RETROSPECTIVE REGISTRY-BASED COHORT STUDY · ANZICS-APD

Long-term outcomes of patients with persistent critical illness in Australia and New Zealand

Does a longer ICU stay, in itself, cost survival?

R. Vithanage · E. Thashneem · M. Savage · J. Oroz · M. Ramanan · J. Darvall · A. Burrell · D. Pilcher

Alfred Intensive Care Academic Centre · Monash University · ANZICS CORE

01 · BACKGROUND

Persistent critical illness: a small group, a large footprint

1.8 d

Average ICU stay in ANZ — most admissions are short

3.6%

of ICU admissions become persistently critically ill

~33%

of all ICU bed-days consumed by the PerCI group

What is persistent critical illness (PerCI)?

- Defined epidemiologically at a day-10 transition: from this point antecedent patient characteristics predict mortality better than the acute presenting illness.
- A clinical syndrome of neuroendocrine, neuromuscular and cognitive dysfunction with altered body composition.
- Disproportionate resource use and far higher rates of discharge to institutional care.

The knowledge gap & our question

The gap

- Much is known about who develops PerCI and how to manage it — but long-term survival and functional outcomes remain unclear.
- Prior reports conflict, largely because of heterogeneous definitions (e.g. prolonged mechanical ventilation).
- Whether ICU length of stay independently affects survival — or simply marks sicker patients — is unresolved.

Objective

Determine long-term (5-year) survival of patients with PerCI across ANZ, and how it varies with ICU length of stay.

Hypothesis

The longer the ICU stay in a patient with PerCI, the lower their likelihood of 5-year survival.

Methods

Design & setting

- Population-based retrospective cohort
- All ANZ ICUs reporting to ANZICS-APD (~95% of admissions)
- Linked to NDI / NHI death registers via AIHW
- Index admissions, Jul 2019 – Jun 2024

Cohort & definition

- Age > 16, index ICU admission
- PerCI = cumulative ICU LOS ≥ 10 days
- Cross-hospital transfers chained within 24 h
- Excl: palliation / donation, readmissions, no linkage key

Exposure (a priori)

- 10–13 d (reference)
- 14–20 d
- 21–29 d
- 30–89 d
- ≥ 90 d

Outcome

- All-cause mortality at 12 / 24 / 60 months from ICU discharge
- Kaplan–Meier from ICU discharge (time-zero) — full ICU LOS accrued before follow-up, avoiding immortal time bias; administrative (non-informative) censoring at the 1 Jul 2024 extract
- Secondary: in-hospital mortality, delirium, pressure injury, discharge destination

Adjustment — multivariable Cox

- Age, sex, BMI, Indigenous status, socioeconomic status
- Frailty (CFS), chronic liver / respiratory / cardiac / renal disease
- Acute severity via SOFA-2 (APACHE III/IV & ANZROD in sensitivity analyses)
- PH assumption checked (Schoenfeld residuals, log–log plots)

Cohort derivation

985,594 De-duplicated ICU episodes in study window

970,406 Cross-hospital transfer episodes linked

786,727 Unique patients (index admission retained)

▼

35,573
PerCI analytic cohort · 175 ICUs · 3.6% of admissions

Key exclusions

ICU stay < 10 days — did not meet PerCI definition
748,691

Missing ICU hours / indeterminate LOS
1,677

Still in ICU at 1 Jul 2024 census
420

No statistical linkage key (no NDI/NHI)
210

Palliative / organ-donation, age < 16, date errors
156

Data-quality exclusions meeting PerCI criterion (n=630) were well balanced vs the analytic cohort (SMD < 0.10).

Who are these patients?

