TRIC-BLOCK

Evaluating the prevalence and practice of neuromuscular blockade by infusion within UK Intensive Care Units

Statistical Analysis Plan

R. O'Sullivan with approval from TRIC-BLOCK steering committee prior to database lock

Version 1.0 | 18.08.2026

Prepared with reference to TRIC-BLOCK protocol V1.1

TRICNetwork PICSTAR

The Faculty of Intensive Care Medicine

Intensive Care Society

PCCS Paediatric Critical Care Society

1 Evaluation overview

This is a prospective, multicenter service evaluation conducted across UK adult and paediatric intensive care units, with a two-week screening window and seven-day patient-level follow-up. The evaluation aims to describe current clinical practice in the use of continuous neuromuscular blocking drugs (NMBD) in mechanically ventilated patients. All analyses are descriptive in nature and intended to characterise practice. No hypothesis testing or causal inference will be undertaken. Confidence intervals will be presented solely to describe the precision of prevalence estimates.

Reporting of this evaluation will be conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2 Objectives

Primary objective

To estimate the prevalence of continuous NMBD infusion use in invasively ventilated ICU patients.

Secondary objectives

To describe:

- NMBD agents used and indications
- Dosing regimen and duration of use during follow-up, overall and in the context of BMI, lean body weight, renal / liver function
- Use of bolus dosing before and during continuous infusion
- Assessment/monitoring for depth of neuromuscular blockade
- Assessment/monitoring for depth of sedation in patients receiving NMBD infusion
- NMBD discontinuation practice, including use of emergency reversal agents
- Adverse events and incidents associated with continuous NMBD use
- Sedation practice and use of bolus dosing of NMBD in patients not receiving continuous NMBD

To compare local continuous NMBD guidance from participating UK ICUs and describe current UK practice recommendations.

Exploratory objectives

To examine variation in prevalence and secondary objectives in NMBD use across predefined clinical subgroups:

- Acute hypoxaemic respiratory failure (AHRF)
- Traumatic brain injury (TBI)
- Other ICU population
- Patients admitted to a SARF centre and/or commenced on ECMO specifically for the management of AHRF during the evaluation period

3 Analysis populations

Primary analysis population

The primary analysis population will comprise all patients meeting the inclusion criteria and entered into REDCap, excluding elective surgical patients who remain intubated for ≤24 hours.

This population will be used as the denominator for the primary prevalence estimate of continuous NMBD infusion use and for all secondary outcome analyses, subgroup summaries, and exploratory analyses, unless otherwise stated.

Full eligible population

The full eligible population will comprise all patients meeting the inclusion criteria and entered into REDCap, including elective surgical patients who remain intubated for ≤24 hours.

Elective surgical patients who remain intubated for ≤24 hours will contribute only basic demographic data. A secondary prevalence estimate of continuous NMBD infusion use will be calculated using the full eligible population as the denominator, to describe prevalence across all patients captured during the screening period.

Patients receiving continuous NMBD

Subset of patients receiving continuous NMBD infusion ≥1 hour.

Patients NOT receiving continuous NMBD

Subset of the primary analysis population not receiving continuous NMBD infusion for ≥1 hour.

Subgroups

Pre-specified subgroups will be used for exploratory analyses:

- Acute hypoxaemic respiratory failure (AHRF)
- Traumatic brain injury (TBI)
- Other ICU population (not AHRF or TBI)
- Patients admitted to a SARF centre and/or commenced on ECMO specifically for the management of AHRF during the evaluation period

4 Data preparation and cleaning

Quality control

Data quality will be ensured through targeted validation. A 100% review will be undertaken for all patients receiving continuous NMBD infusion, and a random sample of 10% of remaining records will be checked (or a minimum of two records per site where fewer than 10 patients are included). Any incomplete records or data entry errors identified during this process will be queried directly with site leads for clarification or correction. All participating sites will be required to submit a site closure form confirming that data are complete to the best of their knowledge and that all eligible patients have been included.

Free-text entries

Free-text entries will be independently reviewed by two authors and, where possible, re-categorised into predefined eCRF categories. Discrepancies will be resolved by consensus or by a third author if required. Where entries clearly represent a common category not captured in the eCRF, an additional classification will be assigned by agreement between reviewers. Original free-text entries will be reported in supplementary material.

Missing data

Missing or invalid data will be treated as missing and not imputed. Analyses will use available data, with denominators clearly reported. The proportion of missing data for each variable will be summarised, and findings interpreted cautiously where missingness is substantial.

Data cleaning

Range and logic checks will be applied (e.g. duration ≥0, valid dosing ranges) and any inconsistencies queried with sites where feasible. Any remaining values which are biologically implausible will be removed and treated as missing. All original raw data will be preserved and a record of any excluded values kept.

Derived variables

The following derived variables will be calculated from supplied data for the purpose of stratified descriptive summaries.

