PURSUING COMFORT AND COGNITIVE IN PADIS

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20% Mental Health

60% Cognitive Impair

70% Function Impair

Pain-Agitation-Delirium Important

- **Pain affects cardiac instability, respiratory compromise, and immunosuppression**
  - **Poor ICU outcome**
- **Agitation is frequently associated with elevated anxiety, prolonged mechanically ventilated, and agitation-related harm**
  - **Increased morbidity**
- **Delirium is associated with worse mortality, morbidity, and prolonged mechanically ventilated, and much higher ICU and hospital LOS and costs**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

Immobility-Sleep Disruption Important

- **Immobility significantly worsen the muscle strength at ICU discharge**
  - **Prolong mechanical ventilation use**

- **Sleep Disruption induce emotional distress**
  - **Delirium**
  - **Prolong mechanical ventilation use**
  - **Immune function**
  - **Neurocognitive dysfunction**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

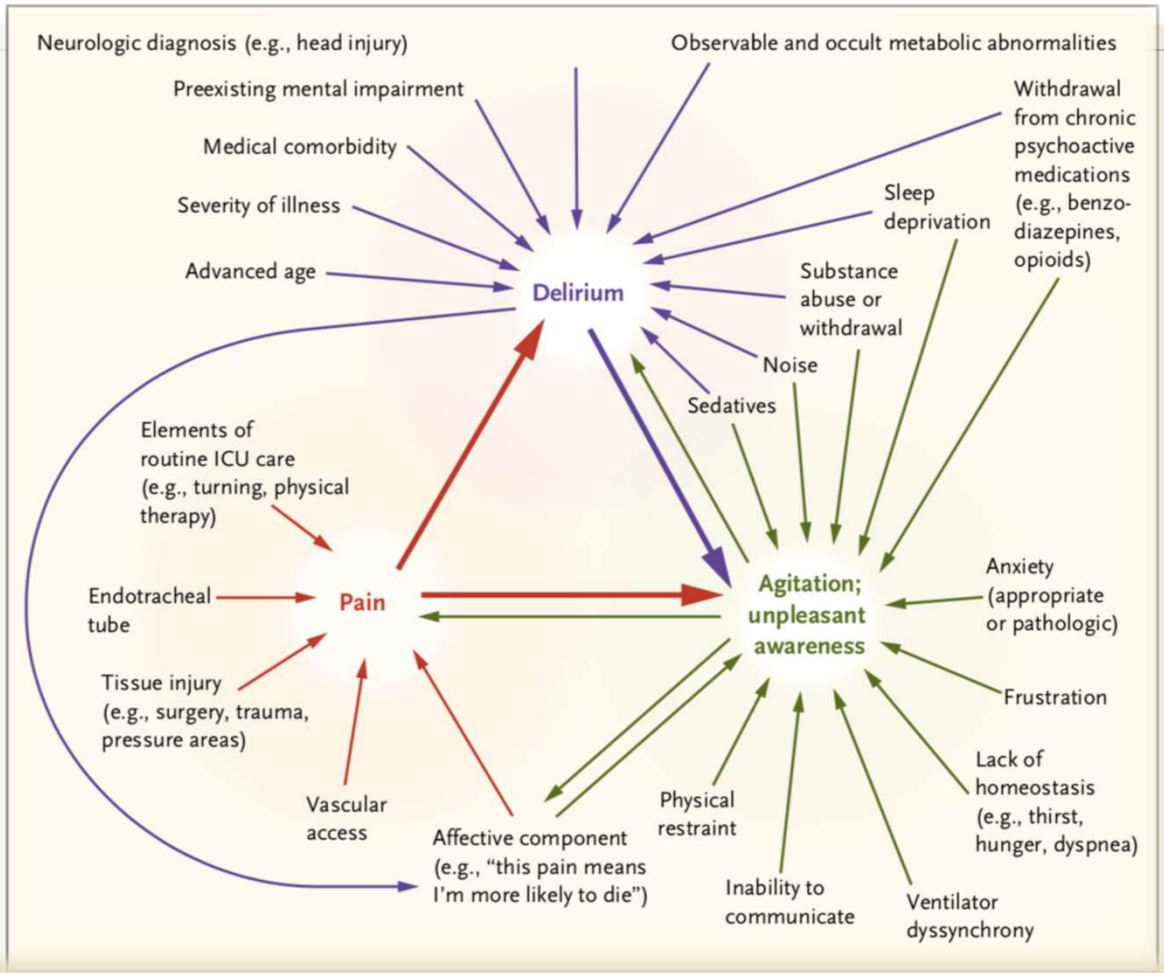
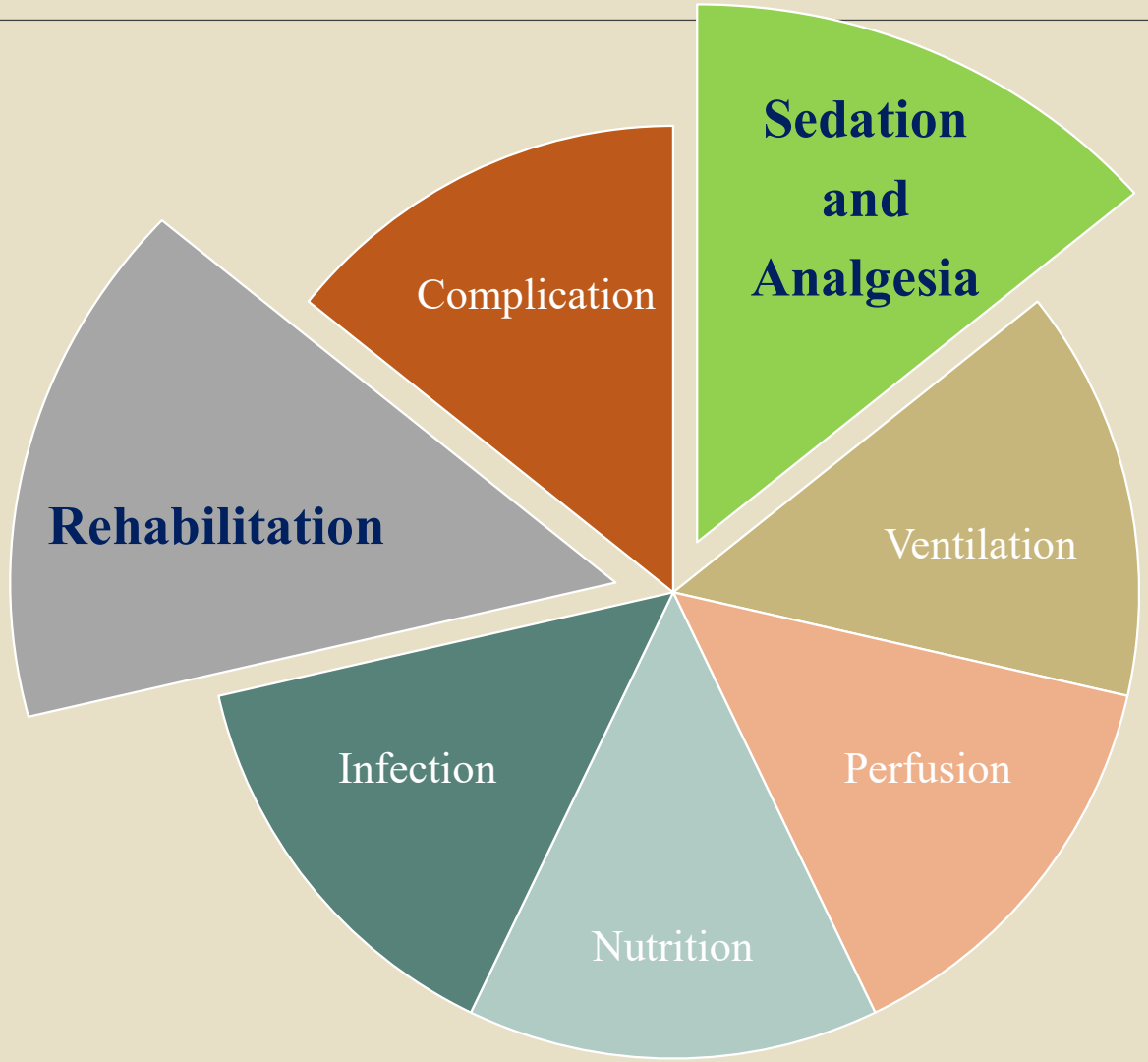


Figure 1. Causes and Interactions of Pain, Agitation, and Delirium.

Drugs and other treatments for pain, agitation, and delirium form an "ICU triad" cognitive management analogous to the "triad of anesthesia," which highlights interactions among hypnotics, analgesics, and muscle relaxants to encourage balanced anesthesia. The "ICU triad" concept highlights that changing one element is unlikely to be as effective as a coordinated approach.


Sedation and Analgesia
Ventilation
Perfusion
Nutrition
Infection
Rehabilitation
Complication

- **Comfort**
- **Orientated**
- **Early mobilized**
- **Normal sleep-wake pattern**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

PAIN

Difficult Approach

- **Individualized**
- **Complex and many origins**
- **Poorly recognized and interpreted**
- **Imperfect protocol**
- **No medication with balanced benefits versus risks**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

Protocol-Based Assessment/Management

- **Routine assessment**
- **Treated before sedative agent**
- **Assessment-driven, protocol-based, stepwise approach**

- **Analgesia-first sedation**

- **Analgesia-based sedation**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

藥物

- **Medication**
  - **Non-neuropathic pain**
    - **IV opioids as 1st-line**
  - **Neuropathic pain**
    - **IV Opioids+enteral gabapentin/carbamazepine**
      - **HLA-B 1502 screening for carbamazepine**
  - **Non-opioid analgesics as adjuvant**

- **Delivery route**

Table 1. Sedatives and Analgesics in Common Use in the ICU.*

Drug (Brand Name)	Mechanism of Action	Typical Adult Dose	Pharmacokinetic Properties	Adverse Effects
Remifentanil (Ultiva)	μ-Opioid agonist (also with κ-opioid agonist effects)	0.5 to 2 μg/kg/min; loading dose of 0.4 to 0.8 μg/kg may be considered	Half-life, 3 to 4 min; does not accumulate with prolonged infusion; metabolized by plasma esterases and so is unaffected by organ function	Nausea, constipation, respiratory depression, bradycardia
Fentanyl (Sublimaze)	μ-Opioid agonist (also with κ-opioid agonist effects)	20 to 100 μg/hr; loading dose of 50 to 100 μg may be considered	Half-life, 1.5 to 6 hr; highly fat soluble, so rapid onset but accumulates with prolonged infusion; metabolized by hepatic oxidation; no active metabolites	Nausea, constipation, respiratory depression, skeletal-muscle rigidity with high bolus doses
Morphine (Roxanol; Duramorph)	μ-Opioid agonist (also with κ-opioid and δ-opioid agonist effects)	1 to 5 mg/hr; loading dose of 2 to 5 mg may be considered	Half-life, 3 to 7 hr; more water soluble, so slower onset than fentanyl with less accumulation; metabolized by hepatic glucuronidation to morphine-6-glucuronide (10%) (20 times as active as parent drug) and morphine-3-glucuronide (90%) (inactive as an analgesic but causes neuroexcitation, at least in animal models), both with renal excretion	Nausea, constipation, respiratory depression, histamine release and consequent vasodilatation and hypotension, itch
Hydromorphone (Dilaudid)	μ-Opioid agonist (also with κ-opioid and δ-opioid agonist effects)	0.5 to 2 mg/hr; loading dose of 0.4 to 1.5 mg may be considered	Half-life, 1.5 to 3.5 hr; 7 to 11 times as potent as morphine; metabolized by hepatic glucuronidation to hydromorphone-3-glucuronide, with effects similar to those of morphine-3-glucuronide	Nausea, constipation, respiratory depression

Fentanyl

- **u-opioid agonist**
- **Dose: loading 50-100mcg, keep 20-100mcg/hr**
- **Rapid onset, half-life: 1.5-6hr**

- **Metabolized by the liver, no active metabolites**
- **Highly fat soluble, accumulates with prolonged infusion**
- **Nausea, constipation, respiratory depression**

Morphine

- **u-opioid agonist**
- **Dose: loading 2 - 5 mg, keep 1-5mg/hr**
- **Slower onset, half-life: 3-7hr**

- **Metabolized by the liver, with active metabolites (excreted through kidney)**
- **Water soluble, so slower onset and less accumulation than Fentanyl**
- **Nausea, constipation, respiratory depression**

Add-On

- **Rest**
  - **Acetaminophen**
  - **Nefopam**
  - **Ketamine- low dose in surgical patient**
  - **Nneuropathic pain medication- neuropathic pain management**
    conditionally used on post CVS surgery

- **Procedural**
  - **Opioid- lowest effective dose**
  - **NSAID by all routes- discrete and infrequent procedures**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

輔助療法

- **Massage**
- **Music- rest and procedural**
- **Cold therapy- procedural**
- **Relaxation techniques- procedural**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

AGITATION

Sedation Consideration

- **Light level sedation unless contraindicated**
  - **Improved outcome**
- **Daily Sedation Interruption(DSIs)**
- **NP-targeted sedation**
- **Suggest analgosedation**
- **Non-BZD based regimen recommended**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

理想藥物

- Rapid onset and offset
- Minimal respiratory depression
- No effect on cardiovascular function
- Inactive metabolites or lack of metabolites
- Metabolism and elimination not dependent on hepatic function
- Metabolism and elimination not dependent on renal function
- No drug interactions
- No pain on injection
- No associated tolerance or withdrawal
- Amnestic
- Inexpensive

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

Table 1. Sedatives and Analgesics in Common Use in the ICU.*

Drug (Brand Name)	Mechanism of Action	Typical Adult Dose	Pharmacokinetic Properties	Adverse Effects
Midazolam (Versed)	$GABA_A$ agonist	Bolus, 1 to 5 mg; infusion, 1 to 5 mg/hr	Half-life, 3 to 11 hr; active metabolite accumulates with prolonged infusion; metabolized by hepatic oxidation, with renal excretion of active metabolite	Possibly a higher risk of delirium and tolerance than with certain other sedatives
Lorazepam (Ativan)	$GABA_A$ agonist	Bolus, 1 to 4 mg; infusion, 1 to 5 mg/hr	Slower onset (5 to 20 min) than that of midazolam or diazepam (2 to 5 min); half-life, 8 to 15 hr; metabolized by hepatic glucuronidation, with no active metabolites, so offset may be more predictable than that of midazolam in critical illness	Possibly a higher risk of delirium and tolerance than with certain other sedatives
Diazepam (Valium; Diazemuls)	$GABA_A$ agonist	Bolus, 1 to 5 mg	Half-life, 20 to 120 hr; metabolized by hepatic desmethylation and hydroxylation; active metabolite accumulates in renal failure	Poorly soluble in water, so prolonged peripheral intravenous infusion may cause phlebitis; possibly a higher risk of delirium and tolerance than certain other sedatives
Propofol (Diprivan)	$GABA_A$ agonist, with other effects, including on glutamate and cannabinoid receptors	50 to 200 mg/hr or 1 to 3 mg/kg/hr	Half-life, 30 to 60 min after infusion; longer after prolonged infusion because of redistribution from fat stores; metabolized by hepatic glucuronidation and hydroxylation	Vasodilatation or negative inotropy causing hypotension or bradycardia; propofol infusion syndrome (lactic acidosis, arrhythmia, and cardiac arrest), mostly associated with prolonged infusion rates of >4 to 5 mg/kg/hr; hypertriglyceridemia; pancreatitis
Dexmedetomidine (Precedex)	α_2-Agonist	0.2 to 1.5 μg/kg/hr	Half-life, 2 hr; does not accumulate with prolonged infusion; metabolized by hepatic glucuronidation and oxidation, with no active metabolites	Transient hypertension, then hypotension; bradycardia, dry mouth, nausea

Midazolam

- **GABA agonist**
- **Dose: Bolus 1-5mg IVP; infusion: 1-10mg/hr**
- **Onset: 2-3 minutes**
- **Half-life: 3 – 11 hr (accumulates in fat)**

- **Active metabolite accumulates with prolonged infusion**
- **Metabolized by hepatic oxidation, with renal excretion of active metabolite**
- **Reversed with Flumazenil**
- **Obese (high lipid soluble) or patients with reduced serum albumin levels have prolonged sedative effect**
- **Possibly higher risk of delirium and tolerance**

Propofol

- **GABA agonist**
- **Dose: 20-100mcg/kg/hr**
- **Onset: 1-2 minutes**
- **Half-life: 30-60 minutes, longer after prolonged infusion because of redistribution from fat stores**

- **Metabolized by the liver**
- **Vasodilatation or negative inotropy causing hypotension or bradycardia**
- **10% lipid emulsion provides 1.1kcal/ml**

Dexmedetomidine

- **Alpha-2 agonist**
- **Dose: 0.2 – 1.5mcg/kg/hr**
- **Onset: 6-10 min**
- **Half-life: 2hrs**

- **Metabolized by liver, no active metabolites**
- **Does not accumulate with prolonged infusion**
- **Transient hypertension, then hypotension**
- **Does not cause respiratory depression**
- **Analgesic effects**

Which Best

- **Propofol or Benzodiazepines in MV patients**
- **Propofol or Dexmedetomidine over Benzodiazepines**
  - **Propopfol or Dexmedetomidine might be better**
  - **Monitor TG when > 2 days**
  - **Calories from Propofol**
  - **Bradycardia and Hypotension**
- **Propofol or Dexmedetomidine**
  - **Favor Dexmedetomidine**

Other Tools Available

- **Objective measures in non-comatose patients**
  - **Auditory evoked potentials**
  - **Bispectral index- best suited for sedative titration during deep sedation or NMBAs**
  - **Narcotrend index**
  - **Patient state index**
  - **State entropy**

