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Adults with childhood-onset chronic conditions admitted to U.S. pediatric and adult intensive care units

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Abstract

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Purpose—To compare demographics, intensive care units (ICU) admission characteristics, and ICU outcomes among adults with childhood-onset chronic conditions (COCC) admitted to U.S. pediatric and adult ICUs.

Materials and Methods—Retrospective cross-sectional analyses of 6,088 adults aged 19–40 years admitted in 2008 to 70 pediatric ICUs that participated in the Virtual Pediatric Intensive Care Unit Performance Systems and 50 adult ICUs that participated in Project IMPACT.

Results—COCC were present in 53% of young adults admitted to pediatric units, compared to 9% of those in adult units. The most common COCC in both groups were congenital cardiac abnormalities, cerebral palsy, and chromosomal abnormalities. Adults with COCC admitted to pediatric units were significantly more likely to be younger, have lower functional status, and be non-trauma patients than those in adult units. The median ICU length-of-stay was 2 days and the intensive care unit mortality rate was 5% for all COCC patients with no statistical difference between pediatric or adult units.

Conclusions—There are marked differences in characteristics between young adults with COCC admitted to PICUs and adult ICUs. Barriers to accommodating these young adults may be reasons why many such adults have not transitioned from pediatric to adult critical care.

Keywords

Critical Care; Intensive Care Units; Young Adult; Chronic Disease

Introduction

With improvements in medical treatments, growing numbers of persons with childhood-onset chronic conditions (COCC), such as congenital heart disease, cystic fibrosis, and cerebral palsy, are surviving into adulthood [1–4]. Consequently, there is an expanding population of adults with COCCs who require specialized acute and critical care. For a number of reasons, pediatric institutions may no longer be the most appropriate place to care for these adults. Pediatric and adult medicine stakeholders internationally have highlighted the importance of transitioning these patients from child- to adult-oriented healthcare [5–8]. Nevertheless, many adults with COCCs continue to receive emergency, inpatient, and critical care from pediatric hospitals [9–13].

While adults with COCCs admitted to U.S. pediatric and adult inpatient services have been studied [9], few studies have focused on those admitted to intensive care units (ICU). Little is known of the COCC prevalence, patient characteristics, or clinical outcomes of those who utilize pediatric ICUs (PICU) as compared to adult ICUs. To prepare for the anticipated increase in the number of critically ill adults with COCCs, additional understanding of those who receive care in ICUs and of their critical care needs is an important first step.

In order to address these knowledge gaps, we conducted a retrospective multi-institutional study of young adults admitted to U.S. PICUs and adult ICUs. Our primary objective was to compare demographics, ICU admission characteristics, reasons for ICU-level care (e.g., emergency versus peri-operative care), and ICU outcomes among adults admitted to pediatric and adult ICUs with a focus on those with COCCs. This information will help

providers and hospitals monitor trends in care delivery and develop transition strategies for adults with COCCs.

Material and Methods

Data Sources and Hospitals

We performed cross-sectional analyses of young adult patients who were admitted to ICUs in 2008 using two datasets; one from a pediatric ICU database, another from an adult ICU database. The Virtual Pediatric Intensive Care Unit Performance Systems (VPS, LLC, Los Angeles, CA) provided data from 70 PICUs (includes cardiac units) in 69 hospitals in 32 states. Project IMPACT (PI, Cerner Corporation, Kansas City, MO) provided data from 50 adult ICUs in 27 hospitals in 18 states. Both databases are voluntary, fee-based, clinical information databases that have been described in detail elsewhere [14–15]. Participating unit types include medical/surgical and cardiac in VPS and medical/surgical, cardiac, trauma, and neurologic in PI. VPS sites submitted mandatory and voluntary data on all consecutive admissions. PI sites could submit mandatory and voluntary data on all consecutive admissions or, alternatively, a 50% or 75% random sample. The most recent sample available from PI was 2008.

To describe the sites, we reported the number of ICU beds at participating hospitals and the proportion affiliated with medical schools, pediatric residencies, pediatric critical care fellowship programs, internal medicine residencies, and adult pulmonary/critical care fellowship programs.

