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Pediatric Observation Units in the US: A Systematic Review

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Abstract

Background—As the United States' (US) health system seeks more efficient and value-based care models, geographically distinct observation units (OUs) may become an integral part of hospital-based care for children.

Purpose—To systematically review the literature and evaluate the structure and function of pediatric OUs in the US.

Data Sources—Searches were conducted in Medline, Web of Science, CINAHL, HCAB, Lexis Nexis, National Guideline Clearinghouse and Cochrane Reviews through February 2009, with review of select bibliographies.

Study Selection—English language peer-reviewed publications on pediatric OU care in the US.

Data Extraction—Two authors independently determined study eligibility. Studies were graded using a 5-level quality assessment tool. Data were extracted using a standardized form.

Data Synthesis—21 studies met inclusion criteria: 2 randomized trials, 2 prospective observational, 12 retrospective cohort, 2 before and after, and 3 descriptive studies. Studies present data on more than 22,000 children cared for in OUs, most at large academic centers. This systematic review provides a descriptive overview of the structure and function of pediatric OUs in the US. Despite seemingly straightforward outcomes for OU care, significant heterogeneity in the reporting of length of stay, admission rates, return visit rates, and costs precluded our ability to conduct meta-analyses. We propose standard outcome measures and future directions for pediatric OU research.

Conclusions—Future research using consistent outcome measures will be critical to determining whether OUs can improve the quality and cost of providing care to children requiring observation-length stays.

Keywords

Hospitalization; Emergency Department; Observation Unit; Pediatric; Review

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Background

The first observation units were implemented over 40 years ago with the goal of reducing the number and duration of inpatient stays. Since then, observation units (OUs) have evolved as a safe alternative to hospitalization (1–4) for the delivery of finite periods of care, typically less than 24 hours (5–8). Observation services allow for time to determine the need for hospitalization in cases that are unclear after their initial evaluation and treatment (9). Observation status is an administrative classification related to reimbursement that can be applied to patients whose diagnosis, treatment, stabilization, and discharge can reasonably be expected within 24 hours (10,11). The site of care for observation is dependent in part upon existing facility structures; some institutions utilize “virtual” OUs within the emergency department (ED) or hospital ward, while others have dedicated, geographically distinct OUs, which may function as an extension of either the ED or inpatient settings (9).

OUs have been instrumental in providing care to adult patients with chest pain, asthma, and acute infections (12–18). Recently, there has been an increase in the number of publications from pediatric OUs in the United States (US) and abroad. Observation may be a preferred model of care for select pediatric patients, as hospitalized children often experience brief stays (19–21). Previous reviews on this model of care have combined adult and pediatric literature and have included research from countries with health care structures that differ considerably from the US (22–24). To date, no systematic review has summarized the pediatric OU literature with a focus on the US health care system.

As payers and hospitals seek cost effective alternatives to traditional inpatient care, geographically distinct OUs may become integral to the future of health care delivery for children. This systematic review provides a descriptive overview of the structure and function of pediatric OUs in the US. We also scrutinize the outcome measures presented in the included publications and propose future directions for research to improve both observation unit care as well as the care delivered to patients under observation status within general inpatient or ED settings.

Methods

Literature Search

With the assistance of a health services librarian, a search of the following electronic databases from January 1, 1950 through February 5, 2009 was conducted: Medline, Web of Science, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Health Care Advisory Board (HCAB), Lexis Nexis, National Guideline Clearinghouse and Cochrane Reviews. Key words used for the Boolean search are included in Appendix A. In addition, we conducted a manual search of reference lists from reviews, guidelines, and articles meeting inclusion criteria.

We included English language peer-reviewed publications that reported on pediatric OU care in the US. Studies were included if they reported outcomes including lengths of stay, admission from observation rates, return visit rates, costs or charges. Descriptive publications of pediatric OU structure and function were also included. Studies were excluded if they were conducted outside the US, evaluated psychiatric or intensive care, reported on observation status in an ED without an OU or observation status on a traditional inpatient ward. Two reviewers (MM and CK) identified articles for inclusion. Any disagreements between the reviewers were resolved by discussion and consensus agreement. Inter-rater reliability was assessed using the kappa statistic.