62.2

median age (yrs)
[IQR 48.5–72.5]

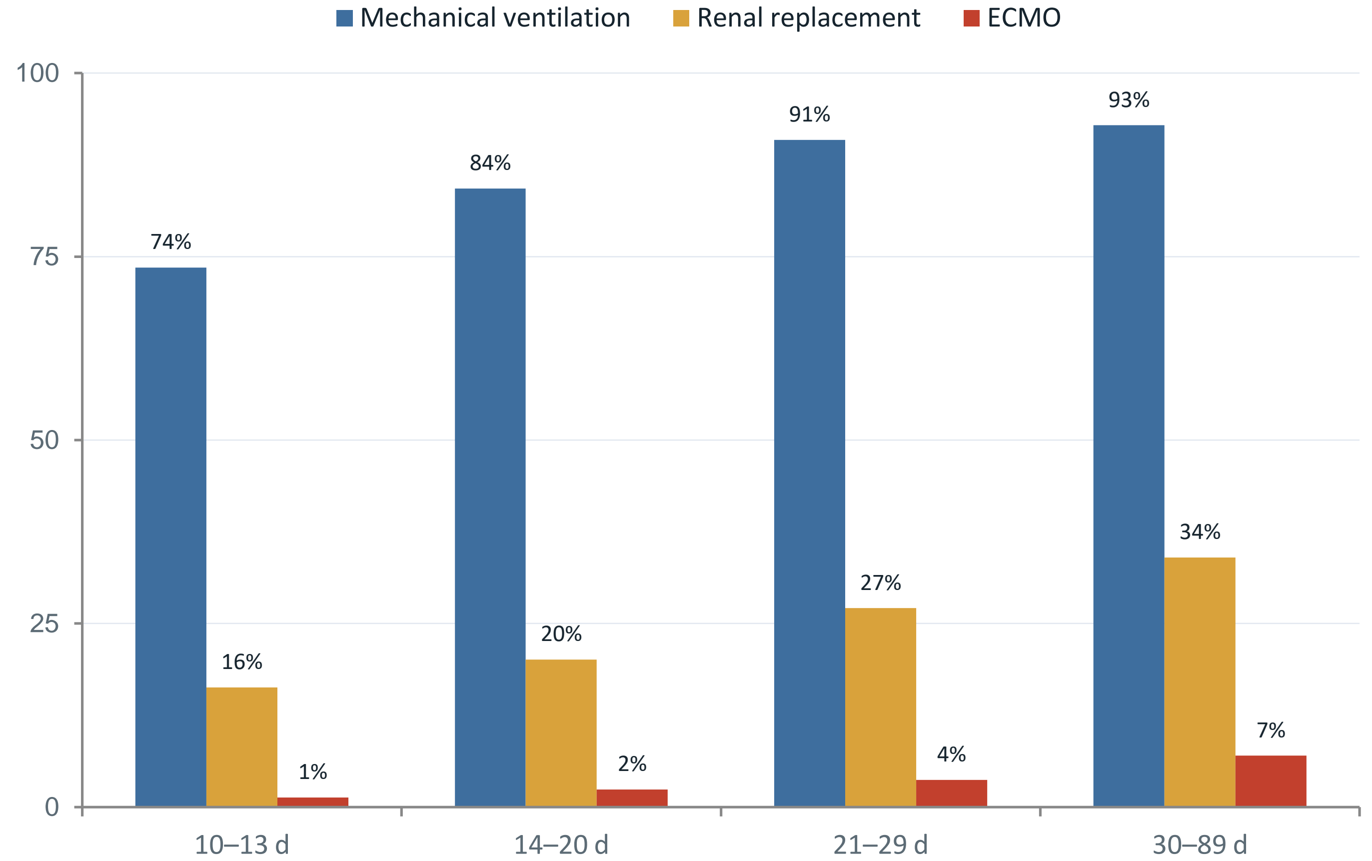
62.6%

male

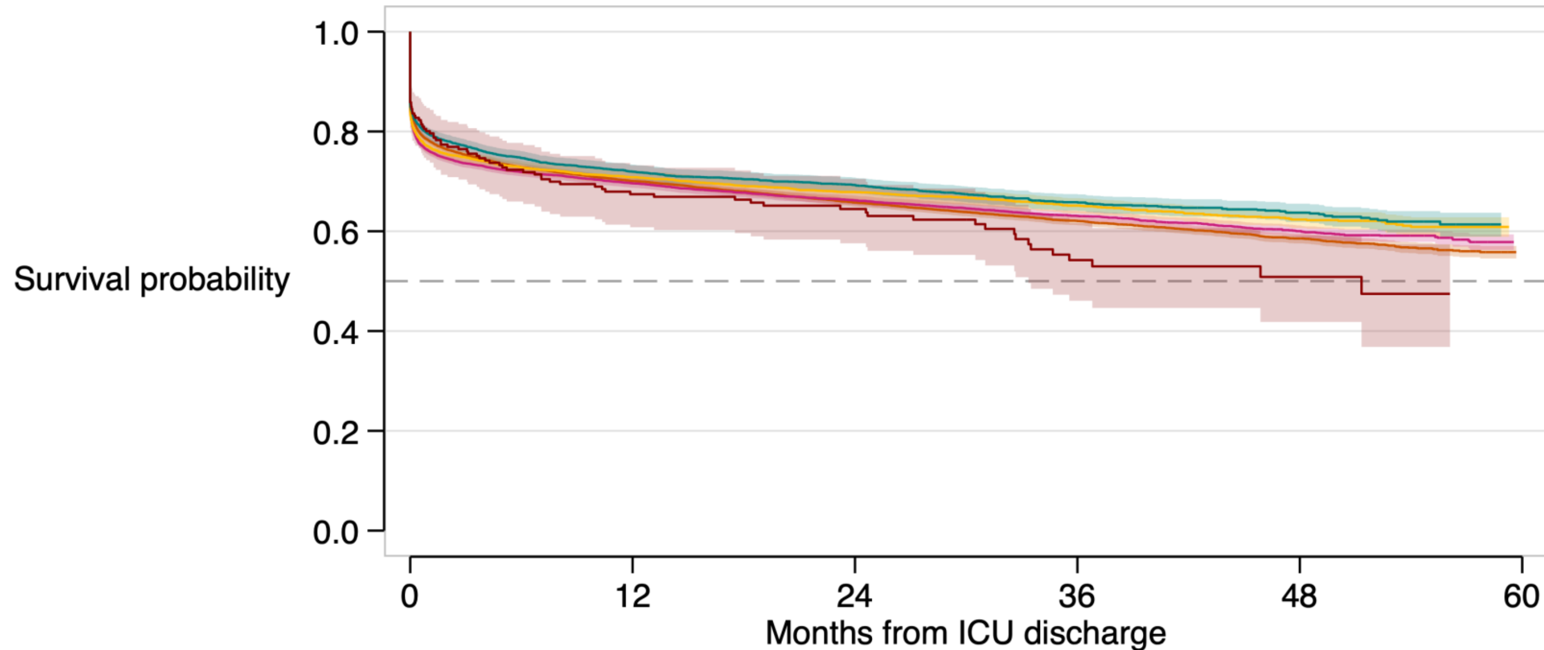
44.9%

stayed only 10–13 days
(0.6% reached ≥ 90 days)

Counter-intuitively, the longest-stay (≥90 d) patients were **younger (58.8 y) with lower admission severity** — APACHE III/IV 59, ANZROD 8.3%.



Most patients survive



Number at risk

	0	12	24	36	48	60
loscatn = 10-13 days	15980	8893	6057	3661	1695	0
loscatn = 14-20 days	10829	5973	4159	2469	1094	0
loscatn = 21-29 days	4643	2612	1793	1108	523	0
loscatn = 30-89 days	3895	2233	1629	928	435	0
loscatn = 90+ days	226	131	93	48	21	0

ICU stay 10-13 days
ICU stay 14-20 days
ICU stay 21-29 days
ICU stay 30-89 days
ICU stay 90+ days

Survival from ICU discharge by LOS group. All groups share t=0 at ICU discharge.
In-hospital deaths included at t~0. Shaded areas = 95% CI (90+ day CI faint).
Log-rank $p < 0.001$.

