# Changes in Pediatric ICU Utilization and Clinical Trends During the Coronavirus Pandemic

*Janine E. Zee-Cheng, MD; Casey K. McCluskey, MD; Margaret J. Klein, MS; Matthew C. Scanlon, MD, CPPS; Alexandre T. Rotta, MD; Steven L. Shein, MD; Jose A. Pineda, MD; Kenneth E. Remy, MD; and Christopher L. Carroll, MD*

**e-Appendiix 1.**

Based on methods originally developed by Huff et al and previously presented ("Trends in Epidemiology of Critically Ill Children in a Large National Database in the United States", Society of Critical Care Medicine Annual Congress, 2020), we re-organized all subjects into one of 73 primary diagnosis. The previously developed methods are as follows:

First, cardiac surgery patients were identified using either the presence of either 1) the VPS variable "Cardiac Procedure directly prior to or during stay" or 2) the VPS variable "Index Procedure RACHS Score". Cardiac surgery patients were further classified into sub-categories based on their RACHS score. If a cardiac surgery patient did not have a RACHS score listed in the VPS database, a RACHS was assigned if possible based on the child's age and primary diagnosis (e.g. coarctation of the aorta at age >30 days). The remaining cardiac surgery patients were grouped together as "cardiac surgery – missing RACHS category."

All other patients (i.e. not cardiac surgery patients) were grouped by their primary STAR Code diagnosis. Each VPS STAR Code was placed into a previously developed list of approximately 70 primary diagnosis "buckets." During the development of this method, STAR Code sorting was independently reviewed, and disagreements were resolved via discussion and consensus.

For the current study, subjects that did not meet cardiac surgery criteria were each assigned to a primary diagnosis bucket using their VPS STAR Code. New STAR Codes have been developed by VPS since the initial development of this methodology, and those new codes were assigned to a primary diagnosis bucket by SLS. Next, after each subject had been assigned to a primary diagnosis bucket, the STAR Codes were independently reviewed within each bucket. Finally, several of the other authors reviewed assigned primary diagnoses, and disagreements were resolved via discussion and consensus. Upon conclusion of this process, each subject had been assigned to a single primary diagnosis based on the presence or absence of cardiac surgery and their primary VPS STAR Code diagnosis.

**e-Table 1. Patient Origin**

| | All N=160,295[1] | Pre-COVID Q1 N=23,197[2] | COVID Q1 N=22,895[1] | P value* | Pre-COVID Q2 N=20,157[2] | COVID Q2 N=13,627[1] | P value* |
|---|---|---|---|---|---|---|---|
| **Another Hospital Non-ICU Monitored Units** | 69 (0.4%) | 11 (0.05%) | 9 (0.04%) | | 9 (0.04%) | 3 (0.02%) | |
| **Another Hospital OR/Cath Lab/Procedure Rooms** | 467 (0.29%) | 65 (0.28%) | 47 (0.21%) | | 67 (0.33%) | 42 (0.31%) | |
| **Another Hospital's ED** | 30,630 (19.1%) | 4,593 (19.8%) | 4,652 (20.3%) | | 3,742 (18.6%) | 2,572 (18.9%) | |
| **Another Hospital's ICU** | 3,212 (2.0%) | 445 (1.9%) | 430 (1.9%) | | 406 (2.0%) | 288 (2.1%) | |
| **Another Hospital's Patient Care Unit** | 3,426 (2.1%) | 709 (3.06%) | 606 (2.7%) | | 277 (1.4%) | 106 (0.78%) | |
| **Non-ICU Monitored Units This Hospital** | 3,562 (2.2%) | 542 (2.3%) | 568 (2.5%) | | 402 (2.0%) | 258 (1.9%) | |
| **OR/Cath Lab/Procedure Room This Hospital** | 36,619 (22.8%) | 4,661 (20.1%) | 4,086 (17.9%) | <0.0001 | 5,198 (25.8%) | 3,693 (27.1%) | <0.0001 |
| **Other** | 2,302 (1.4%) | 316 (1.4%) | 264 (1.2%) | | 337 (1.7%) | 229 (1.7%) | |
| **Other ICUs in This Hospital** | 1,548 (0.97%) | 206 (0.89%) | 224 (0.98%) | | 201 (1.0%) | 169 (1.2%) | |
| **Outpatient Procedure Suite/Physician Office** | 1,916 (1.2%) | 270 (1.2%) | 229 (1.0%) | | 262 (1.3%) | 169 (1.2%) | |
| **Rehabilitation Center/Chronic Care Facility** | 309 (0.19%) | 43 (0.18%) | 40 (0.17%) | | 42.7 (0.2%) | 32 (0.23%) | |
| **Same Hospital's ED** | 55,614 (34.7%) | 8,010 (34.5%) | 8,449 (36.9%) | | 6,951 (34.5%) | 4,758 (34.9%) | |
| **Same Hospital's Patient Care Unit** | 20,621 (12.9%) | 3,329 (14.4%) | 3,291 (14.4%) | | 2,264 (11.2%) | 1,308 (9.6%) | |

