**Online Data Supplement for** The Impact of Strict Public Health Restrictions on Pediatric Critical Illness

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**Supplemental Table 1. Public health orders by state represented in our cohort**

|  |  |  |
| --- | --- | --- |
| **State** | **Limitations on gatherings** | **Stay-at-home orders** |
| Illinois | 3/13/20 | 3/20/20 – 5/31/20 |
| Ohio | 3/14/20 | 3/22/20 – 5/20/20 |
| Washington | 3/11/20 | 3/23/20 – 5/8/20 |
| Colorado | 3/12/20 | 3/25/20 – 5/28/20 |
| North Carolina | 3/14/20 | 3/27/20 – 5/20/20 |
| Texas | 3/10/20 | 3/24/20 – 6/10/20 (Harris County) |

**Supplemental Table 2. Data Element Sources and Definitions.**

|  |  |  |
| --- | --- | --- |
| **Characteristic** | **All Sites****(n=6)** | **VPS Sites (n=5)** |
| **Patient and Admission Characteristics** |
| Age  | X |  |
| Pre-existing chronic conditions by Pediatric Medical Complexity Algorithm |  | Xh |
| Female sex | X |  |
| Race/Ethnicity |  | Xh |
| Admission Sourcea |  | X |
| Elective Admissionb | X |  |
| Primary Diagnosis Categoryc | X |  |
| PRISM III |  | X |
| PIM risk of mortalityd |  | X |
| **Hospitalization Characteristics** |
| Non-invasive ventilation | X |  |
| Complicated PICU Staye | X |  |
| Continuous Renal Replacement Therapy | X |  |
| Extracorporeal Membrane Oxygenation  | X |  |
| Mechanical Ventilation | X |  |
| Days of Mechanical Ventilationf |  | X |
| PICU length of stayg | X |  |
| Hospital length of stayg | X |  |
| Mortality | X |  |

Data elements for five of the six sites were derived from each site’s Virtual Pediatric Systems (VPS, LLC) database (1). Virtual Pediatric Systems is an international, multi-institutional clinical registry dedicated to standardized data sharing to support quality improvement and research in pediatric critical care. The registry includes PICU-specific data elements extracted from the medical record by trained research staff. The sixth site contributed data extracted directly from their site’s electronic health record (EHR).

aPICU admission source was defined as Emergency Department or direct admit (Emergency Department/direct admit), general care floor or step-down unit (ward), operating room including the post anesthesia care unit, and another ICU within the facility.

bElective admissions are defined in the VPS registry as an admission which could have been postponed for more than 6 hours without harm to the patient. Commonly, these admissions are for insertion of a central line, planned chemotherapy, or planned admissions after an elective surgery. The non-VPS site identified elective admissions as PICU admission immediately after elective surgery as this represented the majority of their elective admissions. cPrimary diagnoses derived from billing codes were categorized into matching VPS diagnosis categories and reviewed for consistency by two authors (AM and TC). Billing codes inconsistent with a primary PICU diagnosis (e.g., family history of asthma) were categorized as “undeterminable.”

dOne site contributed PIM2 and four sites contributed PIM3 scores, which were converted to risk of mortality and combined for reporting (2, 3).

eComplicated Pediatric Intensive Care Unit (PICU) stay was defined by receipt of either continuous renal replacement therapy (CRRT), extracorporeal membrane oxygenation (ECMO), or invasive mechanical ventilation.

fDuration of invasive mechanical ventilation was restricted to the duration provided during the PICU stay.

gDuration of PICU and hospital stays were truncated on 8/15/2020. Patients who remained hospitalized on 8/15/2020 were designated as survivors.

hWe were unable to determine pre-existing chronic conditions for 4 patients and race/ethnicity data were missing for 20 patients.

**Supplemental Table 3. Primary diagnosis sub-categories for diagnoses with relevant diagnosis groups.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Diagnosis Categories** | **2017-2019** | **2017-2019** **(annual average)** | **2020** |
| Total Respiratory | 2466 | 822 | 304 |
| Respiratory infections | 1424 (57.7%) | 475 | 190 |
| Asthma | 462 (18.7%) | 154 | 31 |
| ENT (non-infectious) | 277 (11.2%) | 92 | 32 |
| Other | 303 (12.3%) | 101 | 51 |
| Total Injury | 394 | 131 | 107 |
| Injury | 269 (68.3%) | 90 | 75 |
| Asphyxiation/Foreign Body | 35 (8.9%) | 12 | 12 |
| Drowning/hypothermia | 31 (7.9%) | 10 | 5 |
| Burns | 26 (6.6%) | 9 | 6 |
| Other | 33 (8.4%) | 11 | 9 |
| Total Poisonings/Adverse Effects | 270 | 90 | 112 |
| Poisonings | 194 (71.9%) | 65 | 82 |
| Anaphylaxis | 40 (14.8%)  | 13 | 8 |
| Adverse Effects | 23 (8.5%) | 8 | 22 |
| Other | 13 (4.8%) | 4 | 0 |
| Total Endocrine | 210 | 70 | 90 |
| Diabetic ketoacidosis  | 172 (81.9%) | 57 | 78 |
| Other | 38 (18.1%) | 13 | 12 |