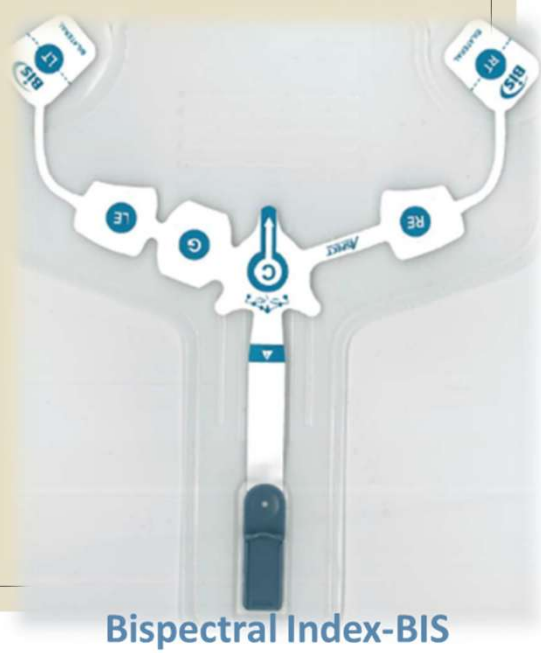
- **Objective measures can’t substitute subjective sedation scoring**

台灣成人加護病房病人疼痛、躁動和譫妄臨床診療指引 (Taiwan PAD)

BIS Index- a Scale correlate to EEG

- **BIS Index: dimensionless number from 0 to 100 scaled correlate to EEG**

BIS™ Monitoring Value Range	
100	Awake Responds to normal voice
80	Light/Moderate Sedation May respond to loud commands or mild prodding/shaking
60	General Anesthesia — Low probability of explicit recall — Unresponsive to verbal stimulus
40	Deep Hypnotic State
20	Burst Suppression
0	Flatline EEG



Bispectral Index-BIS

Time to Paralysis

- **Indications for continuous deep sedation or even paralysis**
  - **Intracranial hypertension**
  - **Severe respiratory failure**
  - **Refractory status epilepticus**
  - **Prevention of awareness in patients treated with NMBAs**

台灣成人加護病房病人疼痛、躁動和譫妄臨床診療指引 (Taiwan PAD)

EEG based Patient State Index(PSI)

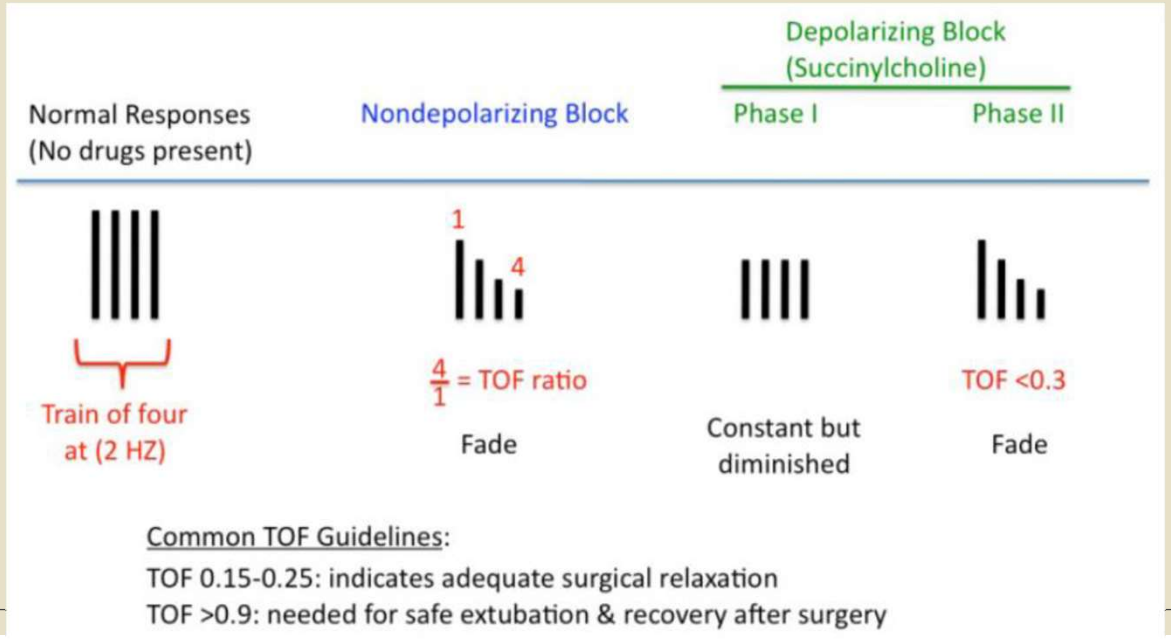
- **PSI: proprietary computed EEG variable that is related to the effect of anesthetic agents**
- **Suppression Ratio(SR): the suppression of the electrical activity of the frontal and pre-frontal cortex of the brain as a percentage of time**
- **Asymmetry(Asym): difference in brain activity between the L't and R't**
- **EMG: the detected muscle activity**

- **對深度鎮靜或麻醉病人意識更完整掌握**

Masimo SedLine Module

Neuro Muscular Transmission(NMT) Measurement

- **Train-Of-Four Stimulation mode(TOF)**
- 對深度鎮靜或麻醉病人意識更完整掌握



NMT Measurement

DELIRIUM

- **Acute change in global cognitive function affecting attention, arousal, orientation, or perception**

- **Worsen prognosis of ICU patients**
- **Prolong ICU stay**
- **Influences subsequent cognitive dysfunction outside ICU**

- **Encourage monitoring ICU patients for symptoms of delirium with an objective instrument**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

- 1/3 patients > 70 y/o admitted to hospital
  - 50% delirious on admission
  - 50% develops delirium in the hospital

- Postoperative delirium among seniors:
  - elective surgery: 15-25%
  - high risk procedures (hip Frx and CVS): > 50%

- ICU: may > 75%
- End of life: as high as 85%

Risk Factors for Delirium in ICU

- **Pre-existing Dementia or cognitive impairment**
- **High Severity of illness on admission**
- **Sedative-induced and multifactorial coma**
- **Old age**
- **History of Alcohol or Drug abuse**

台灣成人加護病房病人疼痛、躁動和譫妄臨床診療指引 (Taiwan PAD)

During the ICU/Hospital Stay

- Increased mortality
- 3x greater re-intubation rate
- Average 10 additional days in hospital
- Higher costs of care

After Hospital Discharge

- Increased mortality
- Long-term cognitive impairment
- Requirement for chronic care facility
- Decreased functional status at 6 months

藥物治療 及 非藥物治療

- 絕對要先排除病人生理（疾病）的問題！
- 情緒和環境的支持為主

- **Medications: Quetiapine (recommended), haloperidol, risperidone**

- **Bring familiar objects (glasses, hearing aids, clockers, calendars, photos of families and friends)**
- **Regular reorientation of the patient by a familiar person**
- **Room with natural lights and restore normal sleep-wake cycle**
- **Recommend early mobilization whenever feasible**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

非藥物治療

Antipsychotics僅減少躁動

- 治療造成Delirium之原因
- Review medication (減少非必要用藥/anticholinergics)
- 減少約束/保持安全性?/情緒支持 and 提供安全感
- 固定照顧的醫療人員/避免更換床位
- 反覆加強定向感 (大數字時鐘/日曆/電視?/music)
- 改善夜間睡眠品質 (夜晚減少噪音&治療/控制光線)
- 盡早讓病人下床活動/抬高床頭/床上活動/看書報
- 向家屬解釋Delirium相關知識/熟悉的家人探望
- 適當營養/水分補充/O_2
- 視力/聽力輔助用具(眼鏡/助聽器)

台灣成人加護病房病人疼痛、躁動和譫妄臨床診療指引 (Taiwan PAD)

- **Recommend early mobilization whenever feasible to reduce delirium**
- **Not suggested: prevention with haloperidol or atypical antipsychotics**
- **Not recommended: treatment with Dexmedetomidine**
  - **no evidence?**

台灣成人加護病房病人疼痛、躁動和譫妄臨床診療指引 (Taiwan PAD)

有效處置

- **Dexmedetomidine for delirium in mechanically ventilated adults where agitation is precluding weaning/extubation**
- **Multicomponent, nonpharmacologic intervention that is focused on (but not limited to) reducing modifiable risk factors for delirium, improving cognition, and optimizing sleep, mobility, hearing, and vision**
- **Performing rehabilitation or mobilization in critically ill adults to optimize functioning and reduce disability in individuals with a health condition**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

IMMOBILITY

- **Survivors long-term sequelae-ICU-acquired muscle weakness (ICUAW)**
  - **Occur in 25–50%**
  - **Associated with survival, physical functioning, and quality of life**

- **Most important risk factor for ICUAW is bed rest**
  - **Influence on ICUAW and impaired physical functioning**
  - **Beneficial as a delirium management**
  - **Participant effect on analgesic and sedation practices**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

- **Rehabilitation/mobilization:**
  - **Significantly:**
    - **Improve muscle strength at ICU discharge**
    - **Reduce duration of mechanical ventilation**
  - **Moderate but not significant:**
    - **Improve health-related quality life in 2 Mons of discharge**
  - **Adverse events incidence very low**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

SLEEP DISRUPTION

重症睡眠照護

- 提升重症病人睡眠品質
  - 國外的文獻很少
  - 國內沒有相關文獻
- 重症睡眠評估不易執行
  - 大多數醫院沒有重症睡眠評估
- 重症優質睡眠不易達到

重要性

- **Common complaint**
- **Source of distress**

- **Characterized by**
  - **Sleep fragmentation**
  - **Abnormal circadian rhythms**
  - **Increased light sleep**
  - **Decreased slow-wave and REM sleep**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

- **Sleep-promoting multicomponent protocol suggested**
- **No preferred medication?**

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

REACHING GOAL .....YET?

EPOC Strategies

- **Cohort studies**
  - **Mortality (risk ratio [RR] 1.01; 95% CI, (**
  - **Delirium (RR 0.92; 95% CI, 0.82–1.03)**
  - **MV duration (weighted mean difference -**
  - **ICU LOS (WMD −0.77 d; 95% CI, −1.51**
- **RCTs**
  - **Reduced Mortality and MV duration**
  - **No difference over Delirium or ICU LOS**

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ICU Liberation

ICU Liberation is the overarching philosophy and practice directed at improving care by "liberating" ICU patients from pain, oversedation, delirium, mechanical ventilation, immobility and isolation, as well as from post-discharge sequelae that can be life-altering for many patients.

2018 Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU (PADIS Guidelines)

The PADIS Guidelines provide a roadmap for developing integrated, evidence-based, and patient-centered protocols which can be implemented through the ICU Liberation Bundle.

Assess, prevent, and manage pain | Both SAT and SBT | Choice of analgesia and sedation | Delirium: Assess, prevent, and manage | Early mobility and exercise | Family engagement and empowerment

The ICU Liberation Bundle

Represents the implementation strategy used to provide each of the recommendations in the PADIS guidelines to every ICU patient.

A — Assess, prevent, and manage pain
Understand pain and find tools for its assessment, treatment, and prevention

B — Both SAT and SBT
Use both spontaneous awakening trials and spontaneous breathing trials

C — Choice of analgesia and sedation
Understand the importance of the depth of sedation and choosing the right medication

D — Delirium: Assess, prevent, and manage
Understand delirium risk factors and find tools for its assessment, treatment, and prevention

E — Early mobility and exercise
ICU early mobility involves more than changing the patient's position

F — Family engagement and empowerment
Involving the family in patient care can help patients recover

Society of Critical Care Medicine
The Intensive Care Professionals

ICU LIBERATION
LIBERATION, ANIMATION, RESTORATION

Implementation of the ICU Liberation Bundle is associated with:

- 72% decrease in next day mechanical ventilation
- 68% reduction in hospital death within 7 days
- 65% decrease in next day comas
- 63% reduction in next day use of physical restraints
- 46% decrease in ICU readmissions
- 40% decrease in next day delirium
- 36% decrease in likelihood of being discharged to nursing home and rehab facilities

Learn more about the ICU Liberation Initiative at iculiberation.org.

ICU LIBERATION

Physical Restraint

NO

- **Restrained associated with**
  - **longer duration of ventilation (5.9 ± 8.2 vs. 0.36 ± 1.4 days; p < .001)**
  - **higher 28-day mortality (0.26 ± 0.45 vs. 0.07 ± 0.25, Z = 6.86, p < .001)**

- **More in-hospital antipsychotic treatment (60 [23.2%] vs. 11 [2.8%], respectively; p < .001)**
- **Greater tendency for agitation(episodes of RASS> 0[1.7 ± 4.0 vs. 0.04 ± 0.27; p < .001])**
- **Severer agitation scores (max. RASS [0.19 ± 1.6 vs. 0.01 ± 0.54, respectively; p < .001])**


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RESEARCH ARTICLE

BACN Nursing in Critical Care WILEY

Physical restraint and associated agitation

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Dexmedetomidine

- **SE increased by 37.6% (29.7;45.6 95% CI) versus 3.7% (11.4;18.8 95% CI)(p < .001)**
- **TST prolonged by 271 min(210;324 95% CI) versus 27 min(82;135 95% CI)(p < .001)**
- **No difference in REM sleep, delirium physical activity, or RASS score**

- **(DecatSepsis)Lower rescue Epinephrine usage**
- **No clinical beneficial effect on Septic shock patient**

- **(A2B RCT)Not superior to Propofol on weaning trial performance**

- **RASS: -2 as outcomes cutting level**


Research

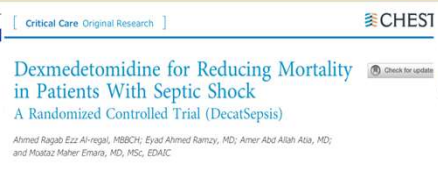
JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Dexmedetomidine- or Clonidine-Based Sedation Compared With Propofol in Critically Ill Patients
The A2B Randomized Clinical Trial


RESEARCH ARTICLE

Sleep quality and quantity determined by polysomnography in mechanically ventilated critically ill patients randomized to dexmedetomidine or placebo

Jakob Oxlund | Torben Knudsen | Mikael Sörberg | Thomas Strøm | Palle Toft | Poul Jørgen Jennum


Critical Care Original Research

CHEST

Dexmedetomidine for Reducing Mortality in Patients With Septic Shock
A Randomized Controlled Trial (DecatSepsis)


Anaesthesia Critical Care & Pain Medicine

Original Article

Effects of dexmedetomidine versus propofol on outcomes in critically ill patients with different sedation depths: a propensity score-weighted cohort study

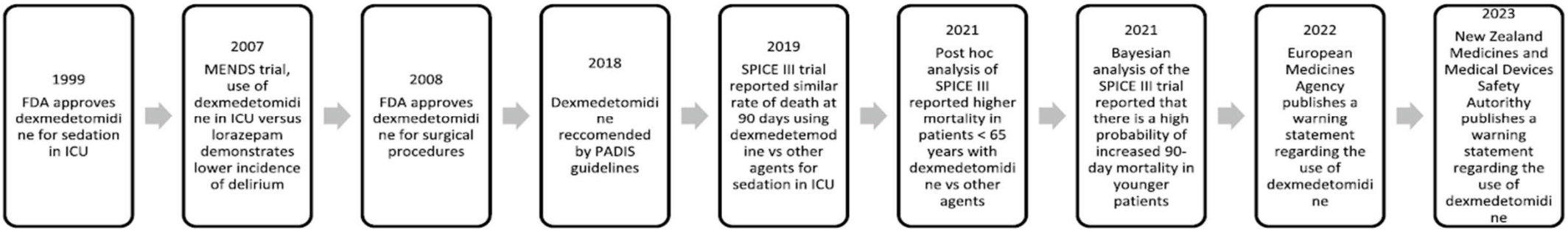


Fig. 1 Timeline of key milestones in the use of dexmedetomidine in critically Ill patients

- **Higher probability of 90-day mortality in aged ≤ 65 years(OR 1.26, 95% CI 1.02–1.56) with a 98.5% probability of harm compared to usual care**
- **Sub-analysis of SPICE III explored that increasing the dexmedetomidine dose was associated with elevated 90-day mortality in younger (age < 65 years) patients (median [IQR] dose, 0.54 [0.35–0.72] vs. 0.44[0.27–0.64] µg/kg/h; *p* =0.001; HR 1.3, 95% CI 1.03–1.65, *p* = 0.029)**
- **Systematic review and meta-analysis of RCT evaluated the use of dexmedetomidine in patients with sepsis reported a lower incidence of mortality associated with dexmedetomidine compared to any other intervention (RR 0.83, 95% CI[0.69, 0.99])**


Pérez-Nieto et al. Critical Care (2023) 27:332
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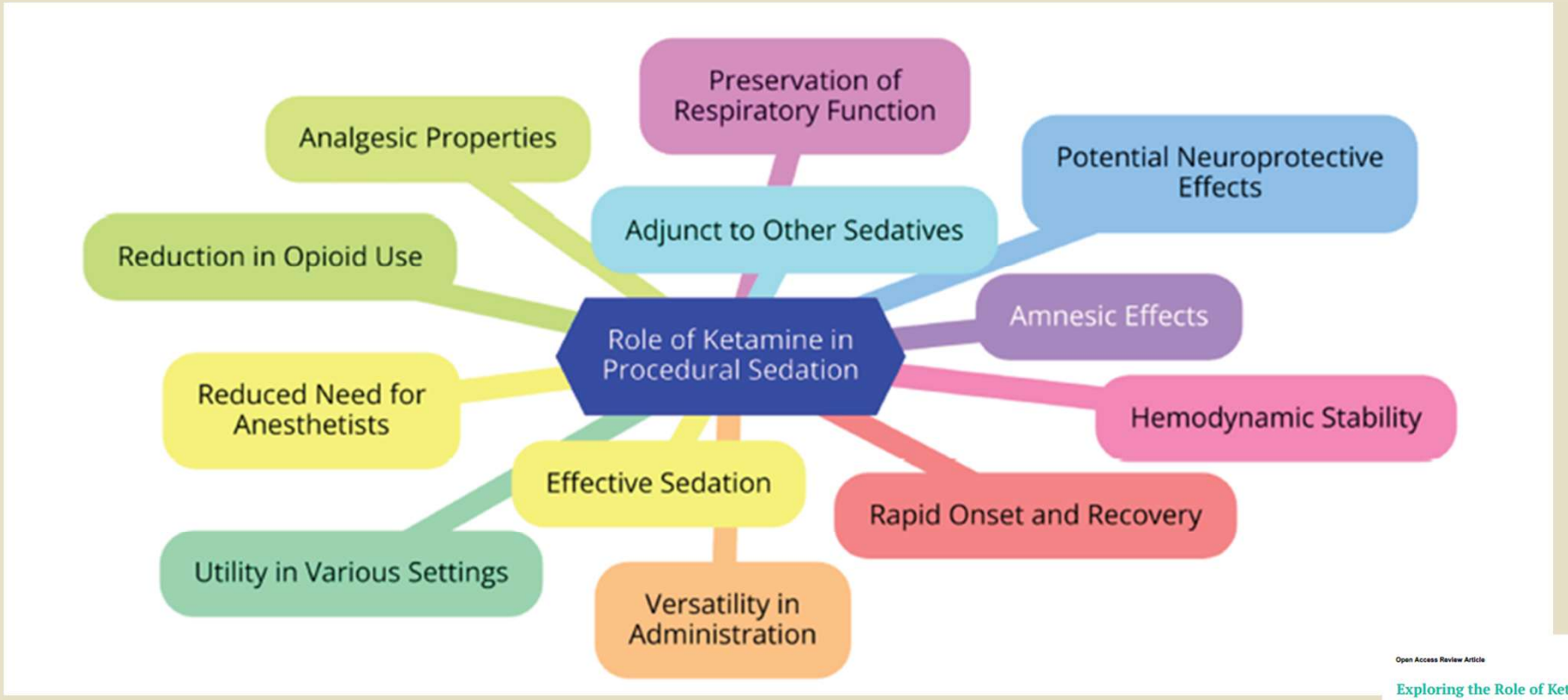
Critical Care

CORRESPONDENCE Open Access

Use of dexmedetomidine in critical-ill patients: is it time to look to the actual evidence?

