.

2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings

This comprehensive Centers for Disease Control and Prevention (CDC) guideline[36] was revised in 2007 to update and expand the original 1996 guideline. It reviews the scientific data regarding the transmission of micro-organisms and the fundamental elements to prevent this transmission, including the application of standard and transmission-based precautions. It applies to all healthcare settings and can be modified as appropriate to reflect service-specific needs.

The guideline has incorporated learning around micro-organisms that have emerged in the past decade, including severe acute respiratory syndrome-associated coronavirus (SARS-CoV) in addition to the identification of multidrug-resistant micro-organisms.

Safe injection practices were reiterated as part of standard precautions in response to the occurrence of viral hepatitis outbreaks in the USA that could have been prevented by adherence to basic principles of aseptic technique for the preparation and administration of parenteral medications. A number of key recommendations for safe injection practices are outlined. The CDC has subsequently developed and implemented the educational One & Only Campaign to promote safe injection practices by raising awareness among patients and healthcare providers about safe injection practices.

A strong emphasis is placed on administrative involvement in the development and support of infection prevention and control programmes. An important administrative priority described is the need for appropriate infection control staffing to meet the ever-expanding role of infection control professionals in the modern, complex healthcare system. Safety culture is also referenced in the guideline as the institutional safety culture is an important factor in influencing adherence to recommendations to prevent the spread of infection.

3.8   Joint Commission International guidelines

Antimicrobial Stewardship Initiative 2012

This manual presents a number of modules to help assist private hospitals comply with safe antimicrobial use.[37] There are five modules presented:

1. Healthcare organisation infection prevention and control programmes: essential partners of antimicrobial stewardship programmes
2. Developing a business case for an antimicrobial stewardship programme
3. Initiating an antimicrobial stewardship programme
4. Create change: using an antimicrobial stewardship programme to improve antimicrobial use
5. Measuring and reporting antimicrobial stewardship metrics.

It strongly advocates for partnership of infection prevention and control programmes with antimicrobial stewardship programmes. In particular, infection prevention and control programme leaders can share their knowledge about locations and patient populations in organisations that have high rates of infection caused by multidrug-resistant micro-organisms, so more intensive stewardship interventions can be used to help curb the spread of these micro-organisms in these areas. As stated, effective antimicrobial stewardship combined with comprehensive infection prevention and control programmes have been shown to limit the emergence and transmission of antimicrobial-resistant bacteria.

An outline is presented on how to develop a business case for an antimicrobial stewardship programme to hospital management. It is important for the team developing the case proposal to identify potential organisational and individual barriers and resistance to change. A number approaches can be used to overcome these barriers:

1. acquire evidence-based data to ensure the success of an antimicrobial stewardship programme
2. prioritise leadership strategic initiatives
3. establish a clear vision for antimicrobial stewardship
4. establish a multidisciplinary team
5. identify a lead physician champion
6. establish a business case and return on investment
7. justify the investment
8. pilot test the antimicrobial stewardship programme for justification and seek administrative approval.

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The difficulties in initiating an antimicrobial stewardship programme are acknowledged. Some strategies are presented that hospitals can use to optimise antimicrobial use. Typically, these strategies use either front-end approach such as formulary restriction or a back-end approach such as feedback to prescribers. A front-end approach is usually easier to implement as it can be incorporated easily into daily work practices, rather than the back-end approach which requires more dedicated time and uses more resources. To understand which of the strategies (front-end, back-end or a combination) will work best for an antimicrobial stewardship programme, the antimicrobial stewardship team should perform a needs assessment and identify required resources.

The importance of cultural change, especially change in prescribing practices, is discussed. A multi-disciplinary committee consisting of physicians and prescribers can serve as a helpful liaison to other medical staff and colleagues. Strong physician leadership and an active antimicrobial stewardship committee can enhance the programme's effectiveness in accomplishing the difficult task of improving antimicrobial use.

Like most improvement initiatives within a hospital, antimicrobial stewardship programmes need to measure and report the impact of their initiatives. Data that helps the antimicrobial stewardship team understand the current state of antimicrobial prescribing patterns and behaviours is essential. This can include antimicrobial-use metrics (such as expenditure, dispensing, and administration data), the number of patients who receive specific agents, aggregate microbiological data, information on admissions or hospital days, and data on adverse drug events. Antimicrobial stewardship programmes should use this data to help engage prescribers to improve antimicrobial use and to highlight the benefits these programmes provide to their hospitals.

3.9   Summary

The international guidelines give a comprehensive account of infection prevention and control best practice in a number of critical areas. Standard and transmission-based precautions are essential in order to protect patients and staff from the risk of developing a healthcare-associated infection. The appropriate placement of patients, management of care equipment and correct hand hygiene are recurrent issues throughout the guidelines. The importance of staff adherence to these recommended practices is repeatedly stated.

A number of guidelines also outline the significance of deciding on care options for patients, especially with regard to antimicrobial selection and invasive medical devices such as urinary and vascular catheters. Overall, the international guidelines are consistent with the key messages and principles of infection prevention and control best practice.

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Section 4: Review of existing guidelines and guidance in Ireland

4.1 Overview

A number of Irish infection prevention and control-related guidance documents have been developed or updated since the publication of the 2009 National Standards. This guidance covers a broad range of topics to support and advise staff at an operational level on infection prevention and control best practice. Recent national guidelines comprehensively cover significant healthcare-associated infections, including those due to Meticillin-Resistant *Staphylococcus aureus* (MRSA), *Clostridium difficile* and multidrug-resistant micro-organisms.

The prevention of medical-device-related infection is well covered, including the prevention of catheter-associated urinary tract infection, intravascular catheter-related infection and ventilator-associated pneumonia. There are also national key recommendations for preventing surgical site infection. A number of guidelines deal exclusively with standard precautions, including hand hygiene, sharps injury prevention, environmental cleaning, decontamination of medical devices and equipment and healthcare waste management.

A number of Irish guidelines have also outlined recommendations for new builds and refurbishments, including the design of patient accommodation, isolation rooms and water systems. The issue of antimicrobial stewardship and outpatient parenteral antimicrobial therapy is also addressed in respective national documents. Finally, the importance of training is outlined in the national core infection prevention and control knowledge and skills guideline. A number of the key recommendations from national guidelines on established good practice were integrated into the revised Standards.

4.2 Clinical guidelines

Specific healthcare-associated infection guidelines

The National Clinical Effectiveness Committee (NCEC) prevention and control of Meticillin-Resistant *Staphylococcus aureus* (MRSA) national clinical guideline was published in 2013, following an update of the previous 2005 guideline.[38] This comprehensive guideline outlines the best available evidence for treating any patients who may be colonised or infected with MRSA. This micro-organism commonly colonises the skin and nose, but can also cause serious infection in susceptible

patients such as bloodstream infections, skin and soft tissue infections and pneumonias. The 53 recommendations are presented under four main themes: prevention and control, management, surveillance and evaluation. Further consideration has been given to the economic impact of the introduction of the above recommendations and the barriers and facilitators to implementation.

The NCEC *Clostridium difficile* guideline published in 2014 takes into account developments in diagnosis and patient management since the previous 2008 guideline.[39] *Clostridium difficile* is the leading cause of healthcare-associated infectious diarrhoea, varying from mild to potentially serious consequences for patients such as fatal colitis. This comprehensive guideline outlines the general and specific measures required to prevent and control *Clostridium difficile* infection. The 43 recommendations are presented under the following themes:

- national recommendations
- a *Clostridium difficile* infection prevention and control programme
- prevention
- surveillance
- laboratory diagnosis
- management of suspected and or confirmed cases
- treatment
- management of outbreaks and clusters.

Further consideration has also been given to the economic impact of the introduction of the above recommendations and the barriers and facilitators to implementation.

The 2012 guidelines for the prevention and control of multidrug-resistant micro-organisms[40] and the subsequent update in 2014 provide the best available evidence and advice on the management of these micro-organisms.[41] These micro-organisms consist of both Enterococci and Enterobacteriaceae, which can produce potent enzymes to counteract antimicrobials. A number of recommendations are discussed, including the importance of obtaining national surveillance data for invasive infection rates and new acquisition rates for multidrug-resistant micro-organisms in Irish hospitals. A detailed list of infection prevention and control measures is outlined, particularly in relation to patient placement and priority for isolation. Specific recommendations are described for the prevention and control of some of the most frequently found multidrug-resistant micro-organisms in hospitalised patients, including vancomycin-resistant *Enterococci*, resistant *Enterobacteriaceae* (such as *Escherichia coli*) and multidrug-resistant *Pseudomonas aeruginosa* and *Acinetobacter baumanii*.

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Due to the increased reporting of resistant *Enterobacteriaceae* in recent years, screening recommendations were updated in 2014 to outline at-risk patient groups. This mostly takes into consideration patient transfers from other healthcare facilities.

The 2002 national guideline on the management of outbreaks of norovirus infection outlines the necessary steps to control an outbreak.[42] As previously described in relation to the Health Protection Scotland (HPS) guideline,[23] norovirus outbreaks are common and can be very disruptive to normal day-to-day activities in a hospital. The key steps required to systematically manage an outbreak are presented, including preliminary investigation, establishing an outbreak control team, clear communication and early control measures. The principle methods to minimise spread at ward level outlined are isolation of affected patients, scrupulous hand hygiene and rapid cleaning and decontamination following symptomatic episodes.