Percentages presented for 2017-2019 as baseline period to delineate proportion of overall diagnosis category represented by each sub-category. Percentages may not sum to 100 due to rounding.ENT: ear, nose, throat.

**Supplemental Table 4. Methods to categorize pre-admission Pediatric Medical Complexity Algorithm (PMCA) status.**

|  |
| --- |
| **Steps to categorize pre-admission Pediatric Medical Complexity Algorithm (PMCA) status for each patient** |
| **Step 1.** Identified VPS diagnoses that were present on admission |
| **Step 2.** Each diagnosis was classified as a complex chronic condition (CCC), non-complex chronic condition (NCCC) or not a chronic condition.a  |
| **Step 3.** PMCA designation: Children were designated as CCC if they had > 1 diagnosis designated as a CCC or if they had > 2 NCCCs across > 2 PMCA organ systems/categories (Neurologic, Respiratory, Orthopedic, Gastrointestinal, Cardiovascular, Transplant, Genetic, Endocrine, Metabolic, Renal/Genitourinary, Psychiatric, Dermatologic, Hematologic, Ophthalmologic, Oncologic, Immunologic, Rheumatologic). Children were designated as having an NCC if they had > 1 NCCC or > 2 NCCCs that did not cross two of the above categories. Children were designated as having no chronic conditions if they had neither an NCCC nor CCC. |
| **Step 4.** To identify patient’s health status prior to the acute illness or injury, we identified patients whose primary diagnoses was designated as a CCC, significant ongoing, and present on admission. We removed these primary diagnoses and PMCA category was determined based on the remaining diagnoses that were present on admission. For example, a previously healthy child newly diagnosed with leukemia would have been categorized as a CCC, but we re-categorized these children based on their health status prior to the acute illness. |

Patients were categorized as having a pre-existing complex chronic condition (CCC), non-complex chronic condition (NCCC), or no chronic conditions based on admission diagnoses in the Virtual Pediatric Systems (VPS) database (4). This algorithm was developed in a cohort 381 critically ill patients and validated in a separate cohort of 252 critically ill children. The algorithm demonstrated sensitivity of 0.80 [95% confidence interval (CI): 0.71-0.87] and specificity 0.95 [0.90-0.98] to identify patients with a complex chronic condition (CCC). It displayed sensitivity of 0.91 [0.85-0.95] and specificity 0.88% [0.80-0.93] to identify patients with no chronic conditions.

aDiagnoses were categorized as CCC, NCCC, and non-chronic based on a previously published algorithm by Edwards et al that was augmented to include diagnoses reflective of pre-existing technology dependence and pre-existing CCCs (e.g., acute chest syndrome) (Supplemental Table 5).(4, 5)

