Trends and Variation in the Use of Observation Stays at Children's Hospitals

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BACKGROUND: Observation status could improve efficiency of healthcare resource use but also might shift financial burdens to patients and hospitals. Although the use of observation stays has increased for adult patient populations, the trends are unknown among hospitalized children.

OBJECTIVE: The goal of this study was to describe recent trends in observation stays for pediatric populations at children's hospitals.

DESIGN, SETTING, AND PARTICIPANTS: Both observation and inpatient stays for all conditions were retrospectively studied using the Pediatric Health Information System database (2010 to 2019).

EXPOSURE, MAIN OUTCOMES, AND MEASURES: Patient type was classified as inpatient or observation status. Main outcomes included annual percentage of observation stays, annual percentage of observation stays having prolonged length of stay (>2 days), and growth rates of observation stays for the 20 most common conditions. Risk adjusted hospital-level use of observation stays was estimated using generalized linear mixed-effects models.

RESULTS: The percentage of observation stays increased from 23.6% in 2010 to 34.3% in 2019 ($P < .001$), and the percentage of observation stays with prolonged length of stay rose from 1.1% to 4.6% ($P < .001$). Observation status was expanded among a diverse group of clinical conditions; diabetes mellitus and surgical procedures showed the highest growth rates. Adjusted hospital-level use ranged from 0% to 67% in 2019, indicating considerable variation among hospitals.

CONCLUSION: Based on the increase in observation stays, future studies should explore the appropriateness of observation care related to efficient use of healthcare resources and financial implications for hospitals and patients. *Journal of Hospital Medicine* 2021;16:XXX-XXX. © 2021 Society of Hospital Medicine

Payors have been refining reimbursement policies for observation and inpatient stays over the past decade, and the effects on the healthcare payment system are significant.[1-4] Advocates claim that observation status could improve efficiency in the use of healthcare resources by reducing emergency department (ED) crowding and lowering costs for inpatient care.[5,6] Critics consider observation status to be a cost-shifting strategy that could lead to financial burdens for patients and hospitals.[7,8]

Although reimbursement policies for observation stays traditionally have been set by the Centers for Medicare and Medicaid Services (CMS) in a uniform manner,[4,8] state Medicaid programs and commercial health insurers have developed a variety of policies for using observation status in broader populations and hospitals.[9-15] Coverage criteria and implementation timelines of these policies vary by states and commercial insurers.[11-15] For example, the California Department of Health Care Services did not have a specific reimbursement rate for observation stays in 2020, while some state Medicaid programs have had reimbursement policies for observation services in place since 2010.[11-15] These inconsistencies likely result in greater variation in use of observation stays across children's hospitals than general hospitals.

Previous studies have shown rising trends in use of observation stays among adult patient populations and related implications for patients and general hospitals,[16-19] but few studies have reported the trends for pediatric populations. In this study, we sought to (1) describe recent trends of observation stays for pediatric populations at children's hospitals from 2010 through 2019 and (2) investigate features of this shifting pattern for pediatric populations and hospital-level use of observation stays.

METHODS

Study Design, Data, and Populations

We performed a retrospective analysis of the Pediatric Health Information System (PHIS), an administrative database that contains inpatient, observation, ambulatory, and ED encounter-level data from 50 not-for-profit, tertiary care children's hospitals affiliated with the Children's Hospital Association (CHA).[20] PHIS has an indicator to classify patient types (inpatient, observation, ED visits, ambulatory surgery, clinic visit, and others). The data are de-identified at the time of submission and subjected to validity and reliability checks by CHA and Truven Health Analytics (Ann

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Arbor, MI) before being included in PHIS. Each encounter in PHIS has only one patient type; therefore, encounters that transition to a higher level of care are assigned to their highest level of care (eg, a patient transitions from observation to inpatient status is classified as an inpatient encounter) to avoid duplicate counting.

