

**Electronic Clinical Decision Support for Identification and Management of Child
Maltreatment in the Emergency Department: Recommendations from a Multi-Disciplinary
Consensus Conference**

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Abbreviations:

AAP: American Academy of Pediatrics
CA-CDS: child abuse-clinical decision support
CAPTA: Child Abuse Prevention and Treatment Act
CDS: clinical decision support
CPS: child protective services
ED: emergency department
EHR: electronic health record
HIPAA: Health Insurance Portability and Accountability Act of 1996
SBAR: Situation, Background, Assessment, Recommendation

Table of Contents Summary (25 words)

This multi-disciplinary consensus statement summarizes the literature and provides recommendations to stakeholders about the role of electronic health record-embedded child abuse clinical decision support.

Contributors' Statement Page

Srinivasan Suresh and Rachel Berger were involved in obtaining funding, conception and design of the project, data acquisition, interpretation of the data, drafting of the manuscript, and critical revision of the manuscript for important intellectual content.

Isabel Barata, David Feldstein, Emily Heineman, Tammy Bimber, Barbara Gaines, Joshua Ross, and Jacki Hoover were involved in drafting of the manuscript and critical revision of the manuscript for important intellectual content.

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Abstract

The 3rd Annual Child Abuse-Clinical Decision Support (CA-CDS) Conference was held remotely in October 2020. This multi-disciplinary consensus conference convened over 100 thought leaders from the fields of child abuse pediatrics, child protective services, emergency medicine, information technology, medical informatics, nursing, pediatric emergency medicine,

pediatrics, pre-hospital care, and pediatric trauma to discuss the current state of electronic health record (EHR)-embedded CA-CDS. Caregivers of children who were abused and adult survivors of maltreatment also participated. Ten national societies representing the fields listed above sent representatives. Five topics were deliberated through subcommittee breakout sessions led by content experts: (1) Identification of child maltreatment: Whether EHR-embedded child abuse screening should be implemented, (2) Evaluation of child maltreatment: How to alert emergency department providers to concerns for maltreatment and offer clinical decision-support to guide evidence-based evaluation, (3) Reporting of suspected maltreatment: How to enhance collaboration between Child Protective Services and medical professionals to improve the quality of abuse reporting, (4) Implementation of CA-CDS: How to measure the success or failure of a CA-CDS system, and (5) Long-term Sustainability for Dissemination and Implementation of CA-CDS: How Do we Get There? Consensus recommendations and recommendations for research priorities from each subcommittee were summarized, approved by respective subcommittees, and combined into a consensus statement which was approved. The consensus statement demonstrates multiple areas of unanimous consensus among diverse experts. Lack of consensus was often due to a desire for additional data.

Background

Child maltreatment is a leading cause of death and disability in children. In 2019, there were almost 4.4 million referrals to Child Protective Service (CPS) agencies across the United States. Approximately 1,840 children died from abuse or neglect in 2019. Seventy (70.3%) percent of all child fatalities were in children younger than three years old.¹

Many children who experience morbidity and/or mortality due to abuse have been evaluated previously by a physician due to injuries which, in hindsight, were due to abuse but were not recognized as such.²⁻⁵ Data support that an evaluation for occult injuries should be performed in all young children with sentinel injuries - injuries suspicious for physical abuse - such as bruising or oral injury,⁶⁻¹⁰ regardless of the presence or absence of any social risks or protective factors.¹¹ Recognizing and responding appropriately to sentinel injuries provides an opportunity to identify and intervene before abuse escalates.¹²

Even when sentinel injuries are recognized to be concerning for abuse, barriers, and challenges in the process of making a report to CPS can lead to poor quality reports that lack consistent inclusion of all necessary content. This can lead to poor communication between clinicians and CPS professionals. When risk for abuse is not fully appreciated, children may remain in high-risk environments, and may lose the opportunity for secondary prevention.^{13, 14} It can also lead to children being removed from homes which are safe.^{15, 16}

Existing data support a change from clinical practice which relies on clinical judgment and social intuition, to one which is routine and objective. The electronic health record (EHR) can be used to standardize care, improve compliance with guidelines and, thereby, improve outcomes.

