



health

Department:
Health
REPUBLIC OF SOUTH AFRICA

2020

Emergency Intensive Care Units



Emergency ICU – Italy- March 2020

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INFRASTRUCTURE
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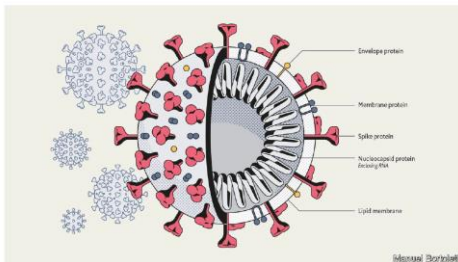


Commented [TL1]: Please do not use the picture of the Vickers transporter as there are only 5 in the country and if they see the picture they are going to think it must be used with Covid patients

1 OBJECTIVE

The objective of this document is to provide guidelines for emergency intensive care units (ICU) required to be built in anticipation of the surge in demand for critical care health services estimated due to the increased numbers of patients that will present with COVID-19 infection in the coming days/months.

Commented [TL2]: Build or established???



2 PATIENT CATEGORIES

Patients should be divided into 3 categories¹:

- Priority 1 : CRITICAL(5%) Intensive care beds(ICU) – Requires very high level of care
- Priority 2: SEVERE (15%) High Care – Not on a ventilator but still requires special care
- Priority 3 MILD/MODERATE (80%) – 10-15% of which still require hospital care and the balance can be accommodated without nursing care – but are COVID-19 infected and require isolation from the community

This document will focus on the ICU facilities required to care for Priority 1 patients (Critical) which comprise 5% of the total patient number.

Of the priority one patients, it is anticipated that, as the virus spreads and patients are admitted for treatment, the first wave of patients will be the elderly who are sick and have co-morbidities. They will require ventilation in an hospital ICU where they will need to be treated for various problems not just COVID-19 and therefore will require more than just ventilation. These patients will stay for as long as 10 days or more. Additional ICU beds will be required to treat the COVID-19 infected patients that are critical.

Commented [TL3]: 10-21 days ventilation

Commented [TL4]: Although current mainly adults are treated, facilities for pediatric patients need to be planned

A regimen will need to be developed to tend to all Priority 1 patients coming into ICU:

Commented [TL5]: See Ministerial Advisory Committee protocol and flowchart for ICU treatment

- The first type of Priority 1 ICU patients are those requiring treatment for more than just the COVID-19 infection will go to the hospital ICUs where they will be ventilated, have syringe drivers and there will be monitors to track their progress – these units must have skilled ICU staff to tend to these patients. The services in these facilities will require at least 2x oxygen outlets, 2 x medical air outlets, 2 x vacuum outlets and 14 plug sockets minimum.

¹ Right to Care : Additional Hospital Facilities

- The second type of Priority 1 patient is for the patient suffering from the COVID-19 virus and requires ventilation as well as a syringe driver to maintain sedation. Monitors are not necessarily required. Services should include 1 x oxygen outlet, 1 x medical air outlet (mounted side by side) and 1 x vacuum outlet. Here the patients will not necessarily be cared for by skilled ICU as they are already limited in number. Training of professional nurses and doctors will be required urgently to enable them to care for COVID-19 infected patients on ventilation.

Commented [TL6]: Must we not refer to this as high care with ventilation facilities?

Commented [TL7]: You think this is feasible?

3 SPACE ALLOCATION FOR A TEMPORARY EMERGENCY ICU

3.1 SIMPLIFICATION OF THE ICU PROVISION IN THE COVID-19 CRISIS

The Covid-19 pandemic is nasty because it affects so many different places at once, and it strikes at Health Care Workers in particular.

Accordingly planning must be for very reduced acuity of care during this pandemic, as there are not enough doctors to manage everyone at the ICU level normally found in the hospitals.

Therefore, for this emergency ICU focus should be purely on the provision of ventilatory capability.

This means:

- reduce the number of plugs
- No renal dialysis - rather transfer patients who warrant higher care to existing hospital ICUs
- Make extensive use of Point of Care testing to avoid a dedicated laboratory.

