Section on Critical Care

Standardizing Training and Assessment: Creation of Pediatric Neurocritical Care Entrustable Professional Activities for Pediatric Critical Care Medicine Fellows

10/21/2023

Oral Presentation

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Background: Graduate medical education (GME) is increasingly adopting competency-based medical education (CBME) principles to standardize trainee assessment and ensure proficiency. Assessment frameworks have evolved from Competencies (e.g., Patient care) and Milestones (e.g., Performs fundamental physical examination) to specialty-board-sponsored entrustable professional activities (EPAs). EPAs integrate Competencies and Milestones into discrete tasks which physicians should be proficient at (e.g., pediatric critical care medicine (PCCM) EPAs; Figure 1). The current PCCM EPAs are broad and supplemental EPAs may aid trainees and training programs with curricula and competency-based decisions about trainee advancement. In particular, pediatric neurocritical care (PNCC) is a sub-field of PCCM wherein diverse institutional settings, variable practice patterns, and a wide array of pathology results in a variable trainee experience; without specific criteria for benchmarking, PCCM fellows have varying levels of proficiency in PNCC at the end of training. To address this gap, we developed a set of validated PNCC EPAs for PCCM fellows to 1) standardize PCCM fellow competency assessment in PNCC and 2) develop a prototype for creating other EPAs as medical education transitions to an outcomes-based CBME training model.

Methods: Local and national interprofessional groups simultaneously created comprehensive lists of essential PCCM PNCC-related activities guided by ABP testing content guidelines and a practice analysis of PCCM knowledge and skills. These activities formed a preliminary set of PCCM PNCC EPAs. Modified Delphi methodology was used to demonstrate content validity and craft acceptable wording of the EPAs. During iterative Delphi rounds using online surveys, experts used a 5-point scale to rate “how essential” and “how clear” each EPA was. The comprehensiveness of the EPA set was rated; opportunity was provided for free text comments and/or identification of additional content. Between rounds, data was analyzed and comments were incorporated into the drafted EPAs prior to survey redistribution. Content validity was estimated using the index of content validity (ICV; proportion of items receiving Likert scale rating of 4 or 5). A priori, EPAs with ICV ≥0.8 were interpreted as sufficient validity for inclusion, ≥0.6-0.79 were revised and revoted on, and < 0.6 were removed. Consensus was reached

when each EPA's essential rating and the EPA set comprehensiveness were ≥0.8. The Delphi panel then met virtually to group and finalize the EPAs (work ongoing).

Results: Experts from PCCM, PNCC, and GME were recruited from a variety of institutional settings. Response rate was 82% (31/38) for Delphi round one and 94% (29/31) for round two. Consensus was achieved with 13 EPAs (Figure 2) with 93% agreement on EPA set comprehensiveness.

Conclusion: Using modified Delphi methodology, we developed a set of PNCC EPAs with content validity for PCCM fellows. Conducted over a virtual platform, this process is readily reproducible for the development of other supplemental EPAs in PCCM and beyond.

Current Pediatric Critical Care Medicine Entrustable Professional Activities

Current Pediatric Critical Care Medicine Entrustable Professional Activities
Acute management of the critically ill patient, including those with underlying chronic disease
Manage and coordinate care in pediatric critical care units for optimal patient outcomes
Management of patients at the end of life

Proposed Pediatric Neurocritical Care Entrustable Professional Activities for Pediatric Critical Care Medicine Fellows

Proposed Pediatric Neurocritical Care Entrustable Professional Activities for Pediatric Critical Care Medicine Fellows
Manage acute symptomatic cerebrovascular disease
Manage moderate and severe traumatic brain injury and increased intracranial pressure
Acute management of seizures, including status epilepticus
Evaluate and manage altered level of consciousness
Evaluate and manage spinal cord and peripheral nervous pathology, including neuromuscular weakness
Implement appropriate neuroprotective strategies to prevent secondary injury
Recognize neurologic complications of critical illness and sequelae of neurologic injury
Evaluate and co-manage common perioperative neurosurgical and neurointerventional conditions with surgical services
Recognize the sedation and procedural considerations specific to a patient with neurologic disease
Apply neuroanatomic and physiologic principles to perform and communicate key aspects of the neurologic exam
Utilize neuroimaging and neuromonitoring technology and devices
Demonstrate the communication skills necessary to discuss neuroprognostication with families
Manage patients at the end of life

Assessing the Health Literacy of Caregivers in the Pediatric Intensive Care Unit: A Mixed-methods Study

10/21/2023

Oral Presentation

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Background: Limited health literacy is associated with increased hospitalizations, emergency department visits, health care cost, and mortality. Health literacy of caregivers of critically ill

children is unknown. This mixed-methods study aims to quantitatively assess the health literacy of caregivers of children admitted to the pediatric intensive care unit (PICU) and qualitatively describe facilitators and barriers to implementing health literacy screening from the provider perspective.

Methods: This was a mixed-methods, prospective single-center study. Caregivers of patients admitted to our quaternary PICU (between August 12, 2022 and March 31, 2023) were screened using the Newest Vital Sign (NVS), which assesses health literacy in both English & Spanish. The primary outcome was health literacy level, which we dichotomized into "Limited Health Literacy" (score of 0-3) and "Adequate Health Literacy" (score of 4-6). Fisher's exact test was used to determine the association between health literacy level and demographic characteristics. Data analysis was completed using Stata 17 (College Station, TX: StataCorp LLC). Qualitatively, we conducted three focus groups of PICU providers to characterize facilitators and barriers to screening. The focus group script was based on the Consolidated Framework for Implementation Research (CFIR). Each focus group was conducted virtually and recorded; sessions were later transcribed and de-identified prior to analysis. Thematic analysis of the transcripts was completed by the PI to develop the initial codebook, which was then used independently by a second reviewer. Inter-rater reliability was reported using a kappa statistic. Final themes were discussed among reviewers and organized by CFIR domains. Analysis was completed using NVivo 12 (QSR, Melbourne, Australia).

Results: Among 48 surveyed caregivers, 79% demonstrated adequate health literacy. The majority of caregivers spoke English (96%), were mothers (85%) and identified as White (75%). 83% of caregivers were able to attend rounds at least once and 98% believed it was helpful, regardless of health literacy level. Within the PICU provider focus groups, there were 11 participants (3 attendings, 3 fellows, 2 advanced practice providers, 1 hospitalist, 2 research assistants). Facilitators and barriers were mapped to CFIR domains. Inter-rater reliability between the two coders was good, with a mean kappa statistic of 0.53. Timing of screening and person administering screening were identified as modifiable factors to improve future implementation.

Conclusion: Health literacy of PICU caregivers is similar to prior assessments of pediatric parental health literacy. Participation in morning rounds promoted caregiver understanding, regardless of health literacy status. Qualitative feedback from providers identified barriers across all CFIR domains, with timing of screening and person administering screening as modifiable factors to improve future implementation.

Table 1: Characteristics of PICU Caregiver Survey Respondents

	All	Limited Literacy	Adequate Literacy	p-value
	N=48	N=10	N=38	
Primary Language				0.040
English	46 (96%)	8 (80%)	38 (100%)	
Spanish	2 (4%)	2 (20%)	0 (0%)	
Age				0.010
18-29 year-old	10 (21%)	5 (50%)	5 (13%)	
30-39 year-old	19 (40%)	2 (20%)	17 (45%)	
40-49 year-old	11 (23%)	0 (0%)	11 (29%)	
>50 year-old	8 (17%)	3 (30%)	5 (13%)	
Gender				1.00
Female	42 (88%)	9 (90%)	33 (87%)	
Male	6 (13%)	1 (10%)	5 (13%)	
Race				0.006
White	36 (75%)	4 (40%)	32 (84%)	
Black/African American	5 (10%)	3 (30%)	2 (5%)	
Asian	2 (4%)	1 (10%)	1 (3%)	
Multi-racial	1 (2%)	0 (0%)	1 (3%)	
Prefer not to answer	2 (4%)	0 (0%)	2 (5%)	
Prefer to self-describe	2 (4%)	2 (20%)	0 (0%)	
Relationship to the child				0.29
Father	6 (13%)	1 (10%)	5 (13%)	
Mother	41 (85%)	8 (80%)	33 (87%)	
Other	1 (2%)	1 (10%)	0 (0%)	
Presence of chronic illness				0.72
No	20 (42%)	5 (50%)	15 (39%)	
Yes	28 (58%)	5 (50%)	23 (61%)	
Has your child ever been hospitalized before?				0.23
Never	9 (19%)	3 (30%)	6 (16%)	
Once	15 (31%)	1 (10%)	14 (37%)	
1-3 times	5 (10%)	2 (20%)	3 (8%)	
More than 3 times	19 (40%)	4 (40%)	15 (39%)	
Have you participated in morning rounds?				0.012
Never	8 (17%)	5 (50%)	3 (8%)	
Once	6 (13%)	0 (0%)	6 (16%)	
1-3 times	13 (27%)	3 (30%)	10 (26%)	
More than 3 times	21 (44%)	2 (20%)	19 (50%)	
Does participating in morning rounds help you understand what is happening with your child?				1.00
Not sure	1 (3%)	0 (0%)	1 (3%)	
Yes	39 (98%)	5 (100%)	34 (97%)	

