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Provision of physiotherapy services for children in intensive care units in Uganda: A descriptive study

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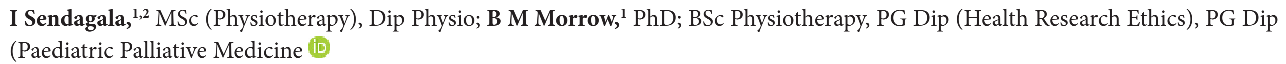

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Background. No prior studies have described physiotherapy practices for critically ill and injured children admitted to intensive care units (ICUs) in Uganda, a low-income African country with high childhood morbidity and mortality.
Objectives. To describe the patient profile and physiotherapy practices of children admitted to Ugandan ICUs.
Methods. Routinely collected data were extracted for all infants and children admitted to three participating Ugandan ICUs on two study days per week over six months. Demographic and clinical admission data were collected, as well as data on physiotherapy service provision, including referral practices, frequency of treatment and modalities used.
Results. A total of 326 patients (49.4% male) were enrolled in the study, on median (interquartile range (IQR)) ICU Day 4.0 (2.0 - 8.0). Most children (63.5%) were >2 years of age. Physiotherapy had been provided to 190 (58.2%) children during their ICU admission. Physiotherapy referrals were made by the attending doctor in 80.5% of cases. Chest physiotherapy – percussions (89.6%) and vibrations (88.8%) – was the most common technique, followed by passive limb exercises in bed (63.4%). Active out-of-bed mobilisation activities were provided in <20% of cases, mostly among children >6 years of age ($p<0.05$) and those with minimal or no respiratory support requirements ($p<0.001$). No invasively mechanically ventilated children were actively mobilised out of bed.
Conclusion. Over 40% of children admitted to Ugandan ICUs did not receive any physiotherapy contact during their admission, suggesting missed opportunities. Most physiotherapy techniques were passive; active out-of-bed activities were seldom implemented and were reserved for older, non-ventilated patients.
Keywords: intensive care units, physiotherapy, paediatrics, Uganda.

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Contribution of study
This is the first study to describe physiotherapy practices for children admitted to intensive care units in Uganda, providing an important baseline for targeted, context-appropriate practice improvement initiatives. The study demonstrates that physiotherapy services in Ugandan ICUs are predominantly passive, referral-dependent and inconsistently applied. Active rehabilitation, including out-of-bed mobilisation, is seldom implemented, representing missed opportunities for early rehabilitation in a resource-constrained setting with a high paediatric critical illness burden.

Uganda is a low-income country in East Africa with a high burden of childhood morbidity and mortality.[1] Critical care services in Uganda are limited in both access and standardisation.[2]

In many settings, physiotherapy is considered an important component of care for critically ill or injured children admitted to intensive care units (ICUs), focusing on cardiopulmonary management[3] and the prevention of secondary complications associated with immobility, critical illness and medical interventions.[4] These critical-illness associated morbidities have been conceptualised in the paediatric post-intensive care syndrome (PICS-p),[5] which includes physical, cognitive, psychosocial and emotional health domains. Current international recommendations emphasise the importance of early active rehabilitation, including mobilisation, in the paediatric ICU (PICU) as part of the 'PICU liberation bundle', with the aim of preventing or mitigating critical illness-associated morbidities and optimising health outcomes in this vulnerable cohort.[6]

In Uganda, 92% of ICUs admitting children offer physiotherapy services.[2] However, physiotherapy practice in this context is largely unstandardised, with few or no protocols in place to guide practice. The practice of physiotherapy for children admitted to ICUs in Uganda – including treatment techniques, referral for treatment and frequency of treatment – has not previously been described in relation to internationally recognised standards.

The aim of this study is therefore to describe the provision of physiotherapy for children admitted to ICU in Uganda and to lay a foundation for future practice improvement.

Objectives

Among children admitted to Ugandan ICUs, this study aimed to:

- describe the proportion who received any physiotherapy intervention(s) during their admission and within the previous 24 hours;

- describe physiotherapy referral practices;
- describe the frequency and nature of physiotherapy treatments administered over a 24-hour period; and
- describe and compare clinical and demographic characteristics between children who did and did not receive physiotherapy treatment.