Quality Assessment

The quality of each study was rated using the Oxford Centre for Evidence-Based Medicine levels of evidence (25). With this system, levels of evidence range from 1a (homogeneous systematic review of randomized, controlled trials) to 5 (expert opinion without explicit critical appraisal).

Data Synthesis

Data on study design, OU characteristics, patient populations, and outcomes were extracted using a standardized form. Heterogeneity of study design, interventions, and outcomes precluded the ability to conduct meta-analyses.

Results

A systematic search of the electronic databases identified 222 unique citations (Figure). One hundred seven abstracts were evaluated. We identified 48 articles for full text review of which 18 met inclusion criteria. Hand search of references yielded 24 additional articles of which 3 met inclusion criteria. Inter-rater agreement for selected articles was high at 98% ($\kappa = 0.85$).

Observation Unit Characteristics

The majority of research on OUs has been conducted at large academic pediatric centers. One publication was from a community hospital (26). These studies present data on more than 22,000 children cared for in OUs of 11 hospitals over a 32 year time span. Most studies were level 2 evidence: 2b - retrospective cohort studies and low quality randomized, controlled trials or 2c - "outcomes" research. Three were descriptive and not assigned a formal evidence level (27–29).

Table 1 highlights general features of US pediatric OUs. Five institutions renovated or expanded clinical space in order to open the OU (27,29–32). Units ranged in size from 3 to 23 beds. The OU was located in or near the emergency department (ED) in all but 2 hospitals, which had ward-based units. The ED was the primary entry point into the OU with only 2 open model units accepting patients from other settings (5,32). The annual number of observation cases ranged from 1,000 to 3,000 in children's hospitals. Approximately 500 ward-based observation cases per year were cared for in the single community hospital studied. Three reports included time trends showing increased OU utilization over study years (5,30,31).

Staffing and Workflow

Staffing models varied and have undergone transitions over time. Prior to 1997, general pediatricians primarily provided physician services. In more recent years, OUs have utilized pediatric emergency medicine (PEM) providers. Three of the 11 units allowed for direct patient care by sub-specialists (5,6,32). One OU was staffed by nurse practitioners (29). OU nursing backgrounds included pediatrics, emergency medicine, or PEM.

Five institutions assembled multidisciplinary teams to define the unit's role and establish policies and procedures (7,27,29–31). Workflow in the OU focused on optimizing efficiency through standardized orders, condition specific treatment protocols, and bedside charting (7,26,33). Several units emphasized the importance of ongoing evaluations by attending physicians who could immediately respond to patient needs. Rounds occurred as often as every 4 hours (5,7). Two centers utilized combined physician-nursing rounds to enhance provider communication (7,34). No publications reported on patient transitions between sites of care or at shift changes.

Criteria for Observation

All 11 hospitals have developed protocols to guide OU admissions (Table 2). Nine publications from four OUs commented on treatments delivered prior to observation (33,35–42). The most commonly cited criteria for admission was approval by the unit's supervising physician. Utilization review was not mentioned as an element in the OU admission decision. Common OU exclusions were the need for intensive care or monitoring while awaiting an inpatient bed; however these were not universal. Eight centers placed bounds around the duration of OU stays, with minimum stays of 2 hours and maximum stays of 8 to 24 hours.

Ages of Children under Observation

Seven of 11 hospitals reported the age range of patients accepted in their OU (Table 2). All but one unit accepted children from infants to young adults, 18 to 21 years of age (43). In the 6 units that reported the age distribution of their OU population, roughly 20% were <1 year, more than 50% were <5 years, and fewer than 30% fell into an adolescent age range (5,6,26,32,34,43).

Conditions under Observation

Many conditions under observation were common across time and location (Table 3). The list of conditions cared for in OUs has expanded in recent years. Medical conditions predominated over surgical. While the majority of observation cases required acute care, nearly half of the units accepted children with scheduled care needs (e.g., routine post-operative care, procedures requiring sedation, infusions, and extended evaluations such as electroencephalograms or pH probes). These scheduled cases, cared for within the OU structure, provided more steady demand for OU services.

Reimbursement

One publication highlighted the special billing rules that must be considered for observation care (27). In three studies, payers recognized cost-savings associated with the OU's ability to provide outpatient management for cases that would traditionally require inpatient care (31,35,38).

