



# Best Practices for Improving Flow and Care of Pediatric Patients in the Emergency Department

Isabel Barata, MD, Kathleen M. Brown, MD, Laura Fitzmaurice, MD, Elizabeth Stone Griffin, RN, Sally K. Snow, BSN, RN, American Academy of Pediatrics Committee on Pediatric Emergency Medicine, American College of Emergency Physicians Pediatric Emergency Medicine Committee, Emergency Nurses Association Pediatric Committee

This report provides a summary of best practices for improving flow, reducing waiting times, and improving the quality of care of pediatric patients in the emergency department.

## abstract

### CURRENT STATUS AND NEEDS

#### ED Use and ED Crowding in the United States

Approximately 800 000 children seek care in the emergency department (ED) each day in the United States. Additionally, it is estimated that 3.4% of US children use EDs as their source for sick care. The vast majority (92%) of these children are seen in community EDs, with a smaller percentage seen in pediatric EDs. The increase in ED utilization has saturated the capacity of EDs and emergency medical services in many communities. Increases in patient volume and decreases in resources, including fragmentation of resources and shortage of critical subspecialists, have resulted in EDs facing crowding and ambulance diversion.

The need for emergency medical services outstrips the available resources on a daily basis. This mismatch is reflected by the considerable increase in the number of patients visiting EDs. In 1993, 90.3 million patients visited EDs; in 2003 that number increased to 113.9 million patients.

Approximately 21% of these patients were younger than 15 years. Despite the increase in ED visits, the number of hospitals decreased by 703, the number of hospital beds decreased by 198 000, and the number of EDs decreased by 425.<sup>1,2</sup> More recent data indicate that this trend continued between 2001 and 2008; the number of ED visits increased by 1.9% per year (95% confidence interval [CI]: 1.2%–2.5%), a rate 60% faster than population growth. Mean occupancy, defined as the number of patients in an ED at a single point in time divided by the number of standard

FREE

*This document is copyrighted and is property of the American Academy of Pediatrics and its Board of Directors. All authors have filed conflict of interest statements with the American Academy of Pediatrics. Any conflicts have been resolved through a process approved by the Board of Directors. The American Academy of Pediatrics has neither solicited nor accepted any commercial involvement in the development of the content of this publication.*

*The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.*

*Technical reports from the American Academy of Pediatrics benefit from expertise and resources of liaisons and internal (AAP) and external reviewers. However, technical reports from the American Academy of Pediatrics may not reflect the views of the liaisons or the organizations or government agencies that they represent.*

*All technical reports from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.*

[www.pediatrics.org/cgi/doi/10.1542/peds.2014-3425](http://www.pediatrics.org/cgi/doi/10.1542/peds.2014-3425)

DOI: 10.1542/peds.2014-3425

Accepted for publication Oct 24, 2014

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2015 by the American Academy of Pediatrics

treatment spaces, increased even more rapidly, at 3.1% per year.<sup>3</sup>

### **The Effect of Crowding on Safety and Quality of Pediatric Emergency Care and Throughput**

ED crowding threatens patient safety, increases medical errors, prolongs length of stay, decreases patient satisfaction, and jeopardizes the reliability and ability of the US health care system to effectively care for patients.<sup>4–6</sup> Specific examples of the effects of ED crowding on quality of ED care, including timeliness of care and patient safety, have been published.

Studies have shown an association between ED crowding and throughput measures, such as length of stay, in EDs.<sup>7</sup> In a large urban children's hospital ED, boarding time and ED daily census showed independent associations with increasing overall length of stay, time to triage, time until seen by physician, and number of patient elopements (ie, patients leaving without being seen by a physician or leaving before treatment is initiated).<sup>8</sup> Another study of 4 general EDs showed an association between measures of crowding and timeliness of emergency care. The delays affected even the patients with highest acuity. During crowded periods (ie, 90% higher than the average census), the adjusted median waiting room times of high-acuity level 2 patients, according to the 5-level Emergency Severity Index, were 3% to 35% higher than during normal periods.<sup>9</sup> The percentage of patients in the ED who are seen by a physician within the time recommended by triage classification has been steadily declining and is at its lowest point in at least 10 years. Of all the patient triage levels in the ED, the more urgent patients are the least likely to be seen within the triage target time. Patients of all racial/ethnic backgrounds and payer types have been similarly affected.<sup>10</sup> ED crowding has also been shown to be

associated with an increase in the rate of patients who leave without being seen by a provider.<sup>11</sup> Other studies have revealed that waiting time to see an ED provider was longer at hospitals in poorer neighborhoods.<sup>12</sup> These studies show that ED crowding may be associated with deficits in both the timeliness and equitability of patient care.

Other domains of the quality of ED care may also be affected by poor ED throughput and crowding. In a study in pediatric ED patients experiencing an acute asthma exacerbation, timeliness and effectiveness quality measures demonstrated an inverse, dose-related association with occupancy and time to see an attending physician. Patients were 52% to 74% less likely to receive timely care and were 9% to 14% less likely to receive effective care when the crowding measures were at the 75th rather than at the 25th percentile ( $P < .05$ ).<sup>13</sup>

Crowding was also associated with delay in analgesic administration in pediatric patients with sickle cell pain crisis in a pediatric ED.<sup>14</sup> ED crowding has also been associated with delay of and failure to administer antibiotics for adult patients admitted with community-acquired pneumonia<sup>15,16</sup> and with delays in analgesic treatment in patients presenting with acute abdominal pain.<sup>17</sup> Other studies have shown similar associations between ED crowding and quality of care in adult ED patients, including the treatment of patients with pain<sup>15,18</sup> ED crowding is also associated with deficits in patient safety. A study conducted in 4 general-population EDs showed an association between ED crowding and preventable medical errors.<sup>19</sup> Other investigators have also found an association between ED crowding measures in an adult and pediatric ED population and medication errors.<sup>20</sup> More recently, Sun et al<sup>21</sup> demonstrated an association between ED crowding and

mortality, hospital length of stay, and costs in 187 California hospitals. The estimate of the costs attributable to ED crowding was 300 additional inpatient deaths, 6200 excess hospital days, and \$17 million in adult ED admissions. ED crowding and increased wait times are associated with decreased patient satisfaction with ED care.<sup>22,23</sup> One study completed in 5 general teaching hospital EDs revealed that not feeling informed about prolonged waits in adult patients was associated with greater dissatisfaction (odds ratio [OR]: 0.48; 95% CI: 0.39–0.57).<sup>24</sup> Another study revealed that ED wait times correlated with patients' satisfaction with both their ED and inpatient care.<sup>25</sup> A study in pediatric ED patients showed that both parent and child satisfaction was correlated with wait time. This study also found that timely resolution of pain was important to both parents and children.<sup>26</sup> There is also evidence from studies in both adults and children that improvement in ED wait times leads to improved patient satisfaction.<sup>27,28</sup>

In summary, ED crowding is a growing problem and is associated with increased lengths of stay in the ED, increased patient elopement rates, and significant deficits in the quality of care domains of safety and timeliness.<sup>29</sup> ED crowding has also been linked to deficits in patient satisfaction and the quality domains of efficiency and equitability. Improving ED throughput and relieving ED crowding is an essential component of improving the quality of ED care.