Methods

Ethical approval

Permission to conduct the research was obtained from the University of Cape Town Faculty of Health Sciences Human Research Ethics Committee (HREC ref. no. 768/2022). Ethical and institutional approval was also obtained from the participating Ugandan study sites. The Mulago Hospital Research and Ethics Committee approved the study in Uganda (MHREC ref. no. 2402), and approval numbers were obtained for study site A (MHREC 2402), study site B (ADM/100/110/01) and study site C (NHL\ADMIN\20230116\01).

Verbal assent for their child to participate in the study was obtained from parents or guardians whenever they were at the bedside. However, the requirement for written informed consent was waived by the HRECs and institutional oversight bodies, considering that *(i)* the study was deemed minimal risk with no associated interventions; *(ii)* only routinely documented clinical data were recorded for analysis; and *(iii)* the study would not have been feasible or scientifically valid if a waiver had not been granted, as many parents in these facilities were not available at the bedside or contactable to grant consent.

Study sites

At the time of this study, there were 12 functional ICUs in Uganda: 11 shared adult/paediatric units and 1 adult-only unit, with a total bed capacity of 55,[2] in addition to 2 standalone surgical PICUs with bed capacities of 6 and 18, respectively. This study was conducted in the central region of Uganda in three shared ICUs that gave permission for data collection. All ICUs in this study were closed ICUs.

Study site A is a government-funded national referral hospital and the largest hospital in the country. It has a 41-bed, intensivist-led shared ICU, with 14 beds dedicated to paediatric patients. Ventilator support for paediatric beds fluctuates according to ICU demand, and there are no ventilators dedicated exclusively to children.

Study site B is a public, tertiary, specialised medical facility managed by the Uganda Ministry of Health that specialises in treating cardiovascular conditions for both adults and children. It has a 4-bed, intensivist-led shared ICU. All beds have ventilator support.

Study site C is a private, for-profit hospital with a 4-bed, intensivist-led shared adult/paediatric ICU and facilities for invasive mechanical ventilation (IMV).

Across all study site ICUs, a dedicated physiotherapist covers the ICU on a rotational basis, with low physiotherapist-to-general-bed ratios (site A 1:105, site B 1:30 and site C 1:20). All the ICUs provide weekend physiotherapy cover; however, there is ordinarily no after-hours service during the week.

Sample

A convenience sample was used, comprising all children aged 1 month to 18 years who were managed in the study site ICUs on data collection days. Neonates in the first 28 days of life were excluded from this study.

Study design

The study followed a pragmatic, descriptive, prospective design.

After initial training in data collection procedures, an on-site physiotherapist at each study site documented study data in real time at the end of the working day on two designated study days per week (Monday and Thursday) for six consecutive months. These days were selected for convenience by the researchers and research assistants. Data were extracted from routinely documented data in the patients' medical files to capture demographic data, admission characteristics, the patient's current level of ventilatory support on the study day, whether they had ever received physiotherapy during their admission and whether they had received physiotherapy within the preceding 24 hours (including the day of data entry). If they had received physiotherapy within the previous 24 hours, the physiotherapist documented the referral source, specific treatment modalities used and the frequency of physiotherapy treatment during that period. Data was obtained from multiple sources, including patient records, nursing notes and written and verbal physiotherapy reports. The on-site physiotherapist also completed a questionnaire documenting any reasons for a patient not receiving physiotherapy. The rationale for collecting more granular data for the preceding 24 hours was to improve accuracy and minimise recall bias associated with retrospective review of earlier clinical notes.

Data analysis

Data were analysed using IBM SPSS Statistics version 28.0.1.1 (IBM Corp., USA). Data were assessed for normality using the Shapiro-Wilks test and continuous descriptive variables were presented as medians (interquartile range (IQR)), as appropriate for non-parametric data. Categorical data were presented as frequencies and percentages of total.

Univariate comparisons were conducted using Mann-Whitney U tests for continuous variables and the χ^2 test, or Fisher's exact test where appropriate, for categorical variables, with Bonferroni correction applied as necessary. Variables associated with the outcome of having received physiotherapy in the preceding 24 hours ($p<0.05$ on univariate analysis) were entered into a best-fit multivariable stepwise regression model to determine independent factors associated with receipt of physiotherapy. Considerations were made to avoid multicollinearity, and only appropriate variables were entered into the final regression model. A p-value of <0.05 was considered statistically significant.

