A Strategy for the Control of
Antimicrobial Resistance in Ireland

SARI

Infection Prevention and Control Building Guidelines for Acute Hospitals in Ireland

Strategy for the control of Antimicrobial Resistance in Ireland (SARI)

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Published on behalf of SARI by HSE Health Protection Surveillance Centre

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

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Foreword

The Health Services Executive (HSE) Healthcare-Associated Infection (HCAI) Governance Committee requested the Strategy for the control of Antimicrobial Resistance in Ireland (SARI) National Committee to provide recommendations on infection prevention and control-related design for acute hospitals in Ireland. A working group was established, and this report is the result. The principal focus of the recommendations included in this report relate to the design and proportion of single rooms in newly-built acute hospitals, along with other design issues relating to inpatient accommodation. The recommendations are based on a review of international literature and, in the opinion of the working group, represent the best options for design of acute hospitals in Ireland. An extensive consultation of relevant professional bodies was carried out, and the draft report updated on the basis of submissions received. The working group would like to thank all of those who took the time to provide submissions.

Robert Cunney
Chair, SARI Healthcare Infection Prevention and Control Design Working Group
December 2008

Executive Summary

Appropriate design of the physical environment in hospitals contributes to improvements in patient well-being and satisfaction, delivery of medical care, staff satisfaction, and reduction in healthcare costs. Appropriate design is also a critical component in preventing healthcare-associated infections (HCAI), 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.

This document contains a series of recommendations for infection prevention and control-related planning and design considerations, for both new and existing acute hospitals. The recommendations were developed by a working group of SARI National Committee, and are based on best available evidence and international best practice. The working group's recommendations are summarised as follows:

1 Planning and governance

1.1 Planning and design

Planning and design of new hospitals, or major hospital refurbishments, should be in line with appropriate international guidance documents, allow for future reconfigurations, and include consultation with hospital staff and service users. A national programme is required to implement the working group's recommendations within 10 years.

1.2 Involvement of infection prevention and control teams

Infection prevention and control teams must be involved in all stages of hospital building or refurbishment programmes. Specific safeguards must be in place to minimise the risk of infection during the construction period.

1.3 Sign-off of completed projects

Final construction and commissioning of new hospital builds or refurbishments must be signed-off by all relevant parties.

2 Inpatient accommodation for new hospital builds or major renovations

2.1 Proportion of single rooms

Newly built acute hospital inpatient accommodation should comprise 100% single-patient rooms. Newly built non-acute hospital inpatient accommodation should comprise a minimum of 50% single-patient rooms.

2.2 Single-patient room design

All single-patient rooms should have "ensuite" shower and toilet facilities, and an additional clinical hand wash sink, and have a minimum floor area of 25m^2. Single-patient rooms in critical care areas should have a minimum floor area of 26m^2 (not including "ensuite" sanitary facilities). Single-patient rooms should be designed to facilitate optimal patient care, patient comfort, and include adequate space for family members and other visitors.

2.3 Proportion of airborne isolation rooms

The minimum proportion of airborne isolation rooms for newly built acute general hospitals should be one per 150 acute inpatient beds, or one per 75 acute inpatient beds for regional or tertiary hospitals. Newly built emergency departments should each have at least one airborne isolation room.

2.4 Airborne isolation room design

Airborne isolation rooms should be based on a "neutral pressure" design, and include a dedicated anteroom with a minimum floor area of 4m^2.

2.5 Multiple-patient room design

Multiple-bedded rooms should not contain any more than three beds, include shower and toilet facilities, and be designed in a way that allows for future reconfiguration. There should be a minimum floor space of 19m^2 around each bed.

2.6 Ward/unit layout
Wards/units that include inpatient accommodation should be designed in line with appropriate international guidance documents, including ample space for ancillary services and storage.

2.7 Ward/unit fixtures and fittings
Fixtures and fittings should be easily cleaned and disinfected, and designed to minimise the risk of transmission of infection, in line with appropriate international guidance documents. Hand hygiene facilities should comply with national guidelines.

2.8 Communicable disease surge capacity
Hospital ward/units that may have an increased patient load during periods of increased communicable disease activity should have sufficient infection prevention and control infrastructure to deal with such activity.

3 Inpatient accommodation in existing acute hospitals

3.1 Infection prevention and control and hospital refurbishment
Refurbishment of existing acute hospitals should follow the planning and governance recommendations outlined in section 1, including involvement of the infection prevention and control team in all stages of project design and implementation.

3.2 Hospital development plans
Existing acute hospitals should produce a development control plan for maximising the number of single-patient rooms, and minimising the number of multiple-patient room. Based on this, an option appraisal should be carried out for each acute hospital site. Construction of the final design solution should be completed within a maximum of 10 years from the publication of these guidelines.

3.3 Internal reconfiguration
Where new hospital buildings or a major extension are not planned within the next 10 years, acute hospitals should reconfigure existing inpatient accommodations to achieve a mixture of single and multiple-bedded rooms. Wherever possible, this should be in line with the recommendations for new hospital builds, included in section 2.

Introduction

The recommendations included in this report were produced by a working group of the SARI National Committee. Details of the working group's remit and membership can be found in Appendix 1.

HCAI result in excess illness, death and financial cost to the healthcare system. Among the 45 Irish hospitals that participated in the 2006 Hospital Infection Society HCAI Prevalence Survey, 4.9% of patients had a HCAI at the time of the survey [1]. In addition, in 2007 there were 1,335 cases of *Staphylococcus aureus* bloodstream infection reported, of which 526 (39%) were caused by meticillin-resistant *S. aureus* (MRSA) [2]. HCAI prevention and control programmes have been shown to result in significant cost savings to healthcare systems. A fully resourced infection prevention and control system only has to prevent 7% of HCAI to cover its costs [3].

Prevention and control of HCAI requires a multi-factorial approach, including appropriate physical infrastructure in healthcare facilities and availability of single rooms for implementation of isolation precautions [4]. In a recent study of 204 hospitals in 32 European countries, the ability to isolate patients colonised with MRSA in single rooms was identified as an independent predictive factor for a low prevalence of MRSA. Conversely, difficulties with isolating patients colonised with MRSA was an independent predictive factor for high MRSA prevalence [5].

In-patient accommodation in hospitals should be designed in a way that addresses a number of requirements, including:

- Maximising patient comfort and dignity
- Ensuring ease of delivery of medical care
- Making appropriate provision for family members, and other visitors
- Minimising the risk of infection
- Minimising the risk of other adverse events, such as falls or medication errors
- Sustainable design and energy efficiency

It is also important that hospital designs allow for flexibility of use over time and planning for future service requirements. Hospital buildings are likely to have a life span of many decades, during which time there are likely to be considerable advances in medical technology and changes in the way in which medical care is delivered.

The recommendations contained in this report are designed to minimise the risk of infection in hospitals. However, many of the same design factors that help to prevent the transmission of infection, such as adequate space around beds, minimising the number of multiple-bedded ward areas and increasing the proportion of single rooms, also address many of the other design requirements listed above. Although the latter requirements are beyond the scope of this report, they need to be considered in the design of any new hospital build or renovation of existing hospital buildings, in parallel with the recommendations in this report.

Single patient rooms in hospital are associated with numerous benefits, compared to rooms accomodating multiple patients, including reduced transmission of infection, reduced medication errors, increased patient privacy and increased patient satisfaction. They are also associated with reduced hospital operating costs, through shorter length of stay, fewer adverse patient events (including infections) and by allowing hospitals to safely operate at high bed occupancy levels. Single patient rooms are associated with higher rates of falls among patients requiring supervision. However, this is offset by the facilitation of visitors and family members to play a greater role in patient care, and ergonomic design of single patient

rooms. Where appropriate provisions are taken the rate of falls in single patient rooms is no higher than for multiple-bedded rooms [6]. The data on patient preference for single versus multiple occupancy rooms is mixed: the majority of patients appear to prefer single rooms (privacy, reduced noise, opportunity for family members to stay etc.), but some prefer multiple occupancy rooms (company, sharing of experiences, potential for help from other room mates). The literature in relation to single versus multiple occupancy hospital rooms was extensively reviewed by Chaudhury et al [6]. The findings of that review are summarised in Appendix 2.

