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National adult ICU/HDU isolation room accommodation survey 2018

Context

In 2017 the Minister for Health activated the Public Health Emergency Plan to address CPE (carbapenemase-producing enterobacteriaceae) in Ireland's health system. Accordingly, the National Public Health Emergency Team (NPHE) for Carbapenem-producing Enterobacteriaceae (CPE) is tasked with collating information concerning notifiable invasive CPE infection and CPE outbreaks and "the development and implementation of a strategy to contain CPE". In the context of Infection Prevention and Control initiatives in the ICU setting, CCP proposed a repeat survey to quantify adult ICU/HDU isolation room capacity in Ireland for critically ill patients. In June 2018 then, following a

teleconference 18/5/18 with HSE Infection Prevention and Control, a national survey of adult ICU/HDU isolation rooms and facilities was commenced. 26 Hospital ICU Directors completed the survey instrument (see Appendix) for their Hospitals' ICU/HDU isolation room facilities.

Theoretical background

In addition to effective hand hygiene and other effective Infection Prevention and Control IPC hygiene and decontamination practices, ICU/HDU isolation room capacity decreases transmission of bacteria including multi-resistant bacteria (MRB) among vulnerable critically ill patients. It is known hospital-acquired bacterial bloodstream infection has an attributable mortality of c. 15% in Ireland, with a higher attributable mortality for multi-resistant bacteria (M Brady et al, J Hosp Inf 2017). Similarly, ICU patients who acquire bloodstream infection from ICU-acquired bacteria inc. multi-resistant bacteria sustain increased mortality (Garrouste-Orgeas et al OUTCOMEREA, Clin Inf Dis 2006). Critically ill patients are vulnerable and are at high risk of increased mortality from bloodstream infection with ICU-acquired bacteria inc. multi-resistant bacteria. HSE/HPSC Infection Prevention and Control 2021 guidance recommends HEPA filtration, air ventilation systems and air flow control infrastructure in 'high risk areas' as follows –

“Filtration - An effective way to prevent infections is to control the source of pathogens. Heating, ventilation and air conditioning systems can be used to control the concentration of airborne particulates in high-risk areas, to minimise the risk of infection by means of air pressure, flow control and air filtration (the physical removal of particulates from air). The level of control should be proportional to the risk. In acute healthcare settings a commonly used approach to filtration is the high efficiency particulate air (HEPA) filter. There is evidence that there is a lower incidence of infection when immunocompromised and other highly vulnerable patients are housed in HEPA filtered isolation rooms. HEPA Filters must comply with relevant standards (Hahn T et al 2002).

Ventilation systems and air flow control - Optimal ventilation rates, air flow patterns and humidity can help to minimise the spread of infection. The ventilation rate is a measure used to control indoor air quality and in healthcare facilities is usually expressed as room air changes per hour. The peak efficiency for particle removal in the airspace often occurs between 12 ACH and 15 ACH. A study of 17 Canadian hospitals found that the risk of healthcare workers acquiring tuberculosis was strongly linked with exposure to infected patients in rooms with low ACH rates such as waiting areas (Menzies et al 2000).

Air flow direction is also important:

- *Negative pressure or neutral pressure is preferred for rooms housing people with airborne infections to prevent the dispersion of pathogen laden aerosols (examples include measles and chicken pox virus and M. tuberculosis). A review of 40 studies HSE Health Protection Surveillance Centre. www.hpsc.ie Page 257 of 345 concluded that there was strong evidence to support and recommend the use of negatively pressurised isolation rooms (Li et al 2007).*

- *Positive or Neutral pressure is desirable in the care of some immunocompromised people (for example some surgical patients, some people with underlying chronic lung disease or requiring haemodialysis, people who are profoundly neutropenic), to safeguard them from airborne pathogens and environmental spores entering from adjacent spaces”.*

HSE/HPSC Interim Guidance on Infection Prevention and Control for the Health Service Executive 2021 V1.3. 11.01.2021, p256-257

Findings

The 2018 ICU / HDU isolation room survey finds fifty-two percent (52%) of ICU / HDU capacity in Ireland has no air management (air exchanges) or treatment (HEPA filtration) isolation room capacity to decrease air-borne transmission of infection. This proportion has worsened since the prior survey in 2013. The prior 2013 survey found “Current isolation capacity in Irish critical care units is inadequate.” The 2018 survey shows ICU/HDU isolation room capacity in Ireland has worsened since the 2013 survey.