Results

A total of 326 patients (49.4% male; n=161) were enrolled in the study on median (IQR) ICU Day 4.0 (2.0 - 8.0) (Table 1). The majority of children (n=207; 63.5%) were ≤2 years of age. Most had good health status before admission (n=222; 68.1%), and very few had a pre-existing severe disability (n=9; 2.5%). Of the 326 included patients, 190 (58.3%) had received at least one physiotherapy treatment during their ICU admission, on median (IQR) ICU Day 3.0 (1.0 - 7.0), with 164 (50.3%) having received physiotherapy within the preceding 24 hours.

Children who received physiotherapy during the preceding 24 hours had spent longer in ICU (median (IQR) 5.0 (2.0 - 12.0) days v. 3.0 (1.0 - 7.0) days; $p<0.001$), and a greater proportion had undergone surgery (59.1% v. 22.2%; $p<0.001$) compared with those who had not received physiotherapy. The type of respiratory support differed significantly between patients who received physiotherapy during the preceding 24 hours ($p<0.001$) and those who did not, with fewer patients in the physiotherapy group on IMV (50.6% v. 80.9%) and a greater proportion of those on nasal cannula or facemask oxygen (32.3% v. 9.3%). Invasive attachments also differed significantly between groups who had received physiotherapy during the preceding 24 hours and those who had not ($p<0.001$), with a greater proportion of patients receiving physiotherapy

Table 1: Characteristics of patients who received physiotherapy in the 24 hours preceding the study day, compared with those who did not receive physiotherapy

Characteristics	All patients (*n*=326)	Received PT in the past 24 hours (*n*=164)	Did not receive PT in the past 24 hours (*n*=162)	*p*-value
Study site				
Study site A	194 (59.5)	74 (45.1)	120 (74.1)	
Study site B	127 (39.0)	85 (51.8)	42 (25.9)	<0.001
Study site C	5 (1.5)	5 (3.0)	0	
Age group				
0 - 2 years	207 (63.5)	97 (59.1)	110 (67.9)	
3 - 6 years	66 (20.2)	39 (23.8)	27 (16.7)	0.03
7 - 12 years	36 (11.0)	15 (9.1)	21 (13.0)	
13 - 18 years	17 (5.2)	13 (7.9)	4 (2.5)	
Male sex	161 (49.4)	85 (51.8)	76 (46.9)	0.4
PICU day	4.0 (2.0 - 8.0)	5.0 (2.0 - 12.0)	3.0 (1.0 - 7.0)	<0.001
Underwent surgery during PICU admission	133 (40.8)	97 (59.1)	36 (22.2)	<0.001
Postoperative day	2.0 (1.0 - 6.0)	3.0 (2.0 - 7.0)	1.0 (0 - 3.0)	<0.001
Pre-admission health status*				
Good	222 (68.1)	117 (71.3)	105 (64.8)	
Mild disability	70 (21.5)	31 (18.9)	39 (24.1)	0.3
Moderate disability	25 (7.7)	10 (6.1)	15 (9.3)	
Severe disability	9 (2.8)	6 (3.7)	3 (1.9)	
Primary admission diagnostic category†				
Cardiac surgery	106 (32.5)	81 (49.4)	25 (15.4)	
Neurosurgery	28 (8.6)	17 (10.4)	11 (6.8)	
Cardiology	25 (7.7)	6 (3.7)	19 (11.7)	
Infection/sepsis	38 (11.7)	10 (6.1)	28 (17.3)	<0.001
Respiratory	89 (27.3)	27 (16.5)	62 (38.3)	
Neurology	134 (41.1)	49 (29.9)	85 (52.5)	
Renal	4 (1.2)	4 (2.4)	0	
Type of respiratory support on study day				
IMV	214 (65.6)	83 (50.6)	131 (80.9)	
Nasal cannula or facemask oxygen	68 (20.9)	53 (32.3)	15 (9.3)	<0.001
NIV-CPAP or BiPAP	23 (7.1)	12 (7.3)	11 (6.8)	
None	21 (6.4)	16 (9.8)	5 (3.1)	
Glasgow Coma Scale				
1 - 4	6 (1.8)	0	6 (3.7)	
5 - 10	119 (36.5)	40 (24.4)	79 (48.8)	
11 - 15	139 (42.6)	86 (52.4)	53 (32.7)	<0.001
Sedated	23 (7.1)	4 (2.4)	5 (3.1)	
Not recorded	39 (12.0)	34 (20.7)	5 (3.1)	
Attachments on study day				
Arterial line	321 (98.5)	159 (97.0)	162 (100)	
Surgical drain	31 (9.5)	21 (12.8)	10 (6.2)	
Urinary catheter	261 (80.1)	119 (72.6)	142 (87.7)	
ICD	69 (21.2)	49 (21.7)	20 (12.3)	<0.001
Central venous line	258 (79.1)	123 (75.0)	135 (83.3)	
Haemodialysis catheter	4 (1.2)	4 (100)	0	
ETT	201 (61.6)	71 (43.3)	130 (80.2)	
Tracheostomy	17 (3.2)	17 (4.5)	0	