A common concern is that hospital designs with a high proportion of single rooms require a higher nurse to patient ratio, compared to designs comprising mostly multiple-bedded rooms. However, there is little or no evidence from the literature to support this concern [6]. Indeed, two recent reports found that changing from a mostly multiple-bedded layout to one comprising 100% single rooms did not require additional nursing staff. Both reports also demonstrated greater staff satisfaction with the 100% single room layout and improved ability to respond to patient's needs [7,8].

An additional common concern is that the capital cost of constructing a new hospital with a high proportion of single rooms, and other "evidence-based" design features, will be prohibitively expensive. A study by the US Center for Health Design calculated that the addition of an array of therapeutic design innovations, such as 100% single patient rooms and decentralised nursing stations, would add six percent to the cost of building or refurbishing a hospital. However, this additional cost would be recouped within as little as one year, through operational savings [9].

Although the clinical, patient comfort and cost benefits of single patient rooms probably outweigh those of multiple patient rooms, there is still some debate as to the ideal proportion of hospital in-patient accommodation that should comprise single rooms. In the United States, 100% single patient rooms has become the standard for new hospital buildings [6,10]. However, this has not become the standard in other countries. For example, hospitals in many European countries are composed of a mixture of single and multiple patient rooms, but with multiple patient rooms generally comprising two or, at most, three beds per room. A minimum of 50% single rooms has been the standard for UK hospitals for some time, though this recommendation is not evidence-based [8]. Reviews of the published literature, including a recent detailed evaluation at the Leeds-Nuffield Hospital in the UK, have concluded that new hospitals should comprise 100% single rooms and that these rooms should be "acuity adaptable" (i.e. allow adaptation for different types of patients or levels of medical care) [6,8,9]. However, these recommendations need to be balanced against what is achievable within existing hospital infrastructure, and what is desirable for different patient populations.

A 2003 survey found that among 66 public and private acute hospitals in Ireland, three (5%) had no available single rooms. Among the remaining hospitals the median proportion of single rooms was only 6% (range 0.6% to 91%), with the highest proportion being in private hospitals. Fifty-five hospitals provided data on the number of single rooms with en-suite bathroom facilities, with a median of five rooms (range 0–144) per hospital. For the 43 hospitals that reported having en-suite single rooms, there was a median of one en-suite room for every 18 acute beds (range 1.1–188) [11]. It is clear from this survey that increasing the proportion of single rooms in acute hospitals in Ireland to meet minimum international standards will be a major undertaking. It is the view of the Working Group that in order to achieve a reasonable improvement in the overall proportion of single rooms in as short a time period as possible, new acute inpatient accommodation should comprise 100% single rooms. Examples of ward layouts comprising 100% single rooms, and single room design, are included in Appendix 3.

A standard single patient room with ensuite sanitary facilities is sufficient for control of most transmissible infections in hospitals. Certain highly transmissible infections, however, such as tuberculosis and Severe Acute Respiratory Syndrome (SARS), require single patient rooms that are specifically designed to

minimise the transmission of these infections. Such "airborne isolation rooms" require a separate ante-room and air handling controls that maintain an air pressure in the room that is negative, relative to the outside corridor (often referred to as a "negative pressure room") [12]. In addition, patients with profound immune deficiency, such as following bone marrow transplantation, require protective isolation in a room where the air pressure is kept positive, relative to the outside corridor (often referred to as a "positive pressure room"). The air handling controls for airborne isolation rooms generally allow switching between negative or positive pressure ventilation. However, with such "switchable" designs, inadvertent setting of the air handling controls to the incorrect form of ventilation, or partial mechanical failure of the system, can potentially increase, rather than decrease, the risk of transmission of infection [13,14]. UK guidelines have recently introduced an alternative "neutral pressure" design for such rooms, which can provide both source isolation of patients with airborne infections and protective isolation of patients with profound immune deficiency, without having to alter the air handling settings [15].

The number of airborne isolation rooms required for a given hospital is dependant on case mix, local prevalence of infections requiring airborne isolation (particularly tuberculosis) and requirements for future emergency planning. A review of airborne isolation room requirements in hospitals in Florida, based on Health Resources and Service Administration critical benchmarks, concluded that large regional hospitals should have at least one airborne isolation room per 75 acute beds, other acute hospitals should have one per 150 beds, and that these should be located as close as possible to the emergency department [16].

In addition to the design and proportion of single and multiple-bedded rooms, other aspects of hospital infrastructure may impact on the transmission of infection. These include design and placement of furniture, hand hygiene facilities, and other fixtures and fittings, along with design of clinical support areas such as clean and dirty utilities [17]. Local infection prevention and control teams need to be involved in all stages of design and building of healthcare facilities, to ensure hospital infrastructure, fixtures and fittings are designed, built and fitted in a way that minimises the risk of transmission of infection, as well as minimising infection risks associated with demolition and building processes [18,19].

Recommendations

1: Planning and Governance

1.1: Planning and design

- Planning and design of hospital of new hospitals, or major hospital refurbishments, should take account of relevant UK Health Technical Memoranda (HTM), Health Building Notes (HBN), or an equivalent international guidance document that has been approved by HSE Estates. Details of current HTMs and HBNs are given in Appendix 4.
- The initial planning and design of new hospitals, or major hospital refurbishments, should maximise the available space for inpatient accommodation and support services within a design that allows for future reconfiguration of inpatient accommodation.
- Plans showing potential future reconfigurations should be included in the design and briefing process.
- In addition to infection prevention and control considerations, the overall shape and layout of new hospital buildings should optimise staff workflow, patient comfort and safety and allow for optimal delivery of healthcare.
- Long term cost-benefit should be factored into the choice of a particular ward/unit design, selection of fixtures and fittings, and other infection prevention and control-related aspects of planning and design.
- There should be consultation with all grades of staff who will be potential users of the ward/unit, early in the brief phase, to ensure adequate space is allocated for all services, including ancillary or support services (such as collection and disposal of healthcare waste). Patients and other potential clients should be included in the consultation process, where relevant.
- The Health Services Executive (HSE) should put in place a hospital building/refurbishment programme, to address the recommendations contained in this report.

1.2: Involvement of infection prevention and control teams

- The local infection prevention and control team must be involved at all stages of new hospital builds, or hospital refurbishments, including preparing the brief, design, planning, construction and commissioning, and be represented on the project team coordinating the new build or refurbishment.
- Consultation and inclusion of the infection prevention and control team in the process should be in line with the recommendations detailed in HFN 30 (“Infection control in the built environment”) [19].
- For new builds or major refurbishments, the project team should include, or seek input from, a person with practical experience in the infection prevention and control aspects of hospital design
- Infection prevention and control requirements must be considered in the design and fit-out of all areas of a hospital involved in patient care, including outpatient departments, day wards, operating theatres, physiotherapy departments, accident and emergency departments, central

sterile supplies departments etc. The design of such areas should take account of the relevant UK HTM (or equivalent), where one exists.

- Appropriate safeguards must be put in place to minimise the risk of transmission of infection during the construction period, with particular reference prevention of *Aspergillus* and *Legionella* transmission, in accordance with relevant national guidelines.

1.3: Sign-off of completed projects

- When the construction and commissioning of a new hospital building, or major refurbishment project, is completed the work must be signed-off by the relevant contractors, design team, project team and the hospital manager/CEO.
- The final documentation should include evidence that advice was sought from the infection prevention and control team at all relevant stages of the project.
- The Design Team should be required to provide for future planning, thereby ensuring ready adaptability and/or reconfiguration of ward and hospital department layouts.

