

# Safe Storage of Opioid Pain Relievers Among Adults Living in Households With Children

Eileen M. McDonald, MS,<sup>a,b</sup> Alene Kennedy-Hendricks, PhD,<sup>c,d</sup> Emma E. McGinty, PhD, MS,<sup>a,c,d,e</sup> Wendy C. Shields, MPH,<sup>a,d</sup> Colleen L. Barry, PhD, MPP,<sup>c,d,e</sup> Andrea C. Gielen, ScD<sup>a,b</sup>

abstract

**OBJECTIVES:** To describe safe storage practices and beliefs among adults who have used a prescription opioid pain reliever (OPR) in the past year; to compare practices and beliefs among those living with younger (<7 years) versus older children (7–17 years).

**METHODS:** A survey was administered to a nationally representative sample of adults reporting OPR use in the previous 12 months and who had children <18 years old living with them. We used Health Belief Model–derived items to measure beliefs. Safe storage was defined as locked or latched for younger children and as locked for older children. Regression models examined the association between beliefs and safe storage practices.

**RESULTS:** Among 681 adults who completed our survey and reported having children in their home, safe storage was reported by 32.6% (95% confidence interval [CI], 21.4–43.8) of those with only young children, 11.7% (95% CI, 7.2–16.2) among those with only older children, and 29.0% (95% CI, 18.3–39.8) among those with children in both age groups. Among those asked to answer survey questions thinking about only their oldest child, the odds of reporting safe storage decreased by half as perceived barriers increased (0.505; 95% CI, 0.369–0.692), increased twofold as efficacy increased (2.112; 95% CI, 1.390–3.210), and increased (1.728; 95% CI, 1.374–2.174) as worry increased.

**CONCLUSIONS:** OPRs are stored unsafely in many households with children. Educational messages should address perceived barriers related to safe storage while emphasizing how it may reduce OPR access among children.



<sup>a</sup>Johns Hopkins Center for Injury Research and Policy, <sup>b</sup>Department of Health, Behavior and Society, <sup>c</sup>Center for Mental Health and Addiction Policy Research, <sup>d</sup>Department of Health Policy and Management, and <sup>e</sup>Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland

**DOI:** 10.1542/peds.2016-2161

Accepted for publication Dec 8, 2016

Address correspondence to Eileen M. McDonald, MS, Department of Health, Behavior and Society, Johns Hopkins Bloomberg School of Public Health, 624 N Broadway, Room 731, Baltimore, MD 21205. E-mail: emcdona1@jh.u.edu

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2017 by the American Academy of Pediatrics

**FINANCIAL DISCLOSURE:** The authors have indicated they have no financial relationships relevant to this article to disclose.

**FUNDING:** Supported by an unrestricted research grant from American International Group, Inc. The funding body had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication.

**WHAT'S KNOWN ON THIS SUBJECT:** The United States is in the midst of an opioid epidemic. Opioids are increasingly implicated in unintentional ingestions among young children. Overdose fatalities related to opioid exposures have more than doubled among adolescents and young adults.

**WHAT THIS STUDY ADDS:** This study demonstrates that opioid pain reliever (OPR) storage is suboptimal in households with children and adolescents despite most respondents reporting high perceived threats from OPRs and despite high perceived benefits and low perceived barriers to safe OPR storage.

**To cite:** McDonald EM, Kennedy-Hendricks A, McGinty EE, et al. Safe Storage of Opioid Pain Relievers Among Adults Living in Households With Children. *Pediatrics*. 2017;139(3):e20162161

The opioid epidemic in the United States is a complex problem. National surveys suggest that almost 2 million people start opioid pain relievers (OPRs) annually,<sup>1</sup> and in 2012 health care providers wrote 259 million OPR prescriptions.<sup>2</sup> In 2014, >10 million people reported using OPRs nonmedically.<sup>3</sup> Problematic OPR use has been linked to heroin use and to the rapid increase in drug poisoning deaths in this country.<sup>4,5</sup>

Children and adolescents are at risk for unintentional and intentional exposure as a result of OPRs' pervasive presence in US households. Burghardt et al<sup>6</sup> demonstrated an association between adult prescription drug use and pediatric medication poisonings between 2000 and 2009, with the greatest risk for children <6 years old. Among children this age who were hospitalized because of an unintentional ingestion, opioids were the most commonly implicated prescription medication.<sup>7</sup> Nonmedical use among adolescents is also problematic. The 2014 National Survey on Drug Use and Health<sup>3</sup> indicated that the second most common illicit drug use category among those 12 to 17 years old, after marijuana, was OPRs. Overdose fatalities from drug exposures more than doubled among adolescents and young adults between 1999 and 2008.<sup>5</sup>

Efforts to protect children from medication-related poisonings have used both policy and educational approaches. The Poison Prevention Packaging Act of 1970, which requires special packaging to render access to hazardous substances difficult for young children, has been a major policy success.<sup>8,9</sup> Professional groups and organizations endorse educational messages that support locking or latching medicines and other household products implicated in pediatric poisonings,<sup>10-12</sup> despite the absence of clinical trials documenting their efficacy. For

example, the Institute of Medicine recommends that programs distribute cabinet latches and advise parents to lock up medications.<sup>10</sup> This combined approach was recently shown, in a network meta-analysis, to increase poison prevention practices in households with children.<sup>13</sup>

