

Impact of congenital neurosurgical and acute neurological conditions on length of hospital stay among neonates admitted to a neonatal intensive care unit

Sérgio Neto

sgsnnc@gmail.com

Clínica Girassol

Moisés Cinco Reis

Hospital do Prenda

Paula Quaresma

Hospital pediátrico David Bernardino

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Abstract

Background. Neonatal intensive care units (NICUs) routinely host two clinically and operationally distinct cohorts: neonates with congenital anomalies whose course is dominated by neurosurgical decision-making, and neonates with acute acquired neurological insults. Whether these two trajectories translate into measurably different lengths of hospital stay (LOS) in a low-resource Southern African setting remains poorly characterised.

Objective. To compare LOS between the congenital/neurosurgical and the acute acquired neurological macrogroups among neonates admitted with neurological or neurosurgical conditions to a tertiary NICU in Luanda, Angola.

Methods. A retrospective observational study was conducted on a cleaned administrative database of 1,728 NICU episodes (after deduplication and terminology normalisation of 1,774 original records). Of 536 neurological/neurosurgical cases, 153 formed the congenital/neurosurgical macrogroup and 383 the acute acquired neurological macrogroup. LOS was compared with the Mann–Whitney U test; anticonvulsant use was compared with Pearson's χ^2 ; heterogeneity across the seven primary diagnostic groups was assessed with the Kruskal–Wallis test. Reporting followed the STROBE framework [1].

Results. LOS was substantially longer in the congenital/neurosurgical macrogroup ($n = 137$ with LOS data; median 26.0 days; Q1–Q3 17.0–38.0; mean 29.54 ± 18.68) than in the acute acquired neurological macrogroup ($n = 341$ with LOS data; median 6.0 days; Q1–Q3 4.0–13.0; mean 9.57 ± 8.77 ; Mann–Whitney $U = 40,352.5$; $p = 1.20 \times 10^{-35}$). Anticonvulsants were used in 3.27% (5/153) of the congenital/neurosurgical macrogroup versus 19.06% (73/383) of the acute acquired macrogroup ($\chi^2 = 20.68$; $p = 5.44 \times 10^{-6}$). Heterogeneity in LOS across the seven primary diagnostic groups was confirmed (Kruskal–Wallis $H = 160.04$; $p = 5.81 \times 10^{-32}$).

Conclusion. Congenital neurosurgical admissions consumed markedly more inpatient days than acute neurological admissions, with an effect that is statistically robust and clinically plausible. The distinction has direct implications for bed planning, operating-room prioritisation, transfer pathways and the organisation of neonatology–neurosurgery interfaces in Angola and comparable Sub-Saharan African settings. Causal inference, mortality and definitive functional outcomes cannot be drawn from this design.

1. Introduction

The consolidation of neonatal neurology and the diffusion of neonatal neurocritical-care models have reshaped how critically ill newborns are managed [2–5]. The developing brain is now regarded as a specific target of surveillance, therapeutic decision-making and protection, requiring structured articulation between neonatology, paediatric neurology, neurosurgery, neuro-imaging and specialised nursing. Within this framework, systematic differentiation between admissions driven by acute

neurological insults and those shaped by congenital anomalies with a neurosurgical trajectory is increasingly recognised as both clinically and operationally informative.

Globally, the public-health weight of these two poles is substantial. Approximately 1.2 million neonates develop hypoxic-ischaemic encephalopathy (HIE) each year, with an estimated 96% occurring in low- and middle-income countries (LMICs), where incidence is 15–20-fold higher than in high-income settings [6–8]. In Sub-Saharan Africa, recent multicountry surveys have documented persistent gaps in diagnostic resources, therapeutic-hypothermia capacity and standardised neurological monitoring for HIE [9, 10]. Neonatal bacterial meningitis imposes a disproportionate burden in African cohorts, with case-fatality rates substantially higher than those reported from high-income paediatric intensive care [11–13]. Reported neonatal tetanus cases have plateaued at approximately 1,000–1,400 per year since the late 2010s, with resurgence signals in several countries previously validated for elimination [14, 15]. Acute seizures cross multiple aetiologies and demand prompt electroencephalographic confirmation, structured investigation and targeted treatment [16, 17].

On the congenital side, neural tube defects (NTDs) affect roughly 2 per 1,000 pregnancies worldwide, translating into an estimated 214,000–322,000 affected pregnancies annually, with the heaviest burden concentrated in regions of low folate intake and limited primary prevention [18–20]. In Africa, the pooled birth prevalence of spina bifida remains the highest documented globally at approximately 1.3 per 1,000 births, with myelomeningocele the dominant phenotype [21]. Surgical series from Lusaka, Zambia, confirm that neurosurgical myelomeningocele repair in Sub-Saharan Africa is feasible but is followed by predictable postoperative and 30-day complications that extend inpatient stay [22].

