Post Intensive Care Syndrome

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Disclosures

- I have no actual or potential conflict of interests in relation to this presentation.

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Objectives

At the conclusion of this presentation, these objectives will be addressed:

- What happens after an ICU stay
- Understand Post Intensive Care Syndrome
- Understand the risk factors for PIC Syndrome
- Strategies we can use to reduce PIC Syndrome

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Case

- 24 yof presents with dyspnea, cough, chills, fevers in MCB ER.
- Evaluation notable for hypoxia sats 50s, improved w/ high flow
- CXR w/ diffuse GGO's, elevated CRP, 4Plex (+) SARS-COV 2
- Admitted to ICU for respiratory failure- HFNC 60%
- Physical exam remarkable for tachypnea
- Placed on CPAP 10, Fio2 100%..... Continues to desat
  - Next step?

Case Continued…

- Intubated, sedated, nimbex started and she was proned.
- ABG is bad; P/F 90 , Plats >30, permissive hypercapnea
  - Unfortunately, both pumps at CHICUMCBMMC-CSH are occupied
- Current therapies continued
- Ultimately improves with time
- Extubated, no trach, walks out of hospital….

Critical illness

- About 5.7 million annual admissions to ICU
- Approximately, 4.8 million survive their ICU stay
  - Pre pandemic data
- They usually aren't the same after their stay
  - What happens in the ICU, doesn't necessarily stay in the ICU
- Each day of bedrest in critically ill patients =11% decrease in muscle strength

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Critical illness sequela

- Critical illness myopathy
  - Selective loss of myosin, no reaction to myosin ATPase in non-necrotic fibers
  - Preserved sensory response, reduced motor response,
- Critical illness polyneuropathy
  - Limb muscle weakness, reduced/absent DTRs, delayed vent weaning
  - Common in sepsis, injury to microcirculation of distal nerves → ischemia & axonal degeneration
- Combined critical illness myopathy & polyneuropathy
- Diagnose with electrodiagnostic studies

Challenges after surviving ICU

- Haines et al interviewed 66 patients, 20 caregivers
- Focused on 3 domains
  - Challenges encountered by pt's along the transitions of care
    - Interaction with the health system, gaps in care, managing expectations
  - Challenges encountered by caregiver
    - Health system shortfalls, inadequate communication, lack of support
  - Pt & caregiver problem solving across the transitions of care
    - Personal attributes, resources, initiative, receiving support

Haines et al. Transitions of Care After Critical Illness-Challenges to Recovery & Adaptive Problem Solving. Critical Care Medicine. 2021

What is Post Intensive Care Syndrome?

- Sequela of critical illness
- 3 domains
  - Physical
  - Cognitive
  - Mental Health
- Associated with mortality
- More common in those with co morbidities
- Present up to 6-12 + months after a hospitalization

Smith et al. Covid-19 & Post-intensive care syndrome: Community-based care for ICU survivors. Home Health Care Management & Practice. 2021, Vol 33(2) 117-124.

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What about family members?

- Worried, anxious, confused, overwhelmed
- Stop tending to their own needs/obligations
- PICS in family members →→→ PICS-F
  - Anxiety
  - Depression
  - PTSD
- Can occur up to 30%

Smith et al. Covid-19 & Post-intensive care syndrome: Community-based care for ICU survivors. Home Health Care Management & Practice. 2021, Vol 33(2) 117-124.

Physical Domain

- ICU weakness is the most common physical impairment
- Mobility issues at 6 months out
  - Increased risk of falls
- Many have chronic pain after discharge
- Prevents from doing activities that bring joy
- Can lead to depression and withdrawal
- Interferes with ability to work

Cognitive Domain

- Incidence 25-78 %
- Symptoms suggestive of TBI & mild dementia
- Memory loss
- Difficulty thinking
- Task completion
- Executive functioning!!!

Psychiatric Domain

- Depression
- Anxiety
- Ptsd
  - More common in ARDS survivors
- Difficulty with falling or staying asleep
- Nightmares
- Flashbacks

The BRAIN-ICU Study

- Multicenter, prospective cohort study
- 821 patients admitted to M/S ICU
  - Respiratory failure, cardiogenic shock, septic shock
- 3 & 12 month f/u - delirium, cognition, executive function
- Examined 2 risk factors
  - Delirium
  - Use of sedatives or analgesics

Pandharipande et al. Long-Term Cognitive Impairment after Critical Illness. N Engl J Med 2013; 369:1306-1316

BRAIN-ICU study

- CAM-ICU used to evaluate for delirium
- RASS used to evaluate level of consciousness
- 74% (606) experienced delirium
- Median duration of delirium= 4 days
- 31% (252) died within 3 months from discharge
- 79% of surviving patients had follow up cognitive testing
- 59 patients died before 12-month follow-up