The national guidelines for Legionellosis published in 2009[43] were an update of the 2002 guidelines. *Legionella* bacteria are typically found in water, and they can cause a mild self-limiting influenza-like illness or legionnaires' disease, a more serious and potentially fatal illness characterised by pneumonia. This comprehensive guideline is underpinned by relevant occupational health and safety legislation, which means that healthcare facilities have to consider possible exposure to *Legionella* bacteria in their water management system and address such risk in a safety statement.

It is important that persons undertaking the risk assessment and those who devise and implement preventive measures should have the relevant knowledge, skills and training to carry out their tasks effectively and safely. A systematic risk management approach ensures that the prevention and control measures, including engineering controls, are appropriate for the level of risk and that a process for review and continual improvement is in place. As stated in the guidelines, water systems in new or refurbished buildings should be designed to ensure risks from *Legionella* bacteria are eliminated wherever possible or reduced as far as is reasonably practicable.

The national blood-borne diseases guideline was published in 2005,[44] with updates for renal settings published in 2010, 2013 and 2014.[45] The most serious potential blood-borne viruses include hepatitis B virus, hepatitis C virus and human immunodeficiency virus (HIV). Healthcare workers undertaking exposure-prone procedures are at risk of contracting blood-borne viruses from the patients they are treating, though there is also a small risk that patients who are undergoing such procedures may become infected by the healthcare workers who are treating them.

The document examines the risk management and infection control policies that are most effective in preventing the transmission of blood-borne viruses in the healthcare setting. The guideline states that it is the duty of all healthcare workers to actively take steps to protect themselves and their patients from such risks. The revision of the guidance for renal settings has clarified advice for managing those patients who are infected with hepatitis C virus and are undergoing renal dialysis or renal transplantation. Rigorous adherence to the standard precautions recommended is advised in order to prevent the transmission of blood-borne viruses.

A draft protocol for the reporting and management of cases of transmissible spongiform encephalopathies, including Creutzfeldt-Jacob disease, was published in 2016. [46] This is an update of the 2004 guidelines. Transmissible spongiform encephalopathies are fatal degenerative brain diseases caused by protein prions that can be transmitted through invasive clinical procedures, including surgery, endoscopy, blood donations, and organ and tissue donations.

Even though cases are rare, the fact that prion proteins are so resistant to inactivation and that transmissible spongiform encephalopathies are invariably fatal, rigorous precautions need to be routinely taken in the above situations to prevent transmission. The protocol outlines pre-operative assessment, managing the risk of possible exposure of patients following a surgical procedure and the role of various service providers in the management and investigation of potential exposures.

Prevention of medical device-related infection guidelines

As outlined earlier, the effective management of medical devices is essential given the significant association of medical devices with healthcare-associated infections. A number of Irish guidelines have been developed that outline the key recommendations to avoid such infections in the first instance.

The national guidelines for the prevention of catheter-associated urinary tract infection were published in 2011.[47] Urinary tract infection has been shown to be one of the most common healthcare-associated infections, with the majority related to the presence of a urinary catheter.[1] These detailed guidelines outline what needs to be considered before catheterisation and the best practice for insertion and management of urinary catheters.

It is recommended that every healthcare facility should consider including catheter-associated urinary tract infection surveillance in their infection surveillance programme depending on the risk profile of their patients and available resources. The process of how to define, collect and feedback this surveillance data is

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presented. As stated, staff training and education is the key to preventing catheter-associated urinary tract infection. Appropriate training and education of patients, relatives and carers on the management of urinary catheters is also recommended.

The national guidelines for the prevention of intravascular catheter-related infection were originally published in 2009 and reviewed and updated in 2014.[48] Intravascular catheter-related bloodstream infections are significant as they are associated with substantial morbidity and mortality. The guidelines outlines a series of recommendations that reflect international best practice for the prevention, surveillance and management of both central and peripheral intravascular catheters. The process of how to define, collect and feedback this surveillance data is also presented. Dissemination of the learning from intravascular catheter-related bloodstream infection incidents when they do occur is promoted to help prevent recurrence. Considerations are outlined for specific settings, including emergency departments, haemodialysis units and critical care units.

National guidelines for the prevention of ventilator-associated pneumonia were published in 2011.[49] Ventilator-associated pneumonia is a common healthcare-associated infection in intensive care units. It is also significant given the associated morbidity and mortality, especially if infection is caused by multidrug-resistant micro-organisms. A number of evidence-based recommendations are presented which are underpinned by general preventative infection prevention and control measures.

Prevention of surgical site infection guideline

A document outlining the key recommendations for preventing surgical site infection was published in 2012.[50] Surgical site infection is one of the commonest healthcare-associated infections[1] and results in significant morbidity and increased healthcare costs. A multidisciplinary team approach is advocated in this document to ensure successful implementation of the recommendations. The recommendations are listed under preoperative, intraoperative and postoperative sections that cover all the stages of a patient's surgical care. It is advised that these measures should be used as a dataset for audit to check compliance with best practice. The multidisciplinary team can then identify key points along the surgical care pathway for improvement and agree how these improvements can be made.

Bloodstream infection surveillance protocol

A national bloodstream infection surveillance protocol for Irish critical care units was published in 2013.[51] Patients in critical care units are particularly vulnerable to healthcare-associated infections for multi-factorial reasons including being

immunocompromised, high prevalence of invasive medical device use and surgical procedures. This protocol provides guidance for Irish critical care units planning to undertake surveillance of unit-acquired bloodstream infection.

It is based on the European Centre for Disease Prevention and Control (ECDC) protocol for surveillance of infection in intensive care units. The key requirements for performing this surveillance are described, including the assembly of a multi-disciplinary team. The methodology of how to identify, collect and record unit-acquired bloodstream infection surveillance data is outlined.

4.3   Standard precautions

Standard precautions guidelines

The national guidelines on standard precautions published in 2009,[52] is based on the evidence-based practices published by the Centers for Disease Control and Prevention (CDC) in 2007.[36] Standard precautions require all healthcare workers to assume that every person is potentially infected or colonised with a micro-organism that could be transmitted in the healthcare setting. Standard precautions should, therefore, be applied by all healthcare workers for all patients at all times. In some cases, highly transmissible infections require additional precautions called transmission-based precautions, which include contact, airborne and droplet precautions. A clear outline is provided of all the different types of standard precautions, including hand hygiene, use of personal protective equipment and management of healthcare risk waste.

The 2013 guidelines on infection prevention and control of influenza in healthcare settings focus on appropriate precautions when caring for a suspected or confirmed case of influenza.[53] Certain standard precaution also apply to patients with influenza-like illness, including respiratory hygiene, cough etiquette and the application of personal protective equipment during patient movement or transfer.

Hand hygiene guidance

The 2015 national hand hygiene guidelines[54] updated the 2005 guidelines. The recommendations have been ranked, based on the ranking of evidence in the World Health Organization (WHO) evidence-based guidelines on hand hygiene.[32] The purpose of this guideline is to assist Irish healthcare facilities and services to improve hand hygiene through these recommendations that reflect best practice. It is advised that staff adhere to the 'bare wrists' recommendation when delivering clinical care.

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Recommendations on hand hygiene moments, techniques, products and facilities are all outlined.

The national hand hygiene observation audit standard operating procedure was published in 2014.[55] This standard operating procedure for direct observation of hand hygiene compliance was developed to provide a standardised audit method. All healthcare workers in acute healthcare services must strictly adhere to the standard operating procedure when undertaking hand hygiene compliance audits for national reporting purposes.

Guidelines on the management of needle stick injuries

The 2016 emergency management of injuries and post-exposure prophylaxis guidelines[56] are a revision of the 2012 guidelines. These comprehensive guidelines apply to all persons at risk in all settings, including injuries sustained occupationally by healthcare workers. It covers the initial assessment, risk assessment, treatment following a significant exposure and follow-up. A number of algorithms are presented for ease-of-reference, including a decision-aid for when to administer post-exposure prophylaxis. As stated in the guidelines, the appropriate management of such injuries, in the emergency and follow-up periods, is critical in terms of minimising the risk of transmission of blood borne viruses and in allaying the psychological impact on the injured person.

A guide to the European Union (EU) regulations on sharps injuries prevention was published in 2014.[57] As stated in the guide, sharps injuries pose serious risks to healthcare workers in Ireland and represent a high cost for health systems and society in general. The employer must ensure that there is a risk management system in place to protect the safety, health and welfare of employees and to provide a safe working environment.

The guide outlines the steps of risk assessment, including identifying the hazard, assessing the risk, selecting appropriate controls and implementing them. The regulations require the employer to have policies and procedures in place that must be followed in the case of a needle stick injury at work. The guide describes the necessary arrangements for managing injuries during out-of-hours, providing post-exposure prophylaxis and investigating the factors that lead to the incident.

