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Principles of Pediatric Patient Safety: Reducing Harm Due to Medical Care

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COUNCIL ON QUALITY IMPROVEMENT AND PATIENT SAFETY, COMMITTEE ON HOSPITAL CARE

abstract

Pediatricians render care in an increasingly complex environment, which results in multiple opportunities to cause unintended harm. National awareness of patient safety risks has grown since the National Academy of Medicine (formerly the Institute of Medicine) published its report "To Err Is Human: Building a Safer Health System" in 1999. Patients and society as a whole continue to challenge health care providers to examine their practices and implement safety solutions. The depth and breadth of harm incurred by the practice of medicine is still being defined as reports continue to reveal a variety of avoidable errors, from those that involve specific high-risk medications to those that are more generalizable, such as patient misidentification and diagnostic error. Pediatric health care providers in all practice environments benefit from having a working knowledge of patient safety language. Pediatric providers should serve as advocates for best practices and policies with the goal of attending to risks that are unique to children, identifying and supporting a culture of safety, and leading efforts to eliminate avoidable harm in any setting in which medical care is rendered to children. In this Policy Statement, we provide an update to the 2011 Policy Statement "Principles of Pediatric Patient Safety: Reducing Harm Due to Medical Care."

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BACKGROUND INFORMATION

Patient safety is defined as the prevention of harm to patients.[1] Although patient safety is only 1 of the 6 domains of quality of care defined by the National Academy of Medicine (formerly the Institute of Medicine [IOM]),[2] it is undoubtedly one of the most important. There are real and growing concerns regarding pediatric errors and harms reported related to specific populations, such as with the use of temporary names in newborn care,[3] as well as issues spanning all populations, such as diagnostic errors in ambulatory and hospital settings[4] and information technology errors in prescribing.[5] Pediatricians in all practice settings can help champion the

concept that patient safety means preventing injury to children caused not only by life's accidents but also directly by the health care system.

Over the past several years, patient safety has become a key priority for health systems. Since the publication of the 1999 IOM report "To Err Is Human: Building a Safer Health System," there have been dramatic increases in research, standards, collaborative efforts, education, and measures focused on patient safety.[1,6–9] Much has been learned about pediatric patient safety. However, despite increased awareness, harm to patients is still common and has not shown a significant decline.[10] Errors still affect as many as one-third of all hospitalized children[11,12] and an unknown number of children in ambulatory settings.

In this Policy Statement, we summarize the current understanding of issues and practices to minimize pediatric medical errors and improve the quality of care. Three key issues are the focus in this Policy Statement: the significance of pediatric patient safety, the science behind the culture of safety, and strategies to ensure patient safety.

STATEMENT OF THE PROBLEM: SIGNIFICANCE OF PEDIATRIC PATIENT SAFETY

Pediatric medical errors and patient harm both differ in several ways from the errors and harms associated with adults. Children are at greater risk of medication errors than are adults because of childhood development, demographics, dependency on parents and other care providers, and the different epidemiology of medical conditions.[13] Errors in prescribing, dispensing, and administering medications represent a substantial portion of the preventable medical errors in children despite electronic prescribing.[5,14–17] Electronic health records (EHRs) are most often

designed for adults and have limited effectiveness in reducing a variety of pediatric-specific errors. Moreover, these EHRs may cause increases in errors and harms until they are modified with customized decision support, such as weight-based and body surface area–based dosing.[18–20]

Reasons for the unique attributes of patient safety problems and solutions for children are multifactorial. Woods et al[21] detailed these factors as involving 3 key domains: (1) physical characteristics (eg, weight-based medication dosing), (2) developmental issues (eg, physical or mental age), and (3) issues regarding legal status as a minor (ie, lack of adult assistance in care of confidential health concerns). Layered onto these distinguishing characteristics is a general patient safety approach that involves 3 main components: (1) awareness of the epidemiology of errors and the institution of methods for error identification; (2) the integration of improvement science, including a safety culture, into daily work; and (3) the creation and implementation of core patient-safety solutions. Each of these components can be incorporated into pediatric patient safety risk assessment and solution development, with attention paid to the unique domains of pediatric patient safety risks.[21]