Paediatric hydrocephalus is increasingly characterised as an emerging public-health problem in Sub-Saharan Africa, with late presentation, scarce endoscopic capacity and prolonged inpatient trajectories documented across multiple tertiary centres [23, 24]. A meta-analytic synthesis of 12,355 African children with hydrocephalus confirms prolonged inpatient trajectories and identifies ventriculoperitoneal shunting as the dominant definitive treatment in the region [24]. Comparative institutional series from KwaZulu-Natal, South Africa, reinforce the wide variability in referral patterns and outcomes across the region, with stays frequently exceeding several weeks before definitive intervention [25]. The combined effect is a clinical profile in which neonates with surgically actionable congenital anomalies occupy NICU beds for substantially longer periods than those whose course is dominated by acute medical illness [26–28, 31].

Within Angola, the evidence base is thin but consistent with regional patterns. Birth asphyxia accounts for a substantial share of neonatal deaths, and case–control data from Angolan referral paediatric services place perinatal asphyxia among the leading individual contributors to neonatal mortality, consistent with regional pooled estimates from East and Central Africa [29, 30]. Facility-level hospital series from neighbouring Sub-Saharan African settings place the birth prevalence of NTDs well above the global mean, and the burden of paediatric hydrocephalus in tertiary Angolan neurosurgical practice mirrors that reported from elsewhere in the region [21, 23]. Luanda, the most populous province and the

location of the present study, concentrates tertiary paediatric and neurosurgical capacity but, to our knowledge, no contemporary analysis has compared the inpatient footprint of congenital neurosurgical and acute neurological admissions at NICU level.

Length of stay is, in this context, more than a descriptive metric. In resource-limited NICUs, LOS governs bed turnover, peri-operative planning, imaging utilisation, transfer logistics and institutional expenditure, and therefore constitutes a first-order operational endpoint. The transparent reporting of observational evidence on this question is explicitly required by the STROBE framework [1], and the comparative angle is aligned with global calls to strengthen the neonatal neurosurgical workforce and referral architecture in LMICs [23, 28].

Research question. Among neonates admitted to a NICU with neurological or neurosurgical conditions, do cases classified as congenital/neurosurgical present a longer length of hospital stay than cases classified as acute acquired neurological?

Aim. The present study addresses this question with previously validated outputs from the institutional database. The central interest is neither prognostic, nor mortality-related, nor causal, but the demonstration that aetiological organisation of cases translates into distinct inpatient trajectories — a premise essential for bed planning, theatre prioritisation and the design of neonatology–neurosurgery interfaces in Angola and comparable Sub-Saharan African settings.

2. Methods

2.1. Study design and reporting framework

A retrospective observational study was conducted using a secondary administrative database of NICU admissions. The description of design, sample selection, variables and the limits of inference conform to the STROBE statement for observational research [1].

2.2. Setting

The study was set in the Neonatal Intensive Care Unit of Hospital Pediátrico David Bernardino, a tertiary paediatric referral hospital in Luanda, Angola. Affiliated neurosurgical care is delivered at Clínica Girassol and Hospital do Prenda, both in Luanda.

2.3. Data source and data preparation

The original database comprised 1,774 records. After structured-field review, free-text inspection, spelling correction and terminology normalisation, followed by probabilistic deduplication, a clean analytic base of 1,728 episodes was obtained. Identification of neurological/neurosurgical cases combined explicit database variables with semantic review of complaints, diagnoses and clinical markers already mapped to an internally consistent nomenclature.

2.4. Definition of the neurological/neurosurgical subset

Among 1,728 episodes, 536 neurological/neurosurgical cases were identified and grouped into two analytical macrogroups.

Congenital/neurosurgical macrogroup (n = 153): neural tube defects and spinal dysraphism (n = 80), hydrocephalus and CSF circulation disorders (n = 52), encephalocele and other cranial or CNS malformations (n = 21).

Acute acquired neurological macrogroup (n = 383): CNS infection and neonatal tetanus (n = 212), hypoxic-ischaemic encephalopathy and perinatal asphyxia (n = 116), neonatal seizures and spasms (n = 33), and birth trauma, intracranial haemorrhage or cephalohaematoma (n = 22).

Twenty-two postoperative neurosurgical cases were handled as an operational marker of overlap rather than as an autonomous primary group. Of these, 14 belonged to hydrocephalus/CSF disorders, 7 to neural tube defects / spinal dysraphism, and 1 to encephalocele / cranial malformations.