*Data presented n (%) for categorical measures. Comparisons completed using Fisher's exact test

Table 2: Facilitators and Barriers to Health Literacy Screening Categorized by CFIR Domain

CFIR Domain	Key Elements	Facilitators	Barriers
Outer Setting	External Pressure	--	Socioeconomic factors preventing parents from being at the bedside
Inner Setting	Relative Priority	Survey is most successful when respondents have time and no competing priorities (i.e. in waiting room)	ICU is stressful Caregivers place higher priority on child's status relative to survey completion
Individuals	Motivation of team members	--	Desire not to label families as health "illiterate"
	Motivation of families	Motivation is high if have interest in research	Motivation is low if low interest or distrust in research
Intervention	Design	--	Screener focuses on nutrition label, which has little relevance to ICU medicine Screener is visual whereas most communication in ICU is verbal
Process	Adapting	Adjust time of approach to include nights/weekends to reach more families Change who administers survey so that it is an existing team member	Researcher is not familiar part of team
	Tailoring strategies	Using QR code/electronic interface is easier for data collection	QR code is difficult if no phone or less technologically savvy

Terminal Extubation and Terminal Weaning: Withdrawal of Life Sustaining Therapy in Children. Secondary Analysis of the DONATE Study

10/21/2023

Oral Presentation

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Background: Terminal extubation (TE) and terminal weaning (TW) during withdrawal of life sustaining therapies (WLST) have been described and defined in adults. The recent Death One Hour After Terminal Extubation (DONATE) study aimed to validate a model developed to predict whether a child would die within one hour after discontinuation of mechanical ventilation for WLST. In this pre-planned secondary analysis, we aim to describe and define these practices in children, as well as compare characteristics of patients who did have ventilator support decreased prior to WLST with those who did not.

Methods: Secondary analysis of multi-center retrospective cohort study of 913 patients who died after WLST in ten pediatric ICUs in the United States. TE was defined as no wean of any ventilator support parameter in the 6 hours prior to WLST. TW was defined as any decreasing of ventilator support parameters in the six hours preceding WLST. Clinically relevant decrease of support (TWR; >=25% wean from maximum support within 6 hours prior to WLST for any individual ventilator parameter) was compared with likely incidental decrease of support (TWI; < 25% wean for all individual ventilator parameters).

Results: 71.4% (n=652) had TE without decrease in ventilator support in the 6 hours prior. 11%

(n=100) had clinically relevant decrease in ventilator support prior to WLST; 17.6% (n=161) had likely incidental decrease in ventilator support prior to WLST. TWR subjects were noted to have clinically relevant decreases of their FiO2 and/or ventilator set rates prior to TE. There were single subjects each with >25% decrease of MAP, PEEP or PS. There was notable consistency across nine of the participating institutions with 67.9-83.6% (median of overall sample 71.4%) TE, however one of the institutions demonstrated a differing practice pattern with only 35.4% TE. Patients with respiratory illness were not more likely to have TW than patients who were comatose. There were no significant differences in any of the other evaluated patient characteristics between groups (weight, BMI, unit type, primary diagnostic category, presence of coma, time to death after WLST, analgosedative requirements, post-extubation respiratory support modality).

Conclusion: Decreasing of ventilator support prior to WLST with extubation in children does occur. This practice does not impact palliative analgosedation requirements or time to death after extubation. We present these findings on behalf of the DONATE investigators.

Table 1. Comparison TE vs TW characteristics - age, diagnosis, coma, time to death

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	Overall	TE	TW-Relevant	p-value
(n)	**752**	**652**	**100**	
Age (in years):	2.0 [0.4, 10.9]	2.0 [0.3, 10.9]	2.9 [0.6, 10.7]	0.5174
Time to Death (min)	18.8 [10.0, 48.5]	19.0 [10.0, 50.8]	17.1 [10.0, 39.5]	0.8536
Primary Diagnosis:				
Cardiac	176 (23.4)	147 (22.6)	29 (29.0)	0.1558
Gastrointestinal	32 (4.3)	25 (3.8)	7 (7.0)	0.1768F
Hematologic	5 (0.7)	5 (0.8)	--	1.0000F
Infectious	58 (7.7)	49 (7.5)	9 (9.0)	0.6043
Metabolic	16 (2.1)	16 (2.5)	--	0.1488F
Neurologic	113 (15.0)	99 (15.2)	14 (14.0)	0.7577
Oncologic	55 (7.3)	52 (8.0)	3 (3.0)	0.0752
Renal	5 (0.7)	5 (0.8)	--	1.0000F
Respiratory	191 (25.4)	165 (25.3)	26 (26.0)	0.8821
Toxin	10 (1.3)	8 (1.2)	2 (2.0)	0.6301F
Trauma	87 (11.6)	79 (12.1)	8 (8.0)	0.2308
Other	4 (0.5)	2 (0.3)	2 (2.0)	0.0877F
Coma Evaluated	**563**	**485**	**78**	
Had Coma				
Last GCS BTE	3.0 [3.0, 3.0]	3.0 [3.0, 3.0]	3.0 [3.0, 3.0]	0.8070
Max GCS BTE	3.0 [3.0, 5.0]	3.0 [3.0, 5.0]	3.0 [3.0, 6.0]	0.9669

Presented: Descriptive Statistics within Columns; Categorical data, n(%); Continuous data, Median [Q1, Q3]
Primary Diagnoses Recoded and Tested as Individual Predictors
Statistical Testing: Categorical Variables 2*2 CHISQ, Fisher's Exact used where expected cell counts are low; denotedF Continuous Variables t-test; Satterthwaite for: time to death due to unequal variances

Presented: Descriptive Statistics within Columns; Categorical data, n(%); Continuous data, Median [Q1, Q3] Primary Diagnoses Recoded and Tested as Individual Predictors Statistical Testing: Categorical Variables 2*2 CHISQ, Fisher's Exact used where expected cell counts are low; denotedF Continuous Variables t-test; Satterthwaite for: time to death due to unequal variances

Table 2. Sedative requirements: Rate of use and dosage adjusted for weight in kg among those terminally extubated, and those with relevant terminal weaning

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	Overall	TE	TW-Relevant
(n)	709	614	95
Sedative:			
Diazepam	2 (0.3)	2 (0.3)	--
Fentanyl	130 (18.3)	113 (18.4)	17 (17.9)
Hydromorphone	61 (8.6)	51 (8.3)	10 (10.5)
Lorazepam	52 (7.3)	46 (7.5)	6 (6.3)
Morphine	185 (26.1)	164 (26.7)	21 (22.1)
Midazolam	123 (17.4)	103 (16.8)	20 (21.0)
Dexmedetomidine*	52 (7.3)	46 (7.5)	6 (6.3)

Among those with use, sedative totals adjusted for weight in kg	TE	TW-Relevant
Total Diazepam (mg/kg)	0.1 [0.1, 0.1]	--
Total Fentanyl (mcg/kg)	2.0 [1.1, 5.0]	2.5 [1.5, 5.3]
Total Hydromorphone (mg/kg)	0.04 [0.02, 0.11]	0.03 [0.02, 0.17]
Total Lorazepam (mg/kg)	0.1 [0.1, 0.2]	0.2 [0.1, 0.4]
Total Morphine (mg/kg)	0.2 [0.1, 0.5]	0.1 [0.1, 0.4]
Total Midazolam (mg/kg)	0.1 [0.1, 0.3]	0.1 [0.1, 0.5]

Presented: Descriptive Statistics within Columns; Categorical data, n(%); Continuous data, Median [Q1, Q3]
*Dexmedetomidine administered 1 hour ATE (dosage not recorded)
There are no statistically significant differences in the rates or amounts of sedatives used between those TE/TW-Relevant

Presented: Descriptive Statistics within Columns; Categorical data, n(%); Continuous data, Median [Q1, Q3] *Dexmedetomidine administered 1 hour ATE (dosage not recorded) There are no statistically significant differences in the rates or amounts of sedatives used between those TE/TW-Relevant

Compliance with Implementation of a Pediatric Intensive Care Unit Specific Intrahospital Transport Checklist and Associated Decreased Rates of Adverse Events

10/21/2023

Oral Presentation

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Purpose/Objectives: Transport for diagnostic or therapeutic procedures is potentially hazardous for critically ill pediatric patients. The use of safety checklists might help decrease adverse events during these high-risk activities. In a quality improvement initiative, we aimed to describe compliance with a multidisciplinary checklist prior to intra-hospital transport for pediatric ICU patients requiring respiratory support. The secondary aim was to characterize the nature of adverse events and their association with checklist compliance.