Pediatric errors in the inpatient setting have been reviewed by several investigators.[22–24] A study of hospitalized, pediatric, nonnewborn patients in the United States revealed a medication error rate of 1.81 to 2.96 per 100 discharges.[25] Teaching hospitals and settings where patients had more complex medical needs showed significantly higher error rates, whereas sex, payer, and zip code did not significantly affect outcomes. Among 10 778 orders in 1120 admissions reviewed by Kaushal et al[14] in 2 academic pediatric hospitals, there were 616 medication errors (5.7%), or 55

medication errors per 100 admissions. They also identified 26 adverse drug events (0.24%), of which 5 (19%) were preventable by using computerized physician order entry (CPOE) or unit-based clinical pharmacists. Serious errors occurred more often in critical-care settings, and potential adverse drug events occurred 3 times more frequently among pediatric patients than among adults. This 2001 publication predated significant EHR use, and the authors cited CPOE as a potential solution but also identified the need for ward-based clinical pharmacists. A 2016 study of 41 pediatric inpatient facilities in which a validated tool was used revealed that these pediatric CPOE systems were able to be used to identify 62% of potential medication errors in test scenarios, but this ability to detect errors varied widely across the sites, from 23% to 91%, and had no association with the EHR vendor.[26] Importantly for pediatric care, in which dose calculation errors are common, institutions did fairly well in this study when identifying dosing errors for a single inappropriate dose. An average of 81.1% (95% confidence interval 72.7%–89.5%) of these errors were identified across all 41 sites, suggesting that customized EHRs can aid in error avoidance. Other studies, including one in which a trigger tool was used, have revealed myriad nonmedication harms, with total rates as high as 40 harms per 100 patients.[27] Harms reported include accidental extubation, pressure ulcers, patient misidentification, delays in diagnosis, intravenous infiltrates, and other adverse events attributed to communication, training, and systems failures.[27] In children with chronic diseases, who by nature have a greater number of medications and medical interventions, the error rate can be higher.[28] In the Vermont Oxford Network, an analysis of medical errors in NICUs revealed that 47% of the cases involved medications, 14%

involved errors in the administration of or method of using a treatment, 11% involved patient misidentification, and 7% involved delays or errors in diagnosis.[8,29,30]

Pediatric errors in emergency department (ED) settings may be attributable to multiple factors, including incorrect patient identification, lack of experience of many ED staff with pediatric patients versus with adults, and challenges with performing technical procedures in and calculating medication doses for children.[31,32] Other sources of error include communication between prehospital and ED staff; among ED staff, particularly during change-of-shift sign off; between ED and inpatient staff; and between ED staff and family members. The use of a standardized hand-off process has been shown to decrease errors.[33,34] Other important sources of errors in the ED include diagnostic mistakes, medication errors unrelated to dose calculation, and environmental deficits, such as equipment malfunction. In a Canadian pediatric ED, 100 prescribing errors and 39 medication administration errors occurred per 1000 patients.[35]

Pediatric errors in the ambulatory setting have more limited published studies despite the fact that children have far more outpatient than hospital care interactions.[16,36,37] The Learning From Errors in Ambulatory Pediatrics study revealed 147 medical errors reported in 14 practices over 4 months (no denominator was reported).[38] The largest group of errors was attributed to medical treatment (37%). Other errors included patient identification (22%); preventive care, including immunizations (15%); diagnostic testing (13%); patient communication (8%); and less frequent causes. Among medical treatment errors, 85% were medication errors. Of these, 55% were related to prescribing errors, 30% were related to failure to order,

11% were related to administration, 2% were related to transcribing, and 2% were dispensing errors. In a prospective cohort study at 6 pediatric practices in or near Boston, Massachusetts, over a 2-month period, 3% of 1788 patients had preventable adverse drug events.[39] The preventive strategies with the most potential to reduce errors were determined to be improved communication between providers and parents and between pharmacists and parents. Among new prescriptions for 22 common medications in outpatient pediatric clinics, 15% were issued with potential dosing errors.[40] In addition, drug samples are often dispensed with inadequate documentation.[15] Children with special health care needs have been reported to be at higher risk for medication errors.[36,37,41]