Observation Unit Outcomes

Outcomes reported for pediatric OU stays fall into four major categories: length of stay (LOS), admission rates, return visit rates, and costs. Despite these seemingly straightforward groupings, there was significant heterogeneity in reporting these outcomes.

Length of stay—The start time for OU LOS is not clearly defined in the articles included in this review. While the start of an observation period is assumed to begin at the time the order for observation is placed, it is possible that the LOS reported in these publications began at the time of ED arrival or the time the patient was physically transferred to the OU. The average LOS for individual OUs ranged from 10 to 15 hours (5,6,26,30,35,38,40,41,43). One ward-based and one ED-based unit reported LOS extending beyond 24 hours (7,30), with averages of 35 and 9 hours respectively. Two units limited the duration of care to <10 hours (31,38).

For studies that included a comparison group, OU stays were consistently shorter than a traditional inpatient stay by 6 to 110 hours (7,36,38,39,42). No significant differences in clinical parameters between groups were reported. There was appreciable variation in the average LOS across institutions for similar conditions, 12 to 35 hours for asthma (5,7,34,35), and 9 to 18 hours for dehydration (5,34,36,38).

Admission rates—Rates of hospital admission after observation from the 9 OUs reporting this outcome are presented in Table 4. Three publications from a single institution counted hospital admission in the 48–72 hours following discharge from the OU as though the patient were admitted to the hospital directly from the index OU stay (33,40,41). Conditions with the lowest admission rates, <10%, included croup, neurologic conditions, ingestions, trauma, and orthopedic injuries. The highest admission rates, >50%, were for respiratory conditions including asthma, pneumonia, and bronchiolitis.

Return visit rates—Unscheduled return visit rates were reported in 9 publications from 6 institutions and ranged from 0.01% to 5% (7,26,33,35–37,39–41). Follow-up timeframes ranged from 48 hours to 1 month. Return visits were inconsistently defined. In most studies, rates were measured in terms of ED visits (26,33,35–37,39,41). One ward-based unit counted only hospital readmissions toward return visit rates (7). Three publications, from ED-based units, counted hospital readmissions in the 2 to 5 days following observation toward admission rates and not as return visits (33,40,41). In most studies, data on return visits were collected from patient logs or patient tracking systems. Three studies contacted patients by phone and counted return visits to clinic (35–37). No studies reported on adherence to scheduled visits following observation.

Costs—Seven studies reported financial benefits of OU care when compared with traditional hospital care (7,30,31,35,37,38,42). Two centers admitted patients to inpatient care if their observation period reached a set time limit, after which cost savings were no longer realized (31,35). Cost savings associated with the OU treatment of asthma and dehydration were attributed to lower charges for an OU bed (35,38). Decreased charges for the OU treatment of croup were related to shorter LOS (42).

Discussion

In the 40 years since the first studies of pediatric OUs, several US health systems have extended observation services to children. This model of care may be expanding, as suggested by an increase in the number of publications in the past ten years. However, the number of centers within the US reporting on their OU experience remains small. Our systematic review identified a recurrent theme related to OUs - the opportunity to improve operational processes of care compared with the traditional inpatient alternative. We have identified the need to standardize OU outcomes and propose measures for future OU research.

Observation Unit Operations

The OU care model expands outpatient management of acute conditions to include children who are neither ready for discharge nor clear candidates for inpatient admission. OUs have demonstrated the ability to care for patients across the pediatric age spectrum. Over the decades spanning these publications, advances in medical therapy such as anti-emetics for gastroenteritis and early administration of systemic steroids for asthma may have resulted in lower admission rates or shorter time to recovery (44,45). Despite these advances, there are marked consistencies in the conditions cared for within OUs over time. The data summarized here may help guide institutions as they consider specific pediatric conditions amenable to observation care.

The hospitals included in this review either added physical space or revised services within existing structures to establish their OU. Hospitals facing physical constraints may look to underutilized areas, such as recovery rooms, to provide observation care, as observation does not require the use of licensed inpatient beds. Several units have responded to daily

fluctuations in unscheduled observation cases by also serving patients who require outpatient procedures, brief therapeutic interventions, and diagnostic testing. By caring for patients with these scheduled care needs during the day, there is a more steady flow of patients into the OU. While hospitals traditionally have used post-anesthesia care units and treatment rooms for scheduled cases, OUs appear to benefit from the consistent resource allocation associated with a constant demand for services.