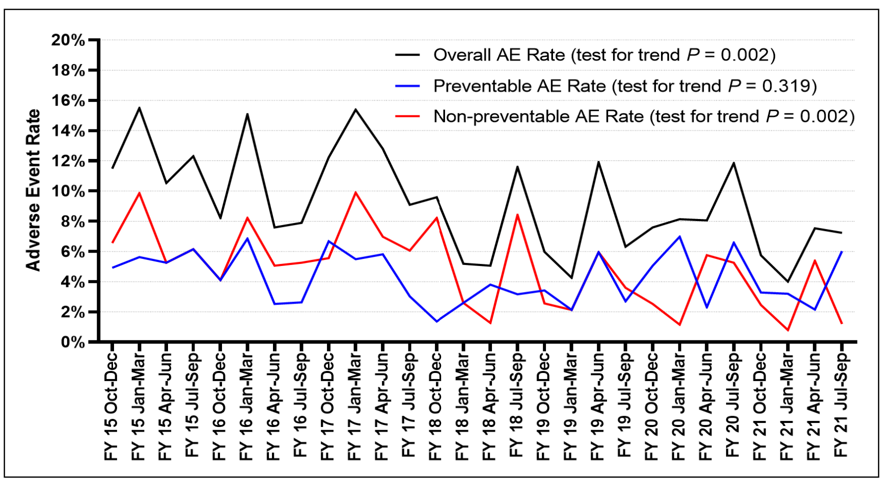
Design/Methods: This is a single center retrospective analysis of quality improvement data collected between 2015 and 2021, after implementation of a checklist prior to intrahospital transport for mechanically ventilated patients in the PICU. After multidisciplinary input and unit-wide education, a checklist comprising of plans for personnel, resources, and anticipated problems was implemented. All pediatric medical-surgical ICU patients receiving invasive or non-invasive mechanical ventilation, as well as patients determined to be at high risk by the medical team, qualified for use of the checklist. The checklist was completed in real time by the multidisciplinary clinical team prior to transport. Checklist data and adverse events were recorded immediately after transport by the Respiratory Therapist. We used the Cochrane-

Armitage test to evaluate compliance with checklist utilization (percentage of eligible patients with completed intervention) over time. Adverse events were classified as "preventable" or "non-preventable" and categorized into 4 event types: physiologic, sedation-related, equipment-related, and systems-related.

Results: A total of 2720 eligible intra-hospital transports were performed during the 7-year review period; 1989 (73.3%) had completed checklists. On average, 32 checklist-eligible transports were performed per month. Checklist compliance improved over the study period from a mean of 70% to 81% (p=0.008). Overall adverse event rate decreased from 12.4% to 5.9% (16.8 events to 5.9 events per 100 transports, p= 0.002) and non-preventable adverse event rate decreased from 6.9% to 2.4% (8 events to 2.3 events per 100 transports, p=0.002). Of the preventable events recorded, the majority (51%) were systems problems, while non-preventable events were primarily physiologic in nature.

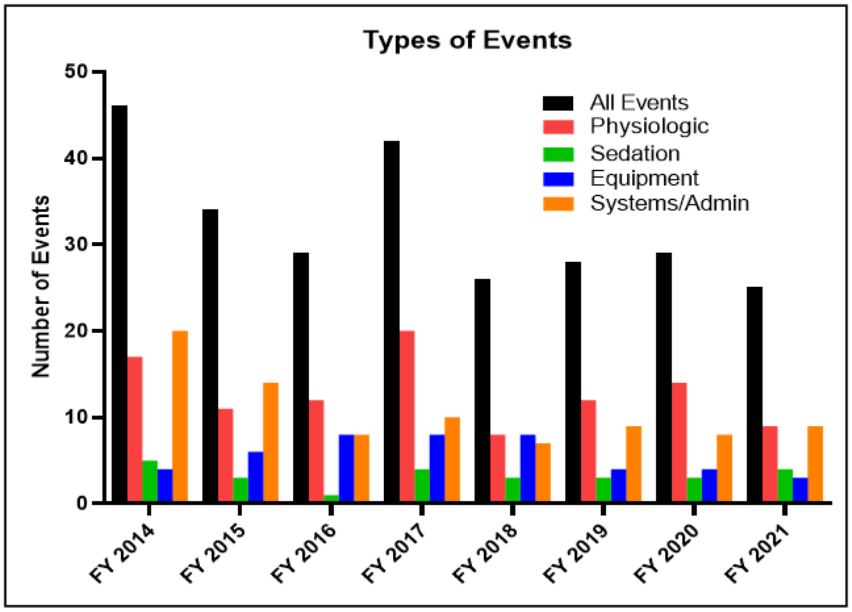
Conclusion/Discussion: Checklist implementation was successful, with improving compliance and decreased adverse events over time. We observed a significant reduction in non-preventable events, particularly events that were related to changes in physiology. We also observed a non-significant downward trend in preventable events. The documentation and classification of adverse events during intra-hospital transport highlighted potential areas for improvement in the timing, resources allocated, and procedural support provided during intrahospital transport of vulnerable PICU patients.

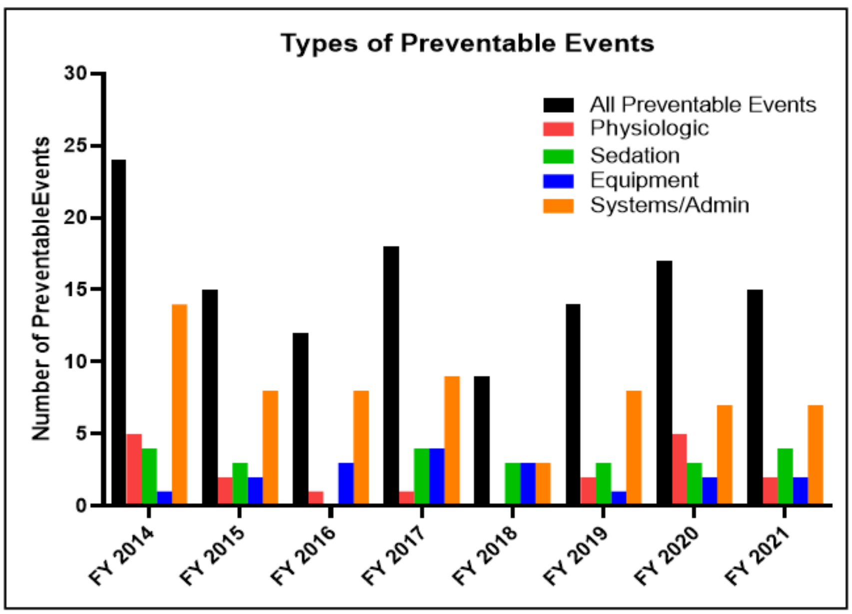
Trends in Adverse Event Rates Over Time



Percentages of total adverse events, preventable events, and non-preventable events over the study period.

