

SUPPLEMENT

ORGANISATION AND FINANCING OF INTENSIVE CARE SERVICES IN BELGIUM



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Reported interests: All experts and stakeholders consulted within this report were selected because of their involvement in the organisation and financing of intensive care. Therefore, by definition, each of them might have a certain degree of conflict of interest to the main topic of this report.

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- The external experts were consulted about a (preliminary) version of the scientific report. Their comments were discussed during meetings. They did not co-author the scientific report and did not necessarily agree with its content.
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1 APPENDIX TO CHAPTER 5

1.1 Instruments

NURSING ACTIVITIES SCORE (NAS)

NAS_DATE

Date of registration

SHIFT GROUP (CODE_SHIFT_DUUR)

The most common organization of shifts within 24 hours:

8h+8h+8h

12h+12h

NAS Points Morning Shift (NAS_morning_CALC)

Score ranging from 0 to 170 for the morning shift

NAS Points Afternoon Shift (NAS_afternoon_CALC)

Score ranging from 0 to 170 for the afternoon shift

NAS Points Night Shift (NAS_night_CALC)

Score ranging from 0 to 170 for the night shift

Each of the following items is scored per shift:

ITEM 1 Monitoring and titration (CODE_NAS: NAS1)

Patients requiring normal monitoring of vital signs according to ICU routine. Monitoring includes the use of assessment scales, fluid balance monitoring (including nasogastric and nasoenteral tubes) requiring regular treatment adjustments, therapy or monitoring intensification. It also includes assisted oral feeding. The reason for extended monitoring is secondary to the time allocated for it.

0. None (SCORE_NAS: '0'; WEIGHT_NAS: '0')
1. Regular monitoring (every 2h) of vital parameters and nutrition Every 2 hours: parameter check, urine output, ventilation, standard control of gastric or enteral tubes, gastrostomy without frequent treatment adjustments, no increased monitoring (SCORE_NAS: '1'; WEIGHT_NAS: '4.5')
2. Bedside presence required or actively engaged > 2h/shift Frequent bedside presence needed for safety, severity, treatment (with patient stabilization) (SCORE_NAS: '2'; WEIGHT_NAS: '12.1')
3. Bedside presence required or actively engaged > 4h/shift Continuous bedside presence needed for safety, severity, treatment (without patient stabilization) (SCORE_NAS: '3'; WEIGHT_NAS: '19.6')

ITEM 2 Laboratory (CODE_NAS: NAS2)

Patients undergoing biochemical or microbiological tests (e.g., arterial, venous, or capillary blood sampling) regardless of frequency, performed at the bedside by a nurse.

0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '4.3')

ITEM 3 General Medication (CODE_NAS: NAS3)

Patients receiving any type of medication, regardless of administration method and dose. Vasoactive drugs are scored in a separate category.

0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')



1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '5.6')

ITEM 4 Hygiene Procedures (CODE_NAS: NAS4)

Performing hygiene-related procedures such as wound dressing, intravascular catheters, linen changes, patient washing, incontinence care, vomiting, burns, leaking wounds, complex surgical dressings with irrigation, and special procedures (e.g., for obese patients).

0. None (SCORE_NAS: '0'; WEIGHT_NAS: '0')
1. Hygiene care < 2h/shift (SCORE_NAS: '1'; WEIGHT_NAS: '4.1')
2. Hygiene care > 2h/shift (SCORE_NAS: '2'; WEIGHT_NAS: '16.5')
3. Hygiene care > 4h/shift (SCORE_NAS: '3'; WEIGHT_NAS: '20')

ITEM 5 Drains (except gastric tube) (CODE_NAS: NAS5)

Patients with any type of drain or tube used for drainage (including long-term catheter, External Ventricular Drain (EVD), thoracic drainage, excluding gastric tube).

0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '1.8')

ITEM 6 Mobilization and Positioning (CODE_NAS: NAS6)

Mobilization and repositioning (e.g., turning the patient, moving from bed to chair, lifting immobile patients in traction or prone position).

0. None (SCORE_NAS: '0'; WEIGHT_NAS: '0')
1. Up to 3 times per 24h (SCORE_NAS: '1'; WEIGHT_NAS: '5.5')
2. More than 3 times per 24h or with two nurses (SCORE_NAS: '2'; WEIGHT_NAS: '12.4')
3. Performed with at least three nurses (SCORE_NAS: '3'; WEIGHT_NAS: '17')

ITEM 7 Support for Patient or Family (CODE_NAS: NAS7)

Support for patients and families, including phone calls, interviews, counselling, communication during hygiene procedures, communication with family during visits or care, and patient observation. 0. None or < 1h/shift (SCORE_NAS: '0'; WEIGHT_NAS: '0')

0. None (SCORE_NAS: '0'; WEIGHT_NAS: '0')
1. Support for patient or family > 1h/shift (SCORE_NAS: '1'; WEIGHT_NAS: '4')
2. Support for patient or family > 2h/shift (SCORE_NAS: '2'; WEIGHT_NAS: '32')

ITEM 8 Administrative and Managerial Tasks (CODE_NAS: 'NAS8')

Administrative and managerial tasks depending on duration

0. None (SCORE_NAS: '0'; WEIGHT_NAS: '0')
1. Standard administrative tasks (e.g., processing clinical data, planning examinations, professional exchange of information...) (SCORE_NAS: '1'; WEIGHT_NAS: '4.2')
2. Administrative tasks for 2 hours per shift (e.g., research activities, admission and discharge procedures...) (SCORE_NAS: '2'; WEIGHT_NAS: '23.2')
3. Administrative tasks for 4 hours per shift (e.g., death and organ donation procedures, coordination with other disciplines...) (SCORE_NAS: '3'; WEIGHT_NAS: '30')

ITEM 9 Respiratory Support (CODE_NAS: 'NAS9')

Mechanical ventilation: any form of mechanical ventilation, including assisted ventilation with or without positive end-expiratory pressure (PEEP), with or without muscle relaxants, and spontaneous breathing with PEEP. Additional respiratory support: spontaneous breathing with positive end-

expiratory pressure (e.g., CPAP or BiPAP), with or without an endotracheal tube. Supplemental oxygen provided by any method, except when mechanical ventilation parameters are applied.

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '1.4')

ITEM 10 Care of Artificial Airways (CODE_NAS: 'NAS10')

An endotracheal intubation is performed through the mouth (orotracheal intubation), nose (nasotracheal intubation), or percutaneously (tracheotomy).

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '1.8')

ITEM 11 Treatment for Improving Lung Function (Aerosol/Suction/Triflo) (CODE_NAS: 'NAS11')

Treatment to improve lung function. Examples include pulmonary physiotherapy, incentive spirometry, inhalation therapy...

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '4.4')

ITEM 12 Vasoactive Medication (CODE_NAS: 'NAS12')

Patients who have received vasoactive medication, regardless of type and dose. Examples of vasoactive medication include epinephrine, dopamine, beta-blockers...

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '1.2')

ITEM 13 Intravenous Replacement of Large Fluid Losses (CODE_NAS: 'NAS13')

Patients who have received more than 4.5 liters of fluid per day, regardless of the type of fluid administered.

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '2.5')

ITEM 14 Left Atrium Monitoring (Swan-Ganz) (CODE_NAS: 'NAS14')

Patients using a pulmonary artery catheter (Swan-Ganz catheter). (Includes the use of a pacemaker, intra-aortic balloon pump, cardiac output monitoring, extracorporeal membrane oxygenation (ECMO), ventricular assist devices.)

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '1.7')

ITEM 15 Cardiopulmonary Resuscitation (CPR) (CODE_NAS: 'NAS15')

Patients who had a cardiac event and underwent cardiopulmonary resuscitation, regardless of the environment where the cardiac arrest occurred. This item can only be scored once every 24 hours.

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '7.1')

ITEM 16 Continuous Veno-Venous Hemofiltration (CVVH) (CODE_NAS: 'NAS20')

The presence of CVVH (a renal replacement therapy).

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '7.7')

**ITEM 17** Quantitative Urine Output Measurement (CODE_NAS: 'NAS18')

Quantitative measurement of urine production (e.g., via bladder catheter).

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '7')

ITEM 18 Intracranial Pressure Measurement (CODE_NAS: 'NAS21')

Patients subjected to intracranial pressure monitoring (measurement of intracranial pressure & external ventricular drainage).

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '1.6')

ITEM 19 Treatment of Complicated Metabolic Acidosis/Alkalosis (CODE_NAS: 'NAS19')

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '1.3')

ITEM 20 Intravenous Hyperalimentation or Total Parenteral Nutrition (TPN) (CODE_NAS: 'NAS16')

Patients receiving peripheral or central venous infusion with parenteral nutrition.

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '2.8')

ITEM 21 Enteral Feeding Through Gastric Tube (CODE_NAS: 'NAS17')

Patients receiving tube feeding via direct administration of nutrition into the stomach or intestines. Measurements of aspiration and retention are included.

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '1.3')

ITEM 22 Specific Intervention(s) in the Intensive Care Unit (CODE_NAS: 'NAS22')

Specific interventions in the ICU, such as naso- or orotracheal intubation, pacemaker insertion, cardioversion, endoscopy, insertion of arterial and central venous catheters, and gastric lavage. Routine interventions without impact on the patient's clinical condition, such as X-rays, ultrasounds, Swan-Ganz catheter placement, pacing catheter placement, nasogastric tube insertion, peripheral IV insertion, and bladder catheter insertion, are not included.

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '2.8')

ITEM 23 Specific Interventions Outside the Intensive Care Unit: Surgery or Diagnostic Procedures (CODE_NAS: 'NAS23')

Specific interventions outside the ICU, such as surgical and diagnostic procedures (preparing the patient for transport for examinations/procedures, admission/discharge, and death).

- 0. NO (SCORE_NAS: '0'; WEIGHT_NAS: '0')
- 1. YES (SCORE_NAS: '1'; WEIGHT_NAS: '1.9')

1.2 Content mapping VG-MZG / DI-RHM – NAS

Label	VG-MZG / DI-RHM	NAS
Monitoring	V300 - Monitoring of biological vital parameters: discontinuous monitoring (frequency of the most discontinuously measured parameter) V400 - Monitoring of biological vital parameters: continuous monitoring (number of different parameters continuously monitored, max 13) I100 - Monitoring of neurological function	1. Monitoring and titration
Laboratory	N300 - Venous blood sampling (number of sampling moments) N400 - Arterial blood sampling (number of sampling moments) N500 - Capillary blood sampling (number of sampling moments) V500 - Collection of tissue or organic material samples (number of samples taken)	2. Laboratory, biochemical investigations
Medication	H100 - Administration of medication via IM/SC/ID route (number of different administered medications) H200 - Administration of medication via IV route (number of different administered medications) H500 - Administration of medication via vaginal/anal route (number of different administered medications)	3. Medication, vasoactive drugs excluded
Hygiene (small)	F100 - Hygiene care	4. Hygiene procedures
Hygiene (broad)	F100 - Hygiene care L100 - Monitoring of a wound and/or areas with skin lesions and/or a dressing and/or used material without performed care (total score is calculated by adding the number of wounds monitored, the number of areas with skin lesions monitored) L200 - Care of wounds with sutures and/or insertion sites with material present (total score is calculated by determining the number of independent wounds of this type, determining the frequency of care for each wound, summing all scores) L300 - Simple care of an open wound (total score is calculated by determining the number of independent wounds of this type, determining the frequency of care for each wound, summing all scores) L400 - Complex care of an open wound (total score is calculated by determining the number of independent wounds of this type, determining the frequency of care for each wound, summing all scores) L500 - Care of skin lesions (total score is calculated by determining the number of independent wounds of this type, determining the frequency of care for each wound, summing all scores)	4. Hygiene procedures



Drains	G200 - Care related to the monitoring of an evacuating drain (1 present) N200 - Care and/or monitoring of a used access port (number of used access ports)	5. Care of drains, all (except gastric tube)
Mobilization	V100 - Pressure ulcer prevention: use of dynamic anti-decubitus materials (1 present) V200 - Pressure ulcer prevention: repositioning (number of repositioning instances)	6. Mobilisation and positioning, including procedures
Respiratory support	K200 - Improving breathing: supportive measures K300 - Improving ventilation: artificial ventilation	9. Respiratory support
Artificial ventilation	K200 - Improving breathing: supportive measures; score 2 . An endotracheal tube or laryngeal mask; score 3 . A tracheal or transtracheal cannula K300 - Improving ventilation: artificial ventilation	10. Care of artificial airways
Lung function	H400 - Administration of medication via inhalation (number of different administered medications) K100 - Airway aspiration (1 present)	11. Treatment for improving lung function
PAC	N500 - Capillary blood sampling (number of sampling moments) N600 - Monitoring of electrical cardio-circulatory support (1 present)	14. Left atrium monitoring: pulmonary artery catheter
Dialysis	M100 - Thermoregulation management; score 3 . Temperature regulation via specific techniques: body cavity lavage, extracorporeal warming (continuous veno-venous hemofiltration, heart-lung machine, etc.)	16. Hemofiltration techniques, dialysis techniques
Urine	G100 - Monitoring of nutritional or fluid balance; score 3 . Complete urine output: at least two measurements and a total	17. Quantitative urine output measurement
Intracranial pressure	I200 - Monitoring of intracranial pressure or drainage	18. Measurement of intracranial pressure
Parenteral nutrition	D400 - Care related to the monitoring of total parenteral nutrition (TPN) (1 present)	20. Intravenous hyperalimentation
Enteral nutrition	D300 - Care related to the administration of enteral feeding via a tube (1 present)	21. Enteral feeding through gastric tube
Specific intervention	Z200 - Assistance with non-delegable invasive medical procedures (number of times assistance was provided during non-delegable invasive procedures)	22. Specific intervention(s) in the intensive care unit

2 APPENDIX TO CHAPTER 6

Table 1 – Mapping of Clinical Classifications Software Categories, diagnosis groups and aggregate diagnosis groups

Clinical Classification Software (CCS) category		Diagnosis group		Aggregate diagnosis group	
No	Label	No	Label	No	Label
1	Tuberculosis (TBC)	1	Tuberculosis	1	Infectious and parasitic diseases
2	Septicaemia (except in labour)	2	Septicaemia (except in labour)		
3	Bacterial infection; unspecified site	3	Bacterial infection; unspecified site		
4	Mycoses	4	Mycoses		
5	HIV infection	5	HIV infection		
6	Hepatitis	6	Hepatitis, viral and other infections		
7	Viral infection				
8	Other infections; including parasitic				
9	Sexually transmitted infections (STD) (not HIV or hepatitis)				
10	Immunizations and screening for infectious disease				
11	Cancer of head and neck	7	Cancer of head and neck	2	Neoplasms
12	Cancer of oesophagus	8	Cancer of oesophagus		
13	Cancer of stomach	9	Cancer of stomach		
14	Cancer of colon	10	Cancer of colon		
15	Cancer of rectum and anus	11	Cancer of rectum and anus		
16	Cancer of liver and intrahepatic bile duct	12	Cancer of liver and intrahepatic bile duct		
17	Cancer of pancreas	13	Cancer of pancreas		
18	Cancer of other GI organs; peritoneum	14	Cancer of other GI organs; peritoneum		
19	Cancer of bronchus; lung	15	Cancer of bronchus; lung		
20	Cancer; other respiratory and intrathoracic	16	Cancer; other respiratory and intrathoracic		
21	Cancer of bone and connective tissue	17	Cancer of bone and connective tissue		
22	Melanomas of skin	18	Melanomas of skin and other non-epithelial cancer of skin		
23	Other non-epithelial cancer of skin	19	Cancer of breast		
24	Cancer of breast	20	Cancer of uterus		
25	Cancer of uterus	21	Cancer of cervix and other female genital organs		
26	Cancer of cervix				
28	Cancer of other female genital organs				
27	Cancer of ovary	22	Cancer of ovary		
29	Cancer of prostate	23	Cancer of prostate		
30	Cancer of testis	24	Cancer of testis and other male genital organs		
31	Cancer of other male genital organs				
32	Cancer of bladder	25	Cancer of bladder		



Clinical Classification Software (CCS) category		Diagnosis group		Aggregate diagnosis group	
No	Label	No	Label	No	Label
33	Cancer of kidney and renal pelvis	26	Cancer of kidney, renal pelvis and other urinary organs		
34	Cancer of other urinary organs				
35	Cancer of brain and nervous system				
36	Cancer of thyroid				
37	Hodgkin’s disease				
38	Non-Hodgkin’s lymphoma				
39	Leukaemia				
40	Multiple myeloma				
41	Cancer; other and unspecified primary				
45	Maintenance chemotherapy; radiotherapy				
42	Secondary malignancies				
43	Malignant neoplasm without specification of site				
44	Neoplasms of unspecified nature or uncertain behaviour				
46	Benign neoplasm of uterus				
47	Other and unspecified benign neoplasm				
48	Thyroid disorders	38	Thyroid and other endocrine disorders	3	Endocrine, nutritional and metabolic diseases, and immunity disorders
51	Other endocrine disorders				
49	Diabetes mellitus without complication				
50	Diabetes mellitus with complications				
52	Nutritional deficiencies				
53	Disorders of lipid metabolism				
58	Other nutritional; endocrine; and metabolic disorders				
55	Fluid and electrolyte disorders				
56	Cystic fibrosis				
57	Immunity disorders				
61	Sickle cell anaemia	44	Immunity and coagulation disorders, haemorrhagic disorders	4	Diseases of the blood and blood-forming organs
62	Coagulation and haemorrhagic disorders				
64	Other hematologic conditions				
59	Deficiency and other anaemia				
60	Acute post-haemorrhagic anaemia				
63	Diseases of white blood cells	46	Diseases of white blood cells	5	Mental illness
66	Alcohol-related mental disorders				
67	Substance-related mental disorders				
69	Affective disorders				
72	Anxiety, somatoform, dissociative, and personality disorders	47	Mental, affective, anxiety, somatoform, dissociative, and personality disorders		

Clinical Classification Software (CCS) category		Diagnosis group		Aggregate diagnosis group	
No	Label	No	Label	No	Label
68	Senility and organic mental disorders	48	Senility and organic mental disorders	6	Diseases of the nervous system and sense organs
65	Mental retardation	49	Schizophrenia, mental retardation, preadult disorders and other mental cond.		
70	Schizophrenia and related disorders				
73	Preadult disorders				
74	Other mental conditions				
75	Personal history of mental disorder, mental and behavioural problems, observation and screening for mental condition				
71	Other psychoses	50	Other psychoses		
76	Meningitis (except that caused by TBC or STD)	51	Meningitis, encephalitis, and other central nervous system infections		
77	Encephalitis (except that caused by TBC or STD)				
78	Other CNS infection and poliomyelitis	52	Parkinson`s disease		
79	Parkinson`s disease				
80	Multiple sclerosis	53	Multiple sclerosis and other degenerative nervous system conditions		
81	Other hereditary and degenerative nervous system conditions				
82	Paralysis	54	Paralysis and late effects of cerebrovascular disease		
113	Late effects of cerebrovascular disease				
83	Epilepsy; convulsions	55	Epilepsy and convulsions		
85	Coma; stupor; and brain damage	56	Coma, stupor, and brain damage		
84	Headache; including migraine	57	Headache and other disorders of the sense organs		
86	Cataract				
87	Retinal detachments; defects; vascular occlusion; and retinopathy				
88	Glaucoma				
89	Blindness and vision defects				
90	Inflammation; infection of eye (except that caused by TBC or STD)				
91	Other eye disorders				
92	Otitis media and related conditions				
93	Conditions associated with dizziness or vertigo				
94	Other ear and sense organ disorders				
95	Other nervous system disorders	58	Other nervous system disorders		
96	Heart valve disorders	59	Heart valve disorders		
97	Peri-; endo-; and myocarditis; cardiomyopathy (except that caused by TBC or STD)	60	Peri-, endo-, myocarditis, and cardiomyopathy		
98	Essential hypertension	61	Essential hypertension, hypertension with compl., and secondary hypertension		
99	Hypertension with complications and secondary hypertension				
100	Acute myocardial infarction				
101	Coronary atherosclerosis and other heart disease				
		62	Acute myocardial infarction		
		63	Coronary atherosclerosis and other heart disease		



Clinical Classification Software (CCS) category		Diagnosis group		Aggregate diagnosis group	
No	Label	No	Label	No	Label
102	Nonspecific chest pain	64	Nonspecific chest pain		
103	Pulmonary heart disease	65	Pulmonary heart disease		
104	Other and ill-defined heart disease	66	Other and ill-defined heart disease		
105	Conduction disorders	67	Conduction disorders (heart disease)		
106	Cardiac dysrhythmias	68	Cardiac dysrhythmias		
107	Cardiac arrest and ventricular fibrillation	69	Cardiac arrest and ventricular fibrillation		
108	Congestive heart failure; non-hypertensive	70	Congestive heart failure, non-hypertensive		
109	Acute cerebrovascular disease	71	Acute cerebrovascular disease		
110	Occlusion or stenosis of precerebral arteries	72	Transient cerebral ischemia, and other cerebrovascular disease		
111	Other and ill-defined cerebrovascular disease				
112	Transient cerebral ischemia	73	Peripheral and visceral atherosclerosis		
114	Peripheral and visceral atherosclerosis	74	Aortic and other artery aneurysms		
115	Aortic; peripheral; and visceral artery aneurysms	75	Aortic and arterial embolism or thrombosis		
116	Aortic and peripheral arterial embolism or thrombosis	76	Other circulatory disease		
117	Other circulatory disease	77	Phlebitis, varicose veins, and haemorrhoids		
118	Phlebitis; thrombophlebitis and thromboembolism				
119	Varicose veins of lower extremity				
120	Haemorrhoids				
121	Other diseases of veins and lymphatics	78	Pneumonia	8	Diseases of the respiratory system
122	Pneumonia (except that caused by tuberculosis or STD)	79	Influenza		
123	Influenza	80	Tonsillitis and upper respiratory infections		
124	Acute and chronic tonsillitis	81	Acute bronchitis		
126	Other upper respiratory infections	82	Chronic obstructive pulmonary disease and bronchiectasis		
125	Acute bronchitis	83	Asthma		
127	Chronic obstructive pulmonary disease and bronchiectasis	84	Aspiration pneumonitis; food/vomitus		
128	Asthma	85	Pleurisy; pneumothorax; pulmonary collapse		
129	Aspiration pneumonitis; food/vomitus	86	Respiratory failure; insufficiency; arrest (adult)		
130	Pleurisy; pneumothorax; pulmonary collapse	87	Lung disease due to external agents		
131	Respiratory failure; insufficiency; arrest (adult)	88	Other lower respiratory disease		
132	Lung disease due to external agents	89	Other upper respiratory disease		
133	Other lower respiratory disease	90	Intestinal infection	9	Diseases of the digestive system
134	Other upper respiratory disease	91	Disorders of mouth, teeth, and jaw		
135	Intestinal infection				
136	Disorders of teeth and jaw				
137	Diseases of mouth; excluding dental				

Clinical Classification Software (CCS) category		Diagnosis group		Aggregate diagnosis group			
No	Label	No	Label	No	Label		
138	Oesophageal disorders	92	Oesophageal disorders				
139	Gastroduodenal ulcer (except haemorrhage)	93	Gastroduodenal ulcer				
140	Gastritis and duodenitis	94	Gastritis, duodenitis, and other disorders of stomach and duodenum				
141	Other disorders of stomach and duodenum						
142	Appendicitis and other appendiceal conditions	95	Appendicitis and other appendiceal conditions				
148	Peritonitis and intestinal abscess	96	Peritonitis and intestinal abscess				
143	Abdominal hernia	97	Abdominal hernia				
144	Regional enteritis and ulcerative colitis	98	Regional enteritis and ulcerative colitis				
145	Intestinal obstruction without hernia	99	Intestinal obstruction without hernia				
146	Diverticulosis and diverticulitis	100	Diverticulosis and diverticulitis				
147	Anal and rectal conditions	101	Anal and rectal conditions				
149	Biliary tract disease	102	Biliary tract disease				
150	Liver disease; alcohol-related	103	Liver disease; alcohol-related				
151	Other liver diseases	104	Other liver diseases				
152	Pancreatic disorders (not diabetes)	105	Pancreatic disorders (not diabetes)				
153	Gastrointestinal haemorrhage	106	Gastrointestinal haemorrhage				
154	Non-infectious gastroenteritis	107	Non-infectious gastroenteritis				
155	Other gastrointestinal disorders	108	Other gastrointestinal disorders				
156	Nephritis; nephrosis; renal sclerosis	109	Nephritis; nephrosis; renal sclerosis			10	Diseases of the genitourinary system and non-neoplastic breast conditions
157	Acute and unspecified renal failure	110	Acute and unspecified renal failure				
158	Chronic kidney disease	111	Chronic kidney disease				
159	Urinary tract infections	112	Urinary tract infections				
160	Calculus of urinary tract	113	Calculus and other diseases of urinary tract				
161	Other diseases of kidney and ureters						
162	Other diseases of bladder and urethra						
163	Genitourinary symptoms and ill-defined conditions	114	Genitourinary symptoms and ill-defined conditions				
164	Hyperplasia of prostate	115	Hyperplasia of prostate and other male genital disorders				
165	Inflammatory conditions of male genital organs						
166	Other male genital disorders	116	Non-neoplastic breast conditions				
167	Non-neoplastic breast conditions						
168	Inflammatory diseases of female pelvic organs	117	Prolapse and other female genital disorders				
169	Endometriosis						
170	Prolapse of female genital organs						
171	Menstrual disorders						
172	Ovarian cyst						
173	Menopausal disorders						



Clinical Classification Software (CCS) category		Diagnosis group		Aggregate diagnosis group			
No	Label	No	Label	No	Label		
174	Female infertility	118	Complications of pregnancy, childbirth, and the puerperium; liveborn	11	Complications of pregnancy, childbirth, and the puerperium; liveborn		
175	Other female genital disorders						
176	Contraceptive and procreative management						
177	Spontaneous abortion						
178	Induced abortion						
179	Postabortion complications						
180	Ectopic pregnancy						
181	Other complications of pregnancy						
182	Haemorrhage during pregnancy; abruptio placenta; placenta previa						
183	Hypertension complicating pregnancy; childbirth and puerperium						
184	Early or threatened labour						
185	Prolonged pregnancy						
186	Diabetes or abnormal glucose tolerance complicating pregnancy; childbirth; or the puerperium						
187	Malposition; malpresentation						
188	Foetopelvic disproportion; obstruction						
189	Previous C-section						
190	Foetal distress and abnormal forces of labour						
191	Polyhydramnios and other problems of amniotic cavity						
192	Umbilical cord complication						
193	OB-related trauma to perineum and vulva						
194	Forceps delivery						
195	Other complications of birth; puerperium affecting management of mother						
196	Normal pregnancy and/or delivery						
218	Liveborn						
197	Skin and subcutaneous tissue infections	119	Skin and subcutaneous tissue infections	12	Diseases of the skin and subcutaneous tissue		
198	Other inflammatory condition of skin	120	Other skin disorders, chronic ulcer of skin				
199	Chronic ulcer of skin						
200	Other skin disorders	121	Infective arthritis and osteomyelitis	13	Diseases of the musculoskeletal system and connective tissue		
201	Infective arthritis and osteomyelitis (except that caused by tuberculosis or sexually transmitted disease)						
54	Gout and other crystal arthropathies						
202	Rheumatoid arthritis and related disease	122	Osteoarthritis, rheumatoid arthritis, and other musculoskeletal deformities				
203	Osteoarthritis						

Clinical Classification Software (CCS) category		Diagnosis group		Aggregate diagnosis group			
No	Label	No	Label	No	Label		
208	Acquired foot deformities						
209	Other acquired deformities						
210	Systemic lupus erythematosus and connective tissue disorders						
212	Other bone disease and musculoskeletal deformities						
204	Other non-traumatic joint disorders	123	Other non-traumatic joint disorders				
205	Spondylosis; intervertebral disc disorders; other back problems	124	Spondylosis, back problems, and osteoporosis				
206	Osteoporosis	125	Pathological fracture	14	Congenital anomalies		
207	Pathological fracture	126	Other connective tissue disease				
211	Other connective tissue disease	127	Cardiac and circulatory congenital anomalies				
213	Cardiac and circulatory congenital anomalies	128	Noncardiac congenital anomalies				
214	Digestive congenital anomalies						
215	Genitourinary congenital anomalies						
216	Nervous system congenital anomalies						
217	Other congenital anomalies	129	Short gestation; low birth weight; foetal growth retardation	15	Certain conditions originating in the perinatal period		
219	Short gestation; low birth weight; and foetal growth retardation	130	Intrauterine hypoxia, perinatal asphyxia and jaundice, birth trauma				
220	Intrauterine hypoxia and birth asphyxia						
221	Respiratory distress syndrome						
222	Haemolytic jaundice and perinatal jaundice						
223	Birth trauma	131	Other perinatal conditions			16	Injury and poisoning
224	Other perinatal conditions	132	Joint disorders and dislocations; trauma-related; sprains and strains				
225	Joint disorders and dislocations; trauma-related	133	Fracture of neck of femur (hip)				
232	Sprains and strains	134	Skull and face fractures, spinal cord injury				
226	Fracture of neck of femur (hip)	135	Fracture of upper limb				
227	Spinal cord injury	136	Fracture of lower limb				
228	Skull and face fractures	137	Other fractures				
229	Fracture of upper limb	138	Intracranial injury				
230	Fracture of lower limb	139	Crushing injury or internal injury				
231	Other fractures	140	Open wounds of head; neck; and trunk				
233	Intracranial injury	141	Open wounds of extremities				
234	Crushing injury or internal injury	142	Complication of device; implant or graft				
235	Open wounds of head; neck; and trunk	143	Complications of surgical procedures or medical care				
236	Open wounds of extremities	144	Superficial injury; contusion				
237	Complication of device; implant or graft	145	Burns				
238	Complications of surgical procedures or medical care						
239	Superficial injury; contusion						
240	Burns						



Clinical Classification Software (CCS) category		Diagnosis group		Aggregate diagnosis group		
No	Label	No	Label	No	Label	
241	Poisoning by psychotropic agents	146	Poisoning by psychotropic agents, drugs, or other medications			
242	Poisoning by other medications and drugs					
243	Poisoning by nonmedicinal substances					
244	Other injuries and conditions due to external causes	147	Other injuries and conditions due to external causes			
260	External causes	158	External causes	17	Symptoms; signs; and ill-defined conditions and factors influencing health status	
245	Syncope	148	Syncope			
246	Fever of other and unknown origin	149	Fever of other and unknown origin			
247	Lymphadenitis	150	Lymphadenitis and gangrene			
248	Gangrene					
249	Shock	151	Shock			
250	Nausea and vomiting	152	Nausea and vomiting			
251	Abdominal pain	153	Abdominal pain			
252	Malaise and fatigue	154	Malaise and fatigue			
253	Allergic reactions	155	Allergic reactions			
254	Rehabilitation care; fitting of prostheses; and adjustment of devices	1567	Rehabilitation and other aftercare, medical examination/evaluation/screening			
255	Administrative/social admission					
256	Medical examination/evaluation					
257	Other aftercare					
258	Other screening for suspected conditions (not mental disorders or infectious disease)	157	Residual codes; unclassified			
259	Residual codes; unclassified					

Table 2 – Descriptive information on diagnosis groups

Aggregate diagnosis group		Diagnosis group		sites	All admissions			High-comorbidity admissions (Mortality risk score ≥ 17)			Age: mean + standard deviation	Share of urgent admissions	Share of admissions from other hospital or institution
No	Label	No	Label		N	Annual per site: median [P25-P75]	Mortality rate	N	Share in all admissions	Mortality rate			
1	Infectious and parasitic diseases	2	Septicaemia (except in labour)	131	14 534	24 [11-39]	33.4%	5 925	40.8%	40.1%	69±16	94.9%	18.0%
2	Neoplasms	10	Cancer of colon	129	3 467	6 [3-9]	11.3%	1 848	53.3%	13.5%	74±12	33.0%	4.0%
		15	Cancer of bronchus; lung	128	4 448	7 [3-15]	14.3%	2 067	46.5%	24.4%	67±9	17.7%	3.1%
		31	Leukaemia	81	889	2 [1-6]	37.5%	400	45.0%	41.8%	54±22	47.5%	18.2%
		34	Secondary malignancies	128	4 186	5 [2-12]	11.5%	3 849	91.9%	12.0%	64±13	20.4%	4.1%
3	Endocrine, nutritional and metabolic diseases, and immunity disorders	40	Diabetes mellitus with complications	131	3 890	6 [4-9]	10.6%	580	14.9%	24.3%	53±23	89.4%	10.9%
		42	Fluid and electrolyte disorders	131	3 200	6 [3-9]	12.8%	894	27.9%	20.4%	66±18	94.6%	13.2%
4	Diseases of the blood and blood-forming organs	45	Deficiency and other anaemia	130	1 562	3 [2-3]	20.7%	563	36.0%	31.6%	65±23	83.9%	15.5%
5	Mental illness	47	Mental, affective, anxiety, somatoform, dissociative, and personality disorders	131	3 006	5 [3-9]	11.3%	289	9.6%	33.9%	48±17	94.6%	9.9%
6	Diseases of the nervous system and sense organs	55	Epilepsy and convulsions	131	4 442	5 [3-9]	10.3%	1 096	24.7%	17.5%	49±26	94.2%	20.5%
7	Diseases of the circulatory system	59	Heart valve disorders	87	12 507	21 [1-99]	5.2%	1 736	13.9%	11.5%	72±12	6.0%	2.8%
		60	Peri-, endo-, myocarditis, and cardiomyopathy	128	2 862	3 [1-6]	13.1%	665	23.2%	26.0%	57±20	73.3%	15.4%
		61	Essential hypertension, hypertension with compl., and secondary hypertension	131	6 948	9 [4-15]	17.3%	3 864	55.6%	21.2%	74±13	87.4%	13.2%
		62	Acute myocardial infarction	130	22 703	13 [5-57]	12.6%	3 093	13.6%	28.1%	67±13	88.8%	17.4%
		63	Coronary atherosclerosis and other heart disease	122	19 681	5 [2-84]	4.3%	1 328	6.7%	16.3%	68±10	19.9%	6.0%
		65	Pulmonary heart disease	131	3 960	6 [4-9]	16.0%	867	21.9%	28.5%	65±17	90.9%	11.9%
		68	Cardiac dysrhythmias	131	13 674	9 [4-18]	5.3%	1 576	11.5%	18.1%	67±16	50.8%	6.0%
		69	Cardiac arrest and ventricular fibrillation	126	2 030	3 [1-6]	66.1%	404	19.9%	67.6%	65±18	95.0%	14.7%
		70	Congestive heart failure, non-hypertensive	131	8 003	10 [5-18]	24.5%	4 309	53.8%	29.1%	73±14	86.2%	15.0%
		71	Acute cerebrovascular disease	131	14 462	15 [7-39]	29.8%	5 222	36.1%	40.0%	69±16	92.8%	21.8%
		73	Peripheral and visceral atherosclerosis	131	4 474	8 [4-12]	25.0%	867	19.4%	37.0%	71±12	45.7%	8.3%
		74	Aortic and other artery aneurysms	125	5 584	7 [3-15]	13.8%	674	12.1%	25.1%	70±12	38.1%	10.5%
8		78	Pneumonia	131	11 535	18 [13-27]	31.7%	3 746	32.5%	42.1%	68±20	93.5%	18.0%

	Diseases of the respiratory system	82	Chronic obstructive pulmonary disease and bronchiectasis	131	15 412	26 [18-39]	20.5%	3 751	24.3%	27.8%	69±11	94.6%	12.4%
		84	Aspiration pneumonitis; food/vomitus	131	1 674	3 [2-6]	36.0%	501	29.9%	40.3%	68±19	95.3%	36.4%
		85	Pleurisy; pneumothorax; pulmonary collapse	130	1 730	3 [2-6]	17.6%	372	21.5%	36.8%	59±21	74.1%	12.8%
		86	Respiratory failure; insufficiency; arrest	126	2 085	3 [2-6]	32.6%	640	30.7%	43.1%	64±23	92.6%	23.2%
		88	Other lower respiratory disease	129	1 685	3 [1-6]	27.4%	405	24.0%	36.3%	66±18	74.1%	12.8%
9	Diseases of the digestive system	99	Intestinal obstruction without hernia	131	2 921	5 [3-9]	23.9%	692	23.7%	32.1%	70±20	91.5%	18.1%
		102	Biliary tract disease	130	2 332	4 [2-6]	18.7%	584	25.0%	28.4%	71±16	72.3%	10.5%
		103	Liver disease; alcohol-related	127	2 719	4 [2-6]	42.3%	1 833	67.4%	43.9%	58±10	83.2%	11.3%
		104	Other liver diseases	128	1 417	2 [1-3]	33.3%	797	56.2%	40.0%	59±17	75.8%	20.4%
		105	Pancreatic disorders (not diabetes)	131	2 255	4 [2-6]	17.6%	306	13.6%	31.4%	59±17	87.3%	11.5%
		106	Gastrointestinal haemorrhage	131	4 224	7 [4-12]	15.8%	1 216	28.8%	23.8%	69±16	96.0%	14.2%
10	Diseases of the genitourinary system and non-neoplastic breast conditions	110	Acute and unspecified renal failure	130	2 267	4 [2-6]	16.2%	878	38.7%	24.0%	71±14	92.6%	14.1%
16	Injury and poisoning	133	Fracture of neck of femur (hip)	130	3 294	6 [3-9]	31.4%	937	28.4%	33.6%	80±13	96.2%	22.4%
		134	Skull and face fractures, spinal cord injury	124	2 552	4 [2-9]	14.6%	343	13.4%	29.7%	48±25	94.2%	17.8%
		137	Other fractures	130	4 108	7 [4-9]	12.8%	471	11.5%	31.8%	61±20	94.4%	13.7%
		138	Intracranial injury	130	8 421	10 [3-27]	21.1%	1 722	20.4%	32.7%	59±23	93.8%	20.4%
		142	Complication of device, implant or graft	131	6 402	7 [4-12]	14.5%	1 389	21.7%	25.2%	65±17	48.7%	11.2%
		143	Complications of surgical procedures or medical care	131	5 450	7 [4-12]	13.3%	1 186	21.8%	24.6%	61±19	72.4%	17.9%
		146	Poisoning by psychotropic agents, drugs, or other medications	131	9 631	16 [9-27]	4.1%	455	4.7%	25.5%	44±19	97.2%	10.1%
		147	Other injuries and conditions due to external causes	130	2 417	4 [2-6]	35.9%	506	20.9%	43.7%	64±24	96.4%	17.9%
17	Symptoms; signs; and ill-defined conditions and factors influencing health status	151	Shock	117	683	2 [1-3]	44.9%	298	43.6%	49.0%	69±16	95.3%	19.5%
		157	Residual codes; unclassified	125	1 476	2 [1-3]	30.8%	429	29.1%	47.3%	62±20	60.3%	24.7%

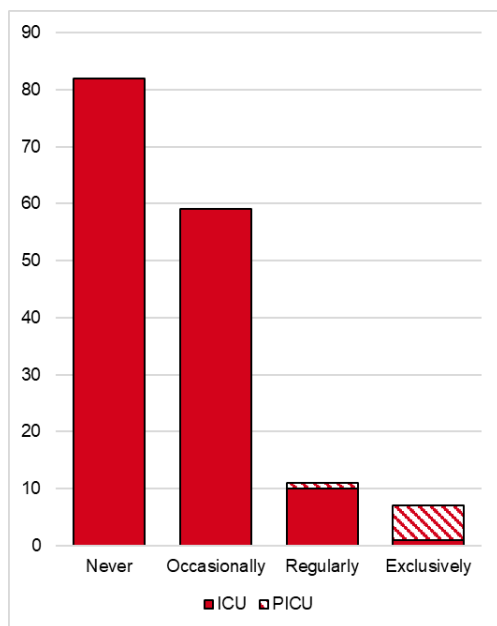
Table 3 – Information on the estimation of standardised mortality rates in diagnosis groups

Aggregate diagnosis group		Diagnosis group		All admissions			C-statistic	Covariates		
No	Label	No	Label	N	Deaths	Mortality rate		Most important	Second most important	Third most important
1	Infectious and parasitic diseases	2	Septicaemia (except in labour)	14 534	4 854	33.4%	0.66	Age	Mortality risk score	Urgency
2	Neoplasms	10	Cancer of colon	3 467	392	11.3%	0.72	Age	Urgency	BIMD
		15	Cancer of bronchus; lung	4 448	635	14.3%	0.88	Urgency	Medical or surgical	Mortality risk score
		31	Leukaemia	889	333	37.5%	0.69	Age	Month of admission	Year of admission
		34	Secondary malignancies	4 186	482	11.5%	0.83	Medical or surgical	Urgency	Age
3	Endocrine, nutritional and metabolic diseases, and immunity disorders	40	Diabetes mellitus with complications	3 890	411	10.6%	0.84	Age	Mortality risk score	Urgency
		42	Fluid and electrolyte disorders	3 200	411	12.8%	0.74	Age	Mortality risk score	Medical or surgical
4	Diseases of the blood and blood-forming organs	45	Deficiency and other anaemia	1 562	323	20.7%	0.73	Mortality risk score	Age	Urgency
5	Mental illness	47	Mental, affective, anxiety, somatoform, dissociative, and personality disorders	3 006	339	11.3%	0.77	Mortality risk score	Age	Urgency
6	Diseases of the nervous system and sense organs	55	Epilepsy and convulsions	4 442	457	10.3%	0.76	Age	Medical or surgical	Mortality risk score
7	Diseases of the circulatory system	59	Heart valve disorders	12 507	650	5.2%	0.75	Mortality risk score	Age	Urgency
		60	Peri-, endo-, myocarditis, and cardiomyopathy	2 862	374	13.1%	0.79	Mortality risk score	Urgency	Age
		61	Essential hypertension, hypertension with compl., and secondary hypertension	6 948	1 202	17.3%	0.68	Age	Mortality risk score	BIMD
		62	Acute myocardial infarction	22 703	2 858	12.6%	0.78	Mortality risk score	Urgency	Age
		63	Coronary atherosclerosis and other heart disease	19 681	853	4.3%	0.84	Urgency	Mortality risk score	Age
		65	Pulmonary heart disease	3 960	632	16.0%	0.75	Mortality risk score	Urgency	Age
		68	Cardiac dysrhythmias	13 674	723	5.3%	0.86	Urgency	Mortality risk score	Age
		69	Cardiac arrest and ventricular fibrillation	2 030	1 342	66.1%	0.81	Medical or surgical	Urgency	Age
		70	Congestive heart failure, non-hypertensive	8 003	1 960	24.5%	0.68	Age	Mortality risk score	BIMD
		71	Acute cerebrovascular disease	14 462	4 315	29.8%	0.69	Urgency	Mortality risk score	Age
		73	Peripheral and visceral atherosclerosis	4 474	1 120	25.0%	0.77	Urgency	Age	Mortality risk score
		74	Aortic and other artery aneurysms	5 584	772	13.8%	0.78	Urgency	Age	Mortality risk score
8	Diseases of the respiratory system	78	Pneumonia	11 535	3 651	31.7%	0.69	Age	Mortality risk score	Urgency
		82	Chronic obstructive pulmonary disease and bronchiectasis	15 412	3 166	20.5%	0.69	Age	Medical or surgical	Mortality risk score
		84	Aspiration pneumonitis; food/vomitus	1 674	603	36.0%	0.69	Age	Month of admission	Sex
		85	Pleurisy; pneumothorax; pulmonary collapse	1 730	305	17.6%	0.83	Age	Mortality risk score	Urgency
		86	Respiratory failure; insufficiency; arrest	2 085	679	32.6%	0.67	Age	Mortality risk score	Admission source
		88	Other lower respiratory disease	1 685	461	27.4%	0.70	Age	BIMD	Mortality risk score
9	Diseases of the digestive system	99	Intestinal obstruction without hernia	2 921	699	23.9%	0.72	Age	Medical or surgical	Mortality risk score
		102	Biliary tract disease	2 332	437	18.7%	0.72	Age	Mortality risk score	Medical or surgical
		103	Liver disease; alcohol-related	2 719	1 149	42.3%	0.65	Medical or surgical	Age	BIMD

		104 Other liver diseases	1 417	472	33.3%	0.70	Mortality risk score	Age	Medical or surgical
		105 Pancreatic disorders (not diabetes)	2 255	397	17.6%	0.77	Age	Admission source	Urgency
		106 Gastrointestinal haemorrhage	4 224	669	15.8%	0.72	Mortality risk score	Age	Admission source
10	Diseases of the genitourinary system and non-neoplastic breast conditions	110 Acute and unspecified renal failure	2 267	367	16.2%	0.73	Mortality risk score	Age	Urgency
16	Injury and poisoning	133 Fracture of neck of femur (hip)	3 294	1 035	31.4%	0.68	Medical or surgical	Age	BIMD
		134 Skull and face fractures, spinal cord injury	2 552	372	14.6%	0.78	Age	Mortality risk score	Urgency
		137 Other fractures	4 108	524	12.8%	0.83	Age	Mortality risk score	BIMD
		138 Intracranial injury	8 421	1 779	21.1%	0.73	Age	Medical or surgical	Urgency
		142 Complication of device, implant or graft	6 402	931	14.5%	0.73	Mortality risk score	Age	Urgency
		143 Complications of surgical procedures or medical care	5 450	723	13.3%	0.75	Age	Mortality risk score	Admission source
		146 Poisoning by psychotropic agents, drugs, or other medications	9 631	395	4.1%	0.84	Mortality risk score	Age	Medical or surgical
17	Symptoms; signs; and ill-defined conditions and factors influencing health status	147 Other injuries and conditions due to external causes	2 417	868	35.9%	0.69	Age	Urgency	Admission source
		151 Shock	683	307	44.9%	0.68	Age	BIMD	Mortality risk score
		157 Residual codes; unclassified	1 476	454	30.8%	0.75	Mortality risk score	Age	BIMD

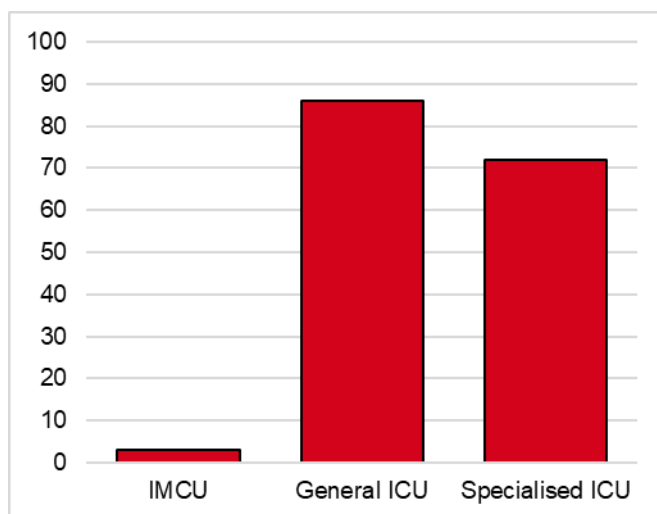
3 APPENDIX TO CHAPTER 7

Figure 1 – Children admitted to the ICU



N = 159, missing = 5.