Variable	Type	How measured / calculated
Body Mass Index (BMI)	Continuous	Calculated as weight (kg)/height (m²). May additionally be categorised according to standard BMI classifications.
Lean body weight (LBW)	Continuous	Adults only. Calculated in kilograms using the Janmahasatian formula.
SOFA-2 score (adults)	Ordinal	Ordinal severity score analysed as a continuous variable. Recorded from worst (furthest from normal) value observed during the first 24 hours of ICU admission.
PIM3 score (paediatric)	Continuous	Predicted mortality risk calculated using variables recorded between first contact and one hour after ICU admission (standard PIM3 criteria).
Renal/hepatic impairment	Categorical	Categorical (yes/no). Derived from renal and hepatic variables recorded for SOFA or PIM3 assessment.
PaO_2/FiO_2 ratio (P/F ratio)	Continuous	Calculated as PaO_2/FiO_2. May additionally be categorised according to Berlin 2012 ARDS severity classifications. In paediatric patients, P/F ratio may also be reported alongside PALICC-2 PARDS severity classifications.
Oxygenation Index (OI)	Continuous	Mean airway pressure × FiO_2 / PaO_2 in paediatric patients. Also reported categorically with reference to PALICC-2 definitions of PARDS severity.
Oxygen Saturation Index (OSI)	Continuous	Mean airway pressure × FiO_2/SpO_2 in paediatric patients. Also reported categorically with reference to PALICC-2 definitions of PARDS severity.

ARDS criteria from Berlin 2012 definition. PARDS criteria from PALICC-2 2023. ARDS/PARDS severity classification will be based on routinely available data captured in the eCRF; patients will not be retrospectively adjudicated beyond the available recorded variables.

5 Sample size justification

No formal sample size calculation has been performed, as this is a descriptive service evaluation. The sample size will be determined by the number of participating ICUs and eligible patients during the 2-week screening period. This is expected to provide a sufficiently precise estimate of NMBD infusion prevalence and allow descriptive assessment of practice variation.

6 Statistical analysis

Statistical analyses will be primarily descriptive, reflecting the service evaluation design. Results will be presented using summary tables and figures. Categorical variables will be summarised using counts and percentages. Continuous variables will be summarised using mean and standard deviation or median and interquartile range, as appropriate, along with minimum and maximum values. Normality will be assessed visually using histograms and QQ plots. Analyses will be performed as follows:

Outcome	Summary measure / estimate	Comments
Primary outcome		
Prevalence of continuous NMBD infusion use in the primary analysis population	n/N (%), 95% CI (Wilson)	Denominator: all eligible REDCap-entered patients excluding elective surgical patients intubated ≤24 hours
Secondary outcomes		
Prevalence of continuous NMBD infusion use in the full eligible population	n/N (%), 95% CI (Wilson)	Denominator: all eligible REDCap-entered patients, including elective surgical patients intubated ≤24 hours
Patients receiving continuous NMBD		
NMBD agent used	n/N (%)	By agent
Indication for NMBD use	n/N (%)	Categorised indications
Infusion rate	Mean (SD) or median (IQR)	Continuous variable
Duration of infusion	Mean (SD) or median (IQR)	Hours and/or days, continuous
Bolus NMBD use before and during continuous infusion	n/N (%)	Reported separately for bolus use before infusion initiation and bolus use during infusion
PNS/TOF monitoring	n/N (%)	Any use, frequency and/or documented TOF target where recorded
Sedative / analgesic agent use	Discrete count, mean (SD) or median (IQR)	Number of continuous sedative/analgesic infusions administered daily during continuous neuromuscular blockade
Sedation monitoring	n/N (%)	Clinical scales and/or EEG-derived measures
Discontinuation method	n/N (%)	Weaning vs abrupt cessation
Reversal agent use	n/N (%)	Yes/No
≥1 adverse event	n/N (%)	Patient-level prevalence
Individual adverse event types	n/N (%)	Event-specific frequencies
Clinical status at Day 7	n/N (%)	Reported across all outcome categories*
Patients not receiving continuous NMBD		
Sedative / analgesic agent use	Discrete count, mean (SD) or median (IQR)	Maximum number of continuous sedative/analgesic infusions administered concurrently for >1 hour during follow-up
Bolus NMBD use	n/N (%)	Yes/No
Failed extubation	n/N (%)	Descriptive summary
Clinical status at Day 7	n/N (%)	Reported across all outcome categories*

*Clinical status categories: remains in ICU invasively ventilated; remains in ICU requiring NIV/high-flow oxygen; remains in ICU requiring low-flow oxygen or no respiratory support; discharged to ward; discharged home; transferred to SARF/ECMO centre; transferred to another hospital; deceased.

6.1 Exploratory analyses

Exploratory analyses will be conducted across pre-specified subgroups as detailed above to allow descriptive summaries of secondary outcomes. Descriptive comparisons between patients who did and did not receive continuous NMBD will be presented without statistical testing.

Outcomes will be stratified by (where appropriate):

- ICU type (adult vs paediatric)
- Hospital type (district general vs teaching hospital)
- Pre-specified clinical subgroups (AHRF, TBI, Other, SARF/ECMO for AHRF)

6.2 Local guideline analysis

Local NMBD guidance documents submitted voluntarily by participating sites will be summarised in a brief narrative review.

Key domains will include:

- NMBD agent recommendations
- Monitoring strategies
- Dosing guidance

7 Potential for bias

This evaluation may be subject to selection bias due to voluntary site participation, and information bias from reliance on routinely recorded clinical data of variable completeness. Inconsistent case identification and variation in documentation across sites may introduce misclassification. The 7-day follow-up may also underestimate later outcomes. A Hawthorne effect may also be present, whereby clinicians alter their usual practice due to awareness of being observed during the evaluation period, potentially influencing estimates of routine NMBD use. Findings will therefore be interpreted as descriptive and potential bias highlighted as a limitation.

8 Presentation of results

Results will be presented through descriptive summaries with tables and figures only. No inferential statistics will be used. All exploratory analyses will be clearly labelled.

9 Deviations

Any deviations from this plan will be documented and justified in final reporting.