Commented [TL8]: If no medical air outlets are available ventilators with own compressors must be used

3.2 SPACE PROVISION

In a mass disaster where additional ICU beds are required, space norms have to be reduced as space is often limited and spaces utilized not always optimum. The following spaces are recommended. In the document, Disaster Medicine (L Wallis, W Smith), the following space requirements for ICU patients are proposed:

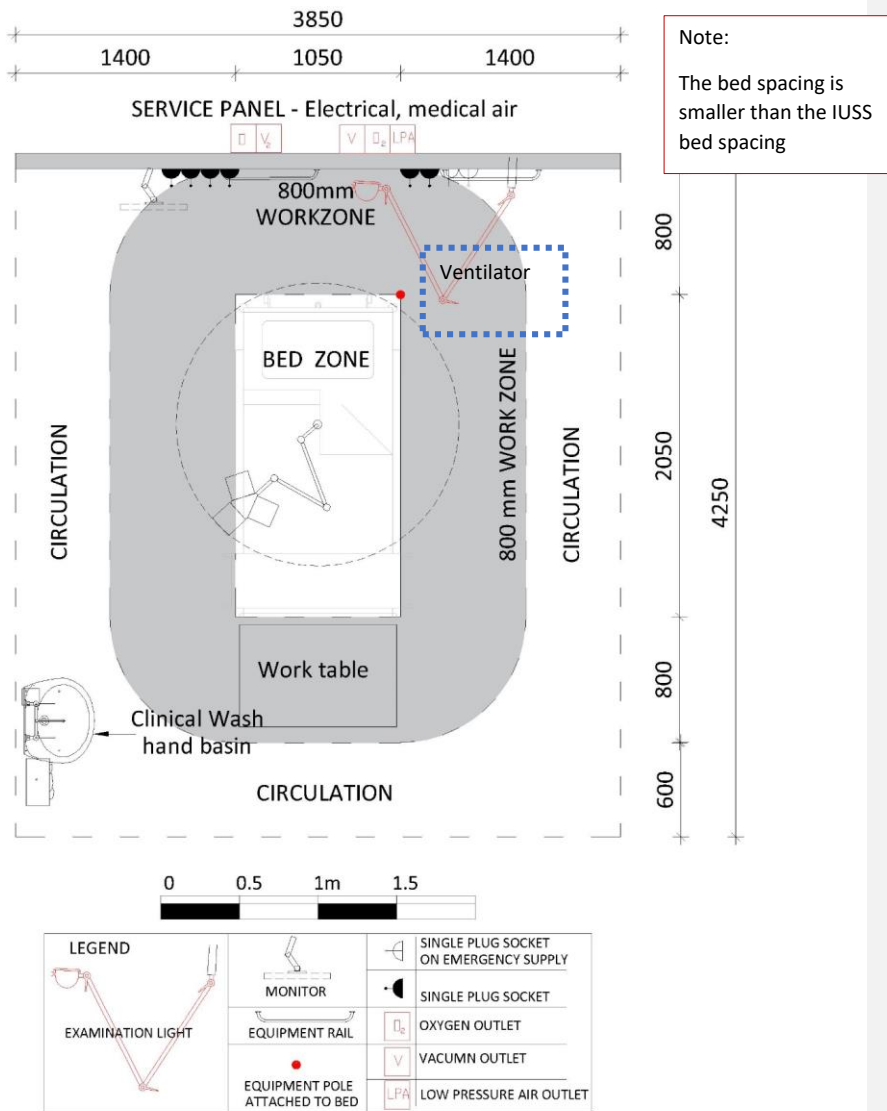
- MINIMUM
 - Patient module (per ICU bed) - 8 m²
 - Bed spacing 2.5m nose to nose (4m preferred)

The following diagram for the Patient ICU Module provides a space of **16,36m** (double the suggested above) but includes the circulation space around the work area around the patient's bed. This is slightly reduced when beds are aligned and share the 600mm wide circulation space (see the 6 bed unit drawing). A distance **between the ICU beds of 2,2m** (3,3m patient nose to patient nose) is recommended though this can be reduced in extreme cases to **1,6m**.

Commented [TL9]: Not in a communicable disease outbreak 2 m minimum

Refer to the drawings illustrating multiple ICU beds.