To ensure consistent evaluations over time, we included 29 children's hospitals that consistently reported both inpatient and observation data to PHIS across all quarters from 2010 through 2019. We identified the 20 most common clinical conditions using the All Patients Refined Diagnosis Related Groups (APR-DRGs; 3M Corporation) based upon their total frequencies of observation and inpatient stays over the study period. Regression analyses were conducted using all encounters within the 20 most common APR-DRGs.

Because all data have been de-identified in the PHIS database, the institutional review board at Ann and Robert H. Lurie Children's Hospital of Chicago granted this study institutional review board–exempt status.

Main Outcome and Measures

We first presented longitudinal trends of observation stays for children's hospitals using annual percentage of observation stays defined as:

$$= \frac{\textit{the number of observation stays}}{\textit{the total number of observation and inpatient stays}} \times 100\%$$

To determine whether different pediatric populations have different trends of observation stays, we measured the growth rates of observation stays for each APR-DRG. Specifically, we first calculated the percentage of observation stays by APR-DRGs and years as described, and then calculated the growth rate of observation stays for each APR-DRG:

$$= \frac{\textit{[percentage of observaton stays in 2019 – percentage of observaton stays in 2010]}}{\textit{percentage of observation stays in 2010}} \times 100\%$$

Next, we employed prolonged length of stay (LOS) and hospitalization resource-intensity scores for kids (H-RISK) to further investigate the shifting pattern of observation stays. Because most state Medicaid and commercial policies dictate that observation stays should not last longer than 48 hours, we defined prolonged LOS as >2 days.[11-15] We defined the annual percentage of observation stays with prolonged LOS for each year as:

$$= \frac{\textit{number of observation stays with prolonged LOS}}{\textit{number of all observation stays}} \times 100\%$$

Numerators and denominators of the three measures were obtained by pooling all children's hospitals included in this study. H-RISK is a continuous variable developed by CHA to measure use of intensive care for children, which is comparable across various APR-DRGs.[21] Changes in the empirical distribution of H-RISK from observation stays were presented over years using percentiles.

Other measures included sex, age, race, payor, and LOS. To investigate the use of observation stays among payors, we categorized payors into five groups: private, in-state Medicaid (managed care), in-state Medicaid (Children's Health Insurance Program [CHIP]/others), other government, and all others, according to the data availability. The "private" group consisted of commercial preferred provider organizations, commercial health maintenance organizations, and commercial others. We combined both CHIP and in-state Medicaid (others), including Medicaid fee-for-service or unspecified Medicaid together as "in-state Medicaid (CHIP/others)." Detailed categorization information is summarized in Appendix Table 1. LOS was classified into four groups: 1 day (24 hours), 2 days (48 hours), 3 to 4 days, and >4 days.

Statistical Analysis

Descriptive statistics were stratified by inpatient and observation status and were summarized using frequency, percent, median, and interquartile range (IQR). Chi-square or Wilcoxon rank-sum tests were performed to examine differences between observation and inpatient status. Trends in annual percentage of observation stays and annual percentage of observation stays with prolonged LOS were estimated using first-order autoregressive models, in which year was considered a continuous variable. A nonparametric measure of rank correlation (Spearman's rank correlation coefficient) was employed to evaluate the correlation between year and H-RISK from observation stays.

The risk-adjusted probability of being admitted as an observation stay was estimated using generalized linear mixed models by adjusting for year, age, sex, race, payor, LOS, H-RISK, and a random intercept for each hospital to control for patient clustering within a hospital (Appendix Model). Hospital-level use of observation stays was measured by risk-adjusted percent use of observation stays for each hospital using the predicted values from generalized linear mixed models. All analyses were performed using SAS software, version 9.4 (SAS Institute) and R (R Core Team, 2019), and $P < .05$ was considered statistically significant.