2.5. Variables and statistical analysis

The primary variable was length of hospital stay in days. Given the expected asymmetric distribution, medians with interquartile ranges (Q1–Q3) are reported alongside means, standard deviations and ranges. The macrogroup comparison used the Mann–Whitney U test. As a secondary comparison, the frequency of anticonvulsant use was tested with Pearson's χ^2 . Heterogeneity in LOS across the seven primary diagnostic groups was assessed with the Kruskal–Wallis test. Significance thresholds were two-sided.

No regression models, odds ratios, multivariable adjustments or causal models were fitted, because these procedures were not part of the pre-validated output set produced from this database. p-values are reported to three significant figures in scientific notation when below 0.001; values above 0.001 are reported as decimals.

2.6. Ethics and data availability

The study used de-identified routine institutional records and was approved by the Hospital Ethics Committee of Hospital Pediátrico David Bernardino (reference: HPDB-DP 99/2026). Access to the underlying data is subject to institutional authorisation and appropriate anonymisation. No external funding was received. The authors declare no conflicts of interest.

3. Results

3.1. Sample selection

The original database comprised 1,774 records. After cleaning and probabilistic deduplication, 1,728 episodes remained. Of these, 536 were classified as neurological/neurosurgical and subsequently split into 153 congenital/neurosurgical cases and 383 acute acquired neurological cases (Fig. 1).

3.2. Clinical composition of the macrogroups

The congenital/neurosurgical macrogroup assembled mainly neural tube defects and spinal dysraphism (n = 80), hydrocephalus and CSF circulation disorders (n = 52), and encephalocele or other cranial/CNS malformations (n = 21). The presence of 22 postoperative neurosurgical cases – 14 within hydrocephalus/CSF disorders, 7 within neural tube defects / spinal dysraphism, and 1 within encephalocele / cranial malformations – illustrates the care-intensity of this macrogroup (Fig. 2).

The acute acquired neurological macrogroup concentrated CNS infection/neonatal tetanus (n = 212), hypoxic-ischaemic encephalopathy/perinatal asphyxia (n = 116), neonatal seizures/spasms (n = 33), and birth trauma with intracranial haemorrhage or cephalohaematoma (n = 22). The profile is dominated by acute cerebral insults in which early intensive response and aetiological control tend to define length of stay.

3.3. Length of stay: main comparison

The principal result was a marked difference in LOS between the two macrogroups. In the congenital/neurosurgical macrogroup, LOS was available in 137 cases: median 26.0 days; Q1 17.0, Q3 38.0; mean 29.54 ± 18.68 ; range 1–105. In the acute acquired neurological macrogroup, LOS was available in 341 cases: median 6.0 days; Q1 4.0, Q3 13.0; mean 9.57 ± 8.77 ; range 0–48. The difference between macrogroups was highly significant on the Mann–Whitney test ($U = 40,352.5$; $p = 1.20 \times 10^{-35}$) (Table 1, Fig. 3). The 20-day median gap mirrors the inpatient burden reported in paediatric neurosurgical series from Sub-Saharan African centres, where hydrocephalus and spinal-dysraphism admissions typically consume several weeks of inpatient stay and median postoperative LOS aligns with the values observed here [22, 24, 25].

Table 1

Main comparison between the congenital/neurosurgical and acute acquired neurological macrogroups. The difference in LOS does not authorise inference about final outcome, mortality or causality.

Variable	Congenital / Neurosurgical	Acute acquired / Neurological	Statistical comparison
n total	153	383	—
Clinical composition (summary)	NTD / spinal dysraphism (80); hydrocephalus / CSF disorders (52); encephalocele / other CNS malformations (21); 22 postoperative neurosurgical cases in partial overlap	CNS infection / neonatal tetanus (212); HIE / perinatal asphyxia (116); neonatal seizures / spasms (33); birth trauma / haemorrhage / cephalohaematoma (22)	Descriptive
n with LOS available	137	341	—
Median LOS (days)	26.0	6.0	Mann–Whitney U = 40,352.5; $p = 1.20 \times 10^{-35}$
Q1–Q3 (days)	17.0–38.0	4.0–13.0	Mann–Whitney U = 40,352.5; $p = 1.20 \times 10^{-35}$
Mean $\pm$ SD (days)	29.54 $\pm$ 18.68	9.57 $\pm$ 8.77	Mann–Whitney U = 40,352.5; $p = 1.20 \times 10^{-35}$
Minimum–maximum (days)	1–105	0–48	Mann–Whitney U = 40,352.5; $p = 1.20 \times 10^{-35}$
Clinical reading	Prolonged stay consistent with surgical trajectory and postoperative surveillance	Generally short stay consistent with acute stabilisation and early aetiological control	Mann–Whitney U = 40,352.5; $p = 1.20 \times 10^{-35}$
Anticonvulsant use	5/153 (3.27%)	73/383 (19.06%)	$\chi^2 = 20.6751$; $p = 5.44 \times 10^{-6}$

Medians (solid line) and means (dashed line). Mann–Whitney U = 40,352.5; $p = 1.20 \times 10^{-35}$.