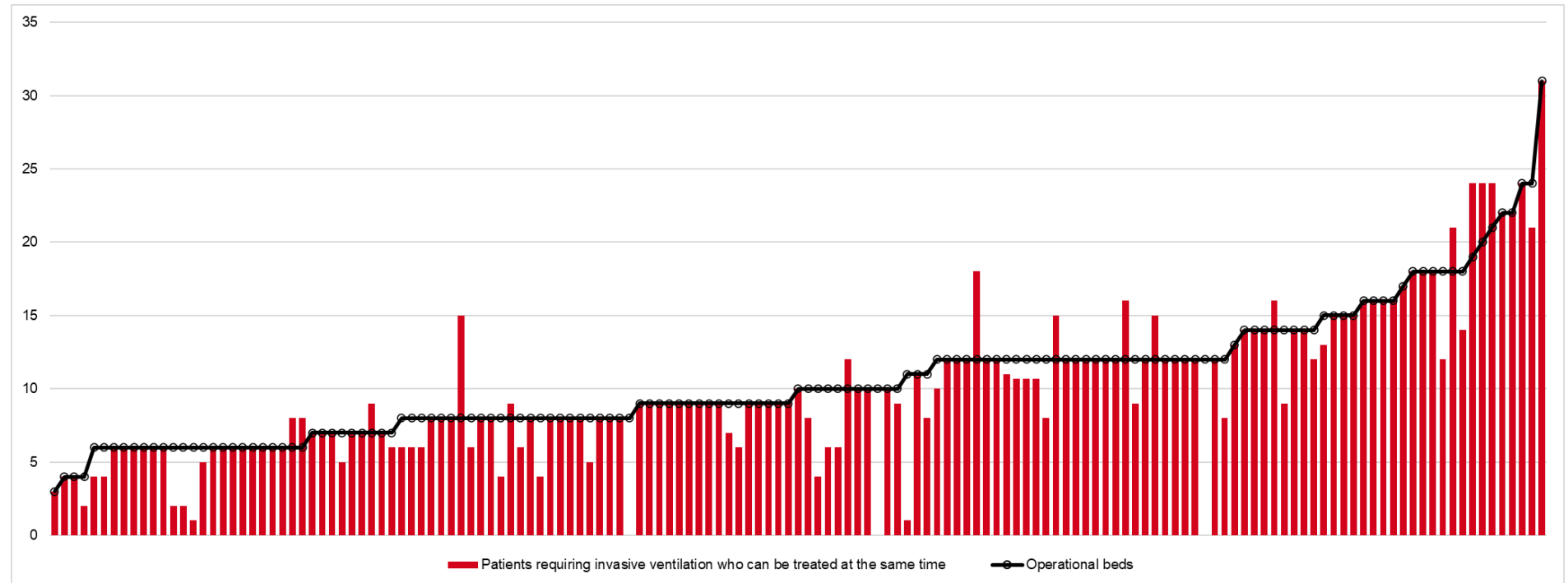
Figure 2 – Self-defined ICU level



N = 161, missing = 3.

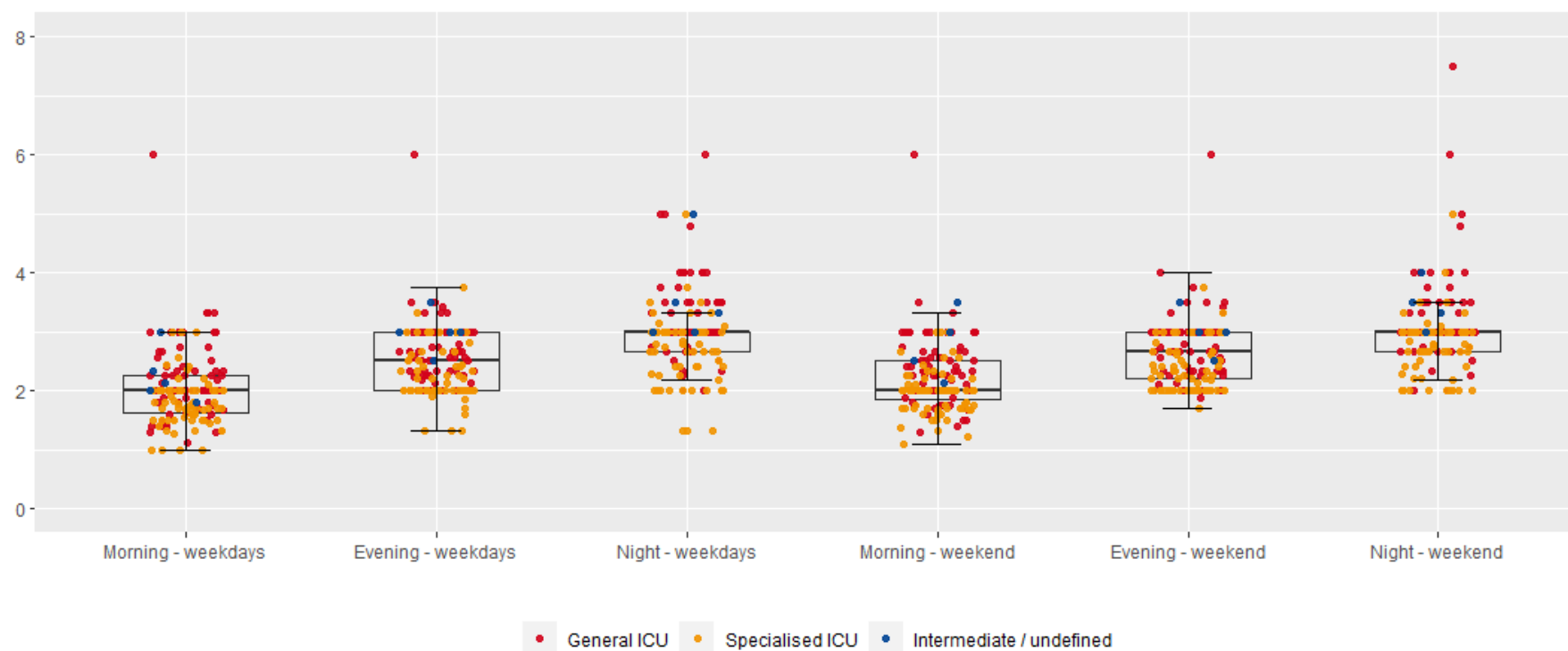


Figure 3 – Number of patients requiring invasive ventilation who can be treated at the same time given the available staff and equipment, per ICU



N = 151, missing = 13. For two hospital sites, the number of patients was clearly given at the site level rather than at the unit level. A correction was made and patients were distributed between the units proportionally to the number of beds.

Figure 4 – Scheduled number of patients per nurse or care assistant, per ICU



Weekdays: $N = 150$, missing = 14; Weekend: $N = 148$, missing = 16. Boxes are drawn from first quartile to third quartile with the median as inside line, whiskers are drawn from the box to the most extreme point that is less than or equal to 1.5 times the IQR, and dots represent ICUs.

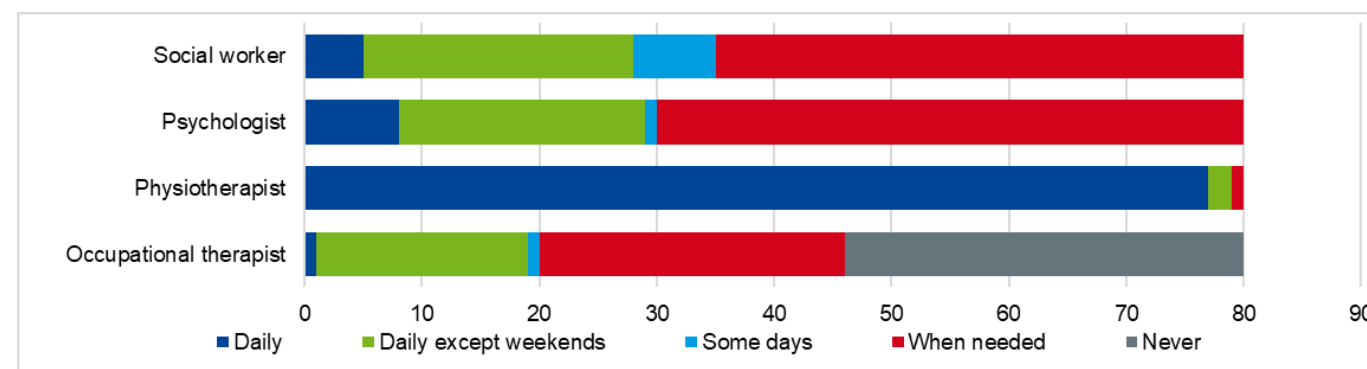


Table 4 – Scheduled logistic and support staff in ICUs, per shift

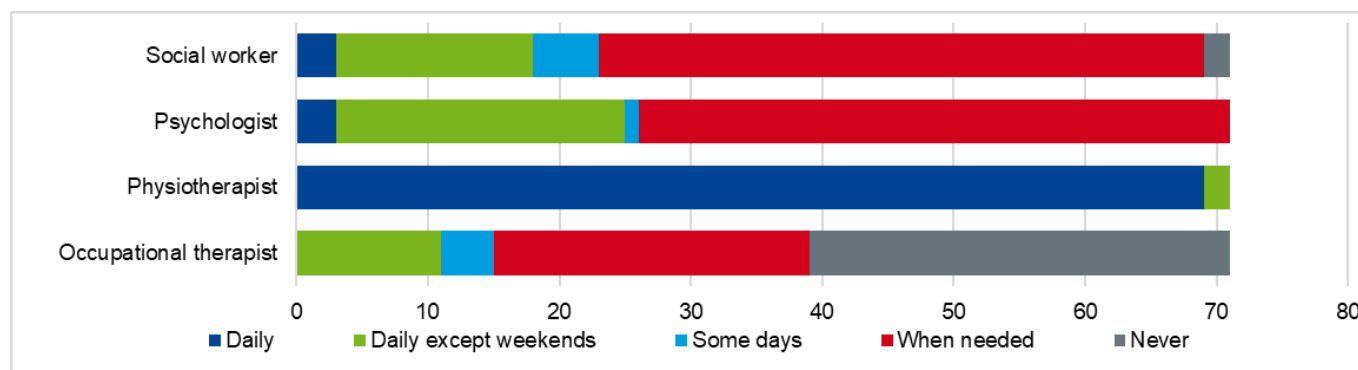
	Morning Weekdays	Evening Weekdays	Night Weekdays	Morning Weekend	Evening Weekend	Night Weekend
<i>No scheduled logistic and support staff</i>	33 (20.8%)	116 (73.0%)	152 (95.6%)	109 (68.6%)	144 (90.6%)	159 (100.0%)
<i>]0-1] scheduled logistic and support staff</i>	101 (63.5%)	40 (25.2%)	7 (4.4%)	47 (29.6%)	14 (8.8%)	0 (0.0%)
<i>]1-2] scheduled logistic and support staff</i>	22 (13.8%)	3 (1.9%)	0 (0.0%)	3 (1.9%)	1 (0.6%)	0 (0.0%)
<i>More than 2 scheduled logistic and support staff</i>	3 (1.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

N = 159, missing = 5.

Figure 5 – Availability of allied healthcare staff and other care professionals in the (self-defined) general ICU



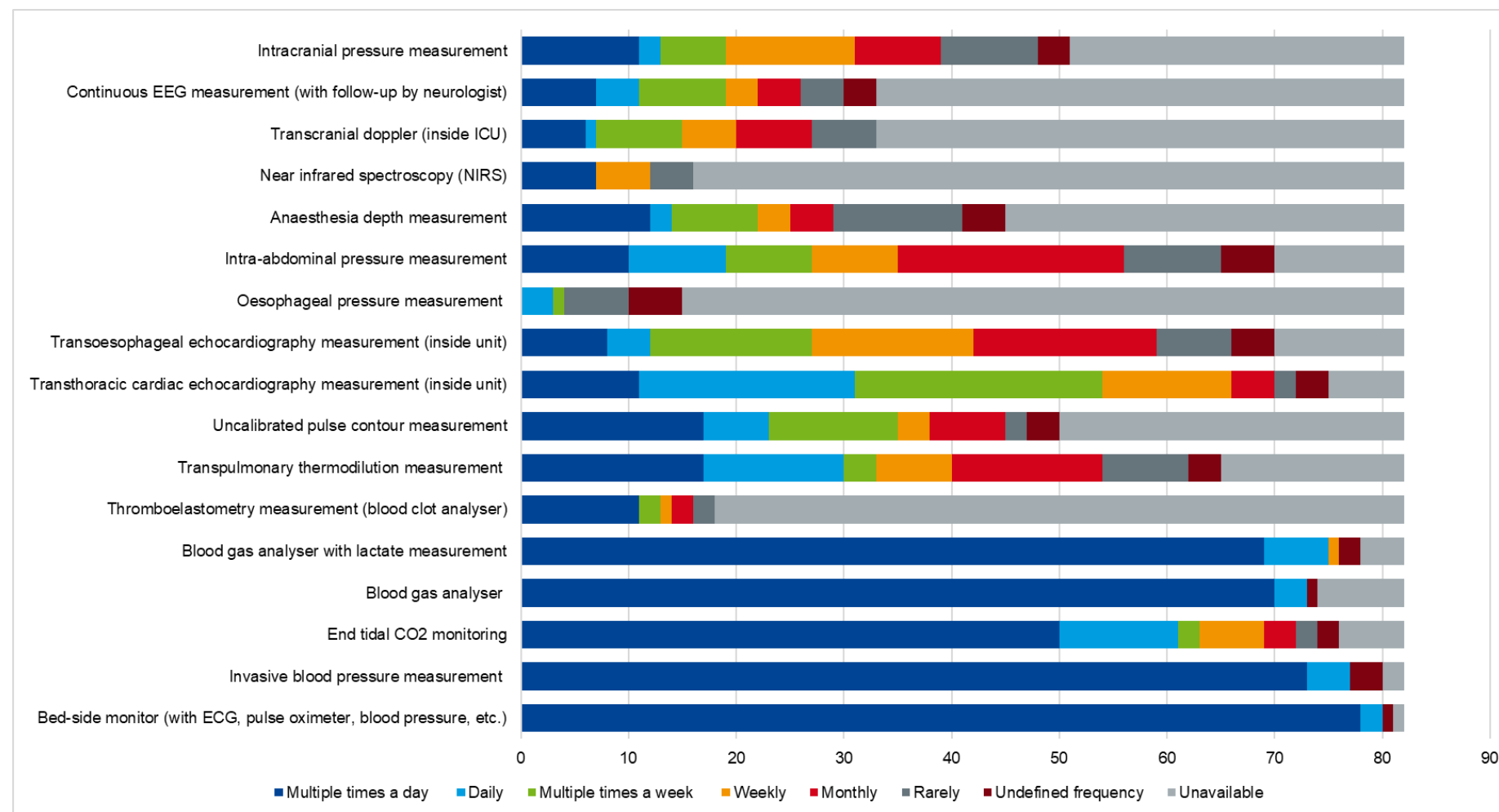
N = 80, missing = 6.

Figure 6 – Availability of allied healthcare staff and other care professionals in the (self-defined) specialised ICU

N = 71, missing = 1.

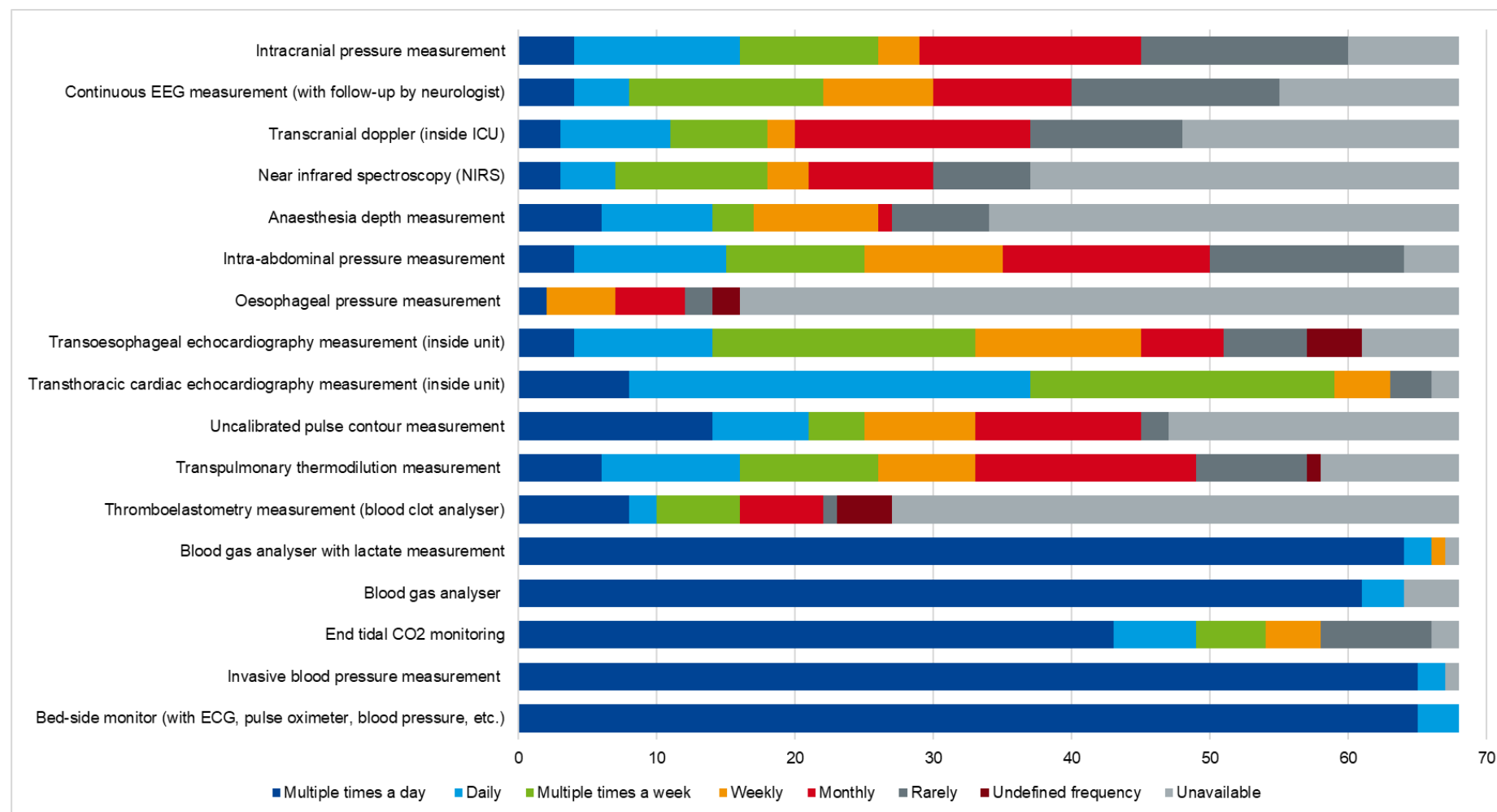


Figure 7 – Availability of monitoring and diagnostic options in (self-defined) general ICUs



N = 82, missing = 4.

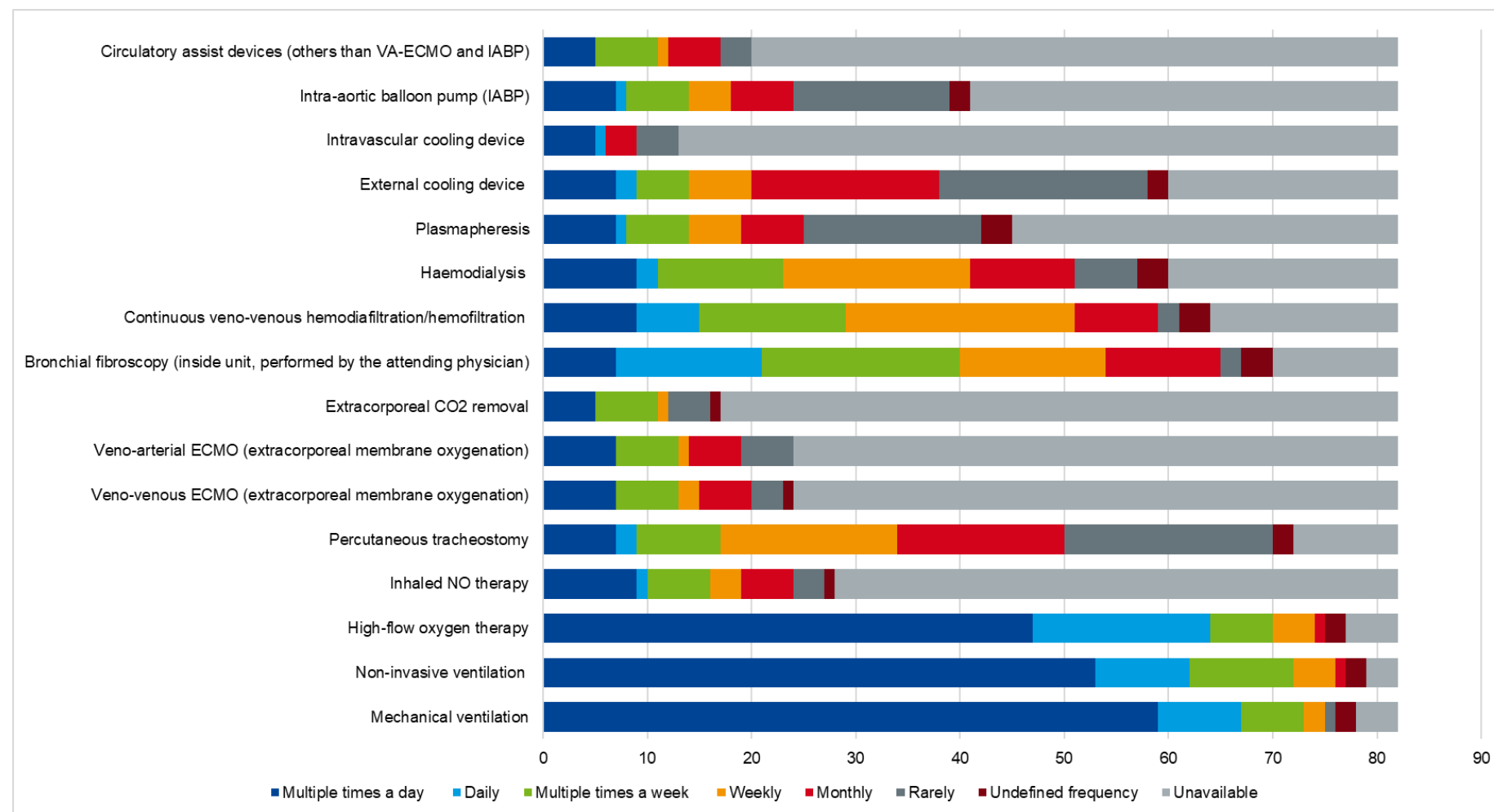
Figure 8 – Availability of monitoring and diagnostic options in (self-defined) specialised ICUs



N = 68, missing = 4.

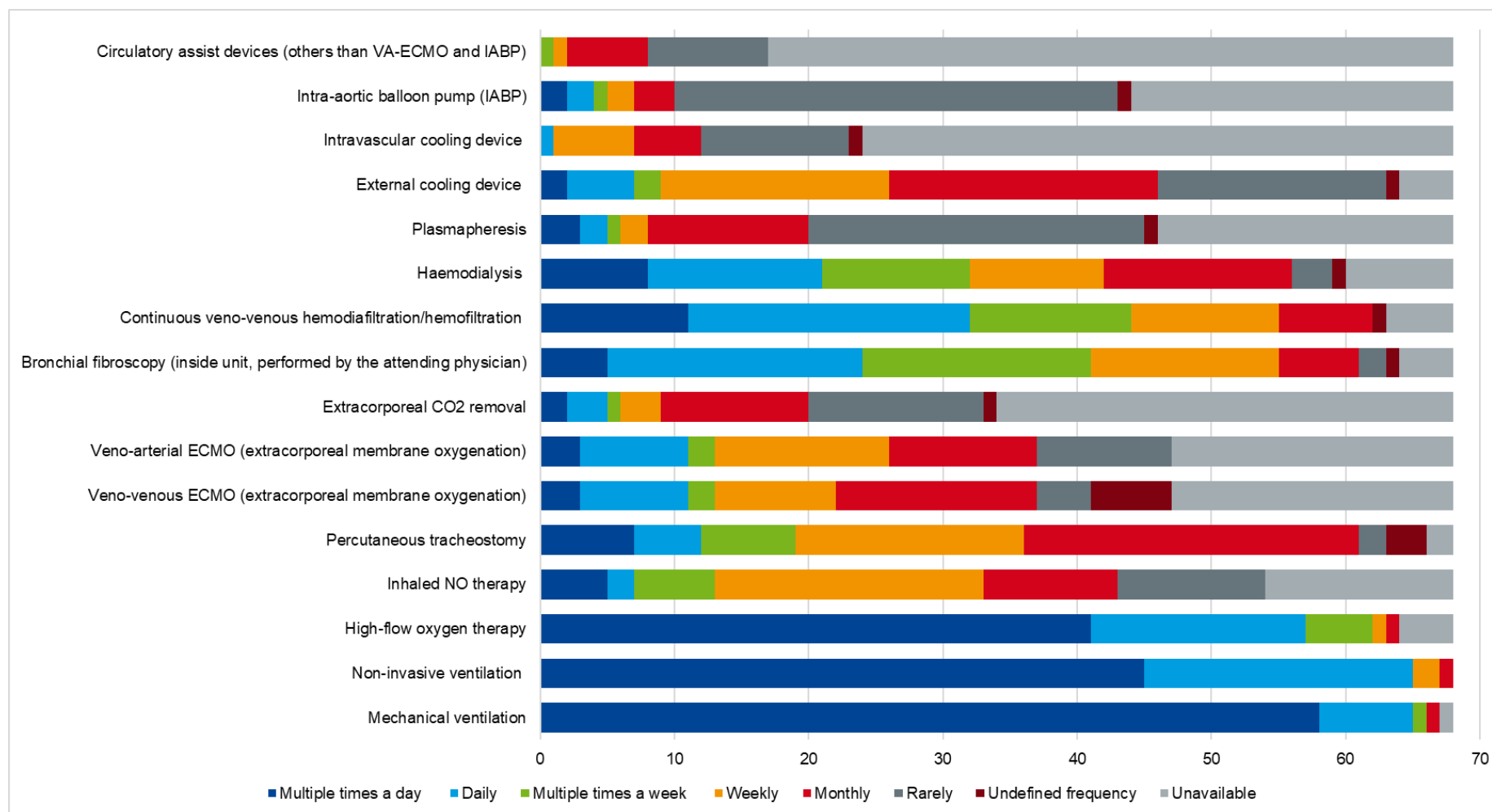


Figure 9 – Availability of therapeutic options in (self-defined) general ICUs



N = 82, missing = 4.

Figure 10 – Availability of therapeutic options in (self-defined) specialised ICUs



N = 68, missing = 4.



Table 5 – Scheduled care assistants in IMCUs, per shift

	Morning Weekdays	Evening Weekdays	Night Weekdays	Morning Weekend	Evening Weekend	Night Weekend
<i>No scheduled care assistant</i>	51 (67.1%)	63 (82.9%)	73 (96.1%)	41 (65.1%)	50 (79.4%)	61 (96.8%)
<i>]0-1] scheduled care assistants</i>	22 (28.9%)	13 (17.1%)	3 (3.9%)	20 (31.7%)	13 (20.6%)	2 (3.2%)
<i>]1-2] scheduled care assistants</i>	3 (3.9%)	0 (0.0%)	0 (0.0%)	2 (3.2%)	0 (0.0%)	0 (0.0%)
<i>More than 2 scheduled care assistants</i>	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

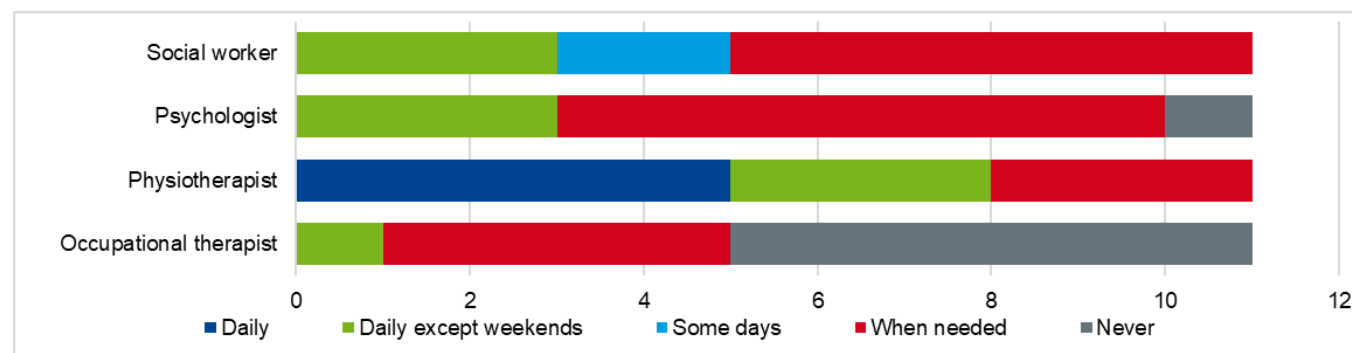
Weekdays: N = 76, missing = 15; Weekend: N= 63, missing = 28.

Table 6 – Scheduled logistic and support staff in IMCUs, per shift

	Morning Weekdays	Evening Weekdays	Night Weekdays	Morning Weekend	Evening Weekend	Night Weekend
<i>No scheduled logistic and support staff</i>	39 (51.3%)	55 (72.4%)	75 (98.7%)	47 (74.6%)	55 (87.3%)	63 (100.0%)
<i>]0-1] scheduled logistic and support staff</i>	31 (40.8%)	19 (25.0%)	1 (1.3%)	14 (22.2%)	8 (12.7%)	0 (0.0%)
<i>]1-2] scheduled logistic and support staff</i>	5 (6.6%)	2 (2.6%)	0 (0.0%)	2 (3.2%)	0 (0.0%)	0 (0.0%)
<i>More than 2 scheduled logistic and support staff</i>	1 (1.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

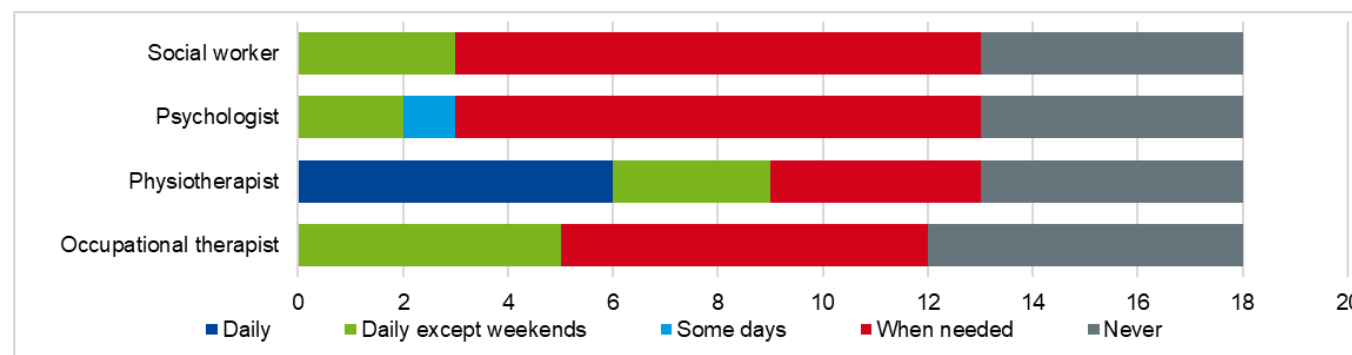
Weekdays: N = 76, missing = 15; Weekend: N= 63, missing = 28.

Figure 11 – Availability of allied healthcare staff and other care professionals in the IMCU (cardiac or CCU)



N= 11, missing = 4.

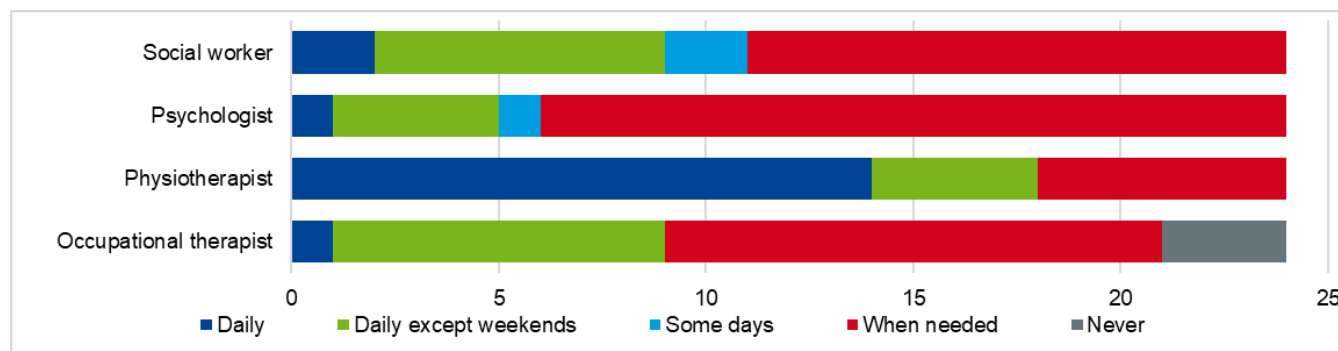
Figure 12 – Availability of allied healthcare staff and other care professionals in the IMCU (step-up/down)



N= 18, missing = 4.

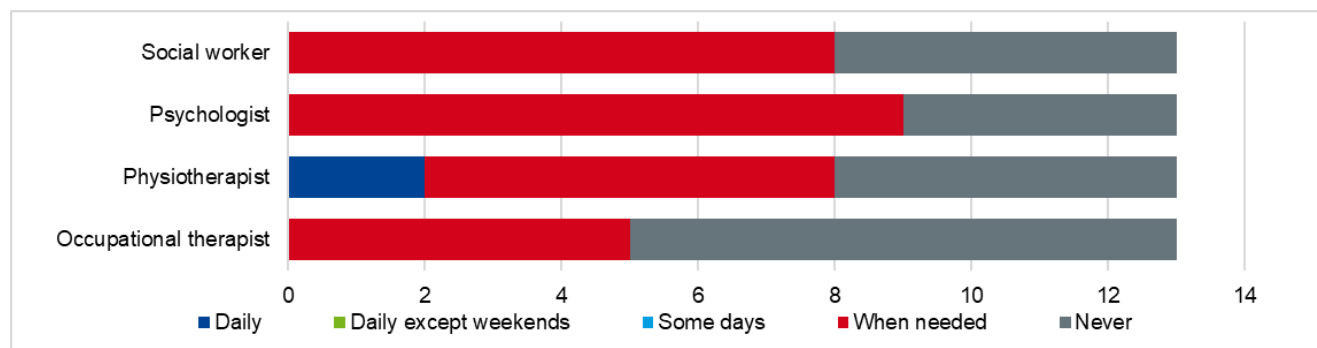


Figure 13 – Availability of allied healthcare staff and other care professionals in the IMCU (stroke unit)



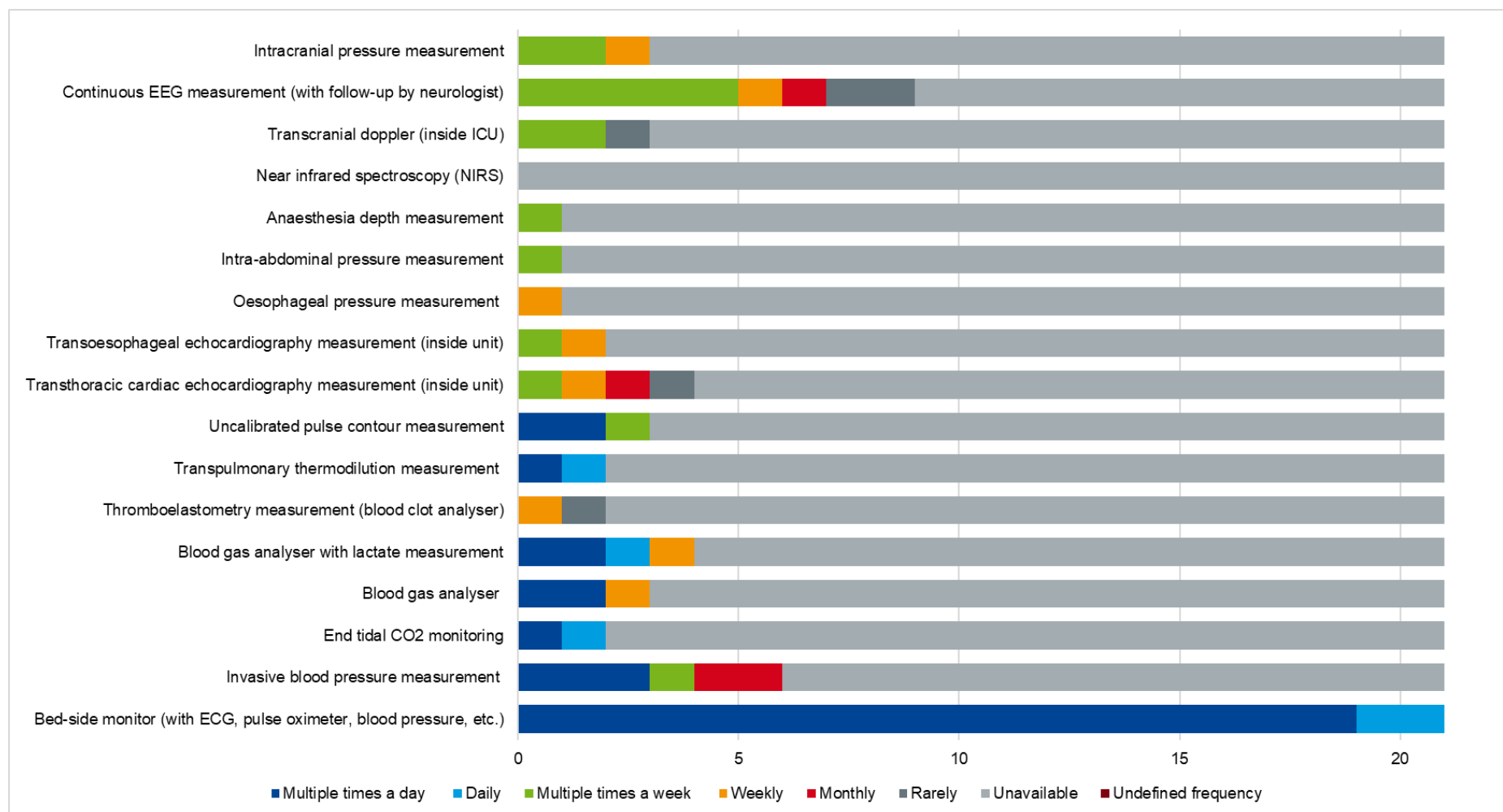
N= 24, missing = 8.

Figure 14 – Availability of allied healthcare staff and other care professionals in the IMCU (PACU)



N= 13, missing = 3.

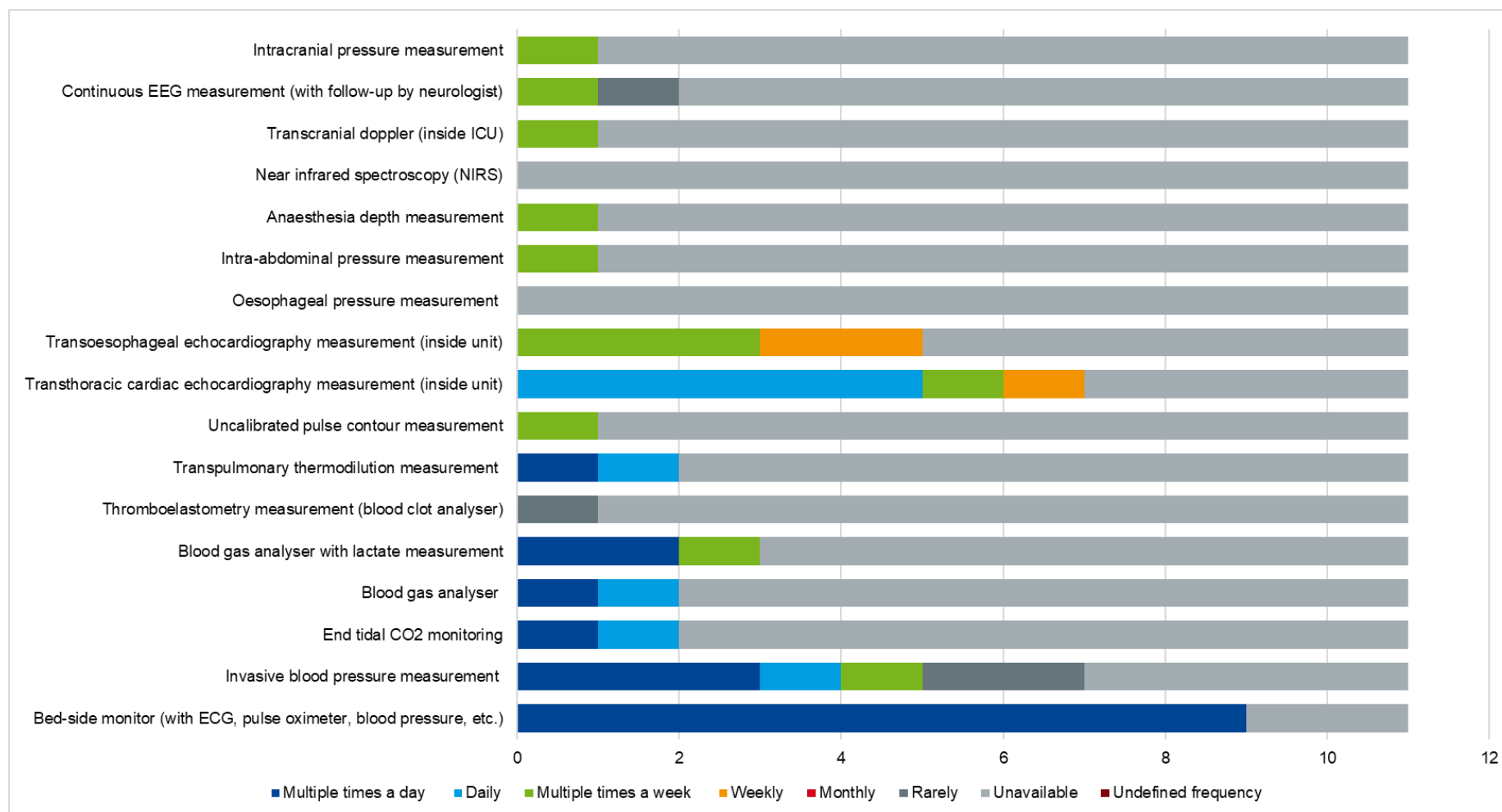
Figure 15 – Availability of monitoring and diagnostic options in the IMCU (stroke unit)



N= 21, missing = 11.

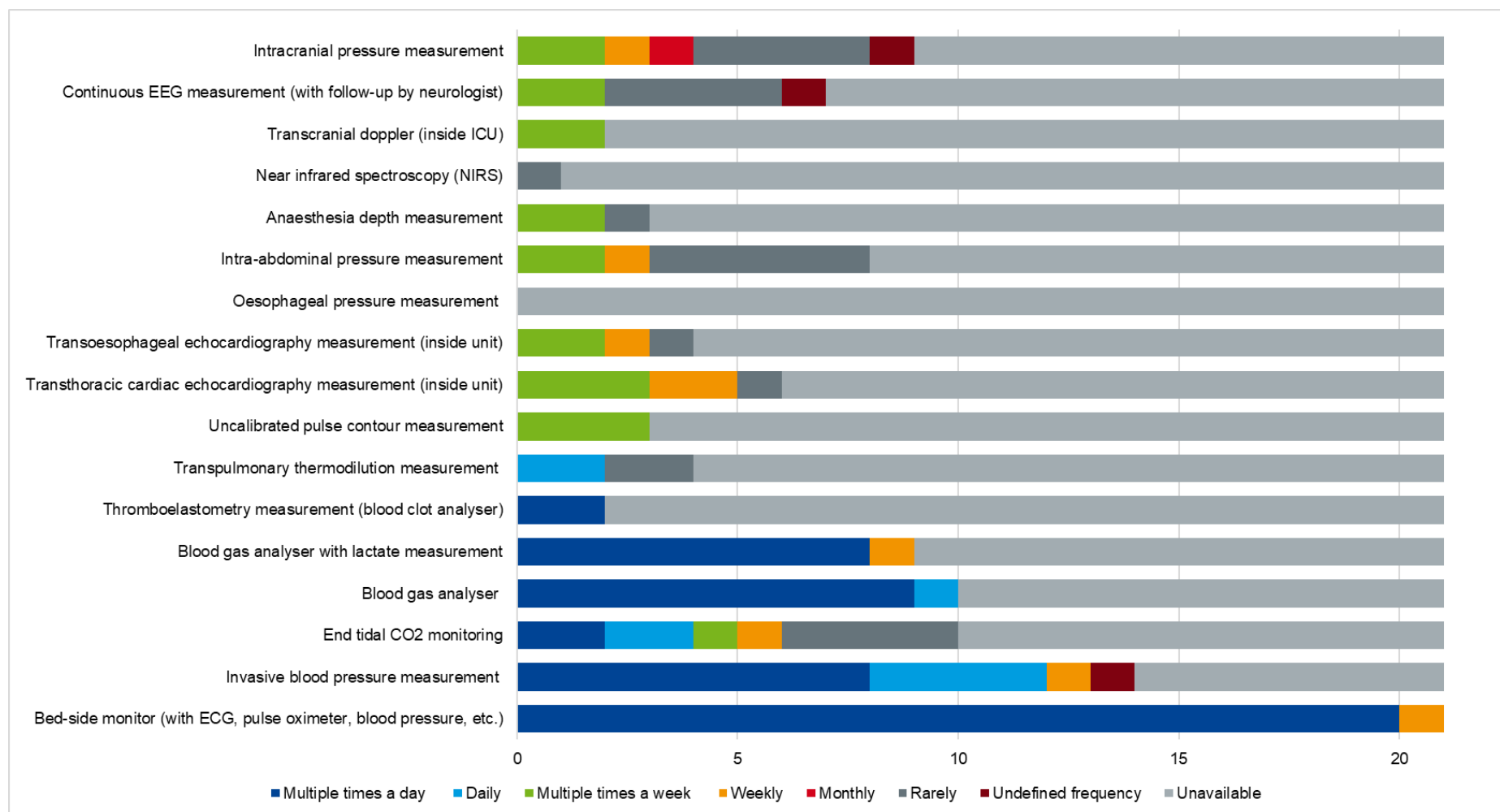


Figure 16 – Availability of monitoring and diagnostic options in the IMCU (cardiac or CCU)



N= 11, missing = 4.

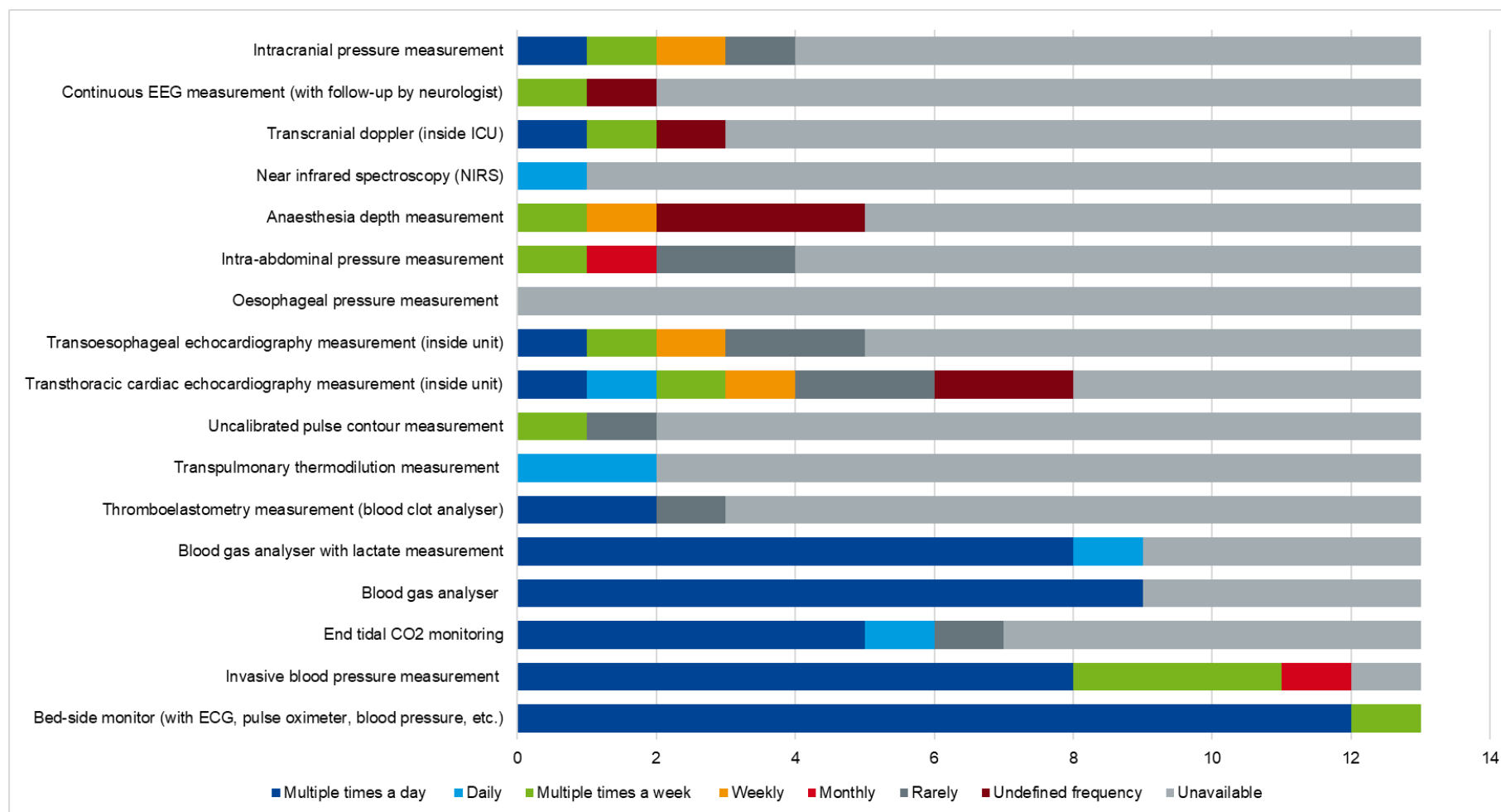
Figure 17 – Availability of monitoring and diagnostic options in the IMCU (step-up/down)



N= 21, missing = 1.