Clinical decision support (CDS) systems can be defined as EHR programming in which the characteristics of an individual patient are used to present patient-specific assessments or recommendations to the clinician towards a decision at the point of care^{17, 18} The potential for electronic CDS to improve quality of care has been increasingly recognized.^{19, 20}

A child abuse-clinical decision support system (CA-CDS) was initially implemented in Cerner EHR (Cerner Corporation, Kansas City, MO) at the University of Pittsburgh Medical Center (UPMC) in 2015. The CA-CDS was first implemented in a tertiary care pediatric hospital and then expanded to all general EDs in the hospital system. In a series of related publications, Berger and colleagues demonstrated that it is possible to embed a set of triggers into the EHR to accurately identify young children with possible physical abuse, that use of routine child abuse screening can improve identification of possible maltreatment and that use of physical abuse order sets can improve compliance with American Academy of Pediatrics (AAP) guidelines for evaluation of suspected physical abuse.²¹⁻²⁴ The CA-CDS has subsequently been implemented in two other EHRs - Epic EHR (Epic Systems Corporation, Verona WI) and All-Scripts (Allscripts Healthcare Solutions, Chicago IL) - in two different hospitals systems.²⁵ Several other US hospital systems have subsequently integrated some type of CA-CDS, although data from these hospital has not generally been published in the peer-reviewed literature.²⁶

In 2018, UPMC held the first CA-CDS conference, a single day conference with representatives from 8 children's hospitals with Cerner EHR interested in exploring the idea of integrating CA-CDS. The two-day 2019 CA-CDS conference included representative from hospitals which used three different EHRs – Cerner EHR, Epic EHR and Allscripts EHR– with the goal of dissemination of CA-CDS to other EHRs. The 2020 conference aimed to bring together several professional societies to identify areas of consensus in the field and generate a research agenda to foster future research, innovation, and scholarship in CA-CDS.

Methods

The 2020 CA-CDS consensus conference was held virtually October 21-22, 2020. There were 116 participants representing 10 professional organizations (Table 1) and experts from 34 US hospitals.

The five consensus topics were determined 3 months prior to the conference. Topics were

- (1) Identification of child maltreatment using CA-CDS: From the pre-hospital setting into the ED
- (2) Evaluation of child maltreatment using CA-CDS: Alerting providers and Offering Order Sets
- (3) Reporting Child Maltreatment: Handing off Information between Medical Providers and CPS
- (4) How do We Measure the Success or Failure of a CA-CDS system?
- (5) Long-term Sustainability for Dissemination and Implementation of CA-CDS: How Do we Get There?

Each group was led by two to three subject experts and one moderator. Specific questions to be discussed were decided prior to the conference by the conference leaders (SS, RB, EH) and the subject experts for each group. Attendees were asked to choose one of the five groups at the time of registration. Questions for each group were emailed to all participants before the conference and they were asked to send comments and questions to their group leaders prior to the conference to focus discussion. Relevant, core readings were assembled and shared electronically (SharePoint, Microsoft, Redmond, WA). All participants were asked to review relevant reading and to additional references (Appendix A).

Plenary sessions and data presentation took place on the first day of the conference, prior to consensus group sessions (Appendix B). Consensus group sessions were 90-minutes and were video and audio recorded (Zoom, San Jose, CA). Participants were encouraged to contribute to discussion and debate, and written comments were collected and saved using the chat function. The number of attendees in each group were as follows: Group 1:29, Group 2:15, Group 3:10, Group 4:12, and Group 5:10. After the consensus group session, all groups re-convened and the moderator of each session provided a summary of the areas of consensus, areas of non-consensus and areas for future research. Consensus groups did not engage in formal voting, and the presence of consensus was determined subjectively by group leaders based on verbal and written comments. Group conclusions and recommendations were presented to all participants for further comment, no recommendations were promulgated over the expressed opposition of any group member.

From October 2020 to January 2021, the subject experts in each group used their notes and the video and audio recordings and chat from each session to summarize the areas of consensus and recommendations for future research. This summary was then distributed to the members of each respective group for review, editing, and approval within 3 weeks. The revised summary was then reviewed by the conference leaders. The summaries from groups 1-4 were integrated into the full consensus statement. A decision was made that group 5 did not lend itself well to consensus and instead, the discussion of this group was summarized without consensus statements. From February to July 2021, three authors (RB, DF, IB) drafted a consensus statement with an introduction, summaries of each consensus, conclusions, and tables. This was then distributed to the representatives from each society which participated in the conference and to all co-authors (subject experts). They were asked to make comments and suggestions during a 4-week period in July and August 2021. All co-authors provided input into the manuscript. The edited document was then submitted to the governing body of each society for approval in September 2021.

Results:

The areas of consensus and research opportunities identified by each consensus group are discussed below and summarized in Table 2.

Group 1: Identification of child maltreatment using CA-CDS: From the pre-hospital setting into the ED

Question 1: Is there consensus that routine child maltreatment screening should be recommended in any clinical setting?

Consensus statement: There was unanimous consensus that routine screening for child maltreatment should be implemented in general and pediatric ED settings.

Support for consensus statement: Multiple studies demonstrate that routine child abuse screening is well-accepted and feasible in the pediatric and general ED settings with minimal impact on ED operations or resource use. Additionally, children who screen positive are at relatively high risk for maltreatment.^{22, 27-30} There was unanimous consensus that routine screening should be implemented in the ED setting and several experts advocated for recommendations to undertake screening in urgent care, outpatient clinics, or pre-hospital/emergency medical services settings. While experts agreed that this was a reasonable approach and a priority area for future research, there was not sufficient consensus to support a recommendation for screening in these settings.