**Supplemental Table 5. Diagnoses to categorize pre-admission Pediatric Medical Complexity Algorithm (PMCA) status.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Diagnosis Status** | **STAR Code Description** | **Category** | **STARCode** | **NCCC** | **CCC** | **Non-chronic** |
| SIGNIFICANT ONGOING | Cardiomyopathy | Cardiovascular | 425 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Long QT Syndrome | Cardiovascular | 426.82 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Other disease of arteries and arterioles | Cardiovascular | 447 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Diseases of capillaries | Cardiovascular | 448 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Tetralogy Of Fallot (ToF) | Cardiovascular | 745.2 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Hypoplastic Left Heart Syndrome (HLHS) | Cardiovascular | 746.7 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Malposition Of Heart/Apex, Dextrocardia/Mesocardia | Cardiovascular | 746.87 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Aortic Arch Anomalies/Vascular Ring/Sling, Aberrant Subclavian/double Aortic Arch | Cardiovascular | 747.21 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Pulmonary Artery Anomalies/Hypoplasia, Pulmonary Sling, Pulmonary AV fistula | Cardiovascular | 747.3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | H/O Heart Transplant V | Cardiovascular | V42.1 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Dermatitis/Eczema | Dermatologic | 692 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Congenital Hypothyroidism | Endocrinologic | 243 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Acquired Hypothyroidism | Endocrinologic | 244 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Type 2 DM, not uncontrolled | Endocrinologic | 250 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Diabetes Mellitus NOS | Endocrinologic | 250 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Parathyroid Disorders | Endocrinologic | 252 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Pituitary/Hypothalamic Disorders | Endocrinologic | 253 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Diabetes Insipidus (DI) | Endocrinologic | 253.5 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Adrenal Insufficiency, Addisons Disease | Endocrinologic | 255.4 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Glucocorticoid Deficient | Endocrinologic | 255.41 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Endocrine Disorder, Other | Endocrinologic | 259 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Short Stature | Endocrinologic | 783.4C | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Hx of past noncompliance | Factors Influencing Health | V15.81 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | HX of ECMO | Factors Influencing Health | V15.87 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Consanguinity | Factors Influencing Health | V19.7 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | H/O Tracheostomy V | Factors Influencing Health | V44.0 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Gastroesophageal Reflux (GER) and noninfectious esophagitis | Gastrointestinal | 530.1 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Regional Enteritis/Crohns Disease | Gastrointestinal | 555 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Proctocolitis/Ulcerative Colitis | Gastrointestinal | 556 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Neurogenic bowel/Constipation/intestine disorder NOS | Gastrointestinal | 564 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Intestinal Disorders NEC | Gastrointestinal | 569.8 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Hepatitis NOS, non-viral | Gastrointestinal | 573.3 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Intestinal Malabsorption | Gastrointestinal | 579 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Small Intestine/Colon/Anal Atresia or Stenosis | Gastrointestinal | 751.1 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Biliary Atresia | Gastrointestinal | 751.61 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Underweight, Failure to Thrive (FTT) | Gastrointestinal | 783.22 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Dysphagia | Gastrointestinal | 787.2 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Ear/Face/Neck Anomalies, Congenital NEC | Genetic | 744 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Aperts Syndrome/Acrocephalosyndactyly | Genetic | 755.1 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Anomalies Of Skull/Face Bones NEC, Includes Craniosynostosis and Crouzon's Hypertelorism/Trigonocephaly | Genetic | 756 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Pierre-Robin Syndrome/Sequence | Genetic | 756.01 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Osteodystrophies | Genetic | 756.5 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Osteogenesis Imperfecta (OI) | Genetic | 756.51 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Anomalies Of Abdominal Wall, Gastroschisis/Exomphalos/Omphalocele | Genetic | 756.7 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Integument Anomalies, Congenital NEC, Skin/hair/Nail/Breast Anomalies, Lymphedema/Vascular Hamartomas, Ichthyosis Congenita/epidermolysis Bullosa, Xeroderma Pigmentosum | Genetic | 757 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Chromosomal Anomalies NEC, Autosomal Deletion/Translocation/Anomalies | Genetic | 758 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Trisomy 21/Downs Syndrome | Genetic | 758 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Trisomy 18/Edwards Syndrome | Genetic | 758.2 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Noonans Syndrome | Genetic | 758.3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Cri-Du-Chat Syndrome | Genetic | 758.31 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Spleen anomaly, including congenital and asplenia | Genetic | 759 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Prader-willi syndrome | Genetic | 759.81 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Congenital anomaly nos | Genetic | 759.9 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Fetal Alcohol Syndrome | Genetic | 760.71 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Disorders of glutathione metabolism including Glucose-6-p Dehydrogenase Deficiency (G6PD) | Hematologic | 282.2 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Thalassemias | Hematologic | 282.4 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Sickle Cell Disease (includes both SS and SC) | Hematologic | 282.6 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Aplastic Anemias | Hematologic | 284 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | White Blood Cell Diseases | Hematologic | 288 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Immune Disorders, NOS | Immunologic | 279 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Humoral Immunity/Immune Globulin Deficiency | Immunologic | 279 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Digeorge Syndrome/Thymic Hypoplasia | Immunologic | 279.11 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Epstein-Barr Virus Infection (EBV), Infectious Mononucleosis | Infectious | 75 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Soft Tissue Disorders/Pain/Foreign Body | Injury/Poisoning/Adverse Effects | 729 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Closed Intracranial Injury/Head Trauma, Closed Intracranial Injury / Head Trauma of Unspecific Natur | Injury/Poisoning/Adverse Effects | 854 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Spinal cord injury without fracture | Injury/Poisoning/Adverse Effects | 952 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Injury to nerve nos | Injury/Poisoning/Adverse Effects | 957.9 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Allergy, Unspecified, Allergic/hypersensitivity Reaction | Injury/Poisoning/Adverse Effects | 995.3 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Suicide/self-inflicted injury | Injury/Poisoning/Adverse Effects | E950 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Vitamin D deficiency including Rickets | Metabolic | 268 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Amino-Acid Transport/Metabolism Disorder | Metabolic | 270 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Carbohydrate Transport/Metabolism Disorder | Metabolic | 271 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Sphingolipidosis, Gauchers Disease/niemann-pick Disease | Metabolic | 272.7 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Alpha-1-Antitrypsin Def | Metabolic | 273.4 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Autoimmune Disease, NEC | Metabolic | 274.9 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Mineral Metabolism Disorders | Metabolic | 275 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Copper Metabolism Disorders, Wilsons Disease | Metabolic | 275.1 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Hypokalemia | Metabolic | 276.8 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Metabolism Disorders, Other | Metabolic | 277 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Mucopolysaccharidosis, Hunters/hurlers Syndrome | Metabolic | 277.5 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Peroxisomal Disorders | Metabolic | 277.86 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Dis Mitochondrial Metab | Metabolic | 277.87 | 0 | 1 | 0 |
| Diagnosis Status | STAR Code Description | Category | STARCode | NCCC | CCC | Non-chronic |
| SIGNIFICANT ONGOING | Metabolic disorders NEC | Metabolic | 277.89 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Developmental Delay, Specific | Neurologic | 315 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Mental Retardation (MR), Developmental Delay, Generalized | Neurologic | 319 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Encephalitis/Myelitis/Encephalomyelitis | Neurologic | 323 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Cerebral Degenerations Of Childhood, Cerebral Sphingolipidosis, Tay-sachs Disease, Leighs Disease | Neurologic | 330 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Hydrocephalus, Obstructive Acquired | Neurologic | 331.4 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Chorea and other movement disorders | Neurologic | 333.5 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Anterior Horn Cell Disease, Hypotonia incl. SMA, Werdnig-Hoffmann | Neurologic | 335.8 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Spinal Cord Diseases, Syringomyelia/syringobulbia | Neurologic | 336 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Autonomic disorders | Neurologic | 337 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Pain not elsewhere classified | Neurologic | 338 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Other demylinating disorders of CNS | Neurologic | 341 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Cerebral Palsy, Infantile (CP) | Neurologic | 343 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Paralytic Syndromes, Quadriplegia/paraplegia/hemiplegia | Neurologic | 344 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Neurogenic bladder | Neurologic | 344.61 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | epilepsy/seizures NOS/NEC | Neurologic | 345 | 0 | 1 | 0 |
|  |  |  |  |  |  |  |
| SIGNIFICANT ONGOING | Infantile Spasms/Hypsarrhythmia | Neurologic | 345.6 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Anoxic Brain Damage, Anoxic/Hypoxic/Ischemic Encephalopathy | Neurologic | 348.1 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Encephalopathy, Unspecified | Neurologic | 348.3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Other Brain Conditions NEC | Neurologic | 348.8 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Bells Palsy/Seventh Nerve Palsy | Neurologic | 351 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Cranial Nerve Disorder | Neurologic | 352 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Myopathy/ Muscular Dystrophy NEC | Neurologic | 359 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Hereditary Progressive Muscular Dystrophy, includes Duchennes Muscular Dystrophy, Fascioscapulohumeral Muscular Dystrophy, Gowers Muscular Dystrophy, Limb-girdle Muscular Dystrophy | Neurologic | 359.1 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Arnold-Chiari Malformation, Hydrocephalus | Neurologic | 741 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Spina Bifida/Meningomyelocele/Meningocele | Neurologic | 741 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Encephalocele/Meningoencephalocele | Neurologic | 742 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Nervous System Anomalies, Congenital, Cerebral Cyst/Macroencephaly/Porencephaly | Neurologic | 742 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Microcephalus/Micrencephaly | Neurologic | 742.1 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Holoprosencephaly/Anencephaly | Neurologic | 742.2 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Hydrocephalus, Congenital, Aqueduct Of Sylvius Stenosis/obstruction | Neurologic | 742.3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Cerebrovascular Anomalies, Cerebral Arteriovenous Malformation (AVM) | Neurologic | 747.81 | 0 | 1 | 0 |