2: Inpatient accommodation for new hospital builds or major renovations

These recommendations apply to:

New hospital builds (i.e. where a wholly new acute hospital facility is being constructed)

Major additions to existing hospitals (i.e. where newly-constructed inpatient accommodation is added on an existing hospital site, such as the addition of a new ward block or wing)

Major renovations to existing hospital in-patient accommodation areas (i.e. where an existing inpatient accommodation area is entirely remodelled, including an extension to provide significant increase in the footprint of the inpatient accommodation area)

2.1: Proportion of single patient rooms

- All newly built acute hospital inpatient accommodation should be made up entirely of single patient rooms.
- All newly built non-acute hospital inpatient accommodation, when included within an acute hospital setting, should be made up of a **minimum** of 50% single patient rooms. The overall proportion within non-acute units may need to be higher, but should be based on risk assessment of the likely patient population, including likely future use, in consultation with the local infection prevention and control team.

2.2: Single patient room design

- All single patient rooms should have "ensuite" shower and toilet facilities.
- All single patient rooms should have a clinical hand wash sink, in close proximity to the entrance to the room (in addition to a sink for patient use, included as part of the "ensuite" facilities). The "ensuite" facilities should be for the sole use of the patient occupying the room.
- Single patient rooms, including "ensuite" sanitary facilities, should have a floor area of at least $25m^2$.
- The design and space requirements of single patient rooms should follow the specifications outlined in UK HBN 04 Supplement 1, or equivalent international guidance document. Single patient rooms in critical care areas (e.g. intensive care units) should have a minimum floor area of $26m^2$ (not including "ensuite" sanitary facilities, if such facilities are present).
- In critical care areas and emergency departments, a proportion of single patient "rooms" may be constructed using moveable transparent walls. This facilitates conversion to partially open

cubicles, or cohorting of multiple patients, to allow for changes in requirements for close patient monitoring or urgent interventions.

- Single patient rooms should be designed in a way that maximises visibility of patients by healthcare staff, while allowing for patient privacy. Single patient rooms should be visible from the nursing/staff base and provided with communication links to the nursing/staff base. Consideration should be given to the use of technology to assist monitoring patients with confusion, frailty or other conditions putting them at risk of injury.
- Single patient rooms should have adequate seating space for family and other visitors that does not interfere with clinical care of the patient. In paediatric settings, this should include facilities to allow a parent or carer to sleep in the room overnight.

2.3: Proportion of airborne isolation rooms

- Newly built general acute hospitals should have a **minimum** of one airborne isolation room for every 150 acute inpatient beds.
- Newly built regional and tertiary hospitals should have a **minimum** of one airborne isolation room for every 75 acute inpatient beds.
- Airborne isolations rooms should be provided within both critical and non-critical care areas.
- Some hospital units will require a higher proportion of airborne isolation rooms, based on local risk assessment, and may need to be wholly composed of such rooms. Such units include:
    - Those likely to house patients with infections transmissible by the airborne route, such as infectious disease units or respiratory disease units (including units for the care of patients with cystic fibrosis)
    - Those likely to house patients with profound immunosuppression, requiring protective isolation, such as solid organ or bone marrow transplantation units. Newly built accident and emergency departments and critical care units should include at least one airborne isolation room.
- The proportion of airborne isolation rooms in any inpatient accommodation, including the above specialist units, should be based on a risk assessment of the likely patient population, in consultation with the local infection prevention and control team.

2.4: Airborne isolation room design

- Airborne isolation rooms should be based on a "neutral pressure" design, as detailed in HBN 04 Supplement 1, rather than a "switchable" negative/positive pressure design.
- Airborne isolation rooms require a dedicated ante room, which should have a minimum floor area of $4m^2$.
- In the design of new acute inpatient accommodation, consideration should be given to including one or more single patient rooms with "ensuite" sanitary facilities and dedicated anterooms in each ward, which could be readily converted to airborne isolation rooms, if required.

2.5: Multiple patient room design

- Multiple-bedded rooms should not contain any more than **three** beds per room.
- Multiple-bedded rooms should be designed in a way that maximises the potential for future reconfiguration of such rooms.
- All multiple-bedded rooms should include shower and toilet facilities for the sole use of the patients occupying the room.
- Shower and toilet facilities should be situated in a way that maximises visibility into the room.
- There should be a minimum floor space of 19m^2 around each bed, to allow for clinical activity and potential future reconfiguration of rooms.

2.6: Ward/unit layout

- Design of wards/units that include inpatient accommodation should take account of recommendations set out in UK HBN-04, or equivalent international guidance document.
- Wards/units should include ample space for ancillary and support services, such as circulation areas, clean and dirty utilities, separate toilet facilities for staff and visitors etc.
- Wards/units should include ample space for storage of patient care equipment, cleaning equipment, linen, waste etc.
- Wards/units should be designed so that the flow of goods, services and waste materials is such that cross-contamination between contaminated and clean items is minimised.
- Consideration should be given to the possibility that the stringency of standards or requirements relating to ancillary services at ward or unit level, such as waste handling, laundry or decontamination of patient equipment, may increase in the future.

2.7: Ward/unit fixtures and fittings

- Furniture, surface finishes and other fixtures and fittings within any ward/unit that includes inpatient accommodation should be easily cleaned and disinfected, and designed to minimise the risk of transmission of infection, in line with the recommendations in UK HFN 30, or equivalent international guidance document.
- Advice should be sought, early in the design phase, on selection of furniture, surface finishes and other fixtures and fittings from the infection prevention and control team.
- Hand hygiene facilities in patient care areas should follow the recommendations included in Guidelines for Hand Hygiene in Irish Healthcare Settings (SARI, 2005).

2.8: Communicable disease surge capacity

- Some areas of the hospital may have to deal with an increased patient load when there is increased communicable disease activity (i.e. seasonal increases in infections, outbreaks and epidemics). Such areas, particularly accident and emergency departments, should have appropriate infection prevention and control infrastructure to deal with patients with communicable diseases and the "surge capacity" to deal with increases in communicable disease activity.

3: In-patient accommodation in existing acute hospitals

These recommendations apply to internal renovations or remodelling of existing in-patient accommodation areas. Such renovations may involve major internal construction work, including remodelling of internal walls, but generally without removal of external wall or significant increase in the existing footprint of inpatient accommodation.

3.1: Infection prevention and control and hospital refurbishment

- The recommendations outlined in section 1 apply to all renovation, remodelling or refurbishment projects in existing acute hospitals.
- The local infection prevention and control team must be involved in all stages of planning, design and implementation of such projects, as outlined in section 1.2 above.
- All such projects should follow current UK Health Building Notes and Health Technical Memoranda, or equivalent international guidance documents.
- Any such project in existing acute hospitals should be seen as an opportunity to improve infection prevention and control infrastructure.

3.2: Hospital development plans

- Acute hospitals should produce a development control plan, in consultation with the local infection prevention and control team, to examine ways of maximising the proportion of single rooms (with "ensuite" facilities) and minimising the proportion of multiple-bedded rooms. The plan should take account of current and future bed capacity and bed usage, in line with HSE regional and national policy. The plan should prioritise delivery of improved infection control-related infrastructure within as brief a time period as possible.
- Based on the development control plan, an option appraisal for each hospital site should be carried out, in consultation with regional and national HSE management. Options to be considered for each hospital may include:
    - Reconfiguration of inpatient accommodation within the existing footprint of the hospital
    - An extension to the existing footprint, to provide new inpatient accommodation
    - Construction of new hospital buildings, on the existing or alternative site.
- Construction and delivery of the final design solution should be achieved within a maximum of 10 years from the publication of these guidelines.