Survival from ICU discharge

~68%

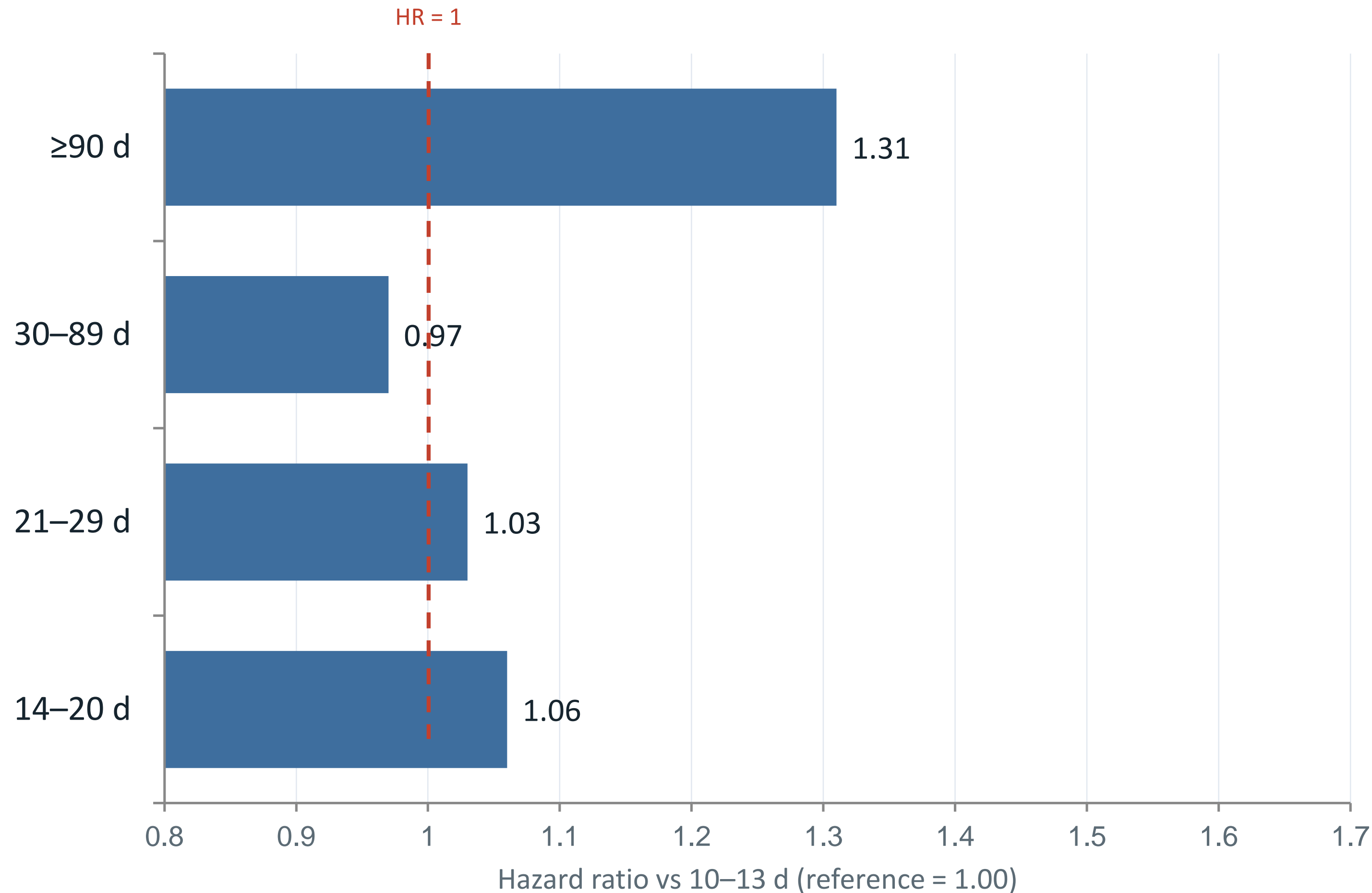
survival at 12 months

46.6–59.4%

survival at 60 months across groups

Curves are near-identical to ~3 months; the ≥90-day group separates downward, falling below 50% at 5 years.