HSE cleaning manual

The national cleaning manual was published by the HSE in 2006 to provide guidance for cleaning services in Irish acute hospitals.[58] As stated in the manual, a clean

environment has an important role to play in reducing healthcare-associated infection and is important for efficient and effective healthcare.The cleaning manual was developed in response to the need for uniform standards, guidelines and audit processes on environmental cleaning across all acute hospitals. It is for use by staff with responsibility for cleaning services, both as a resource to assist them in day-to-day operations as well as for training. The manual provides advice and guidance concerning the general cleaning of the hospital environment, including all fixtures, fittings and equipment, including patient care equipment.

Medical device and equipment decontamination standards and guidelines

The standards and recommended practices for central decontamination units were published in 2011.[59] These comprehensive standards outline the necessary organisational structures and processes that need to be in place in central decontamination units, to identify, assess and manage specified risks in relation to decontamination processes for reusable invasive medical devices. Effective decontamination of reusable invasive medical devices, which is an essential component in the prevention of healthcare-associated infection, involves cleaning, disinfection and sterilisation. As stated, failure to adequately decontaminate reusable invasive medical devices increases the risk of transmission of infection between patients. A number of recommendations concerning best practice in relation to the decontamination process are presented. The decontamination life cycle highlights each stage of the decontamination process through which reusable invasive medical devices must pass prior to every use.

In addition to these standards, a further set of standards and recommended practices for endoscope reprocessing units were published in 2012.[60] These apply specifically to flexible endoscopes, a type of reusable invasive medical device that is decontaminated in designated endoscope reprocessing units. A number of recommendations concerning best practice in relation to decontamination processes for endoscopes are also presented.

The national medical devices and equipment management policy and standard was published in 2009.[61] The policy promotes the use of a standards-based approach to ensure safer, more efficient, and high quality management of all medical devices and equipment. As stated in the document, it is essential that there are systems in place to confirm that medical devices are managed in a way which complies with the requirements of regulation and best practice. This includes all aspects relevant to medical devices and equipment such as infection prevention and control, cleaning and decontamination.

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The 26 associated criteria include that a criterion that assurance is provided to senior management that an appropriate and effective system of managing medical devices and equipment is in place and that the necessary level of controls and monitoring are being implemented. Criteria 13 states that all medical devices and equipment returned for servicing and repair are properly decontaminated.

The Health Service Executive (HSE) also published a guidance document[62] in 2009 to help service areas to comply with the national medical devices and equipment management policy and standard. In relation to criteria 13, it is stated that a senior member of staff should manage all aspects of decontamination, with clear lines of responsibility for decontamination matters across the organisation, including the board.

A guidance document on recommended best practices for the use of reusable invasive medical devices on trial or on loan was originally published in 2004 and ratified in 2016.[63] The practice of loaning increases the risks associated with the decontamination of such reusable invasive medical devices and, therefore, should be discouraged. However, this guidance was developed in recognition of the reality that it may be necessary for reusable invasive medical devices to be borrowed from other organisations. It covers the responsibilities and obligations that the relevant service providers need to undertake when borrowing or trialling reusable invasive medical devices. Borrowed reusable invasive medical devices must be accompanied by a decontamination certificate, a list of contents and decontamination instructions.

A draft guidance document for the decontamination of ultrasound probes was published in 2016.[64] As stated in the document, ultrasound probes are increasingly important in the diagnosis and treatment of patients; however, infection control concerns exist over the use of these probes and their potential for transmission of infection. This guidance document sets out the operational procedures to support safe decontamination of semi-critical probes using high-level disinfection, thereby ensuring decontamination and infection prevention and control practice reflects national and international evidence of what is known to achieve best outcomes for patients.

Waste management guideline

The national healthcare risk waste management segregation, packaging and storage guidelines were published in 2010, [65] an update from the previous 2004 guidelines. The document offers guidance on a uniform system for the segregation and packaging of healthcare risk waste generated in the provision of patient care in acute

Irish hospitals. As stated, good practices in the generation and housekeeping of waste are the key to responsible and successful healthcare waste management. The risk of waste spreading infection is very low when handled properly.

It is imperative that all personnel involved in the management of waste are trained to safely carry out the functions they are responsible for in accordance with best practice and in compliance with statutory requirements.

The HSE also published a handbook in 2011 to help raise awareness of good practice in waste management for all staff working in the healthcare sector.[66] The handbook aims to inform staff, reduce the health and safety risk associated with healthcare risk waste and assist in achieving compliance with government policies, statutory requirements and other relevant health sector guidelines.

4.4   Technical guidelines

Building guidelines

The national *Infection Prevention and Control Building Guidelines for Acute Hospitals* were published in 2009.[67] The principal focus of the recommendations outlined in the guidelines relate to the design and proportion of single rooms in newly-built acute hospitals, along with other design issues relating to inpatient accommodation.

As stated in the document, appropriate design is a critical component in preventing healthcare-associated infections, in particular through the provision of sufficient single-patient rooms, ample physical space in clinical areas and an environment that can be readily cleaned and decontaminated. The guidelines outline specific recommendations in relation to inpatient accommodation for new hospital builds or major renovations, including the proportion of single rooms, size of rooms, number of en-suite facilities, isolation room capacity and the layout of wards.

The 2016 guidelines for the prevention of nosocomial *Aspergillosis*[68] are an update of the original 2002 guidelines. *Aspergillus* species are ubiquitous fungi that can cause problems ranging from allergic type reactions in the respiratory tract to rapidly invasive and disseminated disease. While invasive *Aspergillosis* is primarily an infection of severely immunocompromised patients, it is now recognised that a much broader group of patents without known immunocompromise are at risk, including those with chronic obstructive pulmonary disease and burns as well as neonates.

As stated in the document, a number of environmental risks are recognised in the healthcare setting although some are better defined than others. The association with

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certain types of construction activity is well recognised, and the need for preventive measures whilst such activities are taking place has been accepted. Outbreaks have also been associated with improper operation and poor maintenance of air ventilation systems and dust generating activities such as maintaining the ventilation system, cleaning, vacuuming and dry mopping. The preventative measures to control invasive *Aspergillosis* are outlined, including the steps of a formal invasive *Aspergillosis* risk assessment process by a multidisciplinary team. The design of protective isolation ventilation systems and room air filter units is also described. A high index of suspicion for cases of *Aspergillosis* needs to be maintained when renovation or construction works are ongoing in the healthcare facility or when defects in the hospital's ventilation system are suspected or identified.

Water system guidelines

Guidelines for the prevention and control of infection from water systems were published in 2015.[69] The development of these guidelines was in response to an outbreak of infection due to *Pseudomonas aeruginosa* that affected a number of neonatal units in Northern Ireland.[70] Hospital water systems have frequently been identified as a source of water-related healthcare-associated infection, especially among immunocompromised or critically ill patients. Serious outbreaks of infection have been caused by waterborne micro-organisms such as Legionella species and Pseudomonas species, in particular *Pseudomonas aeruginosa.*

As stated in the guidelines, each healthcare facility is responsible for the management and quality of the water supply in the facility in line with national guidelines. All facilities should have a water safety plan, which incorporates an up-to-date risk assessment. This includes giving particular attention to clinical areas where patients may be at increased risk of waterborne infection, including the cleaning of clinical hand wash sinks, regular flushing of water outlets and an active surveillance programme to detect alert organisms. The document outlines the specific recommendations for augmented care settings, including neonatal units.

4.5   Antimicrobial stewardship guidelines

The national guidelines for antimicrobial stewardship were published in 2009.[71] They outline the rationale for antimicrobial stewardship in hospitals, the resources and structures required and specific guidance on stewardship interventions. Antimicrobial stewardship can minimise the unintended consequences of antimicrobial use, namely, the emergence of antimicrobial resistance (such as multidrug-resistant micro-organisms) and opportunistic micro-organisms (such as *Clostridium difficile*).

As stated, infections caused by these micro-organisms are associated with increased morbidity, mortality and long-term socio-economic impact for patients. The key personnel required for an antimicrobial stewardship programme, including a drugs and therapeutic and or antimicrobial advisory committee and stewardship team, are outlined. Antimicrobial stewardship interventions are categorised into core, high impact, therapeutic interventions, educational interventions and prescribing aids, and laboratory interventions. The advantages and disadvantages of persuasive versus restrictive interventions are discussed.

Outpatient parenteral antimicrobial therapy (OPAT) standards were published in 2010.[72] The overarching aim is to ensure that no patient receiving intravenous antimicrobials who could be treated out of hospital remains an in-patient. The management algorithm for OPAT is presented. As stated, a fully resourced programme could lead to reductions in admission rates or duration of hospital stay for common conditions like pneumonia, further contributing to lower healthcare-associated infection risk.

The 2014 gentamicin improvement guide outlines a quality improvement methodological approach to improving prescribing with this potent antimicrobial.[73] Gentamicin is strategically important as it retains good sensitivity rates at a time when antimicrobial resistance continues to increase. The three steps to start an improvement cycle are outlined: establishing an oversight group and team; developing a SMART (smart, measurable, actionable, realistic, time-framed) aim; and deciding on the key measures and how to start making changes. The process can be mapped out using a driver diagram to help identify and clarify exactly what improvements are needed.