To date, the vast majority of pediatric OUs in the published literature have emerged as an extension of ED services. Now, with the expansion of pediatric hospitalist services and movement toward 24/7 inpatient physician coverage, there may be increased development of ward-based OUs and the designation of inpatient observation status. While ward-based OUs managed by pediatric hospitalists may be well established, we were not able to identify published reports on this structure of care. A national survey of health systems should be undertaken to gather information regarding the current state of pediatric observation services.

When creating policies and procedures for OUs, input should be sought from stakeholders including hospitalists, PEM providers, primary care providers, sub-specialists, mid-level providers, nurses, and ancillary staff. As patients requiring observation level of care do not neatly fit an outpatient or inpatient designation, they present an opportunity for hospitalist and PEM physician groups to collaborate (46–48). Calling on the clinical experiences of inpatient and ED providers could offer unique perspectives leading to the development of innovative observation care models.

This review focused on institutions with dedicated observation services, which in all but one study (26) consisted of a defined geographic unit. It is possible that the practices implemented in an OU could have hospital-wide impact. For example, one study reported reduction in LOS for all asthma cases after opening a ward-based unit (7). Further, pediatric hospitalist services have been associated with shorter LOS (49) and increased use of observation status beds compared with traditional ward services (50). As pediatric hospitalists expand their scope of practice to include both observation and inpatient care, clinical practice may be enhanced across these care areas. It follows that the impact of observation protocols on care in the ward setting should be independently evaluated.

The costs associated with the establishment and daily operations of an OU were not addressed in the reviewed publications. Assertions that observation provides a cost-effective alternative to inpatient care (4,7,23,42) should be balanced by the possibility that OUs extend care for patients who could otherwise be discharged directly home. Studies have not evaluated the cost of OU care compared with ED care alone. Research is also needed to assess variations in testing and treatment intensity in OUs compared with the ED and inpatient alternatives. Reimbursement for observation is dependent in part upon institutional contracts with payers. A full discussion of reimbursement issues around observation services is beyond the scope of this review.

Observation Unit Outcomes

Length of stay—Although most studies reported LOS, direct comparisons across institutions are difficult given the lack of a consistently referenced start to the observation period. Without this, LOS could begin at the time of ED arrival, time of first treatment, or time of admission to the OU. Identifying and reporting the elements contributing to LOS for observation care is necessary. The time of OU admission is important for billing considerations; the time of first treatment is important to understanding the patient's response to medical interventions; the time of ED arrival is important to evaluating ED efficiency. Each of these LOS measures should be reported in future studies.

Direct comparisons of LOS are further complicated by variability in the maximum permissible duration of an OU stay, ranging from 8 to 24 hours in the included studies. Despite these limits, some OU care will extend beyond set limits due to structural bottlenecks. For example, once the inpatient setting reaches capacity, observation LOS for patients who require admission will be prolonged. The best evaluation of LOS would come from prospective study design utilizing either randomization or quality improvement methods.

Defining Success and Failure in Observation Care—In the reviewed literature, “observation failures” have been defined in terms of admission after observation and unscheduled return visit rates. Admission rates are heavily dependent on appropriate selection of cases for observation. Although some observation cases are expected to require inpatient admission, OUs should question the validity of their unit's acceptance guidelines if the rate of admission is >30% (51). High rates could be the result of inadequate treatment or the selection of children too sick to improve within 24 hours. Low rates could indicate overutilization of observation for children who could be discharged directly home. Full reporting on the number of children presenting with a given condition and the different disposition pathways for each is needed to evaluate the success of OUs. Condition-specific benchmarks for admission after observation rates could guide hospitals in their continuous improvement processes.

Unscheduled return visits may reflect premature discharge from care, diagnostic errors, or development of a new illness. OU care may influence patient adherence to scheduled follow-up care but this has not been evaluated to date. In future research, both scheduled and unscheduled return visits following ED visits, observation stays, and brief inpatient admissions for similar disease states should be reported for comparison. Standard methodology for identifying return visits should include medical record review, claims analyses, and direct patient contact.