3.3: Internal reconfiguration

- If an extension to the existing hospital footprint, or construction of new hospitals buildings, is not planned within 10 years, hospitals should aim to convert existing in-patient accommodation in line with the recommendations in section 2 above.
- Where the recommendations in section 2 are not achievable within the existing hospital footprint, hospitals should reconfigure existing inpatient accommodation to achieve a mixture of single and multiple-bedded rooms.

References

1. Fitzpatrick F, McIlvenny G, Oza A, et al. Hospital Infection Society prevalence survey of healthcare-associated infection 2006: comparison of results between Northern Ireland and Republic of Ireland. Journal of Hospital Infection 2008; 69: 265-73

2. European Antimicrobial Resistance Surveillance System (EARSS) (www.hpsc.ie)

3. Plowman R, Graves N, Griffin M, Roberts JA, Swan A, Cookson B, et al. The socio-economic burden of hospital acquired infection. London: PHLS, 2000

4. Humphreys H. Overcrowding, understaffing and infection in hospitals. Irish Medical Journal 2006, 99: 102

5. MacKenzie FM, Bruce J, Struelens MJ, Goossens H, Mollison J, Gould IM; ARPAC Steering Group. Antimicrobial drug use and infection control practices associated with theprevalence of methicillin-resistant Staphylococcus aureus in European hospitals. Clinical Microbiology and Infection. 2007;13: 269-76.

6. Chaudhury H, Mahmood A, Valente M. The use of single patient rooms vs. multiple occupancy rooms in acute care environments: a review and analysis of the literature. The Coalition for Health Environments Research, 2003

7. Janssen PA, Harris SJ, Soolsma J, Klein MC, Seymour LC. Single room maternity care: the nursing response. Birth. 2001;28:173-9

8. Phiri M. One Patient One Room –Theory & Practice: An evaluation of The Leeds Nuffield Hospital. NHS Estates, 2003

9. Zimring C, Ulrich R. The Role of the Physical Environment in the Hospital of the 21st Century: a Once-in-a-lifetime Opportunity. Concord, CA: The Center for Health Design; 2004

10. Guidelines for Design and Construction of Health Care Facilities. American Institute of Architects, 2006 (www.aia.org)

11. Cunney R, Humphreys H, Murphy N, on behalf of the Strategy for the Control of Antimicrobial Resistance in Ireland Infection Control Subcommittee. Survey of acute hospital infection control resources and services in the Republic of Ireland. Journal of Hospital Infection 2006; 64: 63-68

12. Guidelines for Environment Infection Control in Health-Care Facilites. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). MMWR June 6, 2003/ Vol.52/ No. RR-10

13. Hoffman PN, Weinbren MJ, Stuart SA. A practical lesson in negative-pressure isolation ventilation. Journal of Hospital Infection 2004;57:345-6

14. Public Health Agency of Canada. Guidelines for preventing the transmission of tuberculosis in Canadian health care facilities and other institutional settings. Canadian Communicable Disease Report 1996; 22S1

15. Walker JT, Hoffman P, Bennett AM, Vos MC, Thomas M, Tomlinson N. Hospital and community acquired infection and the built environment: design and testing of infection control rooms. Journal of Hospital Infection 2007; 65 (suppl 2): 42-49

16. Negative pressure room study: enhancing airborne infection isolation capacity in Florida hospitals. Florida Hospital Association, July 2004 (www.fha.org)

17. Mueller Bartley J. APIC State-of-Art-Report: the role of infection control during construction in health care facilities. American Journal of Infection Control Volume 28, Number 2, 156

18. Scottish Health Facilities Note 30. Infection control in the built environment- design and planning. NHS Scotland, 2002

19. Health Facilities Notice 30: Infection control in the built environment. NHS Estates, 2003

Appendix 1: Scope and remit of Working Group

The HSE HCAI Governance Committee identified a need for national recommendations on provision of infection prevention and control infrastructure in hospitals in Ireland, particularly with reference to new hospital building projects and major refurbishment of existing hospitals. The SARI National Committee was therefore asked to convene a working group to produce appropriate recommendations.

Terms of reference

1: The Working Group is a subcommittee of the SARI National Committee
2: The Working Group will provide a set of draft recommendations to apply to all HSE acute healthcare institutions, to be ratified by the SARI National Committee and HSE HCAI Governance Committee
3: The specific tasks of the Working Group will be to:

a) Review current literature and recommendations relating to infection prevention and control aspects of physical infrastructure in hospitals and other healthcare institutions
b) Draft recommendations on ward layouts for new hospital buildings, or renovation of existing buildings, with particular reference to provision of single room accommodation and isolation facilities
c) Draft recommendations on inclusion of infection prevention and control requirements in the design, planning, execution and sign-off of new hospital building or renovation projects
d) Draft recommendations on what national or international guidance needs to be followed for all new hospital building or renovation projects

Membership

- Dr. Robert Cunney, Consultant Microbiologist, Childrens University Hospital Temple Street & Health Protection Surveillance Centre, Dublin (Chair)
- Professor Hilary Humphreys, Consultant Microbiologist, RCSI and Beaumont Hospital, Dublin
- Dr. Mary Hynes, Assistant National Director, HSE National Hospitals Office
- Mr Sean Mahon, Brian O'Connell and Associates Architects
- Mr Peter Ryan, Assistant National Director, HSE Estates.
- Ms. Marina Burd, Assistant Director of Nursing, Infection Prevention and Control, Tullamore General Hospital
- Dr Lynda Fenelon, Consultant Microbiologist, St Vincent's University Hospital, Dublin
- Ms Anne Daly, Nurse Planner, HSE Midlands Region

Appendix 2: Summary of literature review on single versus multiple occupancy patient rooms [6]

Category	Issues and findings	Single occupancy room*	Multiple occupancy room*
Cost	Operating costs	Decreased	Inconclusive
	Initial capital costs	Increased	Decreased
	Occupancy rates	Increased	Decreased
	Length of stay	Decreased	Increased
	Medication errors and costs	Decreased	Increased
Infection prevention and control	Rate of nosocomial infection	Decreased	N/A**
	Patient transfers	Decreased	Increased
	Patient length of stay	Decreased	Increased
	Infections in burns patients	Decreased	N/A
	HCV*** transmission between patients	Decreased	N/A
	Hospital-acquired diarrhoea	Decreased	Increased
Falls and accidents	Falls in patients requiring supervision	Increased	Decreased
	Falls in elderly when provisions are taken	Decreased	Decreased
	Access to bathrooms	N/A	Decreased
Hospital design and therapeutic impacts	Privacy	Increased	Decreased
	Pain medication	Inconclusive	Inconclusive
	Patient consultation with physician	Inconclusive	Inconclusive
	Patient preference for room design	Inconclusive	Inconclusive
	Noise level	Decreased	Increased
	Sleep disturbance	Decreased	Increased
	Patient satisfaction	Increased	Decreased
	Patient control	Increased	Decreased
	Crowding	Decreased	Increased
	Stress reduction through music	Increased	Decreased