Pandharipande et al. Long Term Cognitive Impairment after Critical Illness. N Engl J Med 2013; 369:1306-1316

Brain – ICU study – Cognitive outcomes

- Median scores were about 1.5 SD below age-adj mean
  - Similar to patients with mild cognitive impairment
- 40% had scores seen in people with moderate TBI
- 26% had scores similar to those with mild Alzheimer's
- Longer the duration of delirium worse the outcome
  - Especially, long term cognitive impairment
- High doses of benzos a/w reduction in executive function

Pandharipande et al. Long Term Cognitive Impairment after Critical Illness. N Engl J Med 2013; 369:1306-1316

More Delirium

- Delirium is a huge burden on patients, families and staff
  - Hyperactive/hypoactive
  - Forgetful, can not hold a conversation
  - Not the same person
- Associated with:
  - Increased mortality
  - Prolonged ICU and hospital stays
  - Contributes to PICS- cognitive impairment

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PICS + Covid

- Single Study cohort study @ Mount Sinai Hospital, NY 4/21/20-7/7/20
- Referred to covid clinic one month after discharge
  - ICU LOS > 7 days
    - Respiratory failure, shock, multi organ failure
- 121 pt's referred of which 45 followed up
  - Median LOS: 18 days
  - 36 pt were on ventilators; avg vent day 8
    - 15 sedated with propofol
    - 24 on benzo's
    - 20 on opioids
    - 21 were paralyzed
  - 14% diagnosed/documented with delirium

Martillo et al. Post Intensive Care Syndrome in Survivors of Critical Illness Related to Coronavirus Disease 2019: Cohort Study From a New York City Critical Care Recovery Clinic. Critical Care Medicine 2021

Physical Domain

- 39 pt's had at least 1 physical impairment
- 30 pt's had difficulties with mobility – walking about
- 16 pt's had issues with self care
- 30 pt's moderate/extreme pain
- 26 pt's had some degree of disability
  - 6 were severe
- Paralyzed patients had problems with usual activities 66.7% vs 29.2%

Martillo et al. Post Intensive Care Syndrome in Survivors of Critical Illness Related to Coronavirus Disease 2019: Cohort Study From a New York City Critical Care Recovery Clinic. Critical Care Medicine 2021

Psychiatric Domain

- 22 pt's w/ psychiatric impairment
  - Depression
    - 17 – moderately anxious or depressed
    - 2 – extremely anxious or depressed
    - 8 diagnosed with PTSD
  - Insomnia
    - 11 (24%)
    - 6 with severe insomnia

Martillo et al. Post Intensive Care Syndrome in Survivors of Critical Illness Related to Coronavirus Disease 2019: Cohort Study From a New York City Critical Care Recovery Clinic. Critical Care Medicine 2021

Cognitive Domain

- 30 of 45 took the MOCA test
  - 24/30 (80%) X> 19
  - 6/30 (20%) X<19
    - 1 had dementia
- 91% (41) met criteria for PICS diagnosis
  - 22 (53.6%) impairments in 2 domains
  - 2 (4.9%) impairments in 3 domains

Martillo et al. Post Intensive Care Syndrome in Survivors of Critical Illness Related to Coronavirus Disease 2019: Cohort Study From a New York City Critical Care Recovery Clinic. Critical Care Medicine 2021

NEUROLOGIC CRITICAL CARE

Association of Sedation, Coma, and In-Hospital Mortality in Mechanically Ventilated Patients With Coronavirus Disease 2019–Related Acute Respiratory Distress Syndrome: A Retrospective Cohort Study*

Wongtangman, Karuna MD[1,2]; Santer, Peter MD, DPhil[1]; Wachtendorf, Luca J.[1]; Azimaraghi, Omid MD[1]; Baedorf Kassis, Elias MD[1,3]; Teja, Bijan MD, MBA[1,4]; Murugappan, Kadhiresan R. MD[1]; Siddiqui, Shahla MD[1]; Eikermann, Matthias MD, PhD[5]; for the SICU Optimal Mobilization Team (SOMT) Group

Author Information

Critical Care Medicine: September 2021 - Volume 49 - Issue 9 - p 1524-1534
doi: 10.1097/CCM.0000000000005053

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Sedation & Mortality

- Propensity-matched cohort study
  - Comparing C-ARDS vs Regular ARDS mortality and coma days
  - 114 (C-ARDS) vs 228 (Non C-ARDS)
- 7 ICUS in Boston 3/2020 – 5/2020
  - ARDS
- Evaluated q4hours via RASS
  - Coma= (-3) – (-5)
  - Covid-ARDS (+)
  - Non- Covid ARDS
- + vs (-)
  - 66%>36% were in coma states

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TABLE 2.