As hospitals function at or near capacity (52,53), it becomes important to delineate the appropriate length of time to monitor for response to treatments in a given setting. Limited capacity was a frequently cited reason for opening a pediatric OU; however the impact of OUs on capacity has not yet been evaluated. Operations research methods could be used to model OU services' potential to expand hospital capacity. This research could be guided by evaluation of administrative data from across institutions to identify current best practices for pediatric OU and observation status care.

OU benchmarking in the US has begun with a small number of adult units participating in the ED OU Benchmark Alliance (EDOBA) (54). In Table 5 we propose dashboard measures for pediatric OU continuous quality improvement. The proposed measures emphasize the role of observation along the continuum of care for acute conditions, from the ED through the OU with or without an inpatient stay to clinic follow-up. Depending on the structure of observation services, individual institutions may select to monitor different dashboard measures from the proposed list. Patient safety and quality of care measures for the conditions commonly receiving pediatric OU care should also be developed.

Limitations

The most important limitations to this review are the heterogeneity in interventions and reporting of outcomes, which precluded our ability to combine data or conduct meta-analyses. We attempted to organize the outcomes data into clear and consistent groupings. However, we could not compare the performance of one center with another due to differences in OU structure, function and design.

In order to focus this systematic review, we chose to include only peer reviewed publications that describe pediatric OUs within the US. This excludes expert guidelines, which may be of value to institutions developing observation services.

Our search found only a small number of centers that utilize OUs and have published their experience. Thus our review is likely subject to publication bias. Along this line, we identified 9 additional publications where children were cared for alongside adults within a general OU (55–63). This suggests an unmeasured group of children under observation in general EDs, where more than 90% of US children receive acute care (64). These articles were excluded because we were unable to distinguish pediatric specific outcomes from the larger study population.

Finally, retrospective study design is subject to information bias. Without a comparable control group, it is difficult to understand the effects of OUs. Patients directly admitted or discharged from the ED and patients who require admission after observation all differ from patients discharged from observation in ways that should be controlled for with a randomized study design.

Conclusion

Observation units have emerged to provide treatment at the intersection of outpatient and inpatient care during a time of dramatic change in both emergency and hospital medicine. As hospitalists expand their scope of practice to include observation care, opportunities will arise to collaborate with ED physicians and share their growing expertise in quality and efficiency of hospital care delivery to improve observation services for children. OUs have been established with laudable goals - to reduce inpatient admissions, increase patient safety, improve efficiency, and control costs. The current evidence is not adequate to determine if this model of health care delivery achieves these goals for children. Through synthesis of existing data, we have identified a need for standard reporting for OU outcomes and propose consistent measures for future observation care research. Only through prospective evaluation of comparable outcomes can we appraise the performance of pediatric OUs across institutions.

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Appendix A

Search terms:

MeSH terms in bold.

Observation, short stay, assessment, hybrid, holding, admission - unit/ward

OR

Observation level of care, observation status

OR

Emergency Services, Hospital or Emergency Medicine

OR

Observation

OR

Hospital Units

OR
Hospitalist*
 AND
Length of stay (LOS)
 OR
Fees and Charges
 OR
Costs and Cost Analysis
 OR
Outcome (and Process) Assessment
 OR
Patient Admission
 OR
Patient Readmission
 OR
Patient Transfer
 OR
Safety
 OR
Patient Satisfaction
 OR
Hospitalization
 OR
Return visit
 OR
Complication*
 Limits - All child, English language
 NOT
 Psych*
 NOT
 Intensive Care Unit

Abbreviations

OU	Observation Unit
ED	Emergency Department
CINAHL	Cumulative Index to Nursing and Allied Health Literature
HCAB	Health Care Advisory Board
PEM	pediatric emergency medicine
LOS	length of stay