Data displayed as N (%) = frequency (column percentage), median (25th percentile, 75th percentile)
ED=Emergency Department, OR=Operating Room
*P values for categorical data are based on the Chi-Squared Test
1. Raw counts
2. Weighted averages weighted by the number of quarters the center submitted data (from 2017, 2018, and 2019), rounded to the nearest whole number

**e-Table 2:** Changes in Diagnostic Categories between pre-COVID and COVID Q1 and Q2. Includes all 73 data categories. Frequencies calculated from total samples.

| | Pre-COVID Q1 n=23,197 | COVID Q1 n=22,895 | P value | Pre-COVID Q2 n=20,157 | COVID Q2 n=13,627 | P value |
|---|---|---|---|---|---|---|
| Altered mental status | 223 (1.0%) | 209 (0.9%) | >0.99 | 225 (1.1%) | 179 (1.3%) | >0.99 |
| Anaphylaxis | 76 (0.3%) | 67 (0.3%) | >0.99 | 62 (0.3%) | 53 (0.4%) | >0.99 |
| Aspiration | 161 (0.7%) | 175 (0.8%) | >0.99 | 198 (1.0%) | 127 (0.9%) | >0.99 |
| Asthma | 1,299 (5.6%) | 1,292 (5.6%) | >0.99 | 1,327 (6.6%) | 241 (1.8%) | <0.0001 |
| Blood cancer | 143 (0.6%) | 147 (0.6%) | >0.99 | 146 (0.7%) | 158 (1.2%) | 0.0026 |
| Brain cancer | 374 (1.6%) | 317 (1.4%) | >0.99 | 364 (1.8%) | 248 (1.8%) | >0.99 |
| Bronchiolitis | 4,564 (19.7%) | 4,707 (20.6%) | >0.99 | 1,299 (6.5%) | 121 (0.9%) | <0.0001 |
| Cancer (soft tissue, unspecified) | 378 (1.6%) | 338 (1.5%) | >0.99 | 357 (1.8%) | 311 (2.3%) | 0.07 |
| Cardiac arrest-asphyxia | 215 (0.9%) | 193 (0.8%) | >0.99 | 211 (1.1%) | 154 (1.1%) | >0.99 |
| Cardiac surgery (RACHS category 1) | 102 (0.4%) | 62 (0.3%) | >0.99 | 141 (0.7%) | 67 (0.5%) | >0.99 |
| Cardiac surgery (RACHS category 2) | 375 (1.6%) | 333 (1.5%) | >0.99 | 394 (2.0%) | 284 (2.1%) | >0.99 |
| Cardiac surgery (RACHS category 3) | 278 (1.2%) | 225 (1.0%) | >0.99 | 343 (1.7%) | 219 (1.6%) | >0.99 |
| Cardiac surgery (RACHS category 4) | 94 (0.4%) | 70 (0.3%) | >0.99 | 97 (0.5%) | 61 (0.5%) | >0.99 |
| Cardiac surgery (RACHS category 5) | 2 (0.0%) | 3 (0.0%) | >0.99 | 1 (0.0%) | 0 (0.0%) | >0.99 |
| Cardiac surgery (RACHS category 6) | 29 (0.1%) | 25 (0.1%) | >0.99 | 30 (0.2%) | 10 (0.1%) | >0.99 |
| Cardiac surg –missing RACHS category | 73 (0.3%) | 67 (0.3%) | >0.99 | 90 (0.4%) | 69 (0.5%) | >0.99 |
| Cardiovascular - Arrhythmia | 178 (0.8%) | 205 (0.9%) | >0.99 | 179 (0.9%) | 153 (1.1%) | >0.99 |
| Cardiovascular - Congenital Heart Disease | 256 (1.1%) | 249 (1.1%) | >0.99 | 278 (1.4%) | 253 (1.9%) | 0.037 |
| Cardiovascular - Other | 72 (0.3%) | 50 (0.2%) | >0.99 | 77 (0.4%) | 52 (0.4%) | >0.99 |
| Cardiovascular - Vascular | 120 (0.5%) | 127 (0.6%) | >0.99 | 120 (0.6%) | 100 (0.7%) | >0.99 |
| Central Nervous System infection | 228 (1.0%) | 263 (1.2%) | >0.99 | 236 (1.2%) | 138 (1.0%) | >0.99 |
| Dermatologic - All | 23 (0.1%) | 22 (0.1%) | >0.99 | 26 (0.1%) | 24 (0.2%) | >0.99 |
| Diabetes mellitus | 1,072 (4.6%) | 1,054 (4.6%) | >0.99 | 1,033 (5.1%) | 1,276 (9.4%) | <0.0001 |