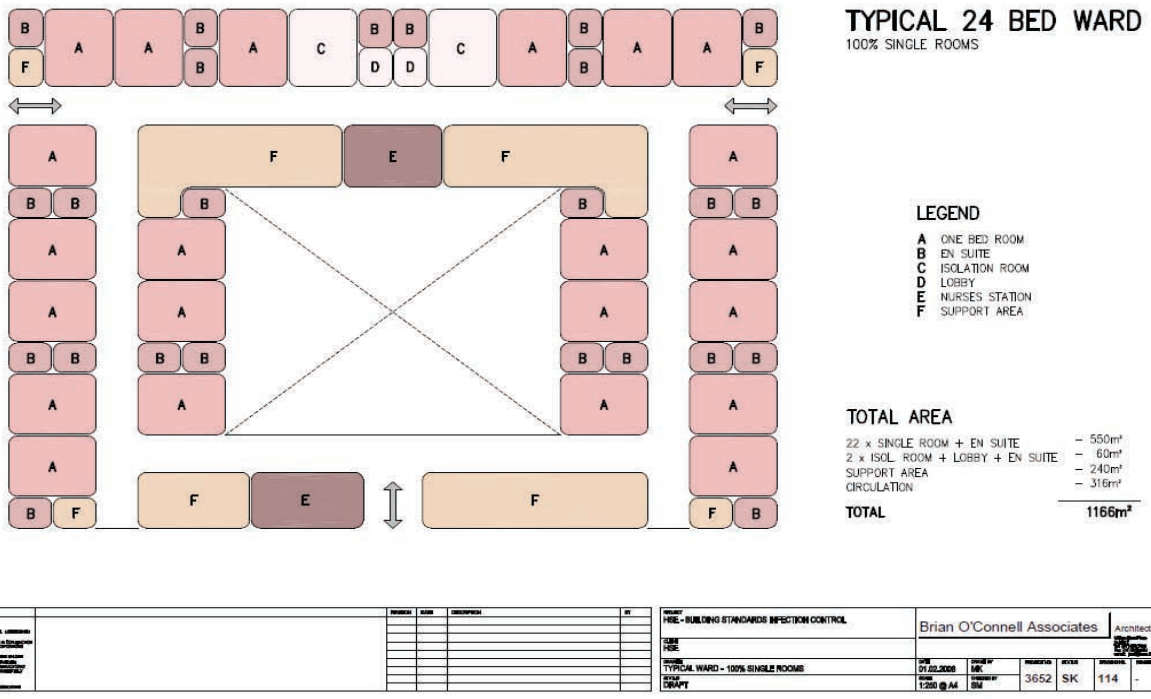
**Beneficial outcomes are underlined*

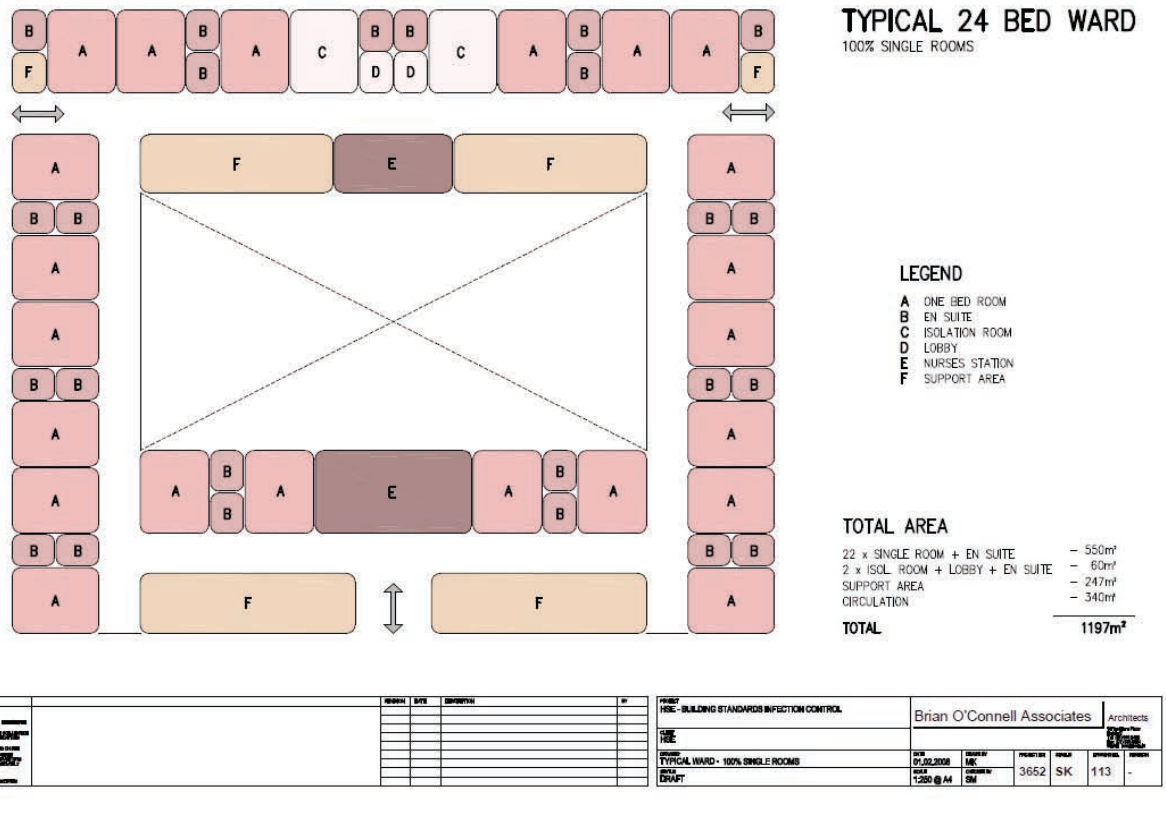
***N/A: not addressed*

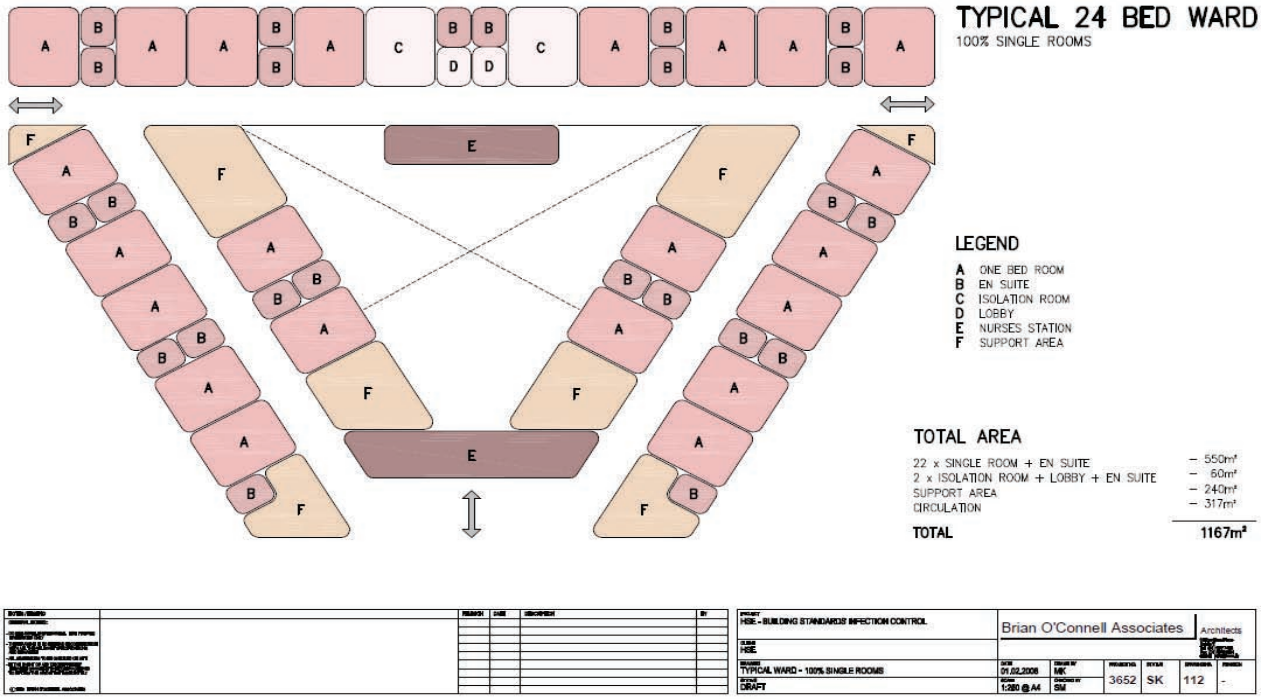
****Hepatitis C virus*

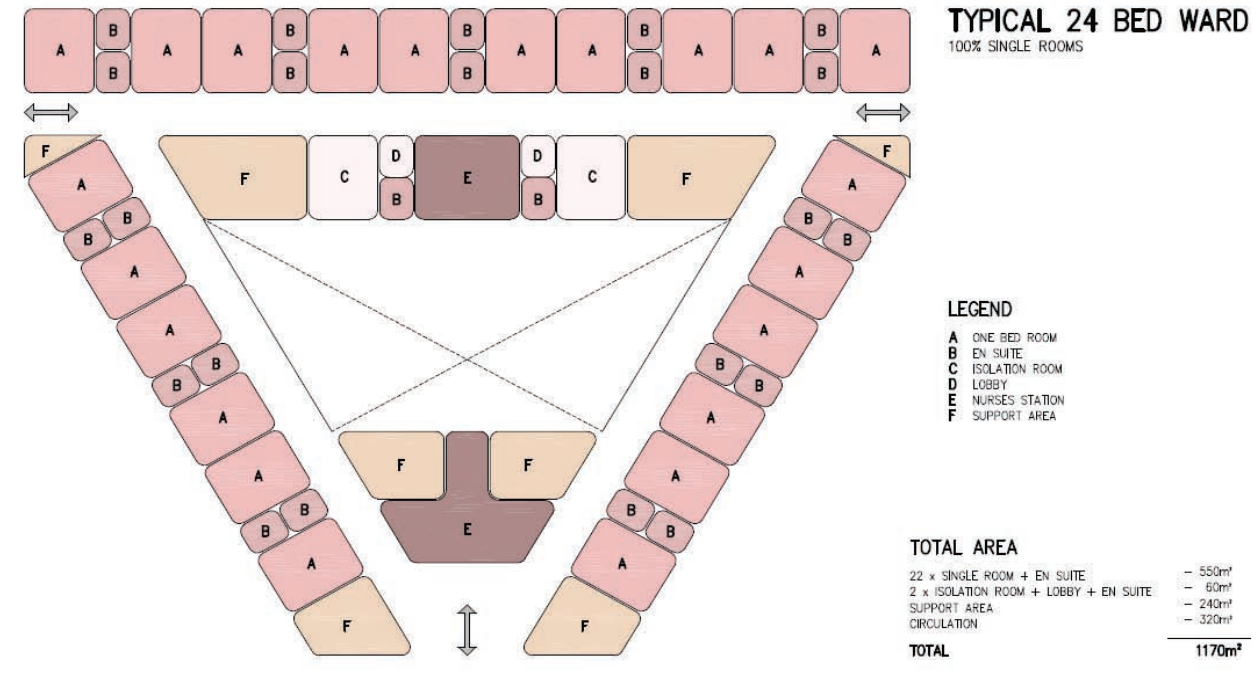
Appendix 3: Examples of ward layouts, comprising 100% single rooms, and single room designs

Note: the following drawings are diagrammatic or schematic only and are included for the purpose of illustration. They are not intended to be scaled or used as exact proposals.






TYPICAL 24 BED WARD
100% SINGLE ROOMS
LEGEND
A ONE BED ROOM
B EN SUITE
C ISOLATION ROOM
D LOBBY
E NURSES STATION
F SUPPORT AREA
TOTAL AREA
22 x SINGLE ROOM + EN SUITE – 550m²
2 x ISOLATION ROOM + LOBBY + EN SUITE – 60m²
SUPPORT AREA – 240m²
CIRCULATION – 317m²
TOTAL 1167m²
HSE - BUILDING STANDARDS INFECTION CONTROL
Brian O'Connell Associates Architects
TYPICAL WARD - 100% SINGLE ROOMS