More data are needed to determine whether routine screening decreases racial or sociodemographic disparities.^{31, 32} Available evidence has not yet conclusively demonstrated that routine screening decreases subsequent serious missed abuse or healthcare costs or utilization. These limitations in the current evidence are balanced by unanimous consensus that the current status quo is one in which maltreatment is often missed and there is marked variability in clinical practice which leads to devastating consequences.

Question 2: Who should be screened?

Consensus statement: There was unanimous consensus that all children under 4 years of age presenting to an ED setting should be screened regardless of the reason for presentation.

Support for consensus statement: Experts considered whether setting, patient age, and/or other clinical characteristics should affect screening recommendations. Experts agreed that screening was most strongly supported for the youngest children since both the prevalence of severe abuse and the proportion of cases in which the diagnosis of abuse is missed are inversely associated with age.^{1,2} There was unanimous consensus that all children under 4 years of age should be screened. Several experts felt that screening should continue through a child's 5th birthday or beyond. While the recommendation to screen older children did not achieve unanimous consensus, no expert was opposed to screening for older children and several participants advocating screening for teen dating violence and other forms of interpersonal violence.

Experts agreed that screening should be performed in all children in the age-group being screened, regardless of the chief complaint or disease acuity. While some settings will need to defer screening in critically ill children, or for other defined reasons, there was consensus that screening should be broad and inclusive. Available hospital resources were considered an essential factor in determining who should be screened.

Question 3: How should screening be conducted?

Consensus statement: There was unanimous consensus that no one screening tool was the gold standard, but rather that any tool needs to incorporate the most up-to-date data about clinical characteristics associated with maltreatment. There was also consensus about the need for

objective screening methods to mitigate racial and socioeconomic disparities, and that continuous data review was needed to ensure this outcome.

Support for consensus statement: Experts agreed that no single screening tool had been demonstrated to be superior but agreed that screening components with the strongest existing evidence (e.g., TEN-4 bruising⁶) should be prioritized.^{6, 33, 34} Specific tools and processes that were recognized included: universal active screening by nurses; passive triggers based on diagnoses, orders, or testing results; and natural language processing based on chief complaint, disease narrative, radiology results, pre-arrival information, and/or discharge diagnosis.^{21-25, 30, 35} Experts agreed that screening processes should take into account patient age and encourage interdisciplinary communication between providers when the risk of maltreatment is identified, rather than relying on prompts within the EHR.

There was consensus that screening should mitigate racial and/or socioeconomic disparities and should not contribute to stigma, or the perception of stigma, in patients and families. Many widely used screening tools included a mix of objective (e.g., Is there bruising in a child <6 months old? Is there an unwitnessed injury in a residence?) and subjective (e.g., Is there an unreasonable delay in seeking care? Is there anything else that is concerning for abuse?) prompts. Even questions that do not explicitly address social or demographic characteristics may promote intrinsic bias if some injuries are more easily recognized in some racial groups or are based on judgements about what constitutes “reasonable” parenting.

Experts agreed that routine screening should be accompanied by a program of data review and/or continuous quality improvement to ensure that screening does not lead to disproportionate risks based on race or socioeconomic status. In addition, experts agreed that clinician education should be provided at the time of implementation, and on an ongoing basis, to improve awareness of implicit bias.

Question 4: What are the priority research questions related to screening?

There was no consensus on the ranking of priority research areas related to screening but there was unanimous consensus that priority research areas included evaluation of the efficacy of different screening tools including the benefits (e.g. potential decrease in subsequent abuse) and harms (e.g., cost and time/efficiency of care provision) of routine screening for maltreatment in different age groups, evaluation of screening in different clinical environments (e.g., urgent care, primary care) and the impact of screening on implicit bias.

Group #2: Evaluation of child maltreatment: How to alert emergency department providers to concerns for maltreatment and offer clinical decision support (e.g., order sets) to guide evidence-based evaluation

Question 1: What are the non-negotiable and negotiable characteristics of alerts?

Consensus statement: There was unanimous consensus that alerts need to be active rather than passive and that the alert should include the reason why the alert was triggered.

Support for consensus statement: Given the high medical and legal risk associated with missing child abuse, a passive alert that requires no action to be performed by the provider, was not felt to be sufficient. Since child abuse screening is intentionally highly sensitive, it was recognized that this would be accompanied by lower specificity. As a result, there was consensus that there must be appropriate options for response to the active alert such as, “not now/remind me later” (giving time for further exam and chart review), “not concerning for abuse”, or “concerning for abuse/already being evaluated”. There was not clear consensus on whether this acknowledgment should be a hard stop (i.e., data field that requires completion to progress) within the EHR.