PT = physiotherapy; PICU = paediatric intensive care unit; IMV = invasive mechanical ventilation; NIV = non-invasive ventilation; CPAP = continuous positive airway pressure; BiPAP = bilevel positive airway pressure, ICD = intercostal drain, ETT = endotracheal tube.
Continuous data are presented as median (IQR) and categorical data as *n* (%).
*Pre-admission health status was adapted from the Pediatric Cerebral Performance Category Scale.
†Some patients had more than one primary admission diagnosis.

having intercostal drains (ICD) and a lower proportion being intubated compared with those who did not received physiotherapy.

A multivariable stepwise backward binary regression analysis was conducted to determine associations between study site, age group, primary admission diagnostic category, attachments, Glasgow Coma Scale, type of respiratory support and ICU Day, and the likelihood of receiving physiotherapy within the preceding 24 hours. The model was statistically significant ($p<0.001$), demonstrated good fit (Nagelkerke $R^2=0.63$) and correctly predicted 81% of cases.

Admission for the management of an infection was independently

associated with increased odds of receiving physiotherapy in the 24 hours preceding the study day (adjusted odds ratio (OR) 10.4; 95% confidence interval (CI) 1.7 - 63.1; p=0.01). A longer ICU stay was also independently associated with increased odds of receiving physiotherapy (OR 1.4; 95% CI 1.2 - 1.5; p<0.001). None of the other variables in the initial model were significantly associated with receipt of physiotherapy during the preceding 24 hours.

Details of physiotherapy referral and treatment practice (Table 2)

Of the patients who received physiotherapy in the preceding 24 hours, 132 (80.5%) had been referred for physiotherapy assessment and treatment by attending doctors on median (IQR) ICU Day 3.0 (1.0 - 7.0). More than 60% of patients who had received physiotherapy were referred within 48 hours of admission.

Most patients (n=117; 71.3%) received physiotherapy once during the preceding 24 hours, 44 (26.8%) received physiotherapy twice and 3 (1.8%) received physiotherapy three times during that period.

Being considered 'medically unstable' was the most commonly reported reason for not receiving physiotherapy (n=79; 48.8%), followed by 'no physiotherapist available' (n=28; 17.3%). 'Perceived risk of dislodging attachments' was the least frequently reported reason (n=1; 0.6%).

Multimodal therapy was common. Almost all patients (98.1%; n=161) were treated with at least one technique from each of the two categories: chest physiotherapy (CPT) and rehabilitation/mobilisation. All patients received more than one treatment modality. Percussions and vibrations were the most frequently used treatment modalities, administered in 147 (89.6%) and 145 (88.4%) cases, respectively. This was followed by suctioning (n=114; 69.5%) and body positioning for respiratory management (n=105; 64.0%). None of the patients received manual or ventilator hyperinflation, and only one patient received cough assistance or augmentation. One patient was positioned in a head-down, inverted postural drainage position. Passive limb exercises in bed were the most frequently used mobilisation technique (63.4%; n=104).

Chest physiotherapy modalities by age group

Conventional CPT techniques (percussions and vibrations) were common across all age groups. Active CPT techniques, including active cycle of breathing technique (ACBT), positive expiratory pressure (PEP) therapy, deep breathing exercises and incentive spirometry, were more frequently used in older children (7 - 12 years and 13 - 18 years) compared with younger age groups (p<0.001) (Table 3).

Passive limb range-of-motion (ROM) exercises were more commonly performed in the two younger cohorts (p=0.002), whereas out-of-bed mobility activities were more common in older age groups (p<0.05) (Table 4).

Rehabilitation activities by respiratory support

There was no significant difference between the proportion of children receiving different levels of respiratory support and receipt of passive mobilisation (p=0.4); however, the proportion of children receiving active limb exercises and out-of-bed activities increased as the level of respiratory support decreased. No patients on IMV, and very few on non-invasive ventilation (NIV), were mobilised out of bed (Fig. 1).