DRAFT
3652
SK
112


TYPICAL 24 BED WARD
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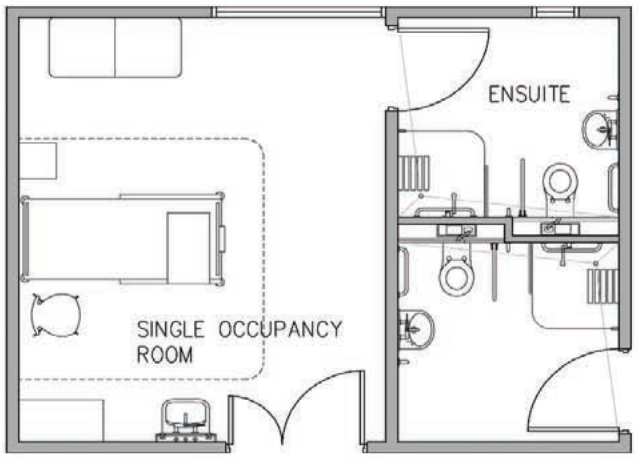
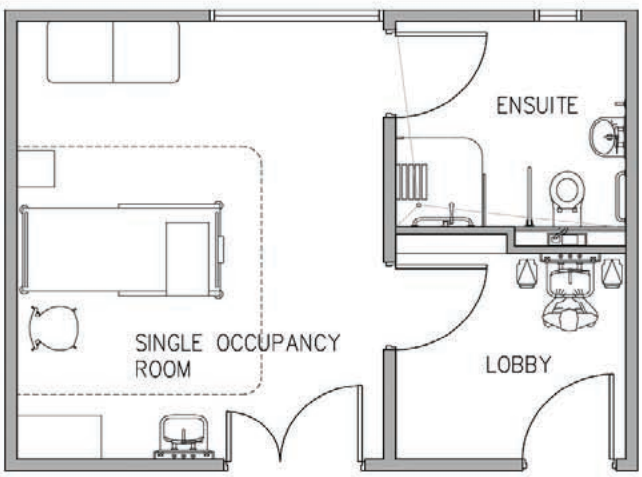
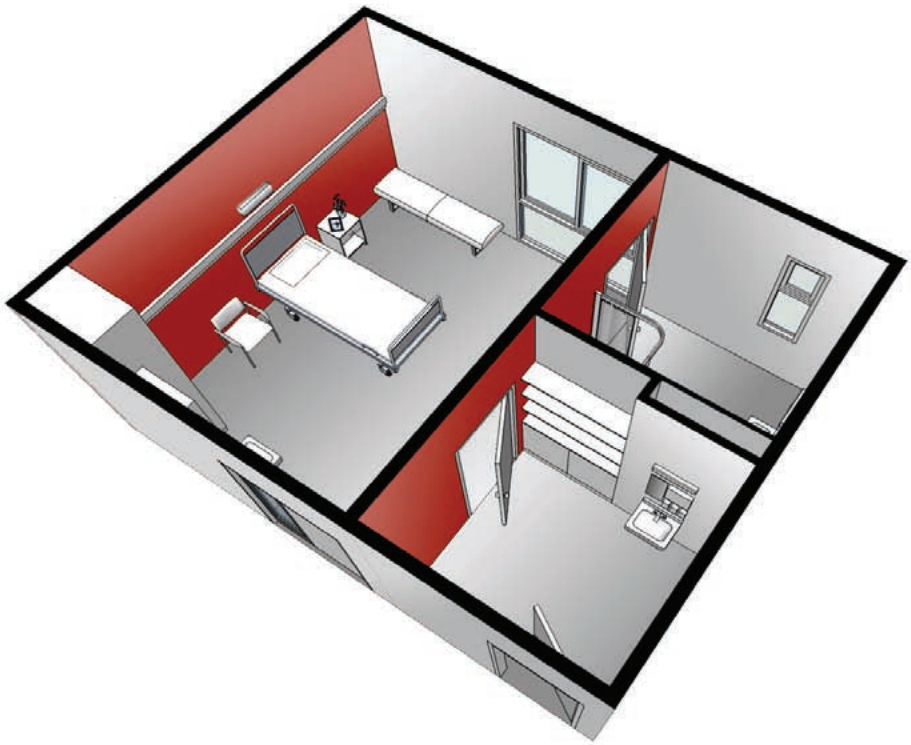
F SUPPORT AREA
TOTAL AREA
22 x SINGLE ROOM + EN SUITE – 550m²
2 x ISOLATION ROOM + LOBBY + EN SUITE – 60m²
SUPPORT AREA – 240m²
CIRCULATION – 320m²
TOTAL 1170m²
HSE - BUILDING STANDARDS INFECTION CONTROL
Brian O'Connell Associates Architects
TYPICAL WARD - 100% SINGLE ROOMS
DRAFT
3652
SK
111

Typical single room



Typical airbourne isolation room





Appendix 4: UK Health Building Notes and Health Technical Memoranda

Health Building Notes (HBNs) and Health Technical Memoranda (HTMs) were previously developed and published by NHS Estates. HBNs and HTMs are now developed by the UK Department of Health, and revised documents are published under new structures, detailed below.