Orlando R. Pérez-Nieto[1], Rafael A. Reyes-Monge[1], Ignacio Rodríguez-Guevara[2], Eder I. Zamarrón-López[2] and José A. Meade-Aguilar[2*]

Ketamime



Open Access Review Article

Published via DMIHER Datta Meghe Medical College

Exploring the Role of Ketamine Sedation in Critically Ill Patients: A Comprehensive Review

Souvik Banik [1], Sheetal Madavi [1]

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Corresponding author: Souvik Banik, souvikbanik714@gmail.com

Ketamime

- **Against using ketamine as monotherapy analgo-sedation in critically ill adults with iMV**
  - **If other analgo-sedatives available**

- **Ketamine as an adjunct to non-ketamine usual care sedatives (e.g., opioids, propofol, dexmedetomidine) or continuing with non-ketamine usual care sedatives alone**


Critical Care and Resuscitation

SPECIAL ARTICLE

Ketamine Analgo-sedation for Mechanically Ventilated Critically Ill Adults: A Rapid Practice Guideline from the Saudi Critical Care Society and the Scandinavian Society of Anesthesiology and Intensive Care Medicine

Marwa Amer[1,2], Morten Hylander Møller[3,4,5], Mohammed Alshahrani[6], Yahya Shehabi[7,8], Yaseen M. Arabi[9], Fayez Alshamsi[10], Martin Ingi Sigurðsson[11,12], Marius Rehn[13,14,15], Michelle S. Chew[16], Maija-Liisa Kalliomäki[17], Kimberley Lewis[18,19], Faisal A. Al-Suwaidan[20,21,22,23], Hasan M. Al-Dorzi[6], Abdulrahman Al-Fares[24,25], Naif Alsadoon[26], Carolyn M. Bell[27,28], Christine M. Groth[29], Rachael Parke[30,31], Sangeeta Mehta[32], Paul E. Wischmeyer[33], Awad Al-Omari[34], Klaus T. Olkkola[35], Waleed Alhazzani[5,18,19,36,37]

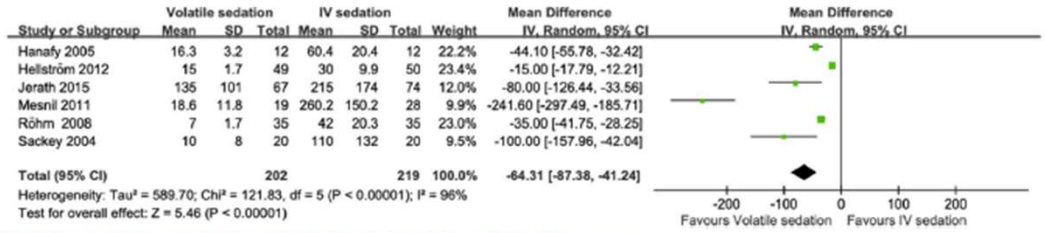


Fig. 4 Forest plot of awakening time (min) in the volatile sedation and IV sedation groups

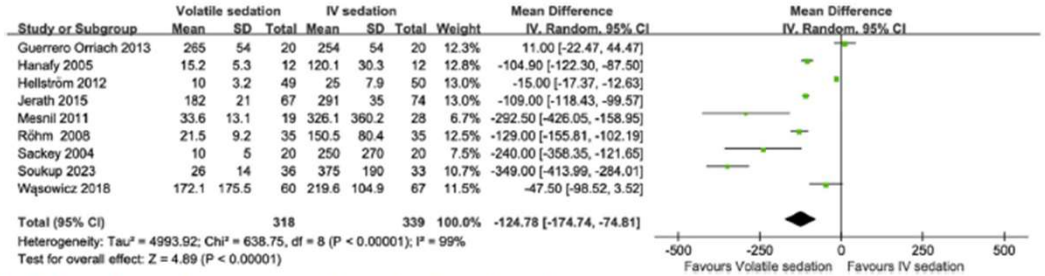


Fig. 5 Forest plot of extubation time (min) in the volatile sedation and IV sedation groups

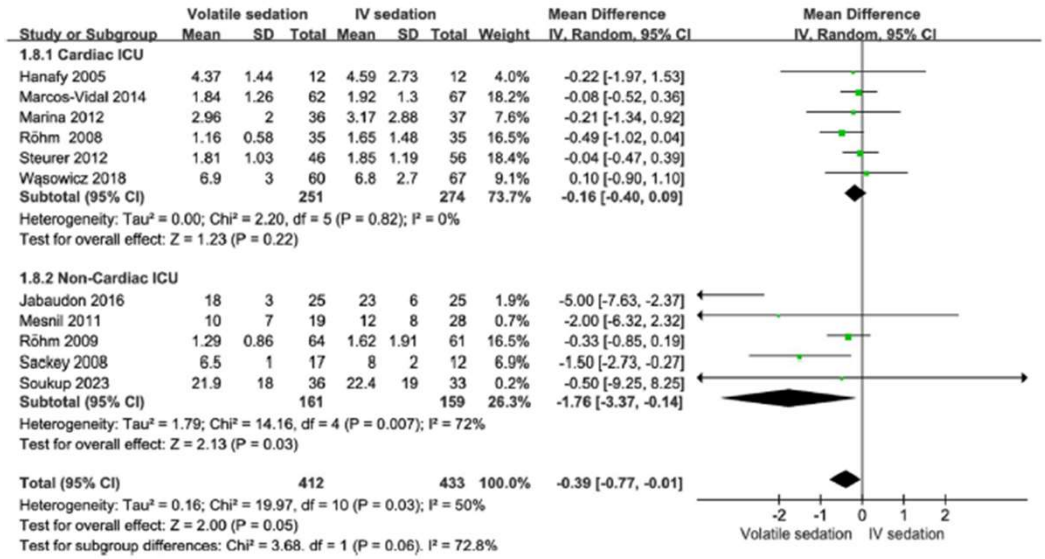


Fig. 6 Forest plot of ICU LOS (days) in the volatile sedation and IV sedation groups

Inhaled Sedative Agents

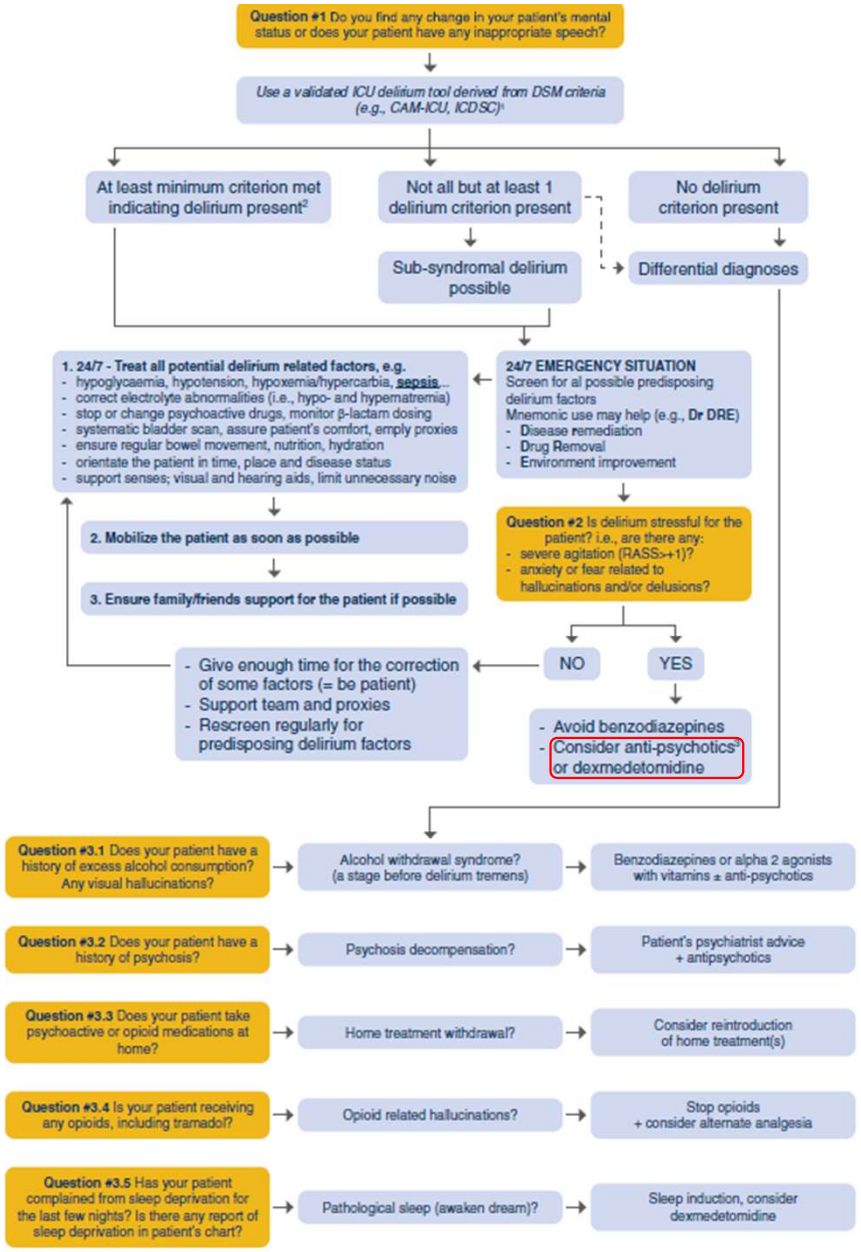
Feng et al. Systematic Reviews (2025) 14:44
https://doi.org/10.1186/s13643-025-02791-6

Systematic Reviews

RESEARCH Open Access

Safety and effectiveness of inhaled sedation in critically ill patients: a systematic review and meta-analysis

Fang Feng[1†], Huaxiong Kang[1†], Zhaohui Yang[1], Li Ma[1] and Yu Chen[1]



NARRATIVE REVIEW

Delirium in critical illness: clinical manifestations, outcomes, and management

Joanna L. Stollings[1,2*], Katarzyna Kotfis[3], Gerald Chanques[4], Brenda T. Pun[1,5], Pratik P. Pandharipande[1,5,6] and E. Wesley Ely[1,5,7,8]

VR 重症虛擬運動會

Hanifa et al. Pilot and Feasibility Studies (2025) 11:124
https://doi.org/10.1186/s40814-025-01707-4
Pilot and Feasibility Studies
RESEARCH
Open Access

Virtual reality for relaxation in intensive care unit patients: feasibility, acceptability and intervention adaptation

Ann Louise Hanifa[1,2*], Pia Dreyer[1,2], Søren Aagaard[3] and Anna Holm[1,2]

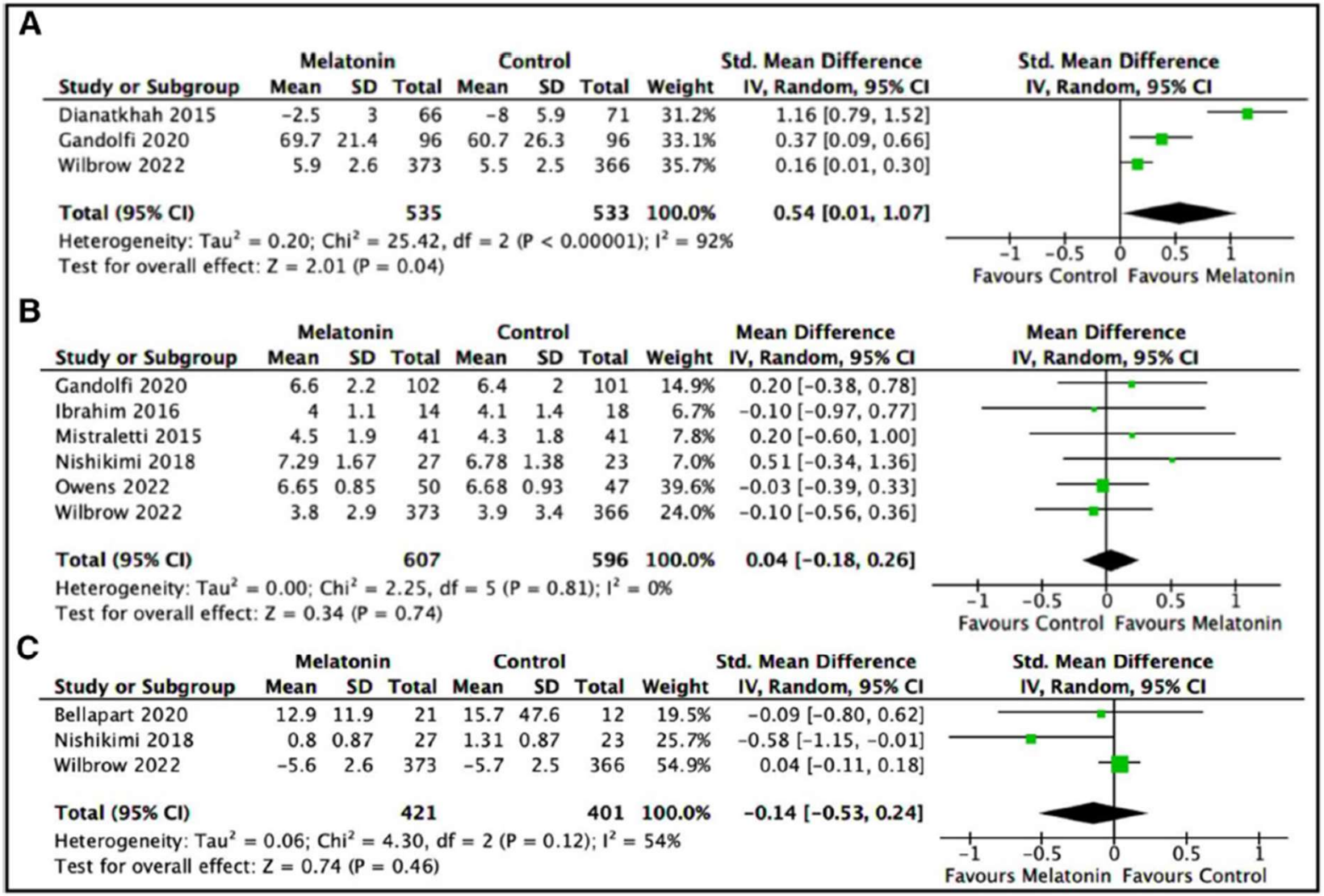


Figure 2. Forest plots of sleep outcomes. **A**, Perceived sleep quality (standard mean difference). **B**, Sleep quantity (total sleep time, hr). **C**, Awakenings (standard mean difference). *df* = degrees of freedom.