Patients and Analyses

We included non-obstetric admissions of adult patients aged 19–40. Age 40 was selected as the upper limit for inclusion because approximately 95% of adults admitted to PICUs were 40 years or younger. In addition, patients over age 40 are often hospitalized for “adult-acquired” conditions, such as myocardial infarction. To compare basic demographics (age and gender) and major reasons for admission (scheduled ICU admission [yes/no], peri-operative [yes/no], and trauma [yes/no]) between admissions of all young adults to the two types of ICUs, we used two-tailed Fisher’s exact and Kruskal-Wallis rank tests.

To describe the prevalence of COCCs among young adults admitted to ICUs, we identified patients with a COCC using diagnoses codes provided by the databases (VPS codes for VPS and International Classification of Diseases 9 codes for PI). We defined COCCs as conditions that normally are first diagnosed before age 19, require inpatient services for acute exacerbations, and are currently treatable well into adulthood. COCC were ascertained among diagnosis codes by three of the authors with pediatric expertise (JDE, AJH, MJO); two-thirds agreement was used to mediate any discrepancies on what diagnoses were COCCs. Because disease-specific variations in utilization may exist between pediatric and adult healthcare settings, we performed subgroup analyses of seven specific conditions/diagnostic categories: cerebral palsy, chromosomal/genetic abnormalities, congenital cardiac abnormalities, cystic fibrosis, congenital muscular dystrophies, sickle cell anemia, and spina bifida. These conditions represent a range of disease prevalence and medical and surgical

management. An eighth subgroup that combined all other COCCs was also analyzed. Examples include congenital immunodeficiencies, congenital cerebral abnormalities, early-onset neuromuscular disorders, and autism. Admissions from sites that did not submit secondary diagnoses were excluded, as this precluded identification of COCCs. Chronic conditions that have a reasonable probability of diagnosis in either childhood or adulthood (e.g., asthma, diabetes mellitus type 1, epilepsy, malignancies) were not considered COCCs, as we could not confirm that they started in childhood in our cohort.

The overall proportion of patients with a COCC among all young adults admitted to PICUs versus adult ICUs was compared using Fisher's exact test. We then analyzed the prevalence and variability of prevalence of any COCC and specific COCCs among non-trauma patients by type of ICU, by reporting their aggregate mean proportions with 95% confidence intervals (CI) and median proportions with interquartile ranges (IQR) by hospital. We focused on non-trauma patients to analyze admissions where patients presumably could have "chosen" where to receive their ICU care.

Next, we reported patient demographics and clinical characteristics of admissions of patients with COCCs. Demographics included gender, age, and race. For baseline functional status of PICU patients, VPS used Pediatric Overall Performance Categories (POPC) [16]. POPCs range from 1 (normal function) to 6 (brain death). Scores of 2, 3, and 4 indicate mild, moderate, and severe disability, respectively; 5 indicates coma or vegetative state. For adult ICU patients, PI categorized baseline functional status as independent, partially dependent, or fully dependent on others for activities of daily living. Clinical characteristics included admission type (scheduled ICU admission, peri-operative, trauma), patient origin, and previous ICU admission during the same hospitalization (yes/no). Severity of illness was assessed using different risk-adjustments systems to estimate probability of mortality. For PICU patients, Paediatric Index of Mortality 2 was used to estimate predicted ICU mortality [17]. For adult ICU patients, the Mortality Probability Model (MPM0-III) was used to estimate predicted hospital mortality [18]. These characteristics and variables were reported as aggregate proportions with 95% CIs, medians with IQRs, or means with standard deviations. When possible, bivariate comparisons of admissions of patients with COCCs admitted to PICUs versus adult ICUs across these variables were performed, using design-based Pearson χ^2 and Kruskal-Wallis rank tests.

In order to provide greater detail on why non-trauma COCC patients were admitted to the different ICUs, we reported the five most common admitting diagnoses of medical admissions and the five most common surgical procedures of peri-operative admissions in patients with cerebral palsy and congenital cardiac abnormalities. These two COCCs were chosen as they were the most prevalent. According to data entry guidelines for both databases, the first diagnosis was the admitting ICU diagnosis.

Finally, we examined clinical outcomes, including length of ICU stay (LOS), ICU disposition location, and ICU mortality of patients with COCCs, as mean proportions with 95% CIs or medians with IQRs. Outcomes between PICUs and adult ICUs were compared using design-based Pearson χ^2 and Kruskal-Wallis rank tests. We also reported the ICU LOS and mortality by specific COCC.