New structure for HBNs
The new structure for HBNs will be rolled out over time as HBNs are updated.

The HBNs have been organised into a suite of 17 core areas. All HBNs are supported by the overarching HBN 00 in which the key areas of design and building are dealt with.

HBN 00 – Core elements
HBN 01 – Cardiac care
HBN 02 – Cancer care
HBN 03 – Mental health
HBN 04 – In-patient care
HBN 05 – Older people
HBN 06 – Diagnostics
HBN 07 – Renal care
HBN 08 – Long-term conditions/long-stay care
HBN 09 – Children, young people and maternity services
HBN 10 – Surgery
HBN 11 – Community care
HBN 12 – Out-patient care
HBN 13 – Decontamination
HBN 14 – Medicines management
HBN 15 – Emergency care
HBN 16 – Pathology

New structure for HTMs
The new structure for HTMs will be rolled out over time as HTMs are updated.
The structure will be as follows, with eight core subjects and one overriding HTM:

HTM 00 Policies and principles (applicable to all HTMs in this series)
HTM 01 Decontamination
HTM 02 Medical gases
HTM 03 Ventilation systems
HTM 04 Water systems
HTM 05 Fire safety
HTM 06 Electrical services
HTM 07 Environment and sustainability
HTM 08 Specialist services

Some subject areas may be further developed into topics shown as -01, -02 etc and further subdivided into Parts A, B etc.

All HTMs are supported by the initial document HTM 00, which embraces the management and operational policies from previous documents and explores risk management issues.

Current HBNs, published under new HBN structure

Series/No	Topic/title	ISBN	Published
HBN 00 Core elements			
-02	Sanitary spaces	978-0-11-322820-1	July 08
-04	Circulation and communication spaces	978-0-11-322784-6	June 07
-07	Resilience planning for the healthcare estate	978-0-11-322782-2	May 07
-08	Estatecode (supersedes 'Estatecode: essential guidance on estates and facilities management')	978-0-11-322783-9	May 07
HBN 04 In-patient care			
-01	Adult in-patient facilities	978-0-11-322795-2	July 08
HBN 07 Renal care			
-01	Satellite dialysis unit (supersedes HBN 53 Volume 1 'Satellite dialysis unit' (2004)	978-0-11-322814-0	Apr 08
-02	Main renal unit	978-0-11-322811-9	Feb 08
HBN 09 Children, young people and maternity services			
-02	Maternity care facilities	978-0-11-322824-9	Aug 08
HBN 10 Surgery			
-02	Day surgery facilities	978-0-11-322763-1	May 07
HBN 12 Out-patient care			
-01	Consulting, examination and treatment facilities Supp A: Sexual and reproductive health clinics	978-0-11-322796-9	March 08
HBN 14 Medicines management			
-01	Pharmacy and radiopharmacy facilities (supersedes 'Accommodation for pharmaceutical services')	978-0-11-322795-2	Aug 07
HBN 15 Emergency care			
-03	Hospital helipads	978-0-11-322785-3	Feb 08

Existing HBNs, published under previous structure

Series/No	Topic/title	ISBN	Published
HBN 4	In-patient accommodation – options for choice Supp 1: Isolation facilities in acute settings	978-0-11-322711-2	May 05
HBN 6	Vol 1 Facilities for diagnostic imaging and interventional radiology	978-0-11-322449-4	Nov 01
	Vol 2 Diagnostic imaging – PACS and specialist imaging	978-0-11-322588-0	July 03
	Vol 3 Extremity and open MRI, magnetic shielding and construction for radiation protection		Electronic version only
HBN 8	Facilities for rehabilitation services	978-0-11-322680-1	Oct 04
HBN 12	Out-patients department	978-0-11-322679-5	Nov 04
	Supp 2: Oral surgery, orthodontics, restorative dentistry	978-0-11-321405-1	Feb 93
	Supp 3: ENT and audiology clinics hearing aid centre	978-0-11-321745-8	Apr 94
	Supp 4: Ophthalmology	978-0-11-322245-2	May 96
HBN 13	Sterile services department (includes capacity planning tool)	978-0-11-322492-0	Oct 04
	Supp 1: Ethylene oxide sterilization section	978-0-11-321737-3	Apr 94
HBN 15	Facilities for pathology services (2nd ed)	978-0-11-322700-6	July 05
HBN 20	Facilities for mortuary and post-mortem room services (3rd ed)	978-0-11-322715-0	Apr 05
HBN 21	Maternity department	978-0-11-322246-9	Jul 96
HBN 22	Accident and emergency facilities for adults and children (2nd ed)	978-0-11-322702-0	Apr 05
HBN 23	Hospital accommodation for children and young people	978-0-11-322496-8	Jan 05

Series/No	Topic/title	ISBN	Published
HBN 26	Facilities for surgical procedures Vol 1 (supersedes previous 1991 edition)	978-0-11-322495-1	Oct 04
HBN 28	Facilities for cardiac services	978-0-11-322747-1	Dec 06
HBN 35	Accommodation for people with mental illness: Part 1 The acute unit	978-0-11-322248-3	July 96
	Accommodation for people with mental illness: Part 2 Treatment and care in the community	978-0-11-322128-8	Dec 98
HBN 37	In-patient facilities for older people	978-0-11-322704-4	Apr 05
HBN 40	Common activity spaces: Vol 1 Public areas	978-0-11-322184-4	Apr 95
	Common activity spaces: Vol 2 Treatment areas	978-0-11-322185-1	Apr 95
	Common activity spaces: Vol 3 Staff areas	978-0-11-322186-8	Apr 95
	Vol 4 has been replaced by HBN 00-04 Circulation and communication spaces Parts of Vols 1, 2 and 3 have been replaced by HBN 00-02 Sanitary spaces		
HBN 44	Accommodation for ambulance services	978-0-11-321710-6	Feb 94
HBN 52	Accommodation for day care: Vol 2 Endoscopy unit	978-0-11-321726-7	Apr 94
	Accommodation for day care: Vol 3 Medical investigation and treatment unit	978-0-11-322180-6	Mar 95
HBN 54	Facilities for cancer services (2nd ed)	978-0-11-322701-3	Apr 06
HBN 57	Facilities for critical care	978-0-11-322459-3	July 03