Melatonin

Critical Care Medicine
[September 2025 • Volume 53 • Number 9 • Pages e1714–e1724]
FEATURE ARTICLE

Melatonin Use in the ICU: A Systematic Review and Meta-Analysis

Melatonin

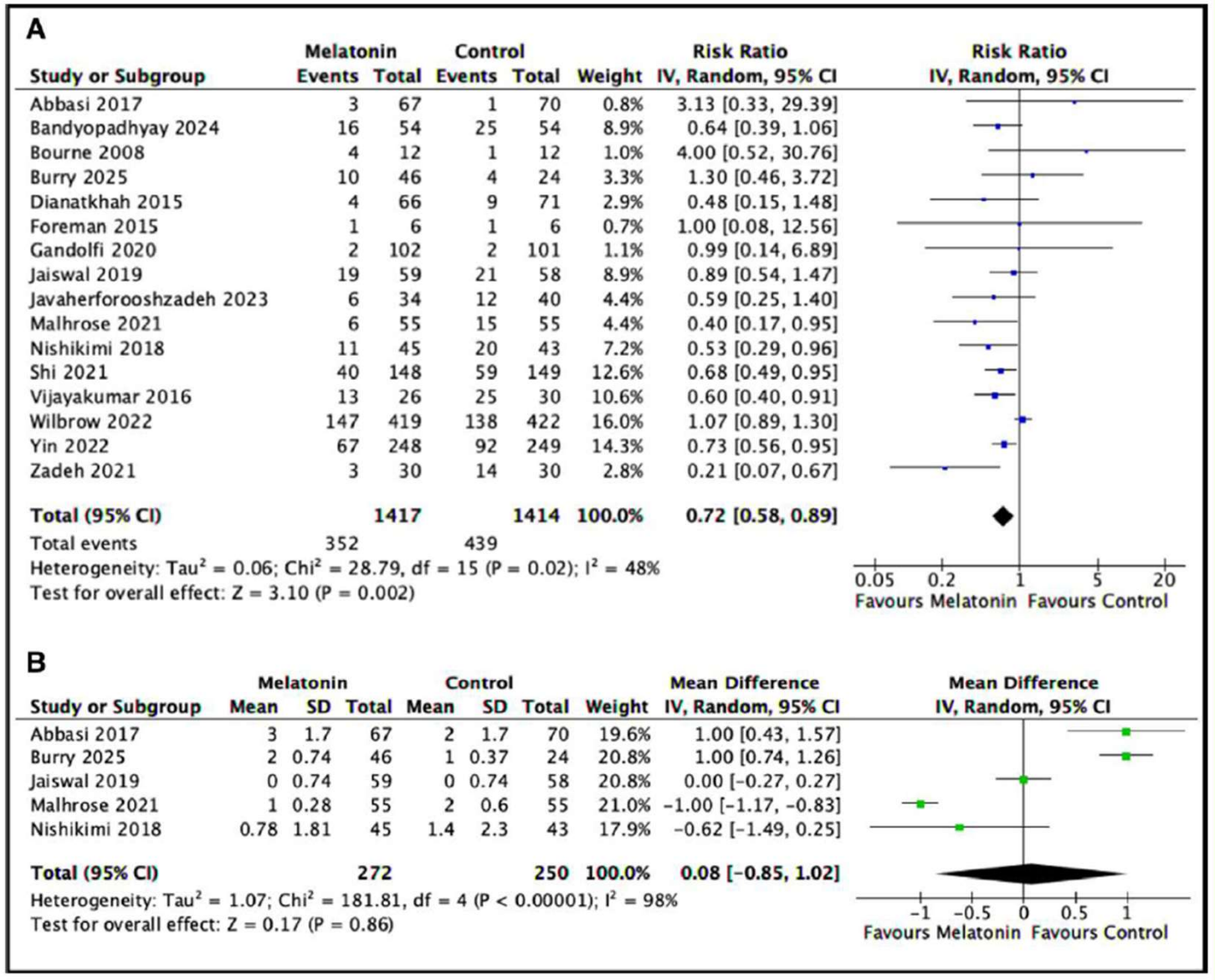
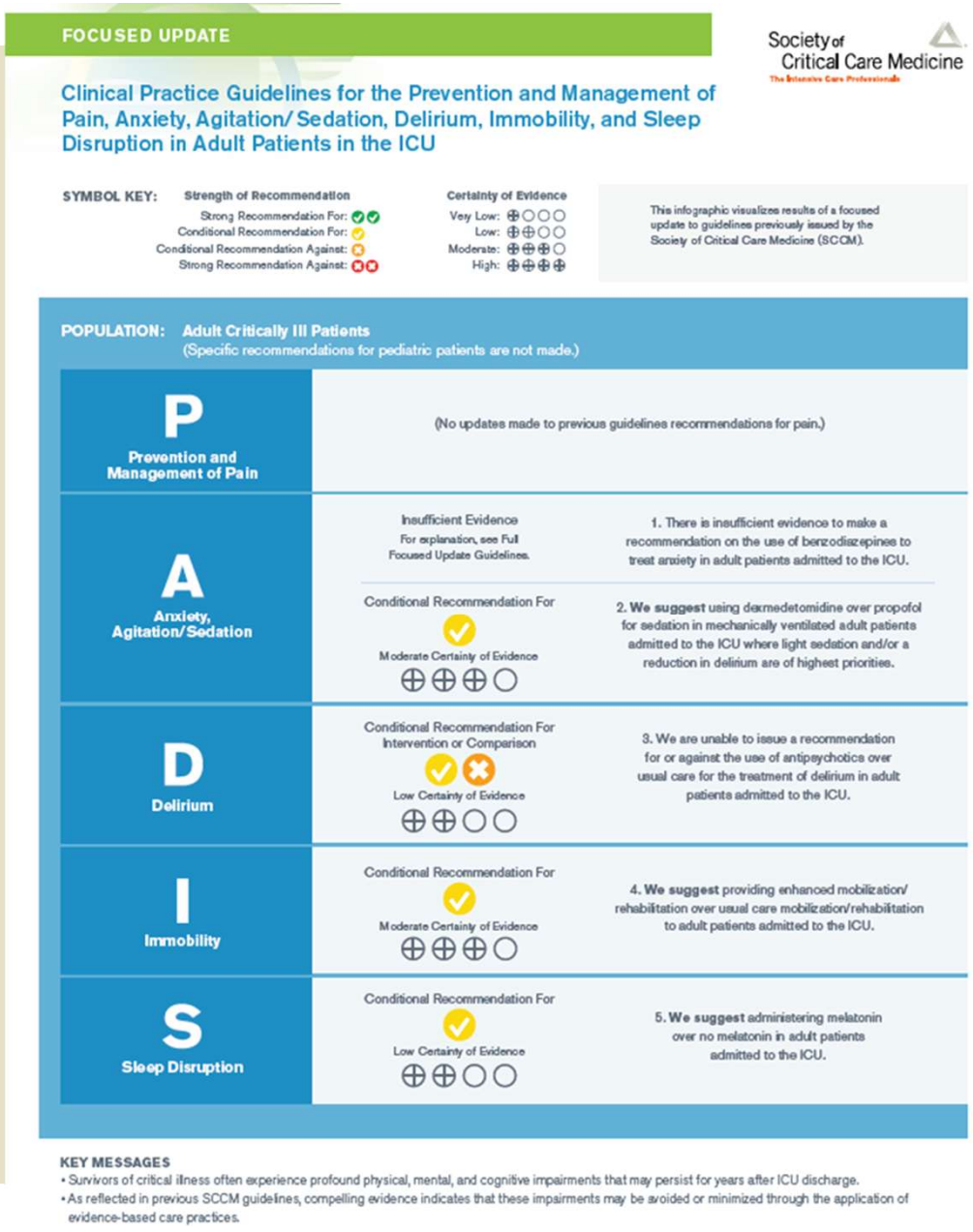


Figure 3. *Forest plots* for delirium outcomes. **A**, Prevalence of delirium. **B**, Duration of delirium (d). *df* = degrees of freedom.

Critical Care Medicine
September 2025 • Volume 53 • Number 9 • Pages e1714–e1724
FEATURE ARTICLE

Melatonin Use in the ICU: A Systematic Review and Meta-Analysis



- **No specific update over Pain control**
- **Not able to recommend treatment over Anxiety**
- **Suggest DEX over Propofol treatment over Agitation/Sedation management from the angle of light sedation and Delirium prevention**
- **Not able to recommend treatment over Delirium with antipsychotic medication**
- **Suggest enhancing rather than usual Mobilization/Rehabilitation plan**
- **Suggest Melatonin for Sleep Disruption management**

A Focused Update to the Clinical Practice Guidelines for the Prevention and Management of Pain, Anxiety, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

本院實務成果

重症PADIS整合資訊評估處置系統

評估 → 提醒 → 處置 → 稽核

創意來源

飛航測試

入院文件 | FS流程表 | N護理紀錄 | N特殊交班事項 | Physician Notes | 藥囑 | 醫囑 | 呼吸治療（RT）

- MDRO主動篩檢個案登錄表
- MDRO泛抗藥性菌株每
- 加護中心特殊護理紀錄
- 床邊復健紀錄表
- 譫妄評估紀錄(CAM-IC
- 體溫表

I

- Pain Graph
- 疼痛持續評估 ...
- CPOT(q4h)
- FLACC
- 數字量表
- 腕譜量表
- RASS(q2h)
- CAM-ICU評估(q8
- 睡眠評估(7AM)

成人加護病房PADIS [每隔4小時自動紀錄]	2019/01/23 07:00	
疼痛評估時機:除使用肌肉鬆弛劑，所有病人每4小時評估一次。		P
若臨時醫囑、需要時醫囑或劑量增加		
CPOT(意識不清或使用鎮靜劑、呼吸器而無法正常表達。		
不能用於使用肌肉鬆弛劑病人)		
CPOT無法評估(系統判斷)		
⊞ CPOT Scale		
RASS	-3	A
RASS變化		
⊞ 處方.		
⊞ Midazolam 60 mg/238 ml 0.9% NS	5/0.016 (77.5)	
特徵1：過去24小時RASS是否變動		D
特徵2：注意力不集中(錯誤>2)		
特徵3：目前意識程度(RASS是否為0)		
睡眠評估(評估條件:意識清楚之病患)		S
⊞ 睡眠評估		

Pain

評估工具：數字量表、CPOT

評估人員：護理師

評估時機：

1. 除使用肌肉鬆弛劑，所有病人每4小時評估一次
2. 若臨時醫囑、需要時醫囑或劑量增加須再評估一次。
（針劑止痛藥後30分鐘、口服止痛藥後1小時）

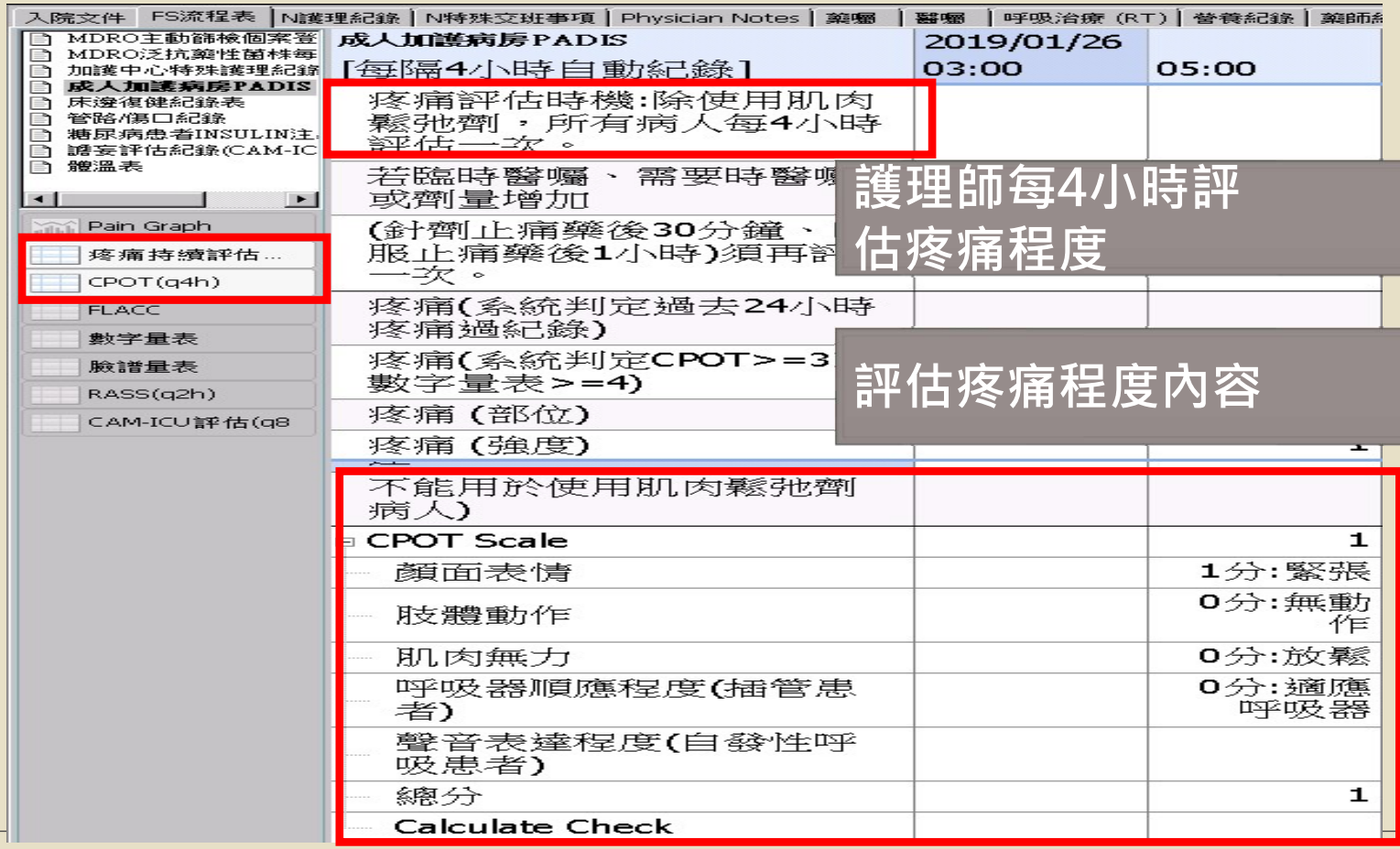
結果及處置：

維持CPOT≦2分、數字量表≦3分

若疼痛分數超過目標值，通知醫師調整止痛劑使用

重症評估資訊系統

評估 提醒 處置 稽核



創意來源

電子報稅系統

Agitation

評估工具：RASS(Richmond Agitation-Sedation Score)

評估人員：護理師

評估時機：

1. 除使用肌肉鬆弛劑，所有病人每2小時評估一次
2. 若病人使用鎮靜劑，由護理人員依RASS分數（白天06:30後維持RASS 0~-1，晚上21:00後維持RASS -1~-3 ）
3. 調整鎮靜劑，維持輕微鎮靜為原則

鎮靜劑劑量調整建議（先減半再微調）

1. 使用Propofol/Precedex病人，於0630開始調整鎮靜劑
2. 使用Midazolam病人，於0500開始調整鎮靜劑

重症躁動評估資訊系統

評估 提醒 處置 稽核

入院文件 | FS流程表 | N護理紀錄 | N特殊交班事項 | Physician Notes | 藥囑 | 醫囑 | 呼吸治療 (RT) | 營養紀錄 | 藥師紀錄 | 復健科 | 檢驗檢

- MDRO主動篩檢個案管
- MDRO泛抗藥性菌株每
- 加護中心特殊護理紀錄
- **成人加護病房PADIS**
- 床邊復健紀錄表
- 管路/傷口紀錄
- 糖尿病患者INSULIN注
- 譫妄評估紀錄(CAM-IC
- 體溫表

- Pain Graph
- 疼痛持續評估...
- CPOT(q4h)
- FLACC
- 數字量表
- 臉譜量表
- RASS(q2h)
- CAM-ICU評估(q8

成人加護病房PADIS [每隔4小時自動紀錄]	2019/01/26 17:00	19:00	21:00
RASS			
RASS變化			
⊞ 處方.			

<清除輸入>
+4=攻擊行為
+3=非常躁動，想要移除管路
+2=躁動，無法配合呼吸器
+1=焦慮
0=警醒且平靜
-1=對聲音有反應，眼神對焦>10秒
-2=對聲音有反應，眼神對焦<10秒
-3=只對聲音有反應
-4=只對刺激有反應，對聲音沒有
-5=完全沒有反應
無法評估
其他...

創意來源

電子報稅系統

鎮靜藥物劑量自動導航資訊系統

評估 → 提醒 → 處置 → 稽核

創意來源
GOOGLE
自動導航

護病房PADIS

成人加護病房PADIS	2019/06/17 21:00	23:00	2019/06/18 01:00	03:00	05:00	07:00	09:00
系統提醒判斷:是否調整鎮靜劑劑量	請調整鎮靜劑-調降用量	---	---	---	---	請調整鎮靜劑-調降用量	請調整鎮靜劑-調升用量
RASS	-2	-2	-3	-3	-3	-3	+

- 白天：06:00 ~ 21:59
- 目標：維持病人 RASS 0 ~ -1
  - RASS ≧1 系統建議 “調升鎮劑藥物劑量”
  - RASS ≦-2 系統建議 “調降鎮劑藥物劑量”
- 晚上：22:00 ~ 05:59
- 目標：維持病人 RASS -1 ~ -3
  - RASS ≧0 系統建議 “調升鎮劑藥物劑量”
  - RASS ≦-4 系統建議 “調降鎮劑藥物劑量”

Delirium

評估工具：**CAM-ICU**

評估人員：護理師

評估時機：

1.所有病人每**8**小時評估一次

2.無法評估者：**RASS -3~-5**系統自動判定無法評估、失聰或重聽到使用聽診器也聽不到

STEP **1** **RICHMOND AGITATION-SEDATION SCALE (RASS)**

Sedation Assessment

Scale	Label	Description	
+4	COMBATIVE	Combative, violent, immediate danger to staff	VOICE
+3	VERY AGITATED	Pulls to remove tubes or catheters; aggressive	
+2	AGITATED	Frequent non-purposeful movement, fights ventilator	
+1	RESTLESS	Anxious, apprehensive, movements not aggressive	
0	ALERT & CALM	Spontaneously pays attention to caregiver	
-1	DROWSY	Not fully alert, but has sustained awakening to voice (eye opening & contact >10 sec)	
-2	LIGHT SEDATION	Briefly awakens to voice (eyes open & contact <10 sec)	
-3	MODERATE SEDATION	Movement or eye opening to voice (no eye contact)	

If RASS is ≥ -3 proceed to CAM-ICU (Is patient CAM-ICU positive or negative?)