There was also consensus that alerts should include the reason why the alert triggered (e.g., chief complaint, nursing screen, etc.) to foster critical thinking and shared understanding amongst the healthcare team. There was also discussion that nurses, as well as providers, should receive alerts. However, it should be the provider who must acknowledge or dismiss them and that that the goal is highly effective communication between nurses and providers about alerts.

A key consideration for any alert is that it offers a link to appropriate decision support (i.e., helps the provider consider next steps) but does not replace the provider’s expertise or critical thinking. The decision support options will be different based on the hospital’s capabilities (e.g., community ED vs. academic pediatric ED), and in certain cases, should offer guidance on appropriate transfer to a higher level of care. Finally, there was discussion about the need to be cognizant of alert fatigue when deciding how many times and how to alert the provider when there are concerns of maltreatment.

Question 2: What are the non-negotiable characteristics of a physical abuse order set?

Consensus statement: There was unanimous consensus that order sets should offer consistent and evidence-based actions and that the American Academy of Pediatrics (AAP) was the leading organization to provide this guidance.

Support for consensus statement: There was unanimous consensus that any physical abuse order set should offer consistent and evidence-based actions, however, there was recognition that there will be variation based on individual hospital capabilities. There was consensus that orders should be tiered, with certain labs and radiology tests ‘prechecked’ based on relevant evidence-based guidelines and hospital capabilities. For example, liver function tests and a CBC (complete blood count) would be recommended in all EDs while parathyroid hormone and Vitamin D levels might be reserved for pediatric trauma centers and/or hospitals with a child abuse pediatrician. Similarly, while a skeletal survey would be considered mandatory and, therefore, ‘pre-checked’ in any ED evaluating a fracture in a non-ambulatory child, decision support around more advanced imaging may vary depending on location (e.g., rapid MRI vs head CT). Further, the availability of pediatric radiologists to interpret both skeletal surveys and advanced cross-sectional imaging should be a key factor to offering guidance within the order set.

While challenging, the group felt that evidence-based evaluation based on age and injury pattern is essential for any order set, and the AAP was identified as a leading organization to provide this guidance.⁹ While the use of more standardized order sets should decrease the need for expert consultation, given the complexity of child abuse diagnosis and evaluation, it is felt that there

should be the ability to consult or refer to a child abuse pediatrician when necessary, by phone, telehealth or when needed, by transfer to a children's hospital.

Question 3: What additional research needs to be done to achieve consensus on the above issues?

There was no consensus on the ranking of priority research areas for group 2. There was unanimous consensus that research is needed to better understand a wide variety of clinical issues including buy-in and engagement of providers with CA-CDS as well as the prevalence of intended (e.g., improved identification, evaluation, and referral to CPS for suspected maltreatment, improved consistency of evaluation, mitigation of bias) and unintended (e.g., increase in unnecessary child abuse evaluations and/or over-referral to CPS) consequences of CA-CDS.

Group #3: Reporting Child Maltreatment: Handing-off Information between Medical Providers and CPS

Question 1: How can we improve the hand-off from the mandated reporter in the ED to the CPS system? What strategies - including technology-based strategies - could be used to improve the quality and consistency of this hand-off?

Consensus statement: There was unanimous consensus that

- (1) To ensure consistent and thorough transfer of information between medical professionals and CPS, a standardized reporting format (both written and verbal) for the mandated reporter is needed.*
- (2) A shared language between CPS and medical professionals, particularly as it relates to the medical professional's documentation of the level of concern about a given injury is needed.*
- (3) CPS workers and medical professionals need to receive formal training about the system in which the other group works*
- (4) Building relationships and removing the silos between healthcare providers and CPS workers is a critical step to ensuring the protection of children.*

Support for consensus statement: There was unanimous consensus that improving the hand-off between the mandated reporter and CPS needs to incorporate the extensive research which has been done related to medical hand-offs, particularly as it relates to use of standardized reporting format and the advantage of direct discussion between parties as opposed an entirely written hand-off which is the current standard practice in most mandated reports from medical professionals to CPS.³⁶⁻³⁹

There was consensus that a skeleton reporting format needs to be standardized at the national level with states having the ability to add more to the form, but not remove any of the standard elements. This is a similar approach to the way in which the Federal Child Abuse Prevention and Treatment Act (CAPTA) approaches mandated reporting. Specifically, CAPTA requires each state to have provisions or procedures for requiring certain individuals to report known or suspected instances of child abuse and neglect. However, it does not provide for information on the manner with which these reports are generated. The use of an electronic written hand-off was

also discussed to minimize misinterpretation of data as it flows from the mandated reporter to a state hotline to the CPS worker responsible for the immediate response. Currently, many states utilize verbal or non-electronic written communication. Using standardized communication can allow for incorporation of specific language which is understood by all parties to represent situations which require immediate attention. In healthcare settings, the SBAR (Situation, Background, Assessment, Recommendation) or similar standardized reporting format has been demonstrated to improve quality of care in medicine.^{37, 40, 41} A similar format could be used for communication from healthcare providers to CPS. Recommendations for the fields in a standardized CPS reporting form are found in Table 3. While the focus of this group was on mandated reporting specifically with regards to child physical abuse, participants felt that the recommendations could be extended to other types of abuse.

