CHILDREN'S HOSPITAL ASSOCIATION

Champions for Children's Health

EXECUTIVE BRIEF

Children's Hospital Facilities: Health Care Infrastructure for Kids

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I. Purpose of this brief

While the United States is home to over 6,000 hospitals, only 2% of these facilities operates as larger acute care children's hospitals providing more specialized programs. While many hospitals provide some amount of pediatric care, children's hospitals are distinguished by their volume of specialized programming, support services, staff and facilities tailored specifically to serve children's unique needs Children's hospitals represent only a fraction of the nation's hospitals but serve as the safety net for the nearly 80 million children representing over 20% of the U.S. population. Most children's hospitals also serve as academic medical centers (AMCs), providing the nation's pediatric medical education and research. Children's hospitals and their primarily adult-focused AMC counterparts embrace similar missions, simply in different demographic segments. It is in serving this different population—the care of children—where the differences emerge in the facility, technology, operations, and staffing requirements of children's hospitals versus hospitals focused on the care of adults.

Over large numbers of AMC campus redevelopments in recent decades, it's common knowledge among professional planners that children's hospitals cost more to build and operate than hospitals primarily focused on adult care. For example, the total space required in a children's hospital is greater than primarily adult-focused academic hospitals serving comparable volumes. While such representations are widespread, they are not substantiated by any depth of published work informing this topic.

To begin addressing this knowledge gap in the children's hospital segment, six of the nation's most accomplished planners in academic medical center facility and campus redevelopment came together to share their experiences. Their mandate and the intent of this briefing is to expound on the premise that children's hospitals are different from hospitals designed primarily to care for adults and to characterize the major implications of these differences. Specifically:

1. What are the key areas of difference between children's and primarily adult-focused hospitals affecting facility planning and capital investment needs?
2. How do these differences affect facility and campus development costs?
3. What are the implications for health care executives, providers, policymakers, advocates, and planners in considering the costs, price and reimbursement of children's hospitals?

The study approach to these questions is experiential, informed by the career experience and information from the authors and their firms. Their perspectives are grounded in how facilities and campuses have been designed and constructed over the past several decades, with all the authors having professional field careers of 30 or more years. Author credentials are referenced at the end of this paper.

II. Findings: Why hospital facilities for children are different

The differences between children's hospitals and primarily adult-focused hospitals emerge along three functional characteristics, each informed by the requirements of children rather than those of adults. These unique characteristics and needs of children drive different hospital design and operating infrastructure along the following drivers:

- The unique role of the family in the care of their child.
- The unique clinical and social needs of children.
- The unique pediatric specialization of support and technology.

Unique Role of the Family in the Care of Their Child

While family plays an important role in health care for every individual, this role is magnified in the care of children and especially young children. Children are legally dependent, functionally less self-sufficient, and often cannot communicate as do adults. For children, this requires their family and guardians play a major role in every part of their care process. This is true across all aspects of the child's experience as a patient, ranging from transportation to and from care venues, legal representations such as consents, and all follow-ups such as medication, home care, and ongoing communication between the patient and care teams.

Beyond the logistics and legal stewardship, the practical and emotional needs of pediatric patients to have an ongoing physical presence of family requires more family-centered spaces across all patient care areas. Support for this physical presence requires family sleep rooms and associated amenities (e.g., laundry) on inpatient floors, significantly influencing the size and function of floor units. The more continuous and extended presence of family members plays a role in defining greater space requirements along the following dimensions:

- Increased space per patient. This includes sleep areas for parents and guests and secured storage for personal belongings in patient rooms and extended stay facilities situations, such as a Ronald McDonald House.
- More types and specialization of support space for families. This includes lounges, laundry, resource areas, sibling play, family respite spaces and waiting areas. Many of these spaces are in costly sectors in the hospital, such as surgical prep and recovery areas where family presence is essential.
- Higher volumes of visitors per patient—parents, siblings, relatives. This requires larger ambulatory care corridors and more traffic flow capacity for higher concentrations of visitors, strollers and wheelchairs. An example is emergency room services, where more space is required to accommodate the wider ranges of equipment necessary to serve the varying sizes of patients and provide room for more family members in each treatment bay.

Overall, more and different facility space is required for the care and socialization of children.