|  |  |  |  |  |  |  |
| SIGNIFICANT ONGOING | Birth Asphyxia/Intrauterine Hypoxia, Fetal Distress/Anoxia | Neurologic | 768 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Hypoxic Ischemic Encephalopathy (HIE) | Neurologic | 768.7 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Symptoms including nervous and musculoskeletal systems | Neurologic | 781 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Abn involun movement nec | Neurologic | 781 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Oligohydramnios-unspec | Newborn/Perinatal | 658 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Maternal ingestion/med aff nb/fetus (excludes Fetal Alcohol syndrome) | Newborn/Perinatal | 760.7 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Short Gestation and Low Birthweight, Preterm Infant/Prematurity | Newborn/Perinatal | 765 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Hydrops Fetalis | Newborn/Perinatal | 778 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Digestive Organ/Peritoneum Neoplasm, Esophagus/stomach/intestine/colon Neoplasm | Oncologic | 159 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Mediastinum/Heart/Thymus Neoplasm | Oncologic | 164 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Brain Neoplasm | Oncologic | 191 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Endocrine Gland Neoplasm | Oncologic | 194 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Secondary Malignancies | Oncologic | 196 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Malinant neoplasm, no site specified | Oncologic | 199 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Burkitts Lymphoma | Oncologic | 200.2 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Hodgkins Disease/Lymphoma | Oncologic | 201 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Letterer-Siwe Disease, Histiocytosis, Malignant/progressive, Histiocytic Medullary Reticulosis | Oncologic | 202.5 | 0 | 1 | 0 |
|  |  |  |  |  |  |  |
| SIGNIFICANT ONGOING | Peripheral T Cell lymphoma | Oncologic | 202.7 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Acute Lymphoid Leukemia (ALL), Acute Lymphoblastic/lymphocytic Leukemia | Oncologic | 204 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Acute Myeloid Leukemia (AML), Acute Myeloblastic/myelocytic Leukemia, Acute Nonlymphocytic Leukemia (ANLL) | Oncologic | 205 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Benign Neoplasms of respiratory and intrathoracic organs | Oncologic | 212 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Benign neoplasm of bone, articular cartilage | Oncologic | 213 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Benign neoplasm of other and unspecified sites | Oncologic | 229 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Neurofibromatosis | Oncologic | 237.7 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Lymphatic/Hemopoietic Neoplasm NEC | Oncologic | 238.7 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Papilloma NEC M | Oncologic | M8050/0 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Hepatocellular Carcinoma/Hepatoma M | Oncologic | M8170/3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Rhabdomyosarcoma NEC M | Oncologic | M8900/3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Nephroblastoma/Wilms Tumor M | Oncologic | M8960/3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Teratoma, Malignant M | Oncologic | M9080/3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Lymphangiomas/Cystic Hygroma NEC M | Oncologic | M9170/0 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Glioma M | Oncologic | M9380/3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Ependymoma NEC M | Oncologic | M9391/3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Astrocytoma NEC M | Oncologic | M9400/3 | 0 | 1 | 0 |
|  |  |  |  |  |  |  |
| SIGNIFICANT ONGOING | Ganglioneuroblastoma M | Oncologic | M9490/3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Neuroblastoma NEC M | Oncologic | M9500/3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Retinoblastoma NEC M | Oncologic | M9510/3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Retrolental Fibroplasia (RLF), Retinopathy Of Prematurity (ROP) | Ophthalmologic | 362.2 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Glaucoma | Ophthalmologic | 365 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Vision/visual disturbance and loss | Ophthalmologic | 367 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Disorders of optic nerve and visual pathway | Ophthalmologic | 377 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Optic Atrophy | Ophthalmologic | 377.1 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Paralytic Strabismus, Third/oculomotor Nerve Palsy, Fourth/trochlear Nerve Palsy, Sixth/abducens Nerve Palsy | Ophthalmologic | 378.5 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Nystagmus | Ophthalmologic | 379.5 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Derangement and dislocation of joint | Orthopedic | 718 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Cervical spinal stenosis | Orthopedic | 723 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Muscle, ligament and fascia disorders | Orthopedic | 728 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Bone/Cartilage Disorders, Other NEC, Bone Cyst/aseptic Necrosis | Orthopedic | 733 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Spine Curvature Disorders, Kyphosis/Lordosis/Scoliosis | Orthopedic | 737 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Congenital dislocation of hip | Orthopedic | 754.3 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Pectus Excavatum | Orthopedic | 754.81 | 1 | 0 | 0 |
|  |  |  |  |  |  |  |
