# Enhancing Health IT Functionality for Children: The 2015 Children's EHR Format

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## abstract

[AQ4] Electronic health record (EHR) use throughout the United States has advanced considerably, but functionality to support the optimal care of children has been slower to develop and deploy. A previous team of experts systematically identified gaps in EHR functionality during collaborative work from 2010 to 2013 that produced the Children's EHR Format (Format), funded under the Children's Health Insurance Program Reauthorization Act of 2009, Public Law 111-3. After that, a team of practitioners, software developers, health policy leaders, and other stakeholders examined the Format's exhaustive list of 547 EHR functional requirements in 26 topic areas and found them to be valuable but in need of further refinement and prioritization. Work began in 2014 to develop a shortened high priority list of requirements and provide guidance to improve their use. Through a modified Delphi process that included key document review, selection criteria, multiple rounds of voting, and small group discussion, a multistakeholder work group identified and refined 47 items on the basis of earlier requirements to form the 2015 Children's EHR Format Priority List and developed 16 recommended uses of the Format. The full report of the Format enhancement activities is publicly available. In this article, we aim to promote awareness of these high priority EHR functional requirements for the care of children, sharpen industry focus on adopting these changes, and align all stakeholders in prioritizing specific health information technology functionalities including those essential for well-child preventive care, medication management, immunization tracking, and growth data for specific pediatric subgroups.

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Pediatricians and other providers caring for children require specific capabilities in their electronic health records (EHRs) that are lacking in EHRs designed for adults and subsequently adapted for the care of children.[1–4] A strong industry focus on adult quality measures and Meaningful Use requirements for certified health information technology (IT)[5] has unintentionally reduced available resources for high priority functionality needed for the care of children.[2,6,7]

To accelerate the design and use of health IT to support and improve care for children, the Centers for Medicare and Medicaid Services (CMS) and the Agency for Healthcare Research and Quality (AHRQ) funded development during 2010–2013 of a set of software functional statements or attributes called the Children's EHR Format (Format).[8] The Format's 547 requirement statements are wide-ranging, hierarchically organized into 26 topics and address the health IT functionalities needed for all children, including those enrolled in Medicaid

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or the Children's Health Insurance Program (CHIP).[9]

The Format functional requirements are intended to serve several audiences, especially ambulatory and inpatient pediatric providers and their staff, who select and use EHRs in the care of children, and software developers enhancing EHR design to support pediatric patients. The Format requirements are also envisioned to serve other EHR stakeholders such as school district medical and nursing staff, public health agencies, policymakers, and quality reporting measure developers.

This article highlights findings from a subsequent 18-month project to enhance the Format and promote its greater adoption, performed in 2014–2015 under contract with AHRQ and with funding and Medicaid and/or CHIP policy guidance by CMS. RTI International, with partners from Vanderbilt University Medical Center and the American Association of Pediatrics, led this project to identify enhancements to the Format, barriers and facilitators to Format [AQ5] use, a short list of high priority Format functional requirements, and specific recommended uses of the Format. A multistakeholder work group (MSWG) composed of diverse stakeholders, with input from a federal work group (FWG), developed the 2015 Children's EHR Format Priority List (hereafter referred to as the 2015 Priority List) and the Recommended Uses of the Format using a modified Delphi process after evaluating the experiences of early adopters using the Format.

## METHODS

The project team conducted semistructured interviews with early adopters of the Format by using a multiple case study approach that included individuals in 7 different roles implementing the Format in ambulatory and inpatient

settings. The team then vetted the Format's individual items with interdisciplinary stakeholders through facilitated discussions with the 19-member MSWG and feedback from the FWG.

### Demonstration Program Interviews

Ambulatory and inpatient participants in 2 state CMS Children's Health Insurance Program Reauthorization Act of 2009 (CHIPRA) Quality Demonstration Programs (NC and PA) had received funds to demonstrate the impact of implementing the Format. Project staff reviewed documents from these 2 demonstration programs and conducted semistructured interviews of North Carolina and Pennsylvania stakeholders with distinct roles and experiences using the Format including pediatricians, [8] health IT developers,[8] IT staff,[9] practice administrators,[4] CHIPRA grantee staff,[9] organizational leadership,[1] and clinical leadership.[5] The team performed qualitative analysis of interview notes and collected documents by applying a priori and emergent codes to the artifacts (NVivo; QSR International, Burlington, MA) to identify themes, enablers, and barriers. Coders met weekly to review coding consistency and completeness and make any necessary adjustments to the codebook. Ten percent of interviews were double-coded to ensure consistency, with interrater reliability (κ of 0.88) indicating substantial agreement.[10]