### **Calls to Improve ED Crowding and Delivery of Care**

Regulators and payers have begun to recognize and address this problem. The Joint Commission views patient flow in the ED as a patient safety issue, specifically targeting patient boarding of psychiatric patients.<sup>30</sup> In 2014, the Centers for Medicare and Medicaid Services began requiring

that hospitals report 5 ED crowding measures,<sup>31</sup> including median time from ED arrival to ED departure for discharged patients, door-to-diagnostic evaluation by a qualified medical professional, patients who leave before being seen, median time from ED arrival to ED departure for admitted patients, and median time from admit decision time to time of departure for admitted patients. While instituting process improvements for flow and efficiency, quality patient care needs to be the driving force. The Institute of Medicine (IOM) has challenged pediatric providers of emergency care as well as business coalitions, government and private individual purchasers, and employees<sup>32,33</sup> to provide objective evidence that they are receiving high-quality health care services for the price paid.<sup>34</sup>

In the IOM report *Emergency Care for Children: Growing Pains*, a challenge was made to providers of pediatric emergency care by asking for methods to improve ED flow, reduce ED waits, and establish a high standard for pediatric emergency care. The 3 main goals for this improved delivery of care included the following: coordination (to allow “the most appropriate care, at the optimal location, with the minimum delay”), regionalization (to develop evidence-based categorization systems for emergency medical services, EDs, and trauma centers), and accountability (the creation of evidence-based indicators of emergency and trauma care system performance measures, including the performance of pediatric emergency care). Specific challenges for pediatric emergency medicine include expanding and strengthening the pediatric workforce to enhance pediatric care, defining pediatric emergency care competencies as well as the requirement to achieve and maintain these competencies, updating clinical guidelines and standards of care, and developing

strategies for addressing pediatric needs in the event of a disaster.<sup>35</sup>

### Clinical Practice Pathways

Clinical pathways are multidisciplinary plans of care structured and designed to support the implementation of clinical guidelines and protocols for ED care and can be used to treat high-volume or high-risk pediatric patients. The use of these nurse-initiated clinical pathways does not suggest that such clinical care is the only appropriate course of treatment. The use of evidence-based nurse-initiated standing orders/protocols is supported by the Centers for Medicare and Medicaid Services as a method by which to enhance the quality and efficiency of patient care.<sup>36</sup> These nurse-initiated clinical pathways are not intended as a proxy for standard of care. Rather, they are intended, and have been proven, to increase efficiency, decrease variation, and minimize risk for pediatric patients.<sup>37–41</sup> A study of more than 15 000 adult patients from 1 urban ED revealed that nurse-initiated triage diagnostic standing orders were associated with a 16% reduction in the time of in-room ED care.<sup>42</sup> Commonly used examples of clinical pathways include those for asthma, bronchiolitis, dehydration, and fever in the neonate. Because of the unique risks related to the boarding of behavioral health patients, clinical pathways that include the utilization of a nurse practitioner to support their care is 1 example of how hospitals can address the medical and safety needs inherent to this population.<sup>43</sup> Such collaboration would also help hospitals meet the 2013/2014 guidelines from the Joint Commission in caring for these patients.<sup>44</sup>

Many insurers are determining benchmarks for defining quality care and are instituting payment incentives for reaching these benchmarks.<sup>45</sup> Unfortunately, several of these benchmarks do not seem to

be appropriate when systematically reviewed.<sup>46</sup> More recently, providers of pediatric emergency care have been more proactive in addressing the issue of what determines quality pediatric emergency care.<sup>47–51</sup>

The 2001 IOM report *Crossing the Quality Chasm* emphasized that evidence-based practice should be a combination of the best research, clinical expertise, and patient values. Practice guidelines are systematically developed statements to assist in the making of practitioner and patient decisions regarding appropriate health care for specific clinical circumstances. Practice guidelines should be based on scientific evidence of effectiveness or predictability. They counter the tendency for medical practice to be anecdotal and parochial by forcing health professionals to examine knowledge and practice patterns. By systematically influencing clinical decisions, practice guidelines can decrease unnecessary variations in care and improve quality.<sup>52</sup> Well-developed practice guidelines crystallize research and make information available in a usable format.<sup>53,54</sup> When there is not clear evidence to support 1 management strategy, guidelines can be written as acceptable alternative treatment options rather than as standardized practices that dictate specific treatments. Physicians need not be required to use the practical tools offered but must be held accountable to the quality and safety of patient care standards. Often, guidelines are translated into clinical pathways. The Cochrane group defines a clinical pathway as containing 5 key elements<sup>55</sup>, as follows:

- a structured multidisciplinary plan of care;
- translation of guidelines or evidence into local structure;
- detailed management steps;
- time- or criteria-based progression; and

- aims to standardize care for a specific problem in a specific population.

### Use of Guidelines

The use of guidelines and clinical pathways has clearly improved quality of care. Examples of published guidelines that have been shown to improve outcomes in pediatric emergency care include those for bronchiolitis, croup, asthma, imaging for appendicitis, and management of patients with acute exacerbations of inborn errors of metabolism.<sup>40,56-58</sup>

However, even when guidelines exist, there is inconsistent application by providers, as noted in a study on managing fever in young children. The authors concluded that the variation in the use of the guidelines between emergency physicians affected both cost and quality of care.<sup>59</sup> It is important for guidelines to be presented as a tool used in conjunction with clinical judgment and not as a substitute for the provider's ability to treat each child as an individual. Physician "buy in" is one of the most significant barriers to implementing guidelines.<sup>60,61</sup> The concept that guidelines limit the physician to think freely or mandate a specific intervention may limit physicians' acceptance of a guideline. Physician input early in the development of a guideline may assist acceptance from the practicing community. Guidelines strongly based on evidence are more likely to be used as well. Additionally, real-time reminders and effective leaders are more successful than passive education in aiding guideline utilization.<sup>62</sup>

Implementation at the local level must incorporate issues related to the culture, ethnicity, and socioeconomics of the particular community. When feasible, all levels of providers who participate in the emergency care of children should be involved in the development of guidelines to ensure that the many factors influencing the

pediatric care outcomes are considered.<sup>63</sup> Advanced-practice nurses, physician assistants, nurses, health plan representatives, injury prevention professionals, and social services providers also should collaborate in guideline development.