4.6   Healthcare worker knowledge and skills guidelines

The *Core Infection Prevention and Control Knowledge and Skills: A Framework Document* was published in 2015.[74] This document defines and standardises the essential core infection prevention and control knowledge and skills that are required by health and social care staff in Ireland. As stated in the document, education and training in infection prevention and control raises awareness of healthcare-associated infection and enables healthcare staff to make informed and evidence-based decisions on how to protect their patients, their colleagues and themselves.

To address the varying training needs, staff are categorised by the degree of contact with patients and blood or body fluids. The core infection prevention and control knowledge and skills have been divided into three areas, namely, basic microbiology,

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standard and transmission-based precautions and clinical assessment skills. It is, however, noted that categorising staff into three groups is a challenge given the diverse range of activities undertaken by staff in healthcare and social care services. Therefore, it is advised that service mangers should assess the activities undertaken by their staff and adjust the training requirements accordingly.

4.7 Summary

Irish national guidelines cover a broad range of topics that outline good standards of infection prevention and control practice. The importance of considering a patient's likely risk of either acquiring or transmitting an infection is discussed in a number of the guidelines. Screening for multidrug-resistant micro-organisms, where appropriate, is critical to the identification and management of antimicrobial resistance within Irish healthcare services.

The effective management of medical devices is essential given the significant association of medical devices with healthcare-associated infections. Standard precautions are the fundamental principles required in order to protect patients and staff from the risk of healthcare-associated infections. Finally, the provision of education and training is essential to enable staff to comply with best practices.

Section 5: Local HIQA data

5.1 Overview

Since 2012, HIQA has engaged in a rolling programme of inspections against the 2009 *National Standards for the Prevention and Control of Healthcare Associated Infections*[3] in order to promote improvement in infection prevention and control practices across Irish hospitals. The monitoring programme should influence a hospital's adoption and implementation of evidence-based practice that is known to contribute to the prevention and control of healthcare-associated infections. These inspections have been conducted using an evidence-based monitoring approach as outlined in HIQA's monitoring guides.

Annual composite inspection reports published by HIQA demonstrate many areas of good infection prevention and control practice, particularly progress towards achieving the Health Service Executive's national performance target of 90% compliance with hand hygiene. However, areas for improvement have been also identified, for example in relation to hospital hygiene standards and maintenance of the physical environment, reducing medical device-related infections and safe injection practices.

In addition to prevention and control of healthcare-associated infections (PCHCAI) inspections, a review of antimicrobial stewardship that included focused inspection in 14 of the 49 Irish hospitals revealed issues with national support structures and oversight. In the meantime, HIQA's inspection process continues to evolve in response to its findings, feedback from service users and providers, changes and challenges to the health service and evidence-based best practice.

5.2 Monitoring programme guides 2012-2015

Guide: Monitoring Programme for the National Standards for the Prevention and Control of Healthcare Associated Infections March 2012

This guide[75] explains the overall methodology and approach that HIQA undertook in 2012 when it commenced monitoring service providers' compliance with the National Standards for the Prevention and Control of Healthcare Associated Infections 2009. Phase 1 of the monitoring programme focused on both announced and unannounced PCHCAI assessments in acute hospitals. Phase 2, which started in 2013, included assessment of the National Ambulance Service's compliance with the National

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Standards. The initial focus of inspections was based on the physical environment and hand hygiene standards as these are the key standard precautions for preventing infection in hospitals.

An outline is provided in the guide on the steps involved in an on-site monitoring assessment:

- **Observation and document review:** to obtain information about the environment and physical facilities and practices and reviewing the related documentation.
- **Service provider meetings:** to provide clarification of any issues that may have been identified during HIQA observations and document reviews.
- **Risk identification and notification:** to ensure mitigation and appropriate escalation of any serious risks to the health or welfare of patients identified during the inspection.
- **Findings and judgement:** to make a judgement of a service provider's compliance with the Standards through gathering and analysing multiple sources of information.
- **Reports of findings:** to allow service providers to see the findings of the assessment, including details of any risks identified, to develop and publish a prioritised quality improvement plan if required and provide assurances to the public that service providers have implemented and are meeting the National Standards.
- **Publication of reports:** to publicly report the inspection report on HIQA's website to allow and enable transparent sharing of the findings.
- **Service provider responses:** to provide assurances to HIQA that any identified risks are being mitigated within the appropriate timeline.
- **Continuous monitoring:** HIQA continue to monitor the service providers quality improvement plan along with other relevant outcome measures and key performance indicators.

The appendices section of the guide provides the hand hygiene, physical environment and equipment observation tools used by HIQA authorised persons in their inspections.

Guide: Monitoring Programme for unannounced inspections undertaken against the National Standards for the Prevention and Control of Healthcare Associated infections 2014

This guide focuses on the approach that HIQA undertook in 2014 when monitoring the compliance of service providers during unannounced PCHCAI inspections.[76] The aim of these unannounced PCHCAI inspections was to assess hygiene in the hospital as observed by the inspection team and experienced by patients at any given time.

The following documentation was required at the beginning of each inspection:

- the hospital's infection prevention and control annual report for the past year
- the hospital's infection prevention and control programme plan for the current year
- policies related to hand hygiene, including training, audit and uniform policies.

The assessment of hand hygiene involved a broad approach based on the WHO's '5 moments for hand hygiene' and 'multi-modal strategy'. The assessment of the physical environment included patient care areas, bathrooms, patient equipment, ancillary rooms and isolation rooms.

Service providers were required to develop a quality improvement plan to address any risks identified during inspections.

Guide: Monitoring Programme for unannounced inspections undertaken against the National Standards for the Prevention and Control of Healthcare Associated infections 2015

This guide[77] outlines the approach that HIQA undertook in 2015 to monitoring against the Standards, focusing predominantly on three key areas:

- hand hygiene best practice
- environmental hygiene performance
- the effectiveness in implementation and monitoring in use of infection prevention care bundles, for example peripheral vascular catheter care bundles and urinary catheter care bundles.

This guide acknowledges that invasive medical device-related infections can cause serious illness or patient mortality and are costly to treat. It is, therefore, essential that invasive medical devices are managed in line with evidence-based practice in order to prevent or reduce the risk of infection. Assessment by HIQA involved monitoring adherence to care bundle implementation; inspection of relevant policies,

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procedures and guidelines, and available patient information; and review of surveillance and feedback measures.

5.3 Inspection reports 2013-2015

Monitoring of measures to prevent and control Healthcare Associated Infections in public acute hospitals: overview report of inspection activity 2014

This report details the findings of both announced and unannounced inspections which occurred from 2012 to 2013 in 49 public acute hospitals.[78] The unannounced inspections focused specifically on environment and equipment cleanliness and compliance with hand hygiene practice (hand washing and or use of appropriate hand-rub). The announced inspections covered a broader remit of assessing infection prevention and control practices under the governance, workforce and safe care themes in the 2012 *National Standards for Safer Better Healthcare*.[79]

The inspections normally started in either the emergency department or outpatient setting in an effort to follow the patient's experience from the first point of contact throughout the care pathway. This approach provided the inspectors with an opportunity to observe and assess the hygiene as experienced by most patients.

The most common areas of environmental non-compliance observed during inspections related to:

- cleanliness of the physical environment
- cleanliness of patient equipment
- waste management, including inappropriate storage of waste
- laundry management practices
- lack of appropriate storage space
- unsecured clean utility rooms.

The overall hand hygiene compliance rate was found to be 69%, with 79% of the observed opportunities compliant with best practice hand hygiene technique. It is worth noting that these compliance rates often improved in hospitals that were re-inspected.

This inspection overview report outlines the key recommendations that were made to hospitals during announced inspections. A significant proportion of the

recommendations relate to the governance of infection prevention and control practices. Overall the key themes of the recommendations concerned:

- communication strategies around healthcare-associated infections
- care bundles
- antimicrobial stewardship
- mandatory theoretical and practical training on the prevention and control of healthcare-associated infections.

In general, the feedback from hospitals shows a positive and constructive response to the recommendations made by HIQA as a result of its inspection programme. The majority of hospitals responded to any identified risks in a timely manner and published their quality improvement plans online as requested.

Overview of inspections in public acute hospitals against the National Standards for the Prevention and Control of Healthcare Associated infections: From February 2014 to January 2015

This overview report presents the findings of 54 unannounced inspections carried out in public acute hospitals between February 2014 and January 2015.[80] Collectively, the inspections covered over 80 clinical areas and almost 20% of the overall bed numbers in Irish public hospitals.

First time inspections occurred in specialised clinical areas where patients may be especially vulnerable to infection, including neonatal intensive care units, renal dialysis units and operating theatres. The main high-risk issues identified by HIQA inspectors relate to:

- environment and facilities management
- hand hygiene
- communicable and or transmissible disease control
- unclean patient equipment.

While most hospitals were generally clean, there were a significant number of hospitals where improvements in environmental hygiene was required. Of concern were the areas of high activity such as patient rooms and bathrooms, which, across the 49 hospitals inspected, had considerably lower compliance than isolation rooms, waste disposal and linen areas.