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|---|---|---|---|---|---|---|
| Drowning | 33 (0.1%) | 37 (0.2%) | >0.99 | 118 (0.6%) | 87 (0.6%) | >0.99 |
| Electrolyte abnormality | 189 (0.8%) | 203 (0.9%) | >0.99 | 186 (0.9%) | 183 (1.3%) | 0.018 |
| Endocrine – All | 57 (0.3%) | 46 (0.2%) | >0.99 | 52 (0.3%) | 53 (0.4%) | >0.99 |
| Gastrointestinal - Hepatic | 89 (0.4%) | 91 (0.4%) | >0.99 | 97 (0.5%) | 64 (0.5%) | >0.99 |
| Gastrointestinal - Intestinal | 266 (1.2%) | 257 (1.1%) | >0.99 | 253 (1.3%) | 186 (1.4%) | >0.99 |
| Gastrointestinal - Other | 181 (0.8%) | 160 (0.7%) | >0.99 | 182 (0.9%) | 135 (1.0%) | >0.99 |
| Gastrointestinal - Pancreatic | 34 (0.2%) | 31 (0.1%) | >0.99 | 35 (0.2%) | 39 (0.3%) | >0.99 |
| Genetic | 51 (0.2%) | 34 (0.2%) | >0.99 | 52 (0.3%) | 23 (0.2%) | >0.99 |
| Gynecologic - All | 7 (0.0%) | 9 (0.0%) | >0.99 | 6 (0.0%) | 9 (0.1%) | >0.99 |
| Head trauma | 649 (2.8%) | 645 (2.8%) | >0.99 | 853 (4.2%) | 757 (5.6%) | <0.0001 |
| Heart failure | 85 (0.4%) | 89 (0.4%) | >0.99 | 91 (0.5%) | 83 (0.6%) | >0.99 |
| Hematologic | 171 (0.7%) | 139 (0.6%) | >0.99 | 162 (0.8%) | 155 (1.1%) | 0.12 |
| Hydrocephalus, ICH, VP shunt | 390 (1.7%) | 353 (1.5%) | >0.99 | 369 (1.8%) | 276 (2.0%) | >0.99 |
| Hypertension (systemic) | 62 (0.3%) | 66 (0.3%) | >0.99 | 62 (0.3%) | 44 (0.3%) | >0.99 |
| Hypovolemia/dehydration | 86 (0.4%) | 69 (0.3%) | >0.99 | 85 (0.4%) | 49 (0.4%) | >0.99 |
| Immunologic – All | 7 (0.0%) | 7 (0.0%) | >0.99 | 11 (0.1%) | 9 (0.1%) | >0.99 |
| Infection – other | 355 (1.5%) | 319 (1.4%) | >0.99 | 338 (1.7%) | 220 (1.6%) | >0.99 |
| Influenza | 465 (2.0%) | 717 (3.1%) | <0.0001 | 56 (0.3%) | 3 (0.0%) | <0.0001 |
| Injury/Poisoning/Adverse Effects – Other | 73 (0.3%) | 57 (0.3%) | >0.99 | 82 (0.4%) | 32 (0.2%) | 0.60 |
| Metabolic – All | 93 (0.4%) | 59 (0.3%) | 0.57 | 86 (0.4%) | 68 (0.5%) | >0.99 |
| Neurologic – Neuromuscular | 66 (0.3%) | 40 (0.2%) | >0.99 | 60 (0.3%) | 31 (0.2%) | >0.99 |
| Neurologic – Neurovascular | 328 (1.4%) | 378 (1.7%) | >0.99 | 375 (1.9%) | 411 (3.0%) | <0.0001 |
| Neurologic - Spinal Cord | 109 (0.5%) | 112 (0.5%) | >0.99 | 114 (0.6%) | 76 (0.6%) | >0.99 |
| Neurology (other) | 281 (1.2%) | 259 (1.1%) | >0.99 | 302 (1.5%) | 253 (1.9%) | 0.83 |
| Newborn/Perinatal – All | 13 (0.1%) | 13 (0.1%) | >0.99 | 20 (0.1%) | 34 (0.3%) | 0.039 |
| Non-head Trauma | 417 (1.8%) | 344 (1.5%) | 0.97 | 520 (2.6%) | 466 (3.4%) | 0.0005 |
| OSA/chronic tonsillitis | 358 (1.5%) | 335 (1.5%) | >0.99 | 427 (2.1%) | 264 (1.9%) | >0.99 |
| Ophthalmologic - All | 17 (0.1%) | 13 (0.1%) | >0.99 | 11 (0.1%) | 2 (0.0%) | >0.99 |
| Orthopedic - All | 364 (1.6%) | 301 (1.3%) | >0.99 | 510 (2.5%) | 302 (2.2%) | >0.99 |
| Other | 347 (1.5%) | 286 (1.3%) | >0.99 | 343 (1.7%) | 338 (2.5%) | <0.0001 |
| Pneumonia | 1,137 (4.9%) | 1,436 (6.3%) | <0.0001 | 1,027 (5.1%) | 318 (2.3%) | <0.0001 |