RESULTS

Increasing Trend of Observation Stays

Over the study period, there were 5,611,001 encounters, including 3,901,873 (69.5%) inpatient and 1,709,128 (30.5%) observation stays (Appendix Table 1). The number of observation stays increased from 117,246 in 2010 to 207,842 in 2019, and the number of inpatient stays slightly increased from 378,433 to 397,994 over the 10 years (Appendix Table 1). Because of different growth rates between observation and inpatient status, the annual percentage of observation stays increased from 23.7% in 2010 to 34.3% in 2019, while the annual percentage of inpatient stays decreased from 76.3% in 2010 to 65.7% in 2019 (Appendix Table 1; Figure 1, $P < .001$).

Different Growth Rates of Observation Stays for Various Pediatric Populations

As shown in the Table, growth rates of observation stays in-

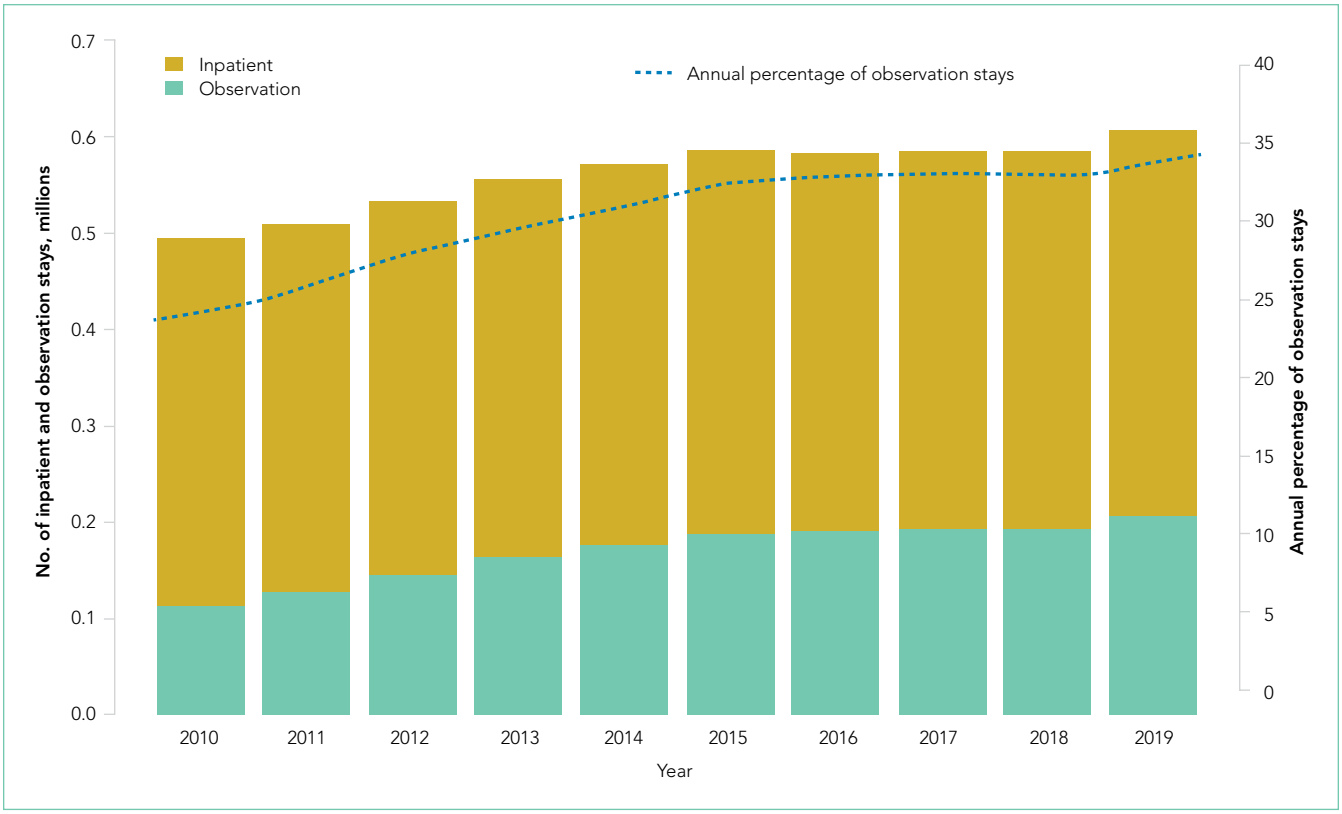

FIG 1. Number of Inpatient and Observation Stays and Annual Percentage of Observation Stays at Children's Hospitals, 2010 to 2019