Even though there had been much improvement in hand hygiene practices in most of the hospitals since 2011, when national hand hygiene audit results were first

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published, further areas for improvement were identified. These included improving awareness amongst healthcare staff in determining the difference between the patient zone and healthcare area for the correct moments for hand hygiene and appropriate use of personal protective equipment.

Of note is the poor compliance observed around patient equipment hygiene. Particular items highlighted included unclean reusable patient equipment such as commodes and glucose monitoring kits. Some hospitals lacked identifiable staff with overall responsibility for ensuring that the cleaning of patient equipment was completed. As stated in the *Cleaning Manual-Acute Hospitals,*[58] every hospital should devise an alphabetised listing of all patient equipment that indicates the item, the method of decontamination and the staff member responsible for cleaning and decontamination.

The report acknowledges that a significant amount of work has been completed in Irish hospitals to reduce the risk of healthcare-associated infection but emphasises the need to continue improvement efforts.

Overview of HIQA unannounced infection prevention and control inspections 2015: Inspections conducted in public acute hospitals against the National Standards for the Prevention and Control of Healthcare Associated Infections

This report summarizes the overall findings from 39 unannounced inspections carried out in 32 acute hospitals in 2015.[80] The 2015 inspection programme placed an increased emphasis on areas in hospitals where high risk invasive procedures were carried out, such as operating theatres, interventional radiology suites, endoscopy units, critical care units, oncology and haematology day wards, and renal dialysis units. In addition, HIQA expanded its focus to include inspection of progress in implementing medical device care bundles.

A significant increase in the number of re-inspections was required, with 22% of hospitals requiring a follow-up inspection. This was mostly attributed to:

- poor hygiene standards
- poor maintenance and management of the environment and facilities.

In many cases, poor performance in relation to hospital hygiene is a wider management issue and should not be considered as the sole responsibility of hospital cleaners. Common non-compliances observed included poor oversight of cleaning

services, insufficient staff and time allocated to clean areas with high-activity and lack of permanent allocation of staff to wards.

Inspectors found many cases where hospital infrastructure and facilities were inadequate, outdated and or poorly maintained and, therefore, could not support the implementation of best infection prevention and control practices. It was noted that the most cited reasons given by hospitals for failing to address maintenance and infrastructure issues were a lack of resources and high occupancy and activity levels.

A number of other infection prevention and control practice risks are mentioned in the report. The importance of adhering to evidence-based practices in the management of invasive medical devices was highlighted. Safe injection practices required improvement. Opportunities to improve facilities for the reprocessing of invasive medical devices were observed in some hospitals inspected. Insufficient and inadequate isolation facilities were seen in many hospitals. Bed spacing in some areas was restricted, meaning limited space for patients to sit out or for staff to circulate freely around patients.

Opportunities to improve control of the risk of Legionella bacteria in water systems were identified in a number of hospitals inspected. Similar opportunities to improve Aspergillosis control measures were identified in some hospitals. It was advised that hospitals implement and adhere to recommended control measures for *Clostridium difficile*. A large proportion of hospitals reported poor compliance with enhanced national screening recommendations for multidrug-resistant micro-organisms. The need to improve the management of and communication around an infection outbreak, which occurred in two of the hospitals at the time of inspection, was also noted.

The report summarises the three key areas of improvement required based on 2015 PCHCAI inspection findings:

- **Better management of hygiene standards and maintenance of the hospital environment:** including the need for a planned proactive maintenance programme for hospitals building and targeted investment specifically in relation to infrastructure where prioritisation is based on risk across the health system.
- **Implementation of infection prevention care bundles:** as recommended in relevant national guidelines and sharing of learning between hospitals regarding the successful implementation of care bundles.
- **Improvement in preparing, labelling and storing intravenous medicines in clinical areas.**

5.4   Antimicrobial stewardship report 2016

This report outlines the review of antimicrobial stewardship in public acute hospitals in 2015.[82] All 49 public acute hospitals were required to complete a self-assessment questionnaire about antimicrobial stewardship in their hospitals. This questionnaire had been developed by HIQA with the assistance of an external advisory group. Following the completed questionnaires, HIQA then carried out announced inspections in a sample of 14 hospitals, which included hospitals from all seven hospital groups. This sample included hospitals that had well-advanced antimicrobial stewardship programmes, alongside those with less well-developed programmes, in order to gain a national perspective of the current arrangements in place across the acute healthcare sector. The review also involved interviews by HIQA with key senior figures within the Health Service Executive (HSE) and other key leadership figures to examine national governance and operational management of healthcare-associated infection, antimicrobial resistance and antimicrobial stewardship.

The report outlines a number of the key areas that were examined including:

- national leadership, governance and management of infection prevention and control and antimicrobial stewardship
- antimicrobial stewardship workforce
- nationally established antimicrobial stewardship support systems
- antimicrobial stewardship in individual hospitals

The need for a national action plan to outline the strategic requirements for progress in both infection prevention and control and antimicrobial stewardship was stated. There is also a need for nationally coordinated mechanisms to be put in place to

provide more effective support to those hospitals that perform less well or, indeed, who find themselves having to deal with specific stewardship resistance problems which are beyond their individual capacity to deal with in isolation.

HIQA identified a number of contributory groups and bodies within and outside of the Health Service Executive (HSE) that are involved in trying to improve the national approach to these two challenges; however, these groups do not have responsibility and authority to ensure their recommendations are acted on. The review also found that the response by the HSE to manage the ever growing national multidrug-resistant micro-organism threat has been inadequate and remains an area for significant improvement.

In terms of the antimicrobial stewardship workforce, there was clear evidence that where appropriate resources have been provided, progress in implementing antimicrobial stewardship programmes has generally advanced. However, a number of hospitals, particularly Model 3 hospitals, did not collectively have the recommended number of infection prevention and control specialised staff and, indeed, a few did not have any dedicated specialised staff at all. Limited clinical pharmacy services were also identified in some hospitals during this review, impacting on the effectiveness of antimicrobial stewardship and the wider hospital approach to medication safety.

HIQA found that the HSE has established good systems for recording and benchmarking antimicrobial prescribing and for recording and comparing antimicrobial resistance rates for serious infections with other European countries. However, the report highlighted that there could be better coordinated systems at national level to improve awareness about locally emerging antimicrobial resistance problems and to address them in a timely manner. The review also found most hospital information and communication technology systems dealing with infection surveillance operated independently of each other.

At an individual hospital level, this review identified that many Irish hospitals have performed very well in implementing antimicrobial stewardship and infection prevention and control best practice. However, a small number of hospitals did not have a drugs and therapeutics committee in place to oversee the antimicrobial stewardship programme, contrary to National Standards. Indeed, a small number of hospitals had no antimicrobial stewardship programme in place at all. This is a significant patient safety concern, not only from an antimicrobial stewardship perspective but also in terms wider medication safety. It was noted that the critical elements identified in higher performing hospitals included:

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- regularly reviewed evidence-based empiric prescribing guidelines
- protected antimicrobial prescribing rights for key strategic antimicrobial agents
- point-of-care interventions
- good collaboration between hospitals to make best use of resources
- the integration of antimicrobial stewardship with wider medication safety and risk management programmes.

The report outlines a number of national and hospital-group and individual hospital recommendations.

5.5 Summary

HIQA's PCHCAI inspections have been underpinned by a standardised methodological approach. The inspections have evolved over the four-year time-frame to include a number of significant areas of infection prevention and control practice. Many good areas of practice have been identified in Irish hospitals, although areas for improvement have also been highlighted, including cleaning performance and maintenance of the physical environment. The learning from HIQA's programme of inspections against the standards across Irish hospitals has been incorporated into the standards.

Section 6: Investigations into outbreaks of infection and adverse events

6.1 Overview

A number of national and international investigation reports have identified serious failings in patient care due to gaps in effective infection prevention and control and antimicrobial stewardship.

The HIQA University Hospital Galway 2013 report reviewed service-wide issues relating to infection management, including the provision of a responsive microbiological service within the acute hospital sector.[83] It outlined the current national-level problems in relation to access of acute hospitals to reference laboratories, standardised surveillance programme and a laboratory-based alert system so that they are able to detect and communicate the results of significant micro-organisms in a timely manner.

The Regulation and Quality Improvement Authority (RQIA) report on the *Pseudomonas aeruginosa* outbreak in Northern Ireland examined the role of deficits in both communication processes and governance arrangements the outbreak of this water-borne infection in neonatal units.[84]

Furthermore, the report on the Vale of Leven *Clostridium difficile* outbreak identified shortcomings in providing good basic care to patients, including appropriate antimicrobial prescribing.[85] However, the fundamental failing in this outbreak was an inadequate governance and management structure.

The findings and recommendations from the above adverse incidents have been taken into account in the development of the National Standards.

6.2 HIQA University Hospital Galway report 2013

In October 2013, HIQA published the report on its investigation into the safety, quality and standards of services provided by the Health Service Executive (HSE) to patients, including pregnant women, at risk of clinical deterioration.[83] The investigation findings reflected a failure in the provision of the most basic elements of patient care to Savita Halappanavar. The report outlines the failures to recognise that she was developing an infection and then to act on the signs of her clinical deterioration in a timely and appropriate manner.