To account for the differential sampling by PI units, observations were weighted by 1 for 100% sampling, 1.33 for 75% sampling, and 2 for 50% sampling, with the ICU being the primary sampling unit. Statistical significance was determined using a P value of $<.05$. Stata version 12 (StataCorp LP, College Station, Texas) and the `svy` command to account for sampling design were used for statistical analyses. When information was available for only a subgroup of the admissions, we noted this in the text or tables. Because all data are deidentified, this study qualified for exemption status by the University of California, San Francisco Committee on Human Research.

Results

Hospital characteristics are shown in Table 1. Participating VPS hospitals had seemingly less number of ICU beds. VPS and PI sites had similar proportions with pediatric and medicine residencies (77% and 74% respectively), though VPS sites were more often affiliated with a medical school and had critical care fellowship program. Twenty PI units submitted 50% random samples; nine PI units submitted 75% random samples.

After excluding observations without secondary diagnoses or with obstetrical diagnoses, our study cohort comprised 1,749 admissions of young adults from 68 PICUs and 4,339 from 50 adult ICUs (Figure 1). Comparing all patients aged 19–40 admitted to PICUs versus adult ICUs, PICU patients were significantly younger than adult ICU patients (PICU median age 20 years [IQR 20–23] versus adult ICU 30 years [IQR 24–36], $P=0.0001$). While median ages between the two cohorts were quite different, patients of all ages (19–40) were represented in both, and the characteristics of “older” and “younger” patients within their respective cohorts were similar. PICUs admitted significantly smaller proportions of male (52% v. 61%), unscheduled (64% v. 88%), non-operative (55% v. 70%), and trauma patients (3% v. 25%), compared to adult ICUs (all $P<0.001$).

Among young adults admitted to ICUs, those with COCCs comprised 53% of PICU admissions, compared to 9% of adult ICU admissions ($P<0.001$). Among non-trauma admissions, there was considerably higher prevalence of COCCs in patients to PICUs compared to adult ICUs (Table 2). The median proportion of non-trauma, critically ill young adults with COCCs admitted to PICUs was 51% (IQR 37–67%); the median proportion admitted to adult ICUs was 10% (IQR 6–13%). Almost all COCCs were more prevalent in PICU patients than adult ICU patients. Patient demographics and clinical characteristics of these COCC admissions are presented in Table 3. PICUs admitted a significantly smaller proportion of COCC patients for trauma (1% v. 5% in adult ICUs, $P=0.002$) and from other ICUs (3% v. 7%, $P=0.001$). PICUs had greater proportions of scheduled (43% v. 28% in adult ICUs) and peri-operative (51% v. 44% in adult ICUs) COCC patients, but these differences were not statistically significant. PICU patients with COCC had significantly lower proportions of previous ICU admissions during the same hospitalization (9% v. 13% in adult ICUs, $P=0.04$). While the databases used different functionality measures and they were available for only a third of the PICU cohort, 25% of PICU patients with a COCC had normal baseline functionality, compared to 75% of those in adult ICUs.

The common admitting diagnoses of medical patients and surgical procedures in peri-operative patients are presented in online Table E1. The admitting diagnoses of medical patients with cerebral palsy in PICUs and adult ICUs were similar. However, while neurosurgical procedures were relatively prevalent in both groups, the surgical procedures of patients with cerebral palsy were not as similar between PICUs and adult ICUs. For patients with congenital heart disease, the admitting medical diagnoses seemed to differ between the two types of units. PICUs appeared to be utilized for more cardiac specific issues (eg, arrhythmia, heart failure) while adult ICUs appear to admit for general illnesses (eg, sepsis, embolism). The surgical procedures of peri-operative patients with congenital heart disease in PICUs and adult ICUs were relatively similar. However, the overall numbers are small in both diagnosis categories.

The disposition and outcomes of COCC patients are presented in Table 4. There was no statistical difference between pediatric and adult ICUs in the proportion of COCC patients discharged to wards, intermediate units, or chronic facilities. However, PICUs discharged a significantly greater proportion of COCC patients directly home (17%) and smaller proportions to other ICUs (1%), compared to adult ICUs (10% and 5%, respectively, both $P<0.05$). For both types of ICUs, the median LOS was about 2 days and the mortality rate was about 5%, with no statistical difference in these outcomes comparing patients with COCCs admitted to different units. There was no statistical difference in the ICU LOS and mortality between patients with specific COCC admitted to pediatric and adult ICUs (online Table E2).