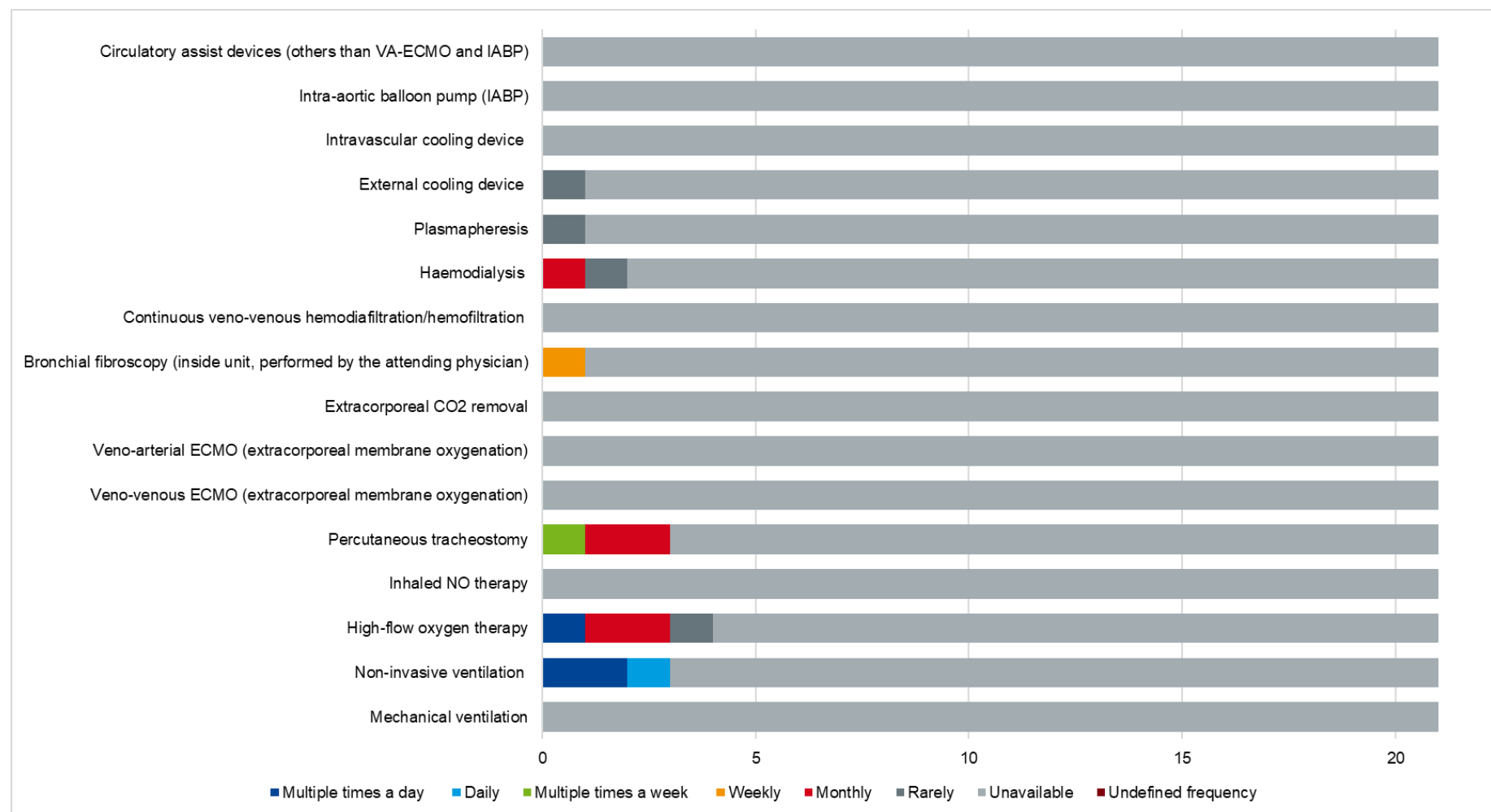


Figure 18 – Availability of monitoring and diagnostic options in the IMCU (PACU)



N= 13, missing = 3.

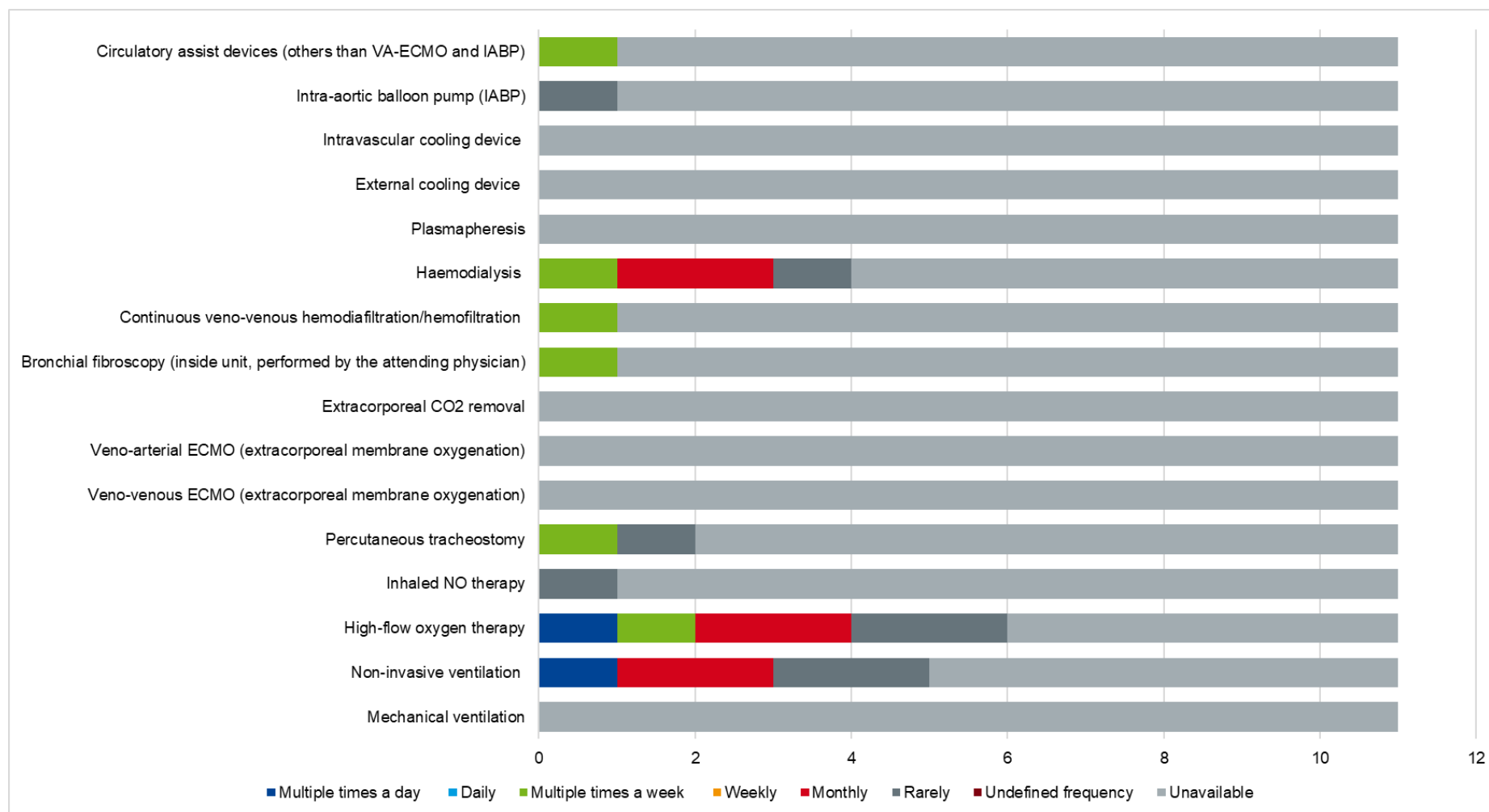
Figure 19 – Availability of therapeutic options in the IMCU (stroke unit)



N= 21, missing = 11.

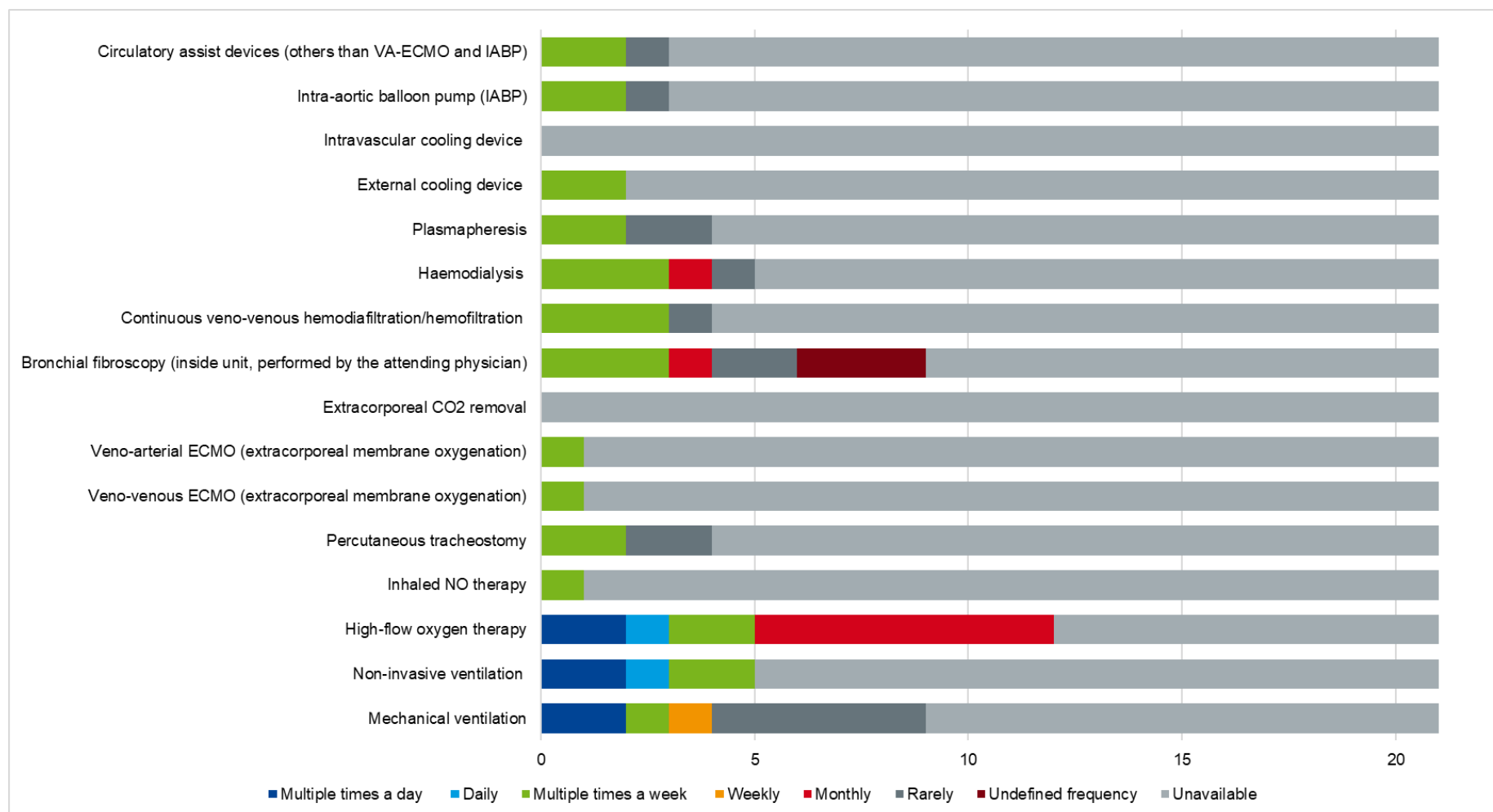


Figure 20 – Availability of therapeutic options in the IMCU (cardiac or CCU)



N= 11, missing = 4.

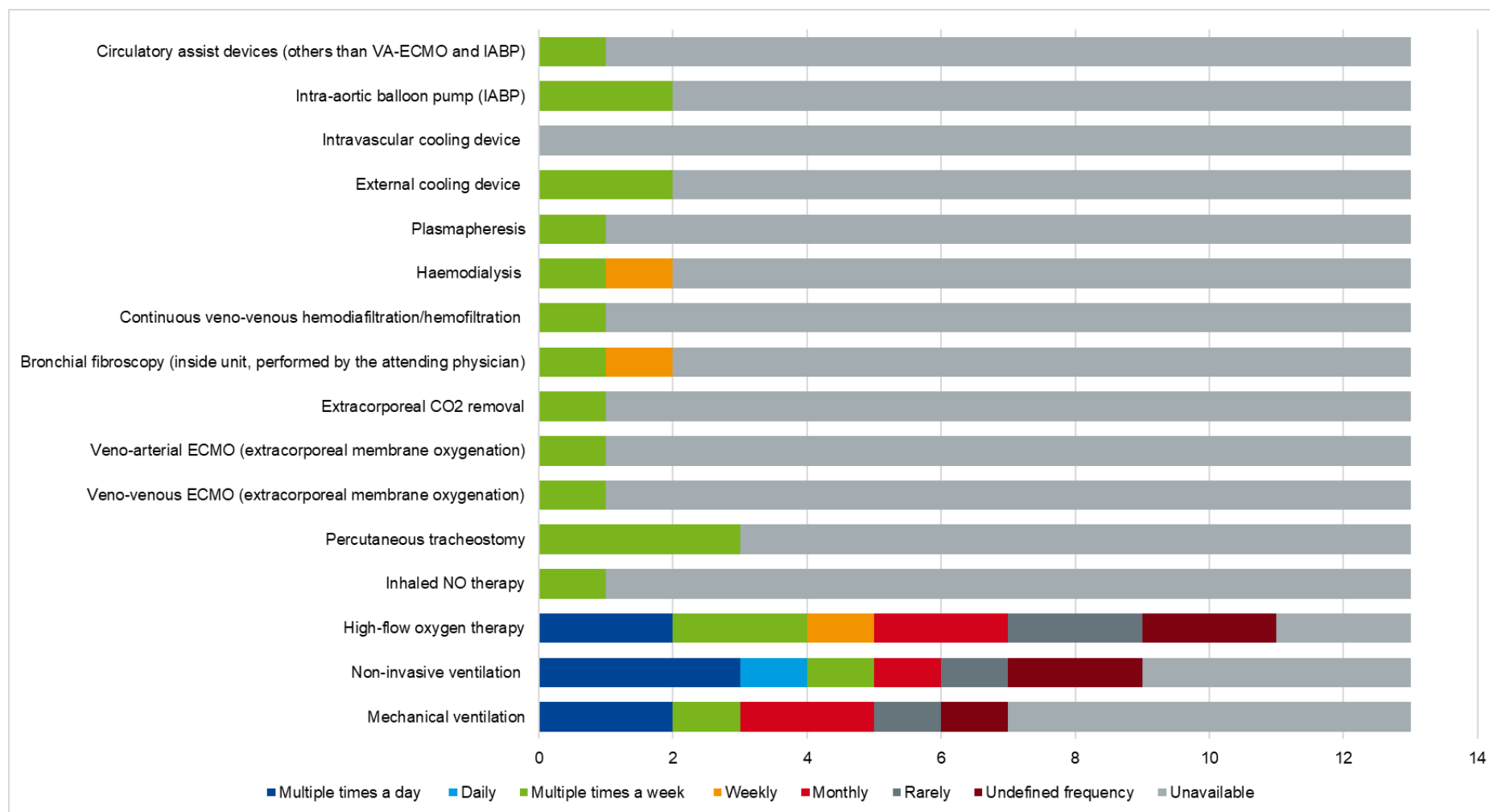
Figure 21 – Availability of therapeutic options in the IMCU (step-up/down)



N= 21, missing = 1.

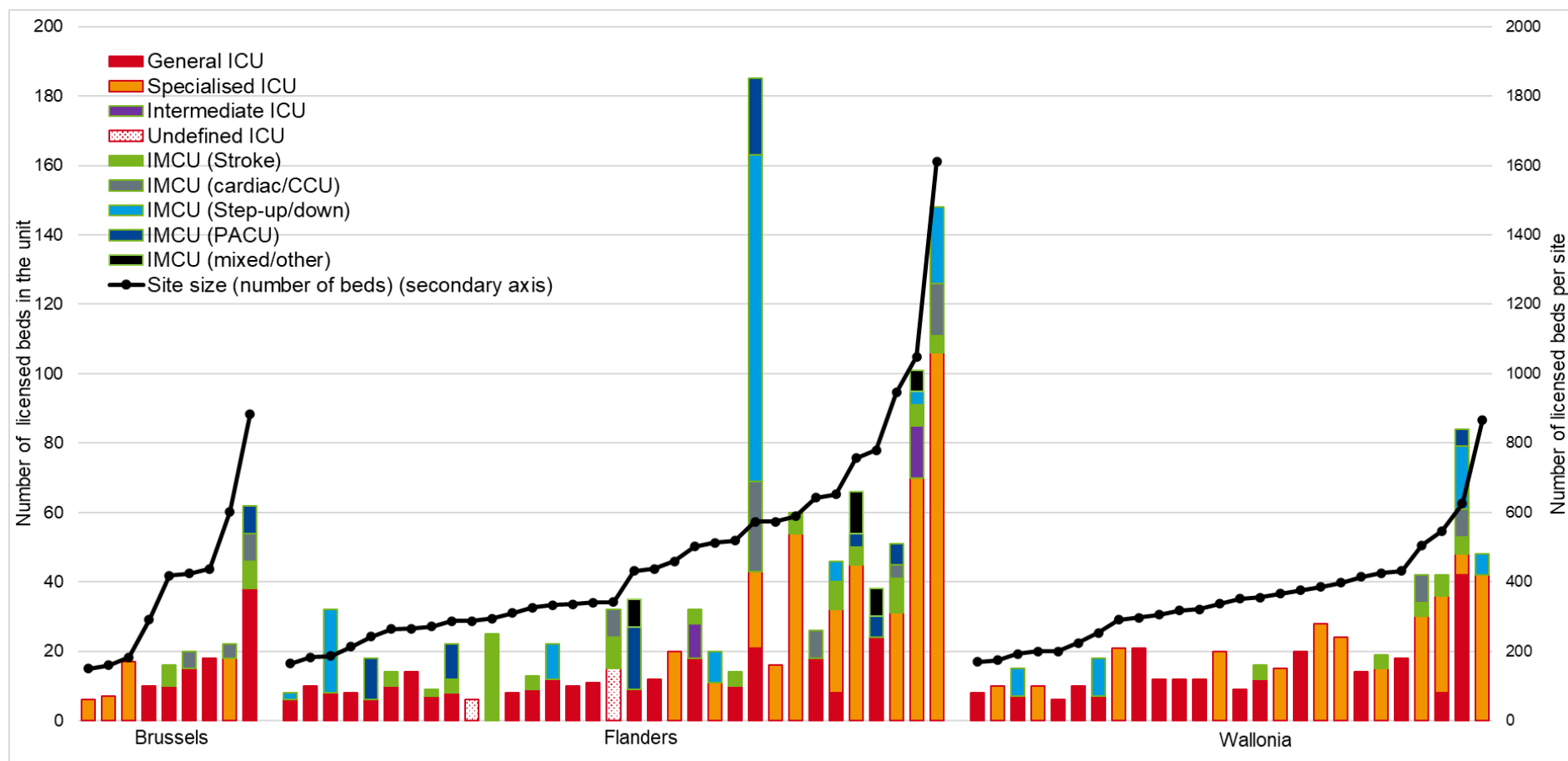


Figure 22 – Availability of therapeutic options in the IMCU (PACU)



N= 13, missing = 3.

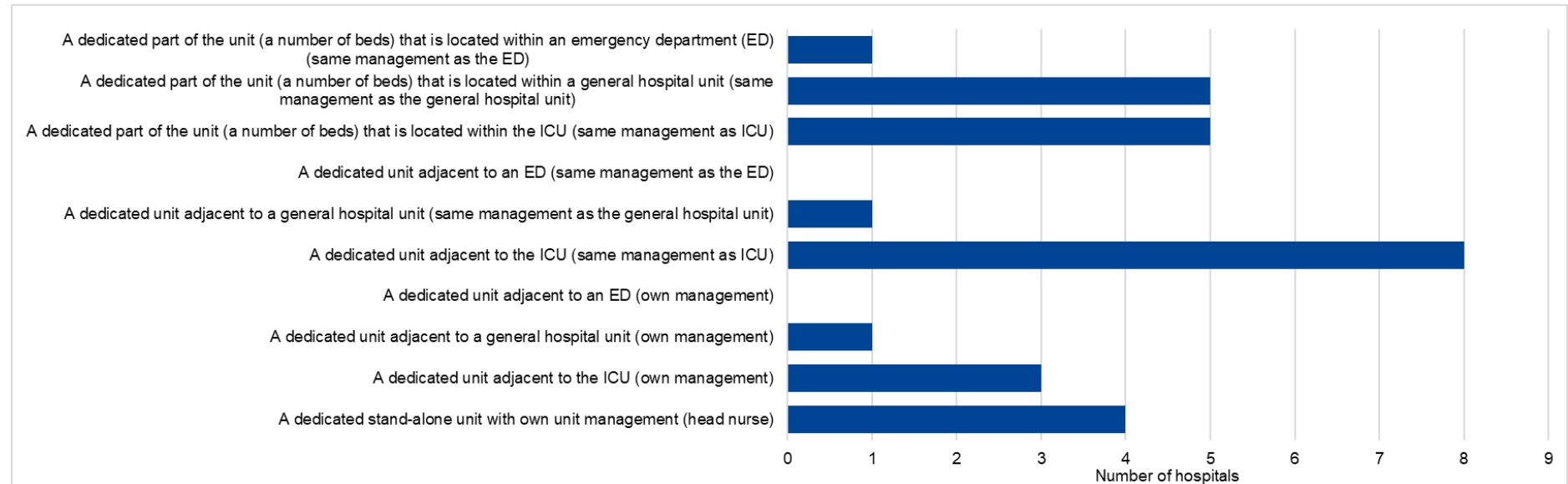
Figure 23 – Number of licensed beds in ICUs and IMCUs, per hospital site



N = 68, missing = 32. The hospital sites are ordered by region (Brussels – Flanders – Wallonia) and total number of licensed beds (all types) in September 2022 (data FOD-SPF). As soon as the number of licensed beds is missing for one unit of the hospital site, the hospital site is considered missing.

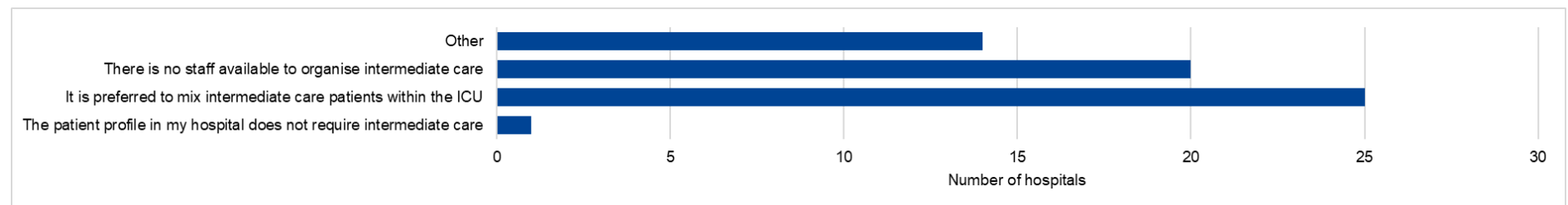


Figure 24 – Organisation of future IMCUs

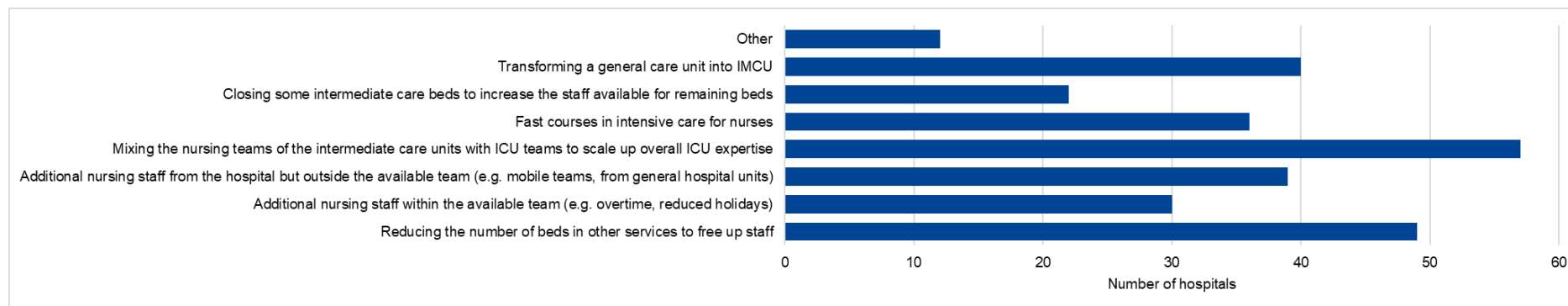


N = 28, missing = 0.

Figure 25 – Reasons not to open (additional) intermediate care units or beds



N = 47, missing = 3.

Figure 26 – Strategies to scale up intermediate care units

N = 77, *missing* = 3.



4 APPENDIX TO CHAPTER 9

Authors: TU Berlin: Elke Berger, Hendrikje Rödiger, Reinhard Busse; KCE: Mélanie Lefèvre, Carine Van de Voorde, Koen Van den Heede

4.1 Introduction

This appendix contains the country reports for Denmark, England, France, Germany, Italy, Sweden and the Netherlands. The country reports are organised in a consistent format and include the following sections:

- Background on healthcare system
- Legal definition and organisation of intensive care
 - Legal definition or not
 - Recent, ongoing or planned reforms
 - Staff requirements
 - Requirements for equipment
 - Levels of intensive care and requirements per level
 - Formal interdependencies with other hospital services/medical specialties
 - (Telemedical) Networks
 - Ability to scale up services in response to a pandemic outbreak or a disaster
- Intermediate care
 - Legal definition and organisation of intermediate care
 - Types of patients and admission criteria
 - Staff requirements
 - Requirements for equipment
- Reimbursement of intensive care
- Measuring, reporting and improving quality of intensive care

The method for the country selection (longlist and shortlist) and the information gathering process are described in the scientific report.

4.2 Background on healthcare systems of European countries

4.2.1 Denmark

The Danish healthcare system is organised according to three administrative levels: the state, region and local levels. Both municipal and state levels of government participate in planning and regulation. The state is responsible for general regulatory and oversight duties and holds fiscal responsibilities but also performs more detailed planning initiatives. Hospitals and self-employed healthcare professionals are among the responsibilities of Denmark's five regions. Tax revenues are the major source of funding for Denmark's healthcare system. The regions and municipalities receive block grants from tax revenues. In return, they provide health services and oversee illness prevention and health promotion.¹

In Denmark, healthcare is universal. Every citizen who is enrolled in Denmark's national health insurance programme is by default covered. The same applies for asylum seekers and legal immigrants. Essential medical care is also available to undocumented immigrants, but only through a different programme. Publicly funded healthcare mainly includes free primary, specialised, hospital, mental health, preventive, and long-term care services. Co-payments for outpatient medications, dental treatment, and other services are covered by optional complementary insurance that residents can acquire. Expanded access to private providers is made possible through supplementary insurance, provided mainly in form of a benefit for employees of private companies. For pharmaceutical co-payments, a financial safety net is created through cost-sharing limits.^{2, 3}

The primary care sector in Denmark includes private (self-employed) practitioners (general practitioners, specialists, physiotherapists, dentists, chiropractors, and pharmacists) as well as municipal health services, including nursing homes, home nurses, municipal dentists, and health visitors. Health visitors provide public health services for vulnerable groups in a domestic setting.⁴ GPs serve as gatekeepers, referring patients to hospitals and specialist care. The majority of secondary and tertiary care takes place in general hospitals owned and operated by the regions. Hospitals provide both inpatient and outpatient care, as well as emergency rooms that are open round-the-clock.^{2, 3}

Up until 2019, the primary method of reimbursing hospitals was through DRGs (Diagnosis Related Groups), which, depending on the region, accounted for between 40% and 55% of hospital reimbursement.⁵ A 2% activity objective was also in place, which encouraged hospitals to grow their activity by 2% yearly. This financing scheme was introduced in the late 1990s when Denmark was struggling with long waiting times in the healthcare system.⁶

In an effort to change incentives from activity and output to quality and efficiency, Denmark has recently announced that it is largely abandoning its DRG system. As a result, Denmark eliminated activity-based funding based on DRGs (*takststyring*, or tariff management) in 2019, replacing it with a framework of value-based payments (*vaerdibaseret styring*, or value-based management), which take into account factors like better accessibility to diagnosis and treatment.^{7, 8} The 2% activity target was also abolished. Currently, the five regions of Denmark are in the process of transitioning the old reimbursement methods to a combination of global budgets and targets.⁶

In 2020, Denmark spent € 3 964 per capita (adjusted for differences in purchasing power) for healthcare. This corresponds to a share of 10.5% of Denmark's GDP (Gross Domestic Product) in the same year.⁹ The bulk of healthcare spending is publicly funded: 84.9% of total health expenditure was public in 2020. Voluntary health insurance and out-of-pocket payments accounted for the other 15.1%.^{9, 10} Denmark spends a higher share of current health expenditure on outpatient than on inpatient care. In 2020, the share of inpatient hospital expenditure was 26.5%, while 34.0% of total current health expenditure was spent on outpatient care.¹⁰

While there were over 100 hospitals in the early 2000s, Denmark introduced a reform in 2007 to consolidate hospitals. Competencies and expertise were concentrated and today there are 18 clinic centres where all kinds of treatments are performed. In addition, there are outpatient clinics where



less intensive treatments are performed. The comparable small hospital sector is also reflected in the number of hospital beds.

In Denmark, inpatient services that are not very complex are assigned to basic care. For common diseases, this applies to services that are provided frequently and whose resource consumption would not justify specialisation; this includes the diagnosis and treatment of type 1 diabetes mellitus or COPD. Basic care is planned at the level of the five regions but requires consultation with the Danish health authorities. Services of higher complexity are assigned to the specialised services which are subdivided into specialised regional and highly specialised services. The definition of these levels of care is ultimately based on the medical complexity of the services.¹¹

Regionally specialised hospital services include tasks of some complexity where the sickness or health services are relatively rare and/or where resource consumption requires a concentration of services. Depending on the treatment volume in the region and the local conditions, a regional function is usually set up in each region. If there are regional functions in several hospitals within a region, a binding cooperation is required. This can include, for example, guidelines for joint treatment, quality monitoring and aftercare. In some hospitals in the region, various regional functions are concentrated in order to create synergies, for example with regard to emergency care.¹¹

Some services are so complex, rare or resource intensive that an adequate level of treatment cannot be independently established in Denmark. This includes, for example, the treatment of very rare diseases and complicated interventions in paediatric or cancer surgery. In these cases, current legislation in Denmark allows patients to be referred abroad, usually to the UK, Germany or the US, for highly specialised hospital services. Such referrals are paid by the national health insurance programme and must be approved by the Danish Health Authority (regulated in Section 89 of the Danish Health Act). Some services may be available from a Danish hospital being provided in cooperation with a hospital abroad.¹¹ Which level of specialisation applies to which procedure is laid down in the respective specialty plans. In 2017, specialty plans existed for a total of 36 service areas including information on which hospitals are approved for around 1 000 procedures. Among other things, the plans explicitly stipulate which specific hospitals may carry out which interventions and which patients they may treat.^{11, 12}

4.2.2 *England*

Since devolution in the late 1990s, the respective governments in England, Scotland, Wales and Northern Ireland have been responsible for organising and delivering healthcare services.

In England (where more than 80% of the UK population lives) the healthcare system is based on the NHS (National Health Service), which provides compulsory universal coverage for all legal residents. The government of the United Kingdom allocates a fixed budget for healthcare in England. In their respective regions, integrated care boards (which took over responsibility from Clinical Commissioning Groups in 2022) are responsible for planning and funding most NHS services in their area, typically covering populations of more than 1 million people. Some planning and delivery also take place at the more local level within each integrated care system. For example, primary care networks are groups of GP practices and NHS community health services that work together to provide and coordinate delivery of a range of community services, such as mental health services and social prescribing, to populations between 30 000 and 50 000.¹³

Primary care services serve as a patient's initial point of contact and provide continuous and comprehensive care. Patients gain access to specialised care through referrals from general practitioners, with primary care acting as a gatekeeper.

In England (as elsewhere in the United Kingdom), general taxes pay for the majority of healthcare costs; out-of-pocket expenses and private health insurance cover for remaining costs. There is no explicit list of benefits covered by the NHS, but legislation that outlines broad categories of healthcare services that should be covered. Some services are provided free of charge to everyone, regardless of immigration and residency status. These include emergency services and primary care services.

For non-emergency hospital treatment, any person that is ordinarily resident in the UK can use NHS healthcare services without paying at the point of use. 'Ordinarily resident' means that the residence is not temporary, and the individual is in the country legally. There are some benefits that are excluded where out-of-pocket payments exist, including social care, dental care, optometry and eye care and prescription charges.

Since 2003, the Payment by Results (PbR) tariff system has been in place, the NHS equivalent to the DRG-system. The PbR tariff provides a fixed payment for a specific episode of care (such as a hip replacement), taking into account the complexity of the patient's healthcare needs. In 2019, PbR-payments made up just under 60% of acute healthcare, being increasingly augmented with other forms of payments such as block contracts and risk-sharing.¹⁴ A Healthcare Resource Group code is given to hospital stays from admission to discharge; if there are multiple episodes of care within a single hospital stay, the dominant episode is the one that is coded.

Although PbR has been successful in inducing more hospital activity, it has provided less incentives for the integration of care or prevention of ill health.¹⁵ In order to overcome this challenge, NHS England started reforming the PbR system in 2020 into a blended payment system, which combines a fixed block payment with a quality-based or outcomes-based element and a 'variable' element that would indicate to what extent waiting lists for elective care could be reduced. This new payment method is currently in the process of implementation.^{6, 16}

In addition, Pay for Performance schemes have been introduced in order to encourage improved quality of care. Quality indicators are agreed upon nationally and locally and include four key areas: prevention of ill health, mental health, patient safety and best practice pathways.¹⁷

4.2.3 France

The French health system administration is strongly centralised and controlled by the government and the SHI (social health insurance) programme (*assurance maladie*). The SHI scheme is made up of multiple non-competing funds in order to provide coverage for French residents. The applicable fund is mostly determined by the location of employment, and all funds offer the same benefits. The majority of funding for SHI derives from income-related contributions made by both employers and employees, income taxes and additional sources such as taxes on tobacco and alcohol. SHI offers a comprehensive benefits package and contributes almost three-quarters to overall health spending.^{18, 19}

The French health system is universal, yet most health services, including primary care visits and hospital admissions, are subject to user fees. Therefore, approximately 95% of the French population has additional complementary health insurance to cover these co-payments, which account for nearly 14% of current health spending.²⁰ Some healthcare professionals are allowed to practice so called fee overruns (*dépassement d'honoraire*). These costs which are not covered by the SHI, may be covered through the complementary health insurance, depending on the individual contract.²¹

The residents have numerous options for public and private healthcare providers. Self-employed health professionals are reimbursed in large on a fee-for-service basis by the SHI plan and generally abide by the tariffs established by the SHI scheme, while some can charge additional fees. Private hospitals also contract with the SHI scheme and are paid through regulated tariffs set at the national level. Patients choose a '*médecin traitant*' (treating physician) who will serve as their initial point of contact throughout an episode of care and who will refer them to specialists. This '*médecin traitant*' is often a general practitioner.^{22, 23}

Under the French medical activity-based payment system (*tarification à l'activité*; T2A), hospital acute care and hospitalisation at home (*hospitalisation à domicile*; HAD) are largely paid by a diagnosis-related group (*groupe homogène de maladies*; GHM) method. Each patient's stay is assigned to one of the about 2 200 GHMs and a corresponding GHS (homogeneous group of stay, or *groupe homogène de séjours*; GHS). Additional activity-based hospital payments cover fees for outpatient consultations and certain expensive technologies and interventions including intensive care. Block



grants provide annual lump sum funding, allocated for services such as emergency care, organ retrieval and transplants.^{22, 24}

France is currently transitioning to a funding model that combines global budgets and activity-based funding.²⁵ In the coming years, it is intended to reduce the share of DRG payments from around 80% to 50%.⁶

4.2.4 Germany

The foundation of the German healthcare system is its compulsory health insurance. Residents are insured either in the SHI or in the co-existing substitutive private health insurance (PHI) and are provided with almost universal healthcare. The SHI system consists of 96 different sickness funds and covers 89% of the population.²⁶ Particular professional groups and all employees with incomes above a certain threshold are eligible for PHI. Currently, 10% of the population is included in the PHI system's coverage. Refugees, asylum seekers and undocumented migrants also have limited access to medical treatment.^{27, 28}

The SHI system is financed by income-related employee and employer contributions. The Central Reallocation Health Fund pools funds, which are then distributed to the sickness funds in accordance with its participants' needs. A risk-adjustment technique based on morbidity determines the allocation. PHI is financed through individual premiums that are determined based on a person's health risk, age, and desired private healthcare services. The SHI package of benefits is explicit and extends beyond basic health services. The SHI covers all legal prescription medications with the exception of those requiring a benefits evaluation.²⁷

Healthcare regulation, management, and delivery are decentralised and dispersed between inpatient hospital care and ambulatory care, which is provided by general practitioners and specialists. In primary care, there is no gatekeeping mechanism, and integration and coordination of services are limited. Ambulatory care providers in SHI are mostly compensated on a fee-for-service basis in accordance with a standard fee catalogue.²⁷

German hospital financing is based on the principle of dual financing. While operating costs are reimbursed using a German version of the DRG (G-DRG) system, investments in hospital infrastructure are funded by the states. The G-DRG system is a patient classification system. The method assigns treatment cases unambiguously to clinically defined groups (i.e. DRGs) characterised by comparable treatment costs. The assignment of treatment cases to a DRG in the G-DRG system is based on a grouping algorithm that uses the hospital discharge dataset as a basis for a variety of criteria, including: primary diagnosis, secondary diagnoses, medical procedures, patient characteristics (gender, age, weight of newborn children), mode of admission, discharge disposition (e.g. death), and length of stay. Due to ongoing diversification, the number of DRGs has expanded to 1 275 in 2021.²⁹ Supplementary fees are used to compensate the costs of certain innovative technologies and expensive services or pharmaceuticals.²⁷

A substantial change to the G-DRG-based reimbursement system was introduced in recent years. Because of nursing staff cutbacks in hospitals witnessed in the years following the implementation of the G-DRG system, the Nursing Staff Empowerment Act (2019) directed self-governing bodies to exempt nursing personnel expenditures from DRG case fee remuneration. Individual nursing staff expenditures in acute care hospitals are now fully covered by sickness funds, while DRGs reimburse all other operating costs.²⁷

4.2.5 Italy

The foundation of the Italian healthcare system is its National Health Service (*Servizio Sanitario Nazionale*, SSN), which mandates compulsory universal coverage for all legal residents. The state determines the national benefits package to be provided by the SSN to all citizens in all regions on the basis of 'essential levels of care' (*Livelli Essenziali di Assistenza*; LEA), which include primary care visits, hospital inpatient care, outpatient health services and pharmaceuticals as well as

rehabilitation, and community health services. Registration with a general practitioner who fulfils a gatekeeping role is mandatory for patients.^{30, 31}

The regulation, management, and delivery of healthcare is highly decentralised. The central government is responsible for formulating national health policies and priorities, regulating SSN, and allocating regional funds. Regional entities are responsible for ensuring the organisation and delivery of care services through local health units and public and private hospitals.

Regional company taxes and a regional surcharge on income tax as well as national levies on value-added goods and services fund the compulsory SSN scheme.³² The Italian health system offers a wide range of publicly funded benefits, though some services, such as specialist outpatient care and prescribed medications, require co-payments from patients. The SSN has limited coverage for dental care and excludes coverage for over-the-counter medications.^{30, 33}

Most hospital revenue is achieved through a diagnosis-related group-based prospective financing system, which is in place nationwide. Hospitals run directly by local health authorities, however, usually operate on global budgets. Each region sets its own payment rates for inpatient and outpatient care, using national rates provided by the Ministry of Health as a baseline.³⁰ The majority of hospital care is paid for using DRG tariffs. All hospital costs, also accounting for the price of expensive equipment and medications, are included in the rates.^{30, 33} The payment system has significant geographical differences in how fees are set, which services are excluded, and the methods used to influence care patterns. However, all areas have methods for reducing fees once a certain spending level is exceeded. In every region, a portion of hospital funding is distributed outside the prospective payment system, for example, to pay for particular services like education programmes and emergency care.^{30, 34}

4.2.6 Sweden

The universal healthcare system in Sweden is nationally regulated and locally administered. The Ministry of Health and Social Affairs determines general health policies, the 21 regions finance and deliver healthcare services, while Sweden's 290 municipalities are legally obliged to meet the care and housing needs of the elderly and disabled population.³⁵

There is a mixture of publicly and privately owned healthcare institutions, however the majority of them are publicly funded. The foundation of the Swedish healthcare system is its primary care sector. GPs do not act as formal gatekeepers, however they usually remain the first point of contact for patients. County and regional hospitals provide care for conditions that demand hospitalisation. Regional hospitals are the primary locations for providing highly specialised care, which requires the most recent and sophisticated medical technology. To encourage collaboration about advanced hospital care, counties are grouped into the six healthcare regions (with a university hospital in each of them).^{36, 37} There is cooperation within these healthcare regions.

In Sweden, healthcare is dominantly financed by taxes. Public spending accounts for almost 80% of total health costs. To fund the services they deliver, county governments and municipalities impose proportional income taxes on the residents. Additionally, county councils and municipalities generate revenue from state grants and user fees. Approximately 14% of the population has VHI (voluntary health insurance), which is often paid for by their employers. VHI accounts for roughly 1% of the total funding. Private expenditures, primarily user fees, account for around 14% of total health expenditures.³⁵ County councils and municipalities individually establish the user charges for healthcare visits and per bed-day.³⁶

In the hospital sector, payment systems vary per county council, however payments based on global budgets, or a mix of global budgets, case-based payment, and performance-based payment, are often used in hospitals. DRGs make up less than half of all payments if employed. Less than 5% of overall payments are performance-based incentives tied to achieving quality goals. For complex cases that significantly exceed the average cost per case, per case reimbursements for outliers may be complemented by additional per diem payments. Primary care practitioners are typically paid on



a capitation basis for enrolled patients supplemented by fee-for-service and performance-based payments.^{36, 37}

4.2.7 The Netherlands

The Netherlands has a mandatory insurance system in which the government, for the main part, plays a remote role as market overseer. However, planning of medical professionals remains the government's responsibility by limiting the number of physicians trained. In the Netherlands, nearly all health insurers are non-profit cooperatives that either return earnings to their participants in the form of decreased premiums or dedicate any profits they make to the reserves they are obligated to maintain. Currently, four insurers control 90% of the insurance market. The integration of health remains fragmented across all policies, despite a growing interest in the topic at the local level. Many public bodies are involved in the health sector of the Netherlands.^{38, 39}

Municipalities are primarily responsible for public health services, which include prevention, screening, and vaccination. The Dutch system is characterised in large part by the gatekeeping principle. All residents are registered with a GP. The primary care system in the Netherlands is robust. Compared to GPs in many other countries, Dutch GPs offer a wide range of services. Only 7% of all patient contacts with a GP result in a referral to secondary care, with primary care handling approximately 93% of all patient contacts.³⁸

The standard benefit package includes access to general practitioner care, maternity care, hospital care, home nursing care, pharmaceutical treatment, and mental health care. VHI provides coverage for services not included in the base plan, such as eyeglasses and dental care. Approximately three-quarters of the cost of healthcare is covered by citizens' required health insurance premiums, with an additional 13% coming from general taxation. Adults pay a community-rated premium to their insurer as well as an income-dependent premium into a central fund that is reallocated among insurers according to a risk-adjusted basis.

Diagnosis Treatment Combinations (DTC) is an adapted form of the DRG approach used to compensate hospitals. It was introduced in 2005 and inspired by the DRG-system. The DTC system offers a distinct DTC for each diagnosis-treatment combination, thereby allowing for patients to have more than one DTC, in contrast to DRG systems, which group patients according to the diagnosis or procedure requiring the greatest amount of resources into a single DRG. In the situation of multi-morbidity, where the patient receives many treatments from different medical specialists during a single hospitalisation, this should allow for more flexibility.³⁸ DTCs pay for the use of medical equipment, diagnostic procedures, nursing care, and specialised medical care. In addition to these direct expenditures, indirect costs including those for education, research, and emergency treatment are also accounted for. The length of a hospital stay (within a range) or the number of diagnostic tests performed have no bearing on the DTC. A DTC care product's pricing does not include certain procedures that would disproportionately raise the cost of care, but they might be billed as add-ons.³⁹ Examples include intensive care admission or the purchase of costly medications. Compensation for expenses that cannot be attributed to a DTC may be granted to the hospital separately. These contributions might be used, among other things, to maintain an emergency room in a rural area where it would otherwise be financially unsustainable.³⁸

In the Netherlands, contracting serves as the organisational foundation for the interaction between purchasers and providers. For curative care, two methods of contracting are available: either negotiations on services based on price, volume, and quality (1) or selective contracts (2). General practitioners are remunerated via a combination of fee-for-service, capitation, bundled payments for integrated care, and pay-for-performance (dependent on parameters such as accessibility and referral patterns).³⁸ Health insurers negotiate annually with hospitals for the price (and quality) of their services and with GPs for integrated care and pay-for-performance. Often the main health insurer does the negotiations and the other insurers follow this.

4.3 International comparison of the organisation of intensive care

4.3.1 Legal definition and organisation of intensive care

4.3.1.1 Denmark

RECENT, ONGOING OR PLANNED REFORMS

The specialty plan for anaesthesiology (*Specialevejledning for Anæstesiologi*)⁴⁰ and the 'General recommendations for intensive care in Denmark' (*Generelle rekommandationer for intensiv terapi i Danmark*)⁴¹ form the base for the definition and organisation of intensive care.

The current levels of intensive care have already been introduced with the first 'General recommendations for intensive care in Denmark' from 1998 and are thus also included in the first specialty plan from 2010. Like all specialty plans in Denmark, the specialty plan for anaesthesiology is being updated regularly, with the latest version being from August 2023. The 'General recommendations for intensive care in Denmark' have been updated in 2013, 2020 and 2024. Since the 2020 edition, it has been a goal to achieve congruence with 'Recommendations on basic requirements for intensive care units' prepared by the European Society of Intensive Care Medicine from 2011 and the Danish Health Authority's (DHA, *Sundhedsstyrelsen*) specialty plan for anaesthesiology from 2019.⁴²

Currently, the provision of a sufficient number of nurses is the main subject of concern when it comes to intensive care in Denmark. Many nurses have left the profession or have taken up employment in the private hospital sector as a result of the COVID-19 outbreak and a nursing strike in 2021. Efforts are being made to train new ICU nurses.⁴³

LEGAL DEFINITION AND ORGANISATION OF INTENSIVE CARE

There is no legal definition of intensive care in Denmark. Instead, the specialty plan for anaesthesiology includes a definition of intensive care which is in line with the definition included in the 'General recommendations for intensive care in Denmark'. Accordingly, intensive care is the monitoring, observation, diagnosis, care and treatment of critically ill patients with potentially life-threatening conditions. Intensive therapy often includes organ-supporting treatment of threatened or failing vital functions.⁴¹

In accordance to the 'General recommendations for intensive care in Denmark', intensive care patients (1) must have failure or threatened failure of one or more organ systems, (2) the condition must be potentially reversible and (3) the need for treatment and/or monitoring cannot be met in an intermediate unit or ordinary bed unit.⁴¹

A distinction is made between a multidisciplinary ICU, monodisciplinary ICU and post-operative ICU.⁴¹

- A multidisciplinary ICU is an intensive care unit that treats patients from several basic specialties and handles observation, diagnostics and treatment of failure in all vital organ systems. Multidisciplinary ICUs can be divided in three levels (see later: *Levels of intensive care*).
- A monodisciplinary ICU (e.g. thoracic surgery or neurosurgery ICU) is an intensive care unit which is designed for a special patient category, but which can also treat failure of several organ systems.
- A post-operative ICU (e.g. postoperative respiratory care) is an intensive care unit designed, equipped and staffed especially for the observation and treatment of patients who have undergone major surgical procedures, where there is a subsequent need for more extensive observation and treatment than can be offered in a recovery unit.