4 PATIENT ICU MODULE



The ICU patient module is required to support all necessary healthcare functions for the patient. The floor space allocated for each bed is to be sufficient to accommodate all equipment and personnel that might be necessary to meet patient care needs.

Area	Minimum proposed bed area 3,85m x 4,25 assuming a bed size of 1,05m x 2,05m
	Minimum ceiling height of 2,6m (3m preferred)
Finishes	Floors - vinyl Walls and ceilings - smooth painted washable PVA Doors - smooth, painted washable finish. Handles stainless steel. minimum opening into bed spaces 1500mm (1800mm preferred)

Table 13: Critical requirements per emergency ICU patient module

A	PATIENT MODULE	
1.0	SERVICES TO ICU PATIENT MODULE	
1.1	Bed head	Freestanding, wall mounted or ceiling mounted depending on what is available.
1.1.1	Electrical power- 8 unswitched socket outlets of 15 amps (2 on uninterruptible power supply if possible).	
1.1.2	Two oxygen outlets should be provided – where two are supplied, one on each side of the bed ²	
1.1.3	One medical air outlet – placed adjacent to oxygen	
1.1.4	One vacuum outlet	
1.1.5	Emergency nurse call system	
1.1.6	Examination light of good quality (for putting up drips, etc.)	
1.1.7	Perspex Sign with bed number & space to write patients name	
1.1.8	Equipment Rails On Bed Head To Support:	
	a	Multi-parameter patient monitor
	b	Infusion pump
	c	Syringe pump
	d	Ambu-bag
	e	HB monitor
	f	HGT monitor
2.0	VENTILATOR	Ventilation and humidification equipment (per patient in ICU)
		Ventilators should be positioned on the left, as the physician will be on patients' right-hand side.
	Respiratory parameters.	Each bedside station must have the capability of providing a continuous measure of arterial oxygen levels. Pulse oximetry and transcutaneous pO2 measurements are presently the preferred modalities of oxygen monitoring. End-tidal CO2 or transcutaneous pCO2 measurements may be used for carbon dioxide monitoring as needed. Respiratory rate monitoring should be available for patients at risk for apnea.

Commented [TL10]: If not available it may need to be substituted with multiplugs.

Commented [TL11]: If not available 2 X 4,8 kg oxygen cylinders with high pressure regulators.

Commented [TL12]: If no medical air is available, care should be taken to ensure ventilators with own compressors are used.

Commented [TL13]: If not available a electrical or battery-driven suction apparatus per bed

Commented [TL14]: Or a manual call device

Commented [TL15]: If not available a mobile light unit.

Commented [TL16]: If not available a whiteboard can be used

Commented [TL17]: If not available a washable steel shelf construction suitable to accommodate equipment