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Figure.
Literature Search

Table 1

General Description of US Pediatric Observation Units

Publication Condition	Study design - Level of evidence Time frame Sample size	Hospital Observation setting Year opened	Site	Beds	Entry point	Staffing Physicians Nurses
Gururaj 1972 All conditions	Retrospective cohort - 2c 1 year 437 cases under observation	King's County Downstate Brooklyn Short Stay Unit	ED	3	Not reported	Pediatric residents General pediatricians
Ellerstein 1980 All conditions	Retrospective cohort - 2c 6 years 5,858 cases of unscheduled care plus 1,403 elective surgery cases	Children's Hospital Buffalo Observation Unit 1972	ED	8	ED Clinic Procedure/OR	Primary care pediatricians Other specialists Pediatric residents
O'Brien 1980 Asthma	Retrospective cohort - 2c 1 month 434 cases of asthma 328 discharged directly from ED 106 treated in holding unit	Children's National DC Holding Unit	ED	6	ED	1-2 Pediatric residents 1-2 Nurses
Willert 1985 Asthma	Randomized* - 2b 578 cases of asthma 166 cases 1.5 hrs post-aminophylline 103 randomized, 52 to holding unit *Limited by bed availability, patient preference.	Children's Memorial Chicago Holding Room	ED	5	ED	General pediatricians Pediatric residents
Listernick 1986 Dehydration	Randomized* - 2b 29 cases of dehydration 22 to holding unit *IV hydration, admission per parent preference.					PEM nurses
Balik 1988 All conditions	Descriptive None given	Minneapolis Children's Short Stay Unit Observation Area 1985	Day surgery area adjacent to ED	Not reported	Not reported	General pediatricians Pediatric nurses (shared w/ ED)
Marks 1997 All conditions Asthma	Retrospective cohort - 2c 5 months 968 cases in short stay unit Pre-post - 2b 400 cases of asthma 102 pre/ 298 post short stay unit	Children's Hospital Boston Short Stay Unit 1994	Ward	4-18	ED	Primary care pediatricians PEM physicians Pediatric residents Pediatric nurses 1:6 nurse:patient ratio

Publication Condition	Study design - Level of evidence Time frame Sample size	Hospital Observation setting Year opened	Site	Beds	Entry point	Staffing Physicians Nurses
Wiley 1998 All conditions	Retrospective cohort - 2c 1 year 805 cases of unscheduled observation plus 595 scheduled cases	Connecticut Children's Outpatient Extended Treatment Site	ED	10	Not reported	PEM physicians Other specialists
Scribano 2001 All conditions	Retrospective cohort - 2b 2 years 1,798 cases under observation					1:5 nurse:patient ratio
Leduc 2002 All conditions	Retrospective cohort - 2c 6 months 686 cases under observation (4.8% of ED visits)	Children's Hospital Denver Observation Unit	ED	6	Not reported	Not reported
Bajaj 2003 Intussusception	Retrospective cohort - 2b 4.5 years 78 cases of intussusception (51 under observation)					
Wathen 2004 Dehydration	Convenience sample - 2c 10 months 182 cases of dehydration (48 under observation)					
Crocetti 2004 All conditions	Retrospective cohort - 2b 2 years 956 cases under observation	John Hopkin's Bayview Observation Status Beds 1997	Ward	Not reported	99% ED 1% "other location"	General pediatricians covering ED and ward
Silvestri 2005 All conditions	Descriptive None given	Children's Hospital of Philadelphia Observation Unit 1999	ED	12	ED	PEM physicians PEM fellows Urgent care pediatricians ED nurse practitioner Inpatient nurses
Alpern 2008 All conditions	Prospective cohort - 1b 30 months 4,453 cases under observation					
Thomas 2000 All conditions	Descriptive None given	Primary Children's Medical Center Rapid Treatment Unit (RTU) 1999	ED	22-26	ED Clinic Procedure/OR	PEM physicians General pediatricians Other specialists No residents
Zebrack 2005 All conditions	Retrospective cohort - 2b 2 years 4,189 cases of unscheduled observation					PEM nurses

Publication Condition	Study design - Level of evidence Time frame Sample size	Hospital Observation setting Year opened	Site	Beds	Entry point	Staffing Physicians Nurses
	plus 2,288 scheduled cases					1:4 nurse:patient ratio
Miescier 2005 Asthma	Retrospective cohort - 2b 2 years 3,029 asthma visits 384 admitted, 301 observed 161 cases met inclusion					
Holsti 2005 Head Injury	Retrospective cohort - 2b 2 years 827 CHI visits 273 admitted, 285 observed 284 cases met inclusion					
Green berg 2006 Croup	Retrospective pre-post - 2b 1 year each 694 croup cases pre-RTU 66 admitted 789 croup cases post-RTU 33 admitted, 76 observed					
Mallory 2006 Dehydration	Retrospective cohort - 2b 1 year 430 dehydration cases under observation					