In the 2020 version of the 'General recommendations for intensive care in Denmark', an intermediate care unit was defined as a unit that is not an ICU, but a unit where a higher degree of observation,



treatment and care can be offered than in an ordinary unit.⁴² In the 2024 version, although reference is made to intermediate care units, no definition is provided.⁴¹

STAFF: REQUIREMENTS IN TERMS OF NUMBERS

The number of physicians and nurses in the ICU must always be adapted to the unit's activity, patient composition (case mix), degree of illness and level of intervention. According to the 'General recommendations for intensive care in Denmark', 1 physician per 2-3 patients during normal daytime activity is suggested.⁴¹

Nursing staffing depends on the patient case mix in the unit and the complexity of the patients. The need may vary from 0.5 to 2 nurses per patient with a higher attendance during daytime compared to out-of-hours periods. The planned number of nurses should be sufficient to ensure optimal patient care.⁴¹

STAFF: REQUIREMENTS IN TERMS OF QUALIFICATION

The permanent medical staff are specialists in anaesthesiology with special practical and theoretical training in intensive therapy. During on-call periods, the department's permanent medical staff can be assisted by the hospital's other anaesthesiologists, always with at least one specialist in attendance. The competences of the staff present must always be sufficient for the task at hand. Newly hospitalised patients should be reviewed by a physician from the medical staff on the first day of admission.⁴¹

STAFF: PERSON IN CHARGE OF AN ICU

The specialists of the ICU have the professional responsibility for the unit, i.e. diagnosis, observation and treatment of patients. In addition, they are responsible for coordinating the overall medical effort. The management consists of a department head/specialty head/chief physician and a head nurse. In practice, management will most often be joint, but with a described clarity of decision-making authority in cases where consensus cannot be reached.

The medical director must be a specialist in anaesthesiology with specific practical and theoretical training in intensive care and relevant management training. The manager has medical and administrative responsibility for the ICU. The head of the ICU must be a full-time staff member and work primarily in the ICU. Medical management must be available at all times and in the absence of the manager, a suitable medical substitute must be appointed.

There must be a head of nursing. The head nurse should be a nurse with specialist training in intensive care nursing. The head nurse has overall responsibility for nursing care in the unit.⁴¹

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

The ICU is a geographically defined unit in the hospital, which is specially staffed, furnished and equipped to handle intensive care at a modern and high professional level. It should be located in the closest possible connection to the acute reception department, operating department, X-ray department, central laboratory, among others.⁴¹ This holds for the three types of ICU.

There should be a minimum of six treatment places for intensive medical care in order to obtain and maintain the best possible professional quality.⁴¹

The ICU should be set up with well-defined areas for patient treatment, workplaces for physicians and nurses with the possibility of full visual monitoring of the patient, cleaning room, medicine depot, equipment depot, goods depot, laboratory, conference room, meeting room, staff accommodation and duty room. There should also be suitable accommodation for relatives. Office facilities and duty rooms for the medical staff should be available in the unit. A permanent personal workplace is recommended as a minimum for permanent physicians. Physicians and nurses with personnel management responsibilities should have their own office.⁴¹

LEVELS OF INTENSIVE CARE

Multidisciplinary ICUs (see above: *Legal definition and organisation of intensive care*) can be divided into the following three levels:⁴¹

- Level 1 (lowest): Can treat patients with moderate organ failure (maximum one organ failure) who do not require transfer to a higher-level ICU. Children younger than 10 years old should not be admitted.
- Level 2: Can treat patients with multi-organ failure who do not require transfer to level 3. Must be in hospitals performing major surgical procedures or other treatment of critically ill patients; and where there is a risk that patients will need intensive medical care and in hospitals with joint medical emergency departments.
- Level 3 (highest): Can perform particularly advanced and rare intensive medical care and can treat patients with all types of organ failure. Must be in hospitals with highly specialised functions.⁴⁰

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION PER LEVEL

There are no level-specific requirements in terms of staffing or their qualification.

STAFF: PERSON IN CHARGE OF AN ICU PER LEVEL

Information not available.

EQUIPMENT: REQUIREMENTS PER LEVEL

In accordance to the specialty plan for anaesthesiology, ECMO (Extracorporeal membrane oxygenation) is classified as a procedure only ICUs in highly specialised hospitals (= level 3 ICUs) are allowed to perform. It is thus only available in four highly specialised units across Denmark.⁴⁰

FORMAL INTERDEPENDENCIES WITH OTHER HOSPITAL SERVICES/MEDICAL SPECIALTIES

A (national) referral system exists to the extent that the regions collaborate to secure sufficient ICU resources. There must be capacity to receive acute patients without delay, which in practice means that the average occupancy rate calculated on an hourly basis should not exceed 75%, so that the department can serve as a contingency and premature and night discharges of intensive care patients are avoided.⁴¹

In hospitals with an ICU, there must be sufficient qualitative and quantitative coverage of medical specialties and other support functions. Relevant functions, e.g. cardiology, surgery, clinical microbiology and blood bank must be present to the extent necessary for optimal patient care. There must be 24-hour laboratory service and diagnostic imaging.⁴¹

(TELEMEDICAL) NETWORKS

Ambulances are linked up to the emergency departments and the hospital networks using the Prehospital Patient Record system (*Præhospitale Patient Journals-system* (PPJ)).⁴⁴

ROLE AS A TRAINING CENTRE

All Level 2 and 3 ICUs act as training centres.



ABILITY TO SCALE UP SERVICES IN RESPONSE TO A PANDEMIC OUTBREAK OR A DISASTER

The regions have developed plans for a stepwise increase of ICU capacity from 1 078 ICU beds (including 645 ICU beds with ventilators usually reserved for patients with elective surgery) by up to 450, 600 and 800 intensive care beds in case of increased pressure on demand.⁴⁵ This also includes plans for staffing (involving retired physicians and physicians in training, and nurses from other specialties).

Each of the five regions has disaster plans. The National Health Agency is part of the national crisis and disaster management organisation and coordinates with the regions.⁴⁶

4.3.1.2 England

RECENT, ONGOING OR PLANNED REFORMS

No major structural reforms have been adopted in recent years and there are no planned or ongoing reforms with regard to ICUs and their organisation.

There is a current NHS England programme of work, looking at critical care. The Transform Clinical Reference Group (CRG) reviews all adult intensive care in England covered as part of specialised pathways and commissioned by NHS England. They have a role in reviewing clinical standards and in restoring and strengthening services. The programme develops a variety of tools and guidance to help commissioners, networks and providers plan and deliver services in their area of responsibility.⁴⁷

LEGAL DEFINITION AND ORGANISATION OF INTENSIVE CARE

In England, there is no legal definition of intensive care but a functional one set by the NHS and only applicable to NHS providers. A critical care period is a period of time within a hospital provider spell during which a patient receives critical care.⁴⁸

The Guidelines for the Provision of Intensive Care Services (GPICS) is a reference source for planning, commissioning and providing adult intensive care services in England.⁴⁹ Following the COVID-19 pandemic in 2020-2021 and the revision of levels of critical care classification (see later: *Levels of intensive care*) in 2021, the GPICS has been reviewed in July 2022.⁵⁰ There are also service specifications for the provision of adult intensive care services.⁴⁷ Service descriptions are important for clearly defining the standards of care for organisations funded by NHS England for the delivery of specialised care.

STAFF: REQUIREMENTS IN TERMS OF NUMBERS

The GPICS contain prerequisites for the number of medical, nursing, and allied healthcare staff, but not for medical equipment.⁵⁰

For medical staff (physicians), the daytime consultant-to-patient ratio must not normally exceed a range between 1:8 and 1:12. This ratio is complex and needs to be cognisant of the seniority and competency of junior staff, the reason for admission (e.g. standard post-operative care pathway) and the number and complexity of emergency admissions. The guideline does not define a night-time ratio for medical staff.

The daytime intensive care resident-to-patient ratio should not normally exceed 1:8. The ratio may need to be reduced if local arrangements dictate that the intensive care resident is expected to provide emergency care outside of the critical care unit (e.g. wards and emergency department). The night-time resident-to-patient ratio should not normally exceed 1:8.

For nurses, staffing ratios are determined by patient level of care (see later: *Staff: Requirements in terms of numbers and qualification per level*) although there is no guidance for the lowest (level 1) level.

For pharmacists, there must be a designated intensive care pharmacist for every critical care unit. Stronger requirements must be met for higher levels of care (see later: *Staff: Requirements in terms of numbers and qualification per level*).

Physiotherapists must participate in opportunities for integrated decision making and dissemination of clinical information. Critical care units must have access five days a week during working hours to a dietitian, to a speech and language therapist, and to occupational therapy services. Psychologists should ensure that patients and relatives receive psychological education to explain the psychological impact of intensive care drugs, procedures and environment. This can be delivered in person or via information leaflets. As all patients must be screened daily for delirium, psychologists should ensure that delirium is accurately assessed by nurses using a validated instrument.

STAFF: REQUIREMENTS IN TERMS OF QUALIFICATION

According to the GPICS, the aspiration is that patients' care must be led by a consultant in intensive care medicine, who is defined as a consultant who is a fellow/associate fellow or eligible to become a fellow/associate fellow of the Faculty of Intensive Care Medicine. A consultant in intensive care medicine will have daytime direct clinical care programmed activities in intensive care medicine identified in their job plan. These programmed activities will be exclusively in intensive care and the consultant cannot be responsible for a second speciality at the same time.⁵⁰

Each designated critical care unit is expected to have an identified lead (senior) nurse who has overall responsibility for the nursing elements of the service. There should also be a supernumerary (i.e. not rostered to deliver direct patient care to a specific patient) senior registered nurse who provides the supervisory clinical coordinator role on duty 24/7 in critical care units. Units with less than six beds may consider having a supernumerary clinical coordinator to provide the supervisory role during peak activity periods, e.g. early shifts. Units with more than ten beds must have additional supernumerary senior registered nursing staff over and above the supervisory clinical coordinator to enable the delivery of safe care (i.e. 11-20 beds +1, 21-30 beds +2, etc.). The number of additional staff per shift is incremental depending on the size and layout of the unit (e.g. multiple pods/bays, single rooms). Consideration for the need of additional staff also needs to be given during events such as an infection outbreak. Each critical care unit must have a dedicated clinical nurse educator responsible for coordinating the education, training and CPD (Continuing Professional Development) framework for intensive care nursing staff and pre-registration student allocation. This should equate to a minimum of 1.0 FTE per 75 nursing staff. A minimum of 50% of registered nursing staff must be in possession of a post-registration academic programme in critical care nursing.⁵⁰

There must be a training strategy in place to achieve a minimum of 50% of nursing staff with a post-registration award in critical care nursing. Critical care services must have an effective clinical governance platform and robust data collection system. This must encompass participation in national audit programmes for adult critical care (ICNARC) Case Mix Programme (see section 4.3.5.2), including patient reported outcome measures (PROMS) when available.⁴⁷

STAFF: PERSON IN CHARGE OF AN ICU

Medical staff: The GPICS states that patients' care should be led by a consultant in intensive care medicine.⁵⁰

Nursing staff: There must be a supernumerary (i.e. not rostered to deliver direct patient care to a specific patient) senior registered nurse who provides the supervisory clinical coordinator role on duty 24/7 in critical care units.⁵⁰

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

An ICU is a high-tech area with a wide range of clinical equipment designed for diagnosis, monitoring and treatment. Around the clock, as well as in emergencies, this equipment must be available. Staff should be trained in the safe use of patient-facing technologies. The GPICS have set some standards and recommendations. This includes, among other things, that the equipment must meet safety



standards, maintenance and testing of use must take place. A clinical equipment manager is responsible for the assessment, procurement, use and replacement of equipment in the ICU.⁵⁰

LEVELS OF INTENSIVE CARE

In England, levels of intensive care are defined at the patient level: a classification is made that describes the levels of care required by critically ill patients in hospital according to their clinical needs, regardless of patient location. In the 2019 version of the GPICS, three levels of critical care were defined. Level 1 patients were 'patients at risk of their condition deteriorating, or those recently relocated from higher levels of care, whose needs can be met on an acute ward with additional advice and support from the critical care team'. In level 2, patients required 'more detailed observation or intervention including support for a single failing organ system or post-operative care or those 'stepping down' from level 3 care.' Level 3 concerned 'patients requiring advanced respiratory support alone, or basic respiratory support together with support of at least two organ systems. This level includes all complex patients requiring support for multi-organ failure.' Level 0 corresponded to general unit care.⁵⁰

However, the 2019 GPICS mentioned the need to review this classification. To do so, the Intensive Care Society consulted a broad range of stakeholders in order to reflect changes in delivery and demand of critical care. The 'Consensus Statement' issued in 2021 does not recommend (yet) any changes in staffing ratios, but merges the pre-existing level 0 and level 1 into general unit care. This allowed to use level 1 of critical care to represent the emerging notion of Enhanced Care (see also section 4.3.3.2). Some changes were also made in the definition of levels 2 and 3 to reflect a more current picture of critical care, in particular the addition of delirium.⁵¹

The revised version of the GPICS (2022) endorsed this classification. Levels of adult critical care are defined as follows:⁵⁰

Level 1 – Enhanced Care:

- Patients requiring more detailed observations or interventions, including basic support for a single organ system and those 'stepping down' from higher levels of care.
- Patients requiring interventions to prevent further deterioration or rehabilitation needs which cannot be met on a normal unit.
- Patients who require ongoing interventions (other than routine follow up) from critical care outreach teams to intervene in deterioration or to support escalation of care.
- Patients needing a greater degree of observation and monitoring that cannot be safely provided on a general unit, judged on the basis of clinical circumstances and ward resources.

Level 2 – Critical Care:

- Patients requiring increased levels of observations or interventions (beyond level 1) including basic support for two or more organ systems and those 'stepping down' from higher levels of care.
- Patients requiring interventions to prevent further deterioration or to support ongoing rehabilitation needs, beyond that of level 1.
- Patients needing two or more basic organ system monitoring and support.
- Patients needing one organ systems monitored and supported at an advanced level (other than advanced respiratory support).
- Patients needing long term advanced respiratory support.
- Patients who require Level 1 care for organ support but who require enhanced nursing for other reasons, in particular maintaining their safety if severely agitated.

- Patients needing extended post-operative care, outside that which can be provided in enhanced care units: extended postoperative observation is required either because of the nature of the procedure and/or the patient's condition and co-morbidities.
- Patients with major uncorrected physiological abnormalities, whose care needs cannot be met elsewhere.
- Patients requiring nursing and therapies input more frequently than available in level 1 areas.

Level 3 – Critical Care:

- Patients needing advanced respiratory monitoring and support alone.
- Patients requiring monitoring and support for two or more organ systems at an advanced level.
- Patients with chronic impairment of one or more organ systems sufficient to restrict daily activities (co-morbidity) and who require support for an acute reversible failure of another organ system.
- Patients who experience delirium and agitation in addition to requiring level 2 care.
- Complex patients requiring support for multiple organ failures, this may not necessarily include advanced respiratory support.

Although the above levels of care are defined at the patient level, hospitals report to the NHS the configuration (in terms of beds) of their critical care units, according to the following definition:⁵²

- Level 2 bed: patients requiring more detailed observation or intervention including support for a single failing organ system or post-operative care and those 'stepping down' from higher levels of care. Units with level 2 beds are also known as 'high dependency units' (HDU) (see section 4.3.3.2).⁵³
- Level 3 bed: patients needing advanced respiratory support alone or two or more organ systems support. It should be noted that basic respiratory and basic cardiovascular support occurring on one day count as one organ. This level includes beds for all complex patients requiring support for multi-organ failure.

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION PER LEVEL

The GPICS emphasise that, while a lower level of care usually requires a lower nurse-to-patient ratio, this may not always apply, and the aim should be flexibility in the provision of staff resources to meet all the care needs of the patient. In that way, the level of care assigned to a patient should influence, but not determine, staffing requirements.⁵⁰ Nevertheless, the following nurse-to-patient ratios are recommended: level 3 patients must have a registered nurse-to-patient ratio of a minimum 1:1 to deliver direct care; level 2 patients must have a registered nurse-to-patient ratio of a minimum of 1:2 to deliver direct care. For level 1 patients, the guideline does not provide information on staffing of nurses.⁵⁰

For pharmacists also, recommendations are differentiated by level: there should be 0.1 FTE pharmacist for every level 3 bed. For every two level 2 beds, there should be a service available five days a week.

STAFF: PERSON IN CHARGE OF AN ICU PER LEVEL

There are no level-specific requirements.

EQUIPMENT: REQUIREMENTS PER LEVEL

Level 2 and 3 facilities should comply with the 'Health Building Note 04-02' issued by the Department of Health.⁵⁰ This note states among others that the following equipment may be required at the bedside on an intermittent or continuous basis:⁵⁴



- mobile X-ray machine
- haemodialysis machine
- hemofiltration machine
- peritoneal dialysis machine
- EEG machines
- electrocardiography machines
- echocardiography machines
- transoesophageal echocardiography machines
- invasive cardiac output monitoring devices
- ultrasound machines
- gamma cameras
- endoscopes (fibre-optic light source).

DEFINITION FOR THE MEDICAL INDICATION FOR INTENSIVE CARE, VENTILATION AND ECMO

For ECMO, there is a service specification that covers the provision of extracorporeal membrane oxygenation in adults.⁵⁵ In addition, there is a BTS (British Thoracic Society)/ICS guideline for ventilation management for acute hypercapnic respiratory failure in adults.⁵⁶ All ECMO services have the same referral criteria in England.⁵⁷

There are seven UK centres commissioned to provide adult respiratory ECMO support, of which six are located in England.⁵⁸ Each of the centres covers a specific geographical area. In addition, there are a number of established critical care networks. The centres work closely together to ensure safe and efficient performance.⁵⁹

FORMAL INTERDEPENDENCIES WITH OTHER HOSPITAL SERVICES/MEDICAL SPECIALTIES

There are formal interdependencies with other hospital services/medical specialties required, set out in the service specification for the provision of adult intensive care services. Critical care services need to ensure that services can respond to changes in demand. This may require the transfer of the patient to another unit where the required specialisation is available. Collaborative working between national and local commissioners (NHS England Specialised Commissioning teams and Clinical Networks (Strategic Clinical Network and Operational Delivery Networks)) is essential to the design and delivery of the service.⁴⁷ Highly specialised services are commissioned at national and regional level and these often incorporate a component of critical care. These include neurosciences, cardiothoracic surgery, specialised cardiology, transplant surgery, specialist cancers, major spinal injuries, specialist burns services and other complex care.

Critical care units participate in development networks that were set up to coordinate pathways and share expertise.⁶⁰

(TELEMEDICAL) NETWORKS

There are telemedical networks in the UK, but they are organised more on a regional and local level. For example, Guy's and St Thomas' Charity (GSTT) provides an e-ICU support to a number of hospitals. The e-ICU programme aims to transform conventional hospital ICUs by providing real-time monitoring of patients around the clock under the supervision of critical care specialists.⁶¹

ROLE AS A TRAINING CENTRE

There is an Intensive Care Medicine Curriculum Document which describes the purpose, learning content, course of training and programme of training required for postgraduate specialist training leading to a Certificate of Completion of Training (CCT) in Intensive Care Medicine. The latest curriculum was implemented on August 2021.^{50, 62} This document is for anyone involved in the development of postgraduate medical curricula for the UK.

ABILITY TO SCALE UP SERVICES IN RESPONSE TO A PANDEMIC OUTBREAK OR A DISASTER

The 'NHS England Emergency Preparedness, Resilience and Response Framework' describes how the NHS in England will fulfil its duty to be properly prepared for dealing with incidents and emergencies. It provides a framework for all NHS-funded organisations in England.⁶³ Objectives of the framework are:⁶³

- to prepare for the common consequences of incidents and emergencies rather than for every individual emergency scenario.
- to have flexible arrangements for responding to incidents and emergencies, which can be scalable and adapted to work in a wide range of specific scenarios.
- to supplement this with specific planning and capability building for the most concerning risks as identified as part of the wider UK resilience.
- to ensure that plans are in place to recover and learn from incidents and emergencies and to provide appropriate support to affected communities.

Furthermore, an updated edition of the adult critical care surge plan guidance has been published recently. This builds on the publication of the national adult critical care transfer service specification and other associated guidance documents. It also incorporates learning from the response to the COVID-19 pandemic.⁶⁴

Furthermore, there is specific guidance for managing surge and escalation in critical care services.⁶⁵

4.3.1.3 France

RECENT, ONGOING OR PLANNED REFORMS

The French intensive care system (called critical care, *soins critiques*) underwent a reform in 2022 which aimed to create a simplified categorisation of critical care levels and a more standardised medical organisation of critical care. In the following sections, the current organisation of critical care and, where relevant, differences with respect to the former legislation are described.

Before the reform, critical care was organised in three levels: resuscitation (*réanimation*), intensive care (*soins intensifs*) and continuous monitoring (USC, *unités de surveillance continue*). In 2019, 28% of critical care beds were located in a resuscitation unit, 30% in an ICU and 42% in a continuous monitoring unit.⁶⁶

Since 2017, there have been reflections on a reform of the legislative framework of critical care. In particular, a reform was deemed necessary regarding continuous monitoring units. These units were created in the 1990s to serve as step-down and step-up units.^{67, 68} They were not subject to strong functioning standards or quality standards.⁶⁸ They could be located on the same hospital site as a resuscitation unit, but this was not mandatory. Following a trend toward more concentration of critical care and the closure of several resuscitation units, many continuous monitoring units (61%) were therefore located in hospital sites without resuscitation unit. In 2021, stand-alone continuous monitoring units (*USC isolées*) accounted for 46% of continuous monitoring beds.⁶⁸ This was considered as the main weakness in the organisation of critical care: the absence of formal rules for



continuous monitoring units led to an increase of stand-alone units, with very heterogeneous functioning and, for part of them, an activity that cannot be qualified as intensive care activity.⁶⁸

The reform was formally initiated during the COVID-19 pandemic. The spirit of the legal reform and the associated healthcare planning (Critical care road map 2022-2025 – *Feuille de route soins critiques 2022-2025*) was to:⁶⁹

- Create a clear care programme for critical care (with the new legal framework for critical care, a new definition of levels of care and a new financing system)
- Increase critical care capacity to meet increasing needs (+ 1 000 resuscitation beds)
- Increase staff resources and decrease the staff turnover (+ 400 specialised physicians within ten years, increase nurse to patient ratios during day and night, an eight week training for nursing staff starting to work in critical care, a net monthly salary bonus of € 100 for nursing staff, etc.)
- Ensure critical care is structured at the regional level (organised by the regional health agencies following national guidelines)
- Create surge capacity plans and reserves of trained healthcare providers in case of a health crisis.

In 2022, two new decrees on the organisation of critical care were published.^{70, 71} The provisions of the decrees entered into force in June 2023.⁷⁰ The decrees modify some provisions in the French Public Health Code (*Code de la Santé Publique*) which includes all regulations related to patient and professional rights with respect to medical goods and health services. One of the main changes is the disappearance of stand-alone continuous monitoring units. Such units can be transformed into 'derogatory general intensive care units' (see below: *Levels of intensive care*) if a medical presence is ensured 24/7, or into 'reinforced care units' (*unités de soins renforcés*) located within other services, notably oncology and interventional imaging (see section 4.3.3.3).⁷²

LEGAL DEFINITION AND ORGANISATION OF INTENSIVE CARE

Since June 2023, critical care is defined in the French Public Health Code, following Decree 2022-690,⁷¹ as the management of patients who have or are likely to have one or more acute organ failure(s) that can be directly life-threatening or alter their functional outcome and that may require the use of one or more supportive methods. Critical care is subdivided into adult and paediatric critical care. In the following sections, only adult critical care is described.

Critical care must include at least a resuscitation unit (*unité de réanimation*) and a general ICU (*unité de soins intensifs polyvalents*). The latter should be adjacent to the former but derogations are possible. A resuscitation unit must have at least eight beds (ten for new units) and a general ICU must have at least six beds (eight for new units). Resuscitation units are used for the long-term management of multiple organ failures while general ICUs are used to treat a single failure for a limited period of time:

- Resuscitation units ensure the care of patients who present or are likely to present one or more acute organ failure(s) that can be directly life-threatening or alter their functional outcome and that may require the use of one or more supportive methods.
- General ICUs ensure the care of patients who are likely to present one or more acute organ failure(s) that can be directly life-threatening or alter their functional outcome, and which may require the *temporary* use of a supportive method, pending transfer to a resuscitation unit if necessary. When the patient has one or more acute failure(s) that can be directly life-threatening or alter their functional outcome and require the use of a supportive method, the patient is transferred to the resuscitation unit.

In addition, there are also specialised ICUs (*unités de soins intensifs spécialisées*) in the following areas: cardiology (at least six beds), vascular neurology (at least four beds), haematology (at least

six beds), nephrology, respiratory and hepato-gastro-enterology. They ensure the care of patients who present or are likely to present an acute failure of the considered organ (without any other organ failure) that can be directly life-threatening or alter their functional outcome and require specific treatment related to the specialism.

For patients who do not require intensive care, postoperative monitoring is organised in a PACU (*salle de surveillance postinterventionnelle*) that may be integrated into an anaesthesia service and/or an operating theatre.⁷³

STAFF: REQUIREMENTS IN TERMS OF NUMBERS

Decree 2022-694 contains prerequisites for the number of medical staff, nursing staff and allied healthcare staff.⁷⁰

Regarding medical staff, requirements are set for the resuscitation unit together with the general ICU. If the general ICU is not adjacent to the resuscitation unit, then specific requirements are defined. Specialised ICUs also have specific requirements regarding medical staff. For nursing staff and allied healthcare staff, specific requirements are set for resuscitation units and for (general and specialised) ICUs (see *Staff: Requirements in terms of numbers and qualification per level* for detailed information).

STAFF: REQUIREMENTS IN TERMS OF QUALIFICATION

The medical team of the resuscitation and general ICUs consists of physicians specialised in intensive medicine and resuscitation or specialised in resuscitation and anaesthesia. The team can be supplemented by other physicians with a training or experience in intensive care.

The medical team of a specialised ICU is composed of physicians specialised in the concerned area, and, if needed, physicians from the previously cited categories.

It is also foreseen that hospitals offering critical care have a training plan, on site, including an eight weeks training for nurses starting to work in the resuscitation unit, which may be reduced in case of previous experience in resuscitation.

STAFF: PERSON IN CHARGE OF AN ICU

In all types of critical care units, coordination is ensured by a member of the medical team. In specialised ICUs, the coordinator-physician is a physician specialised in the concerned speciality with a training or experience in intensive care.

In all types of critical care units, a nurse manager is responsible for nursing and caring staff.

In PACUs, medical responsibility is ensured by a physician specialised in anaesthesia and resuscitation who is available immediately. This physician is responsible for transfers and discharges.

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

Decree 2022-694 contains prerequisites for the type of equipment that should be available in resuscitation units, in general and specialised ICUs.⁷⁰

The reception as well as diagnostic and therapeutic care and monitoring of the patients must be provided 24h a day, every day of the year.

- Critical care units must include at least the following premises:⁷⁴
- a reception area
- a hospitalisation area
- a technical area for cleaning, decontamination and storage of equipment



- a room, within the resuscitation unit or in the immediate vicinity, allowing physicians to ensure medical permanence on site 24 hours a day, every day of the year
- an area adapted for daily collective meetings allowing the reception of the entire medical and paramedical team of the unit and equipped with the digital tools necessary for the realisation of remote meetings.

LEVELS OF INTENSIVE CARE

Since the 2022 decrees, critical care can be broken down into two levels:

- Resuscitation units
- ICUs.

Within ICUs, several types can be distinguished:

- General ICUs, adjacent to the resuscitation unit
- Derogatory general ICUs, not adjacent to a resuscitation unit
- Specialised ICUs (cardiology, vascular neurology, or haematology)
- Other specialised ICUs (nephrology, respiratory or hepato-gastro-enterology).

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION PER LEVEL

The medical presence on site of the resuscitation unit and its adjacent ICU is ensured by at least two physicians from the medical team defined above during the day; and at least one physician specialised in intensive care medicine and resuscitation or specialised in resuscitation and anaesthesia during out-of-hours services.

If the general ICU is not adjacent to the resuscitation unit, then during out-of-hours services at least one physician with training or experience in intensive care should be present on site and at least one physician specialised in intensive care medicine and resuscitation or specialised in resuscitation and anaesthesia should be available on call.

In specialised ICUs, during out-of-hours services at least one physician with training or experience in intensive care should be present on site and at least one physician specialised in the concerned specialism should be available on call.

The requirements for nursing and caring staff are the following:⁷⁰

- Resuscitation unit: two nurses for five open beds and one care assistant for four open beds;
- ICU (general or specialised): one nurse for four open beds and one care assistant for four open beds during the day or eight during the night.

Before the reform, the requirements in resuscitation units were defined in terms of a nurse-to-patient ratio (two nurses per five patients and one care assistant for four patients). Many actors advocated for an increase of the ratio, and the use of a nurse to bed ratio instead of nurse-to-patient ratio.⁶⁸ When the occupancy rate is not maximal, the transformation into a nurse-to-bed ratio decreases the pressure on nursing staff. Although this was not implemented in the 2022 decrees, a ratio of one nurse per two beds was often mentioned.⁶⁸

For allied healthcare staff, decree 2022-694 lays down the following requirements:⁷⁰

- Resuscitation units include at least one physiotherapist with experience in critical care (7 days per week), at least one psychologist, and if needed a dietitian, an occupational therapist, and staff with biomedical expertise.
- General ICUs include at least one physiotherapist with experience in critical care and if needed a psychologist, a dietitian, an occupational therapist and staff with biomedical expertise.

- ICUs specialised in cardiology include at least one physiotherapist, one nutritionist, and if needed a psychologist, a social worker, and staff with biomedical expertise.
- ICUs specialised in vascular neurology include at least one physiotherapist, one speech therapist, and if needed a psychologist, a social worker, a dietitian, and staff with biomedical expertise.
- ICUs specialised in haematology include if needed a psychologist, a social worker, and staff with biomedical expertise.
- ICUs specialised in nephrology, respiratory or hepato-gastro-enterology include at least one physiotherapist with experience in critical care and if needed a psychologist, a dietitian, an occupational therapist and staff with biomedical expertise.

In PACUs, there is always at least one nurse with a training in postoperative monitoring (if possible a nurse-anaesthetist). When there are six or more occupied beds, two persons must be present, but the second person does not need to be a nurse (could be allied health professional).⁷⁵

As described above, the requirements in terms of qualification vary according to the level of critical care. In particular, on site out-of-hours services in resuscitation units should be ensured by a physician specialised in intensive care medicine and resuscitation or specialised in resuscitation and anaesthesia. This is not the case for ICUs, where a physician with training and expertise in critical care needs to be available on site and a physician specialised in intensive care medicine and resuscitation or specialised in resuscitation and anaesthesia should be available on call.

Regarding allied healthcare staff, at least one physiotherapist with experience in critical care should be part of the team of resuscitation units, general ICUs and ICUs specialised in nephrology, respiratory or hepato-gastro-enterology. For ICUs specialised in cardiology and vascular neurology, the physiotherapist does not need to have experience in critical care.

STAFF: PERSON IN CHARGE OF AN ICU PER LEVEL

See Staff: Requirements in terms of numbers and qualification per level for more information.

EQUIPMENT: REQUIREMENTS PER LEVEL

The equipment of each resuscitation unit should allow to perform:⁷⁰

- in the rooms of the unit: radiology, ultrasound and bronchial and digestive endoscopy examinations
- continuous parametric monitoring
- invasive and non-invasive mechanical ventilation
- organ supportive therapy.

The equipment of each ICU should allow the possibility to perform:⁷⁰

- in the rooms of the unit: radiology, ultrasound and bronchial and digestive endoscopy examinations;
- continuous parametric monitoring
- where appropriate, to provisionally perform organ supportive therapy, with the exception of extracorporeal circulation.

General ICUs that are adjacent to the resuscitation unit should have the equipment allowing invasive and non-invasive mechanical ventilation. Specialised ICUs should have the equipment enabling to perform organ supportive therapy for the concerned organ.⁷⁰

As to PACUs, there is a need for equipment allowing ventilation, monitoring and management of body temperature.⁷⁶



FORMAL INTERDEPENDENCIES WITH OTHER HOSPITAL SERVICES/MEDICAL SPECIALTIES

A hospital offering critical care must also have available 24/7:⁷¹

- a surgery unit, on site
- a medical unit, on site or via agreement
- an operating theatre, on site, offering the possibility for post-operative monitoring.

Also, the following services should be available (on site or via agreement): medical imaging (conventional radiology, angiography by scanner and ultrasound, MRI (Magnetic Resonance Imaging) and interventional radiology), bacteriology, haematology, biochemistry, haemostasis, and blood gas tests. Equipment must be available within or near the resuscitation unit, allowing urgent examinations of blood gases, lactate, sodium and potassium, haemoglobin, and glycaemia.

As to the provision of ECMO, some centres act as reference centres, but there is no formal organisation.⁷⁷

(TELEMEDICAL) NETWORKS

In France, any physician can use teleconsultation, regardless of the specialty, the sector and place of practice (hospital or outpatient).⁷⁸ Telemedical anaesthesia consultations before elective surgery are one example.⁷⁹ However, for intensive care no formal telemedical networks exist.

ROLE AS A TRAINING CENTRE

ICUs have a role as centres for training. In France there are 32 teaching hospitals, which are mostly academic. All teaching hospitals must train medical students.⁸⁰

ABILITY TO SCALE UP SERVICES IN RESPONSE TO A PANDEMIC OUTBREAK OR A DISASTER

Each hospital must have a crisis plan (called White Plan, *plan blanc*), which enables it to immediately mobilise resources in case of a surge of patients or to deal with an exceptional health situation. The plan must be revised each year. Since 2014, the ORSAN (*organisation de la réponse du système de santé en situations sanitaires exceptionnelles*) system coordinates the plans at the regional level, also with outpatient and medico-social services.⁸¹

The number of critical care beds increased by 3.6% between the pre-COVID-19 period and the end of 2020.^{82, 83} Most (48%) were created from continuous monitoring units (*unités de surveillance continue*, USC), 32% were created from PACUs or operation theatres and 13% were re-opened from previously closed resuscitation units.⁶⁸ In addition, a number of hospital sites without resuscitation capacity were temporarily authorised to offer resuscitation care.⁶⁸

In 2021, the IGAS report noted that in the context of the upcoming reform, general ICUs, in particular those adjacent to the resuscitation unit, should be used in priority in case capacity needs to be upscaled. This was translated in the 2022-694 decree that states that the equipment of general ICUs adjacent to resuscitation units must be identical to that of a resuscitation unit in order to allow capacity surge in resuscitation **care** beds according to the variation of activity and the levels of patient care.⁷⁰

Also, decree 2022-694 states that each hospital offering critical care should have a 'flexibility plan' for both beds and human resources in order to anticipate variations of activity. The plan should include a training part so that there is always, on site, a sufficient reserve of trained professionals able to support teams in reanimation and ICUs in case of crisis.⁷⁰

4.3.1.4 Germany

RECENT, ONGOING OR PLANNED REFORMS

In Germany, two payment-driven levels of intensive care exist: (1) basic intensive care treatment (OPS 8-980^a) and (2) complex intensive care (OPS 8-98f). In accordance to the newest recommendations from the German Interdisciplinary Society of Intensive and Emergency Care (*Deutsche Interdisziplinäre Vereinigung für Intensiv- und Notfallmedizin*, DIVI) published in 2022, from 2022 on, those two levels should be transferred into three levels of intensive care: (1) basic intensive care, (2) extended intensive care and (3) comprehensive intensive care. In principle, these levels refer to the three hospital levels for emergency care introduced in 2018 by the Federal Joint Committee (*Gemeinsamer Bundesausschuss*, G-BA). The levels are: (1) basic care, (2) extended care and (3) comprehensive care. For each level of inpatient emergency care, the G-BA specified minimum requirements, in particular with regard to:⁸⁴

- the type and number of specialist departments,
- the number and qualifications of the specialist staff to be provided, and
- the temporal scope of the provision of emergency services.

However, the formal introduction was recommended as part of a larger hospital reform.⁸⁵ Hereafter, we first describe the organisation of intensive care according to the DIVI's recommendations. Then, we briefly describe the recent Hospital Care Improvement Act and its impact on the organisation of intensive care.

LEGAL DEFINITION AND ORGANISATION OF INTENSIVE CARE

The DIVI recently published new recommendations for the organisation and equipment of intensive care including a definition of levels of ICUs (see *Levels of intensive care* for more information).⁸⁶ The term ICU explicitly does not refer to intermediate care units or comparable forms of organisation (see section 4.3.3.4).

Even though they are not legally binding, the following information on requirements for intensive care in Germany refers to the recommendation from the DIVI. Information on payment-driven requirements in staffing as well as equipment can be found in section 4.3.4.4.

STAFF: REQUIREMENTS IN TERMS OF NUMBERS

In accordance to the DIVI's recommendation, a number of 0.7 physicians (FTE) per bed plus medical head and its stand-in (in sum 1.3 FTEs) is required. In case of special requirements (e.g. a large number of isolation patients, patients with extensive high-grade burns, polytrauma and extracorporeal organ replacement procedures) and when taking on special tasks (e.g. participation in the resuscitation team, shock room cover, intensive care transport, complex organisational requirements such as high patient throughput, etc.), a larger number of physicians is required. Therefore, at least 0.8 FTE for physicians (according to the local task profile, possibly more FTEs) per bed is required.⁸⁶

As to the number of nurses, DIVI's recommendation states a staffing in accordance to a daily assessment of the patients' severity with a validated assessment tool (i.e. INPULS®). Staffing requirements for shifts should be calculated using Level of Care (LOC) levels averaged over one year or one quarter of normal operation and re-evaluated annually/quarterly. The nurse^b-to-patient ratio is 1:3 for patients with LOC I, 1:2 for patients with LOC II and 1:1 with LOC III. Moreover, a

^a *Operationen- und Prozedurenschlüssel*, Operation and Procedure Classification System (OPS) are procedural codes used for reimbursement within the DRG-system.

^b Directly deployed at the patient's bedside and trained in a structured way.



nursing head and a back-up (1.3 FTEs) per ICU is recommended. For every additional bed over 10 beds, an additional 0.13 FTE is recommended.

Furthermore, to prevent understaffing of nursing-sensitive areas in hospitals, for some hospital areas including intensive care nursing staffing limits have been introduced in 2018^c. Currently, a minimal staffing limit of 2 patients per nurse on day shift and 3 patients per nurse on night shift applies for intensive care.⁸⁷

As to allied healthcare staff, the recommendation does not state a specific number in most of the cases:

- Physiotherapy has to be available daily.
- An ethical consultation should be available within 48-72 hours.
- Needs-based psychological counselling and social work should be available on working days, and pastoral care daily.
- Palliative care should be available.
- For more information on other professions see *Staff: Requirements in terms of numbers and qualification per level*.

STAFF: REQUIREMENTS IN TERMS OF QUALIFICATION

The DIVI's definition contains prerequisites for the (time of) qualification of medical staff, nursing staff, but not for allied healthcare staff.

The share of specially qualified nurses (intensive care nurses) should at least be 30% of the nursing team of an ICU. However, the goal should be 50% (see *Staff: Requirements in terms of numbers and qualification per level* for detailed information on the levels).

As to physicians, see *Staff: Requirements in terms of numbers and qualification per level* for more information.

STAFF: PERSON IN CHARGE OF AN ICU

According to the DIVI's recommendation, an ICU should be headed by a physician who has additional training in intensive care medicine and who works full-time in the ICU. For more information, see *Staff: Requirements in terms of numbers and qualification per level*.

The head nurse is responsible for organisational and professional management. They should continue to be active in patient care. The position may be distributed among individuals or a team, as long as the total number of staff required for this task is guaranteed. The unit manager of an ICU should have the specialist training 'intensive care and anaesthesia' or 'intensive care' and, if possible, a degree in the field of nursing, but at least a state-recognised^d further training of a ward. For more information, see *Staff: Requirements in terms of numbers and qualification per level*.

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

See *Requirements on medical equipment per level* for more information.

^c At the beginning of the COVID-19 pandemic, from March 2020, the regulations were temporarily suspended to enable hospitals to adapt their work processes at very short notice and to relieve them briefly of the requirements for the deployment of nursing staff in care-sensitive areas.

^d In vocational education and training, state-recognised means that the training occupation is trained throughout Germany according to the same state requirements in terms of content and competence development.

LEVELS OF INTENSIVE CARE

In accordance to the DIVI's recommendations there are three levels of intensive care in Germany: (1) basic intensive care, (2) extended intensive care and (3) comprehensive intensive care.

Level 1: Basic intensive care

In a level 1 ICU, emergency treatments, procedures and treatments can be provided for which intensive medical monitoring or short-term monitoring or short-term intensive care may be required. The ICU is able to stabilise vital functions of patients at short notice in such a way that they can be transferred to an ICU of a higher level within the framework of cooperation.

Level 2: Extended intensive care

Level 2 ICUs are equipped in such a way that they can fully care for most conservative and surgical intensive care patients. Patients for whom the corresponding specialties are not available at the site (e.g. neurosurgery, cardiac surgery, transplant medicine) or who need special organ replacement procedures (e.g. ECMO, extracorporeal life support (ECLS)), are treated within the scope of cooperation (see level 1) or are transferred to level 3 ICUs.

Level 3: Comprehensive intensive care

Level 3 ICUs offer the complete spectrum of intensive medical care, possibly distributed over various specialised ICUs. They are adequately staffed and equipped for the care of highly complex patients. As a rule, these are university hospitals and large academic teaching^e hospitals.

It should be noted that the DIVI Intensive Care Register that registers ICU capacity in Germany uses another definition containing two levels: high care treatment and low care treatment (see section 4.3.5.4).

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION PER LEVEL

Table 7 – Physicians: Requirements in terms of numbers and qualification per level

Level 1	Level 2	Level 3
• A physician with the additional training intensive care medicine should carry out at least one unit round daily. • A physician who has been trained for at least 3 months in an ICU of the same level should be present 24/7. • A physician with a period of at least 6 months of further training in intensive care medicine (within the framework of further training as a specialist) should be present in the hospital 24/7 and immediately available in the ICU. • The physician in the ICU may be called in at short	• A physician with the additional training intensive care medicine should carry out at least one unit round daily. • A physician who has been trained for at least 3 months in an ICU of the same level should be present 24/7. • A physician with a period of at least 6-month further training in intensive care medicine (within the framework of further training as a specialist) should be present in the ICU during regular core working hours (e.g. at least 7 hours between 6 a.m. and 10 p.m.); outside of core working hours they have at least to be present in the hospital and	• A physician with the additional training intensive care medicine should carry out at least one ward round daily. • A physician who has been trained for at least 3 months in an ICU of the same level should be present 24/7. • A physician with a period of at least 6 months of further training in intensive care medicine (within the framework of specialist training) should be available on all days during regular core working hours (e.g. at least 7 hours between 6 and 10 p.m.), be present at least in the hospital outside core working hours and immediately available in the ICU.

^e Teaching hospitals are municipal, non-profit, or other hospitals that provide clinical training on a contractual basis. Teaching hospitals are to be distinguished from university hospitals.

notice to deal with emergencies within the hospital (e.g. resuscitation) be called in.	- immediately available in the ICU. - During core working hours, a physician with additional training in intensive care medicine should also be immediately available in the ICU. - Outside these attendance hours, a physician with additional training in intensive care medicine should be immediately available.	- During core working hours, a physician with additional training in intensive care medicine should additionally be present in the ICU during regular working hours (e.g. at least 7 hours between 6 a.m. and 10 p.m.). - Outside of core working hours, a physician with the additional training in intensive care medicine should be available for the patient immediately.
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Source: DIVI (2022).⁸⁶

Table 8 – Nurses: Requirements in terms of numbers and qualification per level

Level 1	Level 2	Level 3
At least 30% of the nursing team of the ICU in each shift with specialist training.	- At least 30% of the nursing team of the ICU in each shift with specialist training. - Structured, active and transparent promotional programme to increase the share to at least 50%.	- At least 30% of the nursing team of the ICU in each shift with specialist training. - Structured, active and transparent promotional programme to increase the share to at least 50%.

Source: DIVI (2022).⁸⁶

Table 9 – Allied healthcare staff: Requirements in terms of numbers and qualification per level

Level 1	Level 2	Level 3
Speech therapist		
n/a	Available on working days.	Available on working days.
Occupational therapist		
n/a	Available on working days.	Available on working days.
Physiotherapist		
Available daily.	Available daily.	Available daily.
Nutritional therapist		
A staff member with a nutritional medicine qualification should be available at least on working days.	- A staff member with a nutritional medicine qualification should be available at least on working days. - A physician or nutritionist with expertise in nutritional medicine should be available on a daily basis or on a consultative basis for special problems.	- A staff member with a nutritional medicine qualification should be available at least on working days. - A physician or nutritionist with expertise in nutritional medicine should be available on a daily basis or on a consultative basis for special problems.
Hygiene and Antibiotic Stewardship		

Hygiene officer	Hygiene officer Antibiotic Stewardship (at least one unit round per week).	Hygiene officer Antibiotic Stewardship (at least two unit rounds per week, available on working days).
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Source: DIVI (2022).⁸⁶

See *Staff: Requirements in terms of numbers* for information on non-level specific requirements with regard to other professions.

STAFF: PERSON IN CHARGE OF AN ICU PER LEVEL

As to the head nurse, there are no level-specific requirements. Requirements for the medical head per level are documented in Table 10.

Table 10 – Physicians: Person in charge of an ICU per level

Level 1	Level 2	Level 3
Additional training in intensive care medicine	- Additional training in intensive care medicine - Working full-time in the ICU and is not subject to directives - Stand-in is also required to have additional training in intensive care medicine	- Additional training in intensive care medicine - Working full-time in the ICU and is not subject to directives - Two stand-ins with additional training in intensive care medicine are required

Source: DIVI (2022).⁸⁶

EQUIPMENT: REQUIREMENTS PER LEVEL

Table 11 – Requirements on medical equipment per level

Level 1 ≥ 6 beds	Level 2 ≥ 10 beds	Level 3 ≥ 20 beds
Mechanical ventilator Resuscitation room 24/7 Computer tomography	Mechanical ventilator Renal replacement Resuscitation room 24/7 Computer tomography 24/7 Endoscopy 24/7 PCI (Percutaneous coronary intervention) 24/7 MRI 24/7 Stroke therapy 24/7 Bronchoscopy	Mechanical ventilator Renal replacement Plasmapheresis ECMO ECLS Resuscitation room 24/7 Computer tomography 24/7 Endoscopy 24/7 PCI 24/7 MRI 24/7 Stroke therapy incl. interventional neuroradiology 24/7 Bronchoscopy 24/7 Interventional radiology

Source: DIVI (2022)⁸⁶; Notes: ECLS: extracorporeal life support; ECMO: extracorporeal membrane oxygenation; MRI: magnetic resonance imaging; PCI: percutaneous coronary intervention



FORMAL INTERDEPENDENCIES WITH OTHER HOSPITAL SERVICES/MEDICAL SPECIALTIES

Table 12 provides information on the required medical specialties stratified by the level of ICU.