Commented [TL18]: Trade name – Bag-valve-mask unit

Commented [TL19]: Preferably

² L.Wallis, W.Smith. Disaster Medicine. Page 59

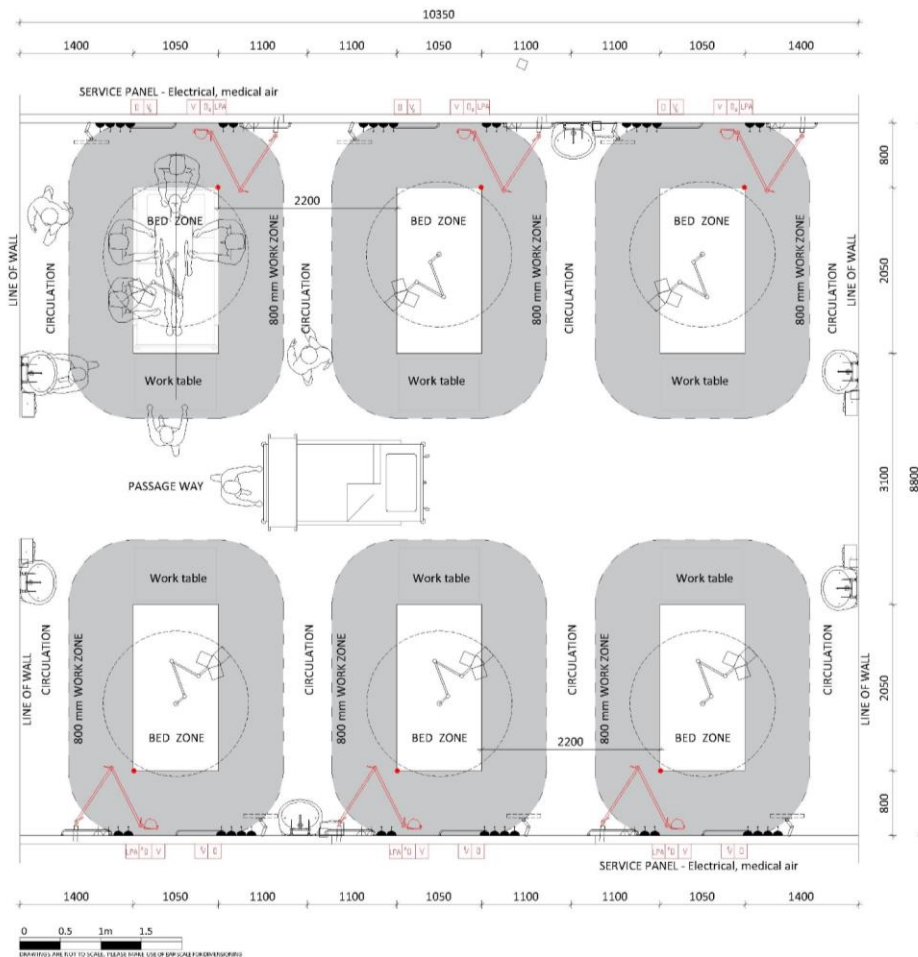
3.0	UPS available	Preferable all electrical power plugs should be connected to UPS support. However, if not possible, at least two plugs per bed to be on emergency backup power. UPS sockets should be colour-coded to differentiate them from one another.	
4.0	COMPUTER	Computerised charting where possible	
5.0	PRIVACY	Debateable whether to have perspex screens between beds - however, these could be used as patient chart board?	
6.0	CHART ON WHEELS	Clinical patient chart board on wheels should be provided	
7.0	ICU BED	ICU bed – assumed size ,05m x 2,05m	
8.0	BED LINEN	Sheets, pillows, pillow cases, draw sheets, cover sheets Linen – 1 rotation set per day per patient. 2 sets per bed	
NOTE			
Monitoring	<p>Bedside monitoring equipment should be located to permit easy access and viewing, and should not interfere with the visualization of or access to the patient. The bedside nurse and/or monitor technician must be able to observe the monitored status of each patient at a glance. This goal can be achieved either by a central monitoring station, or by bedside monitors that permit the observation of more than one patient simultaneously. Weight-bearing surfaces that support monitoring equipment should be sturdy enough to withstand high levels of strain over time.</p>		

Commented [TL20]: Not practical for temporary facilities

5 ICU BED UNIT REQUIREMENTS – 6 BED UNITS

The 6 bed unit diagram serves to illustrate the bed spacing between beds, side to side and foot of bed to foot of bed. Where space is available, these areas can be increased. The minimum is shown below.

Figure 14: Emergency ICU bed unit indicating multiple patient bed modules



ICU beds to be grouped into units preferable not exceeding 8.

Each unit to be treated as an isolation unit and must have an area for gowning immediately outside the entrance to the ICU bed unit in an ante room where staff can gownup or remove their gowns into bins.

