

SEPSIS, NEWS AND INTENSIVE CARE

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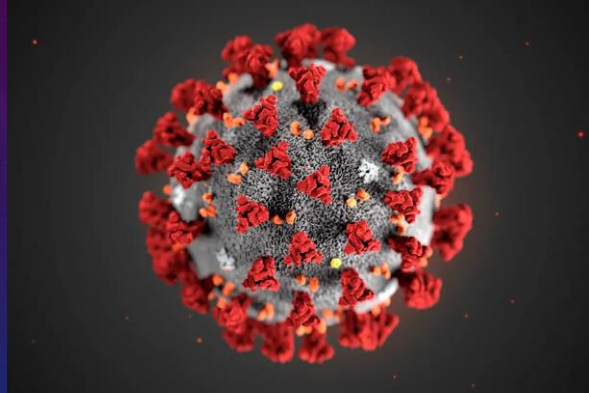
SEPSIS

- Diagnosis
- Treatment
- Monitoring Response
- Escalation to critical care
- Post Sepsis / ICU Syndrome

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SEPSIS

DIAGNOSIS



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INFECTION

- Infection is the invasion of an organism's body tissues by disease-causing agents, such as bacteria, viruses, fungi and parasites.

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SEPSIS - DIAGNOSIS

- Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection.
- Sepsis is the primary cause of death from infection, especially if not recognised and treated promptly.

Singer, Mervyn, Clifford S. Deutschman, Christopher Warren Seymour, Manu Shankar-Hari, Djillali Annane, Michael Bauer, Rinaldo Bellomo, et al. 'The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)'. *JAMA* 315, no. 8 (23 February 2016): 801-810

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ORGAN DYSFUNCTION - SOFA

Table 1. Sequential [Sepsis-Related] Organ Failure Assessment Score^a

System	Score				
	0	1	2	3	4
Respiration					
Pao ₂ /Fio ₂ , mm Hg (kPa)	≥400 (53.3)	<400 (53.3)	<300 (40)	<200 (26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation					
Platelets, ×10 ³ /μL	≥150	<150	<100	<50	<20
Liver					
Bilirubin, mg/dL (μmol/L)	<1.2 (20)	1.2-1.9 (20-32)	2.0-5.9 (33-101)	6.0-11.9 (102-204)	>12.0 (204)
Cardiovascular					
MAP ≥70 mm Hg		MAP <70 mm Hg	Dopamine <5 or dobutamine (any dose) ^b	Dopamine 5.1-15 or epinephrine ≤0.1 or norepinephrine ≤0.1 ^b	Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1 ^b
Central nervous system					
Glasgow Coma Scale score ^c	15	13-14	10-12	6-9	<6
Renal					
Creatinine, mg/dL (μmol/L)	<1.2 (110)	1.2-1.9 (110-170)	2.0-3.4 (171-299)	3.5-4.9 (300-440)	>5.0 (440)
Urine output, mL/d				<500	<200

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ORGAN DYSFUNCTION - SOFA

- Organ dysfunction can be identified as an acute change in total SOFA score ≥ 2 points consequent to the infection.
- The baseline SOFA score can be assumed to be zero in patients not known to have preexisting organ dysfunction.
- A SOFA score ≥ 2 reflects an overall mortality risk of approximately 10% in a general hospital population with suspected infection. Even patients presenting with modest dysfunction can deteriorate further, emphasizing the seriousness of this condition and the need for prompt and appropriate intervention, if not already being instituted.

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ORGAN DYSFUNCTION - Q-SOFA, SEPSIS-6

Box 4. qSOFA (Quick SOFA) Criteria

Respiratory rate $\geq 22/\text{min}$

Altered mentation

Systolic blood pressure $\leq 100 \text{ mm Hg}$

Appendix 1. Septic Shock Screening and Action Tool (always check sepsiscare.org for the latest version)

