

Liquid Medication Dose Errors by Parents

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How Accurately Do Parents Measure Liquid Doses?

Parents often have difficulty dosing liquid preparations, and there is considerable variability in the accuracy with which parents measure out "one teaspoon" or any other prescribed volume of medicine. Parents generally have done better with marked containers than with unmarked containers, and with syringes rather than dosing cups or other dosing instruments, including tablespoons or teaspoons.

A recent study^[1] extended efforts beyond the researchers' previous work by testing parents in multiple locations around the country, including the East Coast, West Coast, and southern United States. They evaluated how accurately parents could measure liquid preparations using dosing instruments (syringes or cups) labeled with milliliters, teaspoons, or both. They also evaluated the potential effect of a mismatch between metric and nonmetric measures (for example, a bottle labeled in milliliters packaged with a dosing instrument calibrated in both milliliters and teaspoons).

The study involved the parents or caregivers of children aged ≤ 8 years who presented for an outpatient clinic evaluation. The children were randomly assigned to one of five groups. The groups differed according to the dosing recommendations on the bottle of liquid medicine and the tool used to measure the prescribed dose (Table).

Table. Label and Measuring Tool Units

Group	Label Unit	Measuring Tool Unit
1	mL	mL
2	mL and tsp	mL and tsp
3	mL and tsp	mL and tsp
4	mL	mL and tsp
5	tsp	mL and tsp

tsp = teaspoon

The caregivers were asked to complete a total of nine tasks—measuring three different volumes (2.5 mL, 5 mL, and 7.5 mL) using each of three different tools. These tools included two syringes that differed by the specificity of their markings (0.2-mL vs 0.5-mL increments) and a standard 30-mL dosing cup. Parents were asked to measure out the volume that was recommended on the bottle's label (standard volumes of 2.5, 5.0, or 7.5 mL, but written as either mL or teaspoon dosing) using each tool.

Dose Measurement Errors by Parents

An "error" was defined as a measured volume that varied by more than 20% of the recommended volume. More than 2000 parents completed the study, 84.4% of whom made at least one error in measurement. On average, the parents made an error in 25% of the measurements attempt. Most of the errors (68%) were overdoses, and 21% of the parents measured out more than twice the recommended dose at least once.

No differences were detected in error rates according to the type of syringe used (0.2-mL vs 0.5-mL incremental markings). The dosing cups were more likely to be associated with error, with an adjusted

odds ratio of 4.6 (95% confidence interval, 4.2-5.1). Parents who received the teaspoon-only label (group 5) were most likely to measure incorrectly. Overall, parents in all groups did better with dose volumes of 5.0 mL than with 2.5 or 7.5 mL.

These findings show that prescribing doses and medicine labeling in milliliters and using syringes marked in milliliters all result in higher accuracy of measurement, although many parents still make dosing errors.

Viewpoint

This lead investigator and colleagues have done excellent work in this area in past years. Their results are fairly consistent that approaches involving metric measurements are superior, and less likely to result in error. Recent recommendations on this topic from the American Academy of Pediatrics are worth reviewing.^[2]

A successful change to metric-only dosing can be accomplished, but physicians are only part of the process. Electronic health record vendors, pharmacies, and all healthcare entities must deliver a consistent message to families.

It is harder to know what to do with the information that many parents make errors even in the controlled setting of a study, but it is certainly concerning, and suggests that we can never spend too much time educating parents on dosing recommendations and how to properly measure liquid medicine doses.

References

1. Yin HS, Parker RM, Sanders LM, et al. Liquid medication errors and dosing tools: a randomized controlled experiment. *Pediatrics*. 2016 Sep 12. [Epub ahead of print].
2. American Academy of Pediatrics. Committee on Drugs. Metric units and the preferred dosing of orally administered liquid medications. *Pediatrics*. 2015;135:784-787.

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