In a general pediatric practice with 26 000 visits per year, Neuspiel et al[16] reported 216 medical errors over a 30-month period from 2008 to 2010. The most frequent reports in both paper and electronic systems were of misfiled or incorrectly entered patient information (32%), laboratory tests being delayed or not being performed (13%), medication prescription or dispensing errors (11%), immunization errors (10%), a requested appointment or referral not being given (7%), and delays in office care (7%); together, these errors comprised 80% of all reports. In this practice, a voluntary, nonpunitive, multidisciplinary team approach was effective in improving error reporting, investigating causes of reported errors, and implementing safety promotion strategies.

In addition to these setting-specific errors, the National Academies of Sciences, Engineering, and Medicine has turned attention to diagnostic decision-making as perhaps the most frequent source of medical error. Errors or delay in diagnosis may be caused by cognitive errors, such as

premature closure (the tendency to prematurely end the decision-making process without considering other possible diagnoses), posterior probability error (the likelihood that diagnosis is overly influenced by previous events), and failures attributable to inexperience, fatigue, or lack of training.[4] The use of inappropriate or outmoded tests or therapies or failure to act on results of monitoring or testing are frequently cited as a basis for malpractice litigation. Of closed pediatric malpractice claims from 2003 to 2012 in the United States, the most frequent cause reported was error in diagnosis.[42] In balance with this is the awareness of potential harms caused by unnecessary medical care and overdiagnosis. The Choosing Wisely campaign (choosingwisely.org) was initiated to reduce overuse in certain conditions and diseases. This campaign includes statements from national societies, including the American Academy of Pediatrics (AAP),[43] regarding conditions for which best evidence supports not performing certain tests or treatments that by themselves can lead to a diagnosis or treatment based on incidental findings.[44] When applied judiciously, these recommendations can lead to a reduction in potential errors and harm events via avoidance of the event itself.

THE SCIENCE OF PATIENT SAFETY

The Safety Culture

In addition to understanding the epidemiology of medical harm to children, the awareness and attitudes of health care providers regarding patient safety are important. Specifically, a culture of safety is fundamental for avoiding patient harm and emphasizes the improvement of systems rather than blaming individual people. This culture supports responding to errors or potential errors in real time, with

the expectation being to escalate or "stop the line" when safety is of concern. Society is demanding a safer health care system. State and federal agencies (eg, the Centers for Medicare and Medicaid Services), certifying organizations (eg, The Joint Commission and the American Board of Pediatrics), and professional societies (eg, the AAP) also have patient safety expectations.[45,46] These combined forces are placing greater pressure on the health care community to develop a culture of safety in which leaders and members understand and act on the basis of a systems approach.

Human-Factors Perspective

A culture of safety addresses human fallibility by concentrating on the conditions under which people work and building defenses to avert errors or mitigate their effects.[47] The culture of safety does not focus on errors of individual people because errors within organizations that deal with high-hazard processes rarely have their ultimate cause rooted in individual behavior.[48] High-reliability organizations recognize variability as a constant and are focused on minimizing that variability and its effects. The basis for this framework in health care rests on research in high-hazard industries (eg, aviation, nuclear power, and petrochemical industries) that have significantly decreased the incidence of catastrophic events.[49,50] Although the complexity of medical care may present difficulties in creating a culture of safety, the science of human factors (the focus on how people interact with each other and their environment) provides common principles that can endow health care providers with the resilience to avoid errors and adverse events.