| SIGNIFICANT ONGOING | Limb Anomalies, Congenital, Polydactyly/Syndactyly | Orthopedic | 755 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Torticollis | Other | 723.5 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Problems with hearing | Other | V41.2 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Delirium and transient menta disorders | Psychiatric | 293 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Psychoses includes schizphrenia, delusional and other types | Psychiatric | 295 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Affective Psychoses | Psychiatric | 296 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Pervasive Developmental disorders including autism | Psychiatric | 299 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Neurotic Disorders | Psychiatric | 300 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | special syndromes or symptoms not elsewhere classified | Psychiatric | 307 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Tics | Psychiatric | 307.2 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Hyperkinetic syndromes including ADHD | Psychiatric | 314 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Behavioral problems nec | Psychiatric | V40.3 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Kidney/Ureter Disorders NEC, Vesicoureteral Reflux | Renal/Genitourinary | 593 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Urinary System Anomalies, Congenital NEC, Accessory/Ectopic/Fused/Horseshoe Kidney, Urinary Bladder Exstrophy/urachus Anomalies | Renal/Genitourinary | 753 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Renal Agenesis/Dysgenesis, Hypoplastic Kidney | Renal/Genitourinary | 753 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Cystic Kidney Disease, Polycystic Kidney Disease/sponge Kidney | Renal/Genitourinary | 753.1 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Cystic Fibrosis (CF) | Respiratory | 277 | 0 | 1 | 0 |
|  |  |  |  |  |  |  |
| SIGNIFICANT ONGOING | Hearing disorders and other ear disorders NEC | Respiratory | 388 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Other diseases of the upper respiratory | Respiratory | 478 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Paralysis, Vocal Cord/Larynx | Respiratory | 478.3 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Asthma Without Status Asthmaticus | Respiratory | 493.9 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Bronchiectasis | Respiratory | 494 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Obstruction, chronic airway NEC | Respiratory | 496 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Other diseases of lower respiratory | Respiratory | 509 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Pleural Effusion | Respiratory | 511.9 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Dental and orthodontia disorders | Respiratory | 520 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Salivary gland disease | Respiratory | 527 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Choanal Atresia | Respiratory | 748 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Agenesis/Hypoplasia Of Lung, Pulmonary Aplasia, Sequestration Of Lung | Respiratory | 748.5 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Bronchopulmonary Dysplasia (BPD) | Respiratory | 770.7 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Obstructive Sleep Apnea (OSA) | Respiratory | 780.57 | 1 | 0 | 0 |
| SIGNIFICANT ONGOING | Respiratory Failure/Arrest | Respiratory | 799.1 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Respirator Depend Status | Respiratory | V46.11 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Systemic Lupus Erythematosus (SLE) and other forms of lupus erythematosus | Rheumatologic | 710 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Juvenile Rheumatoid Arthritis (JRA), Stills Disease | Rheumatologic | 714.3 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Disease of lymphatics | Symptoms | 457 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Complication of intestine transplant including rejection or graft failure | Transplant | 996.87 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | H/O Organ/Tissue Replaced by Transplant NEC V | Transplant | V42 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | H/O Kidney Transplant V | Transplant | V42.0 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | H/O Liver Transplant V | Transplant | V42.7 | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | H/O Bone Marrow Transplant (BMT) V | Transplant | V42.8A | 0 | 1 | 0 |
| SIGNIFICANT ONGOING | Acq Absence Of Organ Nec | Ungroupable | V45.79 | 0 | 0 | 1 |
| SIGNIFICANT ONGOING | Screen-sickle cell dis | Ungroupable | V78.2 | 0 | 1 | 0 |
| ACTIVE  | Hypertension NEC | Cardiovascular | 401.3 | 1 | 0 | 0 |
| ACTIVE  | Pulmonary Hypertension, Secondary or Unspecified | Cardiovascular | 416.8A | 0 | 1 | 0 |
| ACTIVE  | Aneurysm, Artery/Ventricle/Other | Cardiovascular | 442 | 1 | 0 | 0 |
| ACTIVE  | Ventricular Septal Defect (VSD) | Cardiovascular | 745.4 | 1 | 0 | 0 |
| ACTIVE  | Atrial Septal Defect (ASD) | Cardiovascular | 745.5 | 1 | 0 | 0 |
| ACTIVE  | Heart Anomalies, Other Congenital NEC, Congenital Heart Disease NEC (CHD) , Cor Triatriatum/Ectopia Cordis | Cardiovascular | 746 | 0 | 1 | 0 |
| ACTIVE  | Mitral Valve Stenosis | Cardiovascular | 746.5 | 0 | 1 | 0 |
| ACTIVE  | Pulmonary Hypertension, Secondary or Unspecified | Cardiovascular | 416.8A | 0 | 1 | 0 |
| ACTIVE  | Parathyroid Disorders | Endocrine | 252 | 1 | 0 | 0 |
| ACTIVE  | Depend-Supplement Oxygen | Factors influencing health | V46.2 | 0 | 1 | 0 |
| ACTIVE  | Aplastic and Sideroblastic Anemia | Hematologic | 284 | 0 | 1 | 0 |
| ACTIVE  | Infection Associated w/ Central Venous Catheter (CVL or CVC) (includes CLABSI and CLAMBI) | Infectious | 999.31 | 0 | 1 | 0 |
| ACTIVE  | Lipoid Metabolism Disorders | Metabolic | 272 | 0 | 1 | 0 |
| ACTIVE  | Obesity nos | Metabolic | 278 | 1 | 0 | 0 |
| ACTIVE  | Morbid obesity | Metabolic | 278.01 | 1 | 0 | 0 |
| ACTIVE  | Chronic Renal Failure, Uremia/end-stage Renal Disease (ESRD) | Renal/Genitourinary | 585 | 0 | 1 | 0 |
| ACTIVE  | Cleft Lip / Cleft Palate / Cleft Uvula | Respiratory | 749 | 1 | 0 | 0 |
| ACTIVE  | Obstructive Sleep Apnea (OSA) | Respiratory | 780.57 | 1 | 0 | 0 |
| ACTIVE  | Acute Chest Syndrome, Also Code With Sickle Cell | Respiratory | 517.3 | 0 | 1 | 0 |
| ACTIVE  | Tracheostomy Complication | Respiratory | 519 | 0 | 1 | 0 |
| ACTIVE  | Larynx/Subglottic/Trachea/Bronchus/Airway Anomalies, includes Stenosis, Web, Atresia, Cleft, Cyst, Malacia | Respiratory | 748.3 | 0 | 1 | 0 |
| ACTIVE  | Complication of kidney transplant including rejection, infection, or graft failure | Transplant | 996.81 | 0 | 1 | 0 |
| ACTIVE  | Compl marrow transplant includes VOD, GVHD | Transplant | 996.85 | 0 | 1 | 0 |
| ACTIVE  | Respirator Depend Status | Ungroupable | V46.11 | 0 | 1 | 0 |