Discussion

The aim of this study was to describe the provision of physiotherapy for children admitted to ICU in Uganda and to lay a foundation for future practice improvement.

Just over half (58%) of children admitted to Ugandan ICUs received some form of physiotherapy during their admission, and nearly half received physiotherapy within the preceding 24 hours. The majority were referred for physiotherapy by the attending ICU doctor. Admission for management of infection and longer ICU stays were independently associated with receipt of physiotherapy within the previous 24 hours.

Physiotherapy treatment mostly consisted of passive or manual techniques for both CPT and rehabilitation/mobilisation activities. Out-of-bed mobilisation activities were preferred for older children, but not in children receiving IMV. The most commonly reported barrier to physiotherapy was perceived severity of illness (being 'medically unstable'), followed by a lack of available physiotherapists. Further research is warranted to elucidate the specific concerns and perceived contraindications to treatment based on perceived or actual medical instability. The low physiotherapist-to-patient ratios observed at the study sites are potentially modifiable factors contributing to the relatively low proportion of patients receiving physiotherapy.[7]

The majority of children admitted to ICU were aged 0 - 2 years, with only 5% >13 years. This is an accurate reflection of the regional burden of disease in Uganda, where under-five mortality remains unacceptably high at 64 deaths per 1 000 live births.[1,8]

Different patient profiles have been described in disparate contexts, with most

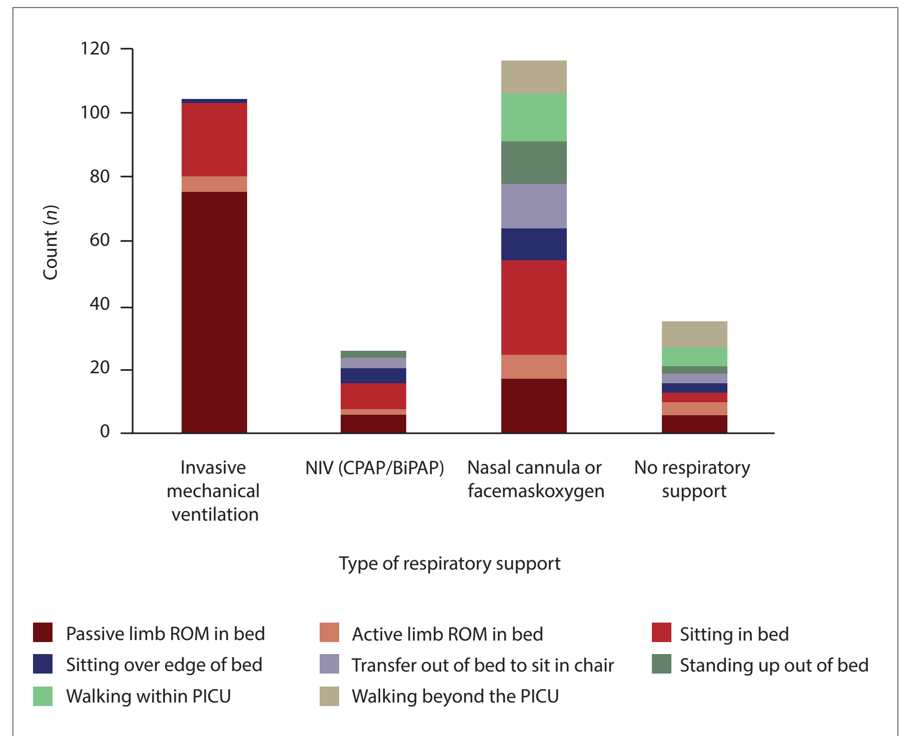

Fig. 1. Rehabilitation activities per type of respiratory support (ROM = range of motion; NIV = non-invasive ventilation; CPAP = continuous positive airway pressure; BiPAP = bilevel positive airway pressure; PICU = paediatric intensive care unit).