There was unanimous consensus about the need to develop a shared language between CPS and medical professionals, particularly as it relates to the medical professional's documentation of the level of concern about a given injury. While it is not possible to change the entire medical profession or the CPS system so that they speak with the same language, there was consensus that there needs to be an effort to allow for a mutual understanding of terminology in the intersection of the two fields. For example, when a physician documents that an injury is "highly concerning for abuse" or that "abuse is the most likely diagnosis" he/she is likely implying that the child needs to be protected from further abuse. But the CPS system may interpret those statements to mean that there are alternative explanations for the injury other than physical abuse. Therefore, the threshold to intervene has not been met. Interpretating the level of concern about a given situation is also much harder to discern in written form and highlights the

important of a verbal conversation between the medical professional and CPS. A verbal conversation also allows for sharing of other information which can be helpful to CPS but is unlikely to be part of a report (e.g., who was present in the exam room, what was the demeanor of the child and caretaker, what was the caretaker response when the reporter told them that he/she was concerned about abuse). There was also consensus about the need to develop a way to translate crucial, complex medical information to non-medical CPS workers to minimize their need to use the internet to obtain medical expertise. Allowing CPS to have an easy way to know that “contusion” is the same as “bruise” or that a “fractured bone” is the same as “broken bone” is an important step in having a shared language. Similarly, if medical professionals were aware of CPS terminology such as “screened out”, “indicated”, “founded” or “kinship care” it would improve the ability of the fields to collaborate.

There was consensus for the need to improve education of medical providers and trainees about the CPS system (e.g., what happens after a report is made, what is training of CPS caseworkers) and a need to educate CPS workers about the medical system (e.g., what is the difference between a resident and an attending physician, what is the difference between a general emergency department physician and a pediatric emergency department physician and a child abuse pediatrician). There was consensus that building relationships and removing the silos between healthcare providers and CPS workers is a critical step to the ensuring protection of children. There was discussion about having CPS professionals co-located with medical professionals and pediatricians and/or nurses embedded in CPS to act liaisons and to gather and decipher critical information and thereby remove these silos. This type of co-location is already

in multiple jurisdictions across the country including Los Angeles County, Philadelphia County and Allegheny County, Pennsylvania.

Question 2: What additional research/studies need to be done and which organizations should be part of these studies?

There was consensus that research should focus on developing a standardized reporting modality and a standardized reporting structure such as SBAR. Data collection and review of ease of use of new reporting structures from CPS and health care providers, including quantification of time required to make a report, as well as measurement of the quality of the hand-off would be beneficial in evaluating the impact of standardized reports.

Group #4: How do We Measure the Success or Failure of a CA-CDS system?

Given that there is robust literature about how to measure CDS effectiveness,⁴²⁻⁴⁴ the focus of this group was on issues specific to measuring success of a CA-CDS system. The broad question about measuring success was broken down into two questions related to the type of data which are needed. The group also reached consensus on the most important characteristics of a successful CA-CDS system based on the Ten Commandments for effective clinical decision support.⁴²

Question 1: What technical data do we need to measure success?

Consensus statement: There was consensus that an accurate, easily accessible data warehouse report should be considered essential for the success of CA-CDS systems.

Support for consensus statement: There was consensus that the most efficient way to extract and share data for any type of CDS is a standard report from the hospital/health system's Data Warehouse. A data warehouse report allows researchers to analyze data directly from the source (primarily the EHR), the data fields associated with CA-CDS and to determine whether a CDS is working as it was intended to (e.g., the system triggers when it should, does not trigger when it shouldn't, that the providers are getting alerts when children trigger the system, etc.). These reports provide valuable information about both the patients who trigger the CA-CDS and the providers who interact with the CA-CDS. There was consensus that an accurate, easily accessible data warehouse report should be considered a non-negotiable necessity for the success of CA-CDS.