COVID-19 impact: The pandemic has stressed and increased the costs of the family role in the care of their child. Infection control has required more screening and testing capacity throughout the hospital, larger waiting areas, different retail configurations such as cafeteria space, with the newly created limitations reducing the numbers of parents and visitors who can participate in the care of their children. These limitations require facility reconfigurations and are especially important for the sickest children who have frequent and long stays in the hospital, where their families play essential roles in their care and healing processes. Essential spaces to provide for parent rooming-in and break/support areas must be reimagined and renovated, often at substantial costs. While providing space adaptability to accommodate changes quickly and with minor disruption to respond to an emergency such as a pandemic adds to initial costs, it is an investment in facility preparedness and responsiveness for the unpredictable but expected surges in demand for pediatric care.

Unique Clinical and Social Needs of Children

While pediatric and adult patients share many hospital infrastructure requirements, children have additional care needs in the clinical and social domains.

On the clinical domain, greater overall square footage is required to support the inpatient bed model in two major ways. The first is the greater diversification of how care units are organized based on patient ages within pediatrics. For example, units focused on medically fragile infants are different than units focused on toddlers or adolescents. The second has to do with the greater specialization of the care necessary to serve children effectively and safely:

- Greater diversity of care organization relates chiefly to bed unit organization in the hospital. While all hospitals have become more specialized by unit (e.g., disease-based units and distinct critical care domains), children's hospitals must additionally consider "age tiers" to recognize the widely varying needs and sizes of the pediatric demographic: infants, toddlers, adolescents, and teens. The combination of acuity, specialization and age sub-specializations result in greater numbers of distinct units, requiring more total beds for the same overall volume of service. Given the fluctuations of average daily bed census, these higher levels of unit specialization restrict the overall bed utilization possible in a children's hospital.

  With continued advances in technology, disease diagnoses and treatments, pediatric hospitals are increasingly providing more of the care for the growing proportion of adult-age patients with chronic and medically complex health challenges developed in childhood, such as cystic fibrosis. Adults challenged with such lifelong diseases of childhood are often not as well cared for in facilities serving primarily adult patients. In addition to these chronic-complex adults, there is a growing need to care directly for mothers with unborn children with health challenges requiring adult and fetal care. This addition of clinical care space for these specialized adult patients adds to the space challenges and demands.

- Greater specialization of care delivery is driven by engaging children in the care provision process. Diagnostic and treatment (D&T) services such as radiology require specialized programming. For example, it is not practical to expect a young child to remain calm and be still for confined procedures such as an MRI without sedation, a process requiring anesthesia support and resulting in a reduced turnover and utilization of high-cost equipment. In other treatments where an adult may need only a local anesthetic, a child may require general anesthesia, which is a much more complex care delivery process. Rehabilitative services such as physical therapy, occupational therapy, speech services, audiology booths and gait labs all require more space in a children's hospital than they do in an adult setting. For cancer programs, most children's hospitals locate their cancer outpatient clinics in the hospital to enable continuity of care, which is more expensive than operating offsite facilities. Unlike the large-scale oncology programs serving adults with cancers acquired over long lifetimes, pediatric cancer is rare and less cost effective to provide, being delivered in much lower volumes. The specialized pediatric staff and pharmacy are often the limiting resource and unavailable as a result in community settings, requiring care be provided in the more costly hospital setting.

  The higher space levels required for pediatric D&T often feels counterintuitive given children are smaller in size than adults. However, clinical programs for children require more space per adjusted caseload than adult programs for these reasons. For example, the operating suites may be of similar size, but the total processing space for children including pre- and post-op and waiting is greater.

On the social domain, children are in early and important developmental phases of their physical, social, emotional and intellectual growth. Younger children have not yet achieved independence outside their families and must be supported in the high-technology and often stressful environments of modern medicine. Older school-age children requiring longer hospital stays must additionally continue their ongoing socialization and educational progress. These developmental and social needs drive additional levels of specialization and programming in the children's hospital:

- More focus on managing high stress levels in patients and importantly, their parents, throughout the care process. Behaviorally, the youngest children cannot articulate their needs and have no context for sitting still or remaining calm. Children's hospitals are set up to anticipate the need to reduce stress and engage children, so their care is not only effective, but sometimes possible at all. This requires space, staff, and specialized programming. Procedure space is often located on the unit to reduce stressful transfers to other areas of the facility, maintaining the inpatient room as a safe area. Stress management programming is essential and includes a range of specialized initiatives overseen by Child Life, a discipline unique to children's hospitals. Such unique programming includes audio/video entertainment, engagement with the arts (e.g., music therapy), access to outdoor spaces and other forms of engagement addressing the emotional, spiritual, and educational needs of a child in a holistic manner. Stress reduction for parents and adults on extended stays with their children requires dedicated lounges providing space and respite from the constant demands of the care process.
- Broader requirements for schooling and socialization of young children, such as age-appropriate educational spaces and play spaces. For example, for hospital stays beyond a week or two, school-

age children will have educational assignments to catch up on, requiring educational programming, space and playrooms, including similar support for siblings also in residence.