-4	DEEP SEDATION	No response to voice, but movement or eye opening to physical stimulation	TOUCH
-5	UNAROUSEABLE	No response to voice or physical stimulation	

If RASS is -4 or -5 → STOP (patient unconscious), RECHECK later

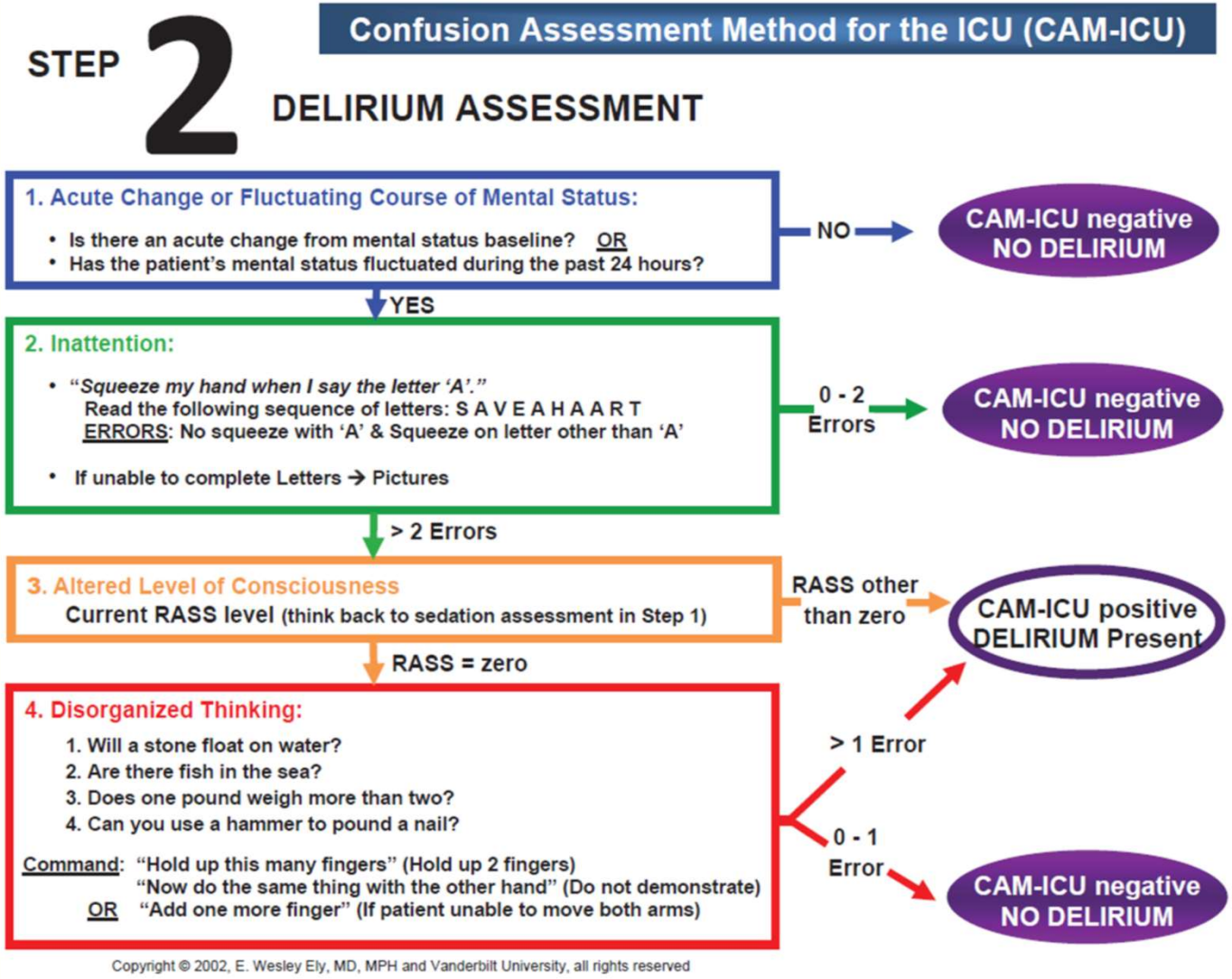
Sessler, et al., Am J Repir Crit Care Med 2002, 166: 1338-1344 Ely, et al., JAMA 2003; 286, 2983-2991

急性發作

注意力不集中

意識改變

思考混亂



CAM-ICU資訊評估系統

評估 提醒 處置 稽核

特徵一、精神狀態改變
(24小時RASS是否波動)

智慧設計

是

特徵二、注意力不集中
(聽到特定數字能正確握手)
護理師評估

錯誤0-2 → 無譫妄

錯誤>2個以上

特徵三、意識程度改變
(RASS是否為0)

智慧設計

RASS=0

特徵四、無組織的思考
1.石頭會浮在水面上?
2.海裡有魚嗎?
3.一斤比兩斤重嗎?
護理師評估

錯誤>1 → 譫妄

錯誤0-1 → 無譫妄

系統自動判定

創意來源
GOOGLE
自動導航

譫妄提醒自動導航資訊系統

評估 → 提醒 → 處置 → 稽核

創意來源
GOOGLE
自動導航

入院文件 | FS流程表 | N護理紀錄 | N特殊交班事項 | Physician Notes | 藥囑 | 醫囑 | 呼吸治療

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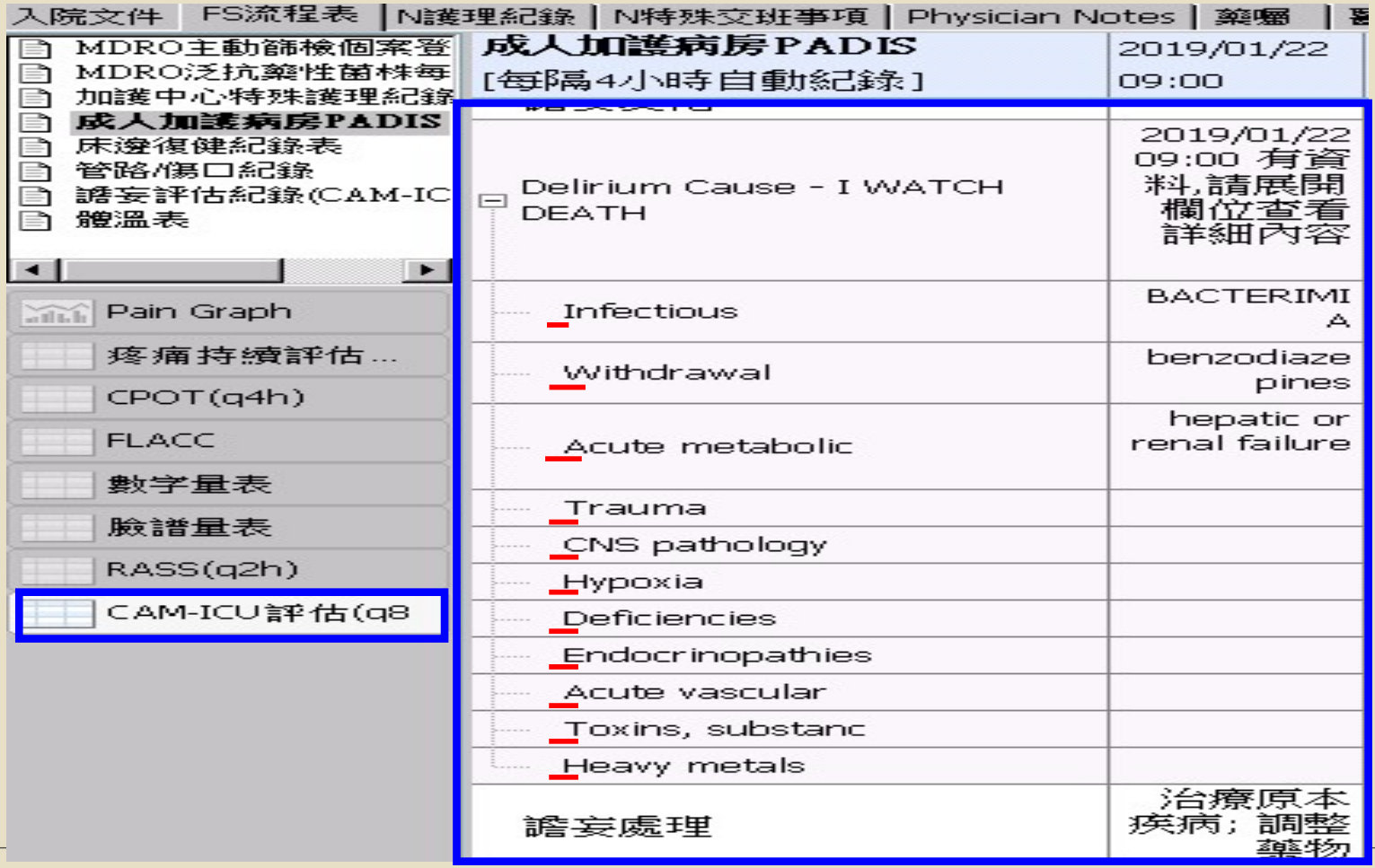
- **成人加護病房PADIS**
- 床邊復健紀錄表
- 管路/傷口紀錄
- 譫妄評估紀錄(CAM-IC
- 體溫表
- Pain Graph
- 疼痛持續評
- CPOT(q4h)
- FLACC
- 數字量表
- 臉譜量表
- RASS(q2h)
- CAM-ICU評估(q8
- 睡眠評估(7AM)

成人加護病房PADIS [每隔4小時自動紀錄]	2019/01/15 07:00	09:00
RASS	-2	-2
RASS變化		
⊞ 處方.		
特徵1：過去24小時RASS是否變動		是
特徵2：注意力不集中(錯誤>2)		是
誤>1)		
譫妄		是
譫妄變化		→*
⊞ Delirium Cause - I WATCH DEATH		
譫妄處理		
⊞ 光療		

系統自動判定是否有譫妄

I WATCH DEATH
重症譫妄原因分析系統



Immobility

評估工具：**EGDM和IMS**

評估人員：護理師

評估時機：

1.所有病人每天評估一次

2.依排除條件系統自動判定排除及納入條件

3.由臨床主責團隊判斷是否早期活動暨復健介入

資訊系統自動篩選早期活動病人

篩選 提醒 執行 登錄

臨床資訊系統，每日0700自動搜尋病人過去24小時資料庫資料

EGDM*生理、臨床參數符合下床條件

未達

未達收案條件

ICIP白板出現請醫師評估EGDM

醫師臨床判定不合適

醫師排除收案

醫師臨床判定排除條件

無

照會復健科

開立運動處方

評估IMS**

依照IMS得分安排心肺復健活動***

請執行心肺復健

創意來源

電腦選花生

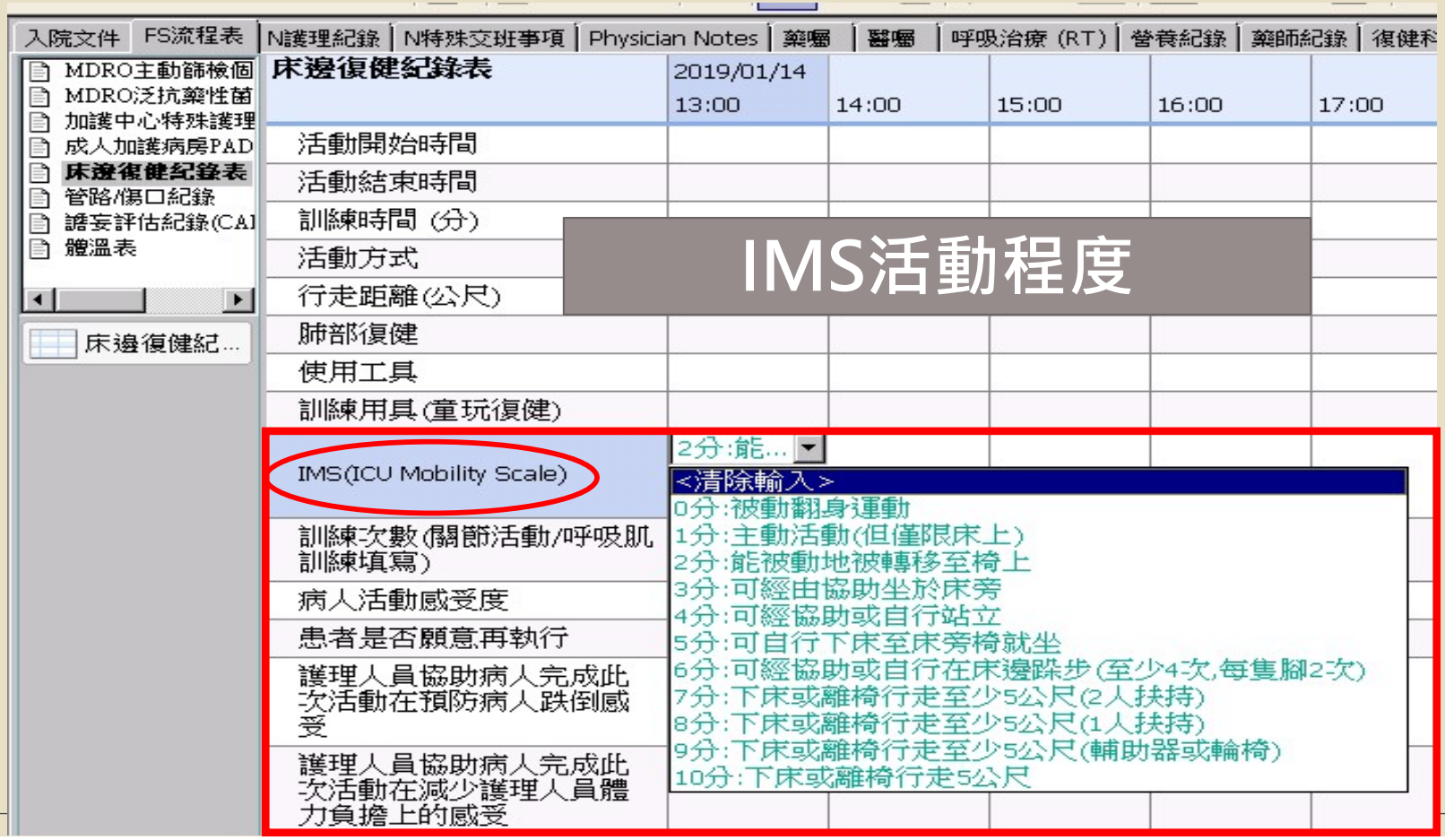
*早期目標導向下床(Early goal-directed mobilization, EGDM)
**加護病房活動量表(ICU mobility scale, IMS)

重症分級(IMS)早期復健系統

篩選 → 提醒 → **執行** → 登錄

創意來源

電影分級

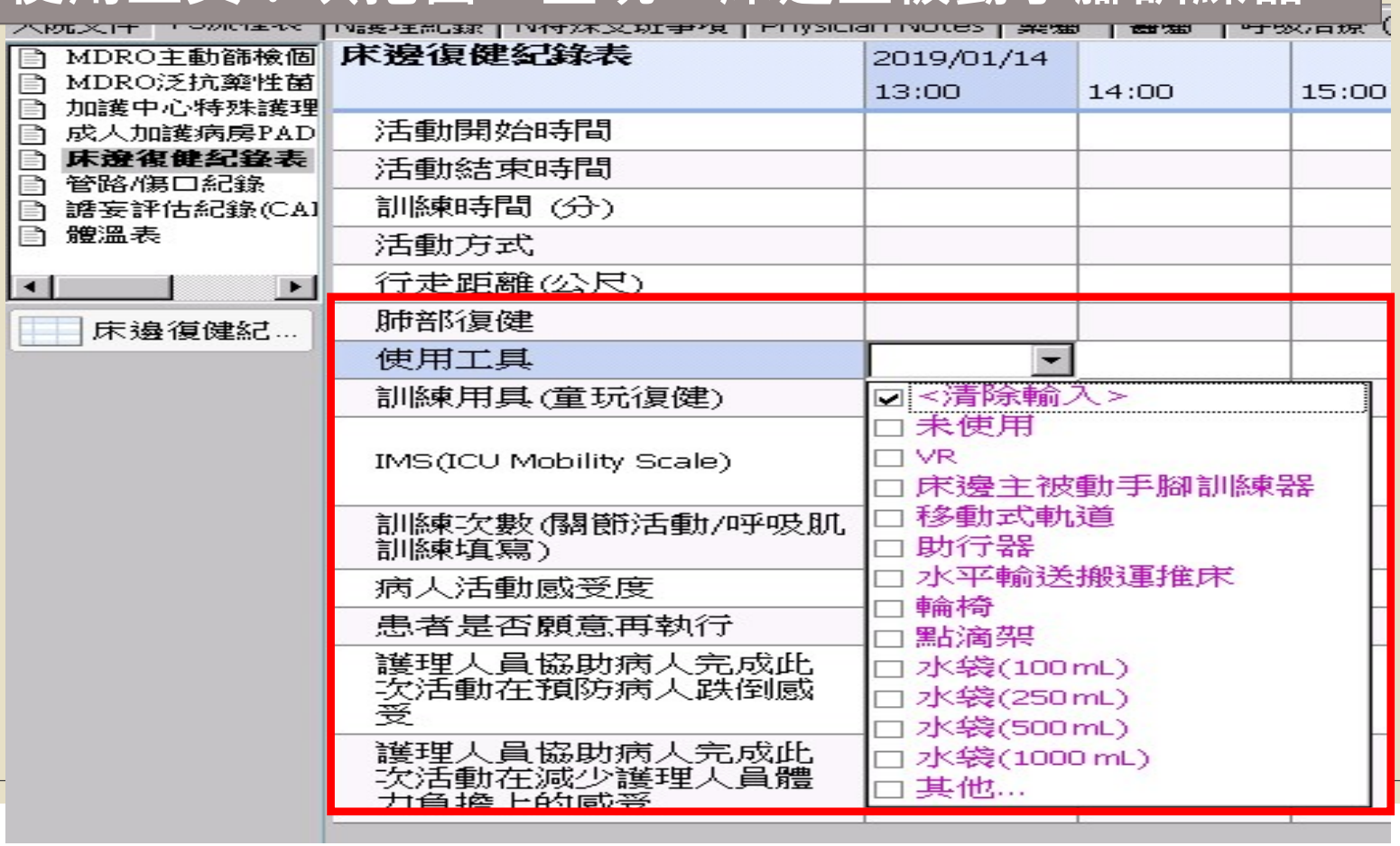


IMS活動程度

全國首創重症分級(IMS)早期復健系統

篩選 → 提醒 → **執行** → 登錄

使用工具：吹捲笛、童玩、床邊主被動手腳訓練器



創意來源

電影分級

Sleep Disruption

評估工具：高榮重症睡眠量表

評估人員：護理師

評估時機：

1.所有病人每天評估一次(早上0700)

2.意識清醒且無譫妄病人，記錄病人回應睡眠的情況

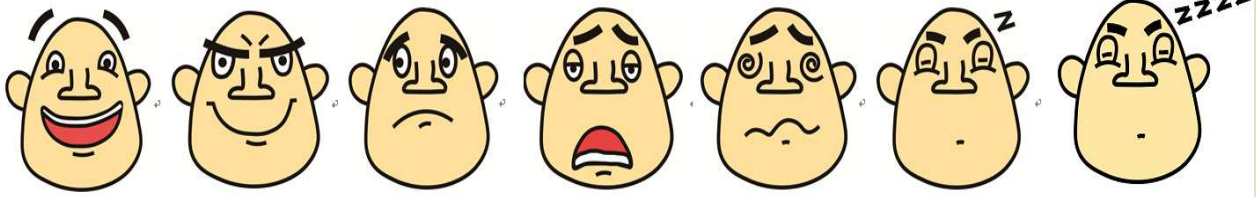
重症睡眠資訊評估系統

創意來源

健康睡眠文化

高雄榮總 重症睡眠量表

2018.12.03 製表



等級 1.	等級 2.	等級 3.	等級 4.	等級 5.	等級 6.	等級 7.
精神百倍	注意力集中	醒著但遲鈍	精神不振	意識模糊	嗜睡	非常嗜睡
（充滿活力）		（醒著，但無法完全警覺，反應遲鈍）	（精神不振）	（意識模糊，難以保持清醒）	（想睡覺，頭昏眼花）	（隨時可以睡著）