Commented [TL21]: A red isolation area

Commented [TL22]: Yellow

Table 24: 6 bed ICU requirements

B	ICU BED UNIT	6 to 10 ICU Bed Units	
1.0	EQUIPMENT	Space for:	
1.1		Blood warmer (per ICU)	
1.2		Feeding pump (per ICU)	
1.3		Mobile X-Ray shared with other ICU bed units	
1.4		Trolleys	
1.5		Emergency trolley (Crash cart) - 2 per 6 bed unit	
1.6		Linen trolley	
1.7		Medical/surgical equipment - trolley or shelves	
1.8		Defibrillator	
1.9		Blood gas analyser	
2.0	CLINICAL HAND WASHING SINK	Hand-washing sinks deep and wide enough to prevent splashing, equipped with elbow taps, to be available near the entrances to patient modules, or between every two patients ICU bed units.	
3.0	MODULE ON WHEELS	With a clock, calendar, bulletin board (white board)	
4.0	X-Ray Viewing panel	Wall mounted	
5.0	CLINICAL WORK AREA	Writing/reporting area for clinical staff	
6.0	Fire protection	Accessible visible extinguisher (no sprinklers) should be provided.	
C ANTE ROOM			
1.0	PPE - area	Area to gown, mask and put head cover on at the entrance. Recommended outside isolation area. Set up a trolley	
2.0	Clinical wash hand basin	Clinical wash hand basin with elbow taps, soap dispenser, automatic towel dispenser and waste bin	
3.0	Shelf for clean PPE	450mm x 1000mm Stainless steel shelf fixed to wall at 1200mm AFFL.	
4.0	Bin for contaminated PPE	Bin for discarding gowns, caps and shoe covers when exiting the patient bed area.	
5.0		One ante room can serve several bed modules and can be used as a working area for the staff who are dedicated to the specific ICU bed unit	
NOTE			
ELECTRICAL		Electrical service to each ICU should be provided by a separate feeder connected to the main circuit breaker panel that serves the branch circuits in the ICU. The main panel should also be connected to an emergency power source that will quickly re-supply power in the event of power interruption. Each outlet or outlet cluster within an ICU should be serviced by its own circuit breaker in the main panel. It is critical that the ICU staff have easy access to the main panel in case power must be interrupted for an electrical emergency.	
		It is critical that the ICU staff have easy access to the main panel in case power must be interrupted for an electrical emergency	

Commented [TL23]: A bit high!!

Commented [TL24]: Debatable

Commented [TL25]: If not available mobile basin units with pumps can be positioned with clean and waste water receptacles

Commented [TL26]: Eich

Commented [TL27]: Or mobile

Commented [TL28]: See note above

Commented [TL29]: Or similar. We find the collapsible plastic shelf units work fantastic. I don't think you must specify wall mounted SS shelf – it will NOT be available in wards

Commented [TL30]: Is this practical for an emergency unit????

WATER		
	The water supply must be from a certified source. Zone stop valves must be installed on pipes entering each ICU to allow service to be turned off should line breaks occur.	
Temporary measures for electrical services	Where temporary facilities are to be erected, wiring can be passed through surface mounted pvc conduiting. This will be easy to remove when the area is decommissioned.	
	As an alternative to a purpose made bed head trunking, standard, off the shelf, power skirting can be utilized to carry the electrical wiring and plugs.	
OXYGEN, COMPRESSED AIR AND VACUUM		
	Centrally supplied oxygen and compressed air must be provided at 50 to 55 psi from main and reserve tanks	
	At least two oxygen outlets per patient are required. One compressed air outlet per bed is required. Connections for oxygen and compressed air outlets must occur by keyed plugs to prevent the accidental interchanging of gases	
	Manual shut-off valves must be located and identified in both areas to permit interruption of the supplies in case of fire, excessive pressure, or for repair purposes.	
	The vacuum system must maintain a vacuum of at least 290 mm Hg at the outlet farthest away from the vacuum pump. Audible and visual alarms must indicate a decrease in vacuum below 194 mm Hg (25).	
	Determine how this is to be supplied - system?	
Temporary measures for mechanical services	Medical gases can be surface mounted piping but must comply with the standard regulations.	
LIGHTING		
	General overhead illumination plus light from the surroundings should be adequate for routine nursing tasks, including charting and patient examination. A flexible examination light mounted on the wall is an option.	
ENVIRONMENTAL CONTROL		
	Suitable and safe air quality must be maintained at all times. A minimum of twelve total air changes per ICU patient room per hour are required, with two air changes per hour composed of outside air	
WASTE	The safe storage and disposal of clinical waste is essential Refuse – removal of general waste (domestic), pathological waste for incineration, recyclable waste and sharps	

Commented [TL31]: Ideally (You are not building a new unit!!!)