Characterization of Adverse Events


Types of Events
Number of Events
50
40
30
20
10
0
All Events
Physiologic
Sedation
Equipment
Systems/Admin
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
FY 2019
FY 2020
FY 2021


Types of Preventable Events
Number of PreventableEvents
30
25
20
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0
All Preventable Events
Physiologic
Sedation
Equipment
Systems/Admin
FY 2014
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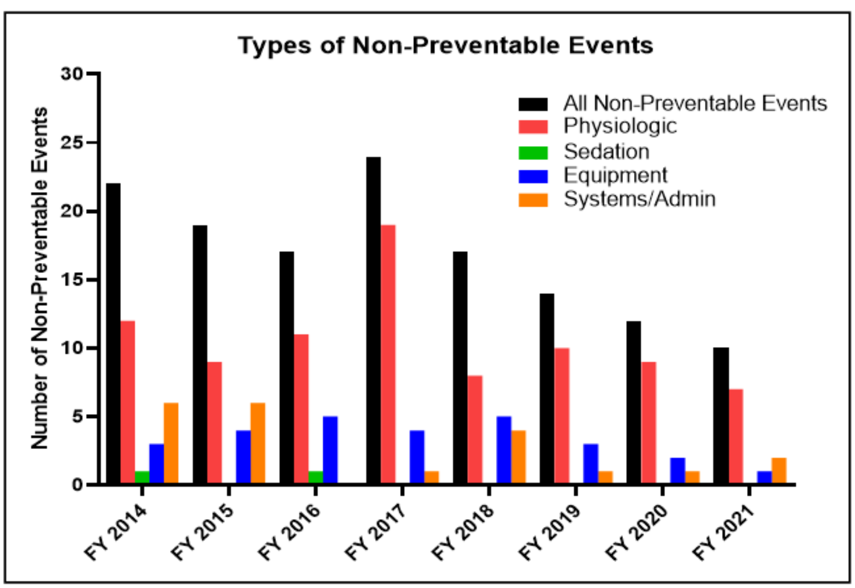
Types of Non-Preventable Events
Number of Non-Preventable Events
30
25
20
15
10
5
0
All Non-Preventable Events
Physiologic
Sedation
Equipment
Systems/Admin
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
FY 2019
FY 2020
FY 2021

Characterization of all adverse events occurring during the study period with additional differentiation by preventable and non-preventable events expressed as absolute event numbers.

Neighborhood Opportunity and Risk of Hospital-acquired Venous Thromboembolism Among Critically Ill Children: A Multicenter, Retrospective Study

10/21/2023

Oral Presentation

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Background: One in 50 critically ill children will develop a hospital-acquired venous thromboembolism (HA-VTE). Acquired morbidity during hospitalization for acute and chronic medical conditions has been associated with social determinants of health including neighborhood-level determinants such as access to education, community resources, affordable housing, and the presence of food insecurity. We aim to characterize and identify potential associations between the Childhood Opportunity Index and HA-VTE among critically ill children.

Methods: We performed a retrospective cohort study assessing encounters from 47 United States hospital centers participating in the Pediatric Health Information Systems (PHIS) registry. We included children < 18 years of age hospitalized in a pediatric intensive care unit (PICU) from January – December 2022 and excluded for VTE presence at time of admission. Our primary outcome was the overall Childhood Opportunity Index scores (an ordinal, parametric scale ranging from: very low, low, moderate, high, and very high) among cohorts defined by the presence of a HA-VTE. Additional HA-VTE risk factors were characterized and assessed as covariates for HA-VTE risk including the presence of a central venous catheter (CVC), invasive mechanical ventilation (IMV), treatment for an infectious disease, and patient age. Qualitative proportional data were analyzed using Chi-squared tests. Quantitative data were assessed using student's t and Wilcoxon rank-sum tests. Candidate HA-VTE risk factors were assessed using univariate and adjusted logistic regression.

Results: Of the 112,068 PICU encounters included for study, 2,551 (2.3%) developed a HA-VTE (78.6% of which represented limb/neck deep venous thromboses and 16.5% were pulmonary emboli). The overall median COI Level was moderate (interquartile range (IQR): low to high) and rates were evenly distributed among critically ill children: very low COI – 22%, Low COI – 20%, Moderate COI – 20.5%, High COI – 19%, and Very High COI – 18.5%. There were no detectable differences in COI levels for those with and without HA-VTE. Children with a HA-VTE were older (median 6.2 [IQR:0.6,14.6] versus 3.7 [IQR:0.8,10.8] years), more commonly had a CVC (45.3% versus 9.2%), received MV (63.6% versus 30.2%), had a greater PHIS pediatric medical complexity algorithm category (very high: 88.5% versus 55.8%), and more commonly were technology dependent (46.9% versus 25.4%) (all P< 0.001). In an adjusted logistic model, greater overall COI was not associated with HA-VTE. Factors associated with HA-VTE included IMV (adjusted odds ratio [aOR]: 2.8, 95% CI: 2.5-3) CVC (aOR: 5.5, 95% CI: 5-5.9), and infectious diagnoses (aOR: 1.7, 95% CI: 1.6-1.9).

Conclusion: In this multicenter, retrospective cohort study, we found no detectable relationship

between COI and acquired HA-VTE during pediatric critical illness. Future studies could consider the impact of neighborhood opportunity of post-discharge outcomes related to HA-VTE.

Referral Communication Practices for Inter-facility Transfer and Admission to the Pediatric Intensive Care Unit

10/21/2023

Oral Presentation

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Background: Up to 80% of serious medical errors during transitions of care involve miscommunication during patient handoffs. Critically ill children requiring a higher level of care are especially vulnerable to harm due to poor communication during inter-facility transfers. Standardizing information exchange by adapting evidence-based handoff interventions to inter-facility referral communication may prevent adverse events and improve outcomes. Our objective was to determine the characteristics of referral communication practices across tertiary referral pediatric intensive care units (PICUs) in the U.S. Doing so will help identify opportunities for improvement during PICU inter-facility referral communication.

Methods: We conducted a cross-sectional electronic survey of administrative leaders (division chief or medical/transport director) of U.S. PICUs with >10 beds. We identified PICUs by cross-referencing the Fellowship and Residency Electronic Interactive Database Access (FREIDA™) list of pediatric critical care fellowship programs, Virtual PICU Systems list of participating U.S. PICUs, and the Children's Hospital Association members list. Survey respondents and contact information were identified through publicly-available online sources. The survey instrument was developed, iteratively revised, and pilot-tested by a group of pediatric intensivists practicing in 7 different PICUs. The survey was designed to gather information on PICU characteristics, inter-facility referral structure and process, and referral communication characteristics. REDCap® was used for survey distribution, administration, and tracking.

Results: Of 167 survey invitations sent to respondents with working email addresses, 61 completed surveys were returned (37% response rate). All U.S. continental regions were represented with a majority of PICUs (99%) being either medical-surgical (no cardiac patients) or mixed units. PICUs had a median of 1200 (IQR 1000-1560) admissions/year with a median of 27% (IQR 15%-39%) admitted as direct transfers from other institutions. For inter-facility

transfers in 93% of PICUs, a verbal handoff occurs between the referring clinician and a receiving PICU provider (typically the attending physician in 67% of PICUs); however, only 24% of handoffs are guided by a standard communication tool. In 72% of PICUs, medical records are only sometimes available prior to patient arrival. Most PICUs (58%) formally track outcomes of directly-transferred patients but only 30% of PICUs have a formal program to deliver patient outcome feedback to referring clinicians (Table). Interviews of purposively selected survey respondents are pending, which will provide qualitative information regarding referral communication practices.

Conclusion: Information exchange for inter-facility patient transfers to the PICU occur mostly through unstructured verbal handoffs between referring clinicians and PICU physicians. Many PICUs track outcomes of transferred patients but most do not have formal feedback systems in place. Interventions to improve inter-facility referral communication between frontline clinical settings and PICUs must be developed and tested to improve the safety and quality of acute care transitions to the PICU.