Recommendation

National Clinical Programme for Critical Care follows JFICMI National Standards 2019 recommendation, “The Intensive Care Unit – Minimum Requirements” (p10), which requires appropriate ICU/HDU facility isolation rooms and air filtration and air ventilation equipment and plant to meet up-to-date Infection Prevention and Control standards and guidances in ICU / HDU construction / retro-fit inc HSE/HPSC IPC and HBN 04-02 guidances –

“Infection Control standards need to be adhered to, with particular reference to the numbers of single rooms, neutral pressure rooms and airborne isolation rooms. The specialty case mix will help determine the numbers of airborne isolation rooms. Design and building standards and infection control standards as referenced below are subject to revision and up-dating. The HBN 04-02 and SARI guidelines are appropriate for 2019 and the most recent versions should be considered the standard of the day” - JFICMI National Standards 2019 - “The Intensive Care Unit – Minimum Requirements” (p10)

The appropriate ICU / HDU IPC construction standard today is provided in UK Department of Health building code, HBN 04-02 (published 2013) and is endorsed by UK ICS *Guidelines for the Provision of Intensive Care Services (GPICS)* 2013 (p22).

UK HBN 04-02 recommends –

“6.4 Single-bed rooms with lobbies are required for the isolation of patients to control the spread of infection or for the protection of immunosuppressed patients” and “6.6 The ventilation system should be designed to provide simultaneous source and protective isolation”. (p11).

As in JFICMI National Standards 2011- *“The specialty case mix will help determine the numbers of airborne isolation rooms”*. Hence local hospital Clinical Microbiology, Infectious Disease, Infection Prevention and Control and Intensive Care Medicine expertise in conjunction with National Clinical Programme Healthcare Associated Infection Antimicrobial Resistance (HCAI-AMR) Clinical Programme expertise and with Critical Care Programme will advise and determine the quantum and location of isolation capacity required during construction / retro-fit. The National Isolation Unit at Mater Hospital has specific Infection Prevention and Control and Intensive Care Medicine requirements for the management of patients with viral haemorrhagic fevers VHF.

References

Brady M, Oza A, Cunney R, Burns K; Attributable mortality of hospital-acquired bloodstream infections in Ireland; J Hosp Inf 2017.

Garrouste-Orgeas et al OUTCOMEREA Study Group; Excess Risk of Death from Intensive Care Unit– Acquired Nosocomial Bloodstream Infections: A Reappraisal; Clinical Infectious Diseases 2006;42:1118–26

Health Service Executive Critical Care Programme & Healthcare Associated Infection Clinical Programme; Survey of Hygiene & Healthcare Associated Infection Prevention Practices in Irish Critical Care Services- Report Version 2; February 2013

HSE/HPSC Interim Guidance on Infection Prevention and Control for the Health Service Executive 2021 V1.3. 11.01.2021, p256-257

Joint Faculty of Intensive Care Medicine of Ireland, National Standards for Critical Care Services 2019.

The Intensive Care Unit – Minimum Requirements (p10) UK Department of Health; Health Building Note HBN 04-02 Critical care units; 2013

UK Intensive Care Society; Guidelines for the Provision of Intensive Care Services; 2013

Appendix 1 - National adult ICU/HDU isolation room survey 2018 – Hospital returns

National Survey Adult ICU/HDU Infection Prevention and Control Isolation Rooms/ Facilities	Total number of ICU/HDU beds open/ operational	Total quantity of ICU/HDU bed-spaces closed/empty /non-operational	Total number of ICU/HDU beds and bed-spaces	Total number of open-plan open-floor beds/bed-spaces- No air management plant (No air filtration (HEPA)/ No air ventilation (12 air exchanges per hour))	Total number of open-plan open-floor beds/bed-spaces- Yes air management plant (Yes air filtration (HEPA)/ Yes air ventilation (12 air exchanges per hour))	Total number of cubicle/partition beds/bed-spaces- No air management plant (No air filtration (HEPA)/ No air ventilation (12 air exchanges per hour)) Ante-room with sink- No	Total number of cubicle/partition beds/bed-spaces- No air management plant (No air filtration (HEPA)/ No air ventilation (12 air exchanges per hour)) Ante-room with sink- Yes	Total number of Airborne Infection Isolation Rooms (AIIRs) with air management plant (Yes air filtration (HEPA)/ Yes air ventilation (12 air exchanges per hour))	Total number of Airborne Infection Isolation Rooms (AIIRs) with air management plant (Yes air filtration (HEPA)/ Yes air ventilation (12 air exchanges per hour))
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								WITH ante-room + sink	WITHOUT ante-room + sink
Dublin Midland Hospital Group									
StJames'	27	4	31	0	17	2 (Burns Unit)	0	12 (Comment 1)	
Portlaoise	3	0	3	3	0	0	0	0	0
Naas	4	0	4		3			1 (Comment 2)	
Tullamore	4	3	7	4	0	0	0	2	0
TUH	14	0	14	9	0	3	0	1	1
Ireland East Hospital Group									
Mater	29	7	36	0	0	25	10	1	
Navan	4	1	5	4	0	4	0	0	1
StVincent's	13	3	16	0	8	3	0	5	0
Mullingar	6	0	6	4	0	2	0	0	0
Kilkenny	4	0	4	4	0	3	0	0	0
Wexford	5	0	5	0	4 (Comment 3)	0	0	0	1