SEPSIS SCREENING TOOL ACUTE ASSESSMENT		AGE 12+
PATIENT DETAILS:		DATE: _____
NAME: _____		TIME: _____
SIGNATURE: _____		
01 START THIS CHART IF THE PATIENT LOOKS UNWELL OR NEWS2 IS 5 OR ABOVE <input type="checkbox"/> Age > 75 <input type="checkbox"/> Recent trauma / surgery / invasive procedure <input type="checkbox"/> Impaired immunity (e.g. diabetes, steroids, chemotherapy) <input type="checkbox"/> Indwelling line / device / wound / skin		
02 COULD THIS BE DUE TO AN INFECTION? UNLIKELY SOURCE: <input type="checkbox"/> Respiratory <input type="checkbox"/> Urine <input type="checkbox"/> Skin / joint / wound <input type="checkbox"/> Indwelling device <input type="checkbox"/> Brain <input type="checkbox"/> Surgical <input type="checkbox"/> Other		SEPSIS UNLIKELY, CONSIDER OTHER DIAGNOSIS
03 ANY RED FLAG PRESENT? <input type="checkbox"/> Altered level of consciousness or altered mental state <input type="checkbox"/> Systolic BP ≤ 100 mmHg (or drop of ≥ 40 from normal) <input type="checkbox"/> Heart rate ≥ 130 per minute <input type="checkbox"/> Respiratory rate ≥ 25 per minute <input type="checkbox"/> Needs O_2 to keep $\text{SpO}_2 \geq 92\%$ (88% on CPAP) <input type="checkbox"/> Non-blanching rash / mottled / skin / capillary refill ≥ 2 seconds <input type="checkbox"/> Recent chemotherapy <input type="checkbox"/> Not passed urine in 18 hours (or 12 hours if on dialysis)		RED FLAG SEPSIS START SEPSIS SIX
04 ANY AMBER FLAG PRESENT? <input type="checkbox"/> Relative concerned about mental status <input type="checkbox"/> Acute deterioration in functional ability (unresponsiveness) <input type="checkbox"/> Trauma / surgery / procedure in last 8 weeks <input type="checkbox"/> Respiratory rate ≥ 25 <input type="checkbox"/> Systolic BP ≤ 100 mmHg <input type="checkbox"/> Heart rate ≥ 130 or new dysrhythmia <input type="checkbox"/> Temperature ≥ 38.5 <input type="checkbox"/> Clinical signs of wound infection		FURTHER REVIEW REQUIRED: - SEND BLOODS AND REVIEW RESULTS - PHONE CLINICAL REVIEW WITHIN 15 MIN TIME OF REVIEW: <input type="checkbox"/> 15 min <input type="checkbox"/> 30 min AND REVIEW RESULTS: <input type="checkbox"/> Yes <input type="checkbox"/> No
NO AMBER FLAGS = ROUTINE CARE / CONSIDER OTHER DIAGNOSIS		

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SEPTIC SHOCK

- Septic shock is a subset of sepsis.
- Patients with septic shock have a mortality in excess of 40%.
- Diagnosing septic shock:
 - Vasopressor requirement to maintain a mean arterial pressure of 65 mmHg or greater and
 - Serum lactate level greater than 2 mmol/L

Singer, Mervyn, Clifford S. Deutschman, Christopher Warren Seymour, Manu Shankar-Hari, Djillali Annane, Michael Bauer, Rinaldo Bellomo, et al. 'The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)'. *JAMA* 315, no. 8 (23 February 2016): 801-810

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SEPSIS TREATMENT



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SURVIVING SEPSIS CAMPAIGN

- IV antimicrobials within the first hour of recognition
- Source control

Rhodes, Andrew, Laura E. Evans, Waleed Alhazzani, Mitchell M. Levy, Massimo Antonelli, Ricard Ferrer, Anand Kumar, et al. 'Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016'. *Intensive Care Medicine* 43, no. 3 (March 2017): 304–77.

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DELAY IN TREATMENT

- In the presence of sepsis or septic shock, each hour delay in treatment is associated with a measurable increase in mortality

Rhodes, Andrew, Laura E. Evans, Waleed Alhazzani, Mitchell M. Levy, Massimo Antonelli, Ricard Ferrer, Anand Kumar, et al. 'Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016'. *Intensive Care Medicine* 43, no. 3 (March 2017): 304–77.

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SEPSIS

MONITORING RESPONSE



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MONITORING TREATMENT AND IDENTIFICATION OF DETERIORATING PATIENT

- Track and Trigger Scores
 - ★ EWS - 2000
 - ★ MEWS - 2005
 - ★ ViEWS - 2010
 - ★ NEWS - 2012
 - ★ NEWS2 - 2017

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NEWS

- NEWS has a greater ability to discriminate patients at risk of deterioration than other Early Warning Scores

Smith, Gary B., David R. Prytherch, Paul Meredith, Paul E. Schmidt, and Peter I. Featherstone. 'The Ability of the Nation

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NATIONAL EARLY WARNING SCORE

NEWS (2012)

Chart 1: National Early Warning Score (NEWS)*

PHYSIOLOGICAL PARAMETERS	3	2	1	0	1	2	3
Respiration Rate	≥8		9-11	12-20		21-24	≥25
Oxygen Saturations	≤91	92-93	94-95	≥96			
Any Supplemental Oxygen		Yes	No				
Temperature	≤35.0		35.1-36.0	36.1-38.0	38.1-39.0	≥39.1	
Systolic BP	≤90	91-100	101-110	111-219			≥220
Heart Rate	≤40	41-50	51-90	91-110	111-130	≥131	
Level of Consciousness			A				V, P, or U

*The NEWS initiative formed from the Royal College of Physicians' NEWS2012, and was jointly developed and funded in collaboration with the Royal College of Physicians, Royal College of Nursing, National Outreach Forum and NHS Training for Innovation.