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Part 6 of the report outlines national recommendations in relation to antimicrobial stewardship and microbiological services. In this case, a gram-negative micro-organism known as extended spectrum beta lactamase (ESBL)-producing *Escherichia coli* (*E*. coli) led to sepsis. ESBL-producing bacteria are usually resistant to multiple antimicrobials and are often associated with an increased morbidity and mortality rate. As the report states, it is, therefore, imperative that the risk associated with antimicrobial resistance is given a high priority at national and local levels. This risk can be controlled by prudent antimicrobial prescribing, antimicrobial stewardship and national alert systems.

The importance of responsive microbiological services that are required to support effective clinical management of infections and infection prevention and control is highlighted in the report. At the time of the investigation not all hospitals had 24/7 access to accredited microbiology laboratory services and expert advice. It was also discovered that not all hospital microbiology services were accredited. The report specifies that all hospitals must have 24/7 access at local level to accredited microbiology laboratory services along with access to expert microbiological advice.

It is imperative that any resistant micro-organisms are detected early and the results are communicated to the treating clinical teams with the relevant advice. It was also found that microbiology services with comprehensive surveillance programmes which feedback to clinical staff contribute to more effective programmes for preventing and controlling infections. The report advises that all designated laboratories should have a designated surveillance scientist who should have sufficient protected time to deliver surveillance requirements.

The report also emphasises the importance of national support structures for microbiology services. For some significant micro-organisms, no national reference laboratory services currently exist in Ireland. The report states that all diagnostic microbiology laboratories should be supported by a network of appropriately resourced and accredited reference laboratory services that meet the European Centre for Disease Control (ECDC) definitions for reference laboratory functions.

The importance of comprehensive standardised surveillance programmes as an essential part of effective infection prevention and control is discussed. Good quality infection surveillance is dependent on the availability of detailed, comparable and timely information on micro-organisms that may pose a substantial threat to public health. It is, therefore, recommended that a national laboratory-based alert system is established to allow real-time analysis of data from local laboratory information systems. Through this, recognition and communication of emerging national

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microbiological threats, including multi-drug-resistant organisms, could occur in a timely way.

As stated, there should be a clear mechanism for the communication of findings from the alert system and clear lines of accountability for acting on such findings.

6.3   RQIA Pseudomonas infection report 2012

This RQIA report details the findings and conclusions in relation to *Pseudomonas aeruginosa* outbreaks and incidents in four maternity hospitals in Northern Ireland, which tragically led to the death of a baby in Altnagelvin Hospital and three babies in the Royal Jubilee Maternity Hospital.[847] *Pseudomonas aeruginosa* is a gram-negative micro-organism that rarely affects healthy people but that can have devastating consequences for those who are already vulnerable to infection, including the immunocompromised and premature babies.

This independent review investigated the circumstances contributing to the occurrences of *Pseudomonas aeruginosa* infection and reviewed the effectiveness of management, governance arrangements and communication across the health and social care trusts. It also examines the experiences of nine families whose babies were affected.

The review team found that four out of the five major neonatal units in Northern Ireland had outbreaks or incidents of *Pseudomonas aeruginosa* between November 2011 and January 2012. It was found that these incidents were caused by different strains of the micro-organism, with the outbreak linked to contaminated tap water in the intensive care units in two of the four hospitals. The most likely spread of the infection was through the use of tap water during nappy changes and to defrost breast milk. Invasive procedures were also likely to have contributed to the development of infections when babies were colonised with the micro-organism on their skin.

The review team engaged with parents of children who were affected by the incidents of Pseudomonas to allow them to share their experiences. Although families in general felt that communication from hospital staff had been good, a number of suggested areas for improvement emerged, including:

- highlighting the seriousness of the condition
- explaining the reason for isolation control measures
- sharing information in a timely manner.

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In terms of the trusts' management of the occurrences of *Pseudomonas aeruginosa* infection and colonisation within neonatal units, a number of key deficiencies were identified, including:

- a lack of a *Pseudomonas aeruginosa* surveillance system across the UK
- a lack of routine practice across the UK to carry out an investigation of possible causes when a single case of *Pseudomonas aeruginosa* was detected
- a lack of a unified approach to the declaration of outbreaks across NHS hospital trusts
- a lack of arrangements for typing of *Pseudomonas aeruginosa* in Northern Ireland
- a lack of a formal operational approach across the neonatal network in Northern Ireland, including working to common policies and procedures.

The governance arrangements across all five health and social care trusts was assessed in relation to ensuring that appropriate action is taken in response to circulars and that optimal management of water distribution systems, prevention and control of infection, reporting and follow-up of incidents is in place. All trusts reviewed and improved their procedures following the *Pseudomonas aeruginosa* incidents.

The learning from review included having systems in place for managing circular guidance documentation and ensuring that all relevant sources of advice are received through a single point of entry. The management of water systems requires organisations having accredited training for staff, water safety plans and arrangements for independent validation of their self-assessment processes in place.

It is essential that augmented care settings, including neonatal units, have systems in place to reduce variation in care, such as using the standardised approach of high impact interventions or care bundles. Once an incident regarding the microbiological safety of water has been detected, it is important for microbiology services to work with estates services to risk assess the water supply and assess the risk to the patient population. Investigating an outbreak should involve analysing all the circumstances relating to the incident and identifying the key points for learning.

The review team also examined the effectiveness of communication between organisations and NHS hospital trusts and in relation to the response to such incidents. A lack of a routine system of sharing early intelligence about infection-related events with other organisations meant that three trusts were not aware for several weeks that an outbreak of Pseudomonas had taken place in the neonatal unit

in Altnagelvin Hospital. The circular guidance documentation that was issued by the Department of Health referred to general advice regarding Pseudomonas in augmented care settings rather than specific advice about infection in a neonatal unit.

The report outlines a number of specific recommendation for neonatal units and governance arrangements for the wider healthcare system.

6.3   The Vale of Leven hospital inquiry report 2014

This report examines a series of failures in the Vale of Leven District General Hospital in Scotland which led to an outbreak of *Clostridium difficile* infection.[85] The outbreak impacted on 143 patients, and there were at least 34 deaths where *Clostridium difficile* was the underlying cause of death or a significant contributory factor. The report investigates the circumstances contributing to the outbreak, including the clinical response and management, the systems in place at the hospital to identify and notify cases and the governance arrangements of NHS Greater Glasgow and Clyde.

Clostridium difficile is a micro-organism that can cause infection in the colon. Up to 4% of healthy adults carry *Clostridium difficile* in the large bowel. However, this percentage may increase to 50% in the hospital environment, particularly in the elderly and new-born infants. There are a number of types or strains of *Clostridium difficile*, such as the hypervirulent strain in this outbreak, that are regarded as significant because they are associated with causing more severe disease and more deaths.

The report identifies a number of deficiencies within the hospital that compromised the care of patients leading to the outbreak of *Clostridium difficile* infection. This is examined under a number of themes, including:

- nursing and medical care
- antimicrobial prescribing
- infection prevention and control
- communication with patients and relatives
- clinical governance
- national structures and systems.

The report highlights a number of nursing and medical care failures that contributed to the outbreak. Nursing issues included a lack of formal training on the recognition and management of *Clostridium difficile* infection, poor admission assessment

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documentation, lack of care plans and delays in isolating symptomatic cases until a positive laboratory result was obtained. Medical failures were caused by a lack of senior staffing, resulting in an over-reliance on junior inexperienced staff. Different antimicrobial policies were being followed on different wards, and there were delays in starting treatment for patients who had tested positive for *Clostridium difficile* infection.

A significant number of inadequacies also occurred in relation to the hospital's infection prevention and control programme. A lack of a fully functioning infection prevention control team meant that the significance of the persisting *Clostridium difficile* infection problem was neither recognised nor reported to the hospital board. No action had been taken on key areas of persistent non-compliance in infection control audits, such as deficits in the physical environment. Families were critical of poor levels of communication from staff, which included difficulties in obtaining information and receiving mixed messages regarding appropriate infection prevention and control precautions.

However, while the inquiry identified the above individual failings in care, it assigned the greatest failing to that of the overall governance and management. This had resulted in an environment where infection prevention and control was deficient. A culture of passive assurance from management meant a reliance upon being told of problems rather than actively seeking assurance about what was in fact happening. Senior managers rarely visited clinical areas and tolerated unprofessional practice. The re-structuring and downgrading of the hospital had led to uncertainty around the hospital's future and had a damaging impact on staff recruitment, staff morale and the hospital's physical environment.

At a national level, despite the existence of national policies and mandatory reporting of *Clostridium difficile* infection, a failure to learn the lessons from other outbreaks in the UK (Stoke Mandeville Hospital and Maidstone and Tunbridge Wells Hospital) and the absence of an independent inspection scheme at the time, contributed to the situation. An inspection regime was introduced by the establishment of the Health Environment Inspectorate (HEI) in 2009 in response to the emergence of this outbreak.

The report makes a total of 75 recommendations.

6.4 Summary

The importance of national support structures for microbiology and infection surveillance requirements of acute public hospitals was outlined in the HIQA University Hospital Galway report.