Administration of Sedatives, Analgesics, and Neuromuscular Blocking Agents During Mechanical Ventilation

Drugs Given	Non-COVID ($n = 228$)			COVID ($n = 114$)			p^a
	No. of Prescriptions, n (%)	Duration of Prescription (d), Mean ± SD	Dose, Median (Interquartile Range)	No. of Prescriptions, n (%)	Duration of Prescription (d), Mean ± SD	Dose, Median (Interquartile Range)	
Opioid (oral morphine equivalents)	214 (93.9)	5.6 ± 4.7	25.1 (12.5–53.1) mg/d	112 (98.2)	10.1 ± 5.7	16.5 (8.1–31.8) mg/d	0.07
Propofol	201 (88.2)	3.9 ± 2.8	1,773 (932–3,176) mg/d	111 (97.4)	7.4 ± 5.0	3,606 (2,188–4,914) mg/d	0.005
Midazolam	120 (52.6)	2.8 ± 2.7	16.1 (3.0–44.8) mg/d	83 (72.8)	6.3 ± 4.4	83.3 (45.5–116.4) mg/d	< 0.001
Lorazepam	42 (18.4)	1.5 ± 1.1	1 (0–2) mg/d	23 (20.2)	1.5 ± 1.1	1.8 (0.5–2.3) mg/d	0.7
Diazepam	1 (0.4)	2	10 (10)	12 (10.5)	3.9 ± 3.0	14.2 (9.8–22.3) mg/d	< 0.001
Dexmedetomidine	103 (44.7)	3.8 ± 2.9	841 (359–1,411) µg/d	65 (57.0)	5.1 ± 3.5	1,157 (806–1,568) µg/d	0.032
Ketamine	2 (0.9)	1.5 ± 0.7	147 (39–254) mg/d	59 (51.8)	7.4 ± 4.5	919 (610–1,570) mg/d	< 0.001
Neuromuscular blocking agent	53 (23.2)	2.6 ± 2.4		64 (56.1)	4.8 ± 3.9		< 0.001
Cisatracurium			138 (89–221) mg/d			182 (112–240) mg/d	
Rocuronium			425 (270–579) mg/d			683 (477–845) mg/d	

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Mortality Association

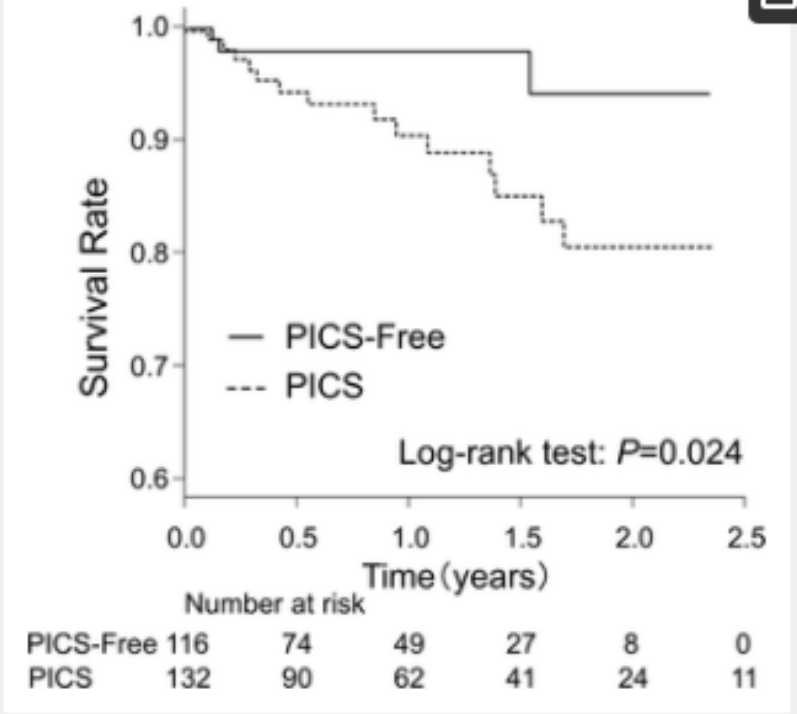
- Retrospective cohort study
- 248 ICU pt's LOS > 3 days , out of 555
  - A lot missing data, some met exclusion criteria
- Japanese heart hospital
- Authors wanted looked at association w/ PICS & mortality

Yanagi et al. (2021) Post-Intensive Care Syndromes as a predictor of mortality in patients with critical illness: A Cohort Study. PLOS ONE 16(3)

PICS & Mortality

- Gait speed used to determine physical disability
  - Walking normal pace over a distance of 10 M
  - Speed < 0.8m/s = disability
- Mini cog used for cognitive function, early dementia
  - 3 item recall, clock drawing,
  - Score< 2 = higher likelihood of cognitive impairment
- PHQ-2
  - Symptoms over last 2 weeks
    - Depressed mood & anhedonia
  - Score >3= Depression

Yanagi et al. (2021) Post-Intensive Care Syndromes as a predictor of mortality in patients with critical illness: A Cohort Study. PLOS ONE 16(3)



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TIFF original image

Fig 2. Kaplan–Meier analysis of all-cause mortality according to Post-Intensive Care Syndrome (PICS) components.