Royal College of Physicians NHS Training for Innovation

NEWS2 (2017)

Chart 1: The NEWS scoring system

Physiological parameter	3	2	1	Score 0	1	2	3
Respiration rate (per minute)	≤8		9-11	12-20		21-24	≥25
SpO ₂ Scale 1 (%)	≤91	92-93	94-95	≥96			
SpO ₂ Scale 2 (%)	≤83	84-85	86-87	88-92 ≥93 on air	93-94 on oxygen	95-96 on oxygen	≥97 on oxygen
Air or oxygen?		Oxygen		Air			
Systolic blood pressure (mmHg)	≤90	91-100	101-110	111-219			≥220
Pulse (per minute)	≤40		41-50	51-90	91-110	111-130	≥131
Consciousness				Alert			CVPU
Temperature (°C)	≤35.0		35.1-36.0	36.1-38.0	38.1-39.0	≥39.1	

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NEWS RESPONSE

Chart 2: NEWS thresholds and triggers

NEWS score	Clinical risk	Response
Aggregate score 0–4	Low	Ward-based response
Red score Score of 3 in any individual parameter	Low–medium	Urgent ward-based response*
Aggregate score 5–6	Medium	Key threshold for urgent response*
Aggregate score 7 or more	High	Urgent or emergency response**

* Response by a clinician or team with competence in the assessment and treatment of acutely ill patients and in recognising when the escalation of care to a critical care team is appropriate.

**The response team must also include staff with critical care skills, including airway management.

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NEWS RESPONSE

Chart 4: Clinical response to the NEWS trigger thresholds

NEWS score	Frequency of monitoring	Clinical response
0	Minimum 12 hourly	<ul style="list-style-type: none"> Continue routine NEWS monitoring
Total 1–4	Minimum 4–6 hourly	<ul style="list-style-type: none"> Inform registered nurse, who must assess the patient Registered nurse decides whether increased frequency of monitoring and/or escalation of care is required
3 in single parameter	Minimum 1 hourly	<ul style="list-style-type: none"> Registered nurse to inform medical team caring for the patient, who will review and decide whether escalation of care is necessary
Total 5 or more Urgent response threshold	Minimum 1 hourly	<ul style="list-style-type: none"> Registered nurse to immediately inform the medical team caring for the patient Registered nurse to request urgent assessment by a clinician or team with core competencies in the care of acutely ill patients Provide clinical care in an environment with monitoring facilities
Total 7 or more Emergency response threshold	Continuous monitoring of vital signs	<ul style="list-style-type: none"> Registered nurse to immediately inform the medical team caring for the patient – this should be at least at specialist registrar level Emergency assessment by a team with critical care competencies, including practitioner(s) with advanced airway management skills Consider transfer of care to a level 2 or 3 clinical care facility, ie higher-dependency unit or ICU Clinical care in an environment with monitoring facilities

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SEPSIS

ESCALATION TO INTENSIVE CARE

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INTENSIVE CARE MEDICINE



Intensive Care = Critical Care



End point for all the sickest patients in the hospital



ICM – specialty status since 1999



Faculty of Intensive Care Established in 2010, will become a Royal College in due course

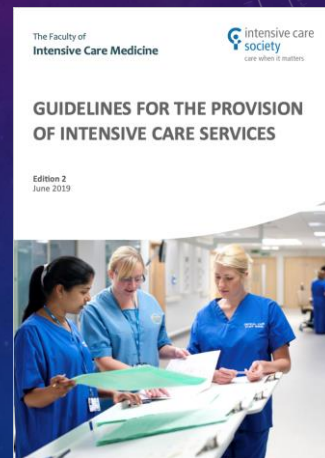
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INTENSIVE CARE MEDICINE

Level 0	Patients whose needs can be met through normal ward care in an acute hospital
Level 1	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
Level 2	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
Level 3	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.

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INTENSIVE CARE MEDICINE



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INTENSIVE CARE MEDICINE

2018 / 19 291,679
ICU admissions in
the UK



Mortality 18% -
about 52,500
deaths

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VARIATION IN NUMBER OF ICU BEDS (PER CAPITA)

Table 2 Data describing numbers of adult acute care, intermediate care and intensive care beds per European country