Table 12 – Formal interdependencies with other hospital services/medical specialties

Level 1	Level 2	Level 3
(Trauma) Surgery	Surgery	Surgery
Internal medicine	Internal Medicine	Internal Medicine
Anaesthesiology	Anaesthesiology	Anaesthesiology
	Additionally ≥ 2 of the following	Additionally ≥ 5 of the following
	Neurosurgery	Neurosurgery
	Orthopaedics/trauma surgery	Orthopaedics/trauma surgery
	Neurology	Neurology
	Internal medicine: Cardiology	Internal medicine: Cardiology
	Internal Medicine: Gastroenterology	Internal Medicine: Gastroenterology
	Gynaecology	Gynaecology
	and ≥ 2 of the following	and ≥ 2 of the following
	Internal medicine: Pneumology	Internal medicine: Pneumology
	Vascular surgery	Vascular surgery
	Thoracic surgery	Thoracic surgery
	Urology	Urology
	ENT medicine	ENT medicine
	Ophthalmology	Ophthalmology
	Maxillofacial surgery	Maxillofacial surgery
	Internal medicine: Haematology/Oncology	Internal medicine: Haematology/Oncology

Source: DIVI (2022).⁸⁶

See also *Requirements on medical equipment per level*. If necessary, transport between hospitals is organised by local rescue services. In case of a transport with ECMO, a team from the hospital joins.

HOSPITAL CARE IMPROVEMENT ACT

The Hospital Care Improve Act (*Krankenhausversorgungsverbesserungsgesetz*), effective from 1 January 2025, maps out all hospital treatments into 65 care delivery groups (*Leistungsgruppen*, LG), one of them (LG 64) being 'intensive care medicine'.⁸⁸ Hospitals will only be eligible for payments for LGs that had been assigned to them by state planning authorities. This assignment is expected to take place by the end of 2026.⁸⁹

Each LG has minimum quality requirements that must be met by hospitals. Requirements for intensive care medicine are structured in three levels of care as described in Table 13. The Act also describes interdependencies between LGs: i.e. related LGs that should be provided at the same location, or through cooperations. For intensive care medicine, no related LGs are formally required. However, the provision of intensive care medicine at the same location is required for the provision of 52 other LGs (e.g. general internal medicine, interventional cardiology, etc.).⁹⁰

Table 13 – Requirements for LG 64 Intensive Care Medicine

Level	Equipment	Staffing: qualification	Staffing: availability	Other structural and process requirements
Minimum	On site emergency laboratory or emergency laboratory in cooperation plus PoC laboratory analysis	Specialist from an area of direct patient care* Specialist with additional training in intensive care medicine Specialist in anaesthesiology	At any time, at least three specialists with intensive care experience on-call. Of these, at least one specialist with additional training in intensive care medicine or one specialist in anaesthesiology.	Minimum patient to nurse ratio in the day shift: 2:1, in the night shift: 3:1. The proportion of nursing assistants in the total number of nursing staff may not exceed 5%.
Complex	Availability of the following examination or treatment procedures in the ICU: a. Continuous renal replacement procedures at any time b. Flexible bronchoscopy eight hours a day in the period from 6 a.m. to 6 p.m. c. Ultrasound procedure eight hours a day in the period from 6 a.m. to 6 p.m.: Abdomen, TTE, TEE on site eight hours a day in the period from 6 am to 6 pm, on site emergency laboratory plus PoC laboratory analysis	Specialist from an area of direct patient care* Specialist with additional training in intensive care medicine	At any time, at least three specialists with intensive care experience on-call. Of these, at least two specialists with additional training in intensive care medicine. Physician presence in the ICU at all times (physician can be called in for a short-term emergency intervention within the hospital)	Minimum patient to nurse ratio in the day shift: 2:1, in the night shift: 3:1. The proportion of nursing assistants in the total number of nursing staff may not exceed 5%.
Highly complex	Availability of the following examination or treatment procedures in the ICU: a. Continuous renal replacement procedures at any time b. Flexible bronchoscopy at any time c. Ultrasound procedures at any time: abdomen, TTE, TEE one site, eight hours a day in the period from 6 a.m. to 6 p.m., on site emergency laboratory plus PoC laboratory analysis	Specialist with additional training in intensive care medicine	At any time, at least three specialist with additional training in intensive care medicine on-call. Physician presence in the ICU at all times (physician can be called in for a short-term emergency intervention within the hospital)	Minimum patient to nurse ratio in the day shift: 2:1, in the night shift: 3:1. The proportion of nursing assistants in the total number of nursing staff may not exceed 5%.

* General medicine, anaesthesiology, occupational medicine, ophthalmology, surgery, gynaecology and obstetrics, otorhinolaryngology, skin and venereal diseases, human genetics, internal medicine, paediatric and adolescent medicine, child and adolescent psychiatry and psychotherapy, oral and maxillofacial surgery, neurosurgery, neurology, nuclear medicine, public health, phoniatics and paediatric audiology, physical and rehabilitative medicine, psychiatry and psychotherapy, psychosomatic medicine and psychotherapy, radiology, radiotherapy, transfusion medicine and urology. Source: Hospital Care Improvement Act.⁸⁸



(TELEMEDICAL) NETWORKS

Since 2020, hospitals designated as specialised care centres have received additional funding for specific treatments or services, on top of DRG payments (see section 4.3.4.4). In parallel, several telemedical networks covering intensive care and funded by the Innovation Funds of the Federal Joint Committee have been established (ERIC, TELnet@NRW). During the COVID-19 pandemic, intensive care digital-supported care networks (IDV centres) for the treatment of patients with COVID-19 have been implemented. These IDV centres had to demonstrate special telemedical competence and equipment, and be able to prove experience in the care of corona-infected patients and have expertise in long-term ventilation (more than 48 hours), among other requirements.⁹¹ The respective financial supplements were limited to the year 2021. In 2022, IDV centres involved in the management of corona-infected patients admitted to intensive care were integrated into existing heart and lung centres and thus into standard care.⁹²

ROLE AS A TRAINING CENTRES

ICUs in academic teaching and university hospitals act as training centres.

ABILITY TO SCALE UP SERVICES IN RESPONSE TO A PANDEMIC OUTBREAK OR A DISASTER

To enable the monitoring of intensive care capacities and the necessity of surge capacity, an intensive care registry has been implemented in response to the COVID-19 pandemic. See more information in section 4.3.5.4. Especially during the first wave of the pandemic, surge capacities for the treatment of patients with COVID-19 were created by postponing elective surgeries as well as additional intensive care beds.⁹³ However, as Germany has a high density of hospital and intensive care beds, the focus was more on allocation of patients to mitigate regional burden on hospitals. As a result and in addition to an existing pandemic preparedness plan, the so-called 'cloverleaf concept' for a structured distribution of patients was developed and agreed between the Federal Government and the Länder for the nationwide transfer of patients suffering from COVID-19 who require intensive care.^{94, 95} Overall, there are six cloverleaves (= five regions plus joint reporting and situation centre of the federal government and the states) in which one designated single point of contact exists. Since March 2022, patients requiring medical treatment in connection with the war in Ukraine have also been transferred via the already established structures of the cloverleaf concept.

4.3.1.5 Italy

RECENT, ONGOING OR PLANNED REFORMS

In 2015, the Ministry of Health issued a ministerial decree on hospital care.⁹⁶ The Ministerial Decree 70/2015 sets structural, technological, quality and performance standards for hospital services (including intensive care). Since this decree, hospitals have been organised in hub and spoke networks. There are 43 hubs (hospitals with more than 802 beds and large catchment areas) and 112 spokes (hospitals with 382 to 802 beds). The hubs offer the full range of services, the spokes are secondary facilities with fewer specialties.

This new decree on the requisites of hospitals introduced new criteria on ICUs. The document defines the conditions necessary to ensure levels of hospital care (including intensive care) throughout the entire national territory, in terms of adequacy of facilities, human resources employed in relation to the number of patients treated, the level of clinical care complexity of the facility and its synergistic interaction within the territorial care network.

Some current actions on ICU are inserted in the New Pandemic Response Plan.⁹⁷ The plan contains, among other things, estimates of hospital beds need in ICU at the pandemic peak in the most likely

pandemic scenarios and a checklist for periodic self-assessment of preparedness with respect to ICUs (beds, health personnel and health personnel training).

LEGAL DEFINITION AND ORGANISATION OF INTENSIVE CARE

In Italy, there is a legal definition of intensive care. Resuscitation and intensive care activities are dedicated to the intensive treatment of people suffering from one or more acute, potentially reversible, organ failure, that can be life-threatening and cause major complications.⁹⁸ The Lazio region, for instance, precises that resuscitation and intensive care activities are dedicated to the monitoring and intensive treatment of critically ill patients 24/7 and that patients who are candidates for admission to resuscitation and intensive care can be grouped into two main classes:⁹⁹

- patients requiring targeted intensive care, as they suffer from one or more potentially reversible acute organ failures, which are life-threatening or the onset of major complications;
- patients who require monitoring and maintenance of vital functions in order to prevent major complications.
- Intermediate care is not structurally organised nor legally defined. An 'intermediate care unit' is to date only a functional term and no specific and additional institutional or financial normative has been introduced to implement intermediate care units. From 2015 to 2020, the activation process of sub-ICUs in Italy has been incomplete and slow. There has been considerable inhomogeneity between the different regions and health authorities, both in terms of activated beds and organisational models.¹⁰⁰ The Ministerial Decree 70/2015 did not provide a specific definition nor was there adequate coding and valorisation for the care and treatment activities carried out in sub-ICUs. (see further: *Levels of intensive care*).

The medical indication for intensive care, ventilation and ECMO is defined by SIAARTI (*Società Italiana Anestesia Analgesia e Terapia Intensiva*) and international guidelines.¹⁰¹⁻¹⁰³

In Italy, they utilise Modified and National Early Warning Scores (MEWS and NEWS) or different scores (like Simplified Acute Physiology Score II, SAPS-II) for monitoring and predicting intensive care admission and in-hospital outcomes.

STAFF: REQUIREMENTS IN TERMS OF NUMBERS

There is no specific and compulsory national regulation on the staffing of medical and auxiliary personnel in healthcare facilities. This is because the subject of healthcare services falls under the competence of the regions, which, in turn, leave the regulation of internal organisation to individual healthcare companies.

The Lazio region, for example, establishes:⁹⁹

- 24 hours presence of an anaesthetist for every 4 beds;
- the presence of a head nurse.

With regard to nursing staffing:⁹⁹

- for patients requiring monitoring and instrumental therapies to support vital functions: a nurse-to-patient ratio of 1:2 should be guaranteed over 24 hours;
- for patients in need of monitoring and non-instrumental therapies the nurse-to-patient ratio should be equal to 1:3 and guaranteed over 24 hours

STAFF: REQUIREMENTS IN TERMS OF QUALIFICATION

Physicians working in intensive care must have a degree in medicine and surgery (Education Graduate in '*Medicina e Chirurgia*') and a post-graduate specialisation in anaesthesia, resuscitation, intensive care, and pain management ('*Anestesia e Rianimazione*' and '*Formazione Continua ECM*')



(*Educazione continua in medicina*)).¹⁰⁴⁻¹⁰⁶ They are also required to be registered with the medical association.

For nurses, a bachelor's degree in nursing is required, while a master's degree in critical care is desirable but not mandatory.

Relevant trainings are the Education Graduate in 'Scienze Infermieristiche', the post-graduate 'Master 1 Livello in Area Critica' and the advanced training 'Formazione Continua ECM'. The Post-Graduate Education and Training is standardised by the National Association of Critical Care Nurses (Associazione Nazionale Infermieri di Area Critica).¹⁰⁷

The national CME (Continuing Medical Education) programme started in 2002 after the approval of Legislative Decree 502/1992, which establishes the obligation of continuous education for medical professionals. After the entry into force of Law 244 of 24 December 2007, the administrative management of the CME programme was transferred to the National Agency for Regional Health Services (Agenas).¹⁰⁸

Following the adoption of the new Professional Code on 18 May 2014, Article 19 states that throughout their professional career, physicians must pursue ongoing education and continuous training to enhance their knowledge – both technical and non-technical – and actively share this knowledge with students and staff.¹⁰⁹

STAFF: PERSON IN CHARGE OF AN ICU

In Italy, the law of reference for awarding medical second-level management positions (chief physicians) within the National Health Service is the Presidential Decree No. 484 of 1997. Specifically, Article 5 provides that to become head of a hospital service, a physician must meet the following requirements:¹¹⁰

- registration in the professional register, if any;
- seven years' seniority, five of which must be in the discipline or an equivalent discipline, and specialisation in the discipline or an equivalent discipline; or ten year's seniority in the discipline;
- curriculum vitae documenting specific professional activity and adequate experience;
- certificate of management training.

However, specialisation is required for the discipline of anaesthesia, resuscitation and intensive care.¹¹⁰

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

The Ministerial Decree of 29 August 1988 (c.d. '*Donat Cattin*') is setting hospital standards and defining staffing standards in the various hospital operating units, implementing the Law of 8 April 1988.

The Presidential Decree of 14 January 1997 defines the minimum structural, organisational and technological requirements for the exercise of healthcare activities (authorisation) and indicates that accreditation is based on additional requirements defined by the regions.⁹⁸ The requirements listed here are the minimum technological requirements indicated by the Presidential Decree as necessary to practice intensive care (at national level):

- technical bed
- anaesthesia apparatus with gas evacuation system also equipped with spirometer and monitoring of the oxygen concentration delivered, automatic respirator also equipped with alarm for patient disconnection
- monitor for measuring vital parameters
- aspirator for bronchial aspiration

- operating light
- wall-mounted diaphanoscope
- refrigerators for storing drugs and blood products
- defibrillator.

At the same time, based on national legislation, regions are responsible for setting the minimum requirements for the construction of facilities and the provision of healthcare services. They also define additional criteria for institutional accreditation. For instance, the Lazio region outlines specific technological requirements for the authorisation of healthcare facilities – particularly regarding intensive care.⁹⁹ At the regional level, a general ICU, which is the only type formally recognised in regulatory terms, must be equipped with the following as a minimum:

- four infusion pumps per bed
- an automatic respirator also equipped with an alarm for patient disconnection
- a bedside monitor for recording vital parameters
- an operating light
- a wall-mounted diaphanoscope and a similar mobile device, that can be positioned as needed near the workstation
- refrigerators for storing drugs and blood products
- an emergency trolley equipped with defibrillator, external pace maker, respiratory assistance material respiratory assistance
- equipment for the prevention of pressure sores
- a patient lift
- electric intensive care beds with joint system and anti-decubitus mattresses.

LEVELS OF INTENSIVE CARE

Hospitals are categorised into three types: basic hospital facilities, first-level hospitals, second-level hospitals. The most complex care services and the most expensive technologies are centralised in second level hospitals.^{31, 111}

In Italy, however, there are no regulations providing for differentiation in levels of intensive care. The Ministerial Decree 70/2015 nevertheless states that basic hospital facilities should be equipped, among others, with beds for 'Short Intensive Observation'. In first-level hospitals, the specialty 'Anaesthesia and Resuscitation' should be available, along with beds for 'Short Intensive Observation' and beds for 'Sub-intensive Therapy'. The latter can be specialised cardiology, respiratory, neurology, etc., but multidisciplinary sub-intensive beds should also be available. In addition to that, second-level hospitals should also offer, among others, cardiac resuscitation, paediatric ICU and neonatal ICU.⁹⁶

Sub-intensive or ultra-specialty therapies (i.e. specialised ICUs in cardiology, respiratory, neurology, etc.) exist but are not actually formally defined and regulated. Also, respiratory ICUs and pulmonary intermediate care units fall among sub-intensive care, for which accreditation pathways and organisational models differ from region to region.¹¹²

A proposal, held by the two Italian scientific societies SIAART (*Società Italiana di Anestesia Analgesia Rianimazione e Terapia Intensiva*) and SIMEU (*Società Italiana di Medicina d'Emergenza-Urgenza*), to amend the Ministerial Decree 70/2015 goes precisely in the direction of formalising a differentiation of intensive care levels that to date is not provided for. Among the proposal are four new levels of intensity of care in intensive and semi-intensive/sub-intensive care. There are different categories:^{113,}



- Level 1: high intensity of care (*alta intensità di cura*) concerns patients who require continuous monitoring. These patients are at risk of developing one or more acute organ failures but do not require organ support immediately or are not expected to deteriorate such that they will need it in the next 12 hours. This also includes patients who are recovering from one or several acute vital organ failures but whose condition is too unstable or when the nursing workload is too high/complex to be managed in a regular unit.
- Level 2: semi-intensive care (*terapia semintensiva*) concerns patients who require continuous monitoring and pharmacological or mechanical support (such as haemodynamic support, non-invasive respiratory support, or renal replacement therapy) of a single organ with acute phase failure that is life-threatening.
- Level 3: critical semi-intensive care (*terapia semintensiva critica*) concerns patients who require continuous monitoring and pharmacological or mechanical support (such as haemodynamic support, non-invasive respiratory support, or renal replacement therapy) of multiple organs with acute phase failure that is life-threatening.
- Level 4: multipurpose/general, postoperative, specialist intensive care (*terapia Intensiva polivalente/generale, postoperatoria, specialistica*) concerns patients with moderate to severe dysfunction of two or more organs, patients on invasive mechanical ventilation, patients with multiple acute organ failure (two or more), or life-threatening acute single organ failure are included. These patients receive organ support through drug infusion or mechanical organ support (haemodynamic, respiratory, or renal replacement therapy).

Italian regions have implemented the Ministerial Decree 70/2015 to introduce accreditation criteria. However, the implementation at regional level is not homogeneous, given the different starting points in terms of bed supply and interregional mobility of patients.³¹ For example, in the region Emilia Romagna¹¹⁵ and the region Lazio⁹⁹, the requirements for intensive care medicine (structural, technological, organisational) are defined, which makes it possible to differentiate intensive care from semi-intensive care:

- Intensive care (*terapia intensiva*) characterised by the clear predominance of patients requiring a high level of technological care (artificial ventilation/CPAP (Continuous Positive Airway Pressure), pulmonary or intracranial pressure monitoring, administration of vasoactive agents associated with haemodialysis/haemofiltration), and 'intensive' nursing. Intensive care may be single-specialist or multi-specialist.¹¹⁵
- Semi-intensive care (*terapia semintensiva*) is defined by the predominance of patients requiring a lower level of care than that provided in an ICU – such as less intensive monitoring or the absence of treatments like vasoactive drug administration or haemodialysis/hemofiltration – yet whose condition is still too critical to be managed in a standard hospital unit. A key distinction at this level is the absence of mechanical ventilation.¹¹⁵

According to clinicians, the revision of the Ministerial Decree 70/2015 classification, as proposed by the Italian Society of Anaesthesia, appears to be more accurate and better reflects the realities of clinical practice.

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION PER LEVEL

Although levels of intensive care are not formally differentiated in Italy, the proposal to amend Ministerial Decree 70/2015 (see above: *Levels of intensive care*) defines staff requirement per level.¹¹³

- Level 1 (high intensity of care): the medical provision is the one of the attached unit, while one dedicated nurse should be provided for every 6 to 8 patients.
- Level 2 (semi-intensive care): medical coverage is required 24/7 by a physician specialised in organ/system dysfunction (respiratory/pneumological, cardiological, neurological, metabolic);

there should be a nurse for every 3 to 4 patients and one FTE physiotherapist for every 6 to 8 beds every day.

- Level 3 (critical semi-intensive care): medical coverage is required 24/7 by a physician specialised in anaesthesia, resuscitation and intensive care; there should be a nurse for every 3 to 4 patients and one FTE physiotherapist for every 6 to 8 beds every day.
- Level 4 (multipurpose/general, postoperative, specialist intensive care): in addition to the coordinating physician, there should be
 - two physicians for every 4 beds during duty hours (weekdays) and one physician for every 8 beds during on-call hours (nights and holidays)
 - one nurse for every two beds and one on-duty nurse for every 8 beds
 - one physiotherapist for every 6 to 8 beds during 8 hours every day
 - one data manager for every 8 to 16 beds
 - one pharmacist for every 16 beds.

STAFF: PERSON IN CHARGE OF AN ICU PER LEVEL

The following requirements are suggested in the proposal to amend Ministerial Decree 70/2015 (see above: *Levels of intensive care*):¹¹³

- Level 1 (high intensity of care): the unit is set up preferably in the continuity of the inpatient unit, therefore management refers to that of the unit.
- Level 2 (semi-intensive care): medical coordination is ensured by the referral specialist for organ failure (pulmonologist for the units, cardiologist for coronary units, neurologist for stroke units, etc.).
- Level 3 (critical semi-intensive care): medical coordination is the responsibility of the specialist in anaesthesia and resuscitation with possible multidisciplinary support.
- Level 4 (multipurpose/general, postoperative, specialist intensive care): medical coordination is the responsibility of the specialist in anaesthesia and resuscitation.

EQUIPMENT: REQUIREMENTS PER LEVEL

In the proposal to amend Ministerial Decree 70/2015 (see above: *Levels of intensive care*), requirements regarding equipment a set, for levels 3 and 4 of the intensive care continuum, according to the hospital level (hub or spoke).¹¹³

In spoke hospitals, level 3 (critical semi-intensive care) and level 4 (multipurpose/general, postoperative, specialist intensive care) units should have at least 8 beds; all modalities of non-invasive cardiovascular care and the possibility to manage patients in aortic counterpulsation; all modalities of respiratory care, up to invasive controlled and assisted mechanical ventilation; continuous extrarenal depurative care; bronchoscopy; ultrasound; continuous cardiac output monitoring.

In hub hospitals, these units should have at least 12 beds. They should be able to perform ECMO for respiratory and/or cardiovascular assistance; advanced shock monitoring and treatment; encephalic death and donor-heart-stopping organ procurement procedure; diagnosis-monitoring-treatment of endocranial hypertension and cerebral great arterial vessel ischaemia. The following should be available: cardiac surgery; neurosurgery; interventional radiology/neuroradiology; trauma centre; burns centre; spinal unit.



FORMAL INTERDEPENDENCIES WITH OTHER HOSPITAL SERVICES/MEDICAL SPECIALTIES

Formal hospital and emergency services interdependencies regarding life-threatening medical conditions such as trauma, stroke, acute myocardial infarction (time-dependent networks) and ECMO are set up at the national level. A report describes the results of the second national survey on the state of implementation of time-dependent networks, conducted by Agenas.¹¹⁶

Formal interdependencies with other hospital services are outlined in the two national decrees on the so-called '*reti territoriali*' and in the implementing decrees issued by each region, which specifically regulate the interdependencies. The provision of specific procedures (i.e. trauma treatment, ECMO) requires interdependencies and the (24/7) availability of other hospital services. The government establishes the organisation by law, although the regions have decision-making autonomy concerning the application of the law.⁹⁶

Usually, the ECMO procedure involves a multidisciplinary team consisting of anaesthesiologists, cardiac surgeons, perfusionists, and critical care nurses. Region Tuscany, for example, has produced a document on the treatment of patients eligible for lung transplantation and the use of ECMO for invasive treatment. This describes who is part of the ECMO team and the process of admission and referral to other centres.¹¹⁷

(TELEMEDICAL) NETWORKS

Telemedicine networks for ICUs exist only for national paediatric ICUs. There are regional telemedical networks, e.g. *Accesso ai servizi*.¹¹⁸ Access can be guaranteed to all professionals through the SPID (*Sistema Pubblico di Identità Digitale*), the nationwide access system that allows to use, with a single digital identity, the online services of the public administration, both central and local.

ROLE AS A TRAINING CENTRE

In Italy, the ICUs of university hospitals and main regional hospitals (hubs) have a role as centres for training. There are 40 post-graduate training schools and a variable number of non-university teaching hospitals. There is only high-level care in the university hospitals or level 1 hospitals (regional hub). The number is variable because it depends on the agreements that are made between individual specialty schools and the healthcare facilities in the so-called training network. The training network encompasses a group of healthcare facilities (including universities, hospitals, and primary care centres) affiliated with a specific School of Specialisation and accredited based on care and training standards.

As defined by Interministerial Decree No. 68 of 4 February 2015, the size and requirements of the training network associated with the schools are determined depending on the training capacity of the specialised school. The inclusion of hospital and primary care facilities within the Health Service in the training network is based on evaluation of structural and quality criteria, with a requirement to allocate at least 20 percent of the annual activities specifically for trainees. The formation of the training network is usually done regionally or across neighbouring regions through specific agreements or memoranda of understanding promoted by the respective universities.¹¹⁹

ABILITY TO SCALE UP SERVICES IN RESPONSE TO A PANDEMIC OUTBREAK OR A DISASTER

The ability to scale up services in response to a pandemic outbreak or a disaster is foreseen in regional disaster plans.¹²⁰ As for pandemics, on 25 January 2021, the State-Regions Conference approved the 'National Strategic-Operational Plan for Influenza Pandemic Preparedness and Response' (PanFlu 2021-2023).⁹⁷ The plan updates and replaces previous influenza pandemic plans and was prepared on the basis of the recommendations of the World Health Organisation.

4.3.1.6 Sweden

RECENT, ONGOING OR PLANNED REFORMS

No major structural reforms have been adopted in recent years and there are no planned or ongoing reforms with regard to ICUs and their organisation. In the last years, the social welfare board in Sweden has evaluated if paediatric intensive care units (PICUs) should be a national resource and centrally controlled. The report finally stated that no change should be performed.¹²¹

LEGAL DEFINITION AND ORGANISATION OF INTENSIVE CARE

A definition of intensive care exists in the 'Guideline for Swedish intensive care' developed by the Swedish Society of Intensive Care (*Svensk Förening för Anestesi och Intensivvård*, SFAI) and the Swedish Intensive Care Association (*Svenska Intensivvårdssällskapet*). This guideline was first published in 1995 and updated in 2015. A second update occurred in 2024, while the next revision is foreseen in 2029. According to the 2024 version of the guideline, intensive care is defined as 'the care of patients with acute or worsening organ failure, either with organ support, organ replacement or organ preservation treatment. Intensive care may also include advanced monitoring of patients with imminent organ failure. Intensive care is initiated by, or in consultation with a specialist in anaesthesia and intensive care'.¹²² There is a categorisation of ICUs in Sweden into three categories. See *Levels of intensive care* for more information.

The 2024 version of the guideline clarifies the distinction between organ-supporting treatments (e.g. vasoactive drugs in moderate doses and non-invasive ventilator treatment) and organ replacement treatments (e.g. invasive ventilator treatment, continuous renal replacement therapy, ECMO). The latter must take place at the ICU. Also, patients with multiple organ system failure requiring organ support treatment should be cared for in the ICU. However, depending on local conditions, organ support treatment can also be given outside an ICU, for example in intermediate care units (see section 4.3.3.6).

The ICU should be co-organised with the department of anaesthesia and pain but it should be logistically distinct and solely dedicated to intensive care. The ICU should be located in very close proximity to the surgical and post-operative departments, emergency department, diagnostic X-ray department, laboratory and blood centre.¹²²

STAFF: REQUIREMENTS IN TERMS OF NUMBERS

The guideline contains requirements for the number of medical staff, nursing staff, and allied healthcare staff. There are different numbers for the different levels of ICU, see *Staff: Requirements in terms of numbers per level* for more information.

STAFF: REQUIREMENTS IN TERMS OF QUALIFICATION

The guideline contains prerequisites for the qualification of medical staff and nursing staff, but not for allied healthcare staff.¹²²

Medical staff

Physicians who mainly work in ICUs in Sweden must have specialist competence in anaesthesia and intensive care. It is recommended that they also undergo a two-year advance training in intensive care. Requirements for on-call competences are differentiated by level (see *Staff: Requirements in terms of numbers and qualification per level*)

Nursing staff

For nurses, further training in intensive care must be required for service in an intensive care unit of category II-III, and should be required for service in an ICU category I. This does not exclude the employment of basic trained nurses as trainees prior to specialist training. In 2023, in 63 out of the 81 ICUs in Sweden, all nurses had a specialist nursing training in intensive care.¹²³ Nursing assistants



are expected to have advanced training in intensive care. However, due to the limited availability of specialised education in this field, it falls to ICUs to deliver the necessary training and help nursing assistants develop the required competencies.

STAFF: PERSON IN CHARGE OF AN ICU

The intensive care work is carried out in teams with specialised nursing staff constantly close to the patient and must be led by a physician with specialist competence in anaesthesia and intensive care and preferably advanced training in intensive care. The physicians assigned to the intensive care unit are responsible for intensive care during their duty, which must be carried out in consultation with physicians responsible for the patients in the main hospital.

The physician who has the medical management responsibility in the ICU must have specialist competence in anaesthesia and intensive care as well as additional **advanced training in intensive care**.¹²² In 2023, this criterion was met in all but one ICU (category I) in Sweden.¹²³ The physician in charge must also be clinically active at least 50% in the ICU.¹²²

Experienced nurse specialists in intensive care should be available around the clock for operational management responsibility in nursing in all ICUs. The function does not exclude simultaneous patient responsibility.¹²²

For more information, see *Staff: Person in charge of an ICU per level*.

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

An ICU should be designed to regularly accommodate care for at least four intensive care patients simultaneously. If this is not feasible, staff must be provided with structured opportunities to gain experience handling larger volumes of intensive care patients.¹²²

The care area must be designed with sufficient space and equipment to ensure unrestricted intensive care delivery. Single-bed rooms should have a minimum area of 25 m² per patient, while multi-bed rooms should allocate at least 20 m² per patient. The patient bed must be positioned to allow access from all sides. In multi-bed rooms, the spacing between beds should be sufficient to facilitate care activities, maintain privacy, and meet hygiene standards.¹²⁴

The ICU must be equipped with adequate lighting (including natural daylight through a window and an examination/operation lamp), sewage facilities for dialysis treatment, CPAP equipment, and easy accessibility around the patient's bed. It should include alarms for both patient and staff, sound attenuation, the ability to support a normal circadian rhythm, and compliance with hygiene regulations. The facility must also provide for nursing interventions, privacy for patients and relatives, and space for documentation (either IT-based or paper format). Essential equipment includes a ventilator, suction devices, stationary pumps, an intensive care bed, a ceiling lift with a scale, temperature regulation systems, sufficient space for examinations and treatments, gas extraction systems, and outlets for electricity, medical gases (air/oxygen or others), radio/TV/telephone/IT, water and sewage (including a sink). Additionally, the unit must have proper ventilation and monitoring equipment.¹²⁴

*Medical equipment, monitoring:*¹²⁴

- Haemodynamics – blood pressure, ECG (electrocardiogram), cardiac output monitoring
- Ventilation – respiratory rate, oxygen saturation, volumes and pressures, oxygen and carbon dioxide concentrations, cuff pressure
- Metabolism – temperature, indirect calorimetry
- Hourly diurnal measurements.

*Medical equipment, diagnostics:*¹²⁴

- Abdominal pressure

- ECG
- Cardiac output
- Laboratory diagnostics – arterial acid-base balance, blood glucose, electrolytes, hemoglobin (Hb), lactate
- Mobile X-ray equipment
- Ultrasound equipment for examination of heart, vessels, lungs, abdomen, nerves and bladder

*Medical equipment, treatment:*¹²⁴

- Blood/liquid warmers
- Continuous Renal Replacement Therapy (CRRT) equipment
- Defibrillator
- Extra syringe/volume pumps
- Fibre bronchoscope
- Temperature control/hypothermia treatment equipment
- Accidental hypothermia warming equipment
- Equipment for establishing a secure airway
- Vascular access equipment (peripheral needle, arterial needle, Central Venous Catheter (CVC), dialysis catheter, etc.)
- Equipment for applying spinal anaesthesia
- Equipment for thoracocentesis/thoracic drainage.

LEVELS OF INTENSIVE CARE

Sweden classifies intensive care into three levels, with level I being the lowest and level III the highest. These levels differ in terms of organisational structure, staffing, expertise, and equipment. The distinction between levels is not only based on the type of intensive care that can be delivered but also on the broader resources available within the hospital.¹²²

Intensive care category I

ICUs in category I are capable of delivering intensive care for patients with failure in any organ system, but they lack most peripheral resources. They do not have 24/7 access to many specialised services, such as paediatrics, vascular surgery, ENT surgery, or a blood centre. However, these units have an established system in place to ensure the safe transfer of patients to and from category II or III intensive care units.

Intensive care category II

ICUs in category II are skilled in providing intensive care for patients with failure in all organ systems, but they lack many of the peripheral resources available in Category III units. They have 24/7 access to most specialties, particularly emergency surgery, radiology, laboratory services, and blood centres. These units also have an established system to ensure the safe transfer of patients to and from category III intensive care units.

Intensive care category III

Category III ICUs are preferably located in university hospitals. General category III ICUs provide the most qualified monitoring and treatment methods that can be offered for various types of organ failure.



Also, university hospitals often have special category III ICUs for e.g. thoracic and neurosurgery, paediatrics and burn care. Hospitals with intensive care categories II-III also depend on these departments for the referral of patients. Organisationally, special ICUs are not always under the same operational area as general ICUs.

In 2023, there were 29 category III ICUs in Sweden, 36 category II and 16 category I.¹²³ This corresponded to 227 beds in category III, 233 in category II and 51 in category I.¹²⁵

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION PER LEVEL

Medical staff:

During office hours, category I ICUs should have at least one physician with specialist competence in anaesthesia and intensive care per unit. In category II and III ICUs, the requirement is between 0.25 and 0.5 physicians with specialist competence in anaesthesia and intensive care per bed.¹²² In 2023, the median number of such physicians per bed was 0.33 in category I ICUs, 0.33 in category II, and 0.4 in category III.¹²³

Requirement in terms of qualification for on-call physicians:¹²²

- Category I: A specialist or resident in anaesthesia and intensive care should be present. If the primary on-call physician in the ICU does not have specialist competence in anaesthesia and intensive care, a physician with such expertise must be available by phone and able to reach the hospital promptly.
- Category II: A specialist or resident in anaesthesia and intensive care is required. If the primary on-call physician in the ICU lacks specialist competence in this area, there should be a parallel hospital-based on-call service with specialist expertise in anaesthesia and intensive care.
- Category III: A physician with specialist competence in anaesthesia and intensive care is required. Experienced residents in anaesthesia and intensive care may be on call under the supervision of a parallel hospital-based on-call service with specialist expertise. It is preferred that a category III ICU backup physician has completed advanced training in intensive care.

Nursing staff:

After completing their training, nurses are designated as specialist nurses in intensive care. The following nurse-to-bed ratios apply: in category I ICUs, 0.25 to 0.5 specialist nurses are required per bed; in category II ICUs, 0.33 to 0.67 per bed; and in category III ICUs, 0.5 to 1.2 per bed.¹²² In 2023, the median number of specialist nurses per bed was 0.71 in category I ICUs, 0.75 in category II, and 0.75 in category III.¹²³

*Allied healthcare staff:*¹²²

Each ICU should have clearly allocated resources for physiotherapists and counsellors, preferably with intensive care-specific experience and knowledge. Access to this expertise should be available when needed even during public holidays and vacation periods. In category I ICUs, the presence of 0.25 FTE physiotherapist is required, 0.25 to 0.5 FTE in category II, and 0.5 to 1 FTE in category III.

Other competences such as occupational therapists, pharmacists, speech therapists, dieticians, other counselling and crisis support, spiritual support and interpreters also have important roles in intensive care, and clear pathways should be available in the ICU.

Table 14 shows the staffing requirements in Swedish ICUs. These requirements are inspired by Waydhas et al. (2023)'s recommendations for the organisation of intensive care in Germany.¹²⁶

Table 14 – Staffing requirements, office hours

	Category I	Category II	Category III
<i>Physicians with specialist expertise in anaesthesia and intensive care (number per bed)</i>	1/unit	0.25-0.5	0.25-0.5
<i>Nurses, further trained in intensive care</i>	0.25-0.5	0.33-0.67	0.5-1.2
<i>Clinically active care staff including nurses, nursing assistants and physicians (number per bed)</i>	0.5-1	0.66-1.2	1-2
<i>Physiotherapist (proportion of full-time position)</i>	25%	25-50%	50-100%

Source: SFAI (2024)¹²²

STAFF: PERSON IN CHARGE OF AN ICU PER LEVEL

An anaesthesiologist and intensivist affiliated with the hospital must be responsible for the ICU at all times, regardless of the category. The physician with overall medical responsibility in an ICU must have specialist competence in anaesthesia and intensive care, along with additional advanced training in intensive care. In category III, this physician should also hold a scientific qualification equivalent to at least a PhD, although possessing an academic degree such as a PhD is not always required.

EQUIPMENT: REQUIREMENTS PER LEVEL

n/a

FORMAL INTERDEPENDENCIES WITH OTHER HOSPITAL SERVICES/MEDICAL SPECIALTIES

There is a system in Sweden with highly specialised care for some treatments/diagnoses. For instance, ECMO is provided by all thoracic ICUs and there is a national highly specialised centre in Stockholm for ECMO where only patients with need for ECMO are treated. The ECMO centre in Stockholm provides ECMO also to neonates and children, and is the only lung-ECMO centre in Sweden. In most regions, there is a trauma centre at one hospital coordinating major trauma.

Patients are referred to a university hospital in cases of special treatment, i.e. thoracic surgery, neurosurgery, paediatric and neonatal care according to national and local routines. There are requirements for emergency services to provide an ICU:

- For all levels of ICU there has to be an emergency unit at the hospital 24/7.
- Pharmacy 24/7 recommended for I and II and required for level III.
- Clinical physiology unit (department providing investigations like echocardiography, radionuclide investigations, respiratory investigations etc.) recommended for level I + II and required for level III.
- Blood supply required at all levels.
- Lab 24/7 all levels required.
- Microbiology recommended at level I + II and required at level III.
- Operating room recommended at level I, required at level II + III.
- X ray recommended at level I, required at level II + III.

Other collaborations/networks with other hospitals exist. Since the pandemic, there is a national system for ICU beds report on a daily basis, but this is not public. During the pandemic the network established by the Swedish Board of Social affairs and Health had digital meetings concerning need for help and logistic systems for transport.



(TELEMEDICAL) NETWORKS

Telemedical networks for/ including ICU do not exist.

ROLE AS A TRAINING CENTRE

The Swedish board for social affairs and health (*Socialstyrelsen*) issue licenses as a physician. To fulfil these requirements a physician in training must complete 2-4 weeks of training at an ICU/anaesthesia department at a Swedish hospital. In the training as a specialist in anaesthesia and intensive care a physician in training must complete 6 months minimum at a general ICU and more rotations at specialised ICUs (thoracic, neuro, paediatric). The documents for the support for the training of supervisors are publicly available. The support provides suggestions for the content of a counsellor training course.¹²⁷

Ability to scale up services in response to a pandemic outbreak or a disaster

There are disaster plans in every region, and these are coordinated by the *Sveriges Kommuner och Regioner* (SKR) and *Socialstyrelsen* on a national level and are granulated to every hospital. Every hospital has its own disaster plan.

4.3.1.7 The Netherlands

RECENT, ONGOING OR PLANNED REFORMS

Before the currently valid 'Quality Standard for Intensive Care' (*Kwaliteitsstandaard Organisatie van Intensive Care*) went into effect in 2016, intensive care organisation was based on the guideline 'Organisation and way of working in intensive care units for adults in the Netherlands' (*Richtlijn Organisatie en werkwijze op intensive care – afdelingen voor volwassenen in Nederland*). Introduced in 2006, this was the first guideline addressing organisation of intensive care in the Netherlands. The guideline defined three levels of intensive care with level 1 being the lowest level of care and level 3 being the highest level of care and set out requirements in terms of organisation, staffing, quality and equipment.¹²⁸ Notably, levels were defined based on annual patient volume (level II: > 2500 treatment days per year; level III: >3000 treatment days per year), number of ICU beds (optimal size for level I: 6 beds; for levels II and III: 12 beds), number of ventilation days (e.g. level II: >1250 ventilation days per year; level III: >1500 ventilation days per year), number of physicians (e.g. intensivist staffing level I: 0.1 – 0.15 FTE per bed; level II: 0.35 – 0.42 FTE per bed; level III: 0.45 – 0.55 FTE per bed) and nurse staffing (level I: 2.7 FTE per ventilation bed, level II: 3.5 FTE per ventilation bed; level III: 4.2 FTE per ventilation bed).

Patients were supposed to be admitted to a level 1 ICU if they need higher care than offered at the normal unit, but where the need for admission to a higher-level ICU (level 2 or 3) was unlikely. ICU patients with a (expected) longer treatment duration than 72 hours are preferably not treated in a level 1 ICU. A level 3 ICU was (part of) an intensive care department with an academic and/or supra-regional function. This usually concerns specific functions such as intensive care treatment of complicated thoracic, neuro and transplant surgery or intensive care treatment of trauma patients or patients with (rare) complicated disorders.¹²⁹

Two years after its introduction in 2006, the Healthcare Inspectorate (*Inspectie voor de Gezondheidszorg*, IGZ^f) identified a few areas of improvement, including regional cooperation and the question of which competences are needed at which times and in which situations. It was thus recommended to revise the guideline. To do so, an independent working group with members from the Dutch Society for Intensive Care (NVIC), the Dutch Society of Anaesthesiology (NVA) and the Dutch Internists Association (NIV) together with other relevant parties such as the national

^f Today called *Inspectie voor de Gezondheidszorg en Jeugd* (IGJ).

organisation of nurses in the Netherlands (*Verpleegkundigen en verzorgenden Nederland*, V&VN)⁹ was convened to work on a new guideline. However, this process has not been completed as the parties involved did not manage to unanimously finalise the guideline – mainly because it was too detailed and thus left too little room for regional interpretations. As a result, the National Health Care Institute (*Zorginstituut Nederland*) asked its Advisory Committee on Quality (ACK) to take over the development of a new intensive care guideline. In light of the discussions before, the ACK chose to recommend structures in a more general sense and to focus on outcomes as well as on stimulating the learning process of professionals and organisations in the region. The resulting Quality Standard thus addresses various aspects related to the organisation of intensive care without having strict recommendations for all aspects, i.e. due to a lack of scientific evidence.¹³⁰ In addition, and on the basis of the Quality Standard's recommendations a blueprint (*Blauwdruk Zorgbeleidsplan*) was compiled by the NVIC between 2016 and 2022. The aim of the blueprint was to allow for comparability of intensive care throughout the Netherlands.¹³¹ In what follows, we will refer to the Quality Standard and the blueprint currently in effect.

In 2023, a working group was assembled to revise the Quality Standard based on the results of its evaluation.¹³² The revised Quality Standard will contain a number of modules related to the organisation of intensive care, including one for crises such as pandemics. Focus will be on regional cooperation and stimulating innovation and clinical leadership of professionals instead of regulatory restrictions.

LEGAL DEFINITION AND ORGANISATION OF INTENSIVE CARE

In the Netherlands, the National Health Care Institute's Quality Standard for Intensive Care contains a legal definition of intensive care which is based on the patient receiving intensive care as a focal point.¹³⁰ Accordingly, an intensive care patient has one or more acutely endangered or disturbed vital functions, where continuous monitoring is necessary and treatment of a potentially reversible condition can lead to recovery of vital functions. A formalised multidisciplinary consultation with active participation by intensivists, ICU physicians^h, ICU nurses and other relevant medical specialists and healthcare professionals should be held daily.

STAFF: REQUIREMENTS IN TERMS OF NUMBERS

The Quality Standard's definition does not contain prerequisites for the number of medical staff and nursing staff, but the blueprint does.

Regarding allied healthcare staff, no specific staffing numbers are prescribed, but their involvement is required. At an early stage of illness, every ICU patient should receive physiotherapy based on the latest clinical guidelines. The division of responsibilities between the ICU nurse and physiotherapist may vary depending on the local context.

The hospital pharmacist participates in the ICU treatment team and can be consulted continuously for the pharmacotherapeutic policy of the individual ICU patient and is responsible for medication safety.

The intensive care department must be supported by the members of the physician-microbiologist department / partnership. They are responsible for a broad range of tasks related to medical microbiology and infection prevention, with daily participation in patient discussions being a key requirement.¹³⁰

⁹ V&VN is the (voluntary) professional association for nurses.

^h Most hospitals differentiate between intensivists (= consultants who completed their education) and (ICU) physicians that are in training to become an intensivist. In the guideline of 2006, this latter category was defined as ICU physician. In the Quality Standard (2016) there is mention of an ICU physician without providing a definition.



In contrast, for medical and nursing staff, the NVIC's blueprint does recommend specific staffing ratios, as outlined in Table 15.

Table 15 – Staff: Requirements in terms of numbers

	ICU with <12 beds ⁱ	ICU with ≥12 beds
Intensivists	0.35-0.45 FTE per operational bed	0.45-0.55 FTE per operational bed
ICU doctors	0.55 FTE per operational bed	0.6-0.9 FTE per operational bed
ICU nurses	daytime: 1 nurse per 1.5 operational beds evening and night: 1 nurse per 1.75 to 2.0 operational beds	

Source: Nederlandse Vereniging voor Intensive Care (2021)¹³¹

In ICUs with fewer than 12 beds, a staffing level of 0.35 to 0.45 FTE intensivists per operational bed is required. For ICUs with 12 beds or more, this requirement rises to between 0.45 and 0.55 FTE per bed.

Regarding ICU physicians and physician assistants, at least one ICU physician must be present in units with fewer than 12 beds, with a minimum staffing level of 0.55 FTE. In ICUs with 12 beds or more, at least one ICU physician or physician assistant must be exclusively available for every 6 ICU beds, with a staffing level ranging from 0.6 to 0.9 FTE per bed.

For ICU nurses, a recommended span of control is 1.5 operational ICU beds per nurse during daytime hours. In the evening, this increases to a maximum of 1.75 beds per nurse, and at night to a maximum of 2.0 beds.

However, it is important to note that the distinction of size does not refer to different levels. In practice, the larger ICUs have more facilities or possibilities either in the ICU itself (ECMO or renal replacement therapy for instance) or within the hospital (cardiac surgery or neurosurgery for instance). There are no other requirements except that intensivists in smaller ICUs have to confer with colleagues in larger ICUs when it concerns very sick patients (see *Formal interdependencies with other hospital services/medical specialties* for more information).

For all ICU patients, an intensivist must be present and available exclusively for patient care in the ICU during the daytime (also on holidays and in weekends) and available within 60 minutes (or less, depending on local rules) during off-hours (evening and night-time). For efficiency reasons, two exceptions to this rule apply:¹³³

- the intensivist may perform short-term work in the emergency care of the hospital;
- if there are no unstable patients after making rounds and drawing up treatment plans during weekends and holidays, there is no need for the intensivist to be present, but an ICU physician has to be present within five minutes.

STAFF: REQUIREMENTS IN TERMS OF QUALIFICATION

The Quality Standard contains prerequisites for the (time of) qualification (i.e. certificates, training, education) of medical staff and nursing staff, but not for allied healthcare staff.

As to physicians, trained intensivists (i.e. certified as such by the Joint Intensivists Commission (GIC)) treat an ICU patient on an ICU (i.e. a unit that meets the conditions described in the Quality Standard). An intensivist needs to be registered in the register of their professional association.

ⁱ Also applies to an ICU with ≥12 beds, but with a bed occupancy <70% over the past 3 years, which means that the number of beds actually is <12.

As to ICU nurses, a *College Zorg Opleidingen* (CZO, College Hospital Training) recognised diploma is required as well as a registration in the V&VN quality register for the intensive care area of expertise.

STAFF: PERSON IN CHARGE OF AN ICU

Each intensive care unit must have a clearly designated medical head, a role that can only be filled by an intensivist accredited by the GIC. The amount of management time allocated for this role should be based on the size, function, and complexity of the ICU to ensure effective leadership. The medical head holds ultimate responsibility for the medical quality within the ICU.