These clinical and social differences between pediatric and adult inpatient care create significant additional space and costs for children's hospitals.

COVID-19 impact: The pandemic has stressed and increased the costs of the clinical and social environments adapted to the needs of children. Social distancing reduced or eliminated age-appropriate education and play spaces, with many of these facilities requiring reconfiguration. Additionally, there is a need for the technology and functionality to offer programming remotely, including connectivity to Child Life program areas such as TV studios, and appropriate areas to hold expanded programs through Zoom, all in service to preventing isolation of pediatric patients. While remote learning was shown to work equally well in a patient room, the need for children to socialize still required play and social spaces, and these remain topics of key exploration. Many pediatric hospitals experienced the need to increase the number of isolation treatment areas with positive or negative air pressure systems to keep patients safe, particularly the immunocompromised, such as patients with cancer and children with complex medical conditions.

Significantly, multiple-bedded inpatient spaces such as two-bedded floor rooms have been marginalized to the point of obsolescence as shared spaces fell short of the new needs for distancing and control. While the trend to single-bedded rooms has been ongoing for many years, the pandemic accelerated the necessity of rebuilding these spaces at substantial costs. Also, the number of children and teens in crisis presenting at the hospital has spiked during the pandemic, highlighting the need to provide and expand behavioral and mental health services and spaces. These have been missing or woefully inadequate in the ED and inpatient spaces, including the ICU, for pediatric patients of all ages.

Unique Pediatric Specialization of Support and Technology

While it is intuitive that children have special equipment, technology and support requirements, the extent of this customization and the cost impact are substantial and often less obvious. These higher costs are driven through three distinct dimensions of requirements, relating to the ranges of physical size of children, their different information requirements, and their transport needs:

- Higher-cost equipment, materials and drugs represent the first of these tailored requirements. Children vary greatly in their size and development over ages 0 to 18 years old. The range from fragile infants weighing 1 pound to adolescents weighing more than 200 pounds creates a significant variance compared to adults. This must be accommodated in wider inventory and higher purchasing costs relating to beds, apparel, support, drugs and equipment, ranging from gowns and syringes to durable medical equipment such as crutches. Radiology equipment, operating room equipment, and dietary and living support are adapted for this wide range of children. In the pharmacy, many medications are manufactured and packaged for adults, and pediatric hospitals must adapt these for

children's dosing and delivery through special orders or create them via custom compounding. This requires more fume hoods and larger compounding spaces resulting in a larger hospital pharmacy. Medical equipment costs alone run 3% to 5% higher in children's hospitals than they do in adult facilities, and furnishings are similarly 1% to 2% higher, totaling millions of dollars of higher costs than is needed in hospitals primarily serving adult patients.

- Costly customization of information technology is another critical area of specialized need. Electronic health records (EHRs), already an expensive aspect of the delivery system, are designed for adult care by the manufacturers and must be additionally customized for pediatrics. The information fields necessary for pediatric care, such as their quality standards, clinical guidelines, safety alerts, follow-up notices, and communications must be specially programmed and maintained at cost premiums for children. This is also true of all the digital content on infusion pumps, ventilators, digital monitoring and staffing systems across the hospital.
- More costly pediatric transport and support provided through ground and air ambulance, is driven by the need to ensure safety in the transfer of medically fragile neonates to children's hospitals serving as regional referral centers, often for large geographic areas of the country. As there are far fewer pediatric referral centers than adult centers, the distances over which children must be transported are longer, particularly in rural areas. Children's hospitals have proportionally greater need for helipads and higher use of fixed-wing aircraft as a result. Support costs are also higher as children are all legal minors, requiring additional physical security and more and different staffing to protect children and particularly infants as they are moved, e.g., in sensitive custody situations or where multiple families are involved.