Characteristics of the Inter-facility Referral Process and Referral Communication for Pediatric Intensive Care Unit Transfers

Table. Characteristics of the Inter-facility Referral Process and Referral Communication for Pediatric Intensive Care Unit Transfers

Characteristics	n=61
PICU operates under a formal inter-facility referral program*, n (%)	
As part of a PICU program dedicated only for critically ill pediatric transfers	13 (21)
As part of a larger general pediatric referral program	32 (52)
As part of a larger adult referral program	8 (13)
No formal program	7 (11)
Verbal handoff occurs between the referring provider and PICU clinician, n (%)	
Always or most of the time	57 (93)
Sometimes	3 (5)
Usual PICU clinician receiving verbal handoff from referring provider, n (%)	
Attending physician	40 (67)
Fellow	18 (30)
Advanced practice provider or other provider	1 (2)
Verbal handoff guided by a standard referral communication tool/template, n (%)	14 (24)
Formal written handoff documentation exists to serve as a record of the verbal handoff between referring provider and PICU clinician, n (%)	18 (31)
Written handoff available to PICU admitting team prior to patient arrival	13 (72)
Availability of patient's pre-PICU medical records prior to patient arrival, n, (%)	
Sometimes available	43 (72)
Never available	12 (20)
PICU uses telemedicine technologies to support referral communication and transfer process, n (%)	15 (25)
Notification of PICU admitting team of expected inter-facility patient transfer, n (%)	50 (83)
Verbal notification of PICU admitting team members by designated PICU staff	21 (42)
Text message sent to PICU admitting team members by designated PICU staff	20 (40)
Other way of notifying PICU admitting team	9 (18)
Availability of pre-PICU medical records after patient arrival, n (%)	
Paper records are transferred with the patient	51 (85)
Paper records are mailed to the PICU later after patient admission	18 (32)
Electronic records are accessible through linked EHRs between institutions	25 (43)
Records are sent electronically through another system outside of the EHR	26 (46)
PICU formally tracks outcomes of patients directly transferred from referring institutions, n (%)	34 (58)
PICU has a formal program to deliver patient outcome feedback to referring clinicians, n (%)	18 (30)

PICU - pediatric intensive care unit, EHR - electronic health record

*A formal inter-facility referral program includes having processes in place that standardizes how all referral calls or requests for PICU admission from outside facilities are handled. This may include processes for initial contact, triaging of calls, designating personnel who receive calls, policies for patient acceptance for admission, etc.

Association of Medical Complexity and Language with Clinical Outcomes in the Pediatric Intensive Care Unit

10/21/2023

Oral Presentation

Mary Pilarz, MD[1]; Elizabeth J. Bleed, MD[1]; Victoria Rodriguez, MD[1]; Carolyn Foster, MD[1]; L. Nelson Sanchez-Pinto, MD[2]; Kathryn Jackson, MS[3]; Latasha Daniels, MA[1], (1) Ann & Robert H. Lurie Children's Hospital of Chicago, Chicago, IL, (2) Ann & Robert H. Lurie Children's of Chicago, Chicago, IL, (3) Northwestern University, Chicago, IL

Background: Using a language other than English (LOE) is common in the United States, yet children in families who use LOE face barriers to equitable care and are more likely to be technology dependent than patients from English proficient families. We hypothesize that in the pediatric intensive care unit (PICU), patients in families who use LOE are more likely to have children with medical complexity (CMC) than their English proficient counterparts and that the coexistence of medical complexity and LOE will have an additive negative effect on clinical outcomes.

Methods: This is a single-site observational study of PICU encounters from 9/1/2017-8/31/2022. CMC were defined as having at least 3 chronic conditions or technology dependence using the Chronic Condition Classification System. We performed univariate and multivariate analyses between demographic factors and the presence of medical complexity. We described differences in outcomes for CMC between language groups using a mixed effects regression model to compare effects of language on outcomes including PICU and total hospital length of stay, ventilator and organ dysfunction free days, total hospital charges, and mortality after adjusting for covariates including severity of illness.

Results: There were 6,802 unique patients with 10,011 total encounters. A total of 5,199 encounters (51.9%) involved CMC and 1433 (14.3%) encounters involved patients from families who use LOE. In univariate analysis, Spanish (OR 1.44; 95% CI 1.32-1.57) and non-Spanish LOE (OR 1.58; 95% CI 1.32-1.84) were both associated with increased odds of medical complexity compared to families who use English. In multivariate analysis, Spanish LOE (OR 1.30; 95% CI 1.15-1.45) and non-Spanish LOE (OR 1.37; 95% CI 1.08-1.66) were independently associated with medical complexity. CMC who used a non-Spanish LOE had 6% fewer organ dysfunction free days ($p = 0.003$) than CMC with familial English use. Among CMC who used a non-Spanish LOE, PICU length of stay was 1.49 times longer ($p = 0.02$), total hospital stay was 1.44 times longer ($p = 0.01$), and total cost was 2.46 times higher ($p < 0.001$) compared to CMC with familial English use. Among patients without medical complexity, hospital stay was 1.82 times longer ($p < 0.001$) for the non-Spanish LOE group than patients with familial English use. There were not significant differences in outcomes for the Spanish use LOE group compared to English for organ dysfunction, ventilator free days, LOS, and cost. No mortality differences were identified.

Conclusion: Familial use of LOE was independently associated with increased medical complexity among patients in the PICU. Among the CMC population, non-Spanish LOE was associated with longer PICU LOS, longer hospital stay, and higher cost compared to the CMC with familial English use cohort.

Table 1

Table 1. Encounter Level Demographics (N = 10011)

Characteristic	Number (%)
Sex	
Male	5511 (55.1%)
Female	4500 (45.0%)
Children with Medical Complexity	4453 (44.5%)
Race	
Asian, non-Hispanic	454 (4.5%)
Black, non-Hispanic	2167 (21.7%)
Hispanic	3334 (33.3%)
White, non-Hispanic	3433 (34.3%)
Other	623 (6.2%)
Insurance	
International	48 (0.5%)
Medicaid	5918 (59.1%)
Medicare	41 (0.4%)
Other	88 (0.9%)
Private	3916 (39.1%)
Preferred Language	
English	8578 (85.7%)
Spanish	1185 (11.8%)
Non–Spanish	248 (2.5%)
Age (Median)	4
PELOD-2 Score (Median)	2

Encounter Demographics

Table 2

Table 2. Combined effect of medical complexity and language on LOS and cost

Complexity/Language	**PICU LOS** Adjusted Estimates (95% CI)	**Hospital LOS** Adjusted Estimates (95% CI)	**Cost** Adjusted Estimates (95% CI)
CMC with English proficiency	Ref.	Ref.	Ref.
CMC with Spanish LOE	1.13 (0.95, 1.34)	1.05 (0.91, 1.21)	1.06 (0.82, 1.36)
CMC with non-Spanish LOE	1.49* (1.08, 2.07)	1.44* (1.10, 1.89)	2.46* (1.53-3.96)
Non-complex with English proficiency	Ref.	Ref.	Ref.
Non-complex with Spanish LOE	1.09 (0.89, 1.33)	1.06 (0.90, 1.25)	1.15 (0.86, 1.54)
Non-complex with non-Spanish LOE	1.10 (0.73, 1.66)	1.82* (1.29, 2.55)	1.36 (0.75, 2.49)

*P < 0.05

Combined effect of medical complexity and language on length of stay and cost

Implementation of a Novel Fresh Tracheostomy Program in a Community Pediatric Hospital

10/21/2023

Oral Presentation

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Background: Historically, fresh tracheostomies were only available at primary pediatric medical centers. This report involves a novel multidisciplinary effort to expand scope of care to include fresh tracheostomies in a pediatric community hospital setting along with providing training of all disciplines. Indications for a tracheostomy in a pediatric patient can vary from congenital and acquired airway anomalies, chronic interstitial pulmonary diseases, other disease processes requiring long term ventilation and/or protection from aspiration and/or pulmonary toilet, and more. The hospitalization process of placing a fresh tracheostomy not only involves the surgical procedure but the intensive post-operative care to allow for adequate healing and providing the education for patients and families involved in managing the tracheostomy at home.

Methods: The creation and implementation of a novel hospital wide program required the expertise of hospital leadership, Critical Care, Anesthesiology, Otolaryngology, and simulation center (Table 1). Four steering committees were created: ● Workflow and operations: Modification of current hospital wide and departmental policies, procedures, and workflows ● Scope of care: Create criteria for admission ● Education: Implementation of training and education for all teams ● Simulation: Test workflow and identify areas of safety risks

Results: The goals of each committee were accomplished over approximately 12 months. Since implementation, we have provided a total of 10 fresh tracheostomies and tracheostomy education to an additional 7 families. The average length of stay from fresh tracheostomy placement to discharge was 18.8 days compared to 32 days at our primary medical center. Contributions that led to decreased length of stay were the initiation of staff engagement and immediate education with families post tracheostomy placement. By allowing patients to receive surgery and education at the community campus, a total of 532 ICU days has been offset from our primary medical center.

Conclusion: Our team successfully expanded our scope of practice and easier access to care for families within the community we serve while offsetting valuable ICU days at our primary medical center.