Discussion

Our retrospective cross-sectional analyses of U.S. PICU and adult ICU databases examined the critical care utilization of adults with COCCs and compared admissions between these two types of ICUs. These PICUs and adult ICUs admitted different distributions of young adults with COCCs and for different reasons. Adults with COCCs admitted to PICUs were significantly more likely to be younger and less likely to be trauma patients than those in adult ICUs. Those admitted to PICUs seemed to have had worse baseline functionality compared to those admitted to adult ICUs. More than 40% of adults with COCC admitted to PICUs had scheduled admissions, compared to less than 30% of those in adult ICUs. At the same time, it is notable that the majority of PICU admissions for adults with COCCs were unscheduled. Thus, many of these younger adults were also using PICUs for their acute care needs. The disproportionate use of PICUs by adults with COCC, many of whom have impaired functionality, likely reflects how PICUs continue to care for the more complex patients with COCCs into adulthood and may be further evidence of a failure to transition them to adult-oriented care.

Like other care settings, the continued use of PICUs by these complex adults may be due to lack of COCC specific knowledge by adult institutions, differences in COCC accommodating resources (e.g. child life services, accommodation of parents during hospitalization), patients'/families' preexisting relationships with pediatric providers and facilities, patient/family/pediatrician choice, and lack of planning by both patients and providers [19]. In addition, pediatric facilities may be unenthusiastic about losing adult

patients who feed into financially-positive programs (eg, procedure-focused or surgical programs). The relative small number of other young adults with COCC in adult ICUs indicates that adult intensivists are not gaining substantial exposure or experience caring for this growing group of patients. The lack of adult-oriented providers with adequate training, experience, and willingness to care for COCCs is another obstacle to transitioning these patients that needs to be addressed [20–22].

Given that most children born with chronic conditions are expected to survive into adulthood [23], the number of adults with COCCs will undoubtedly continue to increase. Many of these adults will continue to utilize PICUs for their acute and peri-operative needs in the near future. Nevertheless, efforts to transition these adults to adult-oriented care will and should continue. As they age, these adults will ultimately become susceptible to diseases of advanced age. These factors will result in an increasing demand for and impact on critical care and other inpatient services in pediatric and, eventually, adult facilities. However, the notable differences in the type of young adults admitted to PICUs and adult ICUs and in their reasons for admission leads to three questions: 1) whether adult ICUs presently have the expertise and resources required to care for the more complex adults with COCCs?; 2) whether PICUs presently have the expertise and resources to care for adults with COCCs as they age and develop age-related diseases?; and 3) whether pediatric and adult intensivists have an integrated system in place that facilitates collaboration?.

Beyond addressing the transition readiness of patient, family, and medical home providers [6], the potential disparities in critical care expertise and resources need to be addressed to ensure the best possible critical care of adults with COCCs. Divisions of knowledge and labor, where pediatric intensivists know COCC-related management and adult intensivists know age-related illnesses management, may not be sustainable or optimal for critically ill adults with COCCs. Pediatric and adult intensivists should work towards a care structure that encourages collaboration and mutual education/training. Adult ICUs will need to adapt to caring for adult patients with substantial COCC-related needs. This includes being mindful that these patients and their families are accustomed to a different healthcare culture [24]. PICUs will need to adapt to care for older adults with more age-related illnesses, at least in the foreseeable future. These efforts would potentially facilitate the transitioning of youths with COCCs to adult-oriented care, by giving patients, families, and providers greater confidence that COCC-related issues can be addressed in adult ICUs. Encouragingly, we found similarities in the admitting diagnoses of medical patients with cerebral palsy admitted to PICUs and adult ICUs. Likewise, we found similarities in the surgical procedures for patients with congenital heart disease admitted to the two unit types. These findings may also help ease concerns of transitioning care of adults with COCC to adult healthcare settings.

Our study has a number of limitations. First, our data is from 2008, which may not reflect the current status of critical care of adults with COCCs. However, 2008 is the most recent year of data available from PI, and there is evidence that there continues to be a pressing need to better transition youth with special health care needs to adult care in the U.S. [25]. Second, this is a one-year cross-sectional study; thus, we are unable to comment on trends of the use of critical care services by adults with COCC. Third, the ICU databases used are