The optimal culture of safety requires an organizational culture that supports 3 key elements: reporting, flexibility, and learning. The goal of a culture of safety is to be an informed culture with constant attentiveness and commitment to avoiding failures by endorsing a reluctance to accept simple explanations for errors that occur (by adhering to a structured investigation of events), commitment to resilience (with debriefing and support after events and integrating consistent skills training), deference to expertise (in which any member of the team can assume a leadership role for a given event on the basis of expertise and skills), and sensitivity to systems-based practices (by promoting team training, communication, and awareness of the effect of the environment on patient care).[51]

For an organization to be informed, it needs to have a "reporting culture." In a reporting culture, providers collect, analyze, and disseminate data about medical errors and adverse events. In this culture, frontline staff with direct patient care contact are willing and able to report errors and adverse events without fear of retribution. Crucial to this culture are the abilities of staff as well as patients and families to communicate easily, confidentially, or anonymously to entities that are separate from those with disciplinary functions. Those filing reports also need to be provided with timely and useful feedback.[16,52,53]

Organizations with a "just culture" encourage and reward error reporting by maintaining a nonpunitive environment. A just culture focuses on a systems approach to human fallibility while holding accountable those who intend to harm or intentionally fail to adhere to policies and procedures that are designed to keep patients safe.[54]

An optimal culture of safety has a "flexible culture" that is capable of adapting effectively to changing demands. A flexible culture depends on staff who consistently adhere to proven protocols and standards and leaders who are chosen not merely by rank but instead by expertise. For the care of children, defining this expertise includes the assessment of specific training and skills necessary to safely render care while attending to patient factors, such as varied ages, disease states, and developmental needs. This culture depends on teamwork; shared values; the use of well-tested standardized operating procedures and prospective risk assessment, such as failure modes and effects analysis; and investment in staff training.[49]

Finally, a "learning culture" promotes an environment in which individuals have the competence and will to make the right conclusions on the basis of safety information and will implement changes when needed, supported by evidence-based guidelines whenever available.[55–57] Providers in this culture learn from mistakes through system-oriented assessments (such as root-cause analyses), share that learning throughout the whole organization, and do not hide mistakes. A culture of safety promotes a compassionate disclosure of errors to those who have suffered harm from those mistakes.[58,59]

These cultures interact to create an informed system that perpetuates safety independent from individual personalities or external forces and provide a set of principles that promote a common culture of safety across our complex medical system. The Agency for Healthcare Research and Quality (AHRQ) has developed safety culture surveys for the hospital and office settings that may be useful to identify specific gaps and monitor improvements.[60]

PATIENT SAFETY STRATEGIES

Despite best efforts by health care providers, active error detection, and an ideal safety culture, errors will inevitably occur in systems as complex as health care. Although it was published 20 years ago, the 1999

FROM THE AMERICAN ACADEMY OF PEDIATRICS

IOM report's key safety-design concepts remain solid foundational elements to consider when striving to reduce medical errors.[1] Additional guidance on creating systems can be found in the IOM principles for the design of safety systems in health care organizations (Appendix).

Methods used to assess and resolve patient safety issues incorporate the IOM's broad key safety-design concepts to improve reliability through redundancy, simplification, and standardization.[1] Specific goals, such as accurate patient identification and the prevention of indwelling catheter infections, are amenable to the introduction of checklists, double-checks at the bedside, or forcing functions, such as mandated barcode scanning before a drug can be administered to a given patient.[61] Liquid dosing errors can be addressed with in-office videos, effective measurement devices, teach-back and show-back counseling techniques, and picture-based handouts.[62] Evidence-based clinical practice guidelines can direct care decisions both toward wanted and away from unwanted actions, resulting in reduced opportunities for harm and in improved outcomes.[57]

Other safety goals, such as the recognition of a change in a patient's status or encouraging patient and family involvement in the patient's care, require a composite of changes to health care systems and expectations of both providers and consumers. In addition to involving patients and families in family-centered rounds in all units, many institutions are encouraging families to report safety concerns to enhance the prevention and identification of problems.[63] Patient- and family-centeredness play important roles in the culture of safety, including consideration of ethnic culture and language as well as health literacy level.[64–66]

Leadership

In "To Err Is Human," the IOM addressed the need for national leaders to set goals for patient safety but also charged that "Chief Executive Officers and Boards of Trustees should be held accountable for making a serious, visible and ongoing commitment to creating safe systems of care."[1] This charge to have leaders engaged in patient safety at all levels—unit, clinic, and system—is more critical now as systems merge and affiliate, which can lead to potentially unclear lines of responsibility for quality-of-care oversight across care delivery sites. This stewardship of patient safety applies to pediatric leaders in all settings. Leaders and clinicians who strive to improve patient safety need to appraise their organizations' safety culture and advocate for the best means for implementing safety strategies.