3.4. Anticonvulsant use

Anticonvulsants were significantly more frequently administered in the acute acquired neurological macrogroup than in the congenital/neurosurgical macrogroup: 73 of 383 patients (19.06%) versus 5 of 153 (3.27%); $\chi^2 = 20.68$; $p = 5.44 \times 10^{-6}$ (Fig. 4). The pattern supports the internal coherence of the macrogroup classification — acute insults more often present with convulsive features during the initial

course, whereas the dominant driver of LOS in congenital/neurosurgical cases appears to be the surgical trajectory and anatomical surveillance rather than anticonvulsant therapy.

Pearson $\chi^2 = 20.68$; $p = 5.44 \times 10^{-6}$. Percentages rounded to one decimal place for visual readability.

3.5. Heterogeneity between primary diagnostic groups

Median LOS varied widely across the seven primary diagnostic groups. Acute-profile groups showed short medians: CNS infection/neonatal tetanus 5 days, HIE/perinatal asphyxia 7 days, neonatal seizures/spasms 6 days, and birth trauma / haemorrhage / cephalohaematoma 8 days. Neurosurgical-profile groups concentrated the higher medians: NTD / spinal dysraphism 27.5 days, hydrocephalus / CSF disorders 25 days, and encephalocele / other CNS malformations 22 days (Table 2). The global Kruskal–Wallis test confirmed the heterogeneity ($H = 160.04$; $p = 5.81 \times 10^{-32}$), and the spread of medians among the neurosurgical primary groups is consistent with the range reported in African paediatric neurosurgical cohorts [24].

Table 2
Primary diagnostic groups and their median LOS. Global Kruskal–Wallis across the seven groups: $H = 160.04$; $p = 5.81 \times 10^{-32}$.

Primary diagnostic group	Median LOS (days)
CNS infection / neonatal tetanus	5
HIE / perinatal asphyxia	7
Neonatal seizures / spasms	6
Birth trauma / haemorrhage / cephalohaematoma	8
Neural tube defects / spinal dysraphism	27.5
Hydrocephalus / CSF disorders	25
Encephalocele / other CNS malformations	22

4. Discussion

The central finding of this study is the magnitude of the LOS gap between the two aetiological macrogroups. Congenital/neurosurgical cases had a median LOS of 26.0 days, against 6.0 days for acute acquired neurological cases. The statistical robustness of this contrast is extreme, but its analytical value does not rest on the p-value alone: the difference is clinically plausible and consistent with the inpatient trajectories expected for each set of conditions.

4.1. The acute acquired neurological macrogroup

The acute acquired neurological macrogroup concentrates the neonates whose LOS is governed by a short, time-bounded care cycle. Even when initial severity is high – as in HIE, neonatal seizures or CNS

infection — management centres on a defined sequence: respiratory and haemodynamic support, anti-infective therapy, seizure control, EEG monitoring where available, imaging for aetiological diagnosis, and assessment of clinical response [6–17]. Sub-Saharan African surveys show that such pathways often run their course within days, particularly where therapeutic hypothermia and continuous EEG monitoring are not routinely deployed and where prematurity and post-asphyxia sequelae drive early mortality rather than prolonged inpatient stay [9, 10, 29, 30]. The 5- to 8-day medians observed for the four acute primary groups in the present series are consistent with that regional pattern, and sit below the longer trajectories documented in tertiary neonatal networks with full cooling and neuromonitoring capacity [10].

4.2. The congenital/neurosurgical macrogroup

In contrast, congenital/neurosurgical admissions incorporate additional steps that systematically lengthen stay. Hydrocephalus frequently demands serial imaging, deliberation about shunt placement versus endoscopic third ventriculostomy, and attentive postoperative follow-up [26, 27]. NTDs and dysraphisms add anatomical complexity, potential associated Chiari II malformation, possible need for concomitant hydrocephalus management, and the risk of wound-related and infection-related complications [18, 21, 22, 31]. The 22 postoperative neurosurgical cases recorded in our series — predominantly in hydrocephalus/CSF disorders and NTD / spinal dysraphism — provide direct evidence of that prolonged trajectory. Importantly, regional surgical series from Lusaka report 30-day complication rates that extend inpatient needs, and meta-analytic data from African paediatric hydrocephalus cohorts place median postoperative LOS in the range of several weeks [22, 24].