voluntary and may not be nationally representative, so we could not extrapolate our data to the general U.S. ICU population. This may have introduced selection bias into our samples. Despite this limitation, these are some of the most comprehensive datasets available for ICU admissions nationally. Fourth, we were unable to risk adjust our mortality and LOS comparisons because VPS and PI used different risk-adjustment strategies, which are not interchangeable and are used for adjusting for different outcomes (ICU v. hospital mortality). We also could not control for patients who had advance directives, as this information was not available in VPS. It is important to note that the place of death and the use/availability of non-ICU end-of-life resources, such as hospice, vary between pediatric and adult settings in the U.S. [26–27]. Similarly, comparisons of ICU mortality and LOS outcomes are likely confounded by differences in acceptance/discharge practices and other processes of care [28]. Thus, we are unable to conclude if our demonstrating no statistical difference in unadjusted ICU mortality or LOS between PICUs and adult ICUs for COCC adults in general or with specific COCCs means that these unit types perform equally well in these clinical outcomes. Furthermore, other important measures of ICU performance, such as patient/family satisfaction, were not measured and could not be analyzed.

Conclusions

Many young adults with COCCs continue to utilize PICUs for their critical care needs. Medical societies advocate for the uninterrupted transition of these young adult patients out of pediatric to adult-focused services [5–8]. To ensure the adult health care system can meet their care needs, pediatric and adult intensivists will need to collaborate in training, research, and clinical care and participate in efforts to safely and effectively transition them. An example of a potential area of research is creating or combining PICU and adult ICU patient registries to follow these patients and compare interchangeable process and outcome measures. In addition, studies to better understand why patients go to one ICU type over another and what are their clinical outcomes will also help elucidate the medical expertise and particular accommodations required to ensure high quality ICU care to this complex, aging population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Flow chart of included and excluded ICU admissions

Table 1

Hospital characteristics

Characteristic	Pediatric hospitals n=69 (100%)	Adult hospitals n=27 (100%)
Number of ICU beds		
10	14 (20)	0
11–20	30 (43)	9 (33)
21–31	17 (25)	9 (33)
32	8 (12)	9 (33)
Medical school affiliation	42 (61)	11 (41)
Affiliated pediatric residency program	53 (77)	13 (48)
Affiliated PCCM fellowship program	28 (41)	2 (7)
Affiliated internal medicine residency program	—	20 (74)
Affiliated Pulmonary/CCM fellowship program	—	7 (26)

CCM, critical care medicine; ICU, intensive care unit; PCCM, pediatric critical care medicine; “—” unknown

Table 2

Prevalence and variability of specific chronic conditions among non-trauma patients aged 19–40 by ICU type

Condition ^a	Mean Proportion % (95% CI)		Median Proportion by hospital median % (IQR)	
	Pediatric ICU patients n=1,702	Adult ICU patients n=3,234	Pediatric ICU patients	Adult ICU patients
Any COCC	53.3 (51–55.7)	11.4 (8.1–15.9)	50.8 (37.1–67.1)	10.3 (5.8–13.3)
Cardiac abnormality, congenital	14.2 (12.6–15.9)	2.3 (1–5.5)	5.7 (0–26.5)	0.5 (0–1.3)
Cerebral palsy	8.7 (7.4–10.1)	1.3 (0.9–2)	5.3 (0–14.6)	0.9 (0–1.5)
Chromosomal/genetic abnormality	7.9 (6.7–9.3)	1.1 (0.7–1.9)	3.7 (0–8.9)	0.5 (0–1.2)
Cystic fibrosis	1.9 (1.3–2.6)	0.8 (0.2–2.4)	0 (0–0)	0 (0–0.5)
Muscular dystrophies	3.2 (2.5–4.2)	0.4 (0.2–0.7)	0 (0–4.7)	0 (0–0.6)
Sickle cell anemia	1.8 (1.3–2.6)	0.6 (0.4–1)	0 (0–1.6)	0 (0–0.9)
Spina bifida	3 (2.3–3.9)	0.6 (0.3–1)	0 (0–3)	0 (0–1.2)
Other childhood conditions	25 (23–27.1)	5.8 (4.3–7.7)	18.9 (0–30.9)	5.3 (2.6–8.3)

CI, confidence interval; COCC childhood-onset chronic condition; ICU, intensive care unit; IQR, interquartile range

^a Each condition category is not mutually exclusive

Table 3

Demographic and clinical admission characteristics of adults aged 19–40 with COCC by ICU type