Clinicians need to be involved to support the success of patient safety as part of larger quality-improvement efforts. Roles vary and depend on the type of clinician, practice setting, and system. In all settings, individual physician participation includes taking responsibility for ongoing knowledge and practice of patient safety principles, providing patient and parent education, actively engaging in safety efforts, and working effectively within a multidisciplinary structure.[67,68] Although financial incentives may be used to facilitate involvement, providing clinicians with data and reminders and ensuring their involvement in designing processes of care are most compelling. Group leaders can perform a physician and/or practice patient-safety assessment on topics such as medication management, clinical (eg, laceration repair), or administrative (eg, acknowledgment of laboratory results) procedures. Leaders also can initiate patient safety projects, such as creating a tracking system for high-risk pregnant teenagers or a tool for parents of children with special needs that clearly defines what changes in clinical status should prompt a call to which specific clinician (Appendix). System leaders' goals and external agency mandates may target changes with a wider impact, such as a multidisciplinary approach toward medication reconciliation.[69,70]

In community and adult settings, there is an added need to advocate for pediatric-specific issues. Physician participation on key hospital committees, such as pharmacy and therapeutics, information technology, sedation, the rapid-response team, and ambulatory clinical practice, is invaluable. The creation of a pediatric multidisciplinary safety team that reports to the hospital or larger medical group board can be a productive way to link specialists and ancillary providers to promote cross-communication on safety issues for children. Pediatric expertise can be of great value when creating diagnosis and/or treatment protocols for nonpediatric clinicians who care for children.

Role of Information Technology

Pediatric-specific technological support of safety is improving, yet most interventions are still in the development phase. Although information technology cannot be used to solve all challenges to patient safety, some issues are particularly amenable to technological solutions in hospital and ambulatory settings. Since the publication of the (now retired) AAP Policy Statement "Prevention of Medication Errors in the Pediatric Inpatient Setting,"[71] it has become more apparent that CPOE systems require robust decision support to be safe and effective.[18,72–76] Some decision-support rules for drug and dosing schedules and CPOE systems are now commercially available for children; however, most of them are still created locally. Order sets, reminders, and evidence-based clinical practice

guidelines embedded within information systems increase adherence to best practices. The use of electronic equipment (specifically, programmable "smart" infusion pumps) has resulted in improved detection of medication errors and decreases in calculation and administration errors.[77]

Technological solutions to medical safety concerns mostly have been applied to pediatric inpatient settings. Barcoding has been used to compare identification bands with medications and blood products before administration.[61] These systems can also be used to identify areas for improved efficiency in time for critical medication administration. Telemedicine systems can be used within a site to allow for audiovisual team communication and enhance response to critical events; however, these systems are not yet widely available. Computers can generate code sheets for bedside posting and link to a patient's most recently updated visit list for patients within an enclosed system. Electronic patient-tracking systems and equipment linked to the EHR can assist with patient flow, the notification of abnormal study results, reduced data entry error, and the identification of changes in clinical status.[78]

Other advances apply to patients seen in varied health care settings. Visual media can be used for more than documenting improvements in examination findings. Patient body diagrams and patient photos can offer clarity when discriminating sidedness (left or right) or offer evidence of catheter locations.[79,80]

Despite noted advantages of EHRs, limitations still exist, including access to technological support, variable ease of use, physician acceptance, implementation and ongoing costs, need for continued end-user training, software integration into existing facility systems and outside providers

and vendors, standardization across systems, the increase in errors after implementation, and ability to address only a subset of potential medical errors. Other examples of medical errors that currently challenge decision-support programs include inappropriate selection of medication for the condition being treated, failure to recognize a change in patient status, alarm fatigue leading to failure or delays in response, excessive data autopopulating notes, documentation copy and paste without editing, and others. The loss of or barriers to accessing information across disparate EHRs is notable at transitions of care and can lead to failures in medication reconciliation, duplicate testing, failure to act on test results, and other harms.