4.3. Internal coherence of the macrogroup classification

The contrasting anticonvulsant use — 19.06% in the acute acquired macrogroup versus 3.27% in the congenital/neurosurgical macrogroup — adds internal coherence to the classification. Seizures are more often integral to the clinical expression of acute insults than to the dominant inpatient problem of congenital/neurosurgical cases, whose course is more often structured by surgical decisions and postoperative care rather than by anticonvulsant therapy [16, 17]. The classification does not aim to capture every dimension of individual patient complexity, but the directional gradient observed suggests that it discriminates inpatient trajectories with operational meaning.

4.4. Comparison with global and regional evidence

The picture that emerges aligns with, and extends, the available published evidence. Globally, neonatal HIE generates approximately 1.2 million cases annually, with a 96% LMIC preponderance concentrated in settings where birth asphyxia remains a leading neonatal killer [6–8, 29, 30]. African data confirm a perinatal-asphyxia burden that contributes disproportionately to regional neonatal mortality [29, 30]. Bacterial meningitis in African neonates is associated with higher case fatality than in high-income settings, but most cases terminate within days to a small number of weeks when treatment succeeds [11–13]. Neonatal tetanus, although less frequent than in previous decades, persists in settings with

incomplete maternal-immunisation coverage and limited skilled birth attendance, and typically resolves over a short inpatient course once human immunoglobulin and supportive care are established [14, 15].

On the congenital side, the African pooled prevalence of spina bifida — approximately 1.3 per 1,000 births [21] — exceeds the global average and provides the demographic substrate for the kind of long-inpatient neurosurgical admissions observed in our macrogroup. Surgical series from Zambia confirm that myelomeningocele repair in Sub-Saharan Africa is feasible but is followed by predictable postoperative and 30-day complications [22]. Comparative institutional data from Southern Africa document substantial variability in referral patterns and outcomes, with patients in resource-limited settings typically presenting late and progressing through long inpatient stays before operative intervention [25]. Paediatric hydrocephalus, increasingly framed as an emerging African public-health problem, compounds this inpatient footprint [23]. Within Angola, dedicated analyses are few, but perinatal asphyxia is repeatedly reported as a leading individual contributor to neonatal mortality at referral paediatric hospitals, including Hospital Pediátrico David Bernardino itself [29, 30], and NTD prevalence in regional hospital samples is several-fold higher than that reported from settings with effective folate programmes [18, 21].

The present series sits squarely within that regional profile and supplies a previously missing quantitative link between these aetiological poles and NICU-level inpatient consumption in an Angolan tertiary centre.

4.5. Organisational implications and resource allocation

The organisational implications of the documented gap are immediate. Units admitting appreciable numbers of neonates with hydrocephalus, NTDs and other congenital neurosurgical conditions require accurate longer-stay forecasting, well-defined postoperative circuits, expedited access to imaging, and close articulation between neonatology, neonatal neurology, paediatric neurosurgery and specialised nursing [2–5, 23–28]. In resource-limited contexts, this distinction is decisive for bed allotment, transfer planning, operating-room prioritisation and the rational use of consumables and human resources. Embedding the LOS differential in unit-level forecasting protocols is consistent with STROBE-aligned evidence use and with broader calls to rationalise neonatal neurosurgical capacity in LMICs [1, 23].

4.6. Limitations and scope of inference

This study has clear limitations. Analysis was restricted to descriptive and non-parametric tests pre-validated for the database; no multivariable adjustment was possible, so the LOS difference may be partially confounded by age at admission, surgical scheduling, comorbidity profiles or transfer delays. Missingness in LOS data differed between macrogroups (16 cases missing in the congenital/neurosurgical group versus 42 in the acute acquired group) and is described rather than imputed. The 'outcome' variable in the source database was not interpreted, because no sufficiently reliable local coding dictionary was available; consequently, mortality, definitive functional outcome and causal attribution cannot be inferred from the present analysis. The single-centre design restricts

generalisability to other Angolan or Sub-Saharan African units, although the direction of the difference is clinically plausible and concordant with regional literature.

5. Conclusion

Within this single-centre Angolan NICU cohort, congenital neurosurgical admissions consumed markedly more inpatient days than acute acquired neurological admissions. The 20-day median gap is both statistically robust and clinically plausible, and the gradient aligns with global, regional and local Angolan evidence on the epidemiology and inpatient profiles of NTDs, hydrocephalus, HIE, neonatal meningitis and neonatal tetanus. The distinction offers operationally relevant guidance for bed planning, operating-room scheduling and the design of neonatology–neurosurgical referral pathways in resource-limited Southern African settings. Further work should pursue prospectively collected, multi-centre data with explicit adjustment for age, comorbidity, transfer patterns and postoperative complications, and should connect LOS to functional outcomes using standardised paediatric neurosurgical follow-up instruments.