In collaboration with the unit's organisational leader (unit manager), the medical head is responsible for tasks such as coordinating with other medical specialists, drafting (or overseeing the drafting of) the annual report, establishing and ensuring adherence to guidelines, protocols, and quality policies, reporting incidents and critical events, managing and complying with budgets, preparing investment plans, initiating regional collaborations, and formulating both an ICU care policy plan and a multi-year medical strategy. The role also includes promoting education and training within the department, although certain responsibilities may be delegated.¹³⁴

To ensure both quality and efficiency of care, all ICU patients are primarily treated by an intensivist, with co-management provided by the relevant primary specialty. This structure is formally outlined in the institution's care policy plan.¹³⁰

The nursing head, or unit manager, holds a formal position within the management structure of the intensive care department. Typically, this role is embedded within the hospital's broader organisational framework. In the local context, the nursing head directly supervises team leaders, ICU nurses, and often also care assistants and administrative staff. Key responsibilities include establishing nursing consultation structures, overseeing ICU consultation processes, and contributing to the department's annual report. The nursing head is also responsible for coordinating nursing activities with other specialties and departments, initiating or supporting the development and adherence to nursing guidelines, protocols, and quality policies, reporting incidents and serious events, managing budgets, preparing investment proposals, and supporting regional collaboration. Additionally, the nursing head plays a central role in drafting the ICU care policy plan and shaping a long-term medical and nursing strategy, as well as promoting education and professional development. These tasks may be delegated but must always be carried out in close coordination with the medical head of the department or their deputy, and must align with locally established agreements regarding responsibilities.¹³⁴

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

The Dutch Quality Standard does not contain requirements in terms of medical equipment. In clinical practice, however, larger ICUs have more advanced support modes (i.e. renal replacement therapy, ECMO). Invasive ventilation should be performed in an ICU, with the exception of immediate post-operative ventilation for the PACU patient. In consultation with the intensivist and provided the team is adequately trained and authorised, non-invasive ventilation (CPAP and Bilevel Positive Airway Pressure (BIPAP)) can also be performed outside the ICU. Furthermore, there should be clear, recorded local agreements between intensivists and the relevant departments with regard to assessment, transfer and consultation.¹³⁰

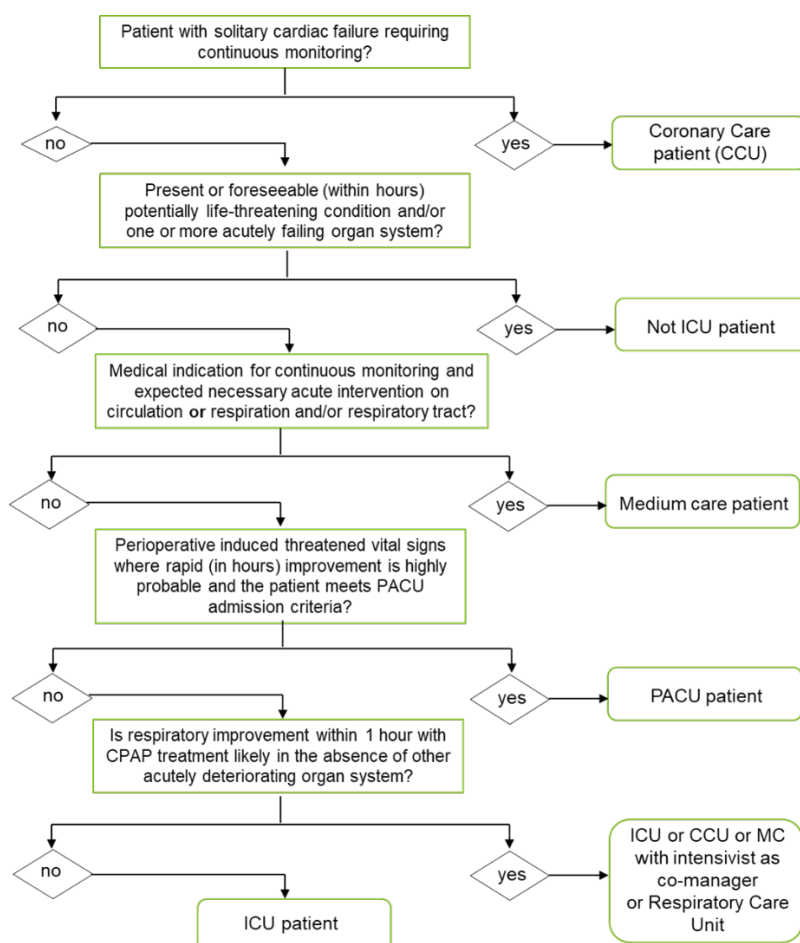
LEVELS OF INTENSIVE CARE

According to the Quality Standard, there are no differences between ICUs in terms of levels. In clinical practice, however, larger ICUs treat more complex patients. The organisation of ICUs in the Netherlands differs considerably. Because intensive care departments are always part of the care chain in a hospital, the differences between types of hospitals are also subject to differences per ICU. Types of hospitals are general, top clinical or academic, bigger or smaller, and that related to whether there is a separate Medium Care department (see section 4.3.3.7) is present and whether it will be used as a step-down and/or step-up facility.¹³⁴

The Dutch Quality Standard for intensive care mentions different types of ICUs: Post Anaesthesia Care Unit (PACU), Medium Care Unit (MCU), Stroke Unit, Coronary Care Unit (CCU), Intensive Care Unit (ICU). However, the Quality Standard does not define all types.

In combination with the flowchart (see Figure 27), it is possible to determine whether a patient meets the criteria for the MCU, Stroke Unit, PACU, CCU or ICU. The definition and the flowchart provide guidance for recognising and acknowledging the type of patient in order to achieve an adequate level of care.

Figure 27 – Flowchart to assess admission criteria



Source: Zorginstituut Nederland (2016)¹³⁰

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION PER LEVEL

The Quality Standard does not contain level-specific prerequisites for the number or qualification of medical staff, nursing staff as well as allied healthcare staff. See section 4.3.3.7 for more information on prerequisites for staffing at Medium Care Units.

STAFF: PERSON IN CHARGE OF AN ICU PER LEVEL

The Quality Standard does not contain level-specific recommendations for the person in charge of an ICU.

EQUIPMENT: REQUIREMENTS PER LEVEL

n/a

FORMAL INTERDEPENDENCIES WITH OTHER HOSPITAL SERVICES/MEDICAL SPECIALTIES

Part of the care policy plan for the ICU (ZBP-IC, *Zorgbeleidsplan IC*) is the regional ICU cooperation plan, in which the agreements between intensive care departments in the ICU region are laid down. In principle, a region corresponds to the already existing Regional Reception Acute Care (*Regionale Opvang Acute Zorg*, ROAZ) and consists of different networks. The ROAZ makes administrative agreements about cooperation and networks in the region. Fifteen intensive care networks with eight centred around an academic hospital were formed after the Quality Standard was implemented in 2016.¹³⁵

The collaboration between intensive care departments of hospitals is on the coordination of the individual content of care for ICU patients. A network of intensive care departments consists of at least three physical ICU locations and at least one 'larger' ICU location, i.e. at least one with 12 beds or more with a bed occupancy of at least 70% over the past 3 years. An ICU location can only belong to one network. Networks create an annual report for their region.

Each intensive care department indicates in the ZBP-IC:

- which tasks, responsibilities, and powers it has in the network and which connections it has with which hospitals in its network in terms of patient flows;
- within how many minutes the intensivist has to be present in the evening and at night;
- their maximum average bed occupancy;
- the drawing up of protocols;
- the promotion of expertise;
- the benchmarking of results, the necessary training and exchange of personnel;
- all medical treatments that are possible in one region, including cardiac surgery, neurosurgery and traumatology, with the exception of very special treatment modalities such as burn care, for which fixed agreements must be made with another region.

Furthermore, intensivists in smaller ICUs (<12 beds) are required to discuss at least all patients with a SOFA score of 10 or higher within 24 hours with either an intensivist in the same hospital (if the ICU has 12 or more beds) or with an intensivist from a larger ICU (12 or more beds).

In addition, hospital locations without an intensivist or intensive care department (but where ICU patients can arise and must therefore also be taken care of) must make agreements with a regional partnership regarding care for ICU patients. Specific numbers on how often this is the case are not known.

Preferably, there are specialised centres in a region for treatments that fall under the Special Medical Procedures Act (*Vergunningen Wet bijzondere medische verrichtingen*, WBMV) and for other highly specialised and low-frequency treatments, such as burn care, neurosurgery, heart surgery and transplant medicine. Not every region necessarily has to be able to provide all medical treatments, but in that case conclusive agreements must be made with other regions. The way in which regions are formed depends on the choices made by hospitals. Intensive care departments in University Medical Centres (UMCs) distinguish themselves from other ICUs by the tertiary referral function (not only on the basis of the required ICU care, but also on the basis of the expertise of other medical specialties) and because the teaching and research tasks performed at UMCs are invested. Due to the concentration of expertise, UMCs play an important role in the innovation of ICU treatment and the treatment of patients who require highly complex care. They also have knowledge in the field of quality improvement that can provide important support the coordination of care in a region.¹³⁴



If an ICU patient needs to be transferred to another facility, this should be done using mobile intensive care unit (MICU) transport – provided the patient's condition allows waiting for this type of transport. MICU transport must be possible at least 16 hours a day. These are organised regionally whereas the regions differ from the ROAZ. If the patient's condition does not allow waiting for an available MICU, a regular ambulance may be used. The medical supervision of an emergency transport is preferably provided by an intensivist, but then the remaining ICU patients must be stable or adequate replacement has been arranged. If the patient to be transported is stable, or if the patients remaining in the ICU are unstable, it is possible to have the emergency transport supervised by another physician (Royal Dutch Medical Association-registered emergency physician, anaesthesiologist or ICU doctor). The condition is that the physician is demonstrably competent in the transport of ICU patients. Each hospital has an emergency ICU transport protocol in which local agreements are recorded. This describes where the responsibilities lie and what conditions must be met.¹³³

There are various moments of consultation between intensivists in the network:¹³⁰

- If the patient is or has been admitted to an ICU with less than 12 beds^j. In that case, consultation must take place within 24 hours with a fellow intensivist of an ICU with 12 beds or more with a bed occupancy of at least 70% over the past three years if:
 - the intensivist of the ICU, based on his/her expertise, deems desirable and/or;
 - in case of serious organ failure, where a SOFA score of 10 or more is given as a guideline and/or;
 - in the event of a possible indication for treatment that is not possible in the ICU concerned.
- If the patient is or has been admitted to an ICU with 12 beds or more with a bed occupancy of at least 70% over the past 3 years. In that case, consultation must take place within 24 hours with a fellow intensivist if:
 - the intensivist, based on his/her expertise, deems desirable and/or;
 - in case of serious organ failure, where a SOFA score of 10 or more is given as a guideline and/or;
 - in the event of a possible indication for treatment that is not possible in the concerned ICU or in the concerned hospital.

(TELEMEDICAL) NETWORKS

(Telemedical) Networks do exist, but they are not formally organised. More information could not be provided by the experts consulted.

ROLE AS A TRAINING CENTRE

ICUs have the role as a training centre. In sum, nine ICUs act as training centres of which eight are located in academic medical hospitals and one in a teaching hospital.

ABILITY TO SCALE UP SERVICES IN RESPONSE TO A PANDEMIC OUTBREAK OR A DISASTER

In the Netherlands, a framework called 'pandemic roadmap' (*Draaiboek pandemie*) was developed during the pandemic. However, the shortage of nurses has prevented the country from scaling up as planned to, especially in the second half of the pandemic.

^j The same applies to ICUs with at least 12 beds with a bed occupancy of less than 70% over the past three years.

4.3.2 Critical appraisal of consulted experts

The consulted experts were asked to assess the availability of personnel, equipment, and infrastructure.

The **Danish** expert indicated that while the country has an adequate supply of hospital beds, ICU beds, ventilators, ECMO machines, and medical personnel, there is a critical shortage of nurses. This shortage currently represents the main bottleneck in the healthcare system. A significant number of nurses left the profession or moved to the private sector following the COVID-19 pandemic and a nursing strike in 2021. In response, initiatives are underway to train new ICU nurses.

The expert from **England** reported an insufficient number of hospital and ICU beds. NHS England is currently working to maintain the availability of recently added expansion beds. There has been a longstanding underinvestment in critical care bed capacity, particularly in the areas of allied healthcare staff and pharmacy services. This issue is further exacerbated by a general shortage of these professionals across the UK. Additionally, there is an overall shortage of physicians and nurses. The Faculty of Intensive Care Medicine is advocating for increased funding to expand intensive care medicine training positions for physicians and highlights these workforce shortages in its reports. On the other hand, the supply of ventilators and ECMO machines is considered sufficient.

There is not a sufficient number of medical staff^{136, 137}, nurses¹³⁷⁻¹³⁹, physiotherapists^{137, 140}, psychologists¹⁴¹, speech therapists¹⁴⁰, respiratory therapists, and social workers. Another key issue that requires attention is the presence of funding disparities in the provision of critical care services across different regions of the UK.

According to one of the **French** experts, the number of hospital beds is insufficient. The French High Council for the Future of Health Insurance advocates a population-based approach to reorganising local healthcare systems, emphasising improved access to coordinated primary care and reserving hospitalisation for last-resort cases. Nevertheless, local elected officials and hospital unions continue to demand an increase in hospital bed capacity. Both experts agree that, in general, the number of ICU beds is adequate. However, during the pandemic, concerns were raised about ICU bed shortages relative to other countries, particularly regarding unequal regional distribution. Temporary authorisations to expand ICU capacity during the crisis proved to be an effective policy. Ventilator supply is considered sufficient, though experts recommend establishing a national reserve of ICU equipment to address future health emergencies or short-term surges in demand.

There is disagreement among experts on whether the number of ECMO devices is sufficient. In terms of medical personnel, one expert highlights the need for increased training to address shortages resulting from the former *numerus clausus* policy. Both experts agree that the number of nurses is inadequate. Many nurses left the profession during 2021–2022 due to difficult working conditions, and recruitment remains challenging due to low job attractiveness.

The experts also differ on whether there are enough physiotherapists, psychologists, speech therapists, and respiratory therapists. The Ministry of Health projects a surplus of physiotherapists by 2040. Psychologists are unevenly distributed across regions, a concern highlighted during the pandemic. According to the Ministry, rehabilitation staff numbers are generally sufficient.

Finally, both experts agree that there is a shortage of social workers, particularly in public hospitals.

According to the expert from **Italy**, the number of hospital beds is insufficient, particularly in intermediate care and semi-intensive units, which are inadequately equipped. While the supply of ICU beds, ventilators, and ECMO devices is considered sufficient, there is a notable shortage of medical staff, including nurses, physiotherapists, psychologists, speech therapists, and respiratory therapists, specifically within intermediate and semi-intensive care settings. Additionally, the number of social workers does not adequately meet the health needs of the population.

According to the expert from **Sweden**, there is an overall shortage of hospital and ICU beds, which is recognised as a widespread issue. The National Board of Health and Welfare has been tasked by the



government with determining the necessary number of hospital and ICU beds. Additionally, the Health and Social Care Inspectorate has raised concerns with several hospitals about inadequate bed and ICU capacity. Sweden currently has fewer than 5 ICU beds per 100 000 inhabitants, which is considered insufficient. Data on intermediate care capacity is currently lacking, though it is expected to become available in the near future.

While the availability of ventilators and ECMO machines is sufficient, the same does not hold true for medical staff. There are notable shortages of nurses, physiotherapists, psychologists, and social workers, reflecting a broader staffing deficit across the healthcare system. This issue is anticipated to worsen in the coming years due to demographic changes. The expert was unable to specify the extent of the physician shortage. In Sweden, speech therapists are not routinely involved in ICU care but are more commonly found in rehabilitation settings, such as Stockholm's long-term ICU facility, Remeo. Respiratory therapists are not used in Sweden.

In the view of the expert in **the Netherlands**, there is an adequate number of hospital beds; however, ICU beds are insufficient, primarily due to a shortage of trained ICU nurses. Another expert agrees that there are enough beds under normal conditions, such as during non-crisis periods or outside of pandemics like COVID-19 or influenza. The expert clarifies that when they refer to 'beds', they are specifically referring to staffed beds, meaning beds with nurses. There is a sufficient number of ventilators, ECMOs, medical staff, and speech therapists, although speech therapists are not typically involved in ICU care.

There is a shortage of psychologists, as they are not available everywhere and are not a standard requirement in ICUs. However, another expert believes there is an adequate number of psychologists. It remains unclear whether there are enough respiratory therapists, as only a small number of hospitals employ them. The Netherlands has organised its workflow differently, with intensivists and ICU nurses managing ventilation instead of relying on respiratory therapists. Experts are divided on whether there are enough social workers, and budget cuts have made it necessary to be creative in addressing this gap. In the Netherlands, every patient has a GP, and ICUs sometimes collaborate with GPs or with social workers from the patient's primary specialty for social support after their ICU stay.

Table 16 summarises the appraisal of the consulted experts.

Table 16 – Critical appraisal of the experts

	Denmark	England	France		Germany	Italy	Sweden	The Netherlands	
<i>Is there a sufficient number of hospital beds?</i>	Yes	No	Yes	No	Yes	No	No	Yes	Yes
<i>Is there a sufficient number of ICU beds?</i>	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes
<i>Is there a sufficient number of ventilators?</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Is there a sufficient number of ECMOs?</i>	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
<i>Is there a sufficient number of medical staff?</i>	Yes	No	-	No	No	No	No	Yes	Yes
<i>Is there a sufficient number of nurses?</i>	No	No	No	No	No	No	No	No	Yes
<i>Is there a sufficient number of physiotherapists?</i>	-	No	Yes	No	Yes	No	No	Yes	Yes
<i>Is there a sufficient number of psychologists?</i>	-	No	No	Yes	No	No	No	No	Yes
<i>Is there a sufficient number of speech therapists?</i>	-	No	Yes	No	-	No	Yes	Yes	Yes
<i>Is there a sufficient number of respiratory therapists?</i>	-	No	Yes	No	No	No	-	No	Yes
<i>Is there a sufficient number of social worker?</i>	-	No	No	No	Yes	Yes	No	No	Yes
<i>Are there are further issues to be addressed?</i>	-	Yes	No	No	No	Yes	No	No	No



4.3.3 Intermediate Care

4.3.3.1 Denmark^k

CONTEXT

The first IMCU opened in 2011 in Nordsjællands Hospital, and served as model for the development of other IMCUs in the country. There are currently five IMCUs in Denmark, with three of them located in the Capital Region.

For many years, Denmark had high-dependency units (HDUs) attached to another department (infectious disease, surgery, etc.), and led by relevant specialists. The aim of the IMCU model was to develop intermediate care in a similar way as intensive care. In particular, IMCUs (as ICUs) are led by anaesthesiologists.

LEGAL DEFINITION AND ORGANISATION OF INTERMEDIATE CARE

There is no legal definition for IMCU in Denmark, but in practice an IMCU is a multidisciplinary unit that is positioned in between an ICU and a regular unit. IMCUs are part of the anaesthesiology department, just like ICUs.

Unlike HDUs, IMCUs are not situated alongside specific departments. Nevertheless, a physician from the relevant general unit is partly responsible for the patients admitted in the IMCU. This specialist (further referred to as the 'receiving physician') works in collaboration with the 'IMCU physician' (an anaesthesiologist responsible for the acute management of the patient).

TYPES OF PATIENTS AND ADMISSION CRITERIA

A patient can be admitted in the IMCU of Nordsjællands Hospital if the following criteria are met:¹⁴²

- The patient has been evaluated by an anaesthesiologist at the referring hospital, and it has been determined in agreement with the IMCU physician (and only the IMCU physician) that intermediate care is required.
- The referring department (i.e. often an ICU) consults with the IMCU physician to determine which department at Nordsjællands Hospital the patient should be assigned to. Prior to IMCU admission, approval must be obtained from the appropriate department at Nordsjællands Hospital.
- The time of transfer and expected arrival at the IMCU has been agreed upon and the receiving physician has been informed and agreed to meet the patient, administer necessary medication and plan the next steps.
- The IMCU staff has been briefed by the IMCU physician about the patient and the patient's condition, and provided with contact information of the receiving physician.
- If the receiving physician cannot be present at admission, the IMCU physician is responsible for administering the necessary medication upon the patient's arrival.
- Patients are admitted at the IMCU in priority order, based on the following three principles:¹⁴²
 - a. The patient needs observation or treatment that can be provided at the IMCU, but not at the patient's regular unit. A prerequisite is that the patient's condition does not require a transfer to the ICU. The latter would be the case, for instance, for patients requiring non-invasive ventilation, incubated patients, infusion of high-dose inotropes and vasopressors, patients with Sengstaken probe or continuous dialysis.

^k N. Wesche, personal communication, 22 August 2024, except stated otherwise.

- b. Physiological parameters are indicative of critical illness. The Early Warning Score (EWS) serves as a guide for prioritisation. Higher priority for the IMCU is given to patients with score 6 to 8. Patients with score 9 should be transferred to the ICU.
- c. The patient belongs to a predefined group where intermediate care is considered particularly beneficial:
 - Endocrinology: moderate ketoacidosis (awake, pH > 0.7); hyperosmolar hyperglycaemia
 - Pulmonary medicine: acute pulmonary disease with reversible component without non-invasive ventilation requirement
 - Nephrology: patients in need of acute haemodialysis and simultaneous monitoring needs due to other organ failure organ failure or risk of arrhythmias; poisonings haemodynamically and respiratory stable, but in need of for monitoring
 - Neurology: unstable patients with elevated intracranial pressure requiring close observation (>1/hour); patients at risk of respiratory failure due to altered consciousness; status epilepticus
 - Surgery and gastro medicine: acute high-risk abdominal surgery patients; bleeding or perforated ulcer in unstable phase; liver coma grade 3-4 with stable hemodynamics; some trauma patients (e.g. liver and spleen lesions with a high risk of bleeding; costa fractures at a high risk of respiratory insufficiency)
 - Orthopaedic surgery: trauma patients with concurrent serious medical conditions
 - Obstetrics: mild cases of pre-eclampsia/HELLP e.g. magnesium infusion in an otherwise asymptomatic patient
 - All specialties: patients with severe sepsis and mono-organ failure; patients with pneumonia with high oxygen demand and/or frequent CPAP need; patients in ASA group 3-4 undergoing elective or emergency surgery with an expected need for perioperative care for more than 24 hours (prolonged recovery); delirium tremens/treatment of severe withdrawal (diazepam requirement > 1 g / phenobarbital requirement); alcohol withdrawal treatment
 - ICU: some post-intensive patients with expected long-term need for intermediate care, e.g. due to tracheotomy or need for CPAP.

STAFF: PERSON IN CHARGE OF AN IMCU

The head of the IMCU is an anaesthesiologist, who is uniquely in charge of the IMCU, i.e. management is not shared with another unit. The head nurse can have an background in intensive care medicine, but it is not necessary.

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION

Nurses in the IMCU of Nordsjællands Hospital are not intensive care nurses, but nurses with an extra education in acute management. As this curriculum did not exist in Denmark, the programme to train intermediate care nurses has been developed in parallel with the IMCU. Currently, collaborations exist to train nurses from newer IMCUs.

There are no official regulations regarding staffing ratios, so that the number of nurses is locally determined for each IMCU. In any case, staffing ratios are higher than in a regular unit, but lower than in an ICU. In Nordsjællands Hospital, that has ten IMCU beds, five nurses are scheduled during daytime, four for the evening and three for the night. This corresponds to roughly half the number of nurses scheduled for ten ICUs beds.

Regarding medical staff, an anaesthesiologist is present 24/7 and has the responsibility of the ABC (airway, breathing, and circulation) acute part of the patient's treatment. Other specialists have overall



responsibility for the patient's treatment. The anaesthesiologist decides (in close collaboration with physicians from other departments) if a transfer from the ICU to IMCU, as well as from the IMCU to a regular unit is needed.

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

Ideally, rooms in IMCUs should be set up so that they can easily be scaled up to ICU rooms in case of need.

4.3.3.2 *England*

CONTEXT

In England, intermediate care is part of the intensive care continuum. Levels 1 and 2 of intensive care (see *Levels of intensive care* in section 4.3.1.2) are considered as intermediate care and only level 3 corresponds to ICU. Therefore, requirements for intermediate care are described in the same documents as requirements for ICUs.

LEGAL DEFINITION AND ORGANISATION OF INTERMEDIATE CARE

High dependency units represent an intermediate level of care, between intensive care and the general unit care.¹⁴³⁻¹⁴⁵ They provide care to patients requiring more detailed observation or intervention, including support for a single failing organ system or post-operative care and those 'stepping down' from higher levels of care, i.e. level 2 patients (see *Levels of intensive care* in section 4.3.1.2).⁵³

Intermediate care (level 2) mainly takes place in flexible beds, within ICUs. In 2022-2023, among the 177 908 care episodes (74.8% of all critical care episodes) for which this information was reported, 4.3% took place in units with level 3 beds only, 14.4% in units with level 2 beds only, and the vast majority (79.6%) in flexible critical units where there is a mix of level 2 and level 3 beds.⁵²

As population is ageing, patients are more likely to have multiple comorbidities. As science evolves, patients are more likely to undergo complex procedures. Patients in these situations cannot safely be managed in a general ward environment due to the frequency of observations or specialist monitoring required. To ensure patient safety and provide a high-quality service, these patients were often admitted to an HDU. This resulted in disruptions in patient flow: when HDU beds are occupied by these patients, patients in the ICU ready to step down cannot be admitted to the HDU. Also, patients requiring HDU or ICU admission as part of their perioperative pathway may have their procedure cancelled.¹⁴⁶

In 2020, The Faculty of Intensive Care Medicine recommended that 'enhanced care' becomes part of the continuum of care from the general unit to the ICU.¹⁴⁶ Enhanced care is defined as 'an intermediate level of care where a higher level of observation, monitoring and interventions can be provided than on a general ward but not requiring high dependency care/organ support. Enhanced advice and support from the critical care team can be accessed.'¹⁴⁶ The revised version of the GPICS (2022) includes enhanced care as corresponding to level 1 patients (see *Levels of intensive care* in section 4.3.1.2).⁵⁰

Enhanced care services are typically co-located and work closely with a particular service, ward or interventional area. They are accountable to a surgery or medicine department separate to critical care. The Faculty of Intensive Care Medicine supports the co-location of emergency care services to facilitate sharing of resources such as equipment, expertise and support services.¹⁴⁶

TYPES OF PATIENTS AND ADMISSION CRITERIA

As stated above, levels of care are defined according to the patient's clinical needs, regardless of patient location. Clinical judgement should be used to determine which level of care is most

appropriate for a patient, based on the definitions of each level (see *Levels of intensive care* in section 4.3.1.2).⁵⁰ It should be noted that the classification (particularly for level 2) is wider than only the presence or absence of organ failure.

The revised version of the GPICS (2022) states explicitly that the arrangements for the transition between level 1 and level 2 should be clear and agreed between all members of the multidisciplinary team.⁵⁰

STAFF: PERSON IN CHARGE OF AN IMCU

Medical staff: According to the GPICS, patients' care, should be led by a consultant in Intensive Care Medicine.⁵⁰ This concerns level 3, but also level 2 patients. Regarding level 1, the guidance for enhanced care states that under normal circumstances it should not be delivered by the critical care team.¹⁴⁶ A consultant should lead a daily ward round with the nurse in charge and input from other appropriate specialties e.g. anaesthesia for perioperative patients, critical care and outreach. A senior clinical decisionmaker must be clearly identified at all times to provide oversight including admission and triage decisions. A competent clinical decisionmaker must be identified to undertake an initial patient assessment, request investigations, review and respond to results and be able to prescribe. It is recommended not to follow the standard model used in many organisations that consists in contacting an intensivist. Indeed, it is considered that this model would risk the safety of patients within critical care.

Nursing staff: According to the GPICS, a supernumerary (i.e. not rostered to deliver direct patient care to a specific patient) senior registered nurse should provide the supervisory clinical coordinator role on duty 24/7 in all types of critical care units (i.e. in ICUs but also in HDUs).⁵⁰ For enhanced care (level 1), a nurse lead/unit manager has responsibility for clinical supervision of patients and staff, manage the unit, nursing staff and maintain oversight of the strategic development or maintenance of the service.¹⁴⁶

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION

According to the GPICS, level 2 patients must have a registered nurse-to-patient ratio of a minimum of 1:2 to deliver direct care.⁵⁰ For level 1 patients, the staffing ratio should match patient acuity, skill mix, work load and the diversity of services offered. Therefore, no clear nurse-to-patient ratio could be set. However, it is unlikely that quality of care could be ensured should the nurse to patient ratio fall below 1:4.

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

HDUs facilities should comply with the 'Health Building Note 04-02' issued by the Department of Health.⁵⁴ These requirements are similar to those of ICUs (level 3) (see *Equipment: Requirements per level* in section 4.3.1.2).

For enhanced care, the availability on the unit at all times of essential equipment such as routine non-invasive monitoring, infusion pumps, etc. is recommended. In addition, real time remote monitoring for certain patients should be considered. Easy access should be granted to arterial blood gas and lactate measuring equipment and other equipment that may only be required intermittently.¹⁴⁶

4.3.3.3 France

CONTEXT

Following the 2022 decrees (see section 4.3.1.3), stand-alone continuous monitoring units that cannot be transformed into an ICU are deemed to disappear. They will be replaced by reinforced care units for which no legal text has been published so far. In the meantime, in April 2024, the Ministry of Health has specified transitional rules for these intermediate care units, called 'continuous monitoring units outside the scope of critical care' (*'unités de surveillance continue en dehors du champs des soins*



critiques).¹⁴⁷ These units are not to be considered as part of the intensive care continuum. However, it was important to define general rules for them as some care programmes (interventional cardiology, cancer and interventional radiology) refer to continuous monitoring units. Existing continuous monitoring units can continue outside these programmes, but the development of new continuous monitoring units outside these programmes should not be allowed. Another objective of the transitional period is to gather enough data (regarding patient profile, staffing, etc.) for these units once the new definitions of resuscitation units and ICUs are fully implemented. This should allow to specify the definition, operating conditions and financing arrangements of the future reinforced care units.¹⁴⁸

LEGAL DEFINITION AND ORGANISATION OF INTERMEDIATE CARE

The existing definition of a continuous monitoring unit given in the French Code of Public Health has not been cancelled by the 2022 decrees. Accordingly, continuous monitoring is carried out in healthcare facilities that include one unit (or, exceptionally, several units if it is justified by the size of the facility) organised to care for patients who, due to the seriousness of their condition or the treatment they are receiving, require repeated and methodical clinical and biological observations.¹⁴⁹ Such unit may operate in a healthcare facility that does not have a resuscitation unit nor an intensive care unit, provided that there is an agreement specifying the conditions for patient transfer with hospitals that have a resuscitation or intensive care unit.¹⁵⁰

It should be noted that PACUs (located close to the operating theatre and aimed at ensuring the safety of patients coming out of general or locoregional anaesthesia for a surgical or interventional procedure) are not considered continuous monitoring units.¹⁴⁷

Continuous monitoring units are not supposed to be adjacent to the reanimation unit or to an ICU. On the contrary, the existing continuous monitoring units that were adjacent to a reanimation unit had the possibility to be transformed into an ICU. In the current vision, continuous monitoring units are either stand-alone units, or units adjacent to a specific service (cancer, etc).

TYPES OF PATIENTS AND ADMISSION CRITERIA

Continuous monitoring units aim to admit patients with an acute medical or surgical pathology, who are stable, with no foreseeable short term risk of organ failure, requiring complex or heavy care as well as repeated and methodical clinical and biological monitoring. This includes preventive and/or curative care. If the patient's status deteriorates during treatment in the continuous monitoring unit and life-threatening failure is likely to occur, transfer to an ICU or resuscitation unit must be organised within a timeframe that is compatible with the safety of the patient.¹⁴⁷

Patients are notably transferred from:¹⁴⁷

- Surgery: patients admitted after an operation, for whom the seriousness of the treatment and/or the existence of co-morbidities and/or the need to treat or avoid a complication, do not allow them to be transferred directly to a regular unit;
- Medical: patients suffering from an acute medical condition or decompensating from a chronic condition and/or who have co-morbidities and/or a complication or a high probability of a complication arising from this condition, and who require repeated monitoring;
- Critical care: patients whose evolution no longer justifies critical care, but for whom the burden of care and/or the need for close monitoring do not allow them to be transferred directly to a regular unit.

Continuous monitoring units cannot admit patients who fall under the scope of critical care, i.e. patients at risk of organ failure or with organ failure.¹⁴⁸

STAFF: PERSON IN CHARGE OF AN IMCU

For each unit, a physician in charge or reference physician should be identified.¹⁴⁷ There is no legal barrier for the physician in charge to be shared with an adjacent unit.

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION

The multidisciplinary team of the continuous monitoring unit is made up of a least one physician with skills appropriate to the type of patient being treated; at least one qualified nurse; at least one healthcare assistant; and any other professional required for patient care.¹⁴⁷ Staffing is sufficient to ensure the continuity of care around the clock and to provide repeated monitoring and technical care that is necessary for the patient.¹⁴⁷

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

Within a timeframe that is compatible with safety of care, the continuous monitoring unit has access on site or by agreement to imaging (scan, MRI and ultrasound) and medical biology examinations. Depending on the type of patients being treated, access to an operating theatre must also be organised.¹⁴⁷

4.3.3.4 Germany

CONTEXT

IMCUs are explicitly excluded from the recommendations for the organisation and equipment of intensive care developed by the DIVI.⁸⁶ Separate recommendations exist for the organisation and equipment of intermediate care units, also developed by the DIVI.¹⁵¹

LEGAL DEFINITION AND ORGANISATION OF INTERMEDIATE CARE

In accordance to the DIVI, intermediate care units (IMCUs) are defined as suitable for the monitoring and treatment of patients with moderate or potentially serious instability of physiological parameters requiring instrumental monitoring and organ support, but not requiring organ replacement. This includes patients requiring less than normal intensive care, but more than what is possible in a regular ward. The IMCUs care for patients whose condition is so serious and/or burdensome that they require constant or close monitoring. These are patients whose condition includes one or more expected organ failures, or whose condition is too serious or unstable for a return to a normal ward. This includes the prevention, diagnosis and treatment of all medical and surgical diseases that can lead to the failure of vital functions. The IMCU can also be specialised, for example neurological or cardiological treatments ('stroke unit', 'coronary care unit', etc.) to guarantee the best possible standard of care.¹⁵¹

Depending on local factors, the IMCU can be integrated within an ICU, adjacent (parallel) to an ICU (with common management) or a stand-alone unit.^{151, 152} At least 10 to 12 beds are recommended for stand-alone IMCUs. For smaller units, an integration or parallel model is recommended.

TYPES OF PATIENTS AND ADMISSION CRITERIA

The IMCU is not intended to replace an ICU. However, there may be overlaps between these two types of units. Whether certain forms of organ support are provided on an IMCU rather than on an ICU may depend notably on the resources available to the hospital or unit. Therefore, the DIVI recommends that each IMCU defines specific criteria regarding admission, discharge and transfer to other levels of care. These criteria should be agreed upon in a binding manner with the adjoining units.^{151, 152}

The DIVI has developed a list of recommended criteria (see Table 17) that can serve as a basis for the development of the criteria in each IMCU.^{151, 152}



Table 17 – Recommended criteria for admission to IMCUs in Germany

	Recommended admission criteria
General	Need for monitoring more than 6×/day or every 4 h Absence of criteria requiring admission to ICU Increased need for care (defined based on a classification such as the Swiss classification, NEMS, RASS or NAS) Exclusion of patients with shock (septic, haemorrhagic, cardiogenic, anaphylactic) Exclusion of acute dialysis, continuous renal replacement therapy (CRRT) Exclusion of patients requiring extensive invasive haemodynamic monitoring (PiCCO, pulmonary artery or right atrial catheter or similar) or cranial pressure measurement
Cardiac system	Non-ST elevation myocardial infarction, haemodynamically stable Arrhythmia, haemodynamically stable Haemodynamically stable patient without myocardial infarction, but requiring a temporary cardiac pacemaker Acute heart failure without shock (Killip Class I, II) Hypertensive emergency without evidence of acute organ damage requiring treatment Exclusion of acute myocardial infarction Exclusion of acute ST-elevation myocardial infarction, acute coronary syndrome with haemodynamic instability, temporary pacemaker, haemodynamic instability of other cause, pulmonary oedema with the risk of an indication for intubation or the risk of heart rhythm disorders Exclusion of high catecholamine requirements or sharply varying/increasing dose, drugs requiring extensive haemodynamic monitoring Exclusion of acute mechanical circulatory support
Respiratory system	Patients with mild respiratory failure or the risk of deterioration of respiratory failure requiring close monitoring and/or intermittent respiratory support (e. g. NIV/continuous positive airway pressure [CPAP]/high flow oxygen) Patients who require close checks on vital parameters or intensive respiratory physiotherapy (e. g. tracheal aspiration more often than 3×/day) Exclusion of patients with acute respiratory failure that have recently been intubated or in whom intubation may be required Exclusion of patients with an endotracheal tube
Neurological system	Acute neurological–neurosurgical picture with the need for frequent neurological examination or frequent suctioning of the oral cavity or positioning Disoriented patients requiring close monitoring and examination for signs of neurological deterioration Stable neurological patients requiring cerebrospinal fluid (CSF) drainage Patients with chronic neurological disorders, e. g. neuromuscular disease requiring frequent care measures Exclusion of patients in status epilepticus

	Exclusion of patients with elevated cranial pressure, subarachnoid haemorrhage (SAH) with vasospasm
Poisonings and Overdoses	Any patient requiring frequent neurological, respiratory or cardiovascular monitoring following poisoning or overdose and that is haemodynamically stable
Gastro-intestinal Disorders	Gastro-intestinal bleeding with mild orthostatic hypotension that reacts to volume administration
Endocrine System	Diabetic ketoacidosis requiring continuous and constant intravenous insulin administration or more frequent insulin injections in the early phase once ketoacidosis has been controlled Hyperosmolar syndrome with increased risk of coma Thyrotoxicosis, hypothyroidism requiring close monitoring
Surgical Conditions	Postoperative patients following major procedures that are haemodynamically stable but with an increased need for volume and transfusion, caused by large fluid shifts Stable postoperative patients but with a high postoperative risk of bleeding (e. g. following mass transfusion, taking anticoagulant therapy, bleeding at the end of the procedure) Postoperative patients requiring close nursing care and monitoring, e. g. following carotid endarterectomy, peripheral vessel reconstruction, V-P shunt revision, kidney transplant
Others	Treated and regressing sepsis without shock or secondary organ failure Patients requiring close monitoring of fluid management Obstetric patients during pregnancy or post-partum with (pre)eclampsia or other medical problems Any patient requiring frequent monitoring or very complex wound management that does not fall into any of the above categories (e. g. Addisonian crisis, acute renal failure, delirium tremens, hypercalcaemia)

Source: Waydhas et al. (2018).¹⁵² CSF = cerebrospinal fluid; CPAP = continuous positive airway pressure; CRRT = continuous renal replacement therapy; ICU = intensive care unit; NAS = nursing activities score; NEMS = nine equivalents of nursing manpower; NIV = non-invasive ventilation; PiCCO = pulse index contour cardiac output; RAS = Richmond agitation-sedation scale; SAH = subarachnoid haemorrhage; V-P = ventriculo-peritoneal.

**STAFF: PERSON IN CHARGE OF AN IMCU^{151, 152}**

According to the DIVI recommendations, a unit director as well as a deputy director should be appointed. The director should be certified in intensive care and the deputy should be a specialist with at least one year experience in intensive care. They are expected to perform daily rounds and visit all patients on the unit at least twice a day on all normal working days.

Also, a head nurse and a deputy must be appointed. The head nurse should have specialist training in intensive care and at least 3 years of working experience on an ICU. The deputy should have at least specialist training in intensive care or intermediate care. The head nurse must have a clearly defined period each day specifically identified in the roster for administrative and organisational management tasks. During this period, the head nurse is not involved in any patient care tasks.

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION^{151, 152}

Medical staff: A physician must be continuously present. At night and weekends, this presence could be organised in the form of an on-call service in the hospital that can reach the patient within 5 minutes. At any time, a specialist with knowledge of intensive care must be present in the unit within 5 minutes. For specialised IMCUs, specific requirements must also be fulfilled (e.g. presence of neurological specialists for stroke units).

Nursing staff: At least two nurses should be present in the unit at all times and at least one nurse with specialist intensive care training should be present during each shift. A minimum of 20% of nurses should have training in intensive care. The rest of the nursing staff should have training in intermediate care or have passed the nursing examination.

The nurse-to-patient ratio should be at least 1:4. For higher treatment requirements, a higher ratio is required.

In each unit, the above requirements regarding nursing staff must be achieved in 95% of the shifts.

Allied healthcare staff: Physiotherapy should be available every day (including weekends and public holidays). The following staff functions should be available at least on weekdays: social services, hygiene officer, clinical pharmacy, psychologist, unit secretary and support staff. In specialised IMCUs, also logotherapy/swallowing therapy and occupational therapy should be available at least on weekdays. In addition, it is desirable to have nutritional advice and care assistants.

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS^{151, 152}

The following monitoring and diagnostic equipment must be present in the unit: electrocardiographic/heart rhythm, non-invasive blood pressure measurement, intra-arterial blood pressure measurement, central venous pressure measurement, temperature, pulse oximetry, breathing rate measurement, monitoring with connection to a central point, blood gas analysis (including lactate, glucose, electrolytes), arrhythmia monitoring, ST analysis, bed scales, mobile 12-lead ECG, transport monitor, bronchoscopy, ultrasound (including Doppler), transthoracic echocardiography, transoesophageal echocardiography (available in the hospital), transcranial Doppler, colour duplex ultrasound (only in neuro-medicine units), mobile X-ray equipment, capnometry, electroencephalography and EVOPS (only in neuro-medicine units, available in the hospital).

The following treatment equipment must be present in the unit: oxygen Insufflation, resuscitation bag, non-invasive ventilation equipment (number depending on organisation, including a range of interfaces), high-flow oxygen administration, transport respirator, equipment for inhalation therapy, airway suction equipment, equipment for physical respiratory therapy, equipment for enteral nutrition, 1-2 infusion pumps per bed, 3-4 injection pumps per bed, emergency equipment, defibrillator, external cardiac pacemaker, cooling/warming procedure for patients (available in the hospital), suction device (for chest drainage, etc.), special beds (e. g. for decubitus prophylaxis or therapy, heavy duty beds – do not need to be available but must be delivered promptly), mobilisation aids.

The following should be available within the hospital:

- 24h availability on site: conventional X-ray, computer tomography, bronchoscopy, ultrasound, specialist medical expertise in internal medicine, in surgery and in anaesthesiology
- 24h availability on site or as a cooperation model within 30 minutes: interventional cardiology diagnosis and therapy, surgical capacity for emergency procedures, gastroscopy, blood bank and competence in transfusion, medicine, clinical chemistry laboratory, ICU. In locations without an ICU, provision must be made for transfer to an ICU elsewhere.
- Availability within 24h (on call or as a cooperation model): MRI, angiography/digital subtraction angiography, neurology, microbiology, pharmacy, hygiene

4.3.3.5 Italy

CONTEXT

Intermediate care is not legally defined nor organised in Italy. Nevertheless, the Ministerial Decree 70/2015 refers to 'short intensive observation' and 'sub-intensive therapy'. The former should be available in all facilities, while the latter should be available in first and second level hospitals (but not in basic facilities). Sub-intensive care refers to ultra-specialty therapies (cardiology, respiratory, neurology, etc.), to respiratory ICUs and pulmonary intermediate care units but also to more general intermediate care units. From 2015 to 2020, the activation process of sub-ICUs in Italy has been incomplete and slow. There has been considerable inhomogeneity between the different regions and health authorities, both in terms of activated beds and organisational models.¹⁰⁰

LEGAL DEFINITION AND ORGANISATION OF INTERMEDIATE CARE

- Although the Ministerial Decree 70/2015 officially introduced 'sub-intensive therapy' in Italy, it does not provide a definition for the concept. Two kinds of units are included: specific units are dedicated to patients with a single-specialty health issue (e.g. stroke units, respiratory intermediate care units, coronary and cardiovascular care units) while more general units are managed by intensivists, internists, or emergency physicians.¹⁵³ Some Italian regions have specified that the sub-intensive units (as well as short intensive observation units) are directly attached to the emergency department.¹⁰⁰

Standards for general sub-intensive units are defined by the Italian Society of Emergency Medicine (SIMEU).¹⁰⁰ For respiratory / pulmonary intermediate care units, standards are defined by the Italian Thoracic Society (ITS-AIPO).¹⁵⁴ In both cases, these standards must be interpreted as recommendations.

The Italian Society of Emergency Medicine recommends that general sub-intensive units are co-located with the emergency department and the short intensive observation unit, or possibly with short-term hospitalisation units.¹⁰⁰ For respiratory intermediate care units, the Italian Thoracic Society acknowledges that several models are possible: independent location (free-standing intermediate unit), parallel model (intermediate unit adjacent to the ICU or co-located with the ICU), integrated model within ICU (intermediate unit inside a general ICU) and integrated model within a pulmonology unit (intermediate unit inside a pulmonary ward).¹⁵⁴

The proposal to define intensive care levels in the Ministerial Decree 70/2015, held by the Italian Society of Anaesthesia, Analgesia, Resuscitation and Intensive Care (SIAART) and the Italian Society of Emergency Medicine (SIMEU), also includes intermediate care as level 2 and 3 of the intensive care continuum (see *Levels of intensive care* in section 4.3.1.5).

TYPES OF PATIENTS AND ADMISSION CRITERIA

According to the Society of Emergency Medicine, sub-intensive units admit critical patients coming from the emergency department (but also from other units based on local needs and agreements).



These are often older patients with different pathologies (traumatic, cardiovascular, respiratory, renal, metabolic, neurological, infectious, etc.), who need an intermediate level of care, lower than that of the ICU, but higher than that of the ordinary acute care wards.¹⁰⁰ The Society of Emergency Medicine recommends the development of sub-intensive care as a clinical and organisational model dedicated to patients at high developmental risk or clinically unstable, but with no indication for admission to the ICU (LOC I or LOC II). These patients may present a single life-threatening acute organ failure (possibly associated with less severe dysfunction of other systems), require monitoring (usually non-invasive) and may require instrumental or pharmacological support of one or more functions (usually not by invasive mechanical ventilation).¹⁰⁰

The Italian Thoracic Society distinguishes two levels of respiratory intermediate care units: pulmonary intensive care units (PICUs) and pulmonary intermediate care units (PICMUs). The PICUs and PICMUs are defined as “a pulmonary monitoring and treatment area for patients with acute respiratory failure and with acute-on-chronic respiratory failure in whom non-invasive monitoring and respiratory support (NRS) (e.g. NIV and HFOT) techniques are mainly used. Difficult to wean tracheostomised patients are also admitted from general ICUs. The discharge planning of ventilator-dependent patients is part of the activities. Interventional procedures, such as bronchoscopy and pleural drainage, chest ultrasound, and analgosedation are usually performed in these units to facilitate the management of ventilated patients”.¹⁵⁴ Although, there are no definitive guidelines on admission criteria, according to the Italian Thoracic Society, the following patients require treatment in one of these respiratory intermediate care units:¹⁵⁴

- Chronic obstructive pulmonary disease with acute respiratory failure requiring mechanical ventilation, mainly non-invasive, and/or monitoring of vital parameters for acute respiratory failure
- Chronic restrictive diseases (neuromuscular and chest wall diseases and diffuse infiltrative lung disease) with acute respiratory failure requiring mechanical ventilation, mainly non-invasive, and/or monitoring of vital parameters
- Patients with central hypoventilation or sleep apnoea syndrome requiring hospitalization for acute respiratory failure
- Patients undergoing mechanical ventilation in an ICU, to complete weaning from the ventilator and/or to restore functional recovery before discharge to the hospital ward or home
- Weaned tracheostomised patients to attempt decannulation
- Patients requiring mechanical ventilation, mainly non-invasive, and/or monitoring of vital parameters due to respiratory complications after surgery
- Patients requiring mechanical ventilation and/or monitoring of vital parameters for hypoxaemic acute respiratory failure following pulmonary parenchyma diseases, with PaO₂/FiO₂ ratio <300 and >100
- Patients requiring mechanical ventilation and/or monitoring of vital parameters for acute asthma exacerbation
- Patients needing interventional procedures (e.g. bronchoscopy, digestive endoscopy, PEG positioning, and trans-oesophageal echocardiography) with acute respiratory failure during conventional oxygen therapy, high-flow oxygen therapy, or non-invasive ventilation

However, the following patients should be admitted to the ICU:¹⁵⁴

- Severe hypoxaemic acute respiratory failure (severe acute respiratory distress syndrome) with PaO₂/FiO₂ ratio <100 during invasive ventilation applicable in rescue treatments such as ECMO, nitric oxide, and pronation
- Acute respiratory failure with multiple organ dysfunction syndrome requiring multiple organ support

- Acute respiratory failure in patients with severe cardiac haemodynamic/electrical instability, for example, uncontrolled cardiac arrhythmia and/or systolic hypotension <70 mm Hg despite volaemic filling and/or use of vasoactive amines
- Septic shock with Acute respiratory failure (only for respiratory intermediate care units not equipped to perform haemodynamic monitoring)

For the definition of patients included in intermediate care under the proposal of intensive care levels held by the Italian Society of Anaesthesia, Analgesia, Resuscitation and Intensive Care (SIAART) and the Italian Society of Emergency Medicine (SIMEU), see *Levels of intensive care* in section 4.3.1.5.