Characteristic, % admissions (95% CI)	Pediatric ICU patients n=921	Adult ICU patients n=389
Male	52.1 (48.1–56.1)	53.2 (46.3–59.8)
Age, median, years (IQR) [†]	21 (20–24)	30 (24–36)
Race ^a		
Caucasian	73.9 (70.4–77.1)	75.8 (65–84)
African American	13.4 (11–16.1)	18.5 (11.5–28.5)
Hispanic	7.7 (5.9–10)	3.6 (1.8–7)
Asian/Native American/other [*]	5 (3.6–7)	1.6 (0.7–4)
Not reported	–	0.5 (0.1–3.9)
Functionality, baseline ^b		
No disability	25.3 (20.7–30.6)	–
Mild disability	13.9 (10.3–18.3)	–
Moderate disability	29.7 (24.8–35.2)	–
Severe disability	29.1 (24.1–34.5)	–
Coma/Vegetative state	2 (0.1–4.5)	–
Not dependent	–	75.1 (62.8–84.3)
Partially dependent	–	11.7 (6.8–19.3)
Fully dependent	–	13.2 (7.7–21.8)
Admission type		
Scheduled	42.5 (39.3–45.7)	27.7 (16–43.5)
Peri-operative	50.9 (47.7–54.1)	44 (25.4–64.4)
Trauma [*]	1.4 (0.8–2.4)	5.1 (2.7–9.7)
Origin		
Emergency department	25.2 (22.5–28.1)	33.2 (21.2–47.8)
OR/Procedure suite	48.3 (45.1–51.6)	37.7 (19.3–60.5)
General ward	17.6 (15.3–20.2)	15.5 (9.5–24.2)
Another ICU [†]	2.5 (1.7–3.7)	7.4 (4.5–12.2)
Intermediate unit	2 (1.2–3.1)	2.6 (1.3–5.3)
Chronic/Rehab facility	0.9 (0.4–1.7)	0.5 (0.1–2.4)
Outpatient/Home	3.5 (2.5–4.9)	2.5 (1.3–4.7)
Other	0.1 (0–0.8)	0.5 (0.1–2.6)
Previous ICU admission ^{c*}	9 (7.1–11.4)	13.2 (9.7–17.7)
Probability of mortality, mean % (SD)		
ICU mortality / PIM2	3.2 (8.4)	–
Hospital mortality / MPM0-III ^d	–	5.8 (11)

CI, confidence interval; COCC, childhood-onset chronic condition; ICU, intensive care unit; IQR, interquartile range; MPM, Mortality Probability Model; PIM, Paediatric Index of Mortality; POPC, Pediatric Overall Performance Category; SD, standard deviation; “–”, not applicable

^{*} P < 0.05;

[†]P < 0.001 by design-based Pearson χ^2 test or Kruskal-Wallis rank test comparing COCC patients admitted to pediatric and adult ICUs

^aFor PICU admissions, race was reported for 674 (73%) admissions from 46 units.

^bFor PICU admissions, POPC was reported for 296 (32%) admissions from 21 units.

^cPrevious ICU admission during same hospitalization. For PICU admissions, this variable was reported for 700 (76%) admissions from 59 units.

^dFor adult ICU admissions, MPM0-III scores were reported for 283 (73%) admissions from 50 units.

Table 4

Outcomes of admissions of COCC adults aged 19–40 by ICU type

Characteristic, % admissions (95% CI)	Pediatric ICU patients n=921	Adult ICU patients n=389
Length of stay, median, days (IQR)	2 (1–4.5)	2.1 (1.1–4.4)
Disposition		
General ward	58.2 (55–61.4)	59.5 (52–66.6)
Intermediate unit	15.7 (13.5–18.2)	11.8 (8.1–17)
Another ICU [*]	1.4 (0.8–2.4)	4.6 (2.8–7.5)
OR [*]	0.1 (0–0.8)	0.8 (0.2–3)
Home [*]	16.8 (14.5–19.4)	10.2 (6.7–15.2)
Chronic/Rehab facility	2.3 (1.5–3.5)	1.6 (0.6–4.2)
Other [†]	0.5 (0.2–1.3)	6 (3.4–10.4)
ICU Mortality	4.9 (3.7–6.5)	5.4 (3.4–8.5)

CI, confidence interval; COCC, childhood-onset chronic condition; ICU, intensive care unit; IQR, interquartile range; OR, operating room; SD, standard deviation

^{*} $P < 0.05$;

[†] $P < 0.001$ by design-based Pearson χ^2 test or Kruskal-Wallis rank test comparing COCC patients admitted to pediatric and adult ICUs