Declarations

This study involved retrospective analysis of de-identified routine institutional records . The requirement for informed consent to participate was waived by the Ethics Committee under its standard retrospective-research protocol, in accordance with Law No. 7/25 of 24 July 2025 (Law on Biomedical and Clinical Research), Law No. 22/11 of 17 June 2011 (Angolan Data Protection Law), and the Declaration of Helsinki.

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Conflicts of interest. The authors declare that they have no conflicts of interest.

Data availability. The data derive from organised institutional clinical records. Access is subject to institutional authorisation and appropriate anonymisation.

Ethics statement. This study involved retrospective analysis of de-identified routine institutional records and received approval from the Hospital Ethics Committee of Hospital Pediátrico David Bernardino (reference: HPDB-DP 99/2026).

Author contributions (CRediT). Sérgio Neto: Conceptualisation; Methodology; Data curation; Formal analysis; Investigation; Visualisation; Writing — original draft; Writing — review & editing; Supervision. Moisés Cinco Reis: Investigation; Data curation; Validation; Writing — review & editing. Paula Quaresma: Investigation; Data curation; Validation; Resources; Writing — review & editing. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Figures

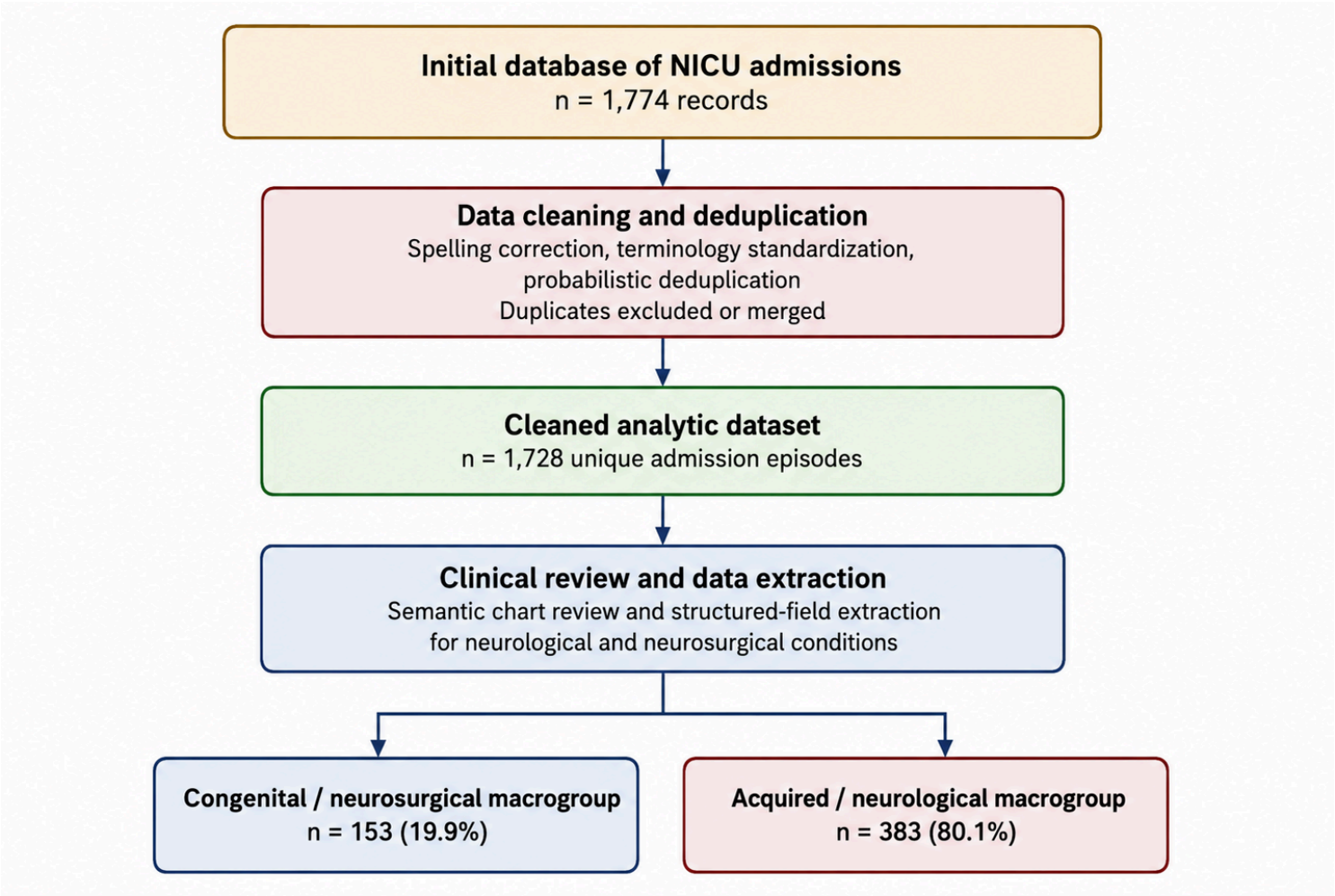


Figure 1

Flow diagram of record selection, deduplication and macrogroup allocation.