Patient Safety Goals and Efforts

Current national patient-safety efforts are embedded in the work of many organizations, such as the National Quality Forum, Institute for Healthcare Improvement–National Patient Safety Foundation, AHRQ, National Institute for Children's Health Quality, Institute for Safe Medication Practices, and others. The Joint Commission's national patient safety goals and campaign initiatives by the Institute for Healthcare Improvement–National Patient Safety Foundation are among the most relevant.[9] The Joint Commission (as well as other organizations, such as the AHRQ, the National Institute for Children's Health Quality, etc) required that elements for patient care include verbal, written, and electronic communication of test results; information transfer at transitions of care (handoffs); medication reconciliation; and ensuring patient and/or family understanding of care plans.[81] The Joint Commission requires hospitals to reduce the risk of health care–associated infections, such as multidrug-resistant organism infections, central line–associated

bloodstream infections, and surgical-site infections, and improve the recognition of and response to changes in a patient's condition, for which many pediatric hospital rapid-response teams are using the Pediatric Early Warning System.[82] Family-centered care is of particular importance and value for children in high-risk settings, such as the ED, and for children with special needs. Patients and families ideally are able to articulate care plans and demonstrate understanding of the anticipated treatment outcome. Stress and fatigue also have been associated with errors, and national efforts focused on reducing workplace stress for physician trainees and other staff are being promoted.[83–85] Diagnostic errors are receiving more attention as well.[86] Medication management continues to be a specific focus for children because of variations in body weight, body surface area, organ system maturity, developmental stage of absorption and excretion ability, dependence on others for medication administration, and need for specially compounded formulations.[45] Accurate weight scales that only measure in metric units (kilograms or grams),[87] standardized equipment throughout a system, drug dose range limits, programmable "smart" infusion pumps for hospitals, and standardized order sets should be used.[88,89] Drug shortages have recently become an additional safety risk.[90] Clinical pharmacists who are trained in pediatrics are invaluable for medication reconciliation (especially for high-risk children) and may be integrated into inpatient rounds and used for the education of staff and families in all settings as often as possible.[80] The use of differing measurement systems (eg, teaspoon versus milliliter) also result in confusion for health care providers and the public.[91,92]

The AAP has launched webinars and Web sites and has partnered with other national leaders to offer specific

tools, resources, and links to best health care safety practices for children (Appendix). Collaborative implementation and the measurement of both the process (adherence to practice) and clinical outcomes of shared strategies are necessary to track and refine care practices for all children. A network of >110 children's hospitals (Solutions for Patient Safety) has set the goal of 0 harms to children with reporting by participating institutions.[93] The realities of penalties for hospital-acquired conditions have brought attention to these events a priority for hospitals. Although clinician engagement is central to success in these endeavors, to date, there are limited pediatric-focused safety-related metrics with an impact on individual providers. However, adult providers are already having to report their individual performance on measures through the Merit-Based Incentive Payment System of the Medicare Access and Children's Health Insurance Program Reauthorization Act of 2015. It would be anticipated that some similar payment model may be implemented for the Medicaid population, which comprises a large percentage of most pediatric provider practices. It is incumbent on pediatricians to engage in safety-improvement networks and lead in identifying feasible and valid metrics for the many medical environments in which children receive care.

CONCLUSIONS

The field of pediatric patient safety has matured much in recent years; there are now more robust data on the epidemiology of errors in children, and there is a meaningful understanding of the concept and measurement of a culture of safety, clear guidance on key elements of patient safety solutions, and an introduction of successful pediatric patient safety solutions. Nonetheless, continued work is needed to infuse these data and concepts into everyday pediatric practice for all clinicians, and special attention should be paid to the training of new clinicians and integrating patient safety into ongoing medical education to help the future workforce incorporate all the tenets of pediatric patient safety as part of everyday work life. It is only through the complete incorporation of the culture of safety, assumption of personal responsibility for patient care outcomes, increasing examination of risk areas for pediatric patient safety, and deployment and rigorous evaluation of systems enhancements that the risks of medical errors to children can be reduced further.

