Effect of Medication Label Units of Measure on Parent Choice of Dosing Tool: A Randomized Experiment

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ABSTRACT

OBJECTIVE: Some experts recommend eliminating "teaspoon" and "tablespoon" terms from pediatric medication dosing instructions, because these terms could inadvertently encourage use of nonstandard tools (ie, kitchen spoons), which are associated with dosing errors. We examined whether use of "teaspoon" or "tsp" on prescription labels affects parents' choice of dosing tools, and the role of health literacy and language.

METHODS: Analysis of data collected as part of a controlled experiment (SAFE Rx for Kids [Safe Administration For Every Prescription for Kids] study), which randomized English- and Spanish-speaking parents (n = 2110) of children 8 years of age and younger to 1 of 5 groups, which varied in unit of measurement pairings on medication labels and dosing tools. Outcome assessed was parent self-reported choice of dosing tool. Parent health literacy was measured using the Newest Vital Sign.

RESULTS: Seventy-seven percent had limited health literacy (36.0% low, 41.0% marginal); 35.0% completed assessments in Spanish. Overall, 27.7% who viewed labels containing either "tsp" or "teaspoon" units (alone or with "mL") chose nonstandard dosing tools (ie, kitchen teaspoon, kitchen tablespoon), compared with 8.3% who viewed "mL"-only labels (adjusted odds ratio [AOR] = 4.4 [95% confidence interval (CI), 3.3–5.8]). Odds varied based on whether "teaspoon" was spelled out or abbreviated ("teaspoon"-alone: AOR = 5.3 [95% CI, 3.8–7.3]); "teaspoon" with mL: AOR = 4.7 [95% CI, 3.3–6.5]; "tsp" with mL: AOR = 3.3 [95% CI, 2.4–4.7]; $P < .001$). Similar findings were noted across health literacy and language groups.

CONCLUSIONS: Use of teaspoon units ("teaspoon" or "tsp") on prescription labels is associated with increased likelihood of parent choice of nonstandard dosing tools. Future studies might be helpful to examine the real-world effect of eliminating teaspoon units from medication labels, and identify additional strategies to promote the safe use of pediatric liquid medications.

KEYWORDS: ambulatory care; dosing errors; health communication; health literacy; injury prevention; medication errors

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WHAT'S NEW

Parents who received prescription labels with teaspoon units had >4 times the odds of choosing a nonstandard kitchen spoon. Findings support avoidance of teaspoon terms on labels, with benefits likely to be seen across health literacy and language groups.

STANDARDIZING LABELS ON pediatric liquid medications has been proposed as a way to reduce dosing errors in the United States.[1–7] The Centers for Disease Control and Prevention (CDC), through its Prevention of Overdoses & Treatment Errors in Children Taskforce (PROTECT) initiative, along with the American Academy of Pediatrics (AAP), have recently begun to advocate for "milliliter"- or "mL"-only dosing, and the elimination of "teaspoon" and "tablespoon" terms on medication labels.[8–10] Although 1 study showed that parents are able to dose more accurately using mL instructions, a significant proportion of parents continued to make errors even with mL dosing.[10] Concerns about moving to the metric-only labeling of medications and

dosing tools in the United States, which has historically relied on a nonmetric spoon-based system,[8,9,11] have led some to call for additional research to better delineate the benefits of a move to an mL-exclusive system.

In this context, some medical providers and public health professionals have suggested that "teaspoon" and "tablespoon" labels could inadvertently cause dosing errors by encouraging parent use of nonstandard dosing tools to measure medications such as kitchen spoons, which vary widely in size and shape.[10,12–14] There is longstanding recognition that kitchen spoons should not be used for dosing pediatric medications.[12,15,16] In fact, since 1975, the AAP has recommended the use of standard dosing tools such as oral syringes, droppers, and dosing cups, which have markings to guide parents in the accurate dosing of medications.[12] The US Food and Drug Administration (FDA) recommends inclusion of standard tools with over-the-counter liquid medications.[3]