### Work Group Activities

The MSWG's 19 members reviewed findings from the demonstration program interviews and previous work on pediatric functional requirements and engaged in structured decision-making exercises developed by the project team to identify and refine items drawn from the 547 functional requirements in the 2013 Format. MSWG members prioritized requirements they

deemed to be of high value to clinicians and patients, clear to diverse stakeholders, feasible to implement with current technology, likely to make a practical difference in the care provided to children, and aligned with inclusion and exclusion criteria described below.

The MSWG included state Medicaid and CHIP officials, pediatric providers, informaticians, EHR implementers, standards experts, vendors, school-based health services, and parent advocates. They used a modified Delphi process for development of the 2015 Priority List that included prework to review individual requirements and refine their content, 3 rounds of voting, and finalization and refinement steps.

- Prework: Initially, a small project team (4 informatics experts including 2 pediatricians: J.S.W., S.R., C.U.L., K.B.J.) identified 166 (of the 547) Format functional requirements for MSWG initial review and produced a starting list of 99 items after removing duplicates and overlapping items and agreeing to the following inclusion and exclusion criteria:

  1. Include EHR functionality that (1) was relevant specifically to the provision of health care to children and (2) had special importance to children (even if useful for both children and adults).

  2. Exclude EHR functionality that (1) was already commonly available in EHRs and/ or covered under current certification criteria for meaningful use Stage 2 compliant systems, (2) could be satisfied by using documentation templates, (3) was too vaguely stated to be implemented, (4) was specific, or (5) could be better addressed in a more general way.

Before the first meeting, the MSWG also was asked to review the clinical report "Special Requirements of Electronic Health Record Systems in Pediatrics,"[1] and the evidence-based practice center technical brief on "Core Functionality in Pediatric Electronic Health Records."[4]

- Iterative Voting: The MSWG engaged in a series of voting activities designed to identify Format items to include, exclude, or further discuss, as well as to clarify and refine each item on the list.

- Round 1. Each MSWG participant voted to "Include," "Exclude," or "Discuss" each of 99 items in the starting list. Items receiving a "supermajority" of more than 80% "Include" votes were marked for inclusion in the priority list. The remaining items were divided by topic area and assigned for subgroup team review.

- Round 2. Each MSWG participant reviewed the subgroup analysis and recommendations for each item, then voted to "Include," "Exclude," or "Discuss." A further vote was cast for each "Include" item to assign a "High," "Medium," " or "Low" rating in each of 3 dimensions: clarity, feasibility, and value and importance. MSWG and subgroup members suggested revisions to Format items to improve their ratings. Finally, each subgroup was asked to consider any unreviewed Format items in the subgroup's topic area to identify critical functionality that might have been missed.

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- Round 3. The MSWG voted on all subgroup consensus items. Items having a supermajority of "Include" were added to the priority list and others were retired from consideration.

- Finalization and Refinement: MSWG members reviewed and further refined the language of included items to ensure that

**TABLE 1** Recommended Uses of the Format

| Primary Stakeholder | Direct Uses (Improvements in Software or Implementation) |
|---|---|
| Providers and associated staff who use and select EHRs | 1. Inform RFP/RFI development to ensure needed EHR functionality for the care of children |
| | 2. Support more productive vendor and/or provider discussions and expectation setting |
| | 3. Support ongoing improvements in the use of the EHR by providers and practice staff |
| Software developers | 4. Improve the design and product road map for an EHR used in the care of children |
| | 5. Support better interoperability and integration within and between systems |
| | Indirect uses (improvements built on direct uses) |
| User advocacy groups, EHR system evaluators, and end users | 6. Surface opportunities to improve workflow and other aspects of EHR use |
| School district providers and medical administrators | 7. Share information with school districts |
| CMS, State Medicaid, and CHIP, and private payers and policymakers | 8. Improve the alignment of EHR functionality with emerging financial policy |
| SDO, certification bodies, and professional associations | 9. Support standards development |
| | 10. Identify functionalities for certifying health IT product functionality |
| State or county health and human services agencies | 11. Establish expectations for electronic data capture and retrieval |
| | 12. Coordination of care, specifically children with special health care needs |
| Public health agencies | 13. Support the public health functions of population health assessment, public health policy development, and assurance of public health policy compliance |
| Administrators, care coordinators, and health plans | 14. Improve reporting around population health management |
| Quality reporting measure developers | 15. Support for eMeasure development and specification |
| Pharmacists, pharmacy staff, and pharmacy management system vendors | 16. Increase communication with pharmacists to support safer medication use |