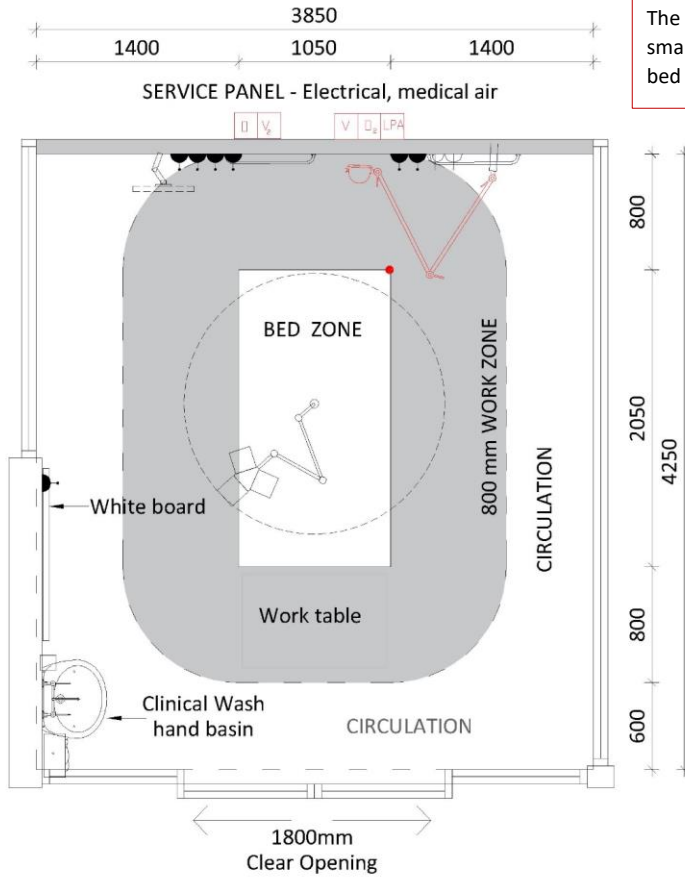
Commented [TL32]: If not available ventilators generating own pressure must be used.

Commented [TL33]: Cylinders can provide an alternative

Commented [TL34]: If not available electrical or battery driven vacuum units can be used.










6 PATIENT ICU ISOLATION

Single ICU isolation module



Note:

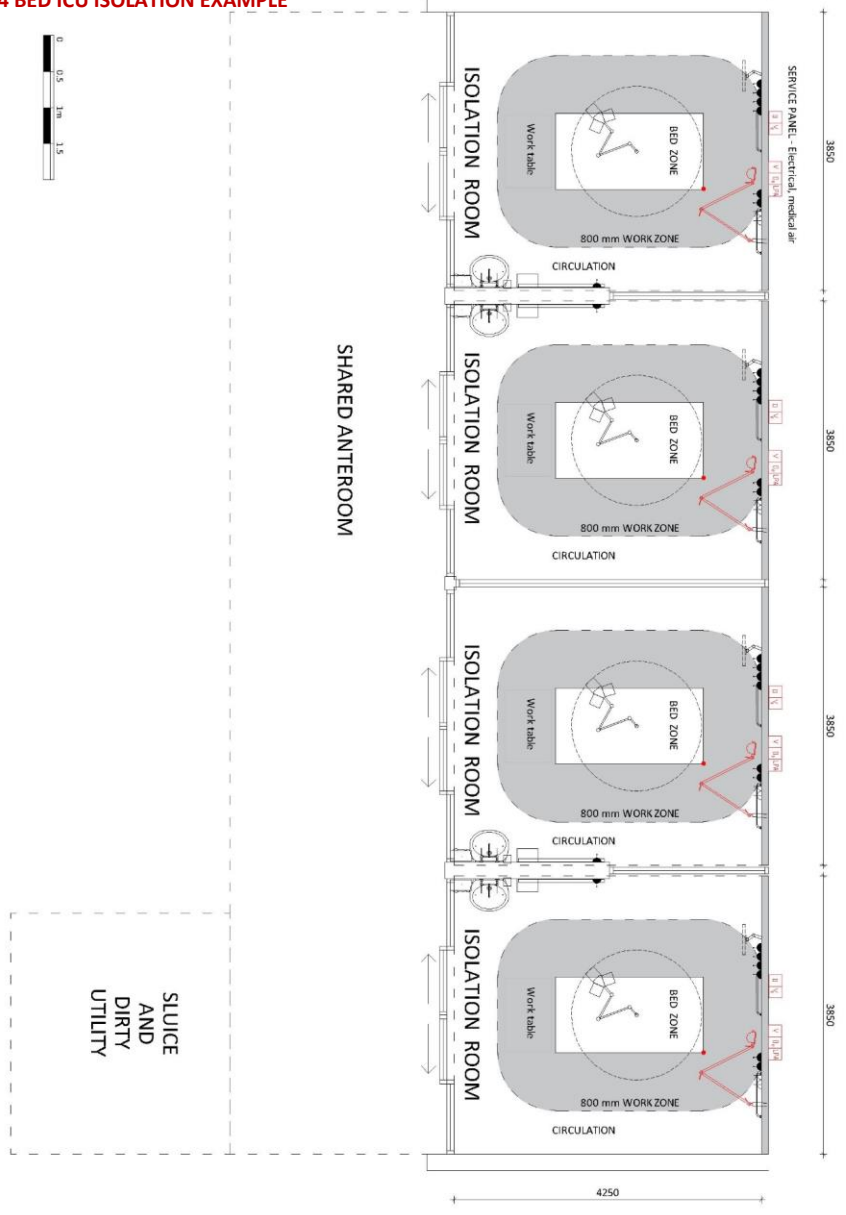
The bed spacing is smaller than the IUSS bed spacing