RECOMMENDATIONS

Reducing pediatric patient harm attributable to medical care requires identifying and reporting errors and adverse events, disseminating best practices to prevent errors, and cultivating a culture of safety. Many interventions to improve the culture of safety are available and are based on principles derived from the experiences of other high-risk industries. These processes have been successful in reducing the incidence of catastrophic events, and their implementation in health care should be encouraged. The outcomes of these interventions should be rigorously measured with valid and reliable tools and monitored for their effectiveness in health care. Leadership is needed to continue to make and accelerate a transformation that acknowledges that health care providers (1) work in high-risk, complex environments; (2) are fallible humans, and therefore, medical errors will occur; (3) are independently and collectively accountable for patient safety; and (4) are integral to the success of systems change. Continuous system improvements are central to creating a culture of safety through reporting errors and adverse events, being just and flexible, and learning and implementing change on the basis of experience and rigorous science.

To help create and propel a comprehensive, accelerated approach toward pediatric patient safety, the following recommendations are made for all pediatricians and other health care providers and organizations caring for children:

1. Raise awareness and improve working knowledge of pediatric patient safety issues and best practices throughout the pediatric community.

    a. Educate and train: Expand interprofessional educational efforts to reach a broad scope of clinicians. Support structures that allow for all clinicians to identify pediatric patient safety issues and describe what they can do to improve them both individually and within systems. Include patient safety curricula for all child health trainees. Emphasize the importance of communication among teams, with patients and parents, and with referring providers.

    b. Network: Participate in available patient safety programming at national and regional meetings to encourage the sharing of patient safety issues and best practices among pediatric clinicians.

    c. Create a safety culture: Challenge all organizations, including practices of all sizes that care for children, to adopt a plan that informs, supports, and educates on pediatric patient safety. Use appropriate local examples of improvements initiated because of errors or "good catches" in which harms were avoided to create a safety culture. Strive to develop programs that support members to improve their

safety culture in their clinical care settings. Start any group meeting with a 2- to 3-minute "safety story" from your own practice that highlights "good catch" or real-harm events from which we can learn.

d. Implement and use standardized protocols of care for specific conditions, such as checklists or clinical practice guidelines, and monitor adherence.

e. Expand focus: Direct the attention of pediatric health care providers to safety in ambulatory settings, including the family-centered medical home and other locations where children receive care. Develop patient safety metrics for the ambulatory pediatric setting, including the home and school environments.

2. Act and advocate to minimize preventable pediatric medical harm by using information on pediatric-specific patient-safety risks.

a. Develop pediatric-specific error reporting: In collaboration with governmental and private entities, develop and support broad-scale pediatric error-reporting systems and analysis of submitted events. Establish nonpunitive medical error-reporting systems in pediatric practices and on interprofessional teams to review and act on reported errors. Identify trends and areas in need of action by using these data to guide action on pediatric patient safety risks.

b. Foster leadership: Take individual responsibility for maintaining awareness of pediatric patient safety issues. When possible, lead or participate in practice-based safety initiatives and quality or patient-safety committees in

any setting, including ambulatory, hospital-based, community, or tertiary-care centers. Spread the current hospital-based focus on patient safety to the ambulatory setting through the designation of patient safety champions for practices.

c. Enhance family-centered care, actively engage patients and families in safety at all points of care, and address issues of ethnic culture, language, and health literacy. Direct families to appropriate resources, and review patients' rights and responsibilities from the perspective of safety. Involve families in identifying, creating, and implementing patient safety best practices with attention to the medical home model in the ambulatory setting. Engage families in creating safety materials and participating in safety committees. Identify opportunities for families to aid in improvements related to health literacy, handoffs, and school and home care, among others. Leverage EHR portals and tools to directly communicate and share materials with patients and families.