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION

Physicians working in general sub-intensive units should have the medical skills peculiar to specialists in Emergency Medicine, acquired through the curriculum of the School of Specialisation, or through specific training paths for doctors already in practice. Regarding nurses, their competences are those peculiar to the management of patients with high intensity of care, acquired in the post-basic specialised training courses or in continuous training courses; in particular: the care of patients with high clinical complexity, the management and prevention of emergencies, intensive monitoring, the management of vascular lines and drains, the use of ventilation systems, the relationship with patients in critical conditions and in end-of-life situations. All professionals working in the general sub-intensive units must possess both the necessary skills to deal with emergencies and those indispensable for the management of complex critical patients.¹⁰⁰ Regarding staffing number, the Society of Emergency Medicine recommends the presence of at least 1 nurse for every 4 beds and 0.6 doctors per bed. A medical coverage should be ensured 24h a day, but physicians can also have activities in the short intensive observation unit and/or in the emergency department.¹⁰⁰ In an analysis of 12 units in 2022, Porta et al. (2024) observed that the average number of beds per nurse was 4 (Q1 = 3.8, median = 4, Q3 = 4.6) and the average number of beds per physician was 9.5 (Q1 = 6.9, median = 10, Q3 = 12.3).¹⁵³

Regarding respiratory intermediate care units, the Italian Thoracic Society recommends a nurse-to-patient ratio of at least 1:4 in PICMUs and 1:3 in PICUs.¹⁵⁴ In a survey of 24 PICMUs and 7 PICUs in 2007, the average nurse-to-patient ratios were 1:4.2 (SD = 1.3) and 1:2.5 (SD = 0.5) respectively.¹⁵⁵ The nurses should have specific knowledge and skills in critical care, near-infrared spectroscopy, airway management, analgosedation, interventional procedures, and monitoring. The team of the respiratory intermediate care unit should also consist of doctors, such as pulmonologists experienced in respiratory intensive care also familiar with airway and cardiopulmonary emergency management, mechanical ventilation, interventional procedures (i.e. bronchoscopy and pleural drainage), analgosedation, etc.¹⁵⁴ In PICUs, at least one dedicated physician should be present 24h a day and in PIMCUs, the physician should be immediately available 24h a day, but he/she may also be responsible for ordinary hospital beds in the pulmonology ward.¹⁵⁴ Also respiratory physiotherapists should be part of the team, with an optimal professional-to-patient ratio of 1:6 per work shift dedicated in the unit. Ideally, physiotherapists with dedicated training and expertise in critically ill patients should be available every day on a 12h/day shift basis.¹⁵⁴

For staff requirements in intermediate care under the proposal of intensive care levels held by the Italian Society of Anaesthesia, Analgesia, Resuscitation and Intensive Care (SIAART) and the Italian Society of Emergency Medicine (SIMEU), see *Staff: Requirements in terms of numbers and qualification per level* in section 4.3.1.5.

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

General sub-intensive care units should be equipped with centralised monitoring system for all beds, defibrillator(s), infusion pumps, medical gas aspiration and delivery systems, multidisciplinary ultrasound, ventilators, blood gas analyser, electrocardiographs and haemodialysis equipment. The latter can be shared with other units.¹⁰⁰



In PICUs, there should be the following equipment inside the unit: multi-function beds monitors, invasive mechanical ventilation, non-invasive mechanical ventilation, bronchoscopy, arterial blood gas analyser, ultrasound, high-flow oxygen therapy, extracorporeal CO₂ removal. In addition, a ultrafiltration device is preferably available inside the unit.¹⁵⁴

In PICMUs, there should be the following equipment inside the unit: multi-function beds monitors, non-invasive mechanical ventilation, bronchoscopy, arterial blood gas analyser and high-flow oxygen therapy. Invasive mechanical ventilation is only necessary for tracheostomized patients. Ultrasound can be available inside or outside the unit.¹⁵⁴

4.3.3.6 Sweden

CONTEXT

The former Guideline for Swedish intensive care (*Riktlinjer för svensk intensivvård* - 2015) defined intermediate care (*Intermediärvård*) as care that is offered when there is no medical indication for intensive care, but when the patient's medical/nursing needs cannot be met in a general care unit.¹²⁴ However, no proper national definition and recommendation for intermediate care was available. During the COVID-19 pandemic, it became clear that there existed a 'grey zone' between a general unit and a full-scale ICU that provided care for patients with conditions approaching a life-threatening stage. This more resource-intensive care was not reported or followed up in a systematic way as ICU care was. This revealed the need to develop recommendations for the organisation of intermediate care and to identify variables to be used as quality indicators.¹²⁵ A National Working Group on intermediate care worked on those objectives in 2022-2023 and published its guidance in October 2023.

Since then, intermediate care is regulated according to the guidance from the National Working Group on intermediate care (*Vägledning för organisation och kompetens inom intermediärvård*). The new guideline for Swedish intensive care (*Riktlinjer för svensk intensivvård* - 2024) only states that 'depending on local conditions, organ support treatment can also be given outside ICU, for example in intermediate care units' and refers to the National Working Group document for further guidance regarding intermediate care. Since 2025, the Swedish Intensive Care Register (see section 4.3.5.6) is open to IMCUs.¹⁵⁶ Variables for intermediate care include basic administrative information about the patient and the care episode, diagnoses, outcomes, length of the care episode, etc. The selection is based on recommendations of the National Working Group on intermediate care from November 2023. The variables are similar to the basic dataset for intensive care, which facilitates getting started in hospitals where there is already an ICU that registers data.

LEGAL DEFINITION AND ORGANISATION OF INTERMEDIATE CARE

Intermediate care is defined as the level of care for patients with threatened or already developed organ dysfunction where organ support treatment may be needed or is needed.¹⁵⁷ It offers organ-supportive treatment and advanced nursing and rehabilitation, which, due to their complexity, cannot be provided on a general ward. An intermediate care unit is characterised by a high staffing density with the required skills. In such unit, vital signs can be monitored continuously.¹⁵⁷

Intermediate care can be provided in any unit depending on the organisation of each hospital as long as the minimum requirements are met. The intermediate care unit can be a stand-alone ward, or be integrated in another ward for instance in the emergency department.¹⁵⁷ The unit must operate 24/7, all year long.¹⁵⁷ In Sweden, IMCUs are usually separate from ICUs.¹⁵⁸

As patients may deteriorate rapidly, effective cooperation between intensive care and intermediate care units is essential. Therefore, hospitals providing intermediate care should also have an intensive care unit. Effective cooperation with other specialities and wards is also required.¹⁵⁷

TYPES OF PATIENTS AND ADMISSION CRITERIA

An intermediate care unit may be broad in its scope, admitting patients from a range of specialities, or it may be more specialised.¹⁵⁷

No recommendations were made by the National Working Group regarding patient groups or diseases that can be managed in an intermediate care unit. The decision about who should be admitted should be made on a case-by-case basis by the attending physician in consultation with the patient and/or their relatives and other staff.¹⁵⁷

In practice, even patients with multi-organ failure can be treated in IMCUs. However, if the patient requires more than one vasopressor, he should preferably be cared for in the ICU. Intermediate care can provide non-invasive ventilator treatment, treatment with vasopressors, arterial needle use and close monitoring of patients with a reduced level of consciousness. However, to be cared for in a IMCU, patients must have a clear airway and breathe independently, i.e. they must not be intubated or require ventilator support.¹⁵⁸

STAFF: PERSON IN CHARGE OF AN IMCU

The vast majority of IMCUs in Sweden were developed by internal medicine practitioners, but some are also run by other specialists such as intensivists or specialists in infectious diseases.¹⁵⁸ The responsibility of patients in IMCUs is ensured by specialist physicians every day of the week.¹⁵⁷

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION

Medical staff

A specialist physician or experienced resident with adequate expertise in intermediate care should be available in the hospital around the clock.¹⁵⁷ Each hospital must define which specialisms are needed depending on which patients are cared for in the IMCU. Specialist physicians should ensure continuity in the IMCU but work in close collaboration with other specialties including ICU and anaesthesia.¹⁵⁷ Usually, there is a specialist physician in the IMCU for 4 to 6 patients.¹⁵⁸

Nursing staff

Normal staffing in an IMCU consists of one nurse and one assistant nurse taking care of two to three patients, depending on local arrangements.¹⁵⁸

According to the National Working Group recommendations, a nurse with sufficient skills and experience in intermediate care should be available on site 24 hours a day. The number of nurses should be based on the level of care required, number of assistant nurses and other resources available, but also on the need for isolation, the design of the premises, etc. The recommended patient-to-nurse ratio is 2:1 to 3:1.¹⁵⁷ Also, an assistant nurse with sufficient skills and experience should be available on site 24 hours a day. The number of assistant nurses should be based on the level of care required, number of nurses and other resources available, but also on the need for isolation, the design of the premises, etc. The recommended patient ratio for assistant nurses is also 2:1 to 3:1.¹⁵⁷

Allied healthcare staff

It is recommended to have a physiotherapist on duty in the IMCU during day and evening hours, from Monday to Sunday. The physiotherapist should have experience and/or specialisation in respiratory or intensive care, e.g. non-invasive respiratory support, high flow oxygenation and cough machine.¹⁵⁷ The following staff should be available in the hospital (occupational therapist, medical counsellor, speech therapist and dietician), as well as on-call (care/discharge coordinator, pharmacist and medical technician).¹⁵⁷



EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

An IMCU should have equipment for continuous monitoring of ECG/heart rate, blood pressure (non-invasive or invasive), respiratory rate and peripheral oxygen saturation.¹⁵⁷ An additional list of recommended equipment for all IMCUs is provided by the National Working Group (see Table 18). In addition, more organ-specific units may also need to have other equipment such as neurological specific monitoring (e.g. continuous EEG monitoring), cardiac specific treatment (e.g. external pacemaker, pericardial drainage), lung specific equipment (e.g. bronchoscopy), haemodialysis, etc.¹⁵⁷

Table 18 – Swedish National Working Group on intermediate care recommendations for equipment for IMCUs

	Recommended equipment
Airway	Equipment to allow airway assessment and to identify and treat threatened or unobstructed airway using simple tools (e.g. swallow tube, nasal cannula) It should be possible to care for patients with tracheostomy in the IMCU.
Respiration	Intensive respiratory physiotherapy and secretion mobilisation Treatment with non-invasive respiratory support and high-flow oxygenation and possibly a cough assist machine
Circulation	Treatment with a vasopressor, primarily noradrenaline Blood gas analysers in the unit or in close proximity Ultrasound machine in close proximity Possibility to monitor and control fluid balance hourly
Level of consciousness/sedation/pain	Assessment of level of consciousness, e.g. RLS or GCS Assessment of sedation level with sedation scale, e.g. RASS Treatment with sedative drugs, e.g. benzodiazepines and dexmedetomidine to at least RASS -2 or equivalent Screening and treatment of delirium, use of e.g. CAM-ICU or NuDESC Pain management and assessment with pain scale e.g. NRS/VAS
Intra-hospital transport	Transport adapted equipment for monitoring vital signs and ongoing necessary treatment during transport, e.g. vasopressor The IMCU team should be able to carry out an intrahospital transport of a seriously ill patient.
Rehabilitation	Screening and treatment of physical and respiratory function at admission/discharge and once a week in between with Chelsea critical care assessment tool. Mobilisation support equipment.

Source: *Nationellt system för kunskapsstyrning hälso- och sjukvård (2023)*¹⁵⁷ CAM-ICU = confusion assessment method for the intensive care unit; GCS = Glasgow coma scale; IMCU = intermediate care unit; NRS = numeric rating scale; NuDESC = nursing delirium screening scale; RASS = Richmond agitation sedation scale; RLS = reaction level scale; VAS = visual analogue scale.

4.3.3.7 The Netherlands

LEGAL DEFINITION AND ORGANISATION OF INTERMEDIATE CARE

In Dutch hospitals, Intermediate Care (Medium Care, MC) Units are increasingly being set up. There seems to be an increasing need for beds with extra monitoring and staff, where patients can receive extra care, monitoring and treatment that they would not be able to get in a general unit.¹³⁴ This may concern patients who come from the emergency department, nursing unit or operating room (step up)

or from the ICU (step down). An MC is a unit with a level of care between the general unit and the ICU. Units with an intermediate level of care have all kinds of different names and functions, such as Medium Care, Heart Care or Stroke Unit, etc., which makes the concept of MC difficult to understand. For the sake of understanding, the Dutch Quality Standard calls all these departments MC from now on.

There are roughly two types of MC in the Netherlands: the specialised or decentralised MC and the central MC. Specialised MCs are departments with monitoring, where more intensive care is also possible and which fall under the supervision of the existing main practitioners (internist, surgeon, cardiologist, neurologist, thoracic surgeon, pulmonologist and others); central MCs treat patients from several sending specialties, usually deliver highly complex and care-intensive tasks, often under the responsibility of an intensivist, who then usually takes over the lead treatment. The following information focuses exclusively on the central MCs.

- According to the Quality Standard, it is possible that hybrid wards could be set up, with space for, for instance, ICU, PACU and MC patients.¹³⁴

TYPES OF PATIENTS AND ADMISSION CRITERIA

Specific reasons for admission to an MC can be:¹³⁴

- stabilisation of vital functions and prevention of (multi)organ failure; and
- monitoring and, where necessary, support of the circulation with fluids, vasopressors and inotropes; respiratory care and bronchial toilet; monitoring of heart rhythm, for example in case of severe electrolyte disturbances, administration of certain medications or primary cardiac conditions; frequent consciousness checks; very intensive nursing care that cannot be provided in a nursing ward.
- It should be avoided that patients who meet or are likely to meet soon the criteria of an ICU patient are admitted to an MC instead of an ICU.

STAFF: PERSON IN CHARGE OF AN IMCU

Central MCs often deliver care under the responsibility of an intensivist, who then usually takes over the lead treatment.¹³⁴

STAFF: REQUIREMENTS IN TERMS OF NUMBERS AND QUALIFICATION

There is currently a national training programme for MC nurses in the Netherlands. A professional profile for MC nurses is being developed. MC nurses working in a MC unit must meet the professional profile being developed by the V&VN and in the future, they will have to be licensed by the College Hospital Training (CZO). The required formation is influenced by the severity of illness and care needs of the specific patient population in a particular hospital. For this reason, it is not possible to give a precise standard that meets all requirements.¹³⁴

A MC unit must have a physician present 24/7, or the physician must be reachable within five minutes. This physician must have at least training at the level of the Fundamental Critical Care Support (FCCS) training. This physician is always supervised by the main practitioner who can be present at the MC within 60 minutes.¹³⁴

EQUIPMENT, LAYOUT AND DIMENSIONING: REQUIREMENTS

The following facilities must be present at the MC:¹³⁴

- continuous monitoring of blood pressure (invasive and non-invasive), heart rhythm, central venous pressure, central venous saturation, transcutaneous oxygen saturation (SpO₂);



- oxygen therapy, intravenous administration of medication, administration of vasopressors, inotropes and vasodilators;
- suction endotracheally;
- registration of severity of illness and outcome of illness according to the guidelines of the National Intensive Care Evaluation (NICE).

The following facilities can be present at the MC but are not mandatory:¹³⁴

- renal replacement therapy (Continuous Veno-Venous Haemodialysis (CVVH) or dialysis) can be used in patients without other signs of organ failure
- non-invasive ventilation.

Invasive ventilation and CVVH for patients with multi-organ failure should not be performed in an MC.¹³⁴

4.3.4 Reimbursement of intensive care

4.3.4.1 Denmark

REIMBURSEMENT OF INTENSIVE CARE IN GENERAL

Intensive care is an integrated part of the hospital budgets. The regions use the DRG classification for internal payment schemes. The DRG classification is used to calculate the overall global budgets from the state to the regions. The home region pays the DRG rate to the treatment region in case of transfers across regional borders unless there are other special agreements. Accounting principles for internal transfers vary between regions. DRGs are based on average cost assessments across all Danish hospitals and data reported to the national patient registry system.

The reimbursement for intensive care is within the DRG payment. If the hospital length of stay is less than 12 days, the case is classified under the normal DRGs. Otherwise, the following specific DRGs apply:¹⁵⁹

- Intensive group I: Simple failure in one or more organs;
- Intensive group II: Increasingly severe failure in single organ;
- Intensive group III: Increasingly severe failure in multiple organs;
- Intensive group IV: Severe multiorgan failure.

The allocation rules for these specific DRGs are determined by a combination of intensive procedure-related codes, which are subject to specific requirements regarding the ICU length of stay and the duration of mechanical ventilation. The allocation method was developed in 2003 by the Danish Society for Anaesthesiology and Intensive Care Medicine (DASAIM) and the Danish Society for Intensive Care Therapy (DSIT), in collaboration with the Danish National Board of Health. Originally, a prerequisite to be assigned to one of these specific DRGs, was that the patient had been admitted to an ICU for more than 24 hours. This threshold aimed to exclude less resource-intensive acute patients and those undergoing elective surgical recovery, assuming that the main costs for these patients were incurred outside the ICU. Since 2007, at the request of the Danish National Board of Health, this threshold is increased to 72 hours. As the average length of stay in many ICUs was less than three days, the change was expected to significantly decrease the number of cases assigned to the four specific DRGs, which raised oppositions from intensive care societies (DSIT and DASAIM).¹⁶⁰⁻

REIMBURSEMENT OF INTENSIVE CARE ACCORDING TO LEVELS

These four specific DRGs for ICUs are independent of the ICU level. However, as some procedures are reserved for ICUs in highly specialised hospitals (see section 4.3.1.1), the reimbursement differs between levels of ICU.

REIMBURSEMENT OF INTENSIVE CARE – ADDITIONAL INFORMATION

The intensive care registry (DID, see section 4.3.5.1) plays no role in reimbursement as it is a clinical quality database. The general patient registry is used for accounting/management within regions.

Physicians are salaried staff in hospitals.

PLANNED OR ONGOING REFORMS

n/a

4.3.4.2 *England*

REIMBURSEMENT OF INTENSIVE CARE IN GENERAL¹

The reimbursement for intensive care is arranged locally and without DRG payment. This is because there is currently no national tariff for critical care. Payments will typically be activity-related and derived from per episode of care and/or critical care days. This could be based on local reference costs, national reference costs or local information. Due to the variation in critical care unit size, payers/commissioners of smaller units may prefer the API model (Aligned Payment and Incentive: a type of blended payment, comprising fixed and variable elements) to ensure capacity and availability of beds. In this model, the fixed element is based on funding an agreed level of activity while the variable element increases or reduces payment based on the actual activity and quality of care delivered. On the other hand, payers/commissioners of larger units may prefer a per patient payment model to incentivise efficiency or movement of beds to meet other strategies (e.g. major trauma).

In the latest provider payment guidance, adult critical care payment is now included as a fixed element in contracts, meaning that providers and purchasers agree a value (which may be based on activity or bed days x price) but the payment will not vary in-year.¹⁶⁴

Where critical care activity is present in submitted patient data, payments are calculated using number of bed days per spell of care and is 'unbundled', and has its own Healthcare Resource Groups (HRGs) currency. HRGs are based on number of organs supported (with higher payment the more intensity / organs supported). There are currently seven HRGs for adult critical care (from 0 organ supported to 6 organs supported).¹⁶⁵ Allocation to HRGs is made using data on the number and types of organ system supported, collected in the Critical Care Minimum Dataset (CCMDS).¹⁶⁶ This does not necessarily reflect the actual number of organs that are failing.

Providers will receive payment for the maximum number of organs supported per bed day, even if a patient's care changes / diminishes in a spell of care (e.g. the number of bed days will be calculated on a six-organ basis if that is what the patient required when admitted, even if support was only needed for fewer organs in the remaining days of treatment).

For some specialised pathways (e.g. specialist cardiac surgery) where only some hospitals / regions have specialism and capacity to provide the care, the responsible funder is NHS England who pays the provider (in accordance with the national payment scheme guidance). NHS England pays

¹ This relates to intensive care as part of unplanned treatment. Critical care that is part of a planned procedure would follow a different system, e.g. elective surgery that might include one night in critical care, that component would be bundled in the standard package of care / Healthcare Resource Groups treatment.



providers on a 'whole provider' model via one of the seven regional commissioners. For example, the London region funds all specialised activity at providers based in London irrespective of which part of the country the patient is from.

If the activity is not part of a specialised service pathway, then the responsible funder is one of the 42 Integrated Care Boards (ICBs). ICBs fund providers on a 'population' model. For example, the South East London ICB will fund non-specialised adult critical care activity at any provider for their own patient population.

REIMBURSEMENT OF INTENSIVE CARE ACCORDING TO LEVELS

For adult critical care, no differences in reimbursement exist between levels of ICUs.

REIMBURSEMENT OF INTENSIVE CARE – ADDITIONAL INFORMATION

In case of a transfer to another hospital, the reimbursement is not shortened.

The reimbursement for (complex) medical transport is part of the ambulance service contract. There is no separate payment to the hospitals. A new model of care was introduced during the pandemic that set up new 7-day adult critical care transfer services, outlining key indications for when transfers are appropriate, and establishing a dedicated adult critical care transfer team. This prevents any one hospital from losing staff when transferring patients and better coordinating capacity during periods of escalation. The 7-day adult critical care transfer is paid for directly by NHS England.

Regarding whether a critical care register plays a role in reimbursement, the ICNARC Case Mix Programme (CMP) (see section 4.3.5.2) does not play a role in reimbursement, but does support collection of the Critical Care Minimum Dataset (CCMDS) which is used to define HRGs. Indeed, the CCMDS has been fully incorporated into and is consistent with the ICNARC data collection.¹⁶⁶

If a high dependency unit is part of a separate unit, then it is unbundled and paid separately via local policies following the same approach as critical care units. However, it is hard to generalise given local peculiarities in how high dependency units are set up, counted, and their extent of integration on critical care wards.

No differences in reimbursement exist between hospital types.

There is an inclusion of remuneration of physicians in the reimbursement of intensive care.

PLANNED OR ONGOING REFORMS

A few reforms are being introduced that may affect how critical care services are reimbursed. For one, NHS England is shifting more of the payment responsibility of some specialised services, including adult critical care, to Integrated Care Boards during 2023/24. The hope is that this would better account for local learning and innovation, better enable change and local investment decisions, and make best use of local pricing while creating more structure and consistency across providers.

Rather than base currencies on average costs for a set of procedures (when actual costs may vary significantly by case mix), it is expected that under new models of reimbursement more local baseline data could be used to understand differences in costs that occur across similar providers / peer groups. The tariff could then be used to help create a global budget / benchmark price that providers could compare their own costs to. In each region, a lead provider and payer would work with operational delivery networks to determine best way of driving efficiency improvements within their payment envelope.

4.3.4.3 France

REIMBURSEMENT OF INTENSIVE CARE IN GENERAL

Critical care services are financed through several mechanisms:⁶⁷

- An activity-based payment (DRG payment) that varies according to the intensity of care provided (*tarification à l'activité – T2A*);
- Per diem payments (*suppléments journaliers*) that depend on the type of unit, the severity level and the performed medical acts;
- Reimbursement for the use of some expensive medicines;
- A co-payment, paid by the patient or his insurance company;
- Some additional endowments, for instance for teaching activities or other missions.
- Together, the first two categories represent 75% to 85% of total revenues of critical care services, which are therefore largely dependent of the volume of activity.⁶⁷

DRG payment is based on the medical information coded by hospitals (based on the ICD-10). According to diagnosis, medical acts or pre-existing conditions, the stay is coded in a DRG group. Then, each DRG is associated to a specific tariff which can be modulated by the length of stay or the severity of the patient. DRG tariffs are based on mean costs of all hospitals for the considered DRG modulated by 'public health priorities' yearly fixed by the French Ministry of Health. DRG tariffs are distinct for public and private hospitals with public hospitals getting higher reimbursement to compensate for training costs.

Care is reimbursed by DRG payment through activity-based financing: each stay matches with a reimbursement. The reimbursement is linked to the stay and so to the healthcare facility: if the patient is hospitalised for eight days and is transferred from healthcare facility A to another healthcare facility B after five days, there would be two stays and so two reimbursements: i) one stay in healthcare facility A for five days, ii) one stay in healthcare facility B for three days.

The per diem payment is added to the reimbursement of a stay in critical care units if the patient is hosted by these units. In 2025, the per diem payment is € 786.73 in resuscitation units in private hospitals and € 1 021.95 in public hospitals, € 384.43 – € 499.93 in ICUs and € 307.54 – € 399.94 in continuous monitoring units.¹⁶⁷ To be eligible for the per diem for resuscitation unit, the patient should be admitted in a resuscitation unit, should have a high severity index (SAPS-2 >15) and at least one relevant medical act (from a defined list) should be performed. If the last two conditions are not met, only a per diem payment for intensive care can be received, even if the patient is hospitalised in a resuscitation unit.⁶⁸

In the past years, the DRG tariffs have decreased for the most common DRGs in critical care. In addition, the per diem payments have also decreased (by 6.5% between 2013 and 2019).⁶⁷ Recently, however, the per diem payments in critical care have increased (+7.7% between 2022 and 2023) to take into account the additional cost of staff due to post COVID-19 supporting measures.⁷² It has been argued that critical care services are largely in deficit.^{67, 68}

REIMBURSEMENT OF INTENSIVE CARE ACCORDING TO LEVELS

No real difference in reimbursement exists between levels of critical care. As explained above, the per diem payment depends more on the severity level and on the type of medical act provided, than on the type of unit (resuscitation or ICU).

REIMBURSEMENT OF INTENSIVE CARE – ADDITIONAL INFORMATION

The reimbursement of transport is the same for resuscitation units and ICUs and depends on the healthcare facility status.



DRG payment for public hospitals includes physicians' remunerations. This is not the case for private hospitals, here a separate reimbursement is linked to medical acts provided by physicians.¹⁶⁸

PLANNED OR ONGOING REFORMS

The fact that critical care services are largely financed on the basis of their activity has also been criticised.⁶⁷ In particular, the per diem system incentivises hospitals to increase lengths of stay in the resuscitation unit (once a patient is eligible for a per diem payment for resuscitation, he is eligible for each day of his stay in the unit) and to evict from the resuscitation units patients requiring heavy and complex nursing care but whose life is not threatened (because they will likely not require a medical act that is relevant for the per diem payment).

In 2021, the Court of Audit recommended to reform the financing system of critical care to minimise these impacts.⁶⁷ The recommended system should combine activity-based financing with lump sum payments. A reflection on such a reform is ongoing since 2017 and principles of a new financing system applicable from 1 January 2025 have been recently established.¹⁶⁹ In that context, specific activities, including intensive care, will be financed by a mix of activity-based payments and global budgets. The latter should be calculated on the basis of the number of beds, with the amount per bed set on the basis of regulatory ratios for non-medical staff and depreciation of intensive care equipment.¹⁷⁰ It is intended to cover the fixed costs of the ICU. The new financing model for intensive care is aimed to be deployed in 2027.¹⁷¹

4.3.4.4 Germany

REIMBURSEMENT OF INTENSIVE CARE IN GENERAL

The reimbursement of intensive care takes place within the G-DRG system. It includes two procedural codes for the remuneration of intensive care medicine, depending on the complexity. The codes 8-980 and 8-98f are referring to basic and complex intensive care respectively (see Table 19). Two other codes (8-981 and 8-98b) refer to neurological treatment. Special intensive care procedures, such as transfusion of plasma and plasma components, plasmapheresis and immunoabsorption, installation and operation of an ECMO/ECLS, measures in the context of resuscitation, etc., must be coded and are therefore reimbursed separately.

Table 19 – Procedural codes for intensive care in Germany

Procedural code	Description	Structural characteristics (resource-related requirements)	Minimum characteristics (treatment-related requirements)
8-980	Intensive care complex treatment (standard procedure)	- Treatment management by a specialist with the additional title of intensive care medicine - Team of nursing staff and physicians in acute treatment readiness - A permanent medical presence in the intensive care unit must be guaranteed. The physician of the intensive care unit can be called in for a short-term emergency intervention within the hospital (e.g. resuscitation).	Continuous, 24-hour monitoring
8-98f	Extensive intensive care complex treatment (standard procedure)	- Treatment management by a specialist with the additional title of intensive care physician, who performs the majority of his medical duties in the intensive care unit - Team of nursing staff and physicians in acute treatment readiness - A specialist with the additional designation of intensive care physician (the treatment supervisor or another specialist with the additional designation of intensive care physician) must be present in the intensive care unit for at least 7 hours between 6 a.m. and 10 p.m. on weekdays. Outside these attendance hours, a specialist with the additional designation of intensive care physician must be available at the patient within 30 minutes. - A permanent medical presence in the intensive care unit must be guaranteed. The ICU physician may be called in for a short-term emergency procedure within the hospital (e.g. resuscitation). 24-hour availability of the following procedures at the hospital site: - Apparent ventilation - Non-invasive and invasive monitoring - Continuous and intermittent renal replacement procedures - Endoscopy of the gastrointestinal tract and tracheobronchial system - Intracranial pressure measurement or hybrid operating room for cardiovascular procedures - Transoesophageal echocardiography 24-hour availability of 3 of the following 4 procedures at the hospital site: - Radiological diagnostics using CT and MRI - Interventional cardiology with acute PTCA - Interventional (neuro)radiology with acute endovascular therapy of vascular and organ injuries and/or cerebral vascular occlusions	- Continuous, 24-hour monitoring - A specialist with the additional designation of intensive care physician (the treatment supervisor or another specialist with the additional designation of intensive care physician) must make at least one daily ward round



- Laboratory services (e.g. blood gas analyses, determination of electrolytes, lactate, differential blood count, coagulation, retention values, enzymes, inflammatory parameters including procalcitonin, tox screen). Specialised laboratory diagnostics may also be performed in third-party laboratories.

At least 6 of the following 8 specialties are available within 30 minutes or less at the hospital site as clinical consults (hospital-affiliated or from neighbouring hospitals):

- Cardiology, Gastroenterology, Neurology, Anaesthesiology, Visceral Surgery, Trauma Surgery, Vascular Surgery, Neurosurgery.
- Daily availability (also on weekends) of physiotherapy services

Source: Bundesinstitut für Arzneimittel und Medizinprodukte (2022)¹⁷²

REIMBURSEMENT OF INTENSIVE CARE ACCORDING TO LEVELS

Code 8-980 refers to a basic intensive care treatment and can be provided by levels 1 to 3. Code 8-98f should only be offered by ICUs levels 2 and 3.

The DIVI initially recommended to remunerate intensive care with a daily value staggered according to the level of care of the hospital. As this was rejected for political reasons, patients were initially reimbursed on the basis of the duration of ventilation, later supplemented by the OPS code 8-980 and cost indices for complex intensive care treatment. The latter were based on a risk score (SAPS II without Glasgow Coma Scale) and the Therapeutic Intervention Scoring System (Core-TISS 10). The billing was linked to certain structural criteria, mainly related to the medical services offered by the hospital. Only very basic minimum characteristics were formulated as requirements for the ICU. However, it appeared that ICU services could not be adequately covered by this system, especially in cases of extreme costs. For this reason, the OPS code 8-98f was introduced, combined with stricter structural criteria. The aim was to limit the billing of this OPS to the small group of hospitals. However, this attempt did not succeed in better differentiating the system (around 441 hospitals billed this code in 2015).¹⁷³

REIMBURSEMENT OF INTENSIVE CARE – ADDITIONAL INFORMATION

The reimbursement of intermediate care units does not differ from hospital care in general.

For reimbursement of telemedical networks see *(Telemedical) Networks* in section 4.3.1.4.

DIVI's Intensive Care Registry (see section 4.3.5.4) does not play a role for reimbursement of intensive care.

Remuneration of physicians is part of the G-DRG system and not calculated separately.

In case of a transfer to another hospital, a case splitting might be applied.

PLANNED OR ONGOING REFORMS

The reform of the hospital payment system in general is effective since January 2025, although changes will be implemented in stages. In addition to the reduced case-based remuneration according to G-DRG, the remuneration of hospital services is given a second pillar: remuneration for the services provided – i.e. remuneration for the availability of the respective services at all times in the sense of the state's provision of services of general interest. This essential component of the remuneration reform aims at reducing the economic pressure on hospitals, as they no longer receive their remuneration exclusively from treated cases, which currently creates an incentive to treat inpatients unnecessarily. In contrast, the DRG component, which continues to exist, ensures that hospitals do not lose their willingness to perform, as would be the case with purely budget-based remuneration systems.¹⁷⁴

Regarding intensive care, hospitals will be allocated a global budget associated with the care delivery groups LG 64, only if this group has been assigned to them in the planning process. This assignment, that will be finalised by the federal states at the end of 2026, takes into account the minimum requirements described in Table 13. For instance, in the state of North Rhine-Westphalia, it is estimated that 305 hospitals will be assigned this care delivery group, among which 56 will be level 1 (minimum), 53 will be level 2 (complex) and 186 will be level 3 (highly complex).¹⁷⁵



4.3.4.5 Italy

REIMBURSEMENT OF INTENSIVE CARE IN GENERAL

The funding mechanism for intensive care in Italy varies and depends on the choices made by each region, fluctuating between the so-called 'function-based funding' (*finanziamento per funzione*) and the DRG-based payment system. In Italy, not all hospital activities are adequately compensated through predetermined fees. That is why the Italian NHS, alongside the DRG system, has a specific remuneration mechanism that reserves resources for 'care functions' (*finanziamento per funzioni assistenziali*) primarily carried out within hospital and outpatient care. These are healthcare activities that are not remunerated via tariffs but rather funded according to the standard cost of the care programme. Activity of providing transplants, blood transfusions, ICUs absorbing high level of technological and organisational resources, is typically financed a-priori depending only on the activity provided. Thus, there are no specific DRGs and/or specific adjustments to 'normal' DRGs.¹⁷⁶

Unified by the same financing method, these non-tariffed functions encompass a wide range of services, mainly hospital-based, including activities related to emergencies, emergency departments, organ transplantation, intensive care, transfusion services, research, and university teaching. These non-tariffed functions are established by Legislative Decree 502/1992, which defines them as care functions (Article 8-sexis). The legislation stipulates that the service providers of hospital and outpatient care should be remunerated based on a global amount determined according to the care functions and activities performed, distinguishing between two financing mechanisms: *function-based financing*, based on standard costs, and *predefined tariffs for hospital admissions* (both inpatient and day hospital) and specialist outpatient care services.¹⁷⁷

The choice of which activities to remunerate based on functions is determined by the regions, within the scope of: a) programmes with strong integration between hospital and community care; b) highly personalised care programmes; c) activities related to prevention programmes; d) programmes for serious illnesses; e) activities with significant waiting costs (such as the health alarm system and emergency transport); f) experimental care programmes; g) organ, bone marrow, and tissue transplantation programmes.

The recourse to function-based financing is rooted in the inadequacy of the tariff system based on DRGs to adequately account for the characteristics of hospital activities that involve costs that are not always or easily attributable to the average consumption of resources. This is the case for services with unpredictable timing, such as emergency departments, or those with a high degree of technical complexity (as well as organisational, managerial, etc.). In this sense, function-based financing can provide compensation for the limitations inherent in a prospective remuneration system.

In general, the activities most frequently financed based on functions by the regions include research, university teaching, organ transplantation-related activities, specialised care, emergencies, emergency departments, neuropsychiatry, intensive care, and transfusion services.

Non-tariffed functions fall within the realm of healthcare policies that allow regional autonomy in deciding which hospital and outpatient care activities to finance through a system that replaces or supplements tariffs, how many resources to allocate through this system, whom to allocate them to, and based on what criteria to regulate their application. In the Lazio region, for instance, the budget for intensive care is allocated to individual providers on the basis of the number of days of occupation of the accredited beds.¹⁷⁸

REIMBURSEMENT OF INTENSIVE CARE ACCORDING TO LEVELS

There are no differences in reimbursement between levels of ICUs because there are no official levels.

REIMBURSEMENT OF INTENSIVE CARE – ADDITIONAL INFORMATION

In case of a transfer to another hospital, the reimbursement is shortened. As for transfers, the invoice of reimbursement is sent only by the discharging hospital, i.e. the hospital to which the patient is transferred.

Data that are used for reimbursement are data from the Hospital Informative System. Hospitals feed data into the national hospitalisation database, which is based on hospital discharge sheets (*Schede Dimissione Ospedaliera*, SDO). In these, diseases are classified according to the codes of the International Classification of Diseases.³¹

An increase in reimbursement has been introduced in 2020-2021 in light of COVID-19, for hospitals whose ICU hosted COVID-19 patients. Article 2 of the decree of 12 August 2021, titled 'Remuneration of an assistance function and a tariff increase for activities provided to COVID-19 patients' defines a maximum tariff amount for COVID-19-related hospital admissions that pass through the ICU, set at € 9 697. It was left to the regions to articulate this tariff increase among the providers of hospital healthcare services.¹⁷⁹ The increased reimbursement ended on 31 March 2022.

The reimbursement of telemedical networks is only defined for remote visits in the follow-up phase post discharge. Each region adopts its own approach, also on tariffs. For Lazio Region, which includes the territory of Rome, there is a document that sets out the guidelines and the development of specialised and territorial telemedicine services. For the health emergency COVID-19, the procedures for creating some specific telemedicine services are described in detail.¹⁸⁰

PLANNED OR ONGOING REFORMS

There is no planned or ongoing comprehensive reform since the COVID-19 pandemic.

4.3.4.6 Sweden

REIMBURSEMENT OF INTENSIVE CARE IN GENERAL

In Sweden, inpatient care is primarily paid through global budgets, with eight regions using exclusively global budgets and 13 regions supplementing it with other methods. DRG-based payments have decreased overall but were reintroduced in part in Region Stockholm in 2021.¹⁸¹

Intensive care is mainly reimbursed by budget. There are different reimbursement calculations.

An example of the different reimbursement calculations is through the burden of care classification VTS2014 (*Vårdtyngdsmätning VTS 2014*). It shows how much work is done every day in intensive care units in Sweden. It also provides a basis for assessing care effort in relation to care results and for assessing staffing needs. The indicators are based on the types of treatment given in the unit for the patient and are assessed three times a day (every 8-hour shift). Examples are ventilator requirement, number of infusions for pharmaceutical drugs, renal replacement therapy, or need for taking care of relatives. VTS2014 consists of eleven indicators and each indicator can generate 0-3 points, depending on the intensity of the activity. Another important factor measured by VTS is the time spent by how many persons to provide intensive care to the patient.¹⁸²

Another example is through cost per patient (*Kostnad per patient, KPP*). KPP means that costs are calculated for each individual care contact. The introduction of patient-related cost accounting in the healthcare system is supported by Swedish Municipalities and Regions (*Sveriges Kommuner och Regioner, SKR*). The cost for intensive care is calculated based on the time the patient spent in ICU and on the VTS score. The total cost includes all ICU costs in terms of management, premises, administration, medical staff, drugs and materials. During the time the patient is being cared for in the ICU, no costs of the initial ward are associated with the patient.¹⁸³ Overall, KPP is aimed to serve as basis to calculate weights in DRG or ACG classification.¹⁸³



REIMBURSEMENT OF INTENSIVE CARE ACCORDING TO LEVELS

n/a

REIMBURSEMENT OF INTENSIVE CARE – ADDITIONAL INFORMATION

KPP is mainly used for patients treated from another region in Sweden.¹⁸⁴ In case of a transfer to another hospital, the hospital in the region where the patient belongs takes the cost.

PLANNED OR ONGOING REFORMS

n/a

4.3.4.7 The Netherlands

REIMBURSEMENT OF INTENSIVE CARE IN GENERAL

For the reimbursement of hospital care, the Netherlands has an adapted DRG-system (DTC). As intensive care is considered as disproportionately raising the cost of care, they are billed as add-ons to the DRG-payment.³⁹ The main category of supplementary products consists of 'other care products' that can be claimed separately or in addition to a DTC care product. In case of intensive care, the following care types are distinguished for the add-ons:

- Care type 51: care pathways for admission to the ICU and for ICU peer consultation outside the ICU with associated treatment by a gate specialist. The add-on is linked to the DTC care process of this gate specialist.
- Care type 52: care processes for admission to the ICU without associated treatment by a gate specialist.¹⁸⁵

The payment differs between two types of intensive care which refer to the roles and responsibilities of IC-locations in a regional network (see Table 20). In accordance to the Dutch Healthcare Authority, this distinction is based on the information in the Quality Standard from 2016. 'Type 1' refers to the smaller locations that collaborate with the larger IC-locations while 'type 2' refers to those larger IC-locations.

Table 20 – Maximum rate per intensive care day

Procedure	Code	Maximum rate (in €)
<i>Intensive care day, type 1</i>	190157	3 557.36
<i>Intensive care day, type 2</i>	190158	3 586.44

Source: Nederlandse Zorgautoriteit¹⁸⁶; Note: A provider may charge an additional maximum 10% on the maximum rate if this has been agreed in writing with the health insurer.

University medical centres which are treating the most complex patients receive special allowances for the adoption of new technologies.³⁹

REIMBURSEMENT OF INTENSIVE CARE ACCORDING TO LEVELS

There are no levels in the Netherlands.

REIMBURSEMENT OF INTENSIVE CARE – ADDITIONAL INFORMATION

For the reimbursement of Intermediate (Medium) Care Units, no add-ons apply. The reimbursement of telemedical networks is not formalised.

The reimbursement for (complex) medical transport occurs via centres that provide services for complex transport (called Mobile Intensive Care Unit – MICU) in the Netherlands. These centres get

reimbursed by the hospital using the service for this. See Table 21 for the maximum rates for the guidance of a MICU transport.

Table 21 – MICU transport: maximum rate

Procedure	Code	Maximum rate (in €)
Guidance MICU transport < 2 hours	190133	3 065.27
Guidance MICU transport ≥ 2 hours	190132	2 280.67

Source: Nederlandse Zorgautoriteit¹⁸⁶; Note: A provider may charge an additional maximum 10% on the maximum rate if this has been agreed in writing with the health insurer..

PLANNED OR ONGOING REFORMS

There are no planned or ongoing reforms of intensive care's reimbursement.

4.3.5 Measuring, reporting and improving quality of intensive care

4.3.5.1 Denmark

A national requirement for the provision of intensive care accreditation was mandatory in the past. However, it is no longer mandatory but there is an obligation for internal and external quality management in so far that reporting takes place to the Danish Intensive Care Database (DID). The DID was established in 2007 by a working group of the Danish Society for Anaesthesiology and Intensive Care, the Danish Society for Intensive Care, and the Department of Clinical Epidemiology, Aarhus University Hospital. To reduce administrative workload for the clinical departments, the database was established using data already routinely reported by the ICUs to the Danish National Registry of Patients (DNRP). The DNRP contains data on all non-psychiatric hospital admissions in Denmark since 1977 and on outpatient clinic and emergency room visits since 1995. It is mandatory for all Danish hospitals to report to the DNRP. The DNRP is used for productivity monitoring and financial reimbursement of hospitals, including intensive care since 2004. The DID contains information on the date and time of each ICU admission, the admission type, organ support, date and time of discharge, status at discharge, and mortality up to 90 days after ICU admission, among others. Further included variables are age, sex, Charlson comorbidity index, and the Simplified Acute Physiology Score (SAPS) 3. The variables are recorded with a completeness of 96-98%, except for SAPS 3, of which the completeness is between 67.2%.¹⁸⁷ The DID currently includes 11 quality indicators (see Table 22). Process indicators include out-of-hour discharge, transfer to other ICUs for capacity reasons and ICU readmission within 48 hours. Outcome indicators include standardised 30-day mortality (adjusted for SAPS 3) and cardiac arrest within 48 hours of discharge from the ICU.¹⁸⁸ The data are updated on a daily basis in the regional management information systems, an aggregated public report is published annually.^{189, 190} Outcomes are not linked directly to organisation and reimbursement but can have consequences for management/organisation.

Table 22 – Quality indicators in the Danish Intensive Care Database, 2023

	Indicator	Type
1a	Proportion of readmissions to the ICU within 48 hours of discharge for patients admitted > 24 hours	Process
1b	Proportion of readmissions to the ICU within 48 hours of discharge to the general unit for patients admitted ≤ 24 hours	Process
2	Proportion of patients discharged between 10 pm and 8 am among patients admitted > 24 hours	Process
3	Proportion of patients transferred to another ICU due to capacity issues	Process

4	Proportion of patients who die within 30 days of admission to the ICU (only calculated for cases where the value of the SAPS 3 score is relevant (patients > 15 years))	Outcome
5	Cardiac arrest within 48 hours of discharge from the ICU	Outcome
6	Proportion of children in intensive care.	Process
7	Proportion of children (< 18 years old) receiving ventilator treatment out of all children admitted to ICUs	Outcome
9	Proportion of cases where the patient is hospitalised with poisoning	Outcome
S62	Standardised mortality ratio (SMR) – patients who die within 30 days of admission to the ICU (only patients with SAPS 3 score)	Outcome
S61	Proportion of patients who die within 30 days of admission to the ICU	Outcome

Source: RKKP (2024).¹⁸⁷

4.3.5.2 England

There is an intensive care registry in the UK, including England. The ICNARC Case Mix Programme (CMP) is the national clinical audit for critical care units in England. The CMP is an audit of patient outcomes from adult, general critical care units (intensive care and combined intensive care/high dependency units) covering England, Wales and Northern Ireland. The CMP is included in the NHS England Quality Accounts List, overseen by the Health Quality Improvement Partnership (HQIP). It is a national clinical audit that trusts are encouraged to participate in. Currently 100% of adult general ICUs participate in the CMP.¹⁹¹ The CMP is open to both NHS (publicly funded) and independent ICUs. ICUs collect data on all patients they admit to their unit. They submit these data securely and the CMP team performs validation checks. Cumulative quarterly unit quality reports are produced showing how the unit compares to other units. An annual CMP quality report is also published and is publicly available. The report compares risk-adjusted mortality and key quality indicators at different levels, this for ICUs, hospitals and trusts.¹⁹²

A Dataset Flow Diagram for the CMP Dataset is available to download from the CMP Resources page and shows what data are collected for the CMP.¹⁹³ The CMP contains information on the length of stay in hospital and in ICU, the source of admission, organ support, mortality at discharge from unit and from ICU, acute hospital mortality, among others. Further included variables are age, sex, deprivation index, body-mass index and Acute Physiology and Chronic Health Evaluation (APACHE) II score. Data completeness varies between variables, from 96% to 100%.¹⁹¹

The quality indicators used as outcome measures in the CMP are:¹⁹¹

- high-risk admissions from the ward
- high-risk sepsis admissions from the ward
- unit-acquired infections in blood
- out-of-hours discharges to the ward (not delayed)
- bed days of care post 8-hour delay
- bed days of care post 24-hour delay
- discharges direct to home
- non-clinical transfers to another unit
- unplanned readmissions within 48 hours
- risk-adjusted acute hospital mortality – observed

- risk-adjusted acute hospital mortality – predicted (using an updated version of the ICNARC risk adjustment model¹⁹⁴).

The CMP data are thoroughly validated through a series of over 600 validation checks, checking for missing, unusual and invalid data, before any analysis is run.

The quality indicators are designed as tangible measures that a unit could look to investigate and address if a point of difference is identified. Many are based on recognised critical care standards (e.g. delayed discharges) and articles (e.g. out-of-hour discharges/ non-clinical transfers).

The outcomes are linked to organisation and reimbursement. The NHS has a scheme for encouraging quality improvement through reimbursement called CQUINS (Commissioning for Quality and Innovation). In 2022-23 there is one CQUIN indicator related to critical care: 'CCG3: Recording of NEWS2 score, escalation time and response for unplanned critical care admissions.' There is no reimbursement based on the ICNARC CMP.¹⁹⁵

4.3.5.3 France

Every four years, each healthcare facility is audited by the French National Authority for Health on quality of care. This control results in a global note and some satisfaction or process indicators.¹⁹⁶

The audit by the French National Authority of Health collects mostly process indicators and some sporadic outcomes indicators as complication rates on specific activities (hip and knee surgery in 2022 for example). The French National Authority of Health anticipates doing more general outcomes measurement as readmission rates of outpatient surgery and complication rates after surgery. However, the scope of outcomes indicators remains on surgery only.¹⁹⁷

Two criteria are specifically evaluated for intensive care:¹⁹⁸

- Teams in are improving their practices, based in particular on the way their patients are cared for: indicators for monitoring care methods are defined by the team and their results are used collectively; the team keeps a register of refusals of admission to the ICU; readmissions at 48/72 hours are monitored; the team implements actions to improve patient care.
- Organ, tissue and haematopoietic stem cell retrieval and transplantation activities are evaluated, resulting in action plans for improvement, the effects of which are measured.