RFP/RFI, request for proposal/request for information; SDO, standards development organization.

any similar or duplicative items were combined or removed. They also created "implementation notes" to improve clarity and address feasibility by providing details and examples to aid in the implementation and use of the 2015 Priority List functional requirements.

After finalizing the 2015 Priority List items, MSWG members developed "Recommended Uses" of the Format by identifying stakeholder groups and relevant activities (Table 1).

### Additional Activities

In addition to the MSWG, a separate FWG from multiple federal agencies convened to review MSWG outputs, inform federal agencies about the MSWG efforts, elicit input on project activities, and ensure that

the work did not duplicate and was aligned with other federal government work. The FWG met 6 times between January and June of 2015 to review the progress of the MSWG and provide feedback for consideration before finalization of the recommendations.

After the work of the MSWG and FWG had concluded, project staff coordinated with the leadership of the American Academy of Pediatrics (AAP) to preview the work with 2 AAP subgroups, the Council on Clinical Information Technology and the Section on Administration and Practice Management. Feedback gathered in a series of small discussions conducted by telephone was incorporated into the final report submitted to AHRQ.

## RESULTS

### Implementation Experiences Report

Grantees from North Carolina and Pennsylvania interviewed about their use of the Format reported that discussing the functional needs for EHRs among clinicians, office staff, and software developers helped them gain a better understanding of the capabilities of their EHR. When asked to identify priority areas, the most commonly reported were as follows: (1) automatically calculating percentiles for blood pressure on the basis of age and weight, BMI, and growth; (2) accommodating specialized calculations tailored for a child's condition such as Down syndrome; (3) integrating existing screening tools and educational resources into decision support and practitioner workflows; (4) exchanging health or health care information; (5) integrating reporting and decision support to manage patient panels and to support the care of individual patients; and (6) linking to other family members (eg, siblings).

Grantees also reported challenges using the Format such as difficulty interpreting and prioritizing requirements, gaps and duplications in the requirements, and difficulty adapting their EHRs to meet the Format requirements. They reported challenges implementing Format items because of excessive use of technical language, few examples or supporting materials, and ambiguous language leading to differing interpretations by individual stakeholders. The large number (547 items) and ambiguity of the requirements added to grantees' difficulty prioritizing them. Practicing physicians and clinical staff also expressed frustration with missing or incomplete functionalities in the Format, including social factors such as socioeconomic status, religious and cultural considerations, food insecurity, conditions in the home,

language considerations, and Women, Infant and Children assessments. The results of grantee interviews were reported to the MSWG to help inform their development of the priority list.

### Development of the Format 2015 Priority List

Each requirement on the 2015 Priority List is based on a single item or combination of items that appeared in the initial Format released in 2013. The MSWG required each chosen item to meet inclusion or exclusion criteria, to offer high value to EHR users and software developers, and to be clear and feasible enough to be implemented in the near term. From the Format's 547 functional requirements in 26 topic areas, the MSWG selected 47 items (8.6%) in 20 topic areas for the 2015 Priority List.

The MSWG removed distinctions such as "Shall, Should, or May," and "Core: Yes or No" during priority list development because all chosen items offered high value, making those distinctions unnecessary. The MSWG edited (if needed) the contents of any field including the title, description, or topic. The MSWG wrote concise text descriptions and additional "implementation notes" to permit more extensive comments.

As shown in Table 2, the 2015 Priority List included only 47 items compared with the 547 items included in the 2013 release of the Format. Detailed documentation for each of the 47 items, including descriptions and implementation notes, is available in the project final report[10] produced for AHRQ on the US Health Information Knowledgebase Web site. The US Health Information Knowledgebase provides multiple ways to view, filter, query, compare, and download the Format items for use in software development, standards development, conformance testing, and purchasing decisions.