Diagnoses were categorized as complex chronic condition (CCC), non-complex chronic condition (NCCC), and non-chronic based on a previously published algorithm by Edwards et al that was augmented to include diagnoses reflective of pre-existing technology dependence and pre-existing CCCs (4, 5).



|  |  |
| --- | --- |
| **Center** | **Number of admissions meeting inclusion criteria, n (%)** |
| **2017****(N=2079)** | **2018****(N=2092)** | **2019****(N=2462)** | **2020** **(N=1327)** |
| 1 | 469 (23) | 514 (25) | 546 (22) | 254 (19) |
| 2 | 337 (16) | 375 (18) | 345 (14) | 195 (15) |
| 3 | 481 (23) | 474 (23) | 496 (20) | 222 (17) |
| 4 | 332 (16) | 293 (14) | 350 (14) | 237 (18) |
| 5a | 327 (16) | 334 (16) | 620 (25) | 363 (27) |
| 6 | 133 (6) | 102 (5) | 105 (4) | 56 (4) |

**Supplemental Figure 1. Admission cohort and distribution of admissions by center. a**PICU size increased in 2018.

**Supplemental Table 6. Patient, admission and hospitalization characteristics based on data extraction from the electronic health record (n=1 site) versus data extraction from the Virtual Pediatric Systems (VPS) database (n=5 sites).**