Length of stay carries little weight — until 90 days



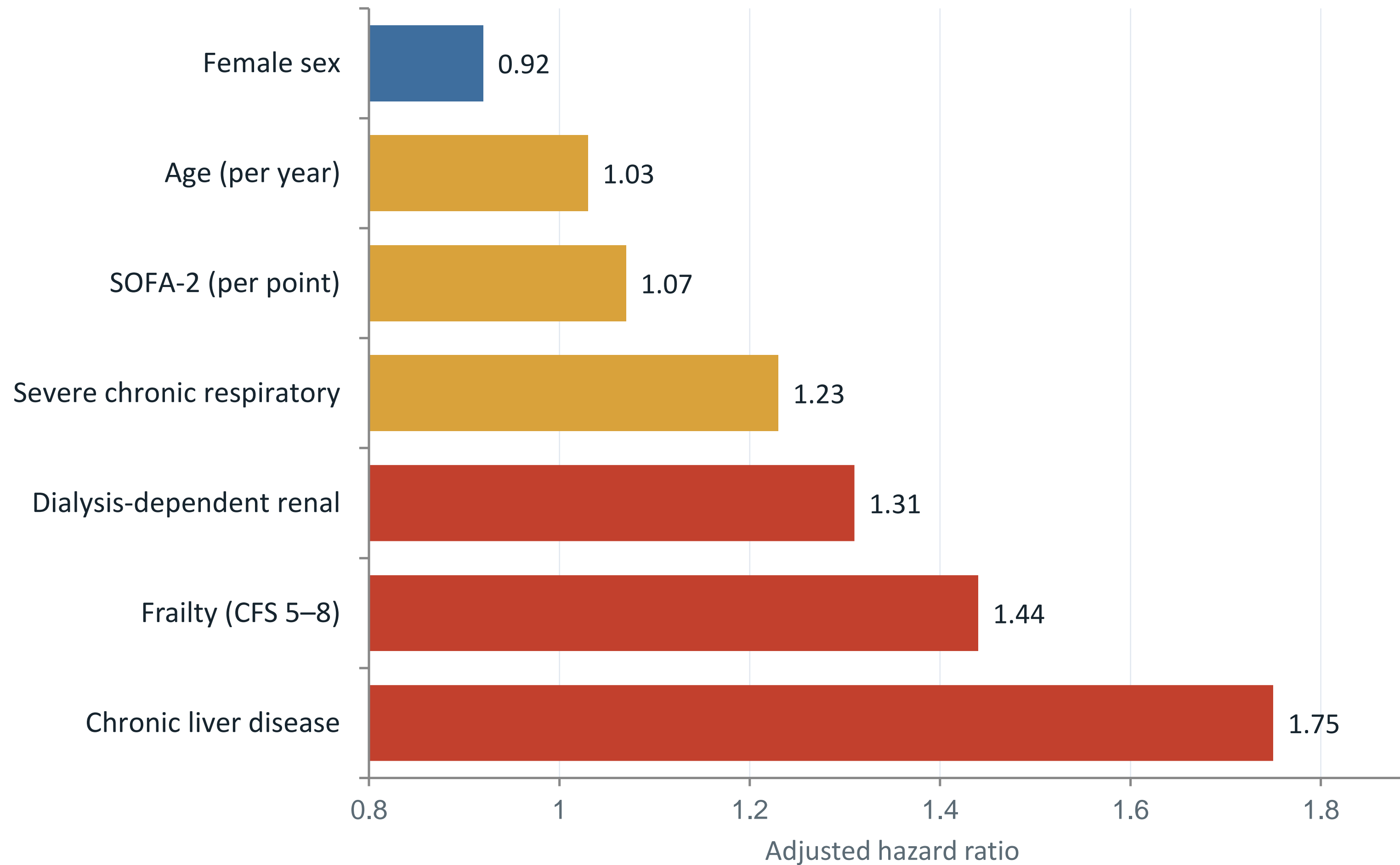
Length of stay vs 5-year hazard

10–89 days: no independent association with survival after adjustment.