PICS group, patients with at least one PICS component; PICS-Free group, patients with no PICS components.

https://doi.org/10.1371/journal.pone.0244564.g002

Yanagi et al. (2021) Post-Intensive Care Syndromes as a predictor of mortality in patients with critical illness: A Cohort Study. PLOS ONE 16(3)

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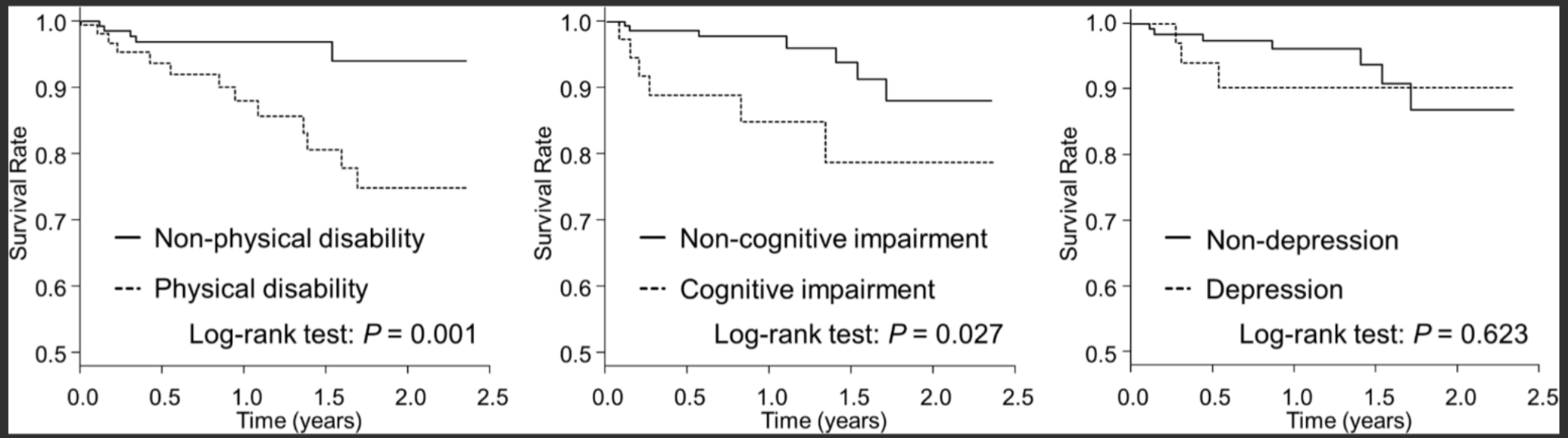

Yanagi et al. (2021) Post-Intensive Care Syndromes as a predictor of mortality in patients with critical illness: A Cohort Study. PLOS ONE 16(3)

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Procedures + Pain

- Turning
- Endotracheal suctioning
- Mobilization
- Respiratory exercises
- Positioning
- Blood draws
- Tracheal suctioning
- Wound care
- Chest tube removal
- Arterial line
- Wound drain removal

Puntillo KA, et al. Determinants of procedural pain intensity in the intensive care unit. The European® study. Am J Respir Crit Care Med. 2014 Jan 1;189(1):39-47. doi: 10.1164/rccm.201306-1174OC. PMID: 24262016.

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Table 2: Differences in Pain Intensity from before the Procedure to during the Procedure

Procedure	N (%)	Preprocedural Pain Intensity Median (IQR)	Pain Intensity During the Procedure Median (IQR)	Difference Median (IQR)	*P* Value*
Chest tube removal	292 (6.1)	2 (0–4)	5 (3–7)	2.5 (0.5–4)	<0.0001
Wound drain removal	75 (1.6)	2 (0–4)	4.5 (2–7)	2 (0–4.5)	<0.0001
Arterial line insertion	199 (4.1)	1 (0–2.5)	4 (2–6)	2.75 (0–5)	<0.0001
Endotracheal suctioning	767 (15.9)	1 (0–4)	4 (1–6)	1.5 (0–4)	<0.0001
Tracheal suctioning	302 (6.3)	1 (0–3.5)	4 (1–6)	1 (0–4)	<0.0001
Peripheral intravenous insertion	315 (6.5)	1 (0–3)	3 (1–5.5)	1 (0–3)	<0.0001
Peripheral blood draw	328 (6.8)	0.5 (0–3)	3 (1–5)	1 (0–3)	<0.0001
Turning	873 (18.1)	1.75 (0–4)	3 (0.25–6)	1 (0–2.5)	<0.0001
Respiratory exercises	439 (9.1)	2 (0–4)	3 (1–5)	1 (0–2)	<0.0001
Positioning	371 (7.7)	1 (0–4)	3 (0–5)	1 (0–2)	<0.0001
Wound care	301 (6.3)	2 (0–4)	3 (1–6)	0.5 (0–2)	<0.0001
Mobilization	526	1 (0–3)	2 (0–5)	0 (0–2)	<0.0001