COVID-19 impact: The pandemic has increased what are already higher specialized and higher pediatric support and technology costs. Hospitals are focusing on designs that allow for rapid surge capacity to accommodate future surges in patients. This includes emphasis on flexible, acuity adaptable treatment areas that can readily be altered for rapid response to different medical emergencies such as viral outbreaks. This heightened capacity to respond requires pediatric building infrastructure including HVAC, power, systems, and services that can meet the potential increases in patient demand. The pandemic has highlighted the need to invest in more resilient environments, ensuring for example, that adequate ventilation and isolation spaces and technology are in place. Similarly, the pandemic has highlighted the need for greater control over the supply chain process to safeguard against shortages such as PPE, by advancing more redundancy in supply sources already stretched by demand, and by accommodating more strategic stockpiles on and off site.

These higher cost drivers are summarized in **Illustration 1**:

Children's Hospitals Facility Uniqueness Drivers

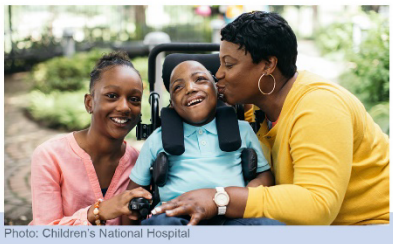


Photo: Children's National Hospital

Role of the Family

The programmatic differences in terms of types of spaces, the overall magnitude of a clinical department (e.g., inpatient unit, exam room) and the overall square footage of family spaces can be substantially higher in pediatric hospitals. Elements contributing to this include:

- Extended inpatient stay family accommodations and support
- Ambulatory buildings designed to accommodate larger corridors and waiting areas
- Sibling play and support spaces

Photo: Shriners Hospitals for Children–Springfield

Needs of Children

The unique needs of caring for a child results in differences in clinical and social needs driving a broader range of space, services and staff.

- The clinical needs of children warrant more space and added procedures, (e.g. sedation in MRI)
- Care delivery requires a greater range of patient units accommodating age cohorts
- Reducing child and family stress through space and programs such as child life and respite spaces

Julia Serat; Shriners Hospitals for Children–Northern California; Sacramento

Pediatric Specialization

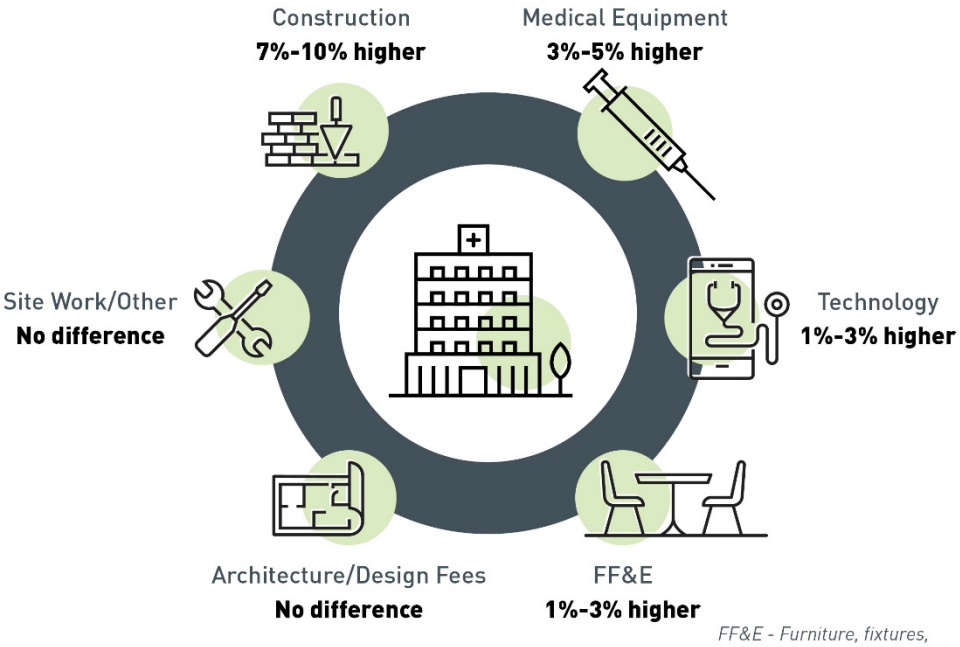
The specialized nature of pediatric care and the level of customization drives more space, technology, equipment and support compared with adult hospitals.