≥90 days: HR 1.31 (95% CI 1.07–1.62), p = 0.010 — a distinct higher-risk group.

Findings unchanged whether SOFA-2, APACHE III/IV or ANZROD was used for severity.

What actually drives long-term death



It's the patient, not the clock

Pre-existing chronic disease and physiological reserve dominate — not the acute ICU course.

Decompensated liver disease carries the highest hazard; frailty stays strongly predictive after full adjustment.

Female sex was independently protective (HR 0.92).

All associations p < 0.001. Reference: CFS 1–4, non-Indigenous, BMI 25–29.9.

09 · INTERPRETATION

Why longer stays didn't mean worse survival

1

Survivor selection

Frailer, sicker patients die — or have treatment limited — before day 10. Reaching prolonged stay selects a resilient group, so the longest-stay patients had the lowest admission severity (APACHE 59, ANZROD 8.3%).

2

LOS ≠ long-term risk

The drivers of a prolonged stay differ from the drivers of long-term survival. Length of stay is an imperfect marker of risk — except at its extreme.

3

True difference may be small

Any survival difference below 90 days may be small or slow to emerge — and undetectable at this size, with nearly half the cohort in the 10–13-day band.

Lower in-hospital mortality in longer-stay groups (18.1% → 12.4%) is consistent with this selection effect.

The ≥90-day group: a distinct exception

HR 1.31

adjusted hazard of death (95% CI 1.07–1.62)

< 50%

five-year survival — the only group below half

58.8 y

younger, with the lowest admission severity scores

An independent late-mortality penalty

- The excess hazard persisted despite favourable selection and after full adjustment — it cannot be attributed to baseline chronic disease.
- Plausibly reflects accumulated disability, deconditioning, nosocomial infection and unmeasured morbidity from a protracted course.
- Discharge home fell from 69.2% to 55.8% across the LOS spectrum — survival increasingly ends somewhere other than home.

Strengths & limitations

Strengths

- Whole-of-ANZ registry (~95% of admissions) linked to national death data — strong generalisability.
- Contemporary 5-year window including the COVID-19 era.
- Small, balanced exclusions (SMD < 0.10) — selection bias unlikely.
- Robust to three different severity scores.

Limitations

- No functional, quality-of-life or longitudinal frailty data — survival alone is incomplete.
- Anchoring at ICU discharge avoids immortal time bias but conditions on surviving the admission — no extrapolation to all ICU patients.
- Retrospective: missingness; absent SOFA-2 inputs set to zero may underestimate severity.
- Categorical LOS; ≥90-day group small (n=226). Nosocomial infection & ICU-acquired weakness not captured.
- Administrative right-censoring at the 1 Jul 2024 extract gives shorter follow-up for later admissions; 5-year estimates rest on earlier-admitted patients.

Conclusions

Measured optimism for most patients

Persistent critical illness in ANZ carries favourable long-term survival — ~68% alive at 12 months — and reaching it should not, by itself, prompt pessimism.

Length of stay adds little prognostic weight to ~3 months

Across 10–89 days, survival was driven by underlying comorbidity and frailty, not by time in ICU. Outcome reflects who entered the ICU more than how long they stayed.

The ≥90-day group is a distinct, higher-risk exception

An independent late-mortality penalty (HR 1.31; 5-yr survival < 50%) warrants particular attention in prognostication and goals-of-care discussions.

Survival is not recovery — functional and quality-of-life trajectories remain the key next question.

Thank you

Questions welcome

ruvini.vithanage@gmail.com

With thanks to ANZICS CORE, contributing sites, data collectors, and the AIHW data linkage team.

Ethics: Alfred Health HREC 713/2021