Fresh Tracheostomy Steering Team

Table 1: Community Tracheostomy Program Steering Team

The Community Trach Program Steering Team will provide oversight of activation teams, remove barriers, & serve as final decision-making authority

Workflow and Operations	Scope Of Care	Education	Simulation
Goal 1: Identification and modification of current policies/procedures for care of tracheostomy patients in the community **Goal 2:** Identify new department workflows for all areas involved in care of tracheostomy patients	**Goal 1**: Create community PICU tracheostomy *criteria for admission*	**Goal 1**: Identify community counterparts for all roles **Goal 2**: Schedule training and education for all roles **Goal 3**: Outline general staff RN education plan & provide education. **Goal 4**: Outline caregiver education plan for community tracheostomies	**Goal 1**: Design simulations required to test workflow and identify areas of latent safety risk (i.e. trach emergency) **Goal 2**: Conduct simulations and provide recommendations regarding findings **Goal 3**: PEPTALK Caregiver Simulation Program to community campus
Members: Appointed Chair(s) Nursing Leadership (ACDs[1], PCMs[1]) CCM MDs and APPs* ENT MDs and APPs* Tracheostomy Coordinators Unit Educators Trach Educators PEPTALC Instructors +Sim Center Respiratory Therapy Care Management Translation Services Child Life Social Work Speech Therapy, OT/PT Supply Chain Sterile Processing	**Members**: Appointed Chair(s) Chief Medical Officers Chief Surgical Officers Anesthesia Nursing Leadership (ACDs[1], PCMs[1]) CCM MDs + APPs[1] ENT MDs + APPs[1]	**Members**: Appointed Chair(s) Nursing Leadership (ACDs[1], PCMs[1]) Trach Coordinators Unit Educators PEPTALC Instructors Sim Center Staff Development Specialists Clinical Specialists	**Members**: Appointed Chair(s) Nursing Leadership (ACDs[1], PCMs[1]) CCM MDs and APPs[1] ENT MDs and APPs[1] Tracheostomy Coordinators Unit Educators Trach Educators PEPTALC Instructors +Sim Center Staff Development Specialists Clinical Specialists

[1]ACD = Assistant Clinical Director, PCM = Patient Care Manager, APPs = Advanced Practice Providers

[2]PEPTALC = Parent Emergency Preparedness for Tracheostomy. A simulation course that allows caregivers to practice high risk scenarios and management for children with tracheostomies

Burden of Viral Bronchiolitis on Children's and Non-children's Hospitals in the US During the 2022 Surge

10/21/2023

Oral Presentation

Rhae Ana Gamber, MPH[1]; Noorein Ahmed, MHA[2]; Ernie Shippey, MA[3]; Satyanarayana Lakshminrusimha, MD FAAP[4], (1) Vizient, Inc., Egg Harbor Township, NJ, (2) Vizient Inc., Chicago, IL, (3) Vizient, Fraser, CO, (4) UC Davis Children's Hospital, Sacramento, CA

Background: Due to the COVID-19 pandemic, there have been significant fluctuations and timing shift in viral bronchiolitis, often secondary to respiratory syncytial virus infection. The surge in hospitalizations among children ≤ 4 years of age during late 2022 surpassed pediatric bed capacity in many states. The precise impact of this surge on children's hospitals versus

non-children's hospitals is unknown.

Methods: We analyzed RSV and other viral bronchiolitis (ICD-10 codes J210, J218, J219) admission and transfer trends among children (0-17 y) from January 2019 to December 2022 by hospital cohort (non-children’s hospitals, n=269 and children’s hospitals, n=89) in the Vizient® Clinical Data Base. Only hospitals with consistent data submitted every month during this period were included in the analysis. Birth discharges were excluded. Mann-Kendall trend tests were used to assess periodic changes.

Results: Overall pediatric viral bronchiolitis inpatient admissions increased 20% in 2022 compared to 2019 (25,177 from 20,923) (P<.001) and decreased 57% from 2019 to 2020 (8,988) (P<.001). The increase in 2022 was accompanied by a 58% increase in intensive care unit utilization at non-children’s hospitals from 2019-2022 (183 to 290) (P<.001) and a 30% increase at children’s hospitals (4,655 to 6,041) (P=.018). The seasonal surge in 2021 started early in Q2, however total annual admissions (18,482) did not surpass 2019 volumes (Figure 1a), though ICU utilization rate peaked at both sites of service (Figure 1b). In 2022, the viral bronchiolitis discharge rate significantly increased beyond seasonal fluctuations in Q4 at both children’s hospitals and non-children’s hospitals, with the biggest increase seen among children aged 1-4 years at non-children’s hospitals (87% increase in Q42022 from Q42019 (P<.001)) (Figure 1c). The number of overall inbound transfer volumes notably declined in 2020, returned to pre-pandemic levels in 2021 and peaked in Q4 2022 (Figure 2a). Overall transfer rates (transfer/admissions) remained stable at children’s hospitals (24%) but increased 33% at non-children’s hospitals (10% in Q42019 vs 13.3% in Q42022) (Figure 2b), similar to viral bronchiolitis trends (Figure 2c). Viral bronchiolitis transfers account for a significantly higher portion of overall transfers in Q42022 at both sites: 11% at children’s hospitals (P<.001) and 14% at non-children’s hospitals (P<.001) (Figure 2d). Median transfer distance among viral bronchiolitis transfers to children’s hospitals increased 11% from 2019-2020 (29.3 [12.4-57.7] to 32.5 [13.9-63.7] miles) and remained elevated through 2022 (32.6 [14.9-61.1] miles).

Conclusion: The viral bronchiolitis inpatient and ICU burden in late 2022 was markedly higher at non-children’s and children’s hospitals compared to pre-pandemic levels, though the impact was most significant for non-children’s hospitals. Transfer distances for pediatric viral bronchiolitis patients has increased since the pandemic onset. A strategic evaluation of optimal pediatric bed and ICU capacity in both non-children’s and children’s hospitals is needed to handle future seasonal surges in pediatric admissions.

Figure 1abc. Viral Bronchiolitis Trends By Hospital Cohort, 2019-2022

Figure 1a. Pediatric Viral Bronchiolitis Discharges by Hospital Cohort

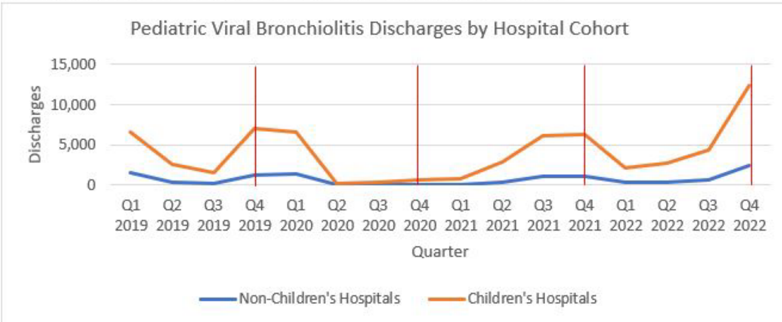


Figure 1b. Pediatric Rate of ICU Utilization Among Viral Bronchiolitis Admissions by Hospital Cohort

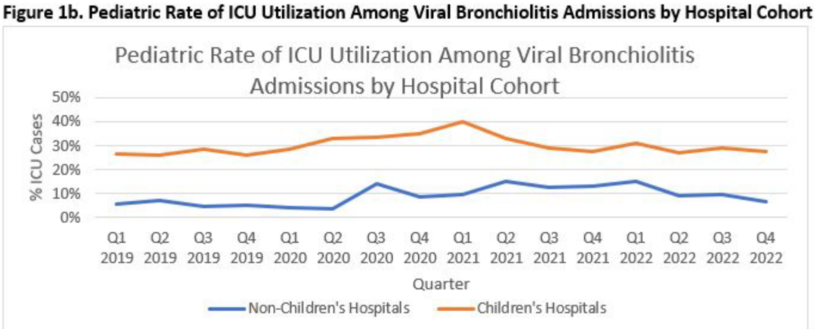
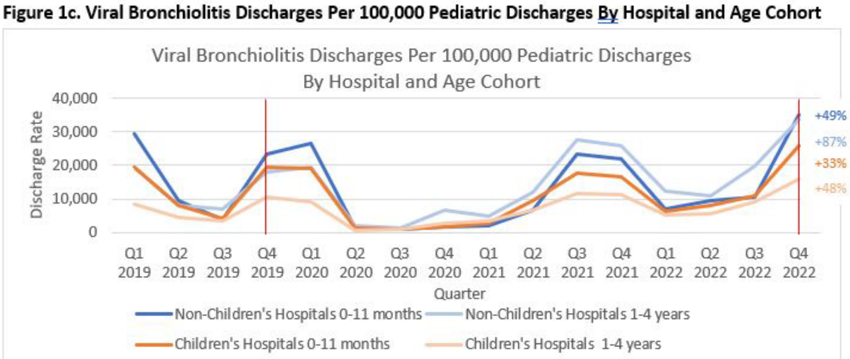


Figure 1c. Viral Bronchiolitis Discharges Per 100,000 Pediatric Discharges By Hospital and Age Cohort



Source: Data from the Vizient Clinical Data Base used with permission of Vizient, Inc. All rights reserved. Time Frame: Q1 2019 – Q4 2022.