- Specialized high cost equipment
- Wider inventory of supplies and equipment
- Larger pharmacies
- Customized EHR
- Additional security needs

III. Results: Serving the unique needs of children

The specialized elements required to serve children and families result in more costly facilities and importantly, our assessment didn't identify any areas where children's hospitals cost *less* than their adult counterparts. While the specific details vary across the many projects we factored into our analysis, our author panel concludes the aggregated cost premiums in the inpatient areas, D&T areas, and equipment and technology can be approximated at the overall facility level as summarized in **Illustration 2**:

Children's Hospital Facility Costs Relative to Adult Hospitals



Our experience suggests total project costs for children's hospitals are conservatively 5% to 10% higher than comparable primarily adult-focused facilities. This is in addition to operating scale diseconomies associated with staffing and maintaining pediatric hospitals, given facilities for children are sized for lower volumes than hospitals primarily serving adults, but still contain the same technical complexity with an even greater diversity of space types. For example, on a replacement basis, a children's hospital is considered very large at 300 beds, and this capacity is defined by the smaller population of children. In comparison, primarily adult-focused academic hospital replacements are commonly twice this size or 600 beds, providing more economies of scale in their development and operation. These additional operating cost drivers are reflected in higher total campus costs and rates to payors of care for children, where children's hospitals are typically among the costliest in the market.

We suggest the 5% to 10% cost differential between pediatric and primarily adult-focused hospitals is a conservative minimum, and case examples of higher costs per bed are common for all the reasons cited. As academic medical center redevelopments routinely exceed $1 billion in costs, we can expect these double-digit cost differentials in children's hospitals to result in costs of upwards of $100 million or more versus comparable adult-focused hospitals.

COVID-19 Legacy of Infrastructure Reinvestment

The COVID-19 pandemic revealed the important and costly changes necessary to provide effective care in future emergencies. These focus mainly on creating flexible, adaptable, clinical areas, particularly in critical care, enabling rapid adaptation to changing social distancing and isolation policies. Children's hospitals are already designed with more and different types of space and specialized support and technology than hospitals focused on adults; adding the additional layer of needs learned from the COVID-19 pandemic compounds these cost challenges.

While the pandemic created the need for more space in numbers of areas, the growth of telehealth and the trend to relocate hospital staff offsite have reduced space needs in others. Telehealth growth has reduced patient visit levels in numbers of practice areas, most notable the emergency department. While the longer-term impact of telehealth on space requirements remains unclear, the technology and cybersecurity support needed to safely expand these virtual care and child life modalities are increasing. Similarly, moving selected operations and staff to remote work increased during the pandemic, offering the possibility of reduced space needs in the future. While technology and remote care and work will certainly ease the demand on selected hospital programs and space, we conclude the overall net facility reinvestment and future operating costs will rise because of the pandemic.

IV. Implications for planners, advocates, and policymakers

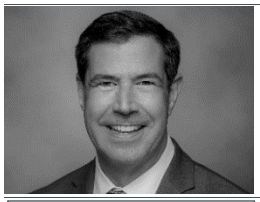
Children's hospitals are among the most technically advanced facilities in the country, staffed by professionals uniquely specializing in children, and caring for the most vulnerable and sickest patients in the nation. These children's facilities are the essential safety nets for all our children, the places of last resort and hope when there are no other answers for children and families in the greatest need.

For policymakers and payors, hospitals for children cost more to build than primarily adult-focused hospitals. The COVID-19 pandemic has created new demands on children's hospitals and public financial support is required to help offset these higher costs. The higher costs translate to higher charges—prices to payers—and are non-comparable to the larger hospitals focused primarily on adults. In an era of transparency and public reporting on the costs of care, grouping children's hospitals in any comparative context with adult care can be misleading and potentially harmful to families, employers, and health plans making choices about where to care for their children. Transparency is essential, and yet it must be conveyed in comparable "apples to apples" formats to facilitate good decisions.

For children's hospital planners and advocates, the business, financing, and philanthropic planning must ensure the reality of higher costs is recognized and accommodated in current and future redevelopment efforts. The reality of children's hospitals costing more should be expected given the unique needs of children. Investing in children's hospitals is among the best actions we can take in securing our own futures, and these facilities must be considered essential infrastructure in the context of the nation's priorities. Today's children are the future community, economy, and leadership of our nation and the world, and children's hospitals are essential to their better care and lives.

About the Authors

The authors represent one of the most experienced and accomplished collaborations of health care planners, architects, and specialists ever assembled on the topic of children's hospital facilities and campus development. Their cumulative career experience totals over 200 years to date, and they have served as leaders in many major children's hospital redevelopment projects undertaken in the U.S. and around the world. Their clients include virtually all the nation's top-ranked pediatric and adult medical centers.



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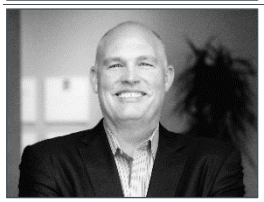

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