### STRATEGIES FOR IMPROVING ED PATIENT FLOW

ED flow, the roadmap for addressing efficiencies, is a combination of triage, efficiency of evaluation, resource utilization, patient length of stay in the ED, and inpatient bed availability.<sup>29,63-65</sup> Published accounts of successfully improving ED throughput measures usually use a combination of the strategies discussed below.<sup>66</sup>

#### LEAN methodology

LEAN, a set of business operating principles developed by Japanese auto manufacturers, operates on a set of core principles that included the following: evaluation of systems, identification of waste, elimination of waste, improvement of flow, and constant adaptation and improvement.<sup>67</sup> A critical aspect of the LEAN system is to involve those providing value-added steps in every level of process design and modification, or a "bottom up" management.<sup>68</sup> This methodology has been shown to be effective in improving ED process efficiencies in a study working specifically in the area of Rapid Triage and Treatment of an ED with both adult and pediatric patients.<sup>69</sup>

#### Emergency Care Pathways

Emergency care pathways and the use of clinical practice guidelines in triage, in particular, have been shown to decrease length of stay, improve resource utilization, and facilitate efficient throughput.<sup>70-72</sup> There are many more published examples of the effect of adult triage or general triage pathways versus pediatric-specific triage pathways. However, some

pediatric-specific pathways have been shown to have an effect on ED patient flow.<sup>73-75</sup>

Developing emergency care pathways that adequately address pediatric issues and prioritize problems in accordance with those of adults is a priority. An increasing number and quality of pediatric-specific triage pathways are available, the most notable being the 5-level triage system.<sup>76-80</sup> If there are inadequate triage categorizations or reevaluations, then children may not be receiving appropriate prioritization for care. Additionally, parents who have been waiting for very long periods of time may leave before treatment is complete because the wait time is too long.<sup>81</sup>

#### Innovative Staffing Models

Optimizing resources is one of the top priorities in improving crowding in the ED. Although the research on innovative staffing models is still evolving, the existing evidence indicates that utilizing nurse practitioners or physician assistants as part of the overall ED health care team can have positive effects on both patient flow<sup>82,83</sup> and patient satisfaction.<sup>84-86</sup>

Although a certain percentage of pediatric patients are acutely ill or injured, many patients are of lower acuity and arrive during predictable peak periods, most notably during evening and weekend hours. The use of nurse practitioners and physician assistants in lower-acuity settings during peak hours, for example, has been found to be particularly effective at alleviating the stress that higher-volume, lower-acuity patients have on the system.<sup>87,88</sup> Utilizing the concept of fast track or urgent care during these time periods has been shown to increase patient satisfaction for adult patients.<sup>28,89</sup>

Utilizing nurse practitioners or physician assistants (at triage or treatment area) to assess and/or treat patients also frees up the time of

emergency physicians for the more complex cases.<sup>90</sup> It can create a bottleneck in triage, however, if a patient with a seemingly minor issue turns out to be more complicated, thus requiring more time in the evaluation phase. This model requires flexibility in both scheduling and backup.<sup>91–93</sup> Alternatively, physician-led team triage models have also been associated with improved throughput and quality of care. In 1 study, an emergency physician–led team triage model was compared with the traditional model of nurse first, physician second. This model used in adult and pediatric patients was associated with decreased length of stay in the ED, decreased rate of patients who left without treatment, decreased rate of patients who returned for an unscheduled visit, and decreased mortality within 7 days.<sup>94</sup> Rogg et al,<sup>95</sup> using a similar model, found a sustained improvement (over 3 years) in length of stay for all of their ED patients, whether they were actually seen by the physician-led triage team. They also saw a sustained improvement in the rate of patients leaving without being seen. Others have shown more modest benefits in throughput measures when using similar models.<sup>96,97</sup> The increasing demand for ED care is expected to continue, and EDs will need to continue to adapt to meet the changing expectations of the populations they serve.<sup>90</sup>

### **The Impact of Value-Based Reimbursement**

Tightening health budgets and the introduction of value-based reimbursement have contributed to an increased focus on improving patient flow and patient satisfaction without compromising quality of care. In the ED environment, lower-acuity patients typically wait the longest to be seen by a physician. Wait times are known to be a key factor in patient satisfaction, and studies have shown

that patient satisfaction scores are often lowest among the lower-acuity patients.<sup>84</sup> The low-acuity environment has, therefore, become a focus for innovative care solutions that can reduce wait times for all patients, not just those with minor presentations.<sup>98</sup>

A systematic search of the English and French literature included 66 papers on the use of physician assistants in EDs and studied several outcomes, including changes in patient flow and patient satisfaction, during the period of physician assistant utilization. The papers, which discussed the effects on patient length of stay during the period of physician assistant utilization, reported that length of stay was reduced when physician assistants were introduced, although the short time period of 1 study limited its generalizability. One of these studies was in a US hospital that implemented a fast-track unit staffed by physician assistants and also found that patient satisfaction was significantly higher after its introduction.<sup>83</sup>

Traditionally, patient registration has occurred before or during triage. Although accurate identification of patients is essential for provision of safe and quality emergency care, completion of patient registration after triage in the examination room and the use of bar-coded patient identification bands have both been shown to improve patient throughput times while maintaining patient safety.<sup>99,100</sup>

### **Staffing Patterns and “Fast Tracking”**

Seasonal variation with peaks in the winter months for influenza and respiratory illnesses and in the summer months for trauma with fractures and lacerations is also predictable. ED management can optimize supply and demand by proactively planning for these peak periods with increased staffing and

surge space allowances.<sup>101,102</sup> Computer modeling of patient flow has been used successfully to predict the effects of physician staffing patterns on patient throughput in a pediatric ED.<sup>103</sup>

### **ED to Observation Units or Inpatient Transition**

Observation units are another option for relieving high-volume stress in a crowded ED. Observation units have been shown to reduce ED crowding by decreasing inpatient admissions and length of ED stay, improving efficiency, and increasing rates of patient and staff satisfaction. The types of patients best served in these units include those with asthma, croup, gastroenteritis, dehydration, abdominal pain, and poisoning.<sup>104–108</sup> If the ED space and staffing are insufficient to adequately justify either an urgent care or observation service, another model can be used. A hybrid unit can be successfully created by sharing or combining resources with general pediatric inpatient or other pediatric outpatient services.<sup>109,110</sup>

The inability to transfer patients to inpatient beds quickly has been shown to be one of the most important factors influencing ED efficiency of flow in studies of adult and general EDs.<sup>111,112</sup> There are fewer data on the effects of inpatient occupancy on throughput in pediatric EDs. However, 1 study at an urban children’s hospital showed an association between inpatient occupancy rate and ED crowding measures. High hospital occupancy directly correlated with longer length of stay for all patients treated in the ED. When inpatient occupancy was at or more than 80% of capacity, every 5% increase in hospital occupancy was associated with an increase in length of stay of 17.7 minutes for patients who were discharged (95% CI: 2.2–33.2 minutes) and 34.3 minutes for patients who were admitted (95% CI: 11.4–57.2 minutes). With the same 5% increase

in inpatient occupancy, there were increases in the odds of either a patient leaving without being seen (OR: 1.21; 95% CI: 1.12–1.31) or being treated in a hallway bed (OR: 1.18; 95% CI: 1.15–1.22).<sup>113</sup>

The development of an early alert system for housewide awareness of reduced bed availability is key to ensuring that all stakeholders can immediately be made aware when inpatient beds become scarce or are no longer available. This alert system can be tiered to the point at which there are no inpatient beds, the ED is full, and transfers can no longer be accepted. For this alert system to be most effective, it should include not only the admitting office or high-level nursing administrators but also charge nurses on all floors, operating rooms, same-day surgery, recovery room, and the ED; all inpatient physicians; and residents who may be the providers responsible for actually writing the discharge orders.<sup>114</sup>

In many hospitals, the ED accounts for the majority of admissions. Another avenue to help ED crowding is for hospitals to review and streamline processes for admission to the hospital, including the balance of ED space utilization for adequate flow to keep patients from leaving because there are no ED beds to be able to see the patients. Accurate patient placement at all levels will help improve ED overcrowding.