Current HTMs, published under new structure

Series/No	Topic/title	ISBN	Published
HTM 00	Best practice guidance for healthcare engineering	978-0-11-322754-9	Oct 06
HTM 01-01	Decontamination of reusable medical devices: Part A – Management and environment	978-0-11-322798-3	Oct 07
HTM 02-01	Medical gas pipeline systems: Part A – Design, installation, validation and verification	978-0-11-322742-6	May 06
	Medical gas pipeline systems: Part B – Operational management	978-0-11-322743-3	May 06
	Medical gas pipeline systems: Bacteria filter permit-to-work	978-0-11-322740-2	Aug 06
	Medical gas pipeline systems: Low hazard permit-to-work	978-0-11-322738-9	Aug 06
	Medical gas pipeline systems: High hazard permit-to-work	978-0-11-322739-6	Aug 06
HTM 03-01	Specialised ventilation for healthcare premises: Part A – Design and validation	978-0-11-322805-8	Nov 07
	Specialised ventilation for healthcare premises: Part B – Operational management and performance verification	978-0-11-322806-5	Nov 07
HTM 04-01	The control of Legionella, hygiene, "safe" hot water, cold water and drinking water systems – Part A: Design, installation and testing	978-0-11-322744-0	Oct 06
	The control of Legionella, hygiene, "safe" hot water, cold water and drinking water systems – Part B: Operational management	978-0-11-322745-7	Oct 06
HTM 06-01	Electrical services supply and distribution – Part A: Design considerations	978-0-11-322755-6	Feb 07
	Electrical services supply and distribution – Part B: Operational management	978-0-11-322756-3	Feb 07
HTM 06-02	Electrical safety guidance for low voltage systems	978-0-11-322757-0	Oct 06
	Electrical safety handbook	978-0-11-322759-4	Oct 06

Series/No	Topic/title	ISBN	Published
HTM 06-03	Electrical safety guidance for high voltage systems	978-0-11-322758-7	Oct 06
	Electrical safety guidance for high voltage systems: Sanction-for-test	978-0-11-322769-3	Nov 06
	Authorised person's logbook	978-0-11-322760-0	Oct 06
HTM 06-02/06-03 joint forms	Certificate of authorisation for live working	978-0-11-322770-9	Nov 06
	Permission for disconnection/interruption of electrical services	978-0-11-322775-4	Nov 06
	Isolation and earthing diagram	978-0-11-322771-6	Nov 06
	Limitation-of-access	978-0-11-322774-7	Nov 06
	Logbook and Permit-to-work	978-0-11-322804-1	Oct 07
	Permit-to-work	978-0-11-322772-3	Nov 06
	Safety programme	978-0-11-322773-0	Nov 06
HTM 06-02/06-03	Logbook and Permit-to-work pad pack	978-0-11-322804-1	Oct 07
	Permit-to-work	978-0-11-322772-3	Nov 06
	Safety programme	978-0-11-322773	Nov 06
HTM 07-01	Safe management of healthcare waste	978-0-11-322766-2	Nov 06
HTM 07-02	EnCO2de-making energy work in healthcare	978-0-11-322731-0	Jan 06
HTM 07-03	Transport management and car-parking	978-0-11-322729-7	Feb 06
HTM 07-05	The treatment, recovery, recycling and safe disposal of waste electrical and electronic equipment	978-0-11-322794-5	July 07
HTM 07-06	Disposal of pharmaceutical waste in community pharmacies	978-0-11-322797-6	Sept 07
HTM 08-01	Acoustics	978-0-11-322813-3	June 08
HTM 08-06	Pathology laboratory gas systems	978-0-11-322781-5	March 07

Existing HTMs, published under previous structure

Series/No	Topic/title	ISBN	Published
HTM 2005	Building management systems: Management policy	978-0-11-322754-9	Sep 96
	Building management systems: Design considerations	978-0-11-322240-7	Sep 96
	Building management systems: Validation and verification	978-0-11-322241-4	Sep 96
	Building management systems: Operational management	978-0-11-322242-1	Sep 96
HBN 2007 has been replaced by HTM 06-01			
HTM 2009	Pneumatic air tube transport system: Management policy	978-0-11-322192-9	Apr 95
	Pneumatic air tube transport systems: Design consideration and Good practice guide	978-0-11-322193-6	Apr 95
As the various parts of HTM 01 are progressively issued, they will supersede the component document of HTM 2010 Management policy has been replaced by HTM 01-01 Part A			
HTM 2010	Sterilization: Design considerations	978-0-11-322182-0	April 95
	Sterilization: Validation and verification	978-0-11-321746-5	April 95
	Sterilization: Good practice guide	978-0-11-322188-2	April 95
	Sterilization: Operational management (new edition) with Testing and validation protocols	978-0-11-322031-1	June 97
HBN 2011 has been replaced by HTM 06-01			
HBN 2014 has been replaced by HTM 06-01			
HTM 2015	Bedhead services: Management policy	978-0-11-321740-3	Mar 94
	Bedhead services: Design considerations	978-0-11-321771-7	Feb 95
	Bedhead services: Validation, verification and operational management	978-0-11-321770-0	Feb 95
HTM 2020 has been replaced by HTM 06-02			
HTM 2021 has been replaced by HTM 06-03			
HTM 2022	Supp 1: Dental compressed air and vacuum systems	978-0-11-322478-4	Jul 03
	Medical gas pipeline systems: Supp 2: Piped medical gases in ambulance vehicles	978-0-11-322052-6	Apr 97
HTM 2022 Medical gas pipeline systems: 'Design, installation, validation and verification' and 'Operational management' have been replaced by HTM 02-01			
HTM 2023	Access and accommodation for engineering services: Management policy	978-0-11-322195-0	Apr 95
	Access and accommodation for engineering services: Good practice guide	978-0-11-322194-3	Apr 95
HTM 2024	Lifts: Management policy	978-0-11-322210-0	Oct 95
	Lifts: Design considerations	978-0-11-322207-0	Oct 95
	Lifts: Validation and verification	978-0-11-322208-7	Oct 95
	Lifts: Operational management	978-0-11-322209-4	Oct 95
HTM 2025 has been replaced by HTM 03-01			
HTM 2027 has been replaced by HTM 04-01			
As the various parts of HTM 01 are progressively issued, they will supersede the component documents of HTM 2030 and HTM 2031 HTM 2030 Management policy has been replaced by HTM 01-01 Part A			
HTM 2030	Washer-disinfectors: Design considerations	978-0-11-322069-4	Oct 97
	Washer-disinfectors: Operational management	978-0-11-322070-0	Oct 97
	Washer-disinfectors: Validation and verification	978-0-11-322071-7	Oct 97
HTM 2031	Clean steam for sterilization	978-0-11-322033-5	May 95
HTM 2040 has been replaced by HTM 04-01			
HTM 2045 has been replaced by HTM 08-01			

HTM Building Components series

Series/No	Topic/title	ISBN	Published
HTM 54	User manual (3rd ed)	978-0-11-322689-4	Mar 05
HTM 55	Windows	978-0-11-322009-0	Jan 98
HTM 56	Partitions (3rd ed)	978-0-11-322714-3	Aug 05
HTM 57	Internal glazing (2nd ed)	978-0-11322709-9	Mar 05
HTM 58	Internal doorsets (2nd ed)	978-0-11-322710-5	Mar 05
HTM 59	Ironmongery (3rd ed)	978-0-11-322697-9	Apr 05
HTM 60	Ceilings (2nd ed)	978-0-11-322696-2	Mar 05
HTM 61	Flooring	978-0-11-322695-5	May 06
HTM 62	Demountable storage system (2nd ed)	978-0-11-322690-0	Mar 05
HTM 63	Fitted storage system (2nd ed)	978-0-11-322692-4	Mar 05
HTM 64	Sanitary assemblies (3rd ed)	978-0-11-322736-5	July 06
HTM 66	Cubicle curtain track	978-0-11-322691-7	Mar 05
HTM 67	Laboratory fitting out system (2nd ed)	978-0-11-322693-1	Mar 05
HTM 68	Duct and panel assemblies	978-0-11-321582-9	Nov 93
HTM 69	Protection (2nd ed)	978-0-11-322694-8	July 05

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