creased for 19 of the 20 most common APR-DRGs. The four APR-DRGs having the highest growth rates in observation stays were appendectomy, diabetes mellitus, kidney and urinary tract infections, and cellulitis and other bacterial skin infections (Appendix Figure). In particular, the annual percentage of observation stays for appendectomy increased from 19.8% in 2010 to 54.7% in 2019, with the number of observation stays growing from 2,321 to 7,876, while the number of inpatient stays decreased from 9,384 to 6,535 (Appendix Figure). The annual percentage of observation stays for diabetes mellitus increased from 8.16% in 2010 to 22.74% in 2019. Tonsil and adenoid procedures consistently held the largest numbers of observation stays across the 10 years among all the APR-DRGs, with 115,207 and 31,125 total observation and inpatient stays, respectively (Table).

Characteristics of Observation and Inpatient Stays

Patient characteristics are summarized in Appendix Table 1. There were 542,344 (32.9%) observation stays among patients with in-state Medicaid (managed care), and 241,157 (27.4%) observation stays among in-state Medicaid (CHIP/others). The percentages of observation and inpatient stays were 29.8% and 70.2% for private payor, as well as 29.6% and 70.4% for other government payor. Overall, the median (IQR) of H-RISK among observation stays was 0.79 (0.57-1.19) vs 1.23 (0.72-2.43) for inpatient stays. There were 1,410,694 (82.5%) observation stays discharged within 1 day and 243,972 (14.3%) observation stays discharged within 2 days. However, there were 47,413 (2.8%) and 7,049 (0.4%) observation stays with LOS 3 to 4 days or >4 days, respectively.

Shifting Pattern in Observation Stays

The annual percentage of observation stays with prolonged LOS (>2 days) rose from 1.1% in 2010 to 4.6% in 2019 ($P <$ .001; Figure 2). The empirical distribution of H-RISK from observation stays by years further suggests a slightly increasing trend in intensity of care under observation stays. As shown in Appendix Table 2, although the 1st, 5th, 10th, 25th, and 99th percentiles of H-RISK were relatively stable, the 50th, 75th, 90th, and 95th percentiles of H-RISK were increasing over time. The correlation between year and intensity of care used under observation stays (H-RISK from observation stays) was found to be weak but significantly positive (Spearman correlation coefficients = 0.04; $P <$ .001).

Interaction coefficients from our regression model demonstrate that the existing inverse association between H-RISK and odds of admission as an observation stay became less negative over the years. In 2010, the adjusted odds ratio (OR) of H-RISK was 0.57 (95% CI, 0.55-0.59). By 2017, the adjusted OR had increased to 0.65 (95% CI, 0.64-0.66). Compared with 2010, the seven adjusted ORs of H-RISK at years 2012 through 2018 were observed to be higher and statistically significant ($P <$ .001, Appendix Table 3).

Hospitals-Level Use of Observation Stays

After adjusting for all covariates and hospital random effects,

TABLE. **Numbers and Growth Rates of Inpatient and Observation Stays for the 20 Most Common All Patients Refined Diagnosis Related Groups, 2010 to 2019**