Table 2: Details of physiotherapy referral, practice and reported reasons for not receiving physiotherapy

Variable	n (%) n=164
Person making PT referral	
Doctor	132 (80.5)
Self-referral by physiotherapist	28 (17.1)
Other ICU staff	3 (1.8)
Patient/caregiver request	1 (0.6)
Number of PT treatments in the previous 24 hours	
One	117 (71.3)
Two	44 (26.8)
Three	3 (1.8)
Reason for not receiving PT (*n*=163)	
Perceived contraindication	5 (3.1)
Documented as 'medically unstable'	79 (48.8)
No clinical indication	10 (6.2)
No physiotherapist available	28 (17.3)
No referral received	10 (6.2)
Doctor forbade PT	14 (8.6)
Postoperative restrictions	11 (6.8)
Perceived risk of dislodging attachments	1 (0.6)
Other – patient just back from theatre	4 (2.5)
Chest physiotherapy interventions received	
Percussions	147 (89.6)
Vibrations	145 (88.4)
Rib springing	3 (1.8)
Body positioning	105 (64.0)
Head-down postural drainage positioning	1 (0.6)
Active cycle of breathing technique	11 (6.7)
Positive expiratory pressure therapy	24 (14.6)
Autogenic drainage	1 (0.6)
Suctioning	114 (69.5)
Assisted cough	1 (0.6)
Deep breathing exercises	15 (9.1)
Incentive spirometry	12 (7.3)
Manual hyperinflation	0
Rehabilitation/mobilisation activities received	
Passive limb exercise in bed	104 (63.4)
Active limb exercise in bed	19 (11.6)
In-bed mobility (rolling, bridging, up/down etc.)	1 (0.6)
Sitting up in bed	63 (38.4)
Sitting over edge of bed	19 (11.6)
Transferred out of bed to sit in chair	20 (12.2)
Standing out of bed	17 (10.4)
Pre-gait exercises (crawling, cruising, supported standing etc.)	3 (1.8)
Walking in ICU	21 (12.8)
Walking out of ICU	18 (11.0)
Transfer out of ICU in wheelchair or bed	1 (0.6)
Resisted exercises	2 (1.2)
Neurodevelopmental therapy	2 (1.2)
Splinting	11 (6.7)
Passive stretches	13 (7.9)
Repositioning	3 (1.8)

PT = physiotherapy; ICU = intensive care unit.

studies from both high-income [9-11] and low-income settings[12,13] reporting that the majority of paediatric ICU admissions occur in children aged 0 - 5 years.

Most children enrolled in this study had good baseline health status before admission to ICU (68%), and children with a pre-existing severe disability were the least frequently admitted (3%). Considering that approximately 5.8% of Uganda's paediatric population is estimated to live with a disability,[14] this comparatively low ICU admission rate is concerning. Access to healthcare in Uganda is generally inequitable and expensive,[15] particularly for critical

Table 3: Chest physiotherapy modalities by age group

CPT modality	Age group				*p*-value
	0 - 2 years (*n*=207)	3 - 6 years (*n*=66)	7 - 12 years (*n*=36)	13 - 18 years (*n*=17)	
Percussions	91 (44.0)	34 (48.5)	14 (38.9)	8 (47.1)	0.62
Vibrations	89 (43.0)	34 (51.5)	14 (38.9)	8 (47.1)	0.57
Rib springing	2 (1.0)	1 (1.5)	0	0	0.86
Positioning	65 (31.4)	26 (39.4)	9 (25)	5 (29.4)	0.47
Head-down PD	0	0	1 (2.8)	0	-
ACBT	1 (0.5)	1 (1.5)	4 (11.1)	5 (29.4)	<0.001
PEP therapy	9 (4.3)	6 (9.1)	4 (11.1)	5 (29.4)	0.001
Autogenic drainage	1 (0.5)	0	0	0	-
Suctioning	71 (34.3)	32 (48.5)	7 (19.4)	4 (23.5)	0.02
Assisted cough	0	0	1 (0.5)	0	-
DBE	1 (0.5)	1 (1.5)	5 (13.9)	8 (47.1)	<0.001
Incentive spirometry	0	3 (4.5)	4 (11.1)	5 (29.4)	<0.001

CPT = chest physiotherapy; PD = postural drainage; ACBT = active cycle of breathing technique; PEP = positive expiratory pressure; DBE = deep breathing exercises.

Table 4: Rehabilitation/mobilisation activities by age group.