Table 2

Observation Unit Entry Criteria

Hospital	Entry Criteria	Age Range	Time	Exclusion Criteria
King's County Downstate Brooklyn	Otherwise required inpatient admission Acute problem of uncertain severity Acute problem not readily diagnosed Diagnostic procedures impractical as outpatient	0 – 13 yrs	Maximum 24 hours Short course periodic treatment	Not reported
Children's Hospital Buffalo	Admission from any source Short stay elective surgery Estimated length of stay < 24 hrs	0 – 21 yrs	Maximum 24 hours	Intensive care needs Routine diagnostic tests Holding prior to admission
Children's National DC	Inadequate response to 3 subcutaneous epinephrine injections	8mos – 19 yrs	Not reported	Not reported
Children's Memorial Chicago	Asthma: Available parent Asthma score <=5 Inadequate response to ED treatment	>1 year	Maximum 24 hours	Past history of BPD, CF, CHD, other debilitating disease
	Dehydration: Cases receiving oral hydration Parent preference if given IV hydration	3 – 24 mos	12 hrs for oral 8 to 12 hrs for IV	Intensive care need Hyponatremia
Minneapolis Children's	Conditions listed in Table 3	Not reported	Maximum 10 hours	Not reported
Children's Hospital Boston	“Straightforward” diagnoses as determined by ED staff Bed availability	Not reported	Not reported	Other complex medical issues
Connecticut Children's	PEM attending discretion	Not reported	After 3–4 hrs in ED	Asthma: no supplemental O2 need, nebulized treatments > Q2hr
	Limited severity of illness Usually confined to a single organ system Clearly identified plan of care		Low likelihood of requiring “extended care” >23 hours	Croup: no supplemental O2 need, <2 racemic epinephrine treatments Dehydration: inability to tolerate orals, bicarbonate >10, 40cc/kg IVF Seizure: partial or generalized, postictal, unable to tolerate orals Poisoning: mild or no symptoms, poison control recommendation
Children's Hospital Denver	Intussusception: following reduction Dehydration: Based on clinical status	0 – 18 years	After 3–4 hrs in ED	Not reported
John Hopkin's Bayview	Consultation with on-duty pediatrician	0 – 18 years	Minimum of 2 hrs High likelihood of discharge at 24 hrs	Patients requiring subspecialty or intensive care services
Children's Hospital of Philadelphia	Sole discretion of the ED attending Single focused acute condition Clinical conditions appropriate for observation	Not reported	Minimum 4 hours Maximum 23 hours	No direct admissions Diagnostic dilemmas Underlying complex medical problems

Hospital	Entry Criteria	Age Range	Time	Exclusion Criteria
Primary Children's Medical Center	Observation unit attending discretion Scheduled procedures as space available ED admit after consult with OU doctor Clear patient care goals Limited severity of illness Diagnostic evaluation	0 – 21 years	Minimum 3 hours Maximum 24 hours	Admission “holds” Intensive care needs Complicated, multi-system disease Need for multiple specialty consults Psychiatric patients

Conditions Cared for in US Pediatric Observation Units

Table 3

	King's County Downstate Brooklyn	Children's Hospital Buffalo	Minneapolis Children's	Children's Hospital Boston	Connecticut Children's	Children's Hospital Denver	John Hopkin's Bayview	Children's Hospital of Philadelphia	Primary Children's Medical Center Salt Lake City
Respiratory		•				•			
Asthma	•		•	•	•		•	•	•
Pneumonia	•			•			•	•	•
Bronchiolitis	•			•			•	•	•
Croup	•		•	•	•		•	•	•
Allergic reaction			•					•	
Cardiology								•	
Gastrointestinal	•	•				•			
Vomiting					•			•	•
Gastro/Dehydration			•	•	•		•	•	•
Abdominal pain					•		•	•	•
Constipation									•
Diabetes								•	
Neurologic		•				•			
Seizure	•				•		•	•	•
Head Injury	•		•		•			•	•
Infection		•				•	•		
Sepsis evaluation				•					•
UTI/pyelonephritis	•			•				•	•
Cellulitis				•				•	•
Fever						•		•	•
Pharyngitis								•	
Otitis media								•	