APR-DRGs	Inpatient	Observation	Growth rate
420 Diabetes	83,255	13,783	1.788
225 Appendectomy	74,596	57,895	1.756
463 Kidney and urinary tract infections	58,523	12,469	1.426
383 Cellulitis and other bacterial skin infections	74,589	32,607	1.227
139 Other pneumonia	109,987	32,097	1.058
138 Bronchiolitis and respiratory syncytial virus pneumonia	166,818	79,015	0.885
141 Asthma	151,042	96,215	0.883
861 Signs, symptoms, and other factors influencing health status	30,946	32,212	0.736
53 Seizure	160,931	97,271	0.659
422 Hypovolemia and related electrolyte disorders	28,290	34,620	0.585
315 Shoulder, upper arm, and forearm procedures	20,833	42,912	0.491
113 Infections of upper respiratory tract	78,907	67,218	0.478
249 Non-bacterial gastroenteritis, nausea, and vomiting	69,726	66,952	0.478
254 Other digestive system diagnoses	66,745	55,262	0.385
662 Sickle cell anemia crisis	55,718	6,219	0.321
97 Tonsil and adenoid procedures	31,125	115,207	0.283
640 Neonate, birth weight > 2,499 g, normal newborn, or neonate with other problem	114,174	12,968	0.140
812 Poisoning of medicinal agents	36,911	27,252	0.063
133 Pulmonary edema and respiratory failure	64,432	1,693	0.044
693 Chemotherapy	127,509	9,508	-0.257

Abbreviation: APR-DRGs, All Patients Refined Diagnosis Related Groups.

hospital-level use of observation stays increased between 2010 and 2019 for 26 out of 29 children's hospitals. Although observation status essentially was not used at two children's hospitals over the study period, the median hospital-level use of observation stays was 26% in 2010 (IQR, 3%-36%) and increased to 46% (IQR: 39%; 55%) in 2019. As shown in Figure 3, the number of hospitals with a low percentage of observation stays (<26%) decreased from 15 in 2010 to 4 in 2019. The number of hospitals with a high percentage of observation stays (≥51%) increased from 5 in 2010 to 10 in 2019. Nevertheless, there remained significant variation in the use of observation stays, and the hospital-level use ranged from 0% to 67% in 2019.

DISCUSSION

By 2020, observation status has become a key component of healthcare for pediatric patients, and its relevance for children's hospitals recently has been described.[22,23] However, trends in observation stays for pediatric populations are not known. This represents the first study showing temporal trends of observation stays at children's hospitals after 2010. Our results confirm that the increase in observation stays for pediatric populations is not attributable to decreasing patient acuity at children's hospitals. We found a weak but significantly positive correlation between year and intensity of care used under observation stays. Although this correlation might not be clinically important, it demonstrates that patient acuity in observation stays is not decreasing. Regression results suggest that observation stays now encompass patients who need relatively higher intensity of care compared with those admitted under observation status in 2010.

This study also identifies a unique pattern in the use of observation stays among pediatric populations. Earlier studies exclusively focused on observation stays that were admitted from EDs.[24] Our results indicate that observation status has been used beyond a bridge from ED care to inpatient admission. In particular, observation status has expanded to include pediatric populations with more diverse clinical conditions (eg, appendicitis and diabetes mellitus), and has become a substantial component of postprocedural admissions (Appendix Figure). Looking forward, it is likely that the use of observation