Viral bronchiolitis discharge volume surged in Q4 2022, and was significantly higher than pre-pandemic (Q4 2019) at both hospital types. The rate of ICU utilization among viral bronchiolitis cases increased at non-children's hospitals in 2021. In 2022, the viral bronchiolitis discharge rate significantly increased beyond seasonal fluctuations in quarter 4 at both children's hospitals and non-children's hospitals, with the biggest increase seen among children aged 1-4 years at non-children's hospitals.

Figure 2abcd. Pediatric Transfer Trends by Hospital Cohort, 2019-2022

Figure 2a. Pediatric Transfer Volume by Hospital Cohort

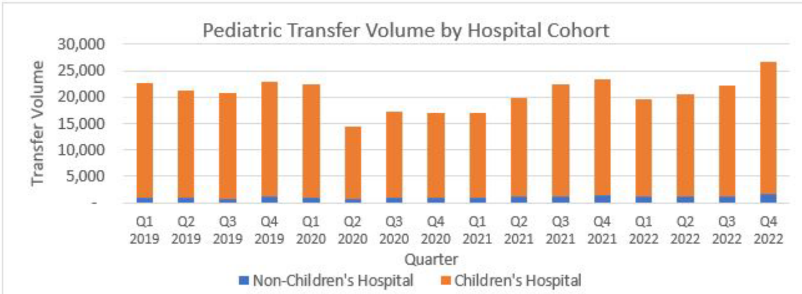


Figure 2b. Overall Pediatric Transfer Rate (% of Cases Transferred In)

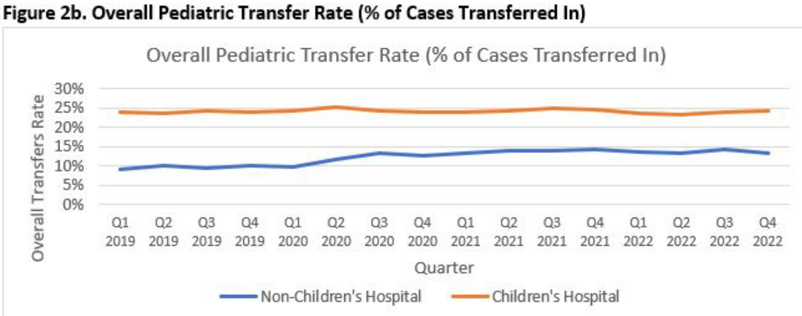


Figure 2c. Proportion of Viral Bronchiolitis Transfers Among All Pediatric Viral Bronchiolitis Cases

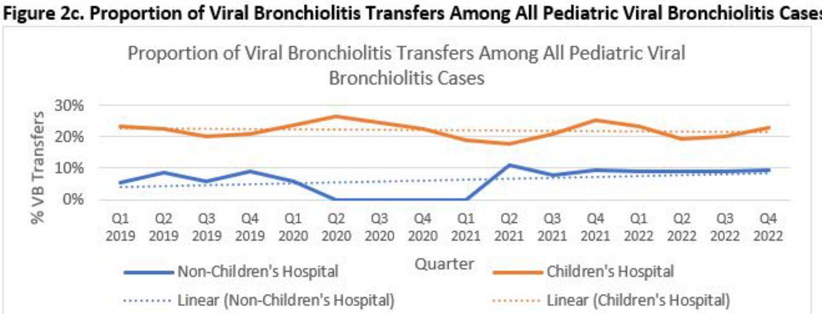
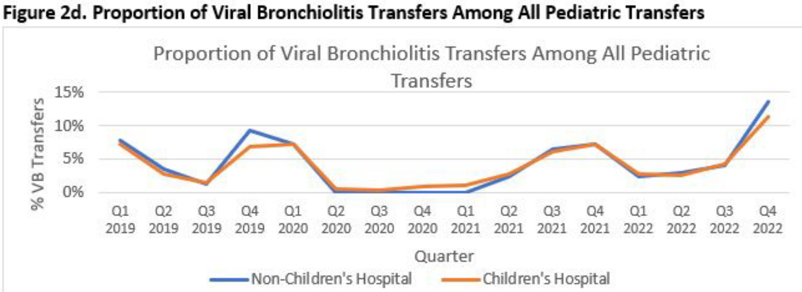


Figure 2d. Proportion of Viral Bronchiolitis Transfers Among All Pediatric Transfers



Source: Data from the Vizient Clinical Data Base used with permission of Vizient, Inc. All rights reserved.
Time Frame: Q1 2019 – Q4 2022. Transfers refer to transfers from a different hospital (admission source code 4).

The number of overall inbound transfer volumes notably declined in 2020, returned to pre-pandemic levels in 2021 and peaked in quarter 4 2022 (Figure 2a). Overall transfer rates remained stable at children's hospitals (24%) throughout the study period but increased 33% at non-children's hospitals (10% in Q42019 vs 13.3% in Q42022) (Figure 2b). Similarly, the rate of incoming transfers among viral bronchiolitis cases remained stable at children's hospitals throughout the study period, while the rate of transfers among viral bronchiolitis cases at non-children's hospitals trended up (Figure 2c). Viral bronchiolitis transfers account for a significantly higher portion of overall transfers in Q42022 at both sites: 11% at children's hospitals and 14% at non-children's hospitals (Figure 2d).

Influence of Social and Environmental Determinants of Health on Respiratory Outcomes in Pediatric Asthma

10/21/2023

Oral Presentation

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Background: Pediatric asthma is the most common chronic disease of childhood, and results in billions of dollars in hospital charges, regular loss of school and work days, and increased total number of years lived with disability. Pediatric asthma is heavily influenced by social and environmental determinants of health, with Black race associated with higher rates of childhood asthma, and poverty associated with worse asthma outcomes. Pediatric asthma symptoms and lung function are worse, and exacerbations and hospitalizations are more frequent, in areas with high levels of air pollution. Few studies have investigated the influence of specific social and environmental determinants of health on pediatric asthma using large-scale geocoding data combined with clinical electronic health record (EHR) data. This study aimed to quantify the impact of social and environmental determinants of health on disease severity among children presenting to the hospital for asthma.

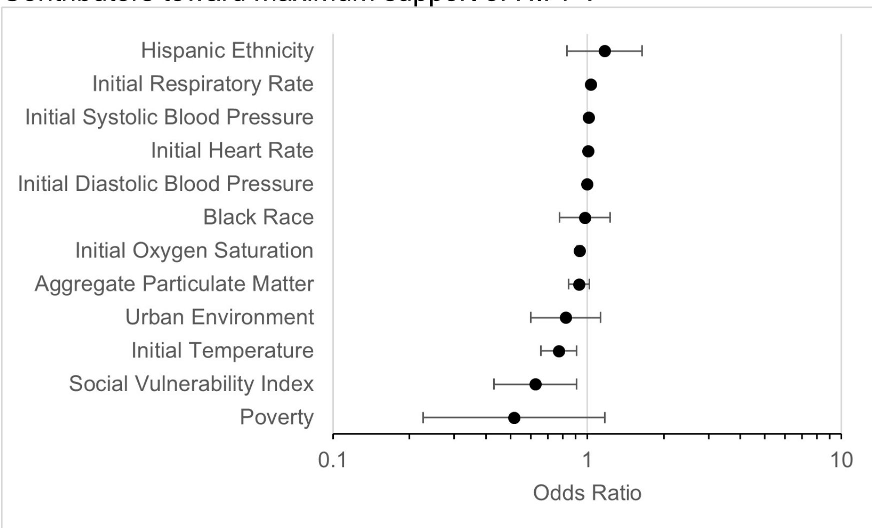
Methods: The study performed was a longitudinal observational study. The study population included all subjects from 2–18 years of age who presented to the hospital with an international classification of diseases (ICD) code for asthma from January 2010–December 2019. Study data were obtained from the Indiana Network for Patient Care (INPC), a comprehensive state-wide health information exchange that incorporates data from more than 90% of the hospitals in Indiana and over 17 million unique subjects. The primary outcome was highest level of respiratory support used during the hospital encounter, with high flow nasal cannula (HFNC), noninvasive positive pressure ventilation (NIPPV), and intubation with mechanical ventilation as the measured categories in increasing order. Logistic regression models including social determinants of health, environmental determinants of health, and vital signs at presentation were used to identify odds ratios (OR) associated with receiving each respiratory modality. Subgroups were created separating the population into three age groups.