LEGEND		
		 SINGLE PLUG SOCKET ON EMERGENCY SUPPLY
		 SINGLE PLUG SOCKET
	 OXYGEN OUTLET	 VACUUM OUTLET
		 LOW PRESSURE AIR OUTLET

Area	Minimum proposed bed area 3,85m x 4,25 assuming a bed size of 1,05m x 2,05m
	Minimum ceiling height of 2,6m (3m preferred)
Finishes	Floors - vinyl Walls and ceilings - smooth painted washable PVA Doors - smooth, painted washable finish. Handles stainless steel. minimum opening into bed spaces 1500mm (1800mm preferred)

EMERGENCY INTENSIVE CARE UNITS

4 BED ICU ISOLATION EXAMPLE



7 SUPPORT SPACES FOR ICU

There are a number of critical support rooms that need to be close to the ICU or even off the ICU area.

These are tabled below.

Table 35: Table of support rooms for ICU

C SUPPORT SPACES			
1.0	SLUICE	Waste management systems in place - critical	
2.0	CLEAN UTILITY	Area required to prepare trolleys and to store essential medical/surgical sundries. This must have space to store medicines, medical surgical supplies and have a schedule drug cupboard mounted on the wall	
3.0	STORAGE	Consider mobile trolleys - medical/surgical supplies/medicine/consumables/linen. Space to charge equipment can be an equipment bay area with plugs and a shelf	
4.0 CLINICAL EQUIPMENT DECONTAMINATION AREA			
		Area to wash down beds and trolleys as well as the cleaning of clinical equipment. This is outside the unit	
5.0	EQUIPMENT PARKING BAYS	An open bay should be provided for the storage of mobile imaging equipment, with hanging space for protective lead aprons. An electrical socket outlet should be provided for charging equipment. Suitable wall brackets attached to a load bearing wall, or mobile stands, are required for this purpose.	
D STAFF AREAS			
1.0	STAFF ON-CALL ROOMS	On-call rooms should be available close to the ICU(s). Toilet and shower facilities should be provided. On-call rooms must be linked to the ICU(s) by telephone and/or voice intercommunication system. In addition, cardiac arrest/emergency alarms must be audible in these rooms.	
2.0	STAFF REST AREA	Rest area with kitchenette	
3.0	STAFF CHANGE	Change area with toilet and showers	
E ACCESS TO LABORATORY SERVICE			
		All ICUs must have available access to 24-hour clinical laboratory services. This must be established in the planning. Haematology testing, including arterial blood gas analysis.	

Commented [TL35]: Is this area practical in situation?

Commented [TL36]: I-Stat ????