討論重症病人睡眠量表（分七個睡眠等級臉譜）

建構量表資訊系統，每日0700大夜護理師評估病人睡眠情況登錄

重症睡眠資訊評估系統

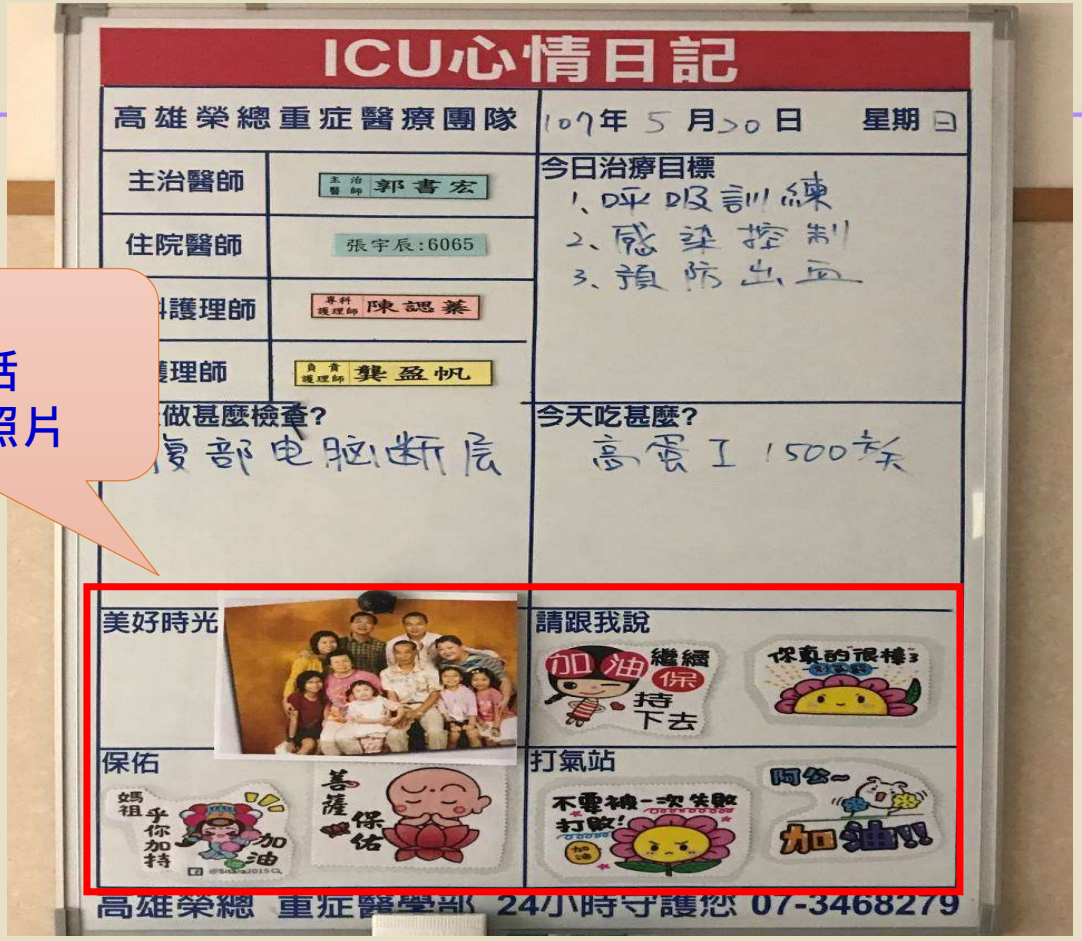
創意來源

健康睡眠文化

討論重症病人睡眠量表（分七個睡眠等級臉譜）

建構量表資訊系統，每日0700大夜護理師評估病人睡眠情況登錄

高榮ICU心情日記



- ✓溫馨片語
- ✓加油打氣話
- ✓家庭生活照片

創意來源

聯絡簿

重症數位溝通平台2.0

內容:日期、時鐘、衛教短片、家庭生活之照片及影帶等增加病人安全感

創意來源

我們是一家人廣告

重症藝術療癒病房

創意來源：藝術治療

藝術家現場彩繪

四季

自然

景觀

人文

軌道懸吊系統復健

重症虛擬運動會

重症虛擬運動記者會

家屬參與重症童玩肌力復健

創意來源

懷舊治療

重症童玩肺部復健

創意來源

懷舊治療

吹捲笛

訓練呼吸肌，合併圓唇吐氣技巧

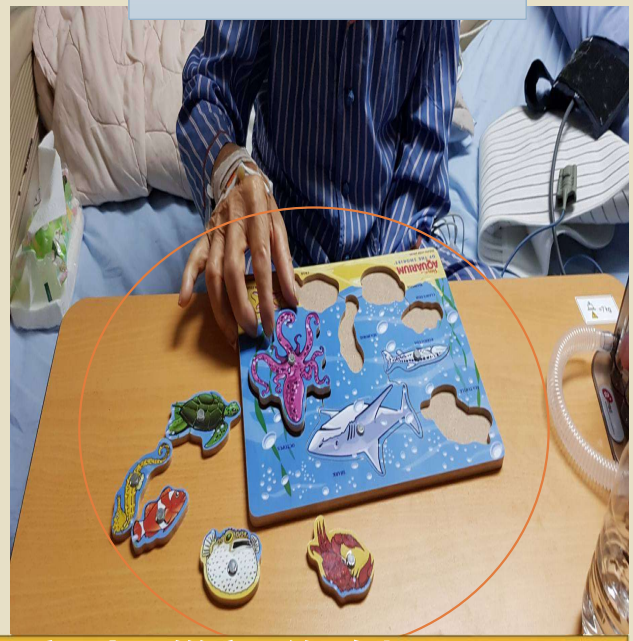
重症童玩腦部復健

創意來源

懷舊治療

塞車遊戲

拼圖遊戲

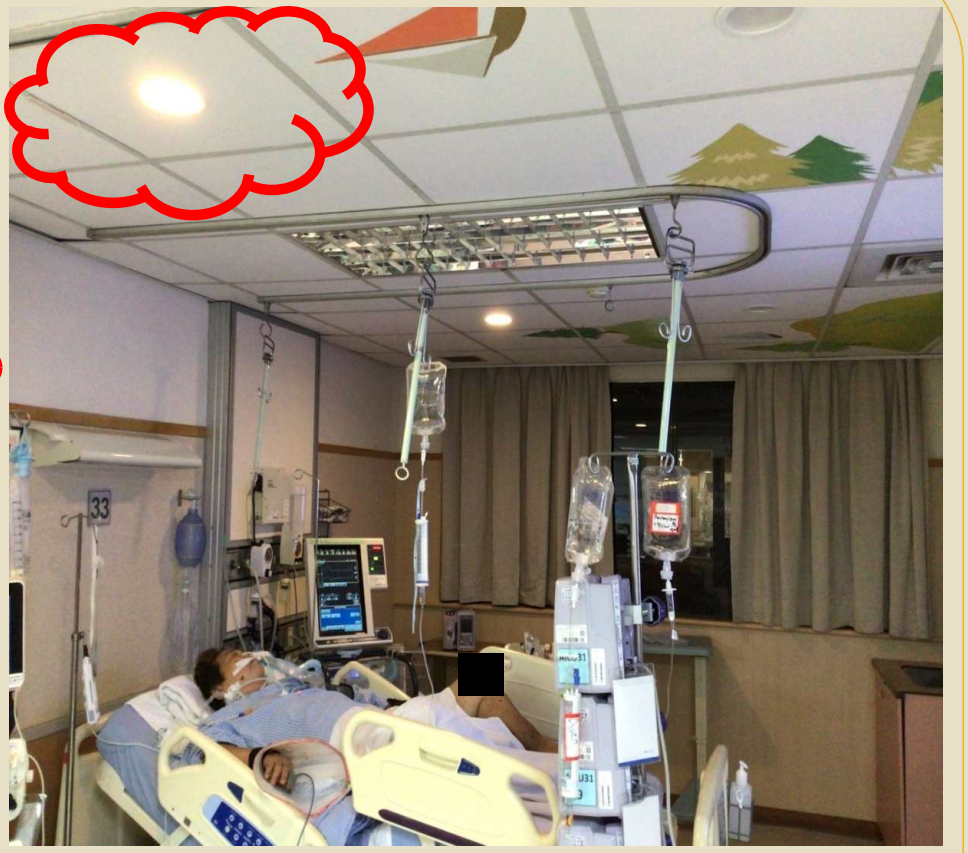


增進精細動作、刺激病人腦部復健、
手眼協調能力及促進專注力、培養耐心

優化重症睡眠照護流程


高榮重症病人
鎮靜劑使用照護
(AICU01-30)
班別
貼心關懷
調整沐浴時間
大夜
昏迷(E1VTM1)
中重度鎮靜的病人(RASS-3~-4)
使用肌肉鬆弛劑病人
白班或小夜
譫妄病人
意識清醒病人
集中治療
鼓勵使用PICC
IV到期，大夜於0500-0800注射
大夜4~6小時翻身
病人睡覺時間(2300-0500)盡量減少干擾
病人午睡時間(1300-1400)盡量減少干擾
20201121修訂
高雄榮總 重症加護病房24小時守護您

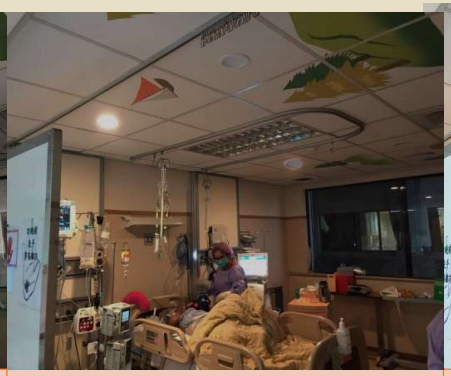
重症智慧情境照明系統



裝設重症時控燈光照護系統

重症智慧情境照明系統

0% 靜謐的夜



20%璀璨繁星

40%舒眠月光

60% 午後時分

80%暖陽斜照

100% 旭日東昇

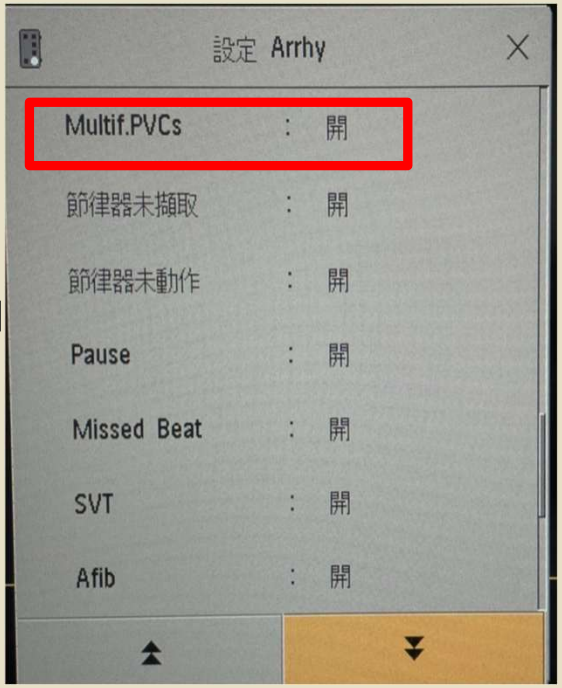
創意來源

薇閣精品旅店

精進重症警訊作業系統

- 調整警示設置系統

- 更改生理監視器警示系統設定
- 調控非必要警示指標
- PAIR PVCs警告設定為『關/靜音』
- Multif. PVCs警告設定為『關/靜音』
- 心跳設定在45-125次/分
- 呼吸設定在8-35次/分
- Spo2 小於89%



精進重症警訊作業系統

利用大數據調控重症警訊示指標

1. 數據採集
2. 數據分析
3. 快速調整

創意來源

Amazon電商平台

	改善前	改善中	改善後
所有警告次數	1279.5	1248.0	581.2
黃色警告	1117.7	1093.9	512.6
紅色警告	161.7	154.1	68.6
心律不整相關警告	1261.4	1215.0	556.6
SpO2相關警告	3.4	10.4	6.4
呼吸相關警告	13.8	20.6	16.9
ABP disconnet	0.9	1.3	1.3

所有警告次數=黃色警告+紅色警告
所有警告次數=心律不整相關警告+ SpO2相關警告+呼吸相關警告+ ABP disconnet

建置重症寧靜照護病房
Silent ICU

調整重症遠端警示照護系統

1. 智慧設備
2. 無聲監控
3. 安全無差別

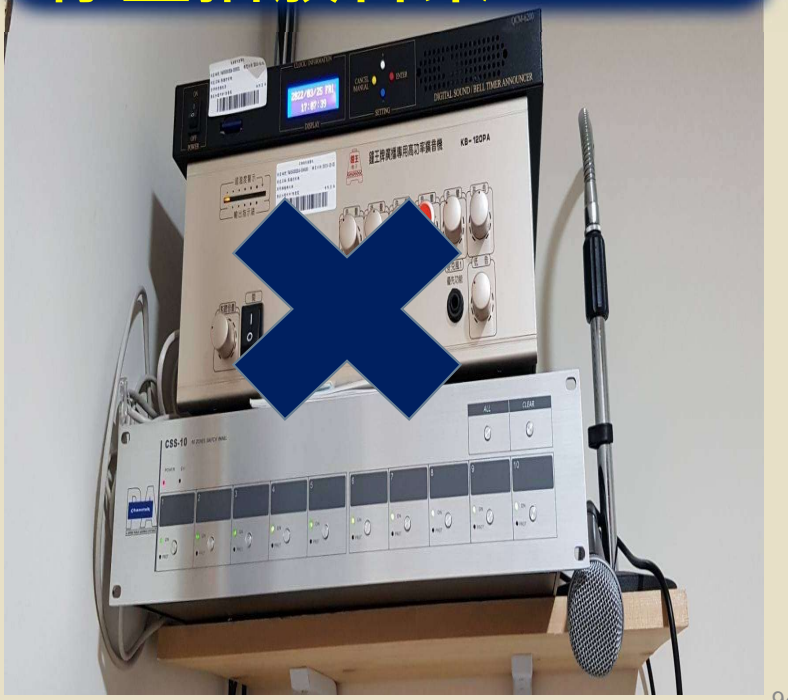
創意來源

智慧掃地機器人

建置重症寧靜照護病房
Silent ICU

- 電腦播放保持安靜提醒

- 夜間停止廣播
- 停止播放音樂



建置重症寧靜照護病房
Silent ICU

調整生理監視器警訊音量

生理監視器 靜音
遠端警報儀 警示功能開啟

生理監視器警示功能開啟
遠端警報儀 警示功能開啟

優化睡眠障礙處置作業

創意來源

商務艙旅行包

創新「高榮重症舒眠包」

- 舒眠照護
- 貼心設計
- 一次到位
- 經濟實惠

優化睡眠障礙處置作業

重症穴位紅外線照射舒眠法

創意來源

SPA紓壓治療

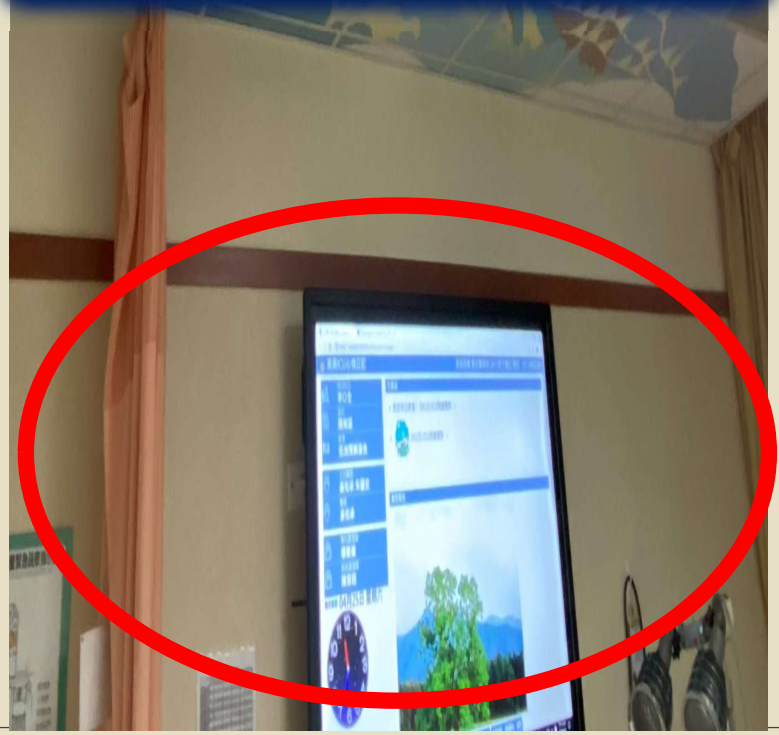
- 醫師處方
- 穴道舒緩
- 安全控溫
- 溫暖療癒

照射距離45-60公分照射時間15分鐘

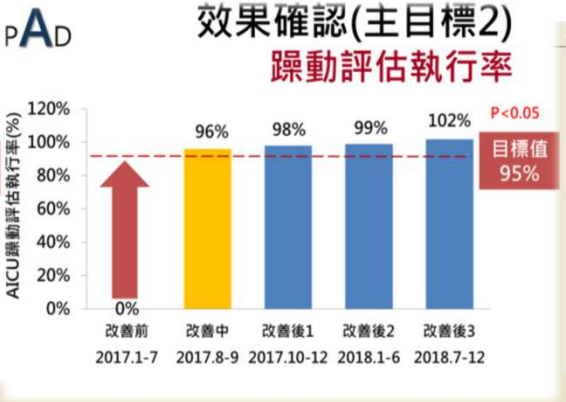
優化睡眠障礙處置作業

- 依病人體感溫度需求使用「冰敷或熱敷」，促進舒適。

- 客製化舒眠音樂治療




PAD
效果確認(主目標1)
疼痛評估執行率
AICU疼痛評估執行率 (%)
120%
100%
80%
60%
40%
20%
0%
75.7%
98%
98%
99%
102%
P<0.05
目標值
95%
改善前 2017.1-7
改善中 2017.8-9
改善後1 2017.10-12
改善後2 2018.1-6
改善後3 2018.7-12