3. Improve health care outcomes for children by adhering to proven best practices for improving pediatric patient safety.

a. Adhere to best practices: Disseminate and exercise proven patient safety interventions, such as vigilant hand-washing, timeouts before procedures, and rigorous patient identification processes and medication reconciliation, particularly in ambulatory settings and for children with special health care needs. Embed safety strategies, such as redundancy, forcing functions, barcoding, standardized order sets, and evidence-based clinical practice guidelines (Appendix)

whenever possible. Consider using data from national medical liability carriers to help identify areas of research regarding medical errors and patient safety.

b. Target drug safety: In collaboration with regulatory agencies, focus efforts on medication safety by advocating for the development and study of effective and safe pediatric medications and formulations and for the withdrawal of medications with unfavorable risk/benefit ratios; promoting the standardization of concentrations in compounded medications; developing, spreading, and advocating for pediatric-specific health care information technology for drug delivery; educating providers on methods to reduce medication errors, including medication reconciliation; ensuring that providers maintain access to and proficiency in the use of a comprehensive and current pharmaceutical knowledge base; and creating policies that advocate for safe medication delivery to children in all health care settings, including effective liquid measurement devices coupled with teach-back and other advanced counseling techniques.

c. If in a position to do so, help redesign clinical systems: Instill safety-design concepts when renovating or creating medical care systems and processes. Focus on human-factor issues in patient safety and include pediatric-specific information technological advancements whenever possible (eg, when implementing barcoding and CPOE systems). Partner with and urge government and other agencies and industries to identify, test, share, and study information systems that

support the unique needs of the pediatric population. Support a change from the current "1 facility at a time," pediatric-specific EHR improvements that result in variations across organizations to meaningful vendor engagement in creating a united pediatric platform that is available equitably across care settings and users.

d. Leadership: Support and expand research to identify and refine effective pediatric patient safety interventions and study how information technology and human factors affect health care teams and the care they deliver. Motivate national health care research-funding systems to include a mandatory pediatric patient safety component.

APPENDIX: TOOLS, PROJECT GUIDES, AND CULTURE OF SAFETY INTERVENTIONS

Tools and resources from the AAP include the following.

- These are available on the AAP's Web site[94]:
  - advocacy and payment resources;
  - a searchable list of opportunities to engage in quality improvement at the AAP;
  - AAP members' activities and information; and
  - a list of AAP quality groups and programs.
- The National Center for Medical Home Implementation: The AAP's National Center for Medical Home Implementation Web site is the premier resource for improving the lives of children and youth with special health care needs and their families through a medical home. For

more information, visit https://medicalhomeinfo.aap.org.

- Partnership for Policy Implementation (PPI): In June 2005, the AAP launched the PPI, a pilot program to integrate health information technology functionalities into AAP policy. The goal of the PPI is to create fundamental paradigm shifts in the development of clinical guidance and recommendations with a specific focus on developing recommendations that can easily be incorporated into clinical decision-support systems within EHRs. For more information, visit the AAP Web site.[95]

Other Web-based patient safety education, resources, and tools include the following:

- AHRQ Patient Safety Network (psnet.ahrq.gov);
- Office of the National Coordinator for Health Information Technology Safety Assurance Factors for EHR Resilience Guides, which provide strategies health care organizations can use to address EHR safety. For more information, visit HealthIT.gov[96];
- issue brief "Recent Evidence that Health IT Improves Patient Safety"[97];
- Solutions for Patient Safety (solutionsforpatientsafety.org);
- Children's Hospital Association Web site[98]; and
- Institute for Healthcare Improvement–National Patient Safety Foundation patient safety resources Web page.[99]

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ABBREVIATIONS

AAP: American Academy of Pediatrics
AHRQ: Agency for Healthcare Research and Quality
CPOE: computerized physician order entry
ED: emergency department
EHR: electronic health record
IOM: Institute of Medicine
PPI: Partnership for Policy Implementation

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Brigitta U. Mueller, Daniel Robert Neuspiel, Erin R. Stucky Fisher and COUNCIL
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