Puntillo KA, et al. Determinants of procedural pain intensity in the intensive care unit. The Europain® study. Am J Respir Crit Care Med. 2014 Jan 1;189(1):39-47. doi: 10.1164/rccm.201306-1174OC. PMID: 24262016.

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What is Delirium

- Disturbance in attention and awareness
  - Global cortical dysfunction
    - Slowing of dominant posterior alpha rhythm
    - Abnormal slow wave activity
- Develops acutely and fluctuates overtime
- Hyperactive
- Hypoactive

Romano J, Engel GL. Delirium: I. Electroencephalographic data.
Arch Neurol Psychiatry 1944; 51:356.

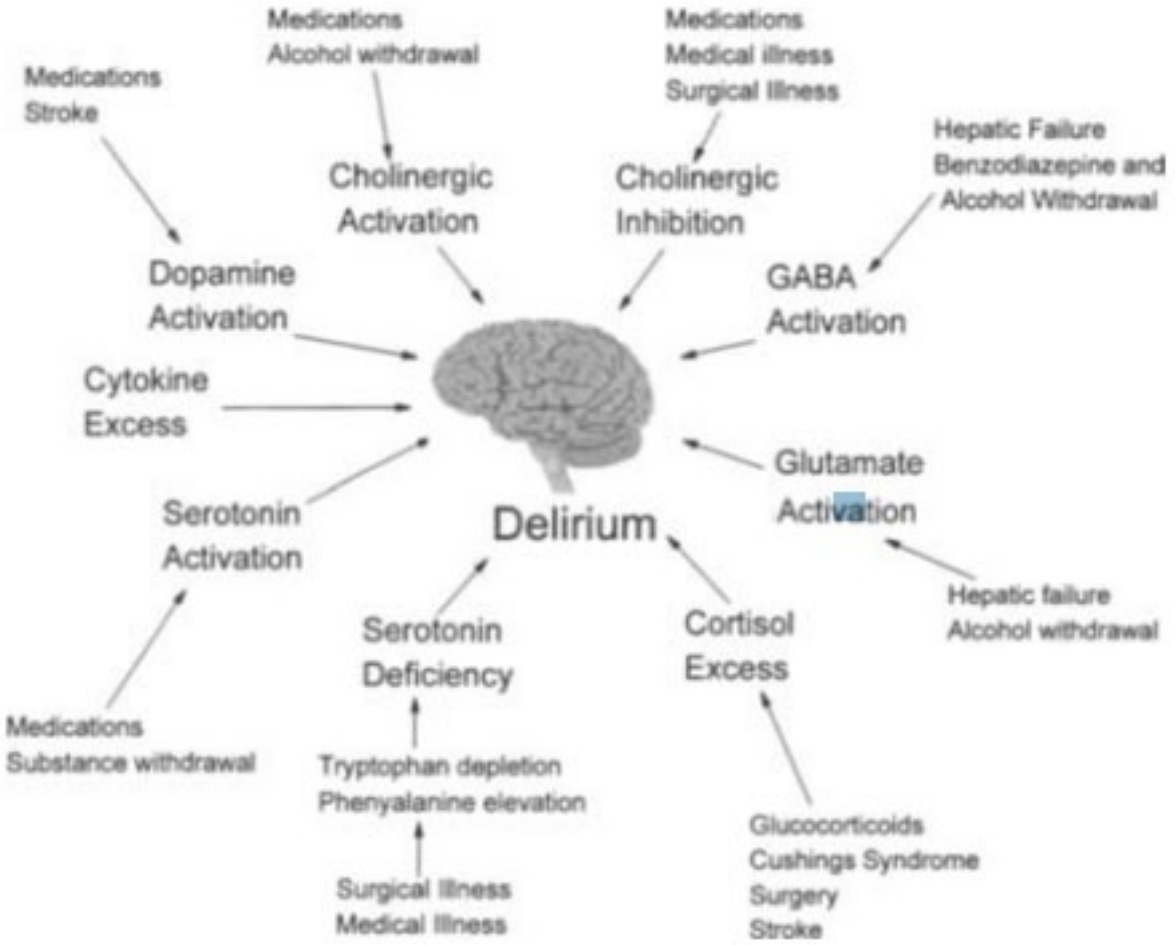

Figure 1. Proposed mechanisms of delirium and possible associated clinical conditions.