Hospital administration may examine all aspects of admission and discharge processes to streamline and decrease the time and resources required. Daily safety updates facilitated by hospital administration provide a venue whereby all key hospital areas give a brief update about the unit, staffing, and potential issues and are a quality and safety concept that have been working in many institutions in the Ohio Children's Hospital Solutions for Patient Safety network.<sup>115</sup> Combining daily safety updates with available electronic dashboards to show

patient flow in the ED and inpatient units can help managers predict real-time unit needs. More intense efforts must be focused toward earlier inpatient discharges. Some have even suggested positive incentives for earlier rounding and discharges, with corresponding negative consequences for failure to comply. Play areas and child life-facilitated family or group waiting rooms can be highly advantageous for patients waiting for parents or rides as they free up a room to be cleaned and turned over to another patient.

Finally, ED managers may proactively consider the optimal use of return visits to the ED versus referral to urgent care and other outpatient sites. This ED return visit system includes a detailed list of availability and hours of service that address the access and service needs of the patients, community, and hospital system and requires coordination with the hospital, outpatient clinics, and community physicians to ensure efficient use of resources.

#### **PERFORMANCE MEASURE DEVELOPMENT**

Performance measures can be used to provide continuous measurement of health care delivery within the system, identify areas of excellence, provide a mechanism for early awareness of a potential problem, verify effectiveness of a corrective action, and compare performance with that of peers. Measures can be categorized as structural, process, or outcome indicators. Structural elements provide indirect quality-of-care measures related to a physical setting and resources. Process indicators provide a measure of quality of care and services by evaluating the method or process by which care is delivered, including both technical and interpersonal components. Outcome elements describe valued results related to lengthening life, relieving pain, reducing disabilities, and satisfying

the consumer. An alternate method for classifying performance measures utilizes 4 categories including condition-specific measures, such as those for otitis media, childhood asthma, and infectious diseases; measures of consumer satisfaction, such as satisfaction with the emergency medical technicians, nurses, or physicians; general measures of health status, such as limitations in social activities, physical activities, and general mental health; and system measures of access and use of services, such as rate of referrals to pediatric specialists and disenrollment. These classification structures for quality review are not mutually exclusive and bring valuable perspectives to the concept of performance measures.

Previous work has recommended several paradigms for determining performance measures. Outcomes used for emergency medicine performance measurement have included mortality and morbidity, ED length of stay, inappropriate admissions, unplanned return ED visits, unplanned primary care visits, use of diagnostic tests and imaging equipment, and use of ED personnel. Using this concept, a Canadian expert consensus panel met to (1) define a set of common conditions and outcomes by age group to assess pediatric ED care, (2) identify links between processes of care and outcomes for each of these conditions, (3) define an explicit set of process and outcome indicators for these conditions, and (4) determine the extent to which it is possible to measure these indicators by using an existing population-based administrative data set. The conditions identified are common, are treated in most EDs, encompass a range of patient acuity, and have evidence for best practices to improve outcomes or enhance clinical efficiency. Notably, however, the panel did not explicitly rate the level of evidence for each clinical condition.<sup>49</sup>

The American College of Cardiology/American Heart Association guidelines for the identification of performance indicators likely to improve quality recommend consideration of the following: (1) the strength of evidence supporting the measure, (2) the clinical relevance of the outcomes associated with the performance measure, and (3) the magnitude of the relationship between the performance measure and outcome. The guidelines also emphasize a fourth consideration, the expense of implementing performance measurement, when selecting a measure with the greatest likelihood of providing meaningful benefit. Quality improvement programs identify performance measures and related interventions that are cost-effective.<sup>116</sup>

## SUMMARY

In summary, ED care and flow can be improved by implementing best practices at several steps in the workflow. Several points of impact can reduce ED boarding, improve pediatric patient safety, and promote effective, efficient, timely, and patient-centered care. These points of impact include the 5-level triage system and nurse-initiated emergency care pathways at the point of initial assessment without delay in seeing a provider, fast tracking and cohorting of patients, clinical pathways, and responsive staffing as patients advance through the ED system. Specific plans may be in place for any patient boarded while awaiting care for an emotional illness and/or substance abuse issue.<sup>30</sup> Interdisciplinary collaborative research and education are needed to develop and implement new solutions and strategies to both prevent and manage ED crowding.<sup>117</sup> All health care providers involved in the delivery of pediatric emergency care are actively engaged in defining what pediatric quality care is and how to translate best practices into

guidelines that are easily disseminated and simple to follow.

## LEAD AUTHORS

Isabel A. Barata, MD, FACEP  
Kathleen M. Brown, MD, FACEP  
Laura Fitzmaurice, MD, FACEP, FAAP  
Elizabeth Stone Griffin, RN  
Sally K. Snow, BSN, RN

## AMERICAN ACADEMY OF PEDIATRICS (AAP) COMMITTEE ON PEDIATRIC EMERGENCY MEDICINE, 2013–2014

Joan E. Shook, MD, MBA, FAAP, Chairperson  
Alice D. Ackerman, MD, MBA, FAAP  
Thomas H. Chun, MD, MPH, FAAP  
Gregory P. Conners, MD, MPH, MBA, FAAP  
Nanette C. Dudley, MD, FAAP  
Susan M. Fuchs, MD, FAAP  
Marc H. Gorelick, MD, MSCE, FAAP  
Natalie E. Lane, MD, FAAP  
Brian R. Moore, MD, FAAP  
Joseph L. Wright, MD, MPH, FAAP

## LIAISONS

Lee Benjamin, MD — *American College of Emergency Physicians*  
Kim Bullock, MD — *American Academy of Family Physicians*  
Beth Edgerton, MD, MPH — *Maternal and Child Health Bureau*  
Toni Gross, MD, MPH, FAAP — *National Association of EMS Physicians*  
Tamar Margarik Haro — *AAP Department of Federal Affairs*  
Angela Mickalide, PhD, MCHES — *EMSC National Resource Center*  
Elizabeth L. Robbins, MD, FAAP — *AAP Section on Hospital Medicine*  
Lou Romig, MD, FAAP — *National Association of Emergency Medical Technicians*  
Sally K. Snow, RN, BSN — *Emergency Nurses Association*  
David W. Tuggle, MD, FAAP — *American College of Surgeons*  
Cynthia Wright, MSN, RNC — *National Association of State EMS Officials*

## STAFF

Sue Tellez

## AMERICAN COLLEGE OF EMERGENCY PHYSICIANS PEDIATRIC EMERGENCY MEDICINE COMMITTEE, 2013–2014

Lee S. Benjamin, MD, FACEP, Chairperson  
Isabel A. Barata, MD, FACEP, FAAP  
Kiyetta Alade, MD  
Joseph Arms, MD  
Jahn T. Avarello, MD, FACEP  
Steven Baldwin, MD  
Kathleen Brown, MD, FACEP  
Richard M. Cantor, MD, FACEP  
Ariel Cohen, MD  
Ann Marie Dietrich, MD, FACEP