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristic** | **Data extracted from electronic health record** **(n=1 site, n=1252 admissions)** | **5 sites with data extracted from VPS** **(n=5 sites, n=6708 admissions)** | **p value** |
| **Patient and Admission Characteristics** |
| Age (years), mean + SD | 7.04±6.34 | 7.36±6.59 | .11 |
| Female sex, n (%) | 565 (45.1) | 3066 (45.7) | .73 |
| Elective Admission, n (%) | 305 (24.4) | 1218 (18.2) | <.001 |
| Primary Diagnosis, n (%) |  |  |  <.001 |
| Respiratory | 267 (21.3) | 2503 (37.3) |
| Neurologic | 103 (8.2) | 934 (13.9) |
| Infectious | 119 (9.5) | 571 (8.5) |
| Injury | 34 (2.7) | 467 (7.0) |
| Oncologic | 20 (1.6) | 354 (5.3) |
| Poisoning/Adverse Effects | 84 (6.7) | 298 (4.4) |
| Cardiovascular | 71 (5.7) | 246 (3.7) |
| Endocrine | 22 (1.8) | 278 (4.1) |
| Other | 254 (20.3) | 873 (13.0) |
| Undetermined | 278 (22.2) | 184 (2.7) |
| **Hospitalization Characteristics** |  |  |  |
| Non-invasive ventilation, n (%) | 290 (23.2) | 1924 (28.7) | <.001 |
| Complicated PICU staya, n (%) | 354 (28.3) | 1804 (26.9) | .33 |
|  CRRT, n (%) | 37 (3.0) | 72 (1.1) | <.001 |
|  ECMO, n (%) | 6 (0.5) | 52 (0.8) | .34 |
|  Invasive mechanical ventilation, n (%) | 342 (27.3) | 1787 (26.6) | .64 |
| Duration of PICU stay (days), median (IQR) | 2.42 (1.12, 5.79) | 1.71 (0.93, 3.61) | <.001 |
| Duration of hospital stay (days), median (IQR) | 5.21 (2.79, 10.92) | 4.88 (2.63, 11.04) | .27 |
| Mortality, n (%) | 25 (2.0) | 184 (2.7) | .16 |

Percentages may not sum to 100 due to rounding.

aComplicated Pediatric Intensive Care Unit (PICU) stay includes receipt of any of the following: continuous renal replacement therapy (CRRT), extra-corporeal membrane oxygenation (ECMO), or invasive mechanical ventilation. SD: standard deviation.

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**Supplemental Figure 2. Univariate models of patient and admission factors associated with admission during 3/15/20-5/14/20 versus the same time period during the baseline period (2017-2019).** aOdds ratios for continuous variables are per standard deviation (age=6.6 years, pediatric risk of mortality [PRISM] III score = 5.5 points, pediatric index of mortality risk of mortality [PIM ROM] score = 9.1 points). bVariable available from 5 centers (n=6,708 admissions). Remainder from 6 centers (n=7,960 admissions). cReference: White, non-Hispanic (largest group). dReference: no chronic conditions. eReference: Emergency Department/Direct admit. fReference: any other diagnosis. PMCA: pediatric medical complexity algorithm; CCC: complex chronic condition; NCCC: non-complex chronic condition; ICU: intensive care unit.

**Supplemental Table 7. Hospitalization characteristics based on year of admission.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Characteristic** | **2017** **(n=2079)** | **2018 (n=2092)** | **2019 (n=2462)** | **2020 (n=1327)** |
| Non-invasive ventilation, n (%) | 536 (25.8) | 609 (29.1) | 748 (30.4) | 321 (24.2) |
| Complicated PICU staya, n (%) | 600 (28.9) | 541 (25.9) | 641 (26.0) | 376 (28.3) |
|  Invasive mechanical ventilation | 592 (28.5) | 533 (25.5) | 637 (25.9) | 367 (27.7) |
|  CRRT | 28 (1.3) | 33 (1.6) | 23 (0.9) | 25 (1.9) |
|  ECMO | 21 (1.0) | 20 (1.0) | 11 (0.4) | 6 (0.5) |
| Days of invasive mechanical ventilation, median (IQR)b | 0 (0, 0.35) | 0 (0, 0.07) | 0 (0, 0.02) | 0 (0, 0.2) |
| Duration of PICU stay (days), median (IQR) | 1.79 (0.92, 3.9) | 1.89 (1, 3.9) | 1.80 (0.96, 3.9) | 1.72 (0.93, 3.83) |
| Duration of hospital stay (days), median (IQR) | 5.17 (2.72, 12.09) | 5.10 (2.71, 11.26) | 4.68 (2.57, 10.07) | 4.88 (2.61, 11.18) |
| Mortality, n (%) | 56 (2.7) | 60 (2.9) | 53 (2.2) | 40 (3.0) |

aComplicated Pediatric Intensive Care Unit (PICU) stay includes receipt of any of the following: continuous renal replacement therapy (CRRT), extra-corporeal membrane oxygenation (ECMO), or invasive mechanical ventilation. bData element available from 5 sites (n=6,708 admissions). Number of patients with data available: n=1,742 (2017), n=1,717 (2018), n=2,117 (2019), n=1,132 (2020). IQR: interquartile range.

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