Flacker JM, Lipsitz LA. Neural mechanisms of delirium: current hypotheses and evolving concepts. J Gerontol A Biol Sci Med Sci. 1999 Jun;54(6):B239-46. doi: 10.1093/gerona/54.6.b239. Erratum in: J Gerontol A Biol Sci Med Sci 1999

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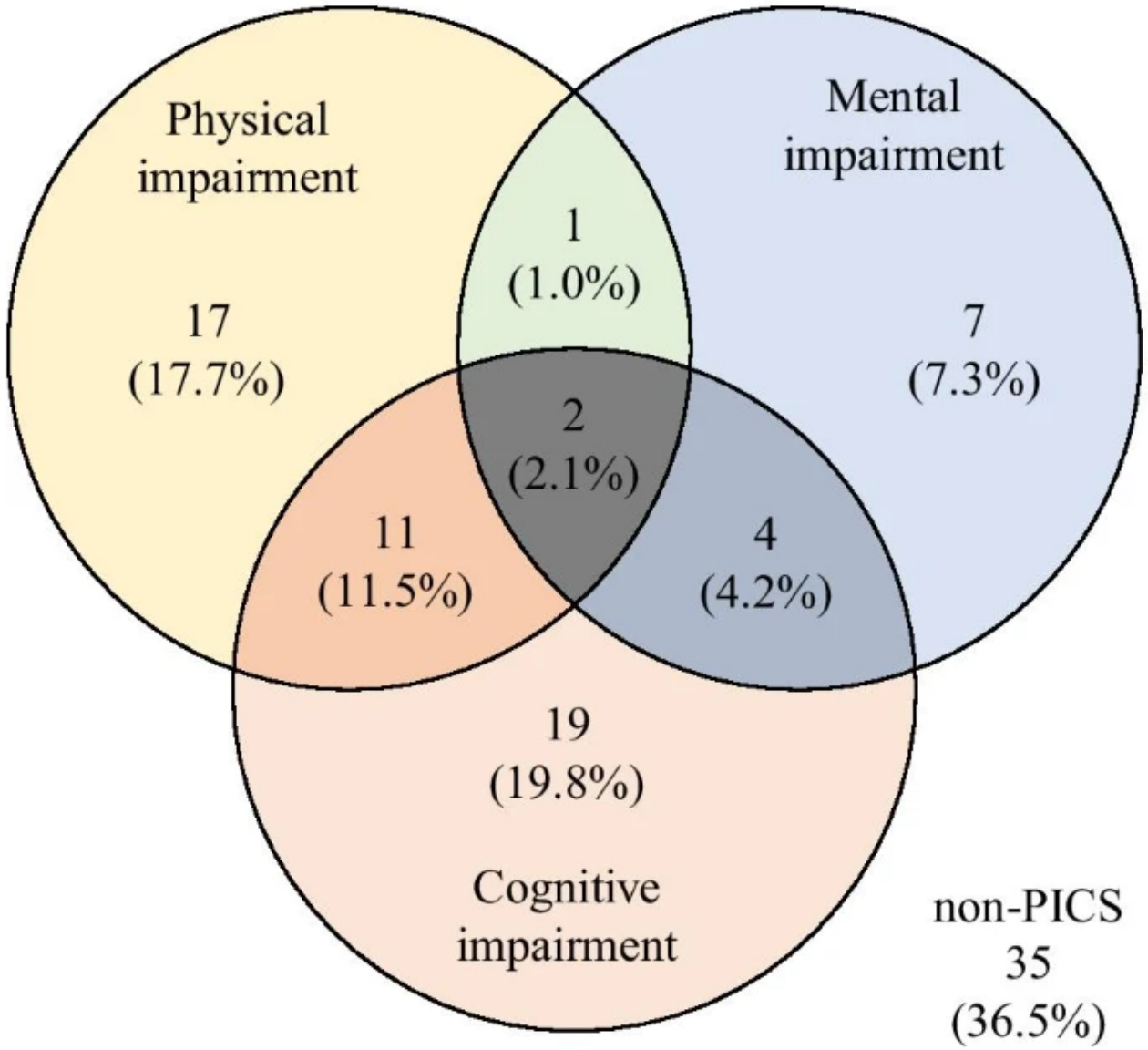
J-PICS Study

- Prospective, multi center, observational cohort study
- Japanese study, 16 ICU's Intubated > 48 hours
- Utilized Short Form – 36 survey (SF-36) before and after
  - Measures quality of life
  - Before was done by proxy and recall 4 weeks prior to illness
- 6 month follow up post ICU discharge

Kawakami et al. Prevalence of post-intensive care syndromes among Japanese intensive care unit patients: a prospective, multicenter, observational J-PICS study. Crit Care (2021)25:69