	Acute care beds ^a	Acute care beds/ 100,000 population	Intermediate care (IMCU) beds	Intensive care (ICU) beds	Critical care beds	ICU and IMCU beds/ 100,000 population	ICU beds as % of acute care beds	GDP (\$million)/ ICU beds
Andorra	188	224			6	7.1	3.2	482.2
Austria	48,446	635	569	1,264	1,833	21.8	3.4	205.9
Belgium	50,156	456			1,755	15.9	3.5	266.5
Bulgaria	57,460	766			913	12.2	1.6	52.2
Croatia	15,629	353			650	14.7	4.2	93.6
Cyprus	2,813	350	9	83	92	11.4	3.3	251.9
Czech Republic	91,068	865			1,227	11.6	1.3	156.5
Denmark	17,124	308			372	6.7	2.2	833.0
Estonia	5,096	380	72	124	196	14.6	3.8	98.2
Finland	12,442	231	28	301	329	6.1	2.6	727.0
France	232,821	358	3,471	4,069	7,540	11.6	3.2	339.9
Germany	469,791	575			23,890	29.2	5.1	137.6
Greece	44,411	392	30	650	680	6.0	1.5	449.1
Hungary	41,574	416			1,374	13.8	3.3	94.9
Iceland	1,169	367			29	9.1	2.5	434.3
Ireland	12,202	272	88	201	289	6.5	2.4	716.2
Italy	201,932	333			7,550	12.5	3.7	272.2
Latvia	11,833	531			217	9.7	1.8	110.7
Lithuania	17,061	526			502	15.5	2.9	72.5
Luxembourg	2,511	204	27	100	127	24.8	5.1	432.7
The Netherlands	56,085	337			1,065	6.4	1.9	733.0
Norway	13,639	277			395	8.0	2.9	1,045.5
Poland	156,662	410			2,635	6.9	1.7	178.1
Portugal	31,722	298		451	451	4.2	1.4	508.1
Romania	108,611	507	2,574	2,000	4,574	21.4	4.2	35.3
Slovakia	32,560	599			500	9.2	1.5	174.9
Slovenia	7,656	373			131	6.4	1.7	364.4
Spain	124,194	269			4,479	9.7	3.6	314.8
Sweden	26,131	278			550	5.8	2.1	834.0
Switzerland	28,096	357			866	11.0	3.1	609.6
UK	147,809	237	1,737	2,377	4,114	6.6	2.8	547.0

^a World Health Organization Regional Office for Europe (2009)

Rhodes, A., P. Ferdinande, H. Flaatten, B. Guidet, P. G. Metnitz, and R. P. Moreno. 'The Variability of Critical Care Be

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SEPSIS

POST SEPSIS / ICU SYNDROME

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LONG TERM OUTCOME

At 5 years:

- Younger patients had a greater rate of recovery than older patients, but neither group returned to normal predicted levels of physical function.
- Pulmonary function was normal to near-normal.
- Other physical and psychological problems are likely to develop.

Herridge, Margaret S, Catherine M Tansey, Andrea Matté, George Tomlinson, Natalia Diaz-Granados, Andrew Cooper, Cameron B Guest, et al. 'Functional Disability 5 Years after

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LONG TERM CONSEQUENCES

PHYSICAL:

- Poor balance
- Difficulty in walking
- Difficulty in swallowing
- Impaired cough

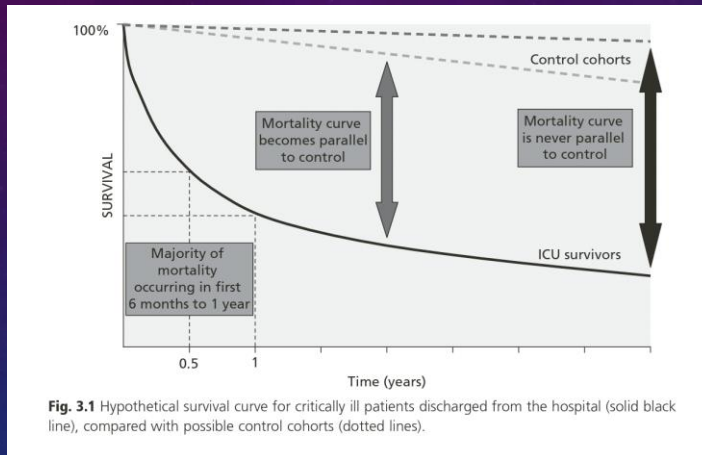
NEUROLOGICAL:

- Cognitive impairments
- Memory
- Attention
- Mental processing speed

Stevens, Robert D., Nicholas Hart, and Margaret S. Herridge. Textbook of Post-ICU Medicine: The Legacy of Critical Care. Oxford University Press, 2014.

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LIFE EXPECTANCY



Stevens, Robert D., Nicholas Hart, and Margaret S. Herridge. Textbook of Post-ICU Medicine: The Legacy of Critical Care. Oxford University Press, 2014.

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SUMMARY

- Sepsis is Infection with Organ Dysfunction
- Early treatment is associated with better outcome
- Response should be monitored with NEWS
- NEWS ≥ 7 must be referred to critical care (including CCOT)
- Post ICU / Sepsis syndrome has long term effects

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