Rehabilitation/ mobilisation activity	Age group				*p*-value
	0 - 2 years (*n*=207)	3 - 6 years (*n*=66)	7 - 12 years (*n*=36)	13 - 18 years (*n*=17)	
Passive limb ROM exercises in bed	73 (35.3)	26 (39.4)	4 (11.1)	1 (5.9)	0.002
Active limb ROM exercises in bed	9 (4.3)	5 (7.6)	2 (5.6)	3 (17.6)	0.14
In-bed mobility exercises	0	0	1 (2.8)	0	-
Sitting in bed	39 (18.8)	12 (18.2)	7 (19.4)	5 (29.4)	0.75
Sitting over edge of bed	9 (4.3)	4 (6.1)	4 (11.1)	2 (11.8)	0.29
Transfer out of bed to sit in chair	6 (2.9)	4 (6.1)	5 (13.9)	5 (29.4)	<0.001
Standing up out of bed	7 (3.4)	3 (4.5)	4 (11.1)	3 (17.6)	0.03
Pre-ambulatory exercises	0	0	2 (5.6)	1 (5.9)	-
Walking within the ICU	8 (3.9)	4 (6.1)	6 (9.1)	3 (17.6)	0.007
Walking beyond the ICU	4 (1.9)	4 (6.1)	5 (13.9)	5 (29.4)	<0.001
Resistance exercises	0	0	2 (5.6)	0	-
Neurodevelopmental therapy	2 (1.0)	0	0	0	-

ICU = intensive care unit; ROM = range of motion.

care services. Children with disabilities face substantial socioeconomic challenges[16,17] that may pose significant barriers to accessing critical care services compared with children without disabilities. This warrants further investigation.

Most physiotherapy referrals (80.5%) were made by the attending ICU doctor, with only 17% of self-referrals by the physiotherapist. This may be problematic, as referrals depend on the doctor's understanding of the role of physiotherapy across different clinical conditions, which has not been explored in this study. For physiotherapists to take the lead in deciding whether patients need treatment in the ICU context requires advanced knowledge and experience.[18] Choong *et al.*[19] similarly recommended that assessment should be done by a multiprofessional team, including both physiotherapists and clinicians, who retain ultimate responsibility for decision-making and patient care.

None of the institutions involved in this study had protocols in place to guide the involvement of physiotherapists in patient care. Furthermore, data were not collected on organisational aspects of the ICU, such as the frequency and presence of physiotherapists on ward rounds and multidisciplinary team meetings, which may profoundly affect the rate and nature of referrals to physiotherapy services. Establishing clear protocols would be beneficial in this setting, especially considering that training of physiotherapists in the country is currently limited to undergraduate level and does not include training or teaching in paediatric critical care. This may affect physiotherapists' ability to appropriately assess and manage patients in this context.

Patients were referred to physiotherapy on median (IQR) ICU Day 3.0. It has been recommended that patients should be assessed for physiotherapy needs within 24 hours of admission, with treatment initiated and progressed according to the individual's needs and condition.[19,20] In this study, more than 60% of patients who received physiotherapy within the preceding 24 hours had been referred within 48 hours of admission, which is in line with current recommendations. Nevertheless, earlier referral and assessment could be a focus for practice improvement in this setting.

Physiotherapy treatment techniques

Although a relatively low proportion of children admitted primarily for the management of respiratory disease received physiotherapy, CPT modalities were the most commonly applied techniques, including manual and passive CPT techniques such as percussions, vibrations, positioning and suctioning. One child received head-down postural drainage, which is no longer recommended because of potential complications and a poor evidence base.[3]

Passive CPT techniques were commonly used across all age groups, whereas active CPT techniques such as ACBT and DBE were more commonly used in older children, possibly reflecting the need for patient participation. The use of multiple CPT techniques is also common in other settings.[18]

Although CPT is a common focus of physiotherapy intervention in the PICU setting,[21] evidence supporting its efficacy is limited.[3] Some literature suggests that routine CPT may offer no significant benefit for mechanically ventilated children,[22] while other scholars point to the detrimental effects of performing routine CPT in critically ill children.[23-25] Consequently, routine CPT is no longer recommended for children in the PICU. Instead, treatment should follow thorough assessment of patients, with identification of symptoms for which CPT could potentially be beneficial, careful evaluation of the risks and benefits and individualisation of treatment.[3,25]

The nature of this study limits our ability to determine the indications, if any, for the interventions provided. However, in alignment with current evidence and given the low physiotherapist-to-patient ratio, it may be more cost-effective to focus on implementing techniques supported by stronger evidence to optimise outcomes.

Mobilisation activities were performed less frequently than CPT activities. More than 40% of patients in this study received no mobilisation activities within the preceding 24 hours. This could be due to several factors, including staffing resource limitations or other contextual barriers discussed previously.