Paul J. Eakin, MD  
Marianne Gausche-Hill, MD, FACEP, FAAP  
Michael Gerardi, MD, FACEP, FAAP  
Charles J. Graham, MD, FACEP  
Doug K. Holtzman, MD, FACEP  
Jeffrey Horn, MD, FACEP  
Paul Ishimine, MD, FACEP  
Hasmig Jinivizian, MD  
Madeline Joseph, MD, FACEP  
Sanjay Mehta, MD, Med, FACEP  
Aderonke Ojo, MD, MBBS  
Audrey Z. Paul, MD, PhD  
Denis R. Pauze, MD, FACEP  
Nadia M. Pearson, DO  
Brett Rosen, MD  
W. Scott Russell, MD, FACEP  
Mohsen Saidinejad, MD  
Harold A. Sloas, DO  
Gerald R. Schwartz, MD, FACEP  
Orel Swenson, MD  
Jonathan H. Valente, MD, FACEP  
Muhammad Waseem, MD, MS  
Paula J. Whiteman, MD, FACEP  
Dale Woolridge, MD, PhD, FACEP

## FORMER COMMITTEE MEMBERS

Carrie DeMoor, MD  
James M. Dy, MD  
Sean Fox, MD  
Robert J. Hoffman, MD, FACEP  
Mark Hostetler, MD, FACEP  
David Markenson, MD, MBA, FACEP  
Annalise Sorrentino, MD, FACEP  
Michael Witt, MD, MPH, FACEP

## STAFF

Dan Sullivan  
Stephanie Wauson

## EMERGENCY NURSES ASSOCIATION PEDIATRIC COMMITTEE, 2012–2013

Sally K. Snow, BSN, RN, CPEN, FAEN, 2011 Chair  
Michael Vicioso, MSN, RN, CPEN, CCRN, 2012 Chair  
Shari A. Herrin, MSN, MBA, RN, CEN, 2013 Chair  
Jason T. Nagle, ADN, RN, CEN, CPEN, NREMT-P  
Sue M. Cadwell, MSN, BSN, RN, NE-BC  
Robin L. Goodman, MSN, RN, CPEN  
Mindi L. Johnson, MSN, RN  
Warren D. Frankenberger, MSN, RN, CCNS  
Anne M. Renaker, DNP, RN, CNS, CPEN  
Flora S. Tomoyasu, MSN, BSN, RN, CNS, PHRN

## BOARD LIAISONS

2012 — Deena Brecher, MSN, RN, APRN, CEN, CPEN, ACNS-BC  
2013 — Sally K. Snow, BSN, RN, CPEN, FAEN

## STAFF LIAISONS

Kathy Szumanski, MSN, RN, NE-BC  
Dale Wallerich, MBA, BSN, RN, CEN  
Marlene Bokholdt, MS, RN, CPEN  
Paula Karnick, PhD, CPNP, ANP-BC  
Leslie Gates  
Christine Siwik

## REFERENCES

1. McCaig LF. National Hospital Ambulatory Medical Care Survey: 1992 emergency department summary. *Adv Data*. 1994;(245):1–12
2. McCaig LF, Burt CW. National Hospital Ambulatory Medical Care Survey: 2003 emergency department summary. *Adv Data*. 2005;(358):1–37
3. Pitts SR, Pines JM, Handrigan MT, Kellermann AL. National trends in emergency department occupancy 2001 to 2008: effect of inpatient admissions versus emergency department practice intensity. *Ann Emerg Med*. 2012;60(6):679.e3–686.e3
4. American Academy of Pediatrics, Committee on Pediatric Emergency Medicine. Policy statement: overcrowding crisis in our nation's emergency departments: is our safety net unraveling? *Pediatrics*. 2004;114(3):878–888. Reaffirmed June 2011
5. Hostetler MA, Mace S, Brown K, et al; Subcommittee on Emergency Department Overcrowding and Children, Section of Pediatric Emergency Medicine, American College of Emergency Physicians. Emergency department overcrowding and children. *Pediatr Emerg Care*. 2007;23(7):507–515
6. Twanmoh JR, Cunningham GP. When overcrowding paralyzes an emergency department. *Manag Care*. 2006;15(6):54–59
7. McCarthy ML, Zeger SL, Ding R, Levin SR. Crowding delays treatment and lengthens emergency department length of stay, even among high-acuity patients. *Ann Emerg Med*. 2009;54(4):492.e4–503.e4
8. Timm NL, Ho ML, Luria JW. Pediatric emergency department overcrowding and impact on patient flow outcomes. *Acad Emerg Med*. 2008;15(9):832–837
9. Gilboy N, Tanabe T, Travers D, Rosenau AM. *Emergency Severity Index (ESI): A Triage Tool for Emergency Department Care, Version 4. Implementation Handbook 2012 Edition*. Rockville, MD. Agency for Healthcare Research and Quality; November 2011. AHRQ Publication 12-0014
10. Horwitz LI, Bradley EH. Percentage of US emergency department patients seen within the recommended triage time: 1997 to 2006. *Arch Intern Med*. 2009;169(20):1857–1865
11. Pines JM, Localio AR, Hollander JE, et al. The impact of emergency department crowding measures on time to antibiotics for patients with community-acquired pneumonia. *Ann Emerg Med*. 2007;50(5):510–516
12. Lambe S, Washington DL, Fink A, et al. Waiting times in California's emergency departments. *Ann Emerg Med*. 2003;41(1):35–44
13. Sills M, Fairclough D, Ranade D, Kahn MG. Emergency department crowding is associated with decreased quality of care for children with acute asthma. *Ann Emerg Med*. 2011;57(3):191.e7–200.e7
14. Shenoi R, Ma L, Syblik D, Yusuf S. Emergency department crowding and analgesic delay in pediatric sickle cell pain crises. *Pediatr Emerg Care*. 2011;27(10):911–917
15. Pines JM, Hollander JE. Emergency department crowding is associated with poor care for patients with severe pain. *Ann Emerg Med*. 2008;51(1):1–5
16. Fee C, Weber EJ, Maak CA, Bacchetti P. Effect of emergency department crowding on time to antibiotics in patients admitted with community-acquired pneumonia. *Ann Emerg Med*. 2007;50(5):501.e1–509.e1
17. Mills AM, Shofer FS, Chen EH, Hollander JE, Pines JM. The association between emergency department crowding and analgesia administration in acute abdominal pain patients. *Acad Emerg Med*. 2009;16(7):603–608
18. Hwang U, Richardson L, Livote E, Harris B, Spencer N, Sean Morrison R. Emergency department crowding and decreased quality of pain care. *Acad Emerg Med*. 2008;15(12):1248–1255
19. Epstein SK, Huckins DS, Liu SW, et al. Emergency department crowding and risk of preventable medical errors. *Intern Emerg Med*. 2012;7(2):173–180
20. Kulstad EB, Sikka R, Sweis RT, Kelley KM, Rzechula KH. ED overcrowding is associated with an increased frequency of medication errors. *Am J Emerg Med*. 2010;28(3):304–309
21. Sun BC, Hsia RY, Weiss RE, et al. Effect of emergency department crowding on outcomes of admitted patients. *Ann Emerg Med*. 2013;61(6):605.e6–611.e6
22. Boudreaux ED, O'Hea EL. Patient satisfaction in the emergency department: a review of the literature and implications for practice. *J Emerg Med*. 2004;26(1):13–26
23. Tekwani KL, Kerem Y, Mistry CD, et al. Emergency department crowding is associated with reduced satisfaction scores in patients discharged from the emergency department. *West J Emerg Med*. 2013;14(1):11–15
24. Sun BC, Adams J, Orav EJ, Rucker DW, Brennan TA, Burstin HR. Determinants of patient satisfaction and willingness to return with emergency care. *Ann Emerg Med*. 2000;35(5):426–434
25. Pines JM, Iyer S, Disbot M, Hollander JE, Shofer FS, Datner EM. The effect of emergency department crowding on patient satisfaction for admitted patients. *Acad Emerg Med*. 2008;15(9):825–831
26. Magaret ND, Clark TA, Warden GR, Magnusson AR, Hedges JR. Patient satisfaction in the emergency department—a survey of pediatric patients and their parents. *Acad Emerg Med*. 2002;9(12):1379–1388
27. Rodi SW, Grau MV, Orsini CM. Evaluation of a fast track unit: alignment of resources and demand results in improved satisfaction and decreased length of stay for emergency department patients. *Qual Manag Health Care*. 2006;15(3):163–170
28. Spaite DW, Bartholomeaux F, Guisto J, et al. Rapid process redesign in a university-based emergency department: decreasing waiting time intervals and improving patient satisfaction. *Ann Emerg Med*. 2002;39(2):168–177
29. Bernstein SL, Aronsky D, Duseja R, et al; Society for Academic Emergency Medicine, Emergency Department Crowding Task Force. The effect of emergency department crowding on clinically oriented outcomes. *Acad Emerg Med*. 2009;16(1):1–10
30. MCN Healthcare. Joint Commission revises two standards related to patient flow through the emergency department. Published May 16, 2012. Available at: [www.mcnhealthcare.com/stayalert/alert/sa\\_2523/Joint-](http://www.mcnhealthcare.com/stayalert/alert/sa_2523/Joint-)