Congenital / Neurosurgical (n = 153)	
Diagnostic category	n (%) *
Neural tube defects / spinal dysraphism	48 (31.4)
Hydrocephalus / CSF circulation disorders	53 (34.6)
Encephalocele / other CNS malformations	40 (26.1)
Postoperative neurosurgical care	12 (7.8)
Total	153 (100)

Acute acquired / Neurological (n = 383)	
Diagnostic category	n (%) *
CNS infection / neonatal tetanus	312 (81.5)
Hypoxic-ischemic encephalopathy / perinatal asphyxia	16 (4.2)
Neonatal seizures / spasms	33 (8.6)
Birth trauma / haemorrhage / cephalohaematoma	22 (5.7)
Total	383 (100)

* Percentages represent the proportional weight of each diagnostic category within its respective macrogroup.

CNS – central nervous system; CSF – cerebrospinal fluid.

Figure 2

Diagnostic composition of the two neuro/neurosurgical macrogroups. The postoperative neurosurgical overlap is shown as an operational marker within the congenital/neurosurgical macrogroup.

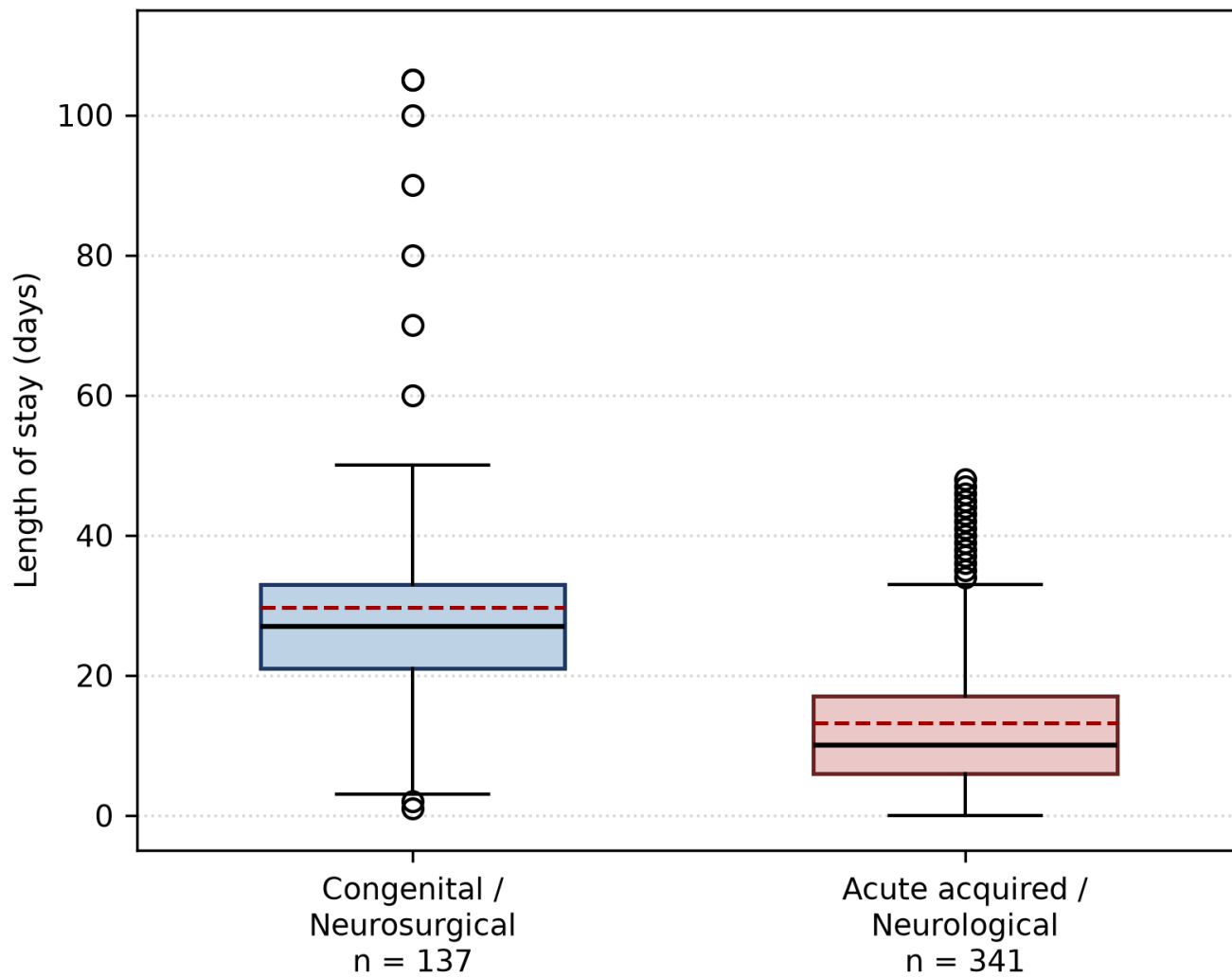


Figure 3

Length of stay by macrogroup.