Passive limb exercises were the most common form of mobilisation exercises performed in this study. Passive mobilisation is considered safe and may be beneficial when active movement is not possible.[19,26,27] However, several documents recommend that mobilisation should target the highest level of functional mobility appropriate to the child's developmental stage.[11,28,29] Therefore, passive mobilisation should not replace active mobilisation when the latter is possible and safe.

Where active mobilisation exercises were implemented, gross motor activities – such as limb exercises, sitting, standing and walking – were more common than transitionary activities, including in-bed mobility and pre-ambulatory exercises. This may suggest poor progression of mobilisation exercises, whereby more difficult activities are attempted before simpler ones can be accomplished. Good progression is an important aspect of early mobilisation in the PICU,[19,26] as it may help minimise the occurrence of adverse events in this vulnerable group.

Active mobilisation activities were performed more frequently in older children than in younger groups. Choong *et al.*[30] suggested that older children may be mobilised more readily in the PICU because their maturity may allow them to better understand instructions and comply with the activity, and because therapists may perceive mobilisation to be safer in older children. Kudchadkar *et al.*[10] similarly found that children >3 years of age were more likely to receive physical or occupational therapist-led mobilisation compared with younger children, who were routinely mobilised by nurses. Choong *et al.*[11] also reported that younger age (<3 years) was the only independent predictor of not receiving therapist-led mobility. Strategies to increase mobilisation of younger children may be beneficial in this setting.

The likelihood of out-of-bed mobilisation increased as the level of respiratory support decreased, and no patients receiving IMV were mobilised out of bed. IMV has been reported as a perceived barrier to mobilisation in both adult and paediatric populations.[10,11,31] Nevertheless, many studies have reported on the successful implementation of early mobilisation programs in the PICU – including children receiving varying degrees of respiratory support – and have registered minimal adverse effects.[10,26,32] This represents another potential focus for future education and practice improvement initiatives in Uganda.

Study strengths and limitations

The study design was a prospective record review, with most data collected from patient folders. There is a risk of inaccuracy due to poor recording and record-keeping practices, with the potential for information bias.

Data were collected on only two days per week, excluding weekends. Weekend practice (which is likely to differ from weekday practice), as well as practice on other weekdays when data were not collected, may not be fully represented in this study. The choice of data collection days may therefore have biased the results, and further confirmatory research is recommended.

The study was conducted in central Uganda, where the majority of ICUs are located; however, other ICUs in different regions of the country were not represented in this study. The findings of this study may therefore not be generalisable to the whole country or to other African regions.

As the people collecting data in this study were part of the team delivering the clinical service, this may have influenced practice and represents a potential source of performance bias. In addition, there is a risk of reporting bias, which was partially mitigated by providing training in data collection methods.

This study focused on assessing the provision of physiotherapy by physiotherapists. Some physiotherapy interventions, such as mobilisation, may have been performed by other categories of staff (e.g. nurses) and therefore may not have been captured. Furthermore, the presence and involvement of caregivers – which are essential for optimal patient- and family-centered practice and have been associated with more effective rehabilitation[10,33] – were not routinely documented and could therefore not be analysed. These aspects warrant further research.

Other variables relevant to physiotherapy and rehabilitation in the PICU were not assessed in this study, including the level of training and experience of physiotherapists treating patients in the PICU, as well as analgesia and sedation practices, which are integral to the PICU liberation bundle.[6] These parameters should be considered in future research.

Conclusion

Physiotherapy was provided to approximately half of the children admitted to ICUs in Uganda, mostly following referral from a medical doctor. CPT using passive manual techniques was the most commonly administered technique, followed by passive mobilisation techniques. Active out-of-bed activities were performed in a minority of cases and were more common among older children. These findings suggest that physiotherapy practice for children in ICUs in Uganda does not currently meet internationally recommended standards. Practice improvement initiatives – including research, training and protocol development – are recommended to achieve a minimum acceptable standard of physiotherapy care for this vulnerable population. Further studies are warranted to determine the cost-effectiveness of physiotherapy and rehabilitation interventions, and to inform the optimal utilisation of scarce resources in this setting.

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Author contributions. IS was responsible for study conceptualisation, data collection, and manuscript writing. BM was the principal investigator and supervisor for the study, contributing to study conceptualisation, data analysis and critical manuscript review. Both authors approved the final draft of the paper.

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Conflicts of interest. None.

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