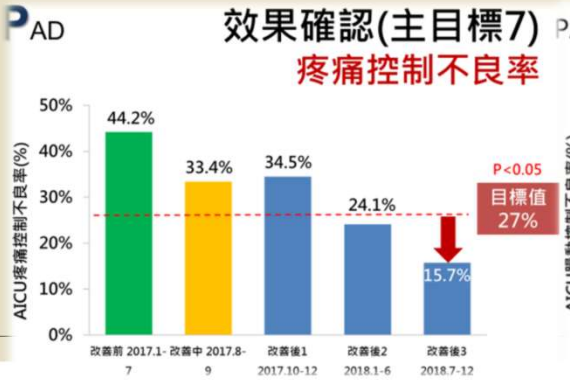

PAD
效果確認(主目標2)
躁動評估執行率
AICU躁動評估執行率(%)
120%
100%
80%
60%
40%
20%
0%
0%
96%
98%
99%
102%
P<0.05
目標值
95%
改善前 2017.1-7
改善中 2017.8-9
改善後1 2017.10-12
改善後2 2018.1-6
改善後3 2018.7-12

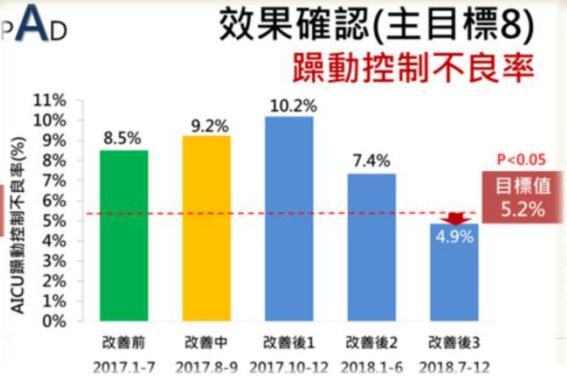

PAD
效果確認(主目標3)
譫妄評估執行率
AICU譫妄評估執行率(%)
120%
100%
80%
60%
40%
20%
0%
0%
77%
78%
85%
103%
P<0.05
目標值
95%
改善前 2017.1-7
改善中 2017.8-9
改善後1 2017.10-12
改善後2 2018.1-6
改善後3 2018.7-12

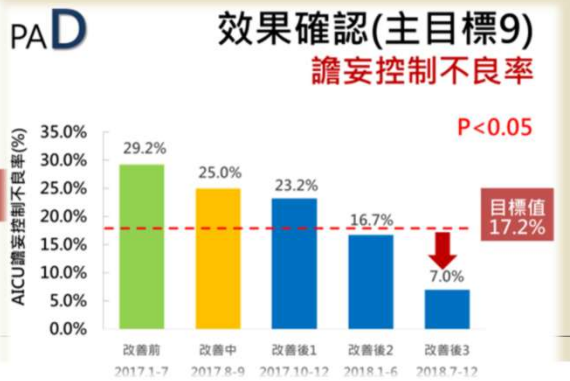

PAD
效果確認(主目標4)
疼痛評估正確率
AICU疼痛評估正確率(%)
120%
100%
80%
60%
40%
20%
0%
79.8%
96.1%
97.2%
98.8%
100.0%
P<0.05
目標值
95%
改善前 2017.1-7
改善中 2017.8-9
改善後1 2017.10-12
改善後2 2018.1-6
改善後3 2018.7-12


PAD
效果確認(主目標5)
躁動評估正確率
AICU躁動評估正確率(%)
120%
100%
80%
60%
40%
20%
0%
77.8%
91.4%
97.2%
98.8%
100.0%
P<0.05
目標值
95%
改善前 2017.1-7
改善中 2017.8-9
改善後1 2017.10-12
改善後2 2018.1-6
改善後3 2018.7-12


PAD
效果確認(主目標6)
譫妄評估正確率
AICU譫妄評估正確率(%)
100%
80%
60%
40%
20%
0%
40.4%
80%
83%
91%
95%
P<0.05
目標值
95%
改善前 2017.1-7
改善中 2017.8-9
改善後1 2017.10-12
改善後2 2018.1-6
改善後3 2018.7-12

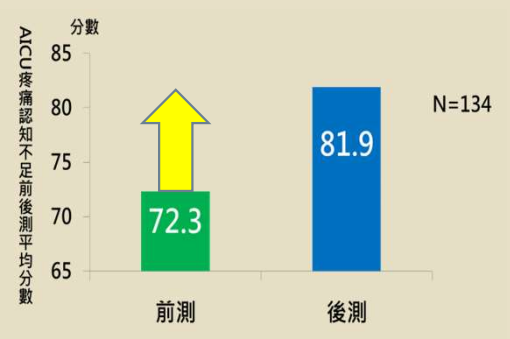

PAD
效果確認(主目標7)
疼痛控制不良率
AICU疼痛控制不良率(%)
50%
40%
30%
20%
10%
0%
44.2%
33.4%
34.5%
24.1%
15.7%
P<0.05
目標值
27%
改善前 2017.1-7
改善中 2017.8-9
改善後1 2017.10-12
改善後2 2018.1-6
改善後3 2018.7-12


PAD
效果確認(主目標8)
躁動控制不良率
AICU躁動控制不良率(%)
11%
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
8.5%
9.2%
10.2%
7.4%
4.9%
P<0.05
目標值
5.2%
改善前 2017.1-7
改善中 2017.8-9
改善後1 2017.10-12
改善後2 2018.1-6
改善後3 2018.7-12

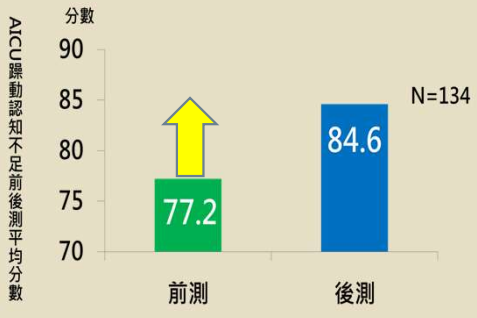

PAD
效果確認(主目標9)
譫妄控制不良率
P<0.05
AICU譫妄控制不良率(%)
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
29.2%
25.0%
23.2%
16.7%
7.0%
目標值
17.2%
改善前 2017.1-7
改善中 2017.8-9
改善後1 2017.10-12
改善後2 2018.1-6
改善後3 2018.7-12

效果確認(附加效益過程指標)

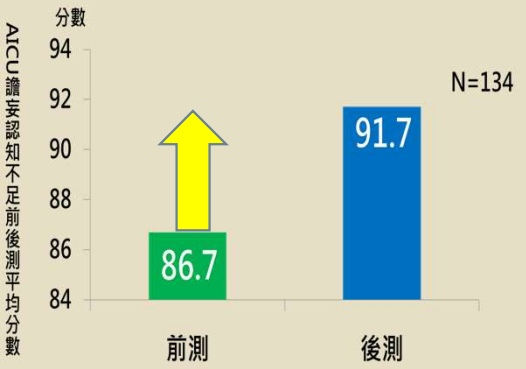
醫護人員疼痛認知



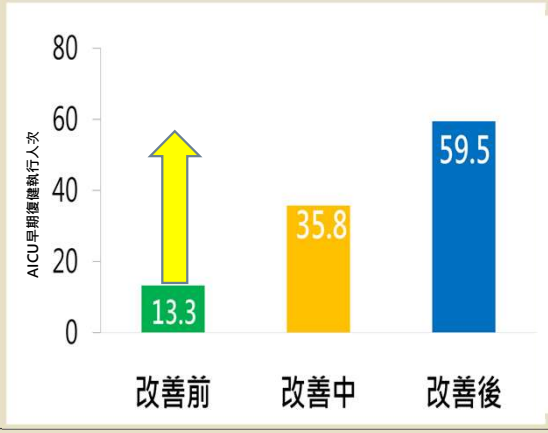
醫護人員躁動認知



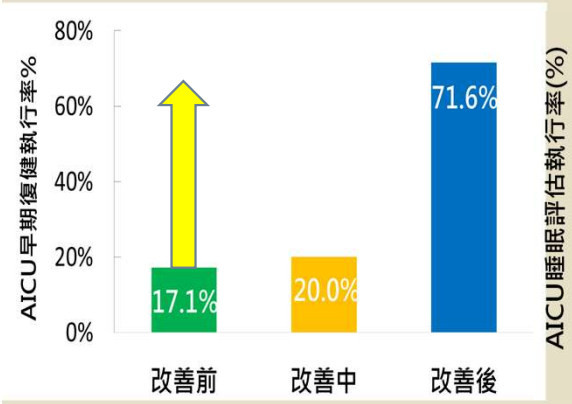
醫護人員譫妄認知



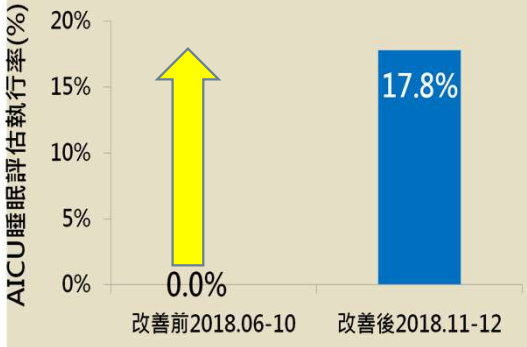
AICU早期復健執行人次



AICU早期復健執行率



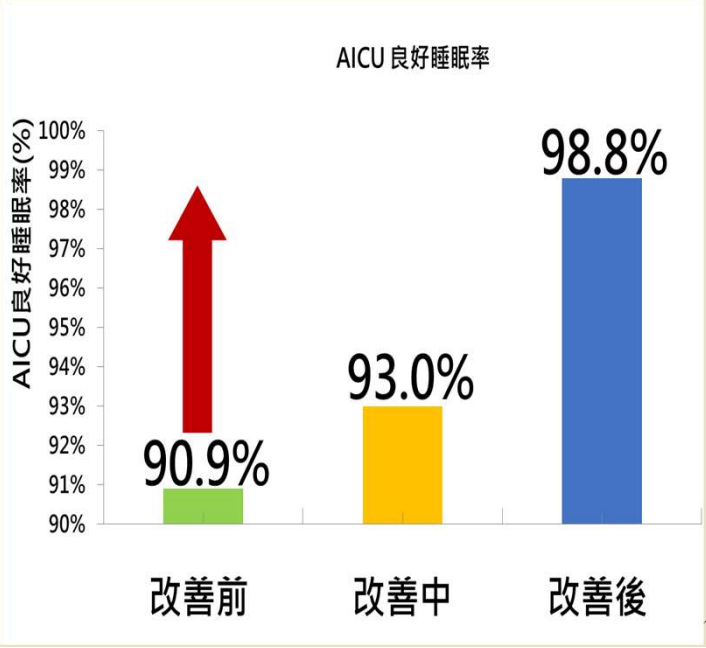
睡眠評估執行率



效果確認(附加效益成果指標)

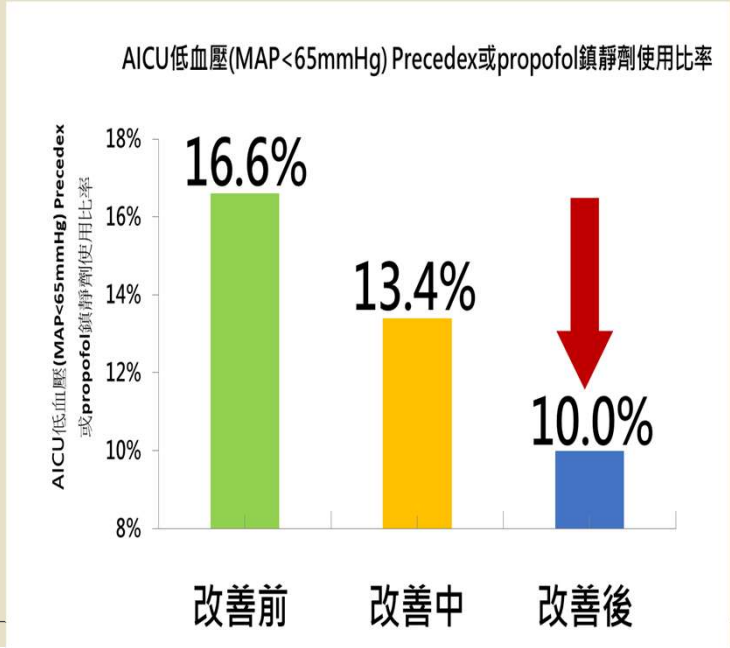
加護病房各優質睡眠比率

成果指標



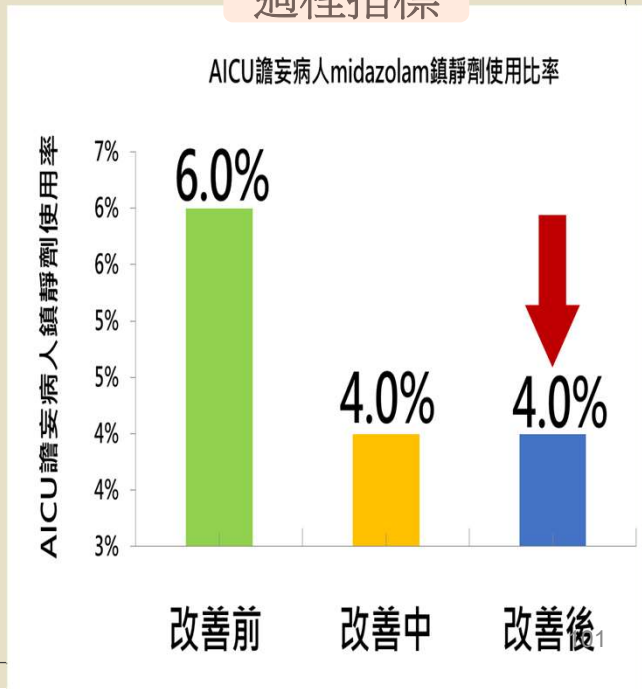
低血壓(MAP<65mmHg) Precedex或propofol鎮靜劑使用比率

過程指標



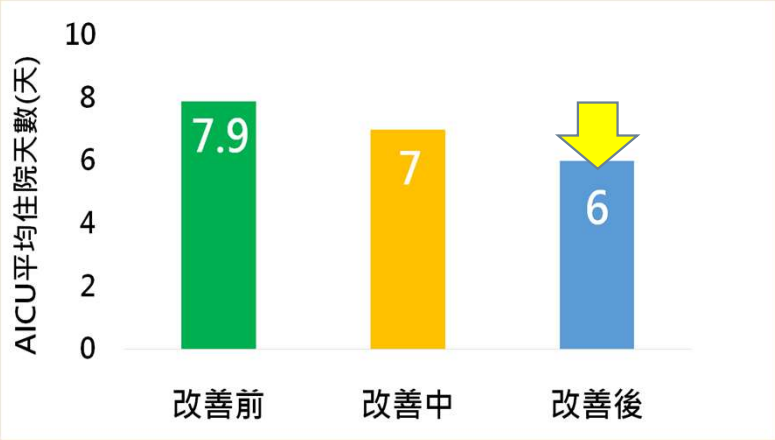
譫妄病人BZD使用比率

過程指標

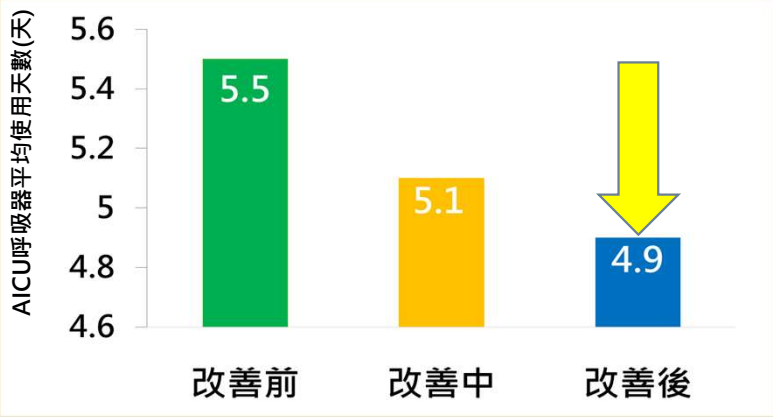


效果確認(附加效益成果指標)