RCSI Hospital Group									
Beaumont	17	5	22	0	14	0	6	2	0
Drogheda	8	1	9	0	0	5	0	1	0
Cavan	4	1	5	4	0	0	0	1	0
Connolly	4	1	5	0	4	0	1	0	0
Saolta Hospital Group									
UHGalway	20	4	24	0	18	2	0	4	
Ballinasloe	5	1	6	0	3 (Comment 4)	0	0	0	5 (Comment 5)
Letterkenny	5	0	5	4	4	0	0	1	0
Castlebar	4	0	4	4	0	4	0	0	0
Sligo	5	0	5	3	0	1	0	1	0
South South West Hospital Group									
CUH- GICU	11	5	16	0	12	4	0	0	0
CUH- Cardiac ICU	6	14 (Comment 6)	20	0	10	0	6	0	4

Waterford	9	1	10	0	8 (Comment 7)	0	0	2	0
Mercy	5	1	6	4		2	0	0	0
Tralee	5	0	5	5	0	2	0	0	0
Clonmel	4	1	5	0	4	0	0	1	0
University Limerick Hospital Group									
UHL	17	11	28	0	0	0	0	13	15
Total	225	45	270	52	83	57	16	48	23

Appendix 2 2018 Survey instrument forwarded to 26 Acute Hospitals

National Survey of Adult ICU/HDU Infection Prevention and Control Isolation Rooms/Facilities	
Hospital name:	Name of unit (e.g. CT/ICU, HDU etc):
Name of ICU Director completing form:	Date of completion: __/__/__
Total number of ICU/HDU beds and bed-spaces in your unit (open/operational + closed/empty/non-operational) = Row A = Row B + Row C	
Total number of ICU/HDU beds open/operational = Row B	
Total number of bed-spaces closed/empty/non-operational = Row C	
Total number of open-plan open-floor beds/bed-spaces- No air management plant (No air filtration (HEPA)/ No air ventilation (12 air exchanges per hour)) = Row D	
Total number of open-plan open-floor beds/bed-spaces-	

<p>Yes air management plant (Yes air filtration (HEPA)/ Yes air ventilation (12 air exchanges per hour)) = Row E</p>	
<p>Total number of cubicle/partition beds/bed-spaces- No air management plant (No air filtration (HEPA)/ No air ventilation (12 air exchanges per hour)) Ante-room with sink- NO = Row F</p>	
<p>Total number of cubicle/partition beds/bed-spaces- No air management plant (No air filtration (HEPA)/ No air ventilation (12 air exchanges per hour)) Ante-room with sink- YES = Row G</p>	
<p>Total number of Airborne Infection Isolation Rooms (AIIRs) with air management plant (Yes air filtration (HEPA)/ Yes air ventilation (12 air exchanges per hour/ Yes positive and negative room pressure)) WITH ante-room + sink = Row H</p>	
<p>Total number of Airborne Infection Isolation Rooms (AIIRs) with air management plant (Yes air filtration (HEPA)/ Yes air ventilation (12 air exchanges per hour/ Yes positive and negative room pressure)) WITHOUT ante-room + sink = Row I</p>	
<p>Confirm Row A = Row B + Row C = Row D + Row E + Row F + Row G + Row H + Row I = Row A = Total number of ICU/HDU beds/bed-spaces in unit (open/operational + closed/empty/non-operational)</p>	Yes/No