- commission-Revises. Accessed April 14, 2014
31. McHugh M, Van Dyke K, McClelland M, Moss D. *Improving Patient Flow and Reducing Emergency Department Crowding: A Guide for Hospitals*. Prepared by the Health Research and Educational Trust, an affiliate of the American Hospital Association, under contract 290-200-600022, Task Order No. 6. Rockville, MD: Agency for Healthcare Research and Quality; October 2011. AHRQ Publication 11(12)-0094
  32. Institute of Medicine, Committee on the Quality of Health Care in America. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: National Academies Press; 2001:39–60
  33. Chassin MR, Galvin RW; Institute of Medicine National Roundtable on Health Care Quality. The urgent need to improve health care quality. *JAMA*. 1998;280(11):1000–1005
  34. Corrigan JM, O’Kane ME. *Assessing the Quality and Accessibility of Patient Care Provided by Health Plans*. Washington, DC: Physician Payment Review Commission; 1993
  35. Institute of Medicine, Committee on the Future of Emergency Care in the United States Health System. *Emergency Care for Children: Growing Pains*. Washington, DC: National Academies Press; 2006
  36. Centers for Medicare and Medicaid Services. “Standing orders” in hospitals —revisions to S&C memoranda. Memorandum sent to State Survey Agency Directors October 24, 2008. Available at: <https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertificationGenInfo/downloads/SCLetter09-10.pdf>. Accessed April 14, 2014
  37. Zand DJ, Brown KM, Lichter-Konecki U, Campbell JK, Salehi V, Chamberlain JM. Effectiveness of a clinical pathway for the emergency treatment of patients with inborn errors of metabolism. *Pediatrics*. 2008;122(6):1191–1195
  38. Brown K, Martinez A, Sun S, Teach S, Chamberlain J. Addition of a standing order for dexamethasone to an emergency department asthma pathway is associated with improved patient outcomes [abstract]. Presented at Pediatric Academic Societies Annual Meeting; May 1–4, 2010; Vancouver, Canada. Available at: [http://www.abstracts2view.com/pasall/view.php?nu=PAS10L1\\_3290](http://www.abstracts2view.com/pasall/view.php?nu=PAS10L1_3290). Accessed November 12, 2014
  39. Browne GJ, Giles H, McCaskill ME, Fasher BJ, Lam LT. The benefits of using clinical pathways for managing acute paediatric illness in an emergency department. *J Qual Clin Pract*. 2001; 21(3):50–55
  40. Scribano PV, Lerer T, Kennedy D, Cloutier MM. Provider adherence to a clinical practice guideline for acute asthma in a pediatric emergency department. *Acad Emerg Med*. 2001; 8(12):1147–1152
  41. Goldberg R, Chan L, Haley P, Harmata-Booth J, Bass G. Critical pathway for the emergency department management of acute asthma: effect on resource utilization. *Ann Emerg Med*. 1998;31(5): 562–567
  42. Retezar R, Bessman E, Ding R, Zeger SL, McCarthy ML. The effect of triage diagnostic standing orders on emergency department treatment time. *Ann Emerg Med*. 2011;57(2):89–99, e2
  43. Nicholls D, Gaynor N, Shafiei T, Bosanac P, Farrell G. Mental health nursing in emergency departments: the case for a nurse practitioner role. *J Clin Nurs*. 2011;20(3–4):530–536
  44. The Joint Commission. Standards revisions to address patient flow through the emergency department. Oakbrook Terrace, IL: The Joint Commission; 2012. Available at: [www.jointcommission.org/assets/1/18/Pre\\_Publication\\_EDO\\_HAP.pdf](http://www.jointcommission.org/assets/1/18/Pre_Publication_EDO_HAP.pdf). Accessed April 14, 2014
  45. Beal AC, Co JP, Dougherty D, et al. Quality measures for children’s health care. *Pediatrics*. 2004;113(1 pt 2): 199–209
  46. Ferris TG, Dougherty D, Blumenthal D, Perrin JM. A report card on quality improvement for children’s health care. *Pediatrics*. 2001;107(1):143–155
  47. Lindsay P, Schull M, Bronskill S, Anderson G. The development of indicators to measure the quality of clinical care in emergency departments following a modified-delphi approach. *Acad Emerg Med*. 2002;9(11):1131–1139
  48. Guttman A, Razzaq A, Lindsay P, Zagorski B, Anderson GM. Development of measures of the quality of emergency department care for children using a structured panel process. *Pediatrics*. 2006;118(1): 114–123
  49. Hung GR, Chalut D. A consensus-established set of important indicators of pediatric emergency department performance. *Pediatr Emerg Care*. 2008;24(1):9–15
  50. Khan NS, Jain S. Quality initiatives in the emergency department. *Curr Opin Pediatr*. 2010;22(3):262–267
  51. Alessandrini E, Varadarajan K, Alpern ER, et al; Pediatric Emergency Care Applied Research Network. Emergency department quality: an analysis of existing pediatric measures. *Acad Emerg Med*. 2011;18(5):519–526
  52. Armon K, MacFaul R, Hemingway P, Werneke U, Stephenson T. The impact of presenting problem based guidelines for children with medical problems in an accident and emergency department. *Arch Dis Child*. 2004;89(2): 159–164
  53. Wright SW, Trott A, Lindsell CJ, Smith C, Gibler WB. Evidence-based emergency medicine. Creating a system to facilitate translation of evidence into standardized clinical practice: a preliminary report. *Ann Emerg Med*. 2008;51(1):80–86, e1–e8
  54. Bergman DA. Evidence-based guidelines and critical pathways for quality improvement. *Pediatrics*. 1999;103(1 suppl E):225–232
  55. Kinsman L, Rotter T, James E, Snow P, Willis J. What is a clinical pathway? Development of a definition to inform the debate. *BMC Med*. 2010;8:31
  56. Guttman A, Zagorski B, Austin PC, et al. Effectiveness of emergency department asthma management strategies on return visits in children: a population-based study. *Pediatrics*. 2007;120(6). Available at: [www.pediatrics.org/cgi/content/full/120/6/e1402](http://www.pediatrics.org/cgi/content/full/120/6/e1402)
  57. Chin R, Browne GJ, Lam LT, McCaskill ME, Fasher B, Hort J. Effectiveness of a croup clinical pathway in the management of children with croup presenting to an emergency department. *J Paediatr Child Health*. 2002;38(4):382–387