Fig. 3



Occurrence of PICS problems among patients at 6 months after ICU admission. *PICS* post-intensive care syndrome

Kawakami et al. Prevalence of post-intensive care syndromes among Japanese intensive care unit patients: a prospective, multicenter, observational J-PICS study. Crit Care (2021)25:69

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Financial impact

- 1/3 of enrolled patients worked prior to their illness
  - PICS:20, Non-PICS: 11
- All non- PICS patients returned to work
- 15/20 PICS patients returned to work

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Working after critical illness

- Meta analysis 1970-2018; 10,015 survivors
- Delayed return to work & unemployment is common
- 3,12,60 months patients R.t.W = 36%, 60%, 68%
- After R.t.W
  - 36% lost job, 17-66% changed occupation, 5-84% less hours
    - Lost earnings, worsening depression

Kamdar BB, Suri R, Suchyta MR, Digrande KF, Sherwood KD, Colantuoni E, Dinglas VD, Needham DM, Hopkins RO. Return to work after critical illness: a systematic review and meta-analysis. Thorax. 2020 Jan;75(1):17-27. doi: 10.1136/thoraxjnl-2019-213803. Epub 2019 Nov 8. PMID: 31704795; PMCID: PMC7418481.

Generally speaking

- 25% people lose their job
- Previously employed are back at work in 3 months: 33%
- 67% are back after one year
- Reduced hours, job change, less effective
- Cost of new medications
- Unable to follow up
- Delay or scrap plans: college, vacation, etc

Smith et al. Covid-19 & Post-intensive care syndrome: Community-based care for ICU survivors. Home Health Care Management & Practice. 2021, Vol 33(2) 117-124.

At the end of the day

- Reduced quality of life
- Prolonged impairment in the 3 domains
- Increased utilization of health care resources & readmissions
- Personality changes
- Difficulty with social interactions
- Family strain

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Know the risk factors for cognitive impairment

- Delirium
  - Especially duration
- Hypoglycemia
- Hyperglycemia
- Hypoxemia
- Hypotension
- Sedation
- Polypharmacy
- Sleep deprivation

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Risk factors for physical impairment

- ARDS
- Prolonged mechanical ventilation
- Sepsis
- Multiorgan failure
- Corticosteroids
- Catabolic state
  - Nutrition
- Neuromuscular blocking agents

Risk factors for psychiatric issues

- Delirium
- Sedation
- Nightmares
- Sleep deprivation
- Prior psychiatric history
- Alcohol abuse
- Physical restraints

Risk factors of PICS-Family

- Female family members
- Younger family members
- Lower education level
- Spouses
- Lack of support
- Caregiving > 100 hours/month

Ahmad MH, Teo SP. Post-intensive Care Syndrome. Ann Geriatr Med Res. 2021 Jun;25(2):72-78. doi: 10.4235/agmr.21.0048. Epub 2021 Jun 25. PMID: 34120434; PMCID: PMC8272999.