Results: Several social and environmental determinants of health were significantly associated with the degree of respiratory support used. Social and environmental factors associated with maximum support of intubation and mechanical ventilation included aggregate particulate matter: OR 1.73 (1.59-1.89, $p < 0.01$); urban environment: OR 0.79 (0.64-0.97, $p=0.03$); Black race: OR 0.68 (0.56-0.82, $p < 0.01$); and Hispanic ethnicity: OR 0.51 (0.36-0.73, $p < 0.01$). Social and environmental factors associated with maximum support of NIPPV were social vulnerability index: OR 0.63 (0.49-0.81, $p < 0.01$); and poverty rate: OR 0.52 (0.29-0.92, $p < 0.02$). The only social or environmental factor associated with maximum support of HFNC was aggregate particulate matter: OR 0.79 (0.73-0.85, $p < 0.01$)

Conclusion: Aggregate particulate matter is significantly associated with intubation and mechanical ventilation for children presenting to the hospital for asthma. This will help clinicians identify patients with an increased likelihood of poor outcomes based on their determinants of

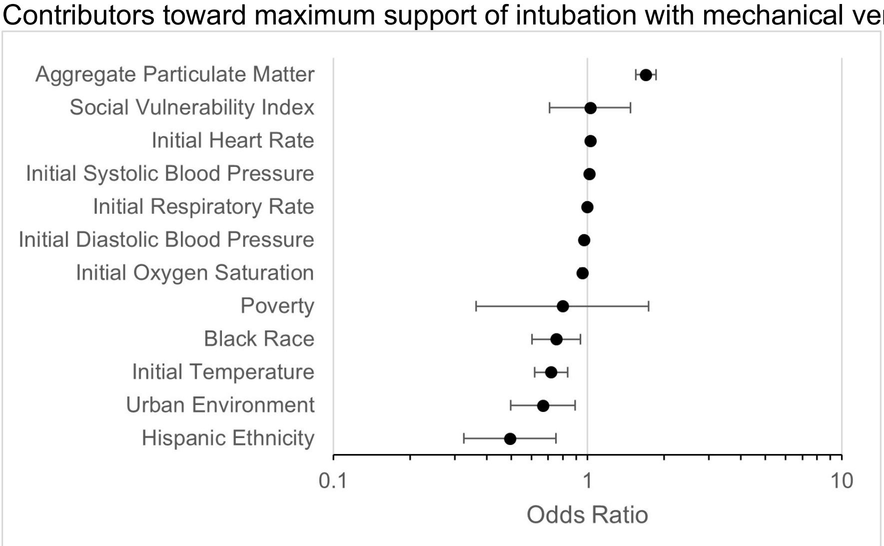
health and inform efforts intended to reduce the burden of pediatric asthma.

Contributors toward maximum support of NIPPV



Logarithmic forest plot showing odds ratio for each social determinant of health, environmental determinant of health, and vital sign included in the model predicting maximum respiratory support of NIPPV

Contributors toward maximum support of intubation with mechanical ventilation



Logarithmic forest plot showing odds ratio for each social determinant of health, environmental determinant of health, and vital sign included in the model predicting maximum respiratory support of intubation with mechanical ventilation

Implementation of an Order Set to Improve Post-cardiac Arrest Care of Children in Pediatric Intensive Care

10/21/2023

Oral Presentation

Suhasini P. Chico, MD[1]; Jigar C. Chauhan, MBBS MD[2], (1) Thomas Jefferson University, Newark, DE, (2) Nemours Children's Hospital, Wilmington, DE

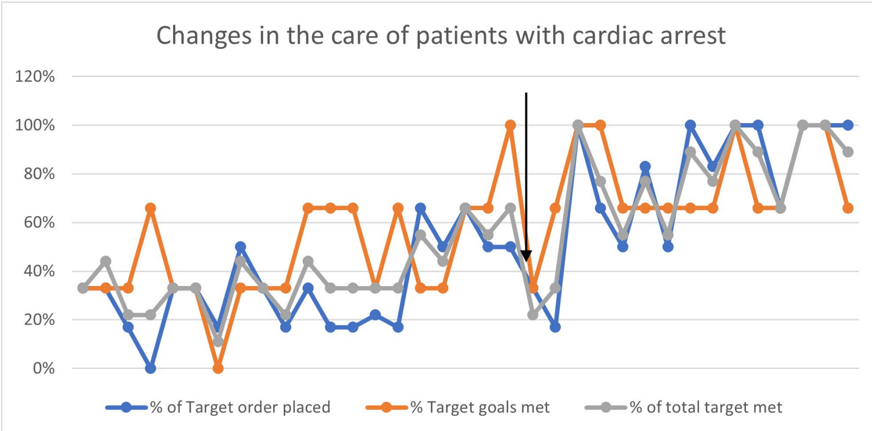
Purpose/Objectives: Pediatric cardiac arrest is associated with significant morbidity and mortality. Among patients who achieve return of circulation (ROC), only 3.8% of out-of-hospital cardiac arrest (OHCA) and 45% of in-hospital cardiac arrest (IHCA) patients survive to hospital discharge. After ROC, many patients experience post-cardiac arrest (PCA) syndrome, a vulnerable time where primary injury is treated, and secondary injury can be prevented. PCA care targets key elements of PCA syndrome such as brain damage, myocardial dysfunction, and reperfusion injury, by preventing hypotension, hypoxia, hypercarbia, and hyperthermia. Delivery of bundled PCA care is associated with improved patient outcomes in adult OHCA; however, it is unknown whether a pediatric PCA bundle improves care delivery or outcomes. By developing a dedicated electronic order set, our goal was to improve adherence to PCA guidelines and improve clinical care in the pediatric intensive care unit (PICU).

Design/Methods: To standardize the care of patients resuscitated from IHCA or OHCA, we created a clinical pathway and an order set in the electronic medical record. These included recommended goals for blood pressure, temperature, blood glucose, oxygenation, ventilation, and suggested monitoring for cardiac function, seizures and neuroimaging. Clinicians were educated on pathway indications and use of the order set. A retrospective analysis was conducted on patients admitted PCA over four years in our tertiary care PICU. 27 patients were included prior to order set implementation and 8 patients after. The primary outcome was defined as adherence to six main orders from the order set (head elevation, end tidal CO2, temperature, blood pressure, blood sugar, and neurology consult), shown in prior studies to affect positive outcomes in PCA care. Secondary outcome was defined as meeting targeted clinical care parameters (temperature of 36° to 37.5° C, blood sugar of 100 to 180 mg/dL, and end tidal CO2 of 35 to 45 ppm), if goals were achieved more than 70% of the time in the first 48 hours.

Results: Prior to the availability of a dedicated PCA order set, baseline order entry rate was an average of 39%, and the initial rate of target clinical parameters met was 53%. After implementation of the order set, there was a significant increase in the order entry rate to 94% ($p < 0.0001$), and goal clinical parameters were achieved in 74% of patients ($p=0.005$).

Conclusion/Discussion: Individual orders in complex clinical scenarios such as cardiac arrest can lead to deficiencies in care. In this study, implementation of a dedicated order set in the electronic medical record targeting clinical parameters in PCA care led to increased adherence to goal parameters for patients. These parameters have been shown to improve patient outcomes in prior studies, thereby demonstrating an achievable avenue for improvement of care through standardization and pathway deployment.

Figure 1



Run chart showing improvement in PCA care parameters with interventions (clinician education and order set implementation)

Table 1

Targets orders/goals of care	Before interventions (n=27)	After interventions (n=8)	P value
Orders (All)	39%	94%	<0.0001
Head end elevation	62%	100%	0.00058
CO2 goal	19%	100%	<0.0001
TTM	19%	88%	0.00043
Blood pressure	22%	100%	<0.0001
Blood sugar	78%	100%	0.01
Neurology consult	45%	75%	0.13
Clinical care goals (All)	53%	79%	0.005
TTM met	48%	50%	0.93
Blood glucose in range	56%	100%	0.0001
EtCO2 in target range	59%	88%	0.09
All Targets	44%	89%	<0.0001

Targeted orders and clinical goals before and after interventions (clinician education and order set implementation)