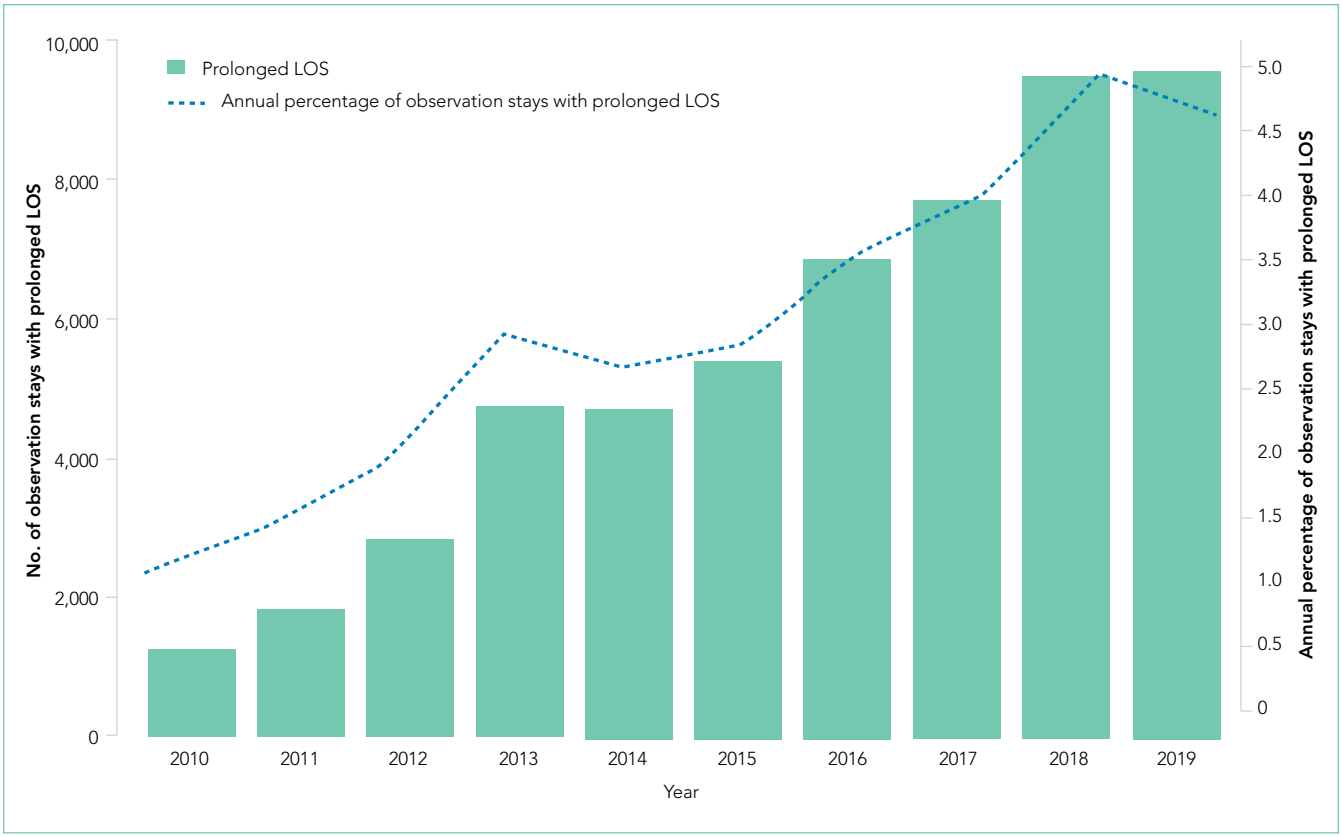

FIG 2. Number and Annual Percentage of Observation Stays with Prolonged Length of Stay (LOS, >2 Days), 2010 to 2019

stays might surpass inpatient admissions for more conditions that primarily involve short-term stays.

Observation status originally was designed as a reimbursement strategy for patients who needed short stays in dedicated ED units or hospitals, but did not qualify for inpatient services.[5,25] After several changes in reimbursement policies, CMS released the "two midnight rule" for Medicare beneficiaries in 2013, which replaced condition-based criteria with time-based criteria to determine an inpatient or observation stay.[1] Some Medicaid programs and commercial payors have developed similar policies. Unlike the universal policy for Medicare populations, the regulations for pediatric populations vary by states and health insurers.[11-15,26-28] This might partially explain the wide variation observed among children's hospital-level use of observation stays. For example, the California Medicaid program did not have a reimbursement rate for observation services as of 2020, while the Texas Medicaid program has had a policy for observation stays since 2010.[12,13] We found that two children's hospitals in California had the lowest use of observation stays (almost zero), whereas the hospital-level use of observation stays was more than 50% for three out of four children's hospitals in Texas. In addition to reimbursement policies, individual hospitals also might have different strategies for observation status designation. An earlier survey showed that there was lack of consistency in billing and payor-based designations of observation status at children's hospitals.[29] These findings suggest that children's hospital-level use of observation stays likely is influenced by reimbursement policy and practical strategy for observation status determination.