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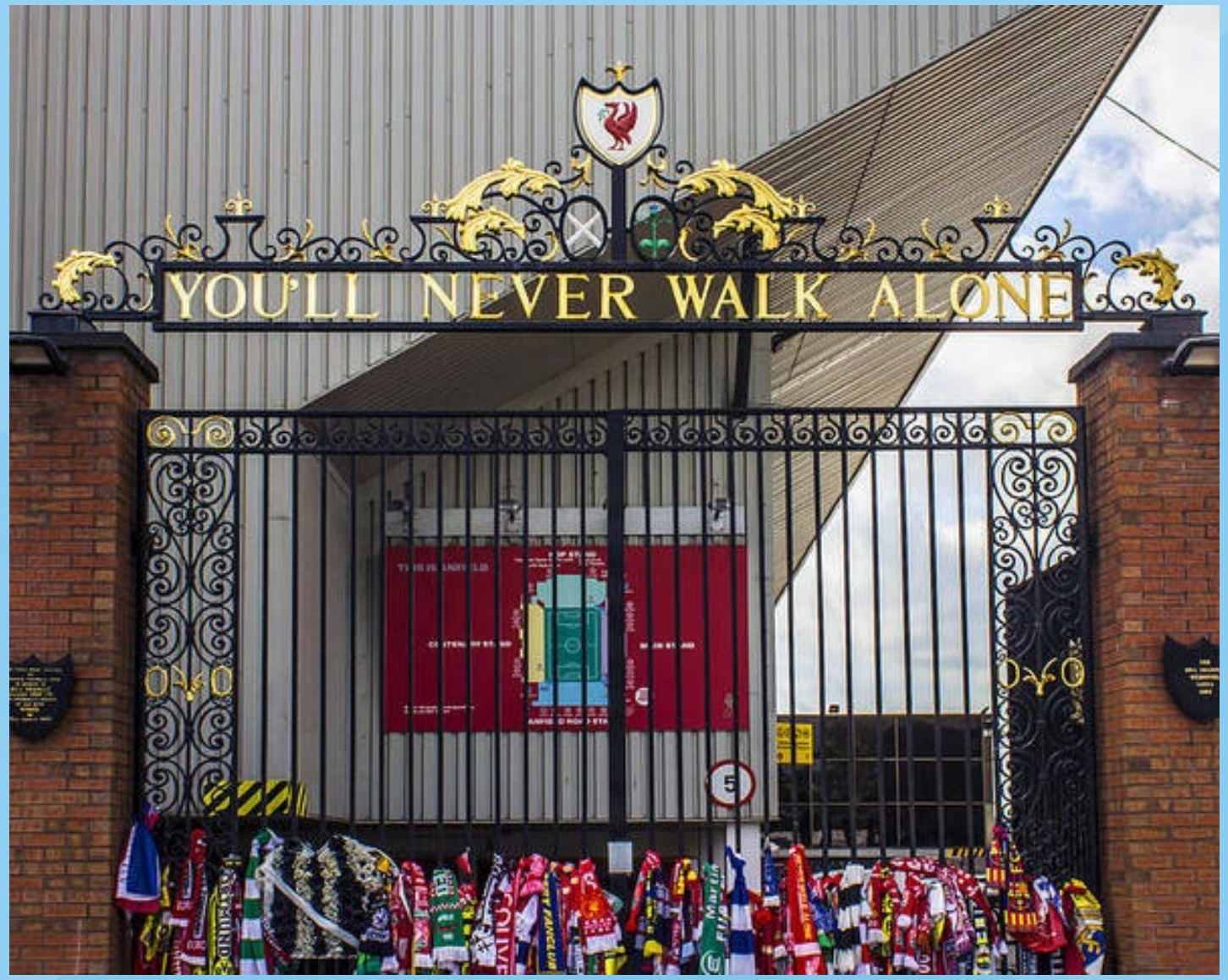
Other risk factors

- Invasive procedures
- Poor pre hospitalization functional status
- Prior history of psychiatric disorders

Not all is lost…



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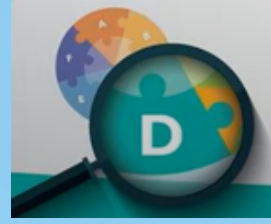
ICU Liberation Bundle

- **A**: Assess, prevent & manage pain
- **B**: Both SAT & SBT
- **C**: Choice of analgesia & sedation
- **D**: Delirium: Assess, prevent & manage
- **E**: Early mobility & exercise
- **F**: Family engagement & empowerment

Prevention Methods

- Sleep Enhancement (via nonpharm & hygiene)
- Appropriate Meds (Reducing exposure to deliriogenic medications)
- Cognitive stimulation/Rehabilation
- Adequate Oxygenation
- Pain Management
- Constipation relief
- Nutrition & fluid repletion
- Sensory assistive devices (vision & hearing)
- Early Mobility/Rehabilation



ICU LIBERATION

AGS Post Operative CPG Guidelines (JAGS 2014)
Inouye et al. N Engl J Med 1999; 9(340):669-676
McNamara et al., Am J Crit Care 2008; 17: 576

Society of Critical Care Medicine

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What can family members due to help

- Keep a diary for patients to review, reflect & connect
- Interact with the patient
- Reorient: remind day, time, year, location
- Playing music or tv shows
- Pictures from home
- Read to the patient

SCCM Recommendations

- Assess patients 2-4 weeks post ICU discharge (Strong)
- Serially assess patients when important changes occur
- 6MWT
- MOCA (Strong)
- Preexisting cognitive dysfunction (Strong)
- Life support (Weak)
- Hospital Anxiety & Depression scale (Strong)

Mikkelse et al. SCCM's International Consensus Conference on PRediction & Identificaiton of Long-Term Impairments after Critical Illness. Crit Care MEd. 2020 NMov;48(11):1670-679

Post ICU Clinics

- PCP
- Social workers
- Pharmacists
- Therapy
- Providers
- Support group

- **https://www.icudelirium.org/**

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How can we prevent & reduce PICS?

- RN:SATs, RASS, minimize sedation, watch for delirium
- RT: SBTs, Pulmonary hygiene
- PT/OT/SLP: Timely intervention & evaluation of needs
- Pharmacy: Med rec and timely discontinuation of therapies
- SW/CM: Resources and help navigating the system
- RD: Critical illness & recovery need a strong foundation
- Families: Integral part of team, be engaged
- MD/DO/MBBS/APP- Utilize your team effectively

Back to our case…6 months later…

- She can’t sleep, can’t eat, trouble thinking
- Vividly remembers hearing family in room but she was unable to move her body.
  - Very distressing
- Telogen effluvium
- ….

Thank you!

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