There was consensus that the frequency of data warehouse reports and the system of review needs to be discussed before the go live. The need for an almost real-time data warehouse report is more important for CA-CDS than for almost any other type of CDS, since children who alert a CA-CDS system may be victims of violence, which can escalate if not identified. Given the risks of missed abuse, there was consensus that ongoing review of the data, no less frequently than weekly, is recommended. If the CA-CDS system has the limitation of being able to trigger without alerting a provider, a more frequent data warehouse report or other alert mechanism, can be developed specifically for these patients. At UPMC Children's Hospital of Pittsburgh, for example, it is possible for the physician to not receive an alert for a patient who triggered if the nurse has a delay in documentation or if the physician doesn't open the chart while the child is in

the ED. Similarly, in the Northwell Health System, there is a non-interruptive alert for specific triggers which means that physicians may not see these alerts. A daily data warehouse report documents these relatively rare non-alerted triggers – generally a few cases a week. These are reviewed by an ED physician at CHP and by a child abuse pediatrician in Northwell to be sure the child does not need to be brought back for additional evaluation. If there is concern, the ED physician decides about the appropriate follow-up in the same way that he/she would if there was a re-read on a radiology test or a blood culture that came back positive after discharge from the ED.

The real-time use of a CA-CDS system data warehouse report contrasts with a data warehouse report which tracks, for example, how often a given order set is used. This type of data is less time sensitive and can be downloaded monthly or even less frequently depending on whether the CA-CDS system is stable and more frequently if changes are being made. This type of data is most useful over time; the ability to combine serial reports allows for evaluation of the functioning of the CA-CDS system and may help identify when the system isn't working properly. To identify any changes over time, it is important to know what each of these metrics – number of order sets or power plans used weekly, proportion of children with a positive child abuse screen, number of children alerting the system, for example – are at baseline.

There was a consensus that supplemental data tools (e.g., a real-time dashboard which provides visual data representation) are desirable in centers with the necessary resources and technical expertise but should not be considered a core requirement.

Question 2: What clinical data do we need to measure success?

Depending on the components of the CA-CDS system, different measures might be applicable. There was consensus that, at minimum, there is a core set of data fields needed to measure provider adoption and successful integration (Table 4a). There was also consensus that more complex measures to evaluate the CA-CDS system could be feasible in hospital settings with more information technology (IT) support and expertise (Table 4b). There was consensus that tracked data should be available as part of a data warehouse report. Since manual chart review for non-discrete and/or non-structured data is time-consuming, chart review should be reserved for individual cases or situations which require additional evaluation, such as a root cause analysis or evaluation of data quality. Each of these data fields and/or complex measures could be evaluated over time, in various age groups, by gender, race, and insurance.

Several of the measures described as core and complex measures are proxy measures of sensitivity and specificity. Measurement of sensitivity is difficult given the lack of a gold standard for both diagnosing maltreatment and defining what constitutes ‘reasonable suspicion’ to report suspected abuse.^{45, 46} There was consensus that it is reasonable to use the extant literature related to the sensitivity and specificity of child abuse screening and CA-CDS in other hospital systems and to combine this with the type of data discussed above.

There was consensus that three most important commandments for the success of CA-CDS systems were, in this order: Fit into user’s workflow (Commandment #3), Simple interventions work best (Commandment #7), Monitor impact, get feedback, and respond (Commandment #9).

- (1) Fitting into user's workflow – Any CA-CDS system should be user-agnostic and should be able to be used with little training by any level of trainee as well as attendings, staff nurses, social workers, etc. To ensure that your CA-CDS system fits into the user workflow, usability testing was agreed upon as a critical tool and this needs to be done by every type of end user before going live. One of the most important workflow issues with a CA-CDS system was to ensure that it triggers early in the visit, ideally before the provider places any orders and certainly before the provider communicates with the family about the plan for evaluation and treatment. Understanding the flow of each ED from the time the child enters, to when the triage and/or primary nurses does an initial evaluation to when providers open the EHR, evaluate patients, and place orders is critically important prior to embedded a CA-CDS system.
- (2) Simple interventions work best – As much as possible, any single part of a CA-CDS system (e.g., child abuse screen, order set) should be visible on a single screen without the need to scroll and should be accessible with the fewest clicks possible.
- (3) Monitor impact, get feedback and respond – This is well-described above in the discussion of the importance of the data warehouse report.

Group #5: Long-term Sustainability for Dissemination and Implementation of CA-CDS:

How Do we Get There?

For there to be systemwide change in how the medical system identifies, evaluates, and reports suspected abuse through the use of CA-CDS, integration of CA-CDS must be feasible, sustainable, and easily disseminated among institutions. The significant differences in children's

hospitals vs. community EDs, among different EHRs and EDs with different ED workflows makes sharing consistent tools and design difficult. In addition to the technical barriers to dissemination, there remains the challenge of long-term sustainability in an environment of limited resources including limited reimbursement from insurers and sometimes burdensome regulation. The need to address medico-legal concerns upfront were also identified as a critical step to enhance sustainability specifically as it relates to CA-CDS.