Communication is a recurrent feature in the Pseudomonas outbreak report, in terms of both the information that is given to parents and that is shared between healthcare staff and organisations. Readily available surveillance information is critical to the early management of emergence of an alert micro-organism. This needs to be facilitated by an effective reporting system from all relevant healthcare professionals and groups to ensure a rapid and co-ordinated response to incidents of communicable disease.

As highlighted in the Vale of Leven report, patient care is a dynamic process that requires regular assessment and reassessment of the patient by nursing and medical staff at the point of care. This is dependent on staff being familiar with infection prevention and control and antimicrobial policies in order to effectively identify and manage infections appropriately.

Good governance and management needs to be proactive and obtain assurances that personnel are functioning effectively and the hospitals' infection prevention and control needs and priorities are being met. It has also been demonstrated that having an external inspection regime in place provides that independent assurance that infection prevention and control is being properly managed and that guidelines and policies implemented.

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Section 7: Surveys

7.1 Overview

A number of Irish studies have been conducted on healthcare-associated infection rates and antimicrobial use over the past few years. The largest of these surveys was a European-wide point prevalence survey in 2012. This offered a snap-shot of healthcare-associated infection rates and antimicrobial use by analysing over 9,000 patients' records during a two-week period in 50 hospitals. The study determined that the average rate of healthcare-associated infections was 5.2%, with Ireland ranking number 14 out of the 33 countries surveyed.

National annual antimicrobial point prevalence surveys conducted since 2009 have identified recurrent issues with prescribing, such as documentation of the indications for use, broad-spectrum antimicrobial use and rates of parenteral administration. Performance indictor data collected by the HSE and Health Protection Surveillance Centre (HPSC) has shown improvement in hand hygiene compliance, overall antimicrobial consumption and a reduction in healthcare-associated infections, including *Clostridium difficile* and Meticillin-Resistant *Staphylococcus aureus* (MRSA).

However, despite these improvements, antimicrobial resistance in other important causative micro-organisms remains a cause for concern. Influenza vaccination uptake among hospital staff was 22.5% during the 2015-2016 season, considerably below the national 40% target set by the HSE. Baseline data on Irish critical care units has identified a number of infection prevention and control issues, especially with regard to limited isolation capacity. A number of the key recommendations arising from the above reports has been taken into consideration and integrated into the revised standards.

7.2 Republic of Ireland National Report 2012

The aim of the 2012 *Point Prevalence Survey of Hospital-Acquired Infections & Antimicrobial Use in European Acute Care Hospitals: Republic of Ireland National Report* was to determine the prevalence of healthcare-associated infection and antimicrobial use.[1] Fifty acute Irish hospitals took part (42 public and 8 private) in the survey. Data on healthcare-associated infections using standardised case definitions were used in accordance with a common protocol to facilitate accurate comparisons of information across the participating EU member states. This data was collected during a two-week period in May 2012 by trained data collectors and was subsequently analysed by the HPSC, with individual feedback provided to each

hospital that participated. In total, 9,030 patients were included in the 2012 study across the 50 participating Irish acute hospitals.

Healthcare-associated infection data

The overall prevalence rate of healthcare-associated infection in Irish hospitals was 5.2%, with 501 active cases identified in 467 patients. The majority of infections occurred in patients over the age of 16 years (92.9%). The overall prevalence of healthcare-associated infection by hospital type was highest for tertiary hospitals (7.5%) and lowest for private hospitals (2.5%). It was found that a number of risk factors contributed to the development of healthcare-associated infection among patients. These included being older, a longer length-of-stay, severity of underlying disease, having had surgery during the current admission and having an invasive medical devices in situ. The prevalence of healthcare-associated infection was also found to be highest in augmented care units (16.5%), including adult and paediatric intensive care units, neonatal care units and high dependency units, followed by surgical wards (6.7%). Psychiatric wards and obstetrics/gynaecology wards had the lowest rate of healthcare-associated infection at 1.5%.

The survey found that surgical site infection (18.2%), pneumonia (17.2%), urinary tract infection (15%) and bloodstream infection (13%) were the most frequently reported healthcare-associated infection types. It was also reported that 42% of blood stream infections were due to an indwelling vascular catheter. As the report authors note, the prevalence of intravascular catheter use and proportion of blood stream infection due to infected intravascular catheters is higher in Ireland than in neighbouring countries (England, Scotland, Wales). Enterobacteriaceae were recorded as being the most frequent group of micro-organisms causing healthcare-associated infection, with one-in-four resistant to the third-generation cephalosporin antimicrobial group.

Of interest, 14% of overall healthcare-associated infections had originated in another hospital.

Antimicrobial use data

The survey found that of the 9,030 patients, 3,108 were receiving systemic antimicrobial therapy, representing a 34% national median prevalence of antimicrobial use. This is a similar rate compared to neighbouring countries assessed during the same survey (England: 35%, Scotland: 32% and Wales: 33%). It was observed that the highest admitted patient prevalence rates of antimicrobial use came under surgical consultants, where it was 45%), compared to 38% for medical

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patients. The study also showed that public hospital healthcare-associated infection prevalence rates were 35% compared to 29% in private hospitals. Significant findings regarding the administration of antimicrobials include the following:

- Documentation of indications: the indication for an antimicrobial prescription was documented in 83% of cases.
- Compliance with antimicrobial guidelines: 27% of antimicrobial prescriptions were found to be non-compliant with local antimicrobial guidelines.
- Parenteral use of antimicrobials: 63% of all antimicrobials were prescribed by the intravenous route.
- Antimicrobial agents used: the top three most commonly used prescribed antimicrobials during 2012 were broad spectrum agents: co-amoxiclav, piperacillin-tazobactam and metronidazole.
- Surgical prophylaxis: Surgical antimicrobial prophylaxis accounted for 11% of all antimicrobial prescriptions during the survey. The majority of prophylaxis administered exceeded single dose (73%) and almost half (47%) continued beyond 24 hours.

From the results of the study, the authors concluded that a lack of compliance with antimicrobial prescribing guidelines, poor documentation of indications for use and a high rate of parenteral antimicrobial use were seen as shortcomings in the quality of antimicrobial prescribing in the Republic of Ireland in 2012.

The report recommends a number of priorities for implementation following analysis of the findings of the report, as summarised below:

1	Ensure all acute hospital staff have been made aware of local and national results of the 2012 point prevalence survey
2	Provide ongoing education and training for healthcare workers, regarding the importance and impact of healthcare-associated infection and antimicrobial resistance
3	Improve hand hygiene compliance in all staff
4	Implement plans to prevent infections associated with medical devices (intravascular catheters, urinary catheters, devices for respiratory tract intubation and prosthetic surgical devices)
5	Monitor and measure infections associated with medical devices and implement prospective surveillance programmes
6	Implement the core, high impact interventions to promote prudent antimicrobial prescribing
7	Ensure that frontline healthcare worker staffing levels reflect patient case mix and dependency levels
8	Ensure that key infection prevention and cotnrol, antimicrobial stewardship and surveillance staff are not diverted to tasks outside their designated roles and activities related to prevention of antimicrobial resistance and Healthcare-associated infection are appropriately resourced
9	Ensure that future strategic developments in Irish healthcare facilities include infrastructure and information technology that support the prevention of healthcare-associated infection and antimicrobial resistance
10	Plan for periodic repeat prevalence surveys, locally and nationally to monitor and measure improvements in healthcare-associated infection prevalence and antimicrobial prescribing practices

7.3   National Annual Antimicrobial Point Prevalence Survey 2015

The most recent annual antimicrobial survey examined current trends in prescribing, comparing results with those from previous years and similar hospital types.[86] The aim was to identify any areas of prescribing that may warrant an intervention or indeed reflect the impact of existing antimicrobial stewardship programmes. In total,

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39 hospitals participated in the survey, including 20 public general hospitals, 7 public regional or tertiary hospitals and 12 other hospital types. The data was analysed by the HPSC and feedback was provided to each participating hospital. A prevalence rate of 37.8% antimicrobial prescribing was determined following a review of 2,988 prescriptions.

Key findings from the survey are summarised as follows:

- Prevalence of antimicrobial prescribing: the median prevalence of antimicrobial use was 35.2% in medicine, 48.4% in surgery and 38.8% in intensive care specialities.
- Antimicrobial agents prescribed: co-amoxiclav and piperacillin/tazobactam constituted 33.8% of all prescribed antimicrobial agents.
- Parenteral and oral therapy: parenteral therapy accounted for 63.3% of all therapies. In 10.1% of cases, a missed opportunity was identified where patients could have been switched to oral equivalents.
- Indication and diagnosis: while the majority of indications for antimicrobial use were community-acquired infections (51%), it was found that healthcare-associated infections accounted for 26% of all antimicrobials prescribed.
- Appropriateness of antimicrobials prescribed: compliance with local antimicrobial guidelines was rated at 77.9%. It was also found that the indication for antimicrobial use was documented for 87.8% of antimicrobial prescriptions.

An overview of the five-year analysis of National Antimicrobial Point Prevalence Surveys prior to this survey (2009 to 2013)[87] identifies some of the improvement efforts which have been sustained, including:

- A decrease in use of ciprofloxacin and metronidazole over the five years in both oral therapy and intravenous therapy (ciprofloxacin fell by 11% and metronidazole by 8%).
- An increase in documentation of indication for antimicrobial use.