Earlier studies reported that observation status could be a more efficient use of healthcare resources.[5,6] However, there are still at least two concerns relevant to children's hospitals during the last decade. The first is whether the use of observation stays can promote cost-saving or if it is just a cost-shifting strategy. An earlier study demonstrated that observation stays with prolonged LOS might increase risk of cost-sharing among adult patients.[29] Our study reveals an increasing trend of observation stays with prolonged LOS for pediatric patients. Similar to adult patients, LOS exceeding 24 or 48 hours could lead to uncovered healthcare costs and financial burdens on families.[30-32] Meanwhile, children's hospitals also might take on a higher financial liability by implementing observation status. Earlier studies have indicated that resource use between observation and inpatient stays at children's hospitals is similar, and increasing use of observation stays might lead to financial risk rather than cost effectiveness.[33] Further, administrative costs of observation determination are considerably high.[34] Medicaid is the major payor for pediatric patients in children's hospitals. In this study, more than 50% of encounters were paid through Medicaid programs. It is well known that Medicaid reimbursement rates are lower than Medicare and commercial plans.[35] Therefore, the cost-saving conclusion drawn from Medicare patients cannot be generalized to pediatric populations at children's hospitals without cautious reevaluation.

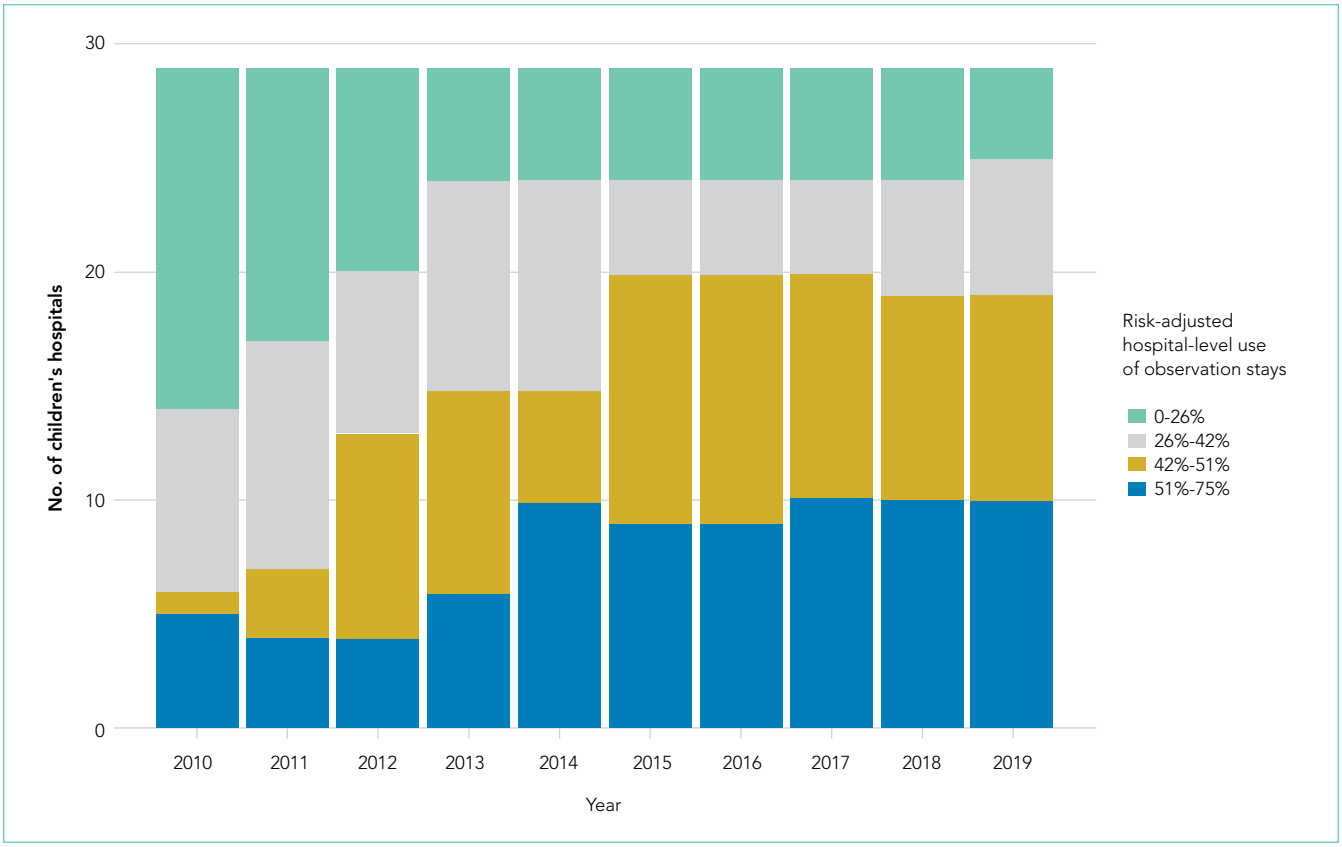

FIG 3. Risk-Adjusted Hospital-Level Use of Observation Stays at Children's Hospitals, 2010 to 2019. A total of 29 children's hospitals (y axis) consistently reported inpatient and observation data to the Pediatric Health Information System from 2010 through 2019 (x axis). Hospital-level use of observations stays was measured by risk-adjusted percent use of observation stays for each hospital; its median was 42% (interquartile range, 26%-51%) over the 10 years. To ensure data confidentiality, hospital-level use of observations stays was categorized and exhibited by four groups using quartiles: 0 to 26%, 26% to 42%, 42% to 51%, and 51% to 75%. For example, the number of hospitals with a low percentage of observation stays (<26%) decreased from 15 in 2010 to four in 2019 (green segments). The number of hospitals with a high percentage of observation stays (≥51%) increased from 5 in 2010 to 10 in 2019 (blue segments).