In this study, we sought to examine the degree to which parents' choice of medication dosing tools is affected by the unit of measurement present on a medication label, in particular the effect of teaspoon terms ("teaspoon", "tsp"). We hypothesized that presence of a teaspoon unit on the label, whether spelled out or abbreviated, would increase the likelihood of a parent inappropriately choosing a nonstandard tool (ie, kitchen spoon) to administer medications. We also sought to examine differences in effect according to parent health literacy and language, because those with low health literacy and limited English proficiency have been previously reported to be at greater risk for misunderstanding drug labels and subsequent medication errors.[10,13,17–20]

METHODS

PARTICIPANTS, RECRUITMENT, AND RANDOMIZATION

Data for this study were collected as part of a randomized controlled experiment to examine the degree to which specific attributes of medication labels and dosing tools affect parent dosing errors (SAFE Rx for Kids [Safe Administration For Every Prescription for Kids] study). Subjects were enrolled from pediatric outpatient clinics affiliated with New York University (Bellevue Hospital Center), Stanford University (Gardner Packard Children's Health Care Center), and Emory University (Children's Hospital of Atlanta at Hughes Spalding) Schools of Medicine. These clinics serve predominantly low-income families (at least 70% enrolled in Medicaid or the Women Infants and Children supplemental [WIC] nutrition program). Northwestern University served as the data management site; no subjects were enrolled at this site. Institutional review board approval was obtained from each partner site (Schools of Medicine at Emory University, New York University, Northwestern University, and Stanford University) and Children's Hospital of Atlanta, as well as the Research Review Committee of Bellevue Hospital Center.

Parents or legal guardians were consecutively approached by trained research assistants to determine eligibility. Those who met inclusion criteria were English- or Spanish-speaking parents or legal guardians (18 years of age or older) who had a child 8 years of age or younger who was presenting for care in the pediatric clinic. Parents also had to be primarily responsible for administering medications to their child, and could not have participated in a previous medication dosing study. Parents were excluded from participation if they had: 1) visual acuity worse than 20/50 (Rosenbaum Pocket Screener), 2) uncorrectable hearing impairment, or 3) if they or their child was too ill to participate. Written, informed consent was obtained from parents before participation in the study.

When parents were enrolled, they were randomized to 1 of 5 groups, which varied according to the pairing of units of measurement used on the medication bottle label and on the dosing tool (Table 1, Fig. 1). Randomization was blocked according to site, in sets of 100 (20 per group for each of the 5 groups); a random number generator was used. Unit label/dosing tool combinations were selected to represent commonly seen standard practices. Consistent with pharmacy guidelines, teaspoon units on English language medication labels were translated for Spanish language parents.[21,22] For the purposes of this analysis, which only involved what was present on the label, groups 1 and 4 were collapsed into 1 group which had "mL-only" labels. Group 2 had mL and a "tsp" abbreviation. Group 3 had mL and "teaspoon" spelled out, and group 5 had "teaspoon" units alone.

Parents were also randomized to receive medication labels with 3 different dose amounts (2.5, 5, and 7.5 mL) and as part of the larger study, were asked to measure those amounts using 3 different dosing tools (2 types of oral syringes, and 1 dosing cup; total of 9 trials).

ASSESSMENTS

Assessments were performed immediately after subject enrollment. Trained research assistants conducted interviews in English or Spanish, as per caregiver preference. The assessment involving choice of nonstandard dosing tool was conducted first; a structured survey was used subsequently to assess sociodemographic characteristics and health literacy. A gift card ($20) was provided to study subjects as a nominal incentive.

CHOICE OF DOSING TOOL

At the beginning of the dosing assessment, parents were shown the first medication bottle label they were

Table 1. Comparison of Randomization Group Characteristics

Group	Unit(s) Used on Medication Bottle Label	Example of How 5 mL or 1 tsp Amount Displayed on Label	
		English	Spanish
1 and 4	mL	5 mL	5 mL
2	mL, tsp	5 mL (1 tsp)	5 mL (1 cdta)
3	mL, teaspoon	5 mL (1 teaspoon)	5 mL (1 cucharadita)
5	teaspoon	1 teaspoon	1 cucharadita

The full study involved variations in pairing of units on the medication label and dosing tool. Findings from this study involved only the bottle label; groups 1 and 4 were exposed to the same label.