

# Pediatric Medication Prescribing Made Simpler and Safer



Children are particularly vulnerable to medication errors that can have significant health consequences; too little can render medication ineffective but too much can be toxic and even fatal. Medication errors pose a greater threat to children than to adults for a number of reasons. Children are smaller than adults and vary in their developmental stage since their bodies and organs are not yet fully developed, and they differ in their ability to metabolize drugs, all of which makes them more sensitive to medication and dosing. Furthermore, accurate pediatric medication administration requires: 1) knowledge of the child's precise weight; 2) correct age and weight-based dose calculation by prescribers, including tailoring doses to an amount that can be easily administered; and 3) the ability of caregivers to measure and administer doses properly, particularly for liquid medications.

In an effort to reduce outpatient pediatric medication errors and to save time calculating doses, Dr. Kevin Johnson and his team at Vanderbilt University developed Safety Through Enhanced e-PreScribing Tools or STEPStools. STEPStools is a clinical decision support tool developed to help providers prescribe appropriate medication doses for children. The tool calculates safe and effective rounded medication doses based on a child's age and development. Inspired by the Harriet Lane Handbook, a commonly used medication prescribing guide for pediatricians, STEPStools is an electronic reference with added functionality to support providers in prescribing. STEPStools is Web-based, allowing it to work with any of the available

electronic prescribing tools that send prescriptions to pharmacies electronically. STEPStools also notifies a provider if a prescribed dose is an over- or under-dose for a particular child.

STEPStools was developed by reviewing 120 medications that make up over 95 percent of the most commonly prescribed medications for children and evaluating these medications for appropriate dosing. STEPStools not only reduces the margin of error for dosing, its drop-down dosage menus can save providers time previously spent making complex calculations to determine appropriate dosages.

STEPStools shows promise for contributing to safer and more efficient pediatric prescribing. Initial testing demonstrates that the dosing knowledgebase and the rounding algorithm used by STEPStools are valid; STEPStools medication dosing recommendations achieved 84 percent accuracy among test cases. Furthermore, integrating the tool into clinical workflow and systems proved feasible.

STEPStools has been well received by users. Pediatricians who used STEPStools are enthusiastic about the concept and its potential to improve medication safety for children, increase efficiency in prescribing, and facilitate better outcomes for children. Accurate and effective medication dosages that best treat conditions in a timely manner will lead to fewer visits to the doctor and absences from school for children, and fewer missed days of work for parents and caregivers.

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**Project Website:** <http://www.pedstep.org/>

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## Developing STEPStools

STEPStools was developed by building on the work of other researchers at Vanderbilt University. STEPStools incorporates the technology of RxStar, an e-prescribing tool that has been used at Vanderbilt University since 2004, and the findings of the Pediatric Safety Through Electronic Prescribing (PedSTEP) project, which looked at the impact of e-prescribing on medication errors in pediatrics. The findings from PedSTEP informed the initial list of medications that were included in the development of medication rounding guidelines that are used in STEPStools.

- During the first phase of the project, a group of experts in pediatrics was convened with support from the American Academy of Pediatrics (AAP) to develop consensus on appropriate rounding of medications for children, starting with the medication list identified in the PedSTEP project.
- During the second phase of the project, with support from AHRQ, an online database named STEPStools was developed to be compatible with a variety of different e-prescribing systems. The team then worked with RxNorm, the National Library of Medicine's database of medication names, to ensure medical language consistency across electronic systems.

STEPStools was initially tested by comparing STEPStools' suggested doses with actually-prescribed doses recorded in a large database of completed prescriptions. When discrepancies were identified, doses in STEPStools were reviewed and corrected as needed.

To ensure the usability of STEPStools, the research team conducted 12 or more hours of observation with seven clinicians representing general pediatrics and

**“From a pediatrician’s perspective, STEPStools makes writing prescriptions for medications that come in multiple strengths faster, safer, and more accurate. For children, STEPStools improves medication safety.”**

**Dr. Sue Kressley, Pediatrician**

the specialties of cardiology and neurology. In addition, they interviewed two outpatient pharmacists and two e-prescribing system software specialists to collect impressions on the impact of STEPStools on dispensing of prescriptions and its implementation into e-prescribing software.

## Future Applications

A significant contribution of this project is the pediatric dosing knowledgebase and enhanced guidelines for medication rounding and dosing developed for the STEPStools technology. Going forward, the project team will continue to develop STEPStools to enhance its capabilities to calculate very small medication doses, including compound formulations and medications with more than one active ingredient, and expand on the list of medications included in the dosing knowledgebase.

Dr. Johnson and his team are in discussion with the AAP Child Health Informatics Center to identify opportunities to make STEPStools and other Web services broadly available to clinicians. Opportunities discussed include the development of a plan to promote and disseminate the STEPStools dosing knowledgebase and the rounding algorithm.