Long-term sustainability requires a tool integrated within the EHR that is easy to perform with concise individual steps and clear, consistent provider expectations. The constant pull between the desire for “out of the box” EHR functionality (e.g., smart sets in Epic EHR, power plans in Cerner EHR) and the desire for customization is not unique to CA-CDS and needs to be recognized as a barrier to rapid, widespread dissemination. Facilitation of dissemination would, therefore, benefit from standard content with adaptable implementation. For example, if societies such as the AAP or Helfer society and governing bodies such as The Joint Commission (TJC) could endorse the use of a set of acceptable tools for routine child abuse screening, the tools could be integrated into the most common EHRs rather than requiring each hospital system to build their own tool. AAP guidelines on the evaluation of physical abuse can be the basis to develop standard order sets.⁹

Technology data exchange remains a barrier to sustainability. The promoting interoperability aspects of the 21st Century Cures Act⁴⁷ can enable this exchange, but there are important aspects

of the exceptions that would be necessary while respecting the HIPAA and state-specific privacy laws.

Finally, developing national quality measures specific to child abuse identification, evaluation and reporting is a critical step to long-term sustainability. There is a need to convene a stakeholder group of regulatory and government players, public and private industry, and medical experts to develop these quality metrics.

Conclusions

Child maltreatment abuse is a leading cause of morbidity and mortality in children. Use of CA-CDS has the potential to improve the identification, evaluation and reporting of child maltreatment and thereby improve the safety of children. There is considerable consensus among experts from a wide variety of medical disciplines as it relates to the need for routine screening for child abuse, the use of EHR-embedded CA-CDS to alert medical providers to the concern for abuse and the need to improve the quality and consistency of communication between CPS and medical professionals. Despite considerable consensus in many areas, there are also multiple areas in which additional research is needed to increase the likelihood of widespread dissemination and sustainability of CA-CDS systems.

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Organization	Abbreviation
American Academy of Pediatrics	AAP
American College of Emergency Physicians	ACEP
American College of Surgeons	ACS
American Pediatric Surgery Association	APSA
Casey Family Programs	N/A
Emergency Medical Services for Children	EMSC
Emergency Nurses Association	ENA
National Association of State EMS Officials	NASEMSO
Pediatric Trauma Society	PTS
Society for Academic Emergency Medicine	SAEM
The Helper Society	N/A

Table 1: Societies who sent at least one representative to participate in the CA-CDS Consensus Conference

Group	Consensus Recommendations	Priority Areas for Future Research
<p>Group 1: Identification of child maltreatment using CA-CDS: From the pre-hospital setting into the ED</p>	<p>General and pediatric emergency departments should implement EHR-based screening</p> <p>All children <4 years old should be screened</p> <p>Screening should be routine regardless of chief complaint or disease acuity</p> <p>Evidence-based screening tools should be used</p> <p>Positive screens should be communicated directly to the care team and should not rely on an EHR alert only</p> <p>Screening implementation should include education about intrinsic bias and monitoring for possible disparities</p>	<p>Efficacy of different screening tools</p> <p>Benefits and harms of screening in different age groups</p> <p>Utility of screening in urgent care, outpatient clinic, and primary care settings</p> <p>Impact of routine screening on subsequent serious abuse</p> <p>Short and long-term outcomes for children who are screened and the impact on hospital systems</p> <p>Impact of screening on risks to patients and families, including stigma and damage to doctor-patient relationship</p> <p>Effects of screening processes on care efficiency</p> <p>Impact of screening on intrinsic bias</p> <p>Outcomes of CPS reports prompted by routine screening</p> <p>Cost of screening</p>

<p>Group 2: Evaluation of child maltreatment using CA-CDS: Alerting providers and Offering Order Sets</p>	<p>Alerts should be active not passive</p> <p>Alerts should include the reason they were triggered</p> <p>Alerts should offer link to appropriate clinical decision support including order sets</p> <p>Order sets should offer evidence-based actions based on AAP guidance</p> <p>Order sets should include pre-checked labs and radiology tests that are essential based on guidelines and hospital capabilities</p>	<p>Impact of active alerts on alert fatigue</p> <p>Potential harms of alerts including unnecessary child abuse evaluations and over-referral to CPS</p> <p>Impact of alerts and CA-CDS on improved identification, appropriate evaluation, and appropriate referral to CPS</p> <p>Impact of CA-CDS on care team intrinsic bias</p> <p>Effective design of CA-CDS for community EDs vs academic pediatric EDs</p> <p>Best methods for obtaining and sustaining buy-in from ED nurses and providers for CA-CDS</p> <p>Reasoning for dismissing alerts or overriding CA-CDS recommendations</p>
<p>Group 3: Reporting Child Maltreatment: Handing off Information between Medical Providers and CPS</p>	<p>A standardized reporting format (written and verbal) should be developed which ensures a share language between CPS and medical professionals</p> <p>Medical trainees need to be educated about the CPS system and decision-making process</p> <p>CPS workers need to be educated about the medical system and roles of different medical professionals and trainees</p> <p>Relationships need to be developed between CPS workers and medical professionals</p>	<p>Evaluation of effectiveness of current reporting systems including paper, verbal and electronic</p> <p>Prospective studies to evaluate the impact of standardized reporting forms and the impact of transitioning among paper, verbal, or electronic reporting</p> <p>Feasibility of reporting directly through the EHR and for patient data – including demographic data - to be pulled directly from the EHR into the report to CPS to decrease duplicate work and improve accuracy.</p> <p>Evaluation of ease of use of new reporting structures from CPS and health care providers, including</p>