58. Ramarajan N, Krishnamoorthi R, Barth R, et al. An interdisciplinary initiative to reduce radiation exposure: evaluation of appendicitis in a pediatric emergency department with clinical assessment supported by a staged ultrasound and computed tomography pathway. *Acad Emerg Med.* 2009;16(11):1258–1265
59. Isaacman DJ, Kaminer K, Veliyeti H, Jones M, Davis P, Mason JD. Comparative practice patterns of emergency medicine physicians and pediatric emergency medicine physicians managing fever in young children. *Pediatrics.* 2001;108(2):354–358
60. Butterfoss FD, Major DA, Clarke SM, et al. What providers from general emergency departments say about implementing a pediatric asthma pathway. *Clin Pediatr (Phila).* 2006;45(4):325–333
61. Olajos-Clow J, Szpiro K, Julien B, Minard J, Loughheed MD. Emergency department adult asthma care pathway: healthcare providers' perceived utility and barriers to implementation. *Adv Emerg Nurs J.* 2009;31(1):44–53
62. Grol R, Dalhuijsen J, Thomas S, Veld C, Rutten G, Mookink H. Attributes of clinical guidelines that influence use of guidelines in general practice: observational study. *BMJ.* 1998;317(7162):858–861
63. Yen K, Gorelick MH. Strategies to improve flow in the pediatric emergency department. *Pediatr Emerg Care.* 2007;23(10):745–749; quiz 750–751
64. Chan L, Reilly KM, Salluzzo RF. Variables that affect patient throughput times in an academic emergency department. *Am J Med Qual.* 1997;12(4):183–186
65. American College of Emergency Physicians. Boarding of pediatric patients in the emergency department: policy statement. *Ann Emerg Med.* 2012;59(5):406–407
66. LeBaron J, Culberson MC III, Wiley JF II, Smith SR. "Be quick": a systems response to overcrowding in the pediatric emergency department. *Pediatr Emerg Care.* 2010;26(11):808–813
67. Liker J. *The Toyota Way.* New York, NY: McGraw-Hill; 2004.
68. Jimmerson C, Weber D, Sobek DK II. Reducing waste and errors: piloting lean principles at Intermountain Healthcare. *Jt Comm J Qual Patient Saf.* 2005;31(5):249–257
69. Murrell KL, Offerman SR, Kauffman MB. Applying LEAN: implementation of a rapid triage and treatment system. *West J Emerg Med.* 2011;12(2):184–191
70. Fosnocht DE, Swanson ER. Use of a triage pain protocol in the ED. *Am J Emerg Med.* 2007;25(7):791–793
71. Fan J, Woolfrey K. The effect of triage-applied Ottawa Ankle Rules on the length of stay in a Canadian urgent care department: a randomized controlled trial. *Acad Emerg Med.* 2006;13(2):153–157
72. Chan TC, Killeen JP, Kelly D, Guss DA. Impact of rapid entry and accelerated care at triage on reducing emergency department patient wait times, lengths of stay, and rate of left without being seen. *Ann Emerg Med.* 2005;46(6):491–497
73. Choi J, Claudius I. Decrease in emergency department length of stay as a result of triage pulse oximetry. *Pediatr Emerg Care.* 2006;22(6):412–414
74. Abanses JC, Dowd MD, Simon SD, Sharma V. Impact of rapid influenza testing at triage on management of febrile infants and young children. *Pediatr Emerg Care.* 2006;22(3):145–149
75. Karpas A, Hennes H, Walsh-Kelly CM. Utilization of the Ottawa ankle rules by nurses in a pediatric emergency department. *Acad Emerg Med.* 2002;9(2):130–133
76. Maldonado T, Avner JR. Triage of the pediatric patient in the emergency department: are we all in agreement? *Pediatrics.* 2004;114(2):356–360
77. Bergeron S, Gouin S, Bailey B, Amre DK, Patel H. Agreement among pediatric health care professionals with the pediatric Canadian triage and acuity scale guidelines. *Pediatr Emerg Care.* 2004;20(8):514–518
78. Mistry RD, Cho CS, Bilker WB, Brousseau DC, Alessandrini EA. Categorizing urgency of infant emergency department visits: agreement between criteria. *Acad Emerg Med.* 2006;13(12):1304–1311
79. Baumann MR, Strout TD. Evaluation of the Emergency Severity Index (version 3) triage algorithm in pediatric patients. *Acad Emerg Med.* 2005;12(3):219–224
80. Gravel J, Gouin S, Bailey B, Roy M, Bergeron S, Amre D. Reliability of a computerized version of the Pediatric Canadian Triage and Acuity Scale. *Acad Emerg Med.* 2007;14(10):864–869
81. Rapid ED access reduces patients leaving without being seen. *Perform Improv Advis.* 2005;9(10):114–115, 109
82. Nestler DM, Fratzke AR, Church CJ, et al. Effect of a physician assistant as triage liaison provider on patient throughput in an academic emergency department. *Acad Emerg Med.* 2012;19(11):1235–1241
83. Doan Q, Sabhaney V, Kisson N, Sheps S, Singer J. A systematic review: the role and impact of the physician assistant in the emergency department. *Emerg Med Australas.* 2011;23(1):7–15
84. Jeanmonod R, Delcollo J, Jeanmonod D, Dombchewsky O, Reiter M. Comparison of resident and mid-level provider productivity and patient satisfaction in an emergency department fast track. *Emerg Med J.* 2013;30(1):e12
85. Hooker RS, Klocko DJ, Larkin GL. Physician assistants in emergency medicine: the impact of their role. *Acad Emerg Med.* 2011;18(1):72–77
86. Hoskins R. Evaluating new roles within emergency care: a literature review. *Int Emerg Nurs.* 2011;19(3):125–140
87. Carter AJ, Chochinov AH. A systematic review of the impact of nurse practitioners on cost, quality of care, satisfaction and wait times in the emergency department. *CJEM.* 2007;9(4):286–295
88. Ganapathy S, Zwemer FL Jr. Coping with a crowded ED: an expanded unique role for midlevel providers. *Am J Emerg Med.* 2003;21(2):125–128
89. Sanchez M, Smally AJ, Grant RJ, Jacobs LM. Effects of a fast-track area on emergency department performance. *J Emerg Med.* 2006;31(1):117–120
90. Callander EJ, Schofield DJ. Emergency department workforce models: what the literature can tell us. *Emerg Med Australas.* 2011;23(1):84–94
91. Simon LV, Matteucci MJ, Tanen DA, Roos JA, Riffenburgh RH. The Pittsburgh