However, prevalence rates of antimicrobial prescribing, parenteral antimicrobial use, the most frequently prescribed types of antimicrobials, and compliance with guidelines remain similar over the years.

7.4   HPSC Annual Epidemiological Report 2014

An overview of healthcare-associated infection, antimicrobial consumption and resistance data collected by the HPSC in 2014 is presented in Chapter 9 of the annual

epidemiological report.[2] This outlines a number of the performance indicators that are currently being assessed in the Irish healthcare system, namely:

- *Clostridium difficile* infection rates
- alcohol hand rub consumption
- hand hygiene compliance
- antimicrobial consumption
- antimicrobial resistance.

The data collected on *Clostridium difficile* infection shows small improvements in infection rates. It is challenging to compare inter-hospital rates due to variation in laboratory testing methodology. However, it is evident that the overall decreasing trend in *Clostridium difficile* infection rates since 2009 continues in Irish hospitals. As suggested in the report, the reasons are likely to be multi-factorial, including improvements in hand hygiene and other infection prevention and control measures, changes in antimicrobial prescribing and better laboratory testing practices. The use of alcohol hand rub improved by 5% from the previous year.

Similarly, it is difficult to compare inter-hospital consumption rates of alcohol hand rub due differences in methodologies for collecting and reporting the data in addition to the use of different types of hand hygiene products. This report also presents hand hygiene compliance data from the biannual HSE audits, as the analysis and management of this data is under the remit of the HPSC since 2013. The general trend is improving, with an overall compliance for hospitals of 86.4%. The potential for methodological bias, including the Hawthorne effect, and the lack of independent external auditor oversight were noted. A small improvement was detected in antimicrobial consumption in the acute hospital setting, with a 2% decrease in the median hospital antimicrobial usage rate from the previous year.

An acknowledged limitation in the data collected is the lack of determination of whether the level of antimicrobial use is appropriate for different patient populations with different clinical needs. Finally, the report outlines the antimicrobial resistance data obtained on important micro-organisms linked to invasive healthcare-associated infections.

This data from this report is submitted to the European Centre for Disease Prevention and Control's European Antimicrobial Resistance Surveillance System (EARS-Net). The proportion of Meticillin-Resistant *Staphylococcus aureus* (MRSA) blood stream infection declined for the eight consecutive year; however, Ireland remained the

European country with the highest proportion of Vancomycin-Resistant *Enterococcus faecium* blood stream infection.

It is believed that a number of factors have contributed to the decline in Meticillin-Resistant *Staphylococcus aureus* (MRSA), including increased compliance with standard precautions, screening of patients for carriage, restricted prescribing of certain broad spectrum antimicrobials and the availability of decolonising regimens to eradicate carriage. *Escherichia coli* is now the most frequently reported micro-organism causing invasive healthcare-associated infection. The overall trend in the proportion of multidrug-resistance in significant micro-organisms continues.

7.5   HPSC Seasonal Influenza vaccine uptake report 2015-2016

The HPSC undertook a survey of all public hospitals and long-term care facilities to evaluate influenza vaccine uptake among healthcare workers employed in these facilities in 2015-2016.[88] Data was also collected from a small number of private hospitals. In total, 89.7% of all acute hospitals, including three private hospitals, participated in the survey.

Key findings from the survey include:

- an average uptake among all categories of hospital healthcare workers of 22.5%
- average uptake ranged by staff category, with the highest value among medical and dental staff and the lowest among nursing staff
- the highest average uptake was shown in the acute paediatric services.

Direct comparison with previous uptake surveys is not possible given the decision to present average figures rather than overall uptake rates for this survey. However, it was noted, that uptake was highest in hospitals where staff size numbers exceeded 2,500 persons and lowest where it was less than 250 persons, which is a pattern that was observed in each of the precious four seasons.

As stated, one possible explanation for this is that larger hospitals with larger staff complements are more likely to have an occupational health department and or a team of influenza vaccine coordinators. As the report acknowledges, influenza vaccination uptake rates are substantially lower in Ireland than neighbouring European countries or indeed in the USA, where it is often a mandatory employment requirement. The report outlines a number of recommendations to improve uptake levels among staff in Irish healthcare organisations.

7.6   Irish Critical Care Services survey 2013

Based on 36 critical care units in 29 hospitals, the 2013 *Survey of Hygiene & Healthcare Associated Infection Prevention Practices in Irish Critical Care Services* establishes baseline data regarding hygiene and infection prevention and control practices in Irish critical care services.[89] As the report states, patients admitted to critical care are at high risk for healthcare-associated infections, with the potential for one-in-four patients to develop such an infection. Some of the specific areas of infection prevention and control analysed included:

- **facilities:** data from the survey demonstrates that current isolation capacity in Irish critical care units is inadequate with single room accommodation accounting for just 28% of critical care unit beds in the 29 participating hospitals. The report highlights the importance of isolation rooms for patients colonised or infected with multidrug-resistant micro-organisms as onward transmission from a nearby patient can occur. A lack of airborne infection isolation rooms was also found, with the report highlighting the importance of prompt isolation of patients with suspected or confirmed infection transmitted through an airborne route.

- **hand hygiene:** access to alcohol hand rub at every bed space was available in 92% of units.

- **training:** training in both standard and transmission-based precautions was provided at least annually in all units. However, not all units provided training on the insertion and maintenance of invasive medical devices.

- **surveillance:** the use of ongoing prospective surveillance was seen to be undertaken only by the minority of the critical care units, despite evidence to support the introduction of systematic healthcare-associated infection surveillance to prevent invasive device-related infections.

- **antimicrobial stewardship:** deficiencies were noted in the organisation and implementation of antimicrobial stewardship, with only 76% of the critical care units having an active antimicrobial stewardship committee, 69% having access to an on-site consultant microbiologist and 72% having a policy of restricted access to certain antimicrobials.

- **seasonal influenza:** average vaccine uptake level was 42% despite every unit having access to an occupational health physician.

A number of recommendations and implementation proposals are detailed within the report, including:

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- Ongoing investment in and capital development of the physical infrastructure of critical care units.

- Ongoing formal training, including education on impact, consequences and prevention of invasive device-related infection. This should be provided to all healthcare workers in the critical care facilities.

- Implementation of care bundles for maintenance of intravascular catheters, urinary catheters and for ventilator-associated pneumonia.

- The establishment of healthcare-associated infection surveillance models. Resources to support this should be prioritised and collation, analysis and reporting of infection surveillance data is recommended.

- All critical care units should have 24 hour access to microbiological advice, and there should be an active antimicrobial stewardship programme.

- All critical care unit healthcare workers should be encouraged to avail of the annual seasonal influenza vaccine. Vaccine uptake should be recorded and reported within each unit.

7.7 Summary

The above studies and data collected on performance in the Irish healthcare system give an overall picture of current healthcare-associated infection and antimicrobial use trends. This baseline information has been extremely valuable in determining where infection prevention and control efforts are best targeted.

Surgical site infection was found to be the most common healthcare-associated infection detected in the Irish national point prevalence survey in 2012. This is of significance, given the increasing number of day surgeries, shorter length-of-postoperative stay and relative lack of surgical site surveillance currently performed in Irish hospitals. The potential risk of spread of healthcare-associated infection has been observed with increased patient transfers between hospitals. National trends in antimicrobial prescribing reflect the importance of monitoring antimicrobial prescribing patterns and implementing and sustaining antimicrobial stewardship efforts. Antimicrobial resistance remains a significant challenge for the Irish healthcare system, with the increasing emergence of multidrug-resistant micro-organisms.

At the time of publication of HIQA's antimicrobial stewardship review report in 2016, there was a relative lack of screening for multidrug-resistant micro-organisms in hospitals compared to the level recommended in national guidelines.

Seasonal influenza immunisation for healthcare workers is an important infection control measure; however, uptake rates remain sub-optimal.

Critical care units, which have the highest prevalence rates of healthcare-associated infection due to vulnerable patients and complexity of care, have also identified infection prevention and control deficiencies. All of the reports advocate for comprehensive infection prevention and control and antimicrobial stewardship programmes, incorporating the key recommendations, to continue to be developed and maintained.

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Section 8: Conclusion

This background document outlines the literature that was reviewed that to inform the revision of the *National Standards for the prevention and control of healthcare-associated infections in acute healthcare services*. Literature reviewed included:

- international standards and relevant guidelines
- Irish national guidelines
- HIQA prevention and control of healthcare-associated infection (PCHCAI) monitoring programme findings
- investigation reports into healthcare-associated infection-related incidents and outbreaks
- Irish surveys on healthcare-associated infection and antimicrobial resistance data.

This desktop research informed an initial draft of the standards, which was then refined through the following stages of the standards development process:

- detailed discussions at meetings of the PCHCAI Standards Advisory Group
- individual meetings with relevant stakeholders
- focus groups with patients, their advocates and front-line staff working in acute services
- an eight-week national public consultation, resulting in 34 submissions that were analysed and reviewed.

Each of these steps, in conjunction with the desktop research documented in this report, formed the evidence base for the development of the *National Standards for the prevention and control of healthcare-associated infections in acute healthcare services.*

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