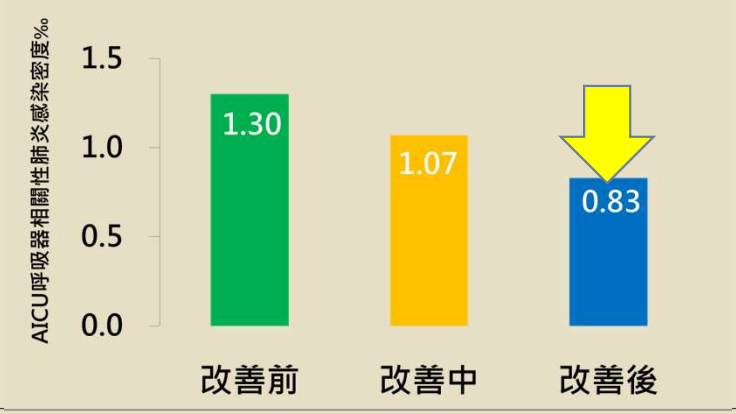
平均住院天數



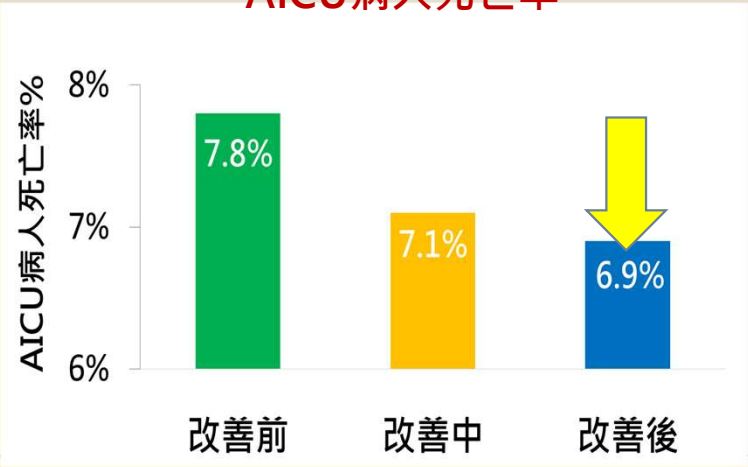
呼吸器脫離平均天數



呼吸器相關性肺炎感染密度

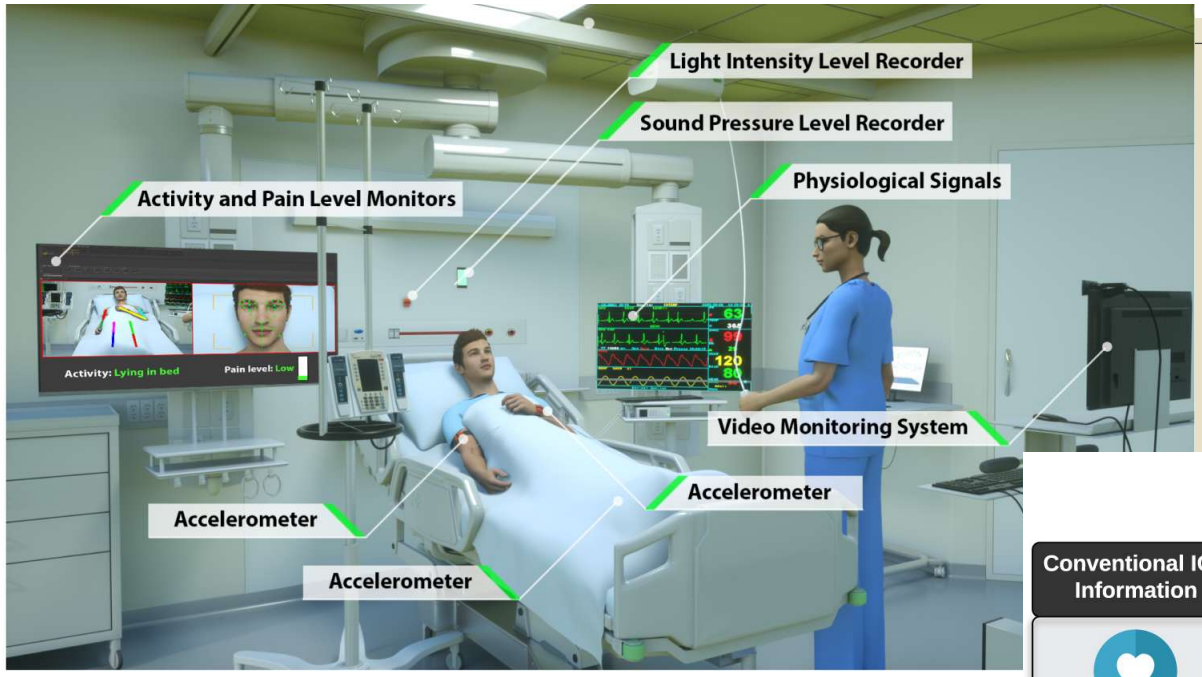


AICU病人死亡率

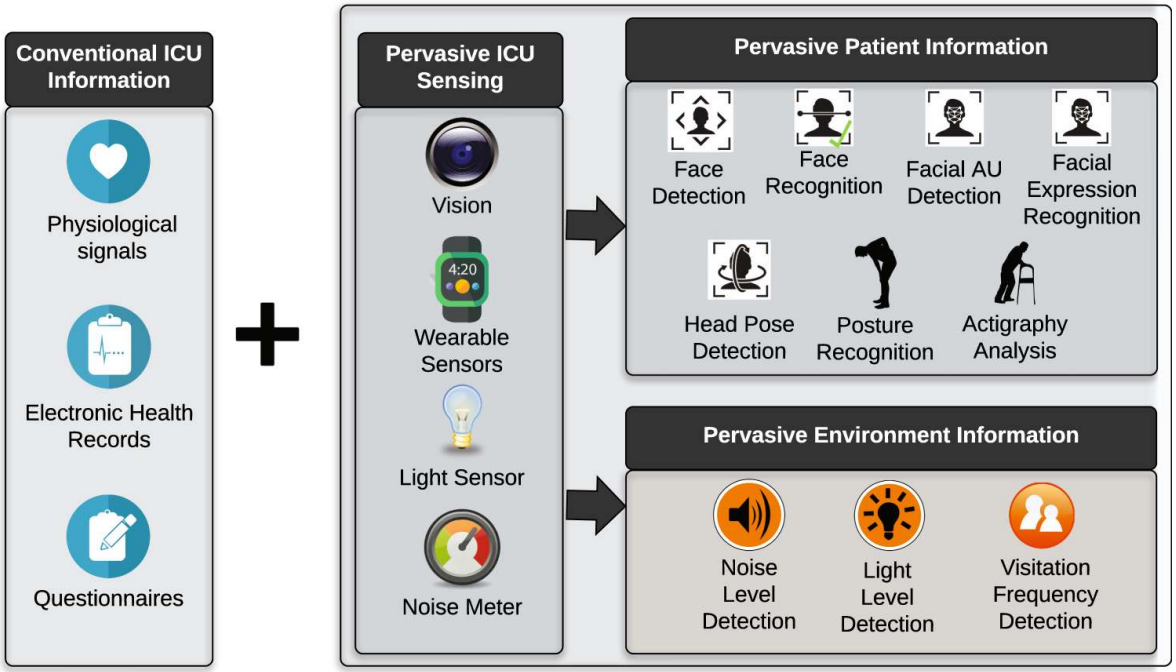


結論

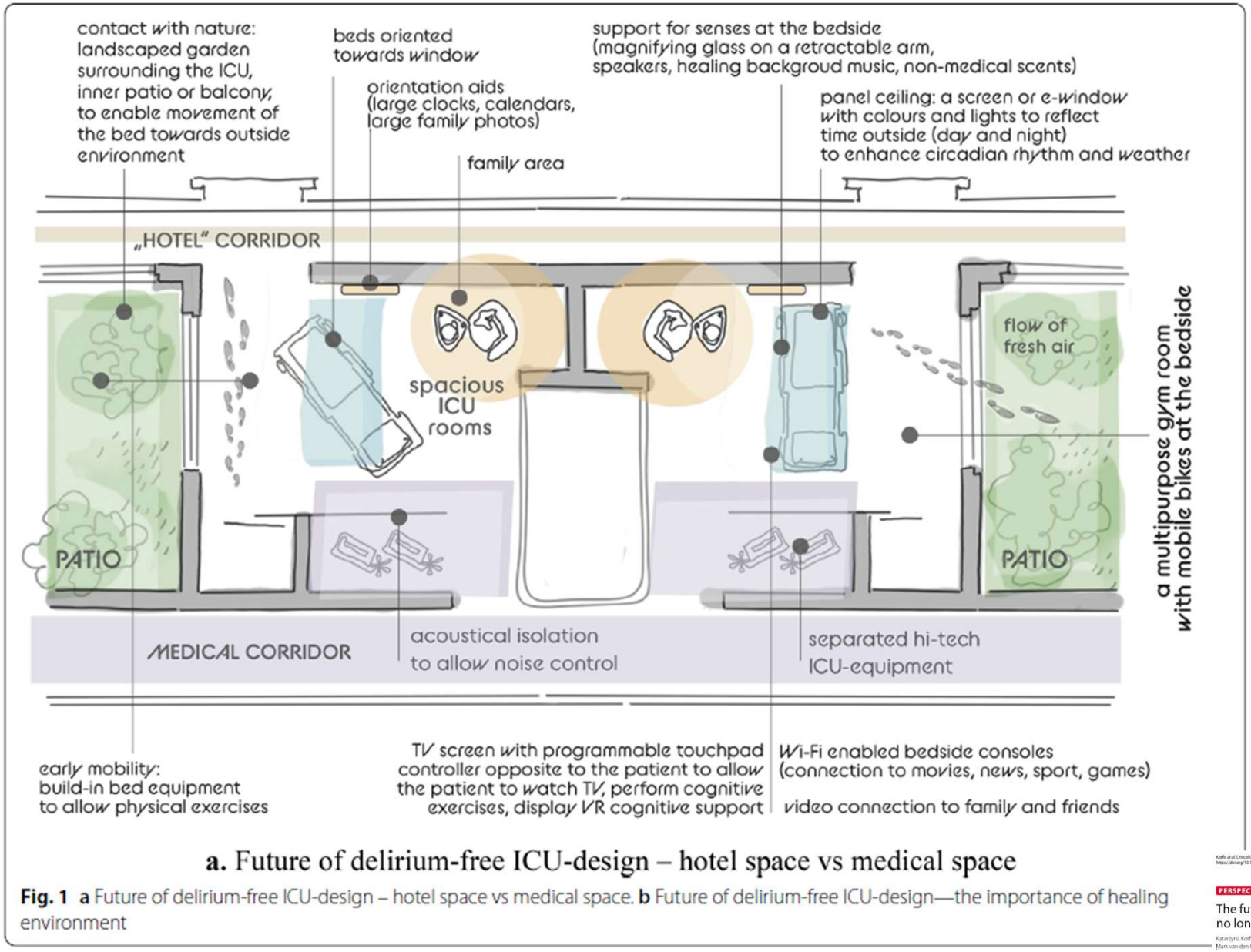
- **Effectively diagnosis, treat, and manage pain, agitation, and delirium in the ICU is key to reduce cost and improve ICU outcomes**
- **A multidisciplinary, protocolized approach can significantly assist clinician's in identifying the diagnosis, direct choice of treatment goals, and assist in mitigating oversedation with sedation algorithms**
- **Comfort and Cognitive still not able to be addressed simultaneously**
- **Artificial intelligence from Humanity angle facilitate in all aspects**



a)



Intelligent ICU for Autonomous Patient Monitoring Using Pervasive Sensing and Deep Learning(2019)



a. Future of delirium-free ICU-design – hotel space vs medical space

Fig. 1 **a** Future of delirium-free ICU-design – hotel space vs medical space. **b** Future of delirium-free ICU-design—the importance of healing environment

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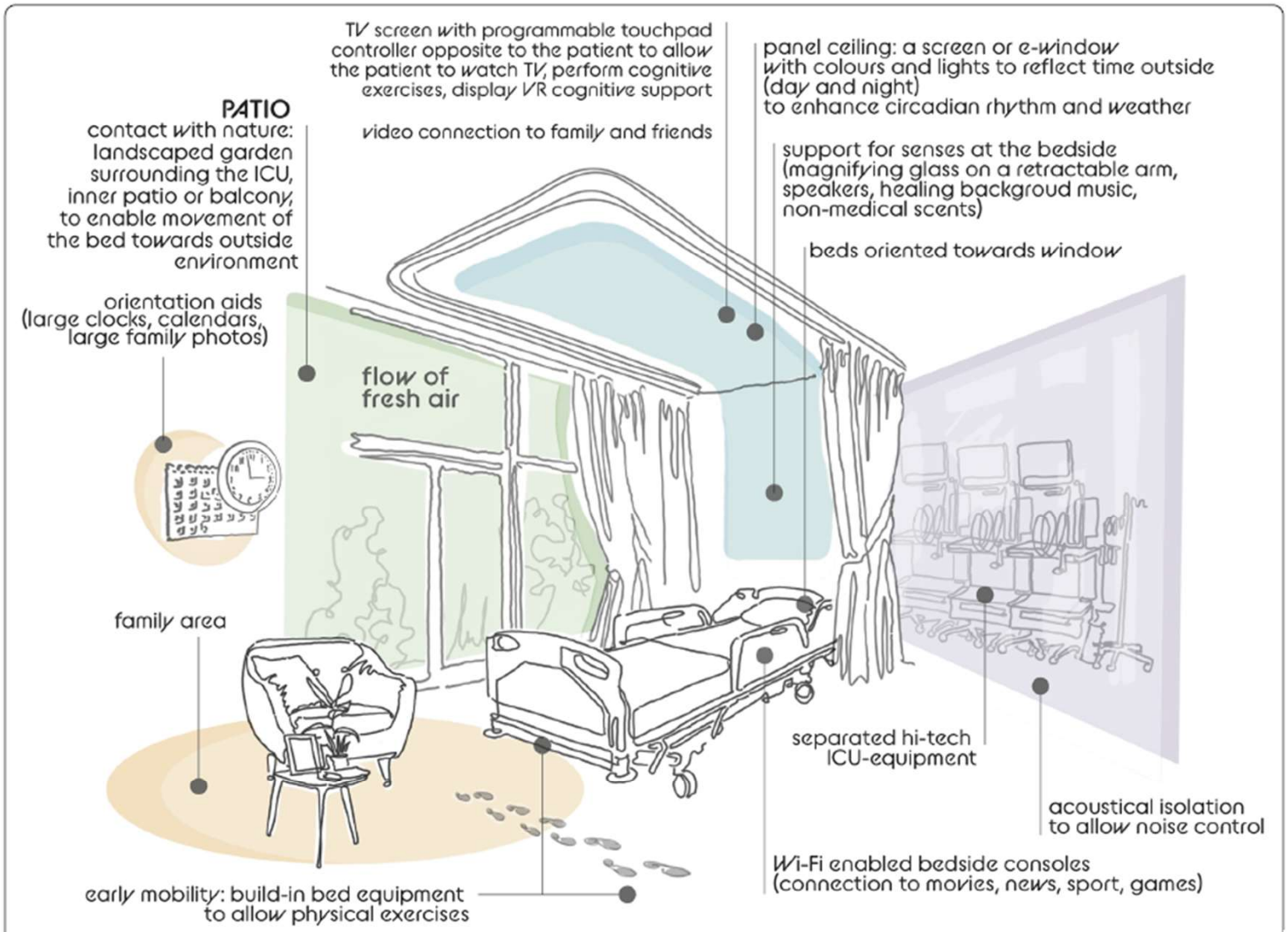

b. Future of delirium-free ICU-design – the importance of healing environment

Fig. 1 continued

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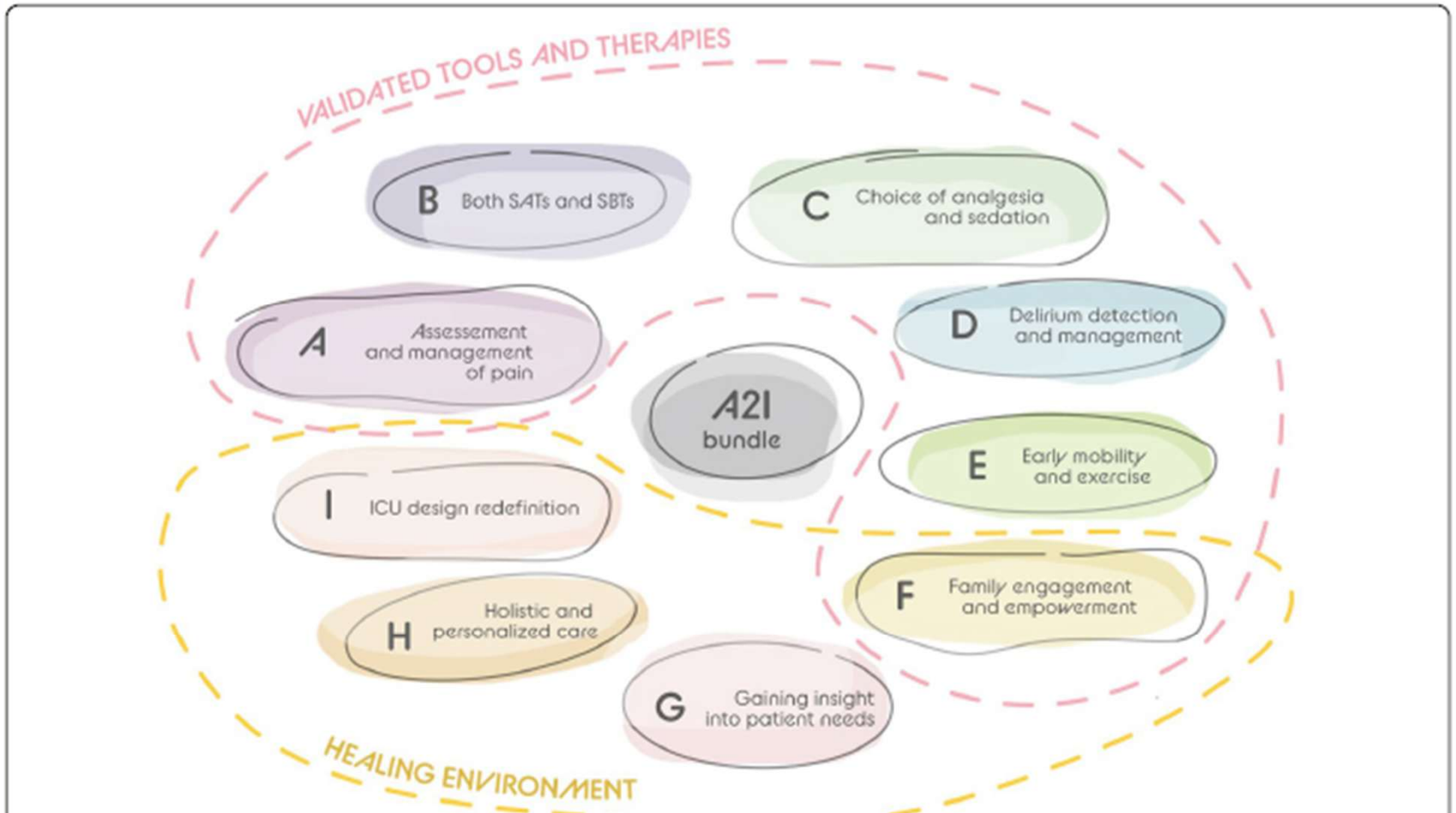

Fig. 2 The ABCDEFGHI bundle—A–I bundle. A—Assessment and management of pain: subjective (NRS, VAS) behavioral tools (CPOT, BPS) shou

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