A second concern with increasing use of observation stays is selection bias in public reporting and comparisons of hospital performance. Presently, four main categories of quality indicators established by the Agency for Healthcare Research and Quality rely heavily on inpatient encounters.[36] In this study, we found that the range of hospital-level use of observation stays was large. In 2019, the risk-adjusted percent use of observation stays was less than 5% at three hospitals, while the percent use was greater than 60% in another three hospitals. Therefore, comparisons made without uniform accounting of observation stays might have significant implications for national rankings of children's hospitals across the United States. These consequences have been investigated in several published studies.[22,23,37-39]

There are several limitations to our study. First, the study sample was limited to children's hospitals that consistently reported inpatient and observation data over the entire study period. Eighteen hospitals (86%) excluded from this study did not consistently submit inpatient and observation data to PHIS from 2010 through 2019. The primary purpose of this study was to present temporal trends of observation stays for children's hospitals, and it was important to build the hospital cohort based on valid and consistent data during the study period. Appendix Table 4 presents differences of hospital characteristics by included and excluded groups of hospitals. Excluded hospitals might have fewer resources (eg, fewer pediatric intensive care beds). Nonetheless, the selection of hospitals was optimized based on data availability. Second, this study was a retrospective review of an administrative database of children's hospitals and units. The sample does not represent all children's hospitals or pediatric patients in the United States, but there are no available data sources—that we know of—that can generate national estimates for both inpatient and observation stays. Third, we did not attempt to conclusively infer any causal effects, and several factors could explain the increasing trends, such as reimbursement policies, hospital-level implementation strategies, determination guidelines for observation status designation, as well as changes in clinical care. Further studies should investigate impact of these factors on the use of observation stays for pediatric patients and children's hospitals.

CONCLUSION

Observation status has been increasingly used for pediatric patients with more diverse clinical conditions, and there is a rising trend of prolonged LOS among observation stays since 2010. Considerable variation exists in hospital-level use of ob-

servation stays across children's hospitals. Observation status could be an opportunity to improve efficiency of healthcare resource use or could lead to a financial risk for patients with prolonged LOS. Future studies should explore appropriateness of observation care in clinical practice through leveraging efficient care and alleviating financial risk.

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