A national registry of the healthcare supply is in progress in France (*Répertoire national de l'Offre et des Ressources en santé et accompagnement medico-social*, ROR). For now, regional registries coexist with the national registry, but full integration is foreseen in 2026. Currently, registered data concern 92% of the hospitals.¹⁹⁹

Implemented in 2007, the registry has gradually evolved to a reference system listing the entire healthcare supply (healthcare institutions and healthcare professionals working in the outpatient sector). It is also the national reference for bed capacity (beds installed, closed and available) in healthcare facilities, with dynamic data. Capacity and availability data are either registered by healthcare facilities or fed automatically by bed management tools. For critical care, an update is expected at least daily outside crisis periods and twice a day in times of tension.²⁰⁰

During the pandemic, the national SI-VIC online health emergency registry was used to collect data on intensive care capacity and patients. The database's aim is to count victims and gather real-time data about capacity (beds) during large-scale health emergencies like natural disasters, terrorist attacks or other exceptional healthcare situations, like the COVID-19 pandemic. The registry includes real-time data on all hospital stays of patients with COVID-19 in acute units or ICU, including data on transfers and hospital outcomes.²⁰¹



4.3.5.4 Germany

Germany has some certifications for ICUs (e.g. ECMO, weaning, etc.), provided by medical societies.

In 2017, so called quality contracts following the idea of Pay-for-Performance have been introduced. Since then, two quality contracts relevant for intensive care were established: (1) for weaning of patients with long-term mechanical ventilation and (2) prophylaxis of post-surgical delirium for the elderly.²⁰²

In 2010, DIVI established quality indicators (QIs) to promote adherence to evidence-based principles. The fourth edition, published in 2022, identified ten indicators including key elements of intensive care medicine: (1) daily multi-professional and interdisciplinary clinical ward rounds with documentation of daily goals, (2) management of sedation, analgesia and delirium, (3) patient-adapted ventilation, (4) early weaning from invasive ventilation, (5) monitoring of infection prevention measures, (6) infection management measures, (7) early enteral nutrition, (8) documentation of structured patient and family communications, (9) early mobilisation, and (10) ICU leadership.²⁰³ The concept, however, is voluntary and studies reported poor implementation of QI-based key performance parameters.^{204, 205}

Since April 2020, the DIVI Intensive Care Register has been recording the free and occupied treatment capacities (operable beds, ECMO) in intensive care medicine of about 1 300 acute hospitals in Germany on a daily basis. In the context of the COVID-19 pandemic, current case numbers of COVID-19 patients treated in intensive care are also recorded. During the pandemic and beyond, the registry starting as a voluntary tool makes it possible to identify bottlenecks in intensive medical care in a regional and temporal comparison. In this way, the DIVI Intensive Care Register aims at creating a valuable basis for reaction and data-based action control in real time.⁸⁶

The intensive care registry uses other definitions of intensive care than the one provided in section 4.3.1.4. Low-care treatment refers to an intensive care treatment with a simple level of care and high-care treatment refers to intensive care treatment with a higher level of care. In low-care treatment units, basic monitoring (heart frequency respiratory rate, oxygen saturation) with high-flow oxygen therapy and non-invasive ventilation and/or tracheotomy patients during weaning are possible. Invasive ventilation in the context of acute care is not possible in low-care ICUs. In high-care treatment units, basic monitoring (as above), differentiated catecholamine therapy, controlled invasive ventilation using intensive care ventilators (via endotracheal tube or tracheal cannula) as part of the acute care of respiratory insufficiency must be available 24/7. Furthermore, extended monitoring, e.g. echocardiography or thermodilution procedures, as well as positioning therapy including prone positioning, options for further organ replacement therapy (e.g. renal replacement procedures) must be available.

4.3.5.5 Italy

In Italy, the institutions of authorisation and accreditation of healthcare facilities have their origin in Legislative Decree 502/92. In fact, this decree prescribed the emission of an act of direction and coordination by the central government 'on the minimum structural, technological and organisational requirements for the provision of healthcare activities by public and private facilities'. This act (Presidential Decree of 14 January 1997) defines the minimum requirements that public and private healthcare facilities must possess in order to carry out specific activities (authorisation), including intensive care activities. The same Presidential Decree devolves to the regions the determination of quality standards that constitute the requirements for accreditation of public and private facilities, while respecting the general criteria for authorisation. Within each region, common requirements are set for all facilities in the local area, which vary according to the different types of services provided. Requirements for accreditation related to the same type of healthcare service also may vary from region to region, depending on organisational needs and the level of quality that each region intends to guarantee.^{119, 177, 206}

In Italy, according to the Ministerial Decree 70/2015, each accredited hospital has to undergo a quality management scheme based on the clinical governance methods (i.e. critical pathways, performance evaluation and, eventually, audit and feedback). Such a system involves also ICUs, as there is no specific obligation for internal and external quality management on intensive care. Since neither the national monitoring system (National Outcomes Program, PNE) nor regional monitoring systems (e.g. *Programma Regionale di Valutazione degli Esiti degli interventi sanitari* (PReVALE) in the Lazio region) have implemented specific quality indicators for intensive care units, the PNE/PReVALE monitoring systems analyse the overall performance of time-dependent pathways (stroke, acute myocardial infarction, trauma) in which ICUs play a central role.

Although there are no specific requirements for monitoring intensive care, the non-profit association GiViTI (*Gruppo Italiano per la Valutazione degli Interventi in Terapia Intensiva*, Italian Group for the Evaluation of Interventions in Intensive Care) collects data from Italian ICUs (approximately 562 units are registered) and develops quality indicators. For example, the Tuscany region has used these indicators in the past to create a report evaluating the quality of care in Tuscan ICUs.

The association GiViTI has implemented the so-called 'National Surveillance System for Infections in Intensive Care (SITIN)' since 2009. It aggregates data from three different independent and collaborative networks (Italian Group for the Evaluation of Interventions in Intensive Care, GiViTI; Prospective Surveillance of Nosocomial Infections in the ICU, SPIN-UTI; Surveillance of Infections in the ICU in Emilia-Romagna, SITIER, which globally cover 142 ICUs) aimed at improving the quality of care in ICUs in a multi-centre setting.²⁰⁷⁻²⁰⁹

Outcome measures are available. Data of the GiViTI are not publicly reported. The PNE protocols include risk management analysis.

In Italy, an intensive care registry exists, called Margherita-PROSAFE, managed by GiViTI. The *Istituto di ricerche farmacologiche 'Mario Negri'* supports the GiViTI and its research projects. The Margherita-PROSAFE project is a volunteer, peer network. It was instituted for research purposes and it is not compulsory and not validated at national level. It was launched in 2002 and has three main objectives: standardisation of data collection on admitted patients, analysis and evaluation of clinical outcomes and resource use in several ICUs, evaluation and monitoring of the performance of each unit.²¹⁰ It was designed as an observational project for the continuous electronic collection of data on patients admitted to ICUs.²¹¹ In 2023, 159 ICUs participated in Margherita-PROSAFE, corresponding to 63 852 patients.²¹²

The purpose of the project is twofold. On the one hand, it allows for the systematic collection of data from patients admitted to the ICU and provides for the continuous assessment of performance in these wards through comparison with the others. On the other hand, the project makes it possible to integrate the basic information (Core) with specific data collections for research projects centred on different topics. Data collected within the Core of the Margherita-PROSAFE software concerns demographic data and clinical characteristics of the patients upon admission and in the first 24 hours, the main complications that have arisen, the therapy and the procedures performed during the stay in the ICU, and the outcome at discharge, including from hospital. It also collects the logistic, structural and organisational characteristics of the ICUs and the hospital.²¹³

4.3.5.6 Sweden

Data for intensive care treatments from 2008 onwards can be obtained from the Swedish Intensive Care Register. The purpose of the Swedish Intensive Care Registry is to assist the responsible authority in the operation, development and follow-up of a national quality register for intensive care in Sweden. All ICUs in Sweden are members and report data (eight quality indicators and a lot of variables of demographic, epidemiological and medical data). The Swedish Intensive Care Registry is not a real-time registry, but data are received as departments have the ability to report. The Swedish Intensive Care Registry started in 2001 and has an open portal. The registry also provides researchers with data. A recent objective is that the registry allows an audit for the ICUs.



In the Swedish Intensive Care Registry, Sweden has registration for neuro-intensive care, general ICUs and paediatric ICUs.

The registry shows the 25 most common diagnoses in Swedish ICUs. Among the most common are cardiac arrest, mental disorder alcohol drugs, and other bacterial diseases.²¹⁴

Outcome measures are available. In the registry local data are available for the ICU. The data can also be mixed at will to compare them. There are many variables and eight quality indicators:

- Q1 Guideline for Swedish intensive care;
- Q2 Risk-adjusted mortality;
- Q3 Isolation of ICU patients with multi-resistant bacteria;
- Q4 Transfer to another ICU due to lack of resources;
- Q5 Unscheduled readmission on the same ICU within 72 hours;
- Q6 Identification of potential donors;
- Q7 Life support treatment and treatment strategy;
- Q8 Sedation scale and sedation objectives.

The quality indicator 'Guidelines for Swedish Intensive Care' indicates how the department follows basic parts of the 'Guidelines for Swedish Intensive Care', published by the Swedish Association for Anaesthesia and Intensive Care and the Swedish Society of Intensive Care Medicine (SFAI/SIS).

Outcomes are not linked to organisation and reimbursement. The measurements are based on Simplified Acute Physiology Score (SAPS) 3 and Standardised Mortality Ratio (SMR) and are part of Q2 above.²¹⁵

4.3.5.7 The Netherlands

In the Netherlands, besides adhering to the Quality Standard from 2016, there are no national formal requirements for the provision of intensive care. There is, however, an obligation for internal and external quality management. To assure intensive care quality, each ICU has an annual quality report and is inspected by the NVIC at least once every five years.¹³¹

All Dutch ICUs provide patient data to the NICE (National Intensive Care Evaluation) registry with the aim of measuring and, if necessary, improving the quality of care provided in accordance to the Plan-Do-Check-Act quality cycle. The NICE registry was established in 1996. Since 2016, all Dutch ICUs have participating in this quality registration. Annually, about 75 000 new ICU admissions are added.²¹⁶

The following is, among other things, registered:

- MDS (Minimum Data Set) registration: The MDS is the core registry of the NICE foundation and contains variables that define demographics, admission and discharge data, physiology, reasons for admission and severity of illness in the first 24 hours of ICU admission as well as outcome measures like hospital mortality, duration of treatment as well as ventilation and readmissions.
- Besides the minimal dataset, an ICU can additionally choose to participate in other optional data modules. One of these optional modules is the capacity registry module, available since 2017, in which data about workload are processed. It aims to provide insight into the nursing workload so that nurses can be deployed more efficiently.

The capacity module contains specific nursing information and was therefore developed in cooperation with the Dutch Society of ICU nurses, the V&VN-IC. This dataset contains among others, Nursing Activity Scores (NAS) data. All separate interventions of the NAS, with the corresponding score, are collected and from these the total NAS score per patient is calculated. The capacity module also

contains the number of ICU nurses per shift and per unit, classified as student or graduated ICU nurse. The NAS data are collected by ICU nurses at the end of each shift. The NICE registry provides both an online monitoring and analyses tool as well as annual benchmark reports with data of individual hospitals compared to the other participating hospitals.^{217, 218}

The KIIC (*Kwaliteitsindicatoren*, quality indicators) registration (version 2017) contains the quality indicators as defined by the Dutch Association of Intensivists and covers a total of ten indicators: four structural indicators (presence of intensivist, nurse-patient ratio, policy to prevent medication errors, patient and family satisfaction), five process indicators (intensive care treatment duration, ventilation duration, days with 100% occupancy, glucose control, re-intubations) and one outcome indicator (mortality). NICE participants can optionally keep track of the KIIC for their patients in addition to the MDS registration.

The Complication Registry (version 2017) contains the eight complications established by the Dutch Intensive Care Association and aims to provide insight into the incidence of complications in Dutch ICUs. Currently, all ICUs have to actively monitor at least two complications of their own choice and improve on these complications with a quality improvement method (i.e. PDCA). NICE participants can optionally keep the Complication Registry for their patients in addition to the MDS and the KIIC.



5 APPENDICES TO CHAPTER 10

5.1 Search strategies

Table 23 – Search strategy in Ovid Medline

Nr	Search term(s)	Hits 18/09/2023	Hits 16/01/2025	Nr	Search term(s)	Hits 18/09/2023	Hits 16/01/2025
1	((medium or intermediate or high) adj3 care adj3 (unit? or ward?)).ab,ti,kf.	1 975	2 164	34	meta-analysis.pt.	187 505	221204
2	(high adj3 (dependency or acuity) adj3 (unit? or ward?)).ab,ti,kf.	1 087	1 178	35	exp Technology Assessment, Biomedical/	12 205	12601
3	((Step-up or step-down or stepdown) adj3 (unit? or ward?)).ab,ti,kf.	510	548	36	health technology assessment.ti,kf.	2 841	3246
4	((Transitional or special or progressive) adj3 care adj3 (unit? or ward?)).ab,ti,kf.	1 814	1 897	37	HtA.ti,kf.	866	1001
5	((subintensive or sub-intensive or subacute or sub-acute or semi-intensive) adj3 care adj3 (unit? or ward?)).ab,ti,kf.	188	204	38	32 or 33 or 34 or 35 or 36 or 37	406 835	471058
6	1 or 2 or 3 or 4 or 5	5 163	5 557	39	31 and 38	46	15
7	exp Mortality/	424 418	436 423	40	randomized controlled trial.pt.	601 152	629861
8	exp Survival Analysis/	334 387	343 019	41	controlled clinical trial.pt.	95 420	95676
9	7 or 8	705 903	725 357	42	randomized.ti,ab.	673 785	737191
10	mortality.ab,ti,kf.	1 000 022	1 095 649	43	placebo.ti,ab.	248 582	262200
11	((death or fatality or survival) adj2 rate?).ab,ti,kf.	243 228	264 371	44	clinical trials as topic/	201 355	204175
12	mean survival time.ab,ti,kf.	5 106	5 460	45	randomly.ti,ab.	418 937	145872
13	years of potential life lost.ab,ti,kf.	604	633	46	trial?.ti.	388 649	430500
14	survival.ab,ti,kf.	1 195 338	1 293 915	47	40 or 41 or 42 or 43 or 44 or 45 or 46	1 596 225	1703066

15	10 or 11 or 12 or 13 or 14	2 050 351	2 230 087	48	exp animal/ not humans/	5 160 847	5297070
16	9 or 15	2 287 213	2 469 897	49	47 not 48	1 471 058	1571855
17	"Length of Stay"/	103 011	108 545	50	31 and 49	81	29
18	"length of stay".ab,ti,kf.	80 625	89 550	51	Epidemiologic studies/	9 407	9645
19	hospital stay.ab,ti,kf.	100 148	109 577	52	exp case control studies/	1 448 149	1568446
20	stay length?.ab,ti,kf.	927	1 124	53	exp cohort studies/	2 526 251	2695787
21	18 or 19 or 20	170 923	188 201	54	Case control.tw.	156 398	168389
22	17 or 21	215 131	233 243	55	(cohort adj (study or studies)).tw.	326 158	379964
23	patient readmission/	22 992	24 893	56	Cohort analy\$.tw.	12 171	14189
24	readmission?.ab,ti,kf.	42 206	48 034	57	(Follow up adj (study or studies)).tw.	56 820	59597
25	23 or 24	49 179	55 210	58	(observational adj (study or studies)).tw.	166 083	192409
26	exp "Costs and Cost Analysis"/	266 553	275 693	59	Longitudinal.tw.	328 908	364576
27	cost?.ab,ti,kf.	733 131	809 382	60	Retrospective.tw.	763 408	868636
28	26 or 27	846 933	925 886	61	Cross sectional.tw.	526 884	603570
29	9 or 16 or 22 or 25 or 28	3 178 139	3 442 741	62	Cross-sectional studies/	479 364	528519
30	6 and 29	2 191	2 367	63	51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62	3 851 285	4174216
31	limit 30 to dt=20130101-20230918 [January 1st, 2013 to September 18, 2023]	1 246	473	64	31 and 63	810	306
32	((systematic review or systematic literature review or systematic scoping review or systematic narrative review or systematic qualitative review or systematic evidence review or systematic quantitative review or systematic meta-review or systematic critical review or systematic mixed studies review or systematic mapping review or systematic cochrane review or "systematic search and review" or systematic integrative review).ti. not comment.pt. not (protocol or protocols).ti. not	283 172	339 565	65	64 not (39 or 50)	770	294



	medline.st.) or (Cochrane Database Syst Rev.ja. and review.pt.) or systematic review.pt.						
33	meta-analys*.ti.	186 070	221 007				
					Limit 65 to dt=20230918-20250116		105

Table 24 – Search strategy in Embase

Nr	Search term(s)	Hits 18/09/2023	Hits 16/01/2025	Nr	Search term(s)	Hits 18/09/2023	Hits 16/01/2025
1	'intermediate care unit'/exp	557	717	29	#27 OR #28	115 393	131 330
2	'high dependency unit'/exp	939	1 117	30	'cost'/exp	411 219	434 548
3	#1 OR #2	1 492	1 829	31	cost\$:ab,ti,kw	976 758	1 069 515
4	((medium OR intermediate OR high) NEAR/3 care NEAR/3 (unit\$ OR ward\$)):ab,ti,kw	3 690	4 057	32	#30 OR #31	1 177 892	1 279 160
5	(high NEAR/3 (dependency OR acuity) NEAR/3 (unit\$ OR ward\$)):ab,ti,kw	2 092	2 250	33	#13 OR #20 OR #26 OR #29 OR #32	4 666 897	5 083 704
6	((('step up' OR 'step down' OR stepdown) NEAR/3 (unit\$ OR ward\$)):ab,ti,kw	1 096	1 185	34	#10 AND #33	4 525	4810
7	((transitional OR special OR progressive) NEAR/3 care NEAR/3 (unit\$ OR ward\$)):ab,ti,kw	2 602	2 750	35	#34 AND [2013-2023]/py	3 022	
					#34 AND [2023-2025]/py		626
8	((subintensive OR 'sub intensive' OR subacute OR 'sub acute' OR 'semi intensive') NEAR/3 care NEAR/3 (unit\$ OR ward\$)):ab,ti,kw	301	327	36	#34 NOT ('conference abstract'/it OR 'conference paper'/it OR 'conference review'/it)	2 811	2997
9	#4 OR #5 OR #6 OR #7 OR #8	9 161	9 592	37	#36 NOT [medline]/lim	611	700
10	#3 OR #9	9 613	10 167	38	#37 AND ('meta-analysis'/exp OR 'meta-analysis' OR 'systematic review'/exp OR 'systematic review')	22	25
11	'mortality'/exp	1 408 508	1 530 319	39	#37 AND (random*:ab,ti OR placebo*:de,ab,ti OR ((double NEXT/1 blind*):ab,ti))	45	54
12	'survival analysis'/de	48 303	61 661	40	'clinical study'/de	164 618	169 003
13	#11 OR #12	1 445 473	1 577 847	41	'case control study'/exp	224 804	245 398
14	mortality:ab,ti,kw	1 479 334	1 623 376	42	'family study'/de	26 329	26 472
15	((death OR fatality OR survival) NEAR/2 rate\$):ab,ti,kw	324 794	373 451	43	'longitudinal study'/de	197 864	228 881

16	'mean survival time':ab,ti,kw	7 112	7 670	44	'retrospective study'/de	1 498 674	1 737 281
17	'years of potential life lost':ab,ti,kw	715	758	45	'prospective study'/de	883 939	954 274
18	survival:ab,ti,kw	1 777 167	1 934 069	46	'randomized controlled trials'/exp	262 793	286 859
19	#14 OR #15 OR #16 OR #17 OR #18	3 014 589	3 291 431	47	#45 NOT #46	873 145	942 524
20	#13 OR #19	3 403 084	3 708 672	48	'cohort analysis'/de	1 054 796	1 269 496
21	'length of stay'/de	273 751	307 151	49	cohort NEAR/5 (study OR studies)	580 272	666 446
22	'length of stay':ab,ti,kw	151 170	166 883	50	('case control' NEAR/5 (study OR studies)):ab,ti,kw	185 618	200 262
23	'hospital stay':ab,ti,kw	167 396	183 179	51	('follow up' NEAR/5 (study OR studies)):ab,ti,kw	169 199	182 353
24	(stay NEAR/1 length\$):ab,ti,kw	1 877	2 206	52	(observational NEAR/5 (study OR studies)):ab,ti,kw	357 604	412 064
25	#22 OR #23 OR #24	300 791	330 489	53	(epidemiologic\$ NEAR/5 (study OR studies)):ab,ti,kw	45 700	47 354
26	#21 OR #25	401 770	445 820	54	('cross sectional' NEAR/5 (study OR studies)):ab,ti,kw	455 504	525 829
27	'hospital readmission'/de	100 177	114 684	55	#40 OR #41 OR #42 OR #43 OR #44 OR #47 OR #48 OR #49 OR #50 OR #51 OR #52 OR #53 OR #54	4 095 040	4 619 171
28	readmission\$:ab,ti,kw	81 951	92 095	56	#55 AND #37	338	
					Update 18 September 2023 – 16 January 2025		81

Table 25 – Search strategy in Cochrane Library

Nr	Search term(s)	Hits 18/09/2023	Hits 16/01/2025	Nr	Search term(s)	Hits 18/09/2023	Hits 16/01/2025
1	((medium or intermediate or high) NEAR/3 care NEAR/3 (unit? or ward?):ab,ti,kw	304	351	17	[mh ^"Length of Stay"]	10 083	9 749
2	(high NEAR/3 (dependency or acuity) NEAR/3 (unit? or ward?):ab,ti,kw	176	201	18	"length of stay":ab,ti,kw	24 747	27 409
3	((Step-up or step-down or stepdown) NEAR/3 (unit? or ward?):ab,ti,kw	86	96	19	"hospital stay":ab,ti,kw	24 716	28 243
4	((Transitional or special or progressive) NEAR/3 care NEAR/3 (unit? or ward?):ab,ti,kw	243	264	20	stay NEAR/1 length?:ab,ti,kw	424	521
5	((subintensive or sub-intensive or subacute or sub-acute or semi-intensive) NEAR/3 care NEAR/3 (unit? or ward?):ab,ti,kw	22	26	21	#18 OR #19 OR #20	42 562	48 064
6	#1 OR #2 OR #3 OR #4 OR #5	775	873	22	#17 OR #21	42 462	48 064
7	[mh Mortality]	21 888	1 9044	23	[mh ^"patient readmission"]	1 393	1 671
8	[mh "Survival Analysis"]	26 150	30 361	24	readmission?:ab,ti,kw	9 493	10 783
9	#7 OR #8	44 268	45 096	25	#23 OR #24	9 493	10 783
10	mortality:ab,ti,kw	114 045	126 730	26	[mh "Costs and Cost Analysis"]	14 632	16 903
11	((death or fatality or survival) NEAR/2 rate?):ab,ti,kw	35 265	38 973	27	cost?:ab,ti,kw	84 796	94 141
12	"mean survival time":ab,ti,kw	335	412	28	#26 OR #27	84 854	94 206
13	"years of potential life lost":ab,ti,kw	6	6	29	#9 OR #16 OR #22 OR #25 OR #28	309 093	342 902
14	survival:ab,ti,kw	129 292	142 845	30	#6 AND #29	393	50
15	#10 OR #11 OR #12 OR #13 OR #14	209 107	231 202	31	#30 with Cochrane Library publication date Between Jan 2000 and Dec 2022, in Cochrane Reviews	18	



					#30 with Cochrane Library publication date Between Jan 2023 and Jan 2025, in Cochrane Reviews		0
16	#9 OR #15	212 316	234 734	32	#30 with Publication Year from 2000 to 2022, in Trials	313	
					#30 with Publication Year from 2023 to 2025, in Trials		50

5.2 Quality assessment

Table 26 – Observational cohort and cross-sectional studies (Part 1)

<i>Item</i>	Capuzzo (2014)	Endo (2022)	Fernando (2019)	Galdeono Lozano (2022)	Gershengorn (2022)	Harlan (2024)	Hunsaker (2021)	Laws (2020)	Lekwijit (2020)	Ludbrook (2023)
<i>Was the research question or objective in this paper clearly stated?</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Was the study population clearly specified and defined?</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Was the participation rate of eligible persons at least 50%?</i>	CD	Y	CD	CD	Y	Y	Y	Y	CD	Y
<i>Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?</i>	Y	Y	NA	CD	Y	Y	Y	Y	N	Y
<i>Was a sample size justification, power description, or variance and effect estimates provided?</i>	N	N	N	N	N	N	N	N	N	Y
<i>For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?</i>	Y	Y	N	Y	Y	N	Y	Y	N	N
<i>Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?</i>	Y	Y	Y	CD	Y	Y	Y	Y	Y	CD
<i>For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?</i>	NA	N	N	CD	NA	NA	CD	NA	NA	NA

<i>Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?</i>	NA	Y	CD	CD	Y	Y	N	Y	Y	Y
<i>Was the exposure(s) assessed more than once over time?</i>	N	N	N	CD	N	N	N	N	N	N
<i>Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?</i>	Y	Y	Y	CD	Y	Y	N	Y	Y	Y
<i>Were the outcome assessors blinded to the exposure status of participants?</i>	N	NA	N	N	N	NR	N	NR	NR	N
<i>Was loss to follow-up after baseline 20% or less?</i>	CD	Y	Y	CD	Y	CD	CD	NA	NR	N
<i>Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?</i>	Y	Y	Y	N	Y	Y	Y	Y	N	Y
Quality rating	Good	Fair	Fair	Poor	Good	Good	Poor	Good	Poor	Good

Y: yes, N: no, CD: cannot determine, NA: not applicable, NR: not reported

Table 27 – Observational cohort and cross-sectional studies (Part 2)

Item	Ohbe (2021)	Ohbe (2022 a)	Ohbe (2022 b)	Ohbe (2023)	Plate (2018)	Sykora (2020)	Umegaki (2024)
<i>Was the research question or objective in this paper clearly stated?</i>	Y	Y	Y	Y	Y	Y	Y
<i>Was the study population clearly specified and defined?</i>	Y	Y	Y	Y	Y	Y	Y
<i>Was the participation rate of eligible persons at least 50%?</i>	CD	CD	CD	CD	CD	Y	CD
<i>Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?</i>	Y	Y	Y	Y	NR	Y	Y
<i>Was a sample size justification, power description, or variance and effect estimates provided?</i>	N	N	N	N	N	N	N
<i>For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?</i>	N	N	N	N	N	N	N
<i>Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?</i>	Y	Y	Y	Y	Y	Y	Y
<i>For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?</i>	NA	NA	NA	NA	NA	N	NA
<i>Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?</i>	Y	Y	Y	Y	Y	Y	Y
<i>Was the exposure(s) assessed more than once over time?</i>	N	N	N	N	N	N	N
<i>Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?</i>	N	N	N	N	Y	Y	Y



<i>Were the outcome assessors blinded to the exposure status of participants?</i>	NR	NR	NR	NR	NR	NR	NR
<i>Was loss to follow-up after baseline 20% or less?</i>	NR	NR	NR	NR	NR	NA	NA
<i>Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?</i>	Y	Y	Y	Y	Y	Y	Y
Quality rating	Good	Good	Good	Good	Poor	Good	Good

Y: yes, N: no, CD: cannot determine, NA: not applicable, NR: not reported

Table 28 – Before-after (pre-post) studies with no control group

Item	Amiruddin (2018)	Chartrain (2017)	Labata (2018)	Mitra (2020)	Schwartz (2022)	Solberg (2014)	Yang (2020)
Was the study question or objective clearly stated?	Y	Y	Y	Y	Y	Y	Y
Were eligibility/selection criteria for the study population prespecified and clearly described?	N	Y	Y	Y	Y	N	Y
Were the participants in the study representative of those who would be eligible for the test/service/intervention in the general or clinical population of interest?	CD	Y	Y	Y	Y	Y	Y
Were all eligible participants that met the prespecified entry criteria enrolled?	CD	CD	Y	Y	Y	CD	Y
Was the sample size sufficiently large to provide confidence in the findings?	Y	N	Y	Y	N	Y	Y
Was the test/service/intervention clearly described and delivered consistently across the study population?	N	CD	Y	Y	N	Y	Y
Were the outcome measures prespecified, clearly defined, valid, reliable, and assessed consistently across all study participants?	Y	Y	Y	Y	Y	Y	Y
Were the people assessing the outcomes blinded to the participants' exposures/interventions?	N	N	CD	NR	NR	NR	NR
Was the loss to follow-up after baseline 20% or less? Were those lost to follow-up accounted for in the analysis?	CD	Y	CD	NR	NR	NR	NR
Did the statistical methods examine changes in outcome measures from before to after the intervention? Were statistical tests done that provided p values for the pre-to-post changes?	Y	Y	Y	Y	Y	Y	Y
Were outcome measures of interest taken multiple times before the intervention and multiple times after the intervention (i.e., did they use an interrupted time-series design)?	N	N	N	N	N	N	NR
If the intervention was conducted at a group level (e.g., a whole hospital, a community, etc.) did the statistical analysis take into account the use of individual-level data to determine effects at the group level?	NA	NA	NA	NA	NA	NA	NA
Quality rating	Poor	Poor	Fair	Poor	Poor	Fair	Fair

Y: yes, N: no, CD: cannot determine, NA: not applicable, NR: not reported



Table 29 – Controlled intervention studies

Item	Hanstad (2020)	Vester-Andersen (2015)
<i>Was the study described as randomized, a randomized trial, a randomized clinical trial, or an RCT?</i>	Y	Y
<i>Was the method of randomization adequate (i.e., use of randomly generated assignment)?</i>	Y	Y
<i>Was the treatment allocation concealed (so that assignments could not be predicted)?</i>	N	Y
<i>Were study participants and providers blinded to treatment group assignment?</i>	CD	N
<i>Were the people assessing the outcomes blinded to the participants' group assignments?</i>	Y	CD
<i>Were the groups similar at baseline on important characteristics that could affect outcomes (e.g., demographics, risk factors, co-morbid conditions)?</i>	Y	Y
<i>Was the overall drop-out rate from the study at endpoint 20% or lower of the number allocated to treatment?</i>	N	N
<i>Was the differential drop-out rate (between treatment groups) at endpoint 15 percentage points or lower?</i>	Y	Y
<i>Was there high adherence to the intervention protocols for each treatment group?</i>	CD	CD
<i>Were other interventions avoided or similar in the groups (e.g., similar background treatments)?</i>	CD	CD
<i>Were outcomes assessed using valid and reliable measures, implemented consistently across all study participants?</i>	Y	Y
<i>Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power?</i>	Y	N
<i>Were outcomes reported or subgroups analyzed prespecified (i.e., identified before analyses were conducted)?</i>	CD	Y
<i>Were all randomized participants analyzed in the group to which they were originally assigned, i.e., did they use an intention-to-treat analysis?</i>	CD	Y
Quality rating	Fair	Fair
Y: yes, N: no, CD: cannot determine, NA: not applicable, NR: not reported		

Table 30 – Case-control studies

Item	Confalonieri (2014)	Thietart (2022)
<i>Was the research question or objective in this paper clearly stated and appropriate?</i>	Y	Y
<i>Was the study population clearly specified and defined?</i>	Y	Y
<i>Did the authors include a sample size justification?</i>	N	N
<i>Were controls selected or recruited from the same or similar population that gave rise to the cases (including the same timeframe)?</i>	CD	Y
<i>Were the definitions, inclusion and exclusion criteria, algorithms or processes used to identify or select cases and controls valid, reliable, and implemented consistently across all study participants?</i>	N	Y
<i>Were the cases clearly defined and differentiated from controls?</i>	N	Y
<i>If less than 100 percent of eligible cases and/or controls were selected for the study, were the cases and/or controls randomly selected from those eligible?</i>	N	
<i>Was there use of concurrent controls?</i>	CD	NR
<i>Were the investigators able to confirm that the exposure/risk occurred prior to the development of the condition or event that defined a participant as a case?</i>	Y	Y
<i>Were the measures of exposure/risk clearly defined, valid, reliable, and implemented consistently (including the same time period) across all study participants?</i>	CD	NR
<i>Were the assessors of exposure/risk blinded to the case or control status of participants?</i>	N	NR
<i>Were key potential confounding variables measured and adjusted statistically in the analyses? If matching was used, did the investigators account for matching during study analysis?</i>	Y	Y
Quality rating	Poor	Fair

Y: yes, N: no, CD: cannot determine, NA: not applicable, NR: not reported



5.3 Description of setting of IMCU and comparator

Table 31 – Description of setting of IMCU and comparator

Author (year)			
<i>Amiruddin et al. (2018)</i>	IMCU	Location	-
		Available equipment/bed	Possibility for invasive monitoring, non-invasive respiratory support and limited vasoactive drug treatment
		Number of beds	10 beds
		Staffing	More ICU expertise than on regular ward
		Patient-to-nurse ratio	2:1
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	22 beds (16 general or surgical and 6 cardiothoracic beds)
		Staffing	-
		Patient-to-nurse ratio	-
	Definition IMCU	-	-
<i>Capuzzo et al. (2014)</i>	IMCU	Location	Physically and administrative independent unit
		Available equipment/bed	-
		Number of beds	< 8 beds: 14% 8-12 beds: 41% > 12 beds: 46%
		Staffing	-
		Patient-to-nurse ratio	Day-time: <0.5 (17 or 12%), 0.5-1 (81 or 58%), > 1 (42 or 30%) Night-time: <0.5 (43 or 31%), 0.5-1 (73 or 52%), > 1 (24 or 17%)
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	< 8 beds: 41% 8-12 beds: 48% > 12 beds: 11%

		Staffing	-
		Patient-to-nurse ratio	Day-time: <0.5 (3 or 11%), 0.5-1 (13 or 48%), > 1 (11 or 41%) Night-time: <0.5 (9 or 33%), 0.5-1 (11 or 41%), > 1 (7 or 26%)
	Definition IMCU	IMU is defined as any physically and administratively independent unit providing level of care I/II to patients open 24h/7d Level of care III represents patients with multiple acute vital organ failure, level of care II represents patients requiring monitoring and pharmacological and/or device-related support of only one acutely failing vital organ system, and level of care I patients experience signs of organ dysfunction necessitating continuous monitoring and minor pharmacological or device-related support	
<i>Chartrain et al. (2017)</i>	IMCU	Location	-
		Available equipment/bed	Management in the IMCU included daily transcranial doppler measurements and hourly neurological examinations
		Number of beds	4 beds
		Staffing	ICU physicians continued to serve as the primary providers for patients in the IMCU
		Patient-to-nurse ratio	4:1
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	16 beds
		Staffing	Team of critical care physicians, critical care fellows and nurse practitioners
		Patient-to-nurse ratio	2:1
	Definition IMCU	SDU, defined as an intermediate ward conceived to treat patients no longer requiring full intensive care but needing closer monitoring than those in the general wards, may be appropriate	
<i>Confalonieri et al. (2015)</i>	IMCU	Location	Independent
		Available equipment/bed	6 beds fully monitored and equipped for mechanical ventilation
		Number of beds	15 beds
		Staffing	Pulmonologist 24h/7d on duty, respiratory physiotherapists part of the team
		Patient-to-nurse ratio	4:1
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-



		Patient-to-nurse ratio	-
	Definition IMCU	Respiratory intermediate care units are specialised dedicated areas that aim to optimize the cost-benefit ratio in the care of these patients, mainly through the provision of a lower level of nursing intensity compared with general ICUs	
<i>Endo et al. (2022)</i>	IMCU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	4:1 to 5:1
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	2:1
	Definition IMCU	-	
<i>Fernando et al. (2019)</i>	IMCU	Location	-
		Available equipment/bed	Cardiac telemetry and non-invasive ventilation
		Number of beds	6 beds
		Staffing	-
		Patient-to-nurse ratio	2:1
	ICU	Location	-
		Available equipment/bed	Invasive ventilation, arterial monitoring, vasoactive medication
		Number of beds	28 beds
		Staffing	-
		Patient-to-nurse ratio	1:1
	Definition IMCU	-	
<i>Galdeano Lozano et al. (2022)</i>	IMCU	Location	Closed structure with individual rooms
		Available equipment/bed	Continuous non-invasive monitoring, ventilators for NIMV (telemetered) and HFOT
		Number of beds	11 beds

	ICU	Staffing	-
		Patient-to-nurse ratio	4:1
		Location	Open structure
		Available equipment/bed	-
		Number of beds	10 beds
		Staffing	-
		Patient-to-nurse ratio	-
	Definition IMCU	-	
<i>Gershengorn et al. (2020)</i>	IMCU	Location	Part of a 12-bed combined medical-surgical SDU
		Available equipment/bed	Telemetry, frequent non-invasive blood pressure surveillance, and continuous pulse oximetry and respiratory rate monitoring No monitoring through invasive devices was available (e.g. central venous, invasive arterial, or intracranial pressure monitoring)
		Number of beds	4 beds
		Staffing	1 critical care trained physician assistant on-site 24h/7d and 1 intensivist on-site during daytime with coverage as needed by a different on-site intensivist primarily responsible for the surgical ICU overnight
		Patient-to-nurse ratio	4:1
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	Medical ICU: 14 beds Mixed surgical, cardiothoracic, coronary ICU: 18 beds
		Staffing	A critical care fellow and 2 critical care trained physician assistants during the daytime and 1 critical care trained physician assistant overnight
		Patient-to-nurse ratio	2:1
	Definition IMCU	-	
<i>Hansted et al. (2020)</i>	IMCU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-



	ICU	Patient-to-nurse ratio	-
		Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	-
	Definition IMCU	Intermediate care was defined as increased monitoring, nurse attention and daily protocol-based rounds by surgeons and intensivists	
<i>Harlan et al. (2024)</i>	IMCU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	-
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	-
	Definition IMCU	Intermediate care units provide patients with a higher level of care than general care but do not require the same fixed staffing resources as ICUs.	
<i>Hunsaker et al. (2021)</i>	IMCU	Location	Part of neurosurgical ICU
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	-
	ICU	Location	-
		Available equipment/bed	Availability of adequate neurologic/ endocrinologic monitoring
		Number of beds	-

		Staffing	Trained nursing staff, protocols for management of pituitary adenoma patients
		Patient-to-nurse ratio	-
	Definition IMCU	The surgical SDU consisted of patients physically located within the standard neurosurgical ICU but with reduced nursing frequency checks to every 2 hours or later. Otherwise, monitoring for visual compromise, diabetes insipidus, and other perioperative complications was identical	
<i>Labata et al. (2018)</i>	IMCU	Location	-
		Available equipment/bed	Continuous non-invasive cardiac monitoring
		Number of beds	8 beds (4 double rooms)
		Staffing	Multidisciplinary team consisting of 2 cardiologists (one cardiologist on duty 24h/7d) with support from cardiac surgery staff
		Patient-to-nurse ratio	4:1
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	4 intensive care physicians
		Patient-to-nurse ratio	2:1
	Definition IMCU	-	
<i>Laws et al. (2020)</i>	IMCU	Location	-
		Available equipment/bed	Continuous telemetry, pulse oximetry, blood pressure measurements, antihypertensive drips
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	3:1 4:1
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	-
	Definition IMCU	-	



<i>Lekwijit et al. (2020)</i>	IMCU	Location	-
		Available equipment/bed	Continuous oximetry and non-invasive ventilation
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	2.5-4:1
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	1-2:1
	Definition IMCU	Intermediate level of care for patients whose illness severity may not warrant ICU care, but who are not stable enough to be treated in general ward	
<i>Ludbrook et al. (2023)</i>	IMCU	Location	Close to the Recovery Room (PACU) and operating rooms – same floor, within 50 metres, single location
		Available equipment/bed	Continuous ECG, heart rate and rhythm, respiratory rate, pulse oximetry, intermittent non-invasive blood pressure (NIBP), temperature, optional continuous NIBP or direct arterial monitoring, and derived parameters, optional trans-thoracic echocardiography – ‘fastscan’ level Spontaneous ventilation, CPAP, continue pre-existing home treatment, nasal and mask, low flow oxygen Access to low dose vasopressor infusion (metaraminol up to 4mg/hr) to maintain MAP > 60-65mmHg whilst diagnosis and optimal fluid management initiated
		Number of beds	2-4 beds per patient bay
		Staffing	Continuous presence of resident medical officer with anaesthesia experience, 24/7 consultant anaesthetist exclusively present 08h00-18h00, and exclusively remotely available after-hours Access to acute pain service and other specialties, as needed, including ICU and MER team
		Patient-to-nurse ratio	2:1 (capacity for temporary 1:1 if needed)
	General surgical unit	Location	Single rooms
		Available equipment/bed	Intermittent non-invasive blood pressure (NIBP), heart rate, pulse oximetry, respiratory rate, sedation scores, temperature, capacity for continuous monitoring (if indicated) Spontaneous ventilation, CPAP, continue pre-existing home treatment, nasal and mask, low flow oxygen

		Number of beds	Approximately 16 beds
		Staffing	Resident medical officers and consultant surgeons for home surgical team in-house during the day, resident surgical medical officers in-house covering approx. 3-4 wards overnight Access to acute pain service and other specialties, as needed, including ICU and MER team
		Patient-to-nurse ratio	10:1 (capacity for care if needed 1:1)
		Definition IMCU	
<i>Mitra et al. (2020)</i>	IMCU	Location	Floor above ICU (same critical care tower)
		Available equipment/bed	-
		Number of beds	20 beds
		Staffing	Critical care physicians, respiratory therapists, dieticians, physiotherapists and high acuity-trained nurses. The attending critical care physician was on-call for both the ICU and the HAU over a 24-hr period, with support from 0-2 medical resident trainees.
		Patient-to-nurse ratio	2:1
	ICU	Location	Floor below HAU
		Available equipment/bed	-
		Number of beds	26 beds
		Staffing	-
		Patient-to-nurse ratio	-
	Definition IMCU	-	
<i>Ohbe et al. (2021)</i>	IMCU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	Consistent with ICU, expect that HDU is not required to employ intensivists
		Patient-to-nurse ratio	4:1 5:1
	ICU	Location	Separate unit
		Available equipment/bed	Equipment necessary to care for critically ill patients (not further specified)
		Number of beds	-



		Staffing	At least one physician on site 24 hours per day, at least two intensivists working full-time, around-the-clock nursing
		Patient-to-nurse ratio	2:1
	Definition IMCU	-	
<i>Ohbe et al. (2022 a)</i>	IMCU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	Consistent with ICU, expect that HDU is not required to employ intensivists
		Patient-to-nurse ratio	4:1 5:1
	ICU	Location	-
		Available equipment/bed	Equipment necessary to care for critically ill patients
		Number of beds	-
		Staffing	At least one physician on site 24h/7d, at least two intensivists working full-time, 24h/7d nursing staff
		Patient-to-nurse ratio	2:1
	Definition IMCU	-	
<i>Ohbe et al. (2022 b)</i>	IMCU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	Consistent with ICU, expect that HDU is not required to employ intensivists
		Patient-to-nurse ratio	4:1 5:1
	ICU	Location	-
		Available equipment/bed	Equipment necessary to care for critically ill patients
		Number of beds	-
		Staffing	At least one physician on site 24h/7d, at least two intensivists working full-time, 24h/7d nursing staff
		Patient-to-nurse ratio	2:1

	Definition IMCU	Also called IMCU or SDU, is an area in which patient care levels and costs are between the levels found in ICU and general ward	
<i>Ohbe et al. (2023)</i>	IMCU	Location	-
		Available equipment/bed	Mechanical ventilation and vasopressor administration
		Number of beds	-
		Staffing	Do not require intensivist staffing
		Patient-to-nurse ratio	4:1 5:1
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	2:1
	Definition IMCU	An HDU, also called an “intermediate care unit” or “step-down unit,” was defined as an area providing critical care services including mechanical ventilation and vasopressor administration, where patient care levels and costs are between the levels found in the ICU and general wards.	
<i>Plate et al. (2018)</i>	IMCU	Location	-
		Available equipment/bed	Mixed-surgical IMCU: hemodynamic monitoring and cardiovascular and respiratory support including inotropic use and supplementary (high-flow) oxygen. It does not provide invasive ventilation and continuous renal replacement therapy. Emphasis is on wound and fracture care Neuro-surgical IMCU: hemodynamic monitoring and cardiovascular and respiratory support, though does not support inotropic use. Emphasis is on neurological observation
		Number of beds	Mixed-surgical IMCU: 6 beds Neuro-surgical IMCU: 6 beds
		Staffing	-
		Patient-to-nurse ratio	1.5:1
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	36 beds
		Staffing	Led by intensivists of various non-surgical backgrounds
		Patient-to-nurse ratio	1:1



	Definition IMCU	-
<i>Schwartz et al. (2022)</i>	IMCU	Location -
		Available equipment/bed -
		Number of beds -
		Staffing -
		Patient-to-nurse ratio 2:1
	ICU	Location -
		Available equipment/bed -
		Number of beds -
		Staffing -
		Patient-to-nurse ratio -
	Definition IMCU	-
<i>Solberg et al. (2014)</i>	IMCU	Location -
		Available equipment/bed -
		Number of beds 6 beds: open concept without isolation facilities
		Staffing Staffed by same team of critical care physicians as ICU Team was on both units 24h/7d available Nursing staff was newly engaged team (were given a special training course), supplemented with one ICU nurse per shift
		Patient-to-nurse ratio 2:1
	ICU	Location -
		Available equipment/bed Medical ventilation
		Number of beds Unit 1: 8 beds Unit 2: 9 beds After opening of IMCU, one ICU bed was closed
		Staffing Staffed by same team of critical care physicians as ICU Team was on both units 24h/7d available
		Patient-to-nurse ratio 1:1
	Definition IMCU	SDU: patients were not directly referred to IMCU without prior ICU stay

		Admission and discharge criteria for ICU and IMCU were based upon criteria defined by guidelines of the Task force of the American College of Critical Care Medicine	
<i>Sykora et al. (2020)</i>	IMCU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	-
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	-
	Definition IMCU	Step-up unit, IMCU manages all acutely ill patients up to the point of requiring vasopressor support and intubation	
<i>Thietart et al. (2022)</i>	IMCU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	-
	ICU	Location	-
		Available equipment/bed	Enhanced capacity for monitoring, and that can provide organ support for multiple life-threatening organ insufficiencies
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	-
	Definition IMCU	Ward providing close patient monitoring to manage patients with unique life-threatening organ insufficiencies, with a lower nurse-to-patient ratio than in an ICU	
<i>Umegaki et al. (2024)</i>	IMCU	Location	-
		Available equipment/bed	-
		Number of beds	-



	ICU 1	Staffing	Dedicated intensivist/physician always on duty in the HCU
		Patient-to-nurse ratio	5:1
		Location	-
		Available equipment/bed	-
		Number of beds	-
	ICU 2	Staffing	Two or more dedicated intensivists (each with ≥ 5 years of experience in critical care) always on duty in the ICU
		Patient-to-nurse ratio	2:1
		Location	-
		Available equipment/bed	-
		Number of beds	-
	Definition IMCU	Staffing	Dedicated intensivist/physician always on duty in the ICU
		Patient-to-nurse ratio	2:1
		While high care units share some similarities in organisation and function with the high-dependency units of other countries, which are designed for critically ill patients who are less severe than those in ICUs.	
Vester-Andersen et al. (2015)	IMCU	Location	-
		Available equipment/bed	Monitor with continuous electrocardiography and pulse oximetry, blood pressure and respiratory rate (measured every other hour when not asleep)
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	-
	ICU	Location	-
		Available equipment/bed	Resources to monitor vital signs every 8h, continuous monitoring of vital signs not possible ^m
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	-

^m Surgical ward instead of ICU

	Definition IMCU	-	
<i>Yang et al. (2020)</i>	IMCU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	Nursing staff and management trained over 3-month period on free flap surgery, tracheotomy and laryngectomy Availability of head and neck nurse practitioner: rounds with the team and works with the nurses, patients, and patients' family to help with teaching, wound care and arrange discharge Weekly meetings with the surgical team, social worker, nurse manager, and speech pathologist are held to discuss surgical cases for the following week and anticipate
		Patient-to-nurse ratio	2:1
	ICU	Location	-
		Available equipment/bed	-
		Number of beds	-
		Staffing	-
		Patient-to-nurse ratio	-
	Definition IMCU	SDU to provide specialised care and implement a standardised postoperative protocol	



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