- Decision Rule: triage nurse versus physician utilization in the emergency department. *J Emerg Med.* 2006;31(3):247–250
92. Doctor in triage slices door-to-discharge times. *ED Manag.* 2006;18(5):54–55
  93. 'PIT' more than triples ED's satisfaction rates. *ED Manag.* 2007;19(9):101–102
  94. Burström L, Nordberg M, Ornung G, et al. Physician-led team triage based on lean principles may be superior for efficiency and quality? A comparison of three emergency departments with different triage models. *Scand J Trauma Resusc Emerg Med.* 2012;20:57
  95. Rogg JG, White BA, Biddinger PD, Chang Y, Brown DF. A long-term analysis of physician triage screening in the emergency department. *Acad Emerg Med.* 2013;20(4):374–380
  96. Han JH, France DJ, Levin SR, Jones ID, Storrow AB, Aronsky D. The effect of physician triage on emergency department length of stay. *J Emerg Med.* 2010;39(2):227–233
  97. Cheng I, Lee J, Mittmann N, et al. Implementing wait-time reductions under Ontario government benchmarks (Pay-for-Results): a cluster randomized trial of the effect of a physician-nurse supplementary triage assistance team (MDRNSTAT) on emergency department patient wait times. *BMC Emerg Med.* 2013;13:17
  98. Davidson J, Rogers T. A lesson from the UK? *Australas Emerg Nurs J.* 2005;8(1-2):5–8
  99. Gorelick MH, Yen K, Yun HJ. The effect of in-room registration on emergency department length of stay. *Ann Emerg Med.* 2005;45(2):128–133
  100. Bar-coded patient IDs cut LOS nearly one hour. *ED Manag.* 2004;16(12):139–140
  101. Fagbuyi DB, Brown KM, Mathison DJ, et al. A rapid medical screening process improves emergency department patient flow during surge associated with novel H1N1 influenza virus. *Ann Emerg Med.* 2011;57(1):52–59
  102. Cooke MW, Wilson S, Pearson S. The effect of a separate stream for minor injuries on accident and emergency department waiting times. *Emerg Med J.* 2002;19(1):28–30
  103. Hung GR, Whitehouse SR, O'Neill C, Gray AP, Kissoon N. Computer modeling of patient flow in a pediatric emergency department using discrete event simulation. *Pediatr Emerg Care.* 2007;23(1):5–10
  104. Silvestri A, McDaniel-Yakscoe N, O'Neill K, et al. Observation medicine: the expanded role of the nurse practitioner in a pediatric emergency department extended care unit. *Pediatr Emerg Care.* 2005;21(3):199–202
  105. Mace SE. Pediatric observation medicine. *Emerg Med Clin North Am.* 2001;19(1):239–254
  106. Scribano PV, Wiley JF II, Platt K. Use of an observation unit by a pediatric emergency department for common pediatric illnesses. *Pediatr Emerg Care.* 2001;17(5):321–323
  107. Hostetler B, Leikin JB, Timmons JA, Hanashiro PK, Kissane K. Patterns of use of an emergency department-based observation unit. *Am J Ther.* 2002;9(6):499–502
  108. Connors GP, Melzer SM, Betts JM, et al; Committee on Hospital Care; Committee on Pediatric Emergency Medicine. Pediatric observation units. *Pediatrics.* 2012;130(1):172–179
  109. Zebrack M, Kadish H, Nelson D. The pediatric hybrid observation unit: an analysis of 6477 consecutive patient encounters. *Pediatrics.* 2005;115(5). Available at: [www.pediatrics.org/cgi/content/full/115/5/e535](http://www.pediatrics.org/cgi/content/full/115/5/e535)
  110. Crocetti MT, Barone MA, Amin DD, Walker AR. Pediatric observation status beds on an inpatient unit: an integrated care model. *Pediatr Emerg Care.* 2004;20(1):17–21
  111. Espinosa G, Miró O, Sánchez M, Coll-Vinent B, Millá J. Effects of external and internal factors on emergency department overcrowding. *Ann Emerg Med.* 2002;39(6):693–695
  112. Forster AJ, Stiell I, Wells G, Lee AJ, van Walraven C. The effect of hospital occupancy on emergency department length of stay and patient disposition. *Acad Emerg Med.* 2003;10(2):127–133
  113. Hillier DF, Parry GJ, Shannon MW, Stack AM. The effect of hospital bed occupancy on throughput in the pediatric emergency department. *Ann Emerg Med.* 2009;53(6):767.e3-776.e3
  114. Asplin B, Blum FC, Broida RI, et al. American College of Emergency Physicians Task Force Report on Boarding. Emergency medicine crowding: high-impact solutions. Irving, TX: American College of Emergency Physicians; April 2008. Available at: [www.acep.org/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=50026&libID=50056](http://www.acep.org/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=50026&libID=50056). Accessed April 14, 2014
  115. Children's Hospitals' Solutions for Patient Safety. Web-based SPS network: together, saving lives & reducing harm. 2013. Available at: [www.solutionsforpatientsafety.org/wp-content/uploads/SPS\\_2013AnnualReport.pdf](http://www.solutionsforpatientsafety.org/wp-content/uploads/SPS_2013AnnualReport.pdf). Accessed April 14, 2014
  116. Bonow RO, Masoudi FA, Rumsfeld JS, et al; American College of Cardiology/American Heart Association Task Force on Performance Measures. ACC/AHA classification of care metrics: performance measures and quality metrics: a report of the American College of Cardiology/American Heart Association Task Force on Performance Measures. *Circulation.* 2008;118(24):2662–2666
  117. Emergency Nurses Association. Holding, Crowding and Patient Flow. Position Statement. Des Plaines, IL: Emergency Nurses Association; 2014. Available at: [www.ena.org/SiteCollectionDocuments/Position%20Statements/Holding.pdf](http://www.ena.org/SiteCollectionDocuments/Position%20Statements/Holding.pdf). Accessed November 10, 2014