Medians (solid line) and means (dashed line). Mann–Whitney $U = 40,352.5$; $p = 1.20 \times 10^{-35}$.

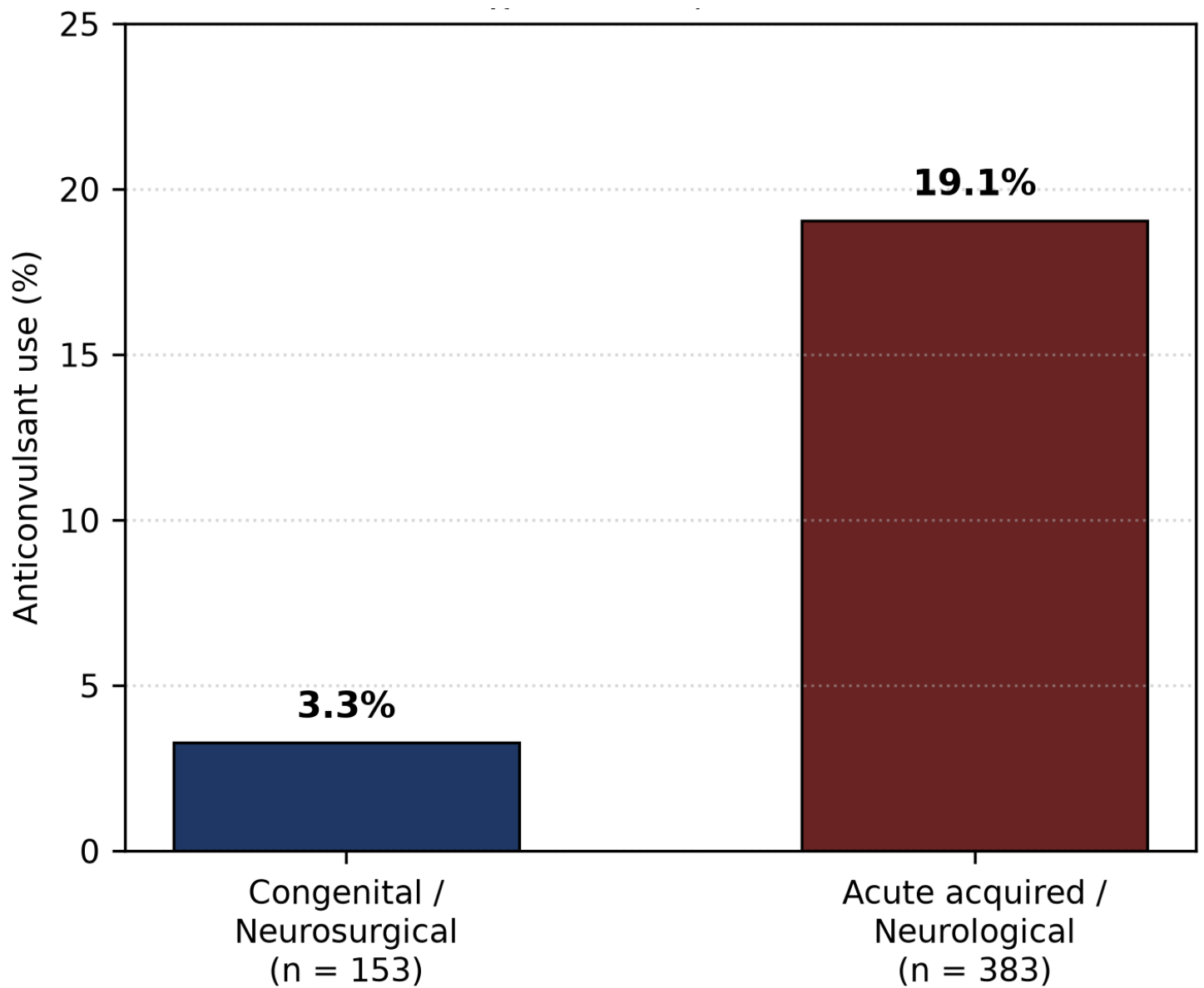


Figure 4

Anticonvulsant use by macrogroup.

Pearson $\chi^2 = 20.68$; $p = 5.44 \times 10^{-6}$. Percentages rounded to one decimal place for visual readability.