### Recommended Uses of the Format

To assist stakeholders, the MSWG developed 16 recommended uses of the Format to describe ways in which practitioners, software developers, policymakers, IT consultants, and others can use the 2015 Priority List and 2013 Format items. These are shown in Table 1.

## DISCUSSION

The goal of the authors of the 2013 Format was to offer a comprehensive list of requirements and supporting materials "structured in a manner that permits parents and caregivers to view and understand the extent to which the care their children receive is clinically appropriate and of high quality."[11] The 2015 Priority List includes a significantly smaller number of items (endorsed by a diverse stakeholder group, edited for clarity, and supplemented with implementation notes) that can be used to address limitations identified by state CHIPRA grantees who reviewed the 2013 Format. The intent of the work group was to help close the gap in EHR functional capabilities necessary for the care of children without duplicating those already required for participation in the CMS Medicare and Medicaid EHR incentive programs. The authors of this work produced a list of 47 high-priority requirements and 16 recommended uses intended to provide actionable recommendations to health IT developers, practitioners, and other health IT stakeholders. These requirements serve as a useful "starting point" for stakeholders as they work to improve the design and use of EHRs in the care of children.

The recommended uses document was developed specifically as a "how to" guide for stakeholders using the 2015 Priority List to support better care for children. It identifies direct uses of the list to design, build, and implement software, and indirect uses to support public health

**TABLE 2** The 47 Items in the 2015 Priority List

| 2015 Priority List Identification | Title |
| --- | --- |
| Req-2001 | Link maternal and birth data to child health record |
| Req-2002 | Record all vital signs and growth parameters precisely |
| Req-2003 | Provide unit conversions calculation and display during data entry and display |
| Req-2004 | Screening tool status |
| Req-2005 | Closest available standardized dose |
| Req-2006 | Ability to access family history, including all guardians and caregivers |
| Req-2007 | Incorporate and adhere to local and national laws in regard to patient EHR access |
| Req-2008 | Ability to document parental (guardian) notification or permission |
| Req-2009 | Allow unknown patient sex |
| Req-2010 | Order blood products in pediatric units |
| Req-2011 | Synchronize immunization histories with registry |
| Req-2012 | Compute wt-based drug dosage |
| Req-2013 | Alert on the basis of age-specific norms |
| Req-2014 | Flag special health care needs |
| Req-2015 | Newborn dried blood spot collection time and state |
| Req-2016 | Record parental notification of newborn screening diagnosis |
| Req-2017 | Record diagnoses on patient problem summary list |
| Req-2018 | Support appropriate newborn screening and follow-up |
| Req-2019 | Record gestational age assessment and persist in the EHR |
| Req-2020 | Physical examination screening results |
| Req-2021 | Associate mother's demographics with newborn |
| Req-2022 | DME and nursing needs |
| Req-2023 | Support previsit history, screening, prevention forms |
| Req-2024 | Track incomplete preventive care opportunities |
| Req-2025 | Age-specific decision support |
| Req-2026 | Transferrable access authority |
| Req-2027 | Produce completed forms from EHR data |
| Req-2028 | Use established immunization messaging standards |
| Req-2029 | Age-based educational cues |
| Req-2030 | Document decision-making authority of patient representative |
| Req-2031 | Adoption history |
| Req-2032 | Authorized nonclinician viewers of EHR data |
| Req-2033 | Placement setting in out-of-home care |
| Req-2034 | Alert for foster care without Medicaid |
| Req-2035 | Rounding for administrable doses |
| Req-2036 | Represcribe medications |
| Req-2037 | Age- and wt-specific single dose range checking |
| Req-2038 | Separate consent, assent, and permission |
| Req-2039 | Problem-specific age of consent |
| Req-2040 | Age of emancipation |
| Req-2041 | Segmented access to information |
| Req-2042 | Support growth charts for children |
| Req-2043 | Scales and scoring |
| Req-2044 | Use biometric-specific norms for growth curves |
| Req-2045 | Provide alerts for out-of-range biometric data |
| Req-2046 | Import data from previsit history, screening, prevention forms |
| Req-2047 | Identify incomplete preventive care opportunities |

Adapted from Agency for Healthcare Research and Quality. Children's EHR format enhancement. Available at: https://healthit.ahrq.gov/ahrq-funded-projects/childrens-ehr-format-enhancement. Accessed xx xx, xxxx. DME, durable medical equipment.

programs, quality measurement, and communication and coordination with patients and families. This work to identify key requirements and recommended uses reflects both local implementation experiences and national multistakeholder experiences.