8 ACKNOWLEDGMENTS

- 1.0 Specialist
 - 1.1 Dr Zane Farina – Greys Hospital and Edendale Hospital
 - 1.2 DR Andy Parish – Livingstone Hospital

9 REFERENCES

- 2.0 IUSS GUIDELINE documentation
- 3.0 Right to Care : Additional Hospital Facilities
- 4.0 L.Wallis, W.Smith: Disaster Medicine
- 5.0 Tanzib Hossain, MD, MSA, Marya Ghazipura, PhD(c), MSb, Jeffrey R. Dichter, MDc
Intensive Care Role in Disaster Management Critical Care Clinics
- 6.0 National Centre for Disease Control, India: COVID-19 Outbreak- Guidelines for Setting up
Isolation Facility/Ward
- 7.0 Australian Health Facility Guidelines: HPU 360 Intensive Care Unit
- 8.0 Randy S. Wax, Preparing the Intensive Care Unit for Disaster

10 ASSESSMENT SHEET

Below is an assessment sheet when going to site to inspect a facility for suitability or when planning the ICU.

ICU FACILITY ASSESSMENT						
Name of facility						
Physical Address						
Contact person						
Phone number						
Email address						
Alternative contact person						
Type of building						
Item	Description	Hospital	School	Residence	Hall	Other
1.0	Building Type					
2.0	Number of ICU beds					
	Are there any beds dedicated for COVID 19 infection already?	YES	NO			
	If Yes, Number of beds dedicated to COVID 19 cases?	YES	NO			
	Intensive care bed area – suitable?	YES	NO			
	Is the distance between beds in ICU more than 1.6 meter?	YES	NO			
	Appropriate ICU bed?	YES	NO			
3.0	Services to bed	Pendant		Bed Head		
	Oxygen – Number of outlets					
	Vacuum– Number of outlets					
	Low pressure air– Number of outlets					
	Electrical three pin sockets					
	Electrical sockets on emergency power supply					
	Equipment rail					
	Is the oxygen supply by cylinder or central connection?	cylinder	central			
4.0	Drip rail	YES	NO			
5.0	ICU bed	YES	NO			

EMERGENCY INTENSIVE CARE UNITS

6.0	Linen available	YES	NO	
7.0	ICU chart trolley	YES	NO	
8.0	Clinical wash hand basin	YES	NO	
9.0	Ante room – gowning area with PPE	YES	NO	
	Are there separate area for donning & doffing of PPE?	YES	NO	
	Hand washing facility & hand sanitizer available at donning & doffing areas	YES	NO	
	All ICU Staff received training in donning & doffing of PPE?	YES	NO	
10.0	Are there any separate Ventilators, nebulizers, Infusion pumps in ICU?	YES	NO	
11.0	Adequate supply of masks, ET tubes, PPE kits available at ICU?	YES	NO	
12.0	Staff change facilities – separate male and female	YES	NO	
13.0	Clean utility area	YES	NO	
14.0	Storage – Linen/ Med-Surgical Consumables / Medicine/Equipment	YES	NO	
15.0	Sluice	YES	NO	
16.0	Waste disposal area internal	YES	NO	
17.0	Waste disposal area external	YES	NO	
18.0	Staff rest and toilet facilities	YES	NO	
19.0	Staff sleeping – on call	YES	NO	
	Staff sleeping – off duty	YES	NO	
20.0	Bulk service availability	YES	NO	
21.0	Water	YES	NO	
22.0	Electricity	YES	NO	
23.0	Mechanical air – air conditioning/fans	YES	NO	<i>Negative pressure important</i>
24.0	How can medical gases be supplied?			
	Oxygen			
	Vacuum			
	Low pressure air			
23.0	Number of working ventilators			
24.0	Laboratory access	YES	NO	

Commented [TL37]: Is this practical to expect

C	HUMAN RESOURCES	Required	Available	Training Required	Area working	Comment
3.0	Clinical					
	Specialists					
	Doctors					
	Specialist ICU professional nurses					
	Professional Nurses					
	Nursing assistants					
	Other medical staff					
4.0	Support					
	Cleaner					
	Waste removal staff					
	Catering staff					
	Security					
	Admin					
	Volunteers					
	Technicians					
	Other					

11 EQUIPMENT LIST