	King's County Downstate Brooklyn	Children's Hospital Buffalo	Minneapolis Children's	Children's Hospital Boston	Connecticut Children's	Children's Hospital Denver	John Hopkin's Bayview	Children's Hospital of Philadelphia	Primary Children's Medical Center Salt Lake City
Adenitis								•	
Ingestion/Poisoning	•	•	•	•	•	•	•	•	•
Hematologic			•			•		•	
Sickle Cell Disease	•								
Transfusion/Infusion			•						•
Psych/social	•	•			•		•	•	
Dental								•	
Surgical conditions									
Foreign Body								•	•
Trauma		•				•	•	•	
Burn							•		
Orthopaedic Injury					•			•	•
Post-op complication								•	•

	King's County Downstate Brooklyn	Children's Hospital Buffalo	Minneapolis Children's	Children's Hospital Boston	Connecticut Children's	Children's Hospital Denver	John Hopkin's Bayview	Children's Hospital of Philadelphia	Primary Children's Medical Center
									Salt Lake City
Scheduled Care									
Diagnostic work-up	•				•				•
Procedures/sedation					•				•
Elective surgery		•	•		•				•

Table 4

Condition Specific Rates of Inpatient Admission following Observation Unit Care

	King's County Downstate Brooklyn	Children's Hospital Buffalo	Connecticut Children's	John Hopkin's Bayview [†]	Children's Hospital of Philadelphia	Primary Children's Medical Center Salt Lake City
Unscheduled Care	42%	17%	11%	25%	25%	15%
Respiratory		32%				
Asthma	57%		16%	26%	22%	22–25%*
Pneumonia				50%	23%	30–48%
Bronchiolitis				46%	32%	43%
Croup			9%	17%	9%	4–6%
Allergic reaction					3%	
Cardiology					22%	
Gastrointestinal	43%	19%				
Vomiting			5%			22%
Gastro/Dehydration				23%	15%/21%	16%*
Abdominal pain				9%	17%	27%
Constipation						9%
Diabetes					17%	
Neurologic		10%				
Seizure			19%	8%	17%	18%
Head Injury					7%	5%*
Infection		19%		34%		
Sepsis evaluation					25%	22%
UTI/pyelonephritis					25%	16%
Cellulitis						15%
Fever					16%	26%
Pharyngitis					13%	

	King's County Downstate Brooklyn	Children's Hospital Buffalo	Connecticut Children's	John Hopkin's Bayview [†]	Children's Hospital of Philadelphia	Primary Children's Medical Center Salt Lake City
Otitis media					21%	
Ingestion/Poisoning	9%	4%	4%	9%	10%	5%
Hematologic Transfusion/Infusion					23%	2%
Psych/social		21%		80%	17%	
Dental					14%	
Surgical conditions						
Foreign Body					53%	5%
Trauma		13%		2%		
Burn				13%		
Orthopaedic Injury					22%	3%
Post-op complication					26%	16%
Scheduled Care						
Diagnostic work-up						0-5%
Procedures/sedation						0.1-9%
Elective surgery		13%				0-5%

% indicates the percentage of children cared for in the OU with a given condition who went on to require inpatient admission.

* Admissions within 48-72 hours of OU discharge were counted as cases requiring inpatient admission from the index OU stay.

[†] Including transfers to tertiary care hospital.

Table 5

Suggested Dashboard Measures for Pediatric Observation Units

	ED	OU	Inpatient	Clinic
Length of Stay *	ED arrival to OU admission	OU admit to disposition	Inpatient admit to discharge	
	ED arrival to discharge home from OU			
	ED arrival to discharge from inpatient following OU care			
		OU admission to discharge home from inpatient care		
Admission *	% ED census admitted inpatient % ED census that is observed	% OU census admitted		
Unscheduled Return Visits * For same diagnosis at 72 hours, 1 week, and 30 days	To ED	Requiring OU admission	Requiring inpatient admission	
Scheduled follow-up *	To ED			To primary care or subspecialist office
Capacity	ED crowding scales ED left before evaluation rates Ambulance diversion		Unable to accept transfers Inpatient occupancy	
Satisfaction	Patient/Parent			
	ED Providers	OU Providers	Inpatient Providers	Follow-up providers
Cost	ED care	OU care	Inpatient care	
	Total encounter			

* Condition-specific measurement should be considered.