		quantification of time required to make a report, and measurement of the quality of the hand-off.
Group 4: How do We Measure the Success or Failure of a CA-CDS system?	<p>Standard EHR data warehouse reports are the most efficient way to evaluate CA-CDS</p> <p>Frequency and components of data warehouse reports should be negotiated between IT and clinicians before implementation</p> <p>There is a minimum core set of outcomes that should be included in the reports including CA-CDS process measures and CPS reporting</p> <p>Hospitals with greater IT support should have more robust reporting of the impact of the CA-CDS on patient care and outcomes</p> <p>Near real-time data reports are necessary to monitor for potential abuse in settings where it is possible for an alert to occur without coming to the attention of a provider</p> <p>Impact of EHR upgrades on the CA-CDS needs to be discussed within the development team prior to implementation</p>	N/A

Table 2: Summary of Consensus Recommendations
Abbreviations: AAP: American Academy of Pediatrics, CA-CDS: Child Abuse - Clinical Decision Support, CPS: Child Protective Services, ED: Emergency Department, EHR: Electronic Health Record, IT: Information Technology

Patient demographic information
Clinical findings which led to concern for abuse
Clear statement of the type of abuse which the reporting source is concerned about – potentially as a drop down with specific choices
Assessment of the level of concern using specific terminology (e.g., diagnostic) which is clearly defined and understood by both reporting source and Child Protective Services
Listed follow-up needs and the urgency of that follow up
Current location of child
Healthcare provider recommendations (e.g., immediate evaluation of siblings by a physician, completion of a urine drug screen in other children in the home)

Table 3: Recommended data fields for a standardized Child Protective Services reporting form

Core measures	Detailed definition
Proportion of Child Abuse Screens (CAS) completed	Number of screens completed divided by all the children in that age group who had a CAS completed *
Proportion of positive CAS	Number of positive screens divided by number of completed screens
Proportion of children in the ED who trigger the CA-CDS system	Number of children who trigger the CA-CDS system divided by the number of children evaluated in the ED
Response to the alerts (if there are choices vs. a simple acknowledgment)	Proportion of time each selection was used
Frequency of use of CA-CDS system specific order sets	How many times in a given time period, the CA-CDS system order set was used
Proportion of triggers which are associated with a report to CPS and ideally, the type of abuse reported	Number of triggers which led to a report to CPS divided by the number of triggers

Table 4a

* If CAS is a hard-stop in the EHR, then proportion will always be 100% and measure not needed

Complex measures	Detailed definition
Compliance with the AAP guidelines for evaluation of young children with specific injuries such as a bruise, fracture, or intracranial hemorrhage	Number of times a provider is partially or fully compliant with the AAP guidelines divided by the number of children who meet criteria to undergo an evaluation – can be measured for each injury type

Use of skeletal surveys and appropriateness of use (e.g., increase in infants with bruises but not an increase in school-aged children, for example)	Number of skeletal surveys performed in a given time period for specific indication determined a priori
Manual review of patients diagnosed as abused, but not identified by the CA-CDS system and assessment of whether the miss was due to human error (and therefore suggests possible avenue for education) or lack of sensitivity of the CA-CDS system (which may suggest a need for a change to the CA-CDS system)	N/A – requires manual review with qualitative data
Manual review of patients who trigger the CA-CDS system to determine whether their triggering is appropriate or a possible over-trigger and whether this can be corrected by education (e.g., a nurse who has much higher rates of positive CAS) or by removal or editing of specific triggers which tend to over-trigger	N/A – requires manual review with qualitative data

Table 4: Recommended core (Table 4a) and complex (Table 4b) measures to evaluate the efficacy of a CA-CDS system. Each of these measures can be measured over time and evaluated as they relate to patient demographics (e.g., age, race).

Abbreviations: AAP: American Academy of Pediatrics, CA-CDS: Child Abuse - Clinical Decision Support, CAS; child abuse screen, CPS: Child Protective Services, ED: Emergency Department

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