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|---|---|---|---|---|---|---|
| Poisoning/ingestion | 761 (3.3%) | 867 (3.8%) | 0.23 | 856 (4.3%) | 946 (6.9%) | <0.0001 |
| Psychiatric - All | 40 (0.2%) | 22 (0.1%) | >0.99 | 32 (0.2%) | 25 (0.2%) | >0.99 |
| Pulmonary hypertension | 55 (0.2%) | 53 (0.2%) | >0.99 | 56 (0.3%) | 48 (0.4%) | >0.99 |
| Renal/Genitourinary - All | 197 (0.9%) | 214 (0.9%) | >0.99 | 223 (1.1%) | 179 (1.3%) | >0.99 |
| Respiratory - lower airway | 274 (1.2%) | 316 (1.4%) | >0.99 | 295 (1.5%) | 169 (1.2%) | >0.99 |
| Respiratory - other | 92 (0.4%) | 136 (0.6%) | 0.19 | 128 (0.6%) | 120 (0.9%) | 0.69 |
| Respiratory - upper airway | 129 (0.6%) | 38 (0.2%) | <0.0001 | 127 (0.6%) | 38 (0.3%) | 0.0004 |
| Respiratory distress | 212 (0.9%) | 173 (0.8%) | >0.99 | 191 (1.0%) | 111 (0.8%) | >0.99 |
| Respiratory failure/arrest (including ARDS) | 651 (2.8%) | 699 (3.1%) | >0.99 | 594 (3.0%) | 280 (2.1%) | <0.0001 |
| Respiratory tract anomalies | 373 (1.6%) | 264 (1.2%) | 0.0022 | 440 (2.2%) | 269 (2.0%) | >0.99 |
| Rheumatologic - All | 43 (0.2%) | 24 (0.1%) | >0.99 | 39 (0.2%) | 24 (0.2%) | >0.99 |
| Seizures/epilepsy | 1,187 (5.1%) | 1,087 (4.8%) | >0.99 | 1,165 (5.8%) | 835 (6.1%) | >0.99 |
| Sepsis | 612 (2.6%) | 639 (2.8%) | >0.99 | 573 (2.8%) | 501 (3.7%) | 0.0013 |
| Shock – not otherwise specified | 80 (0.4%) | 77 (0.3%) | >0.99 | 91 (0.5%) | 87 (0.6%) | >0.99 |
| Skull anomalies/craniosynostosis | 307 (1.3%) | 276 (1.2%) | >0.99 | 330 (1.6%) | 271 (2.0%) | >0.99 |
| Suicide | 53 (0.2%) | 15 (0.1%) | 0.0004 | 46 (0.2%) | 9 (0.1%) | 0.020 |
| Transplant - All | 55 (0.2%) | 44 (0.2%) | >0.99 | 56 (0.3%) | 28 (0.2%) | >0.99 |
| URI (including croup, tracheitis, laryngitis) | 438 (1.9%) | 361 (1.6%) | 0.77 | 345 (1.7%) | 139 (1.0%) | <0.0001 |
| Viral Infections | 526 (2.3%) | 485 (2.1%) | >0.99 | 458 (2.3%) | 280 (2.1%) | >0.99 |

OSA=obstructive sleep apnea; ARDS=Acute Respiratory Disease Syndrome; URI=upper respiratory infection
P values are resulting from 2x2 Chi-Squared tests and are adjusted for multiple comparisons using the Bonferroni adjustment. The Chi-Squared test is comparing each individual diagnosis to all other diagnoses, for example, pneumonia vs. all other non-pneumonia diagnoses.

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