## Future Directions

Future work to address evolving health IT needs is critical to improving health care delivery and health outcomes for children. The 2015 Priority List includes many valuable health IT capabilities to support the care of children while improving provider satisfaction with their EHR. There are, however, a number of high-priority functional requirements that were not included in the 2015 Priority List because they were judged to be too ambitious to implement at this time, too ambiguous, or dependent on other technologies that were themselves still evolving and less mature. Notable topics that were discussed and could be considered for future work include: evidence-driven rules, more accessible data to improve population health, immunization forecasting, requirements that address specific populations, food insecurity, patient and/or caretaker use of EHR information, and requirements to support various quality measurement and improvement activities.

The priority list is a useful starting point to inform a broad spectrum of projects related to health IT supports for pediatric care and further state innovations of health IT implementation across the care continuum. A multipart approach to the continuing evolution of this work is essential to moving forward in a clear, feasible, and scalable manner. It also is essential to ensuring that implementation of any federal programs remain flexible enough to support evidence-based, continuous-improvement models to meet and match related changes in industry standards, technological development, and clinical guidelines.

MSWG's discussion of EHRs used in the care of children also highlighted the critical role of health IT infrastructure such as standards, data harmonization, and data exchange in improving EHR capabilities. Continued work to improve the health IT infrastructure is essential to improving the care of children and adults and to enabling the 2015 Priority List items to have the greatest impact.

The 2015 Priority List was developed with input from pediatricians, family practitioners, pediatric specialists, advocacy organizations, software developers, state Medicaid and CHIP representatives, federal agency representatives, professional organizations, policy experts, and academicians. Collaboration across disciplines and stakeholders proved essential to the initial development of the Format released in 2013 and to the 2015 Priority List work. This collaboration will continue to be critical as the Format is applied and enhanced. Having multiple stakeholders contribute their perspective in this collaborative process meant that the requirements selected transcend any individual stakeholder group. Achieving improvements in health IT design, streamlining practitioner workflow, and satisfying patient and family needs truly require a multidisciplinary approach to understanding the challenges and proposed solutions.

### Limitations

The composition of the 2015 Priority List was influenced by the interests and expertise of the participating stakeholders, the available time to meet and deliberate, inclusion and exclusion heuristics developed during the project, feedback from federal partners and AAP members, and other contextual factors. Health IT product priorities are not static but likely to evolve as technology capabilities advance, new health and care delivery needs emerge, and identified priorities are addressed. Policies such as the CHIPRA legislation that appropriated funds for development of the Format, as well as new CMS payment models

and sharing of promising practices in State Medicaid and CHIP health care transformation activities, can be significant levers for the next phase of health IT priorities.

The functional requirements identified in the 2015 Priority List can serve as important inputs for the design of a software system but were not intended to serve as system technical requirements. Instead, the 2015 Priority List and recommended uses may serve as a useful starting point for dialogue among software users, developers, policy makers, clinicians, and other stakeholders working to improve health IT support of pediatric care.

### CONCLUSIONS

The 2015 Priority List and recommended uses of the Format offer health IT developers, implementers, certification agencies, and stakeholders a specific list of functional requirements important for the health IT-supported care of children and well-suited for near-term adoption. The requirements, implementation notes, and recommended uses developed in this project are now publicly available[10] and are aimed at promoting alignment among key stakeholders working to better support the needs of those who care for children using health IT.

### ACKNOWLEDGMENTS

RTI International, an independent, not-for-profit research institute, led the project in collaboration with Vanderbilt University Medical Center, AAP, and c3 Consulting. Together they reviewed previous Format work, studied the experiences of

Pennsylvania and North Carolina CHIPRA grantees implementing the Format, and developed recommendations to enhance the Format. Vicki Estrin and Sarah France of c3 Consulting aided in the design and facilitation of the MSWG sessions and assured timely achievement of milestones. We also would like to thank Laura Marcial, PhD, who prepared the Format for its placement on the AHRQ USHIK Web site.

This project and previous work on the Format would not have taken place without the early vision of and guidance from Erin Grace, with the AHRQ, who has been a champion of the effort.

The views expressed here do not necessarily represent the views of the federal government, including the AHRQ, the CMS, or the US Department of Health and Human Services.

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