Limited national data exist to assess awareness of OPR dangers among adults with children living in the home or to examine storage beliefs and practices among this group.<sup>14</sup> Our larger study<sup>15</sup> addressed this gap with data from a nationally representative sample of US adults who reported OPR use in the past 12 months, regardless of the presence of children in the home; this study focuses exclusively on respondents with children in the home. To understand modifiable beliefs related to OPR storage, we applied the Health Belief Model (HBM) as the organizing framework to identify correlates of storage practices.<sup>16,17</sup> Used to understand many other health issues,<sup>18,19</sup> the HBM asserts that a health-related behavior is determined after consideration of the health threat (measured as the perceived severity and susceptibility of the health problem), and the benefits and barriers to adopting the protective behavior.<sup>20</sup> Self-efficacy, or confidence in one's ability to engage in the desired behavior, and cues to action are other important constructs of the HBM.<sup>21</sup> Because prescription drug poisoning has historically been treated as a concern primarily for adults with very young children, we hypothesized that respondents with only older children would have less protective beliefs and practices compared with those with younger children. We also hypothesized that adults' safe storage practices would be associated with higher perceived benefits, threats, and self-efficacy and lower perceived barriers to safe storage. Furthermore, we hypothesized that respondents aware of a specific child's death due to

OPRs, referred to as a "cue to action" in the HBM, would be more likely to report safe storage practices because of the greater salience of the issue compared with those without this experience.

In this article, we examine the prevalence of safe storage practices among respondents, how storage practices and beliefs vary among respondents with younger versus older children in the home, and how beliefs may influence safe storage practices in both of these groups. Understanding OPR beliefs and storage practices can help inform pediatric anticipatory guidance and educational campaigns to better protect children and adolescents.

## METHODS

GfK Group's KnowledgePanel is a probability-based Web panel that recruits from a sampling frame encompassing 97% of US households and has been used to assess public opinions on various health issues.<sup>22-24</sup> We randomly selected a nationally representative sample of 4836 adults >18 years old from the panel, oversampling households with children <18 years old. A screening question identified those who reported having used a prescription pain medication in the past 12 months. Throughout the survey, we used the term "prescription pain medication" to refer to OPRs as a means of facilitating comprehension among respondents by reproducing the conventional language used in media coverage.<sup>25</sup> OPRs were described to differentiate them from nonprescription pain medications (eg, Tylenol); respondents could view a list of generic and trademarked OPRs (Supplemental Information A). A \$5 cash equivalent was earned for completing the survey, which was fielded between February 24 and March 16, 2015. Sample size was designed to ensure that we had adequate power to detect differences

between groups of respondents with older (7–17 years old) and younger children (<1–6 years old) living in the household. With a sample size of 681, we had >80% power to detect differences in proportions of 8% between 2 subgroups with 95% confidence. This study was approved as exempt by the authors' university's institutional review board.

GfK provided data on respondents' sociodemographic characteristics, including respondents' age, sex, marital status, education, race, and household income. We also collected information on age and sex of each child in the home and the respondent's relationship to them (ie, parent or guardian).

Twelve survey items captured OPR HBM constructs. Because beliefs may vary by ages of children in respondents' homes, respondents with >1 child were randomly assigned (via random group assignment indicator) to receive instructions to think about their oldest or youngest child in the home when responding to these items. These items assessed perceived threat of OPRs (3 items), perceived benefits of safe storage (3 items), perceived barriers to safe storage (3 items), perceived self-efficacy of safe storage (1 item), worry about OPRs (1 item), and cue to action (ie, aware of child death from OPR) (1 item) (Supplemental Information B). The order of these 6 constructs was randomized to mitigate the impact of question order on responses. Respondents' agreement with individual items was measured on a 7-point Likert scale anchored by 7, strongly agree, and 1, strongly disagree. For descriptive analyses, responses 6 and 7 were collapsed as agree, 3 to 5 as neutral, and 1 and 2 as disagree. We collapsed several items into 3 distinct scales, based on factor analysis, and used mean scale scores in models. These were the perceived threats scale (Cronbach's  $\alpha = .66$ ), perceived benefits scale

**TABLE 1** Sociodemographic Characteristics of Respondents with Past-Year OPR Use in Households With Children, 2015

Sociodemographic Variable	Respondents in Households With Children, N = 681 Mean/Proportion (95% CI)
Age, mean	40.1 (38.4–41.8)
Female, %	59.1 (53.9–64.2)
Married or lives with partner, %	67.5 (61.8–73.1)
Educational attainment, %	
Less than high school	16.3 (11.7–20.8)
High school or equivalent	28.5 (23.8–33.3)
Some college	33.9 (29.1–38.8)
Bachelor's degree or higher	21.3 (17.5–25.1)
Race and ethnicity, %	
White, not Hispanic	51.1 (45.9–56.4)
Black, not Hispanic	18.0 (13.6–22.5)
Hispanic	22.0 (17.5–26.5)
Other race or ethnicity	8.8 (5.5–12.1)
Household income, %	
<\$25 000	16.4 (12.5–20.3)
\$25 000–\$49 999	24.3 (19.7–28.9)
\$50 000–\$74 999	13.4 (10.2–16.7)
≥\$75 000	45.9 (40.7–51.1)
Lives in metropolitan statistical area, %	86.7 (83.1–90.3)
Region, %	
Northeast	18.1 (14.0–22.3)
Midwest	17.7 (14.1–21.3)
South	40.0 (34.7–45.2)
West	24.2 (19.7–28.6)
Using OPR at time of survey, % <sup>a</sup>	43.3 (38.0–48.6)
Respondent not parent of child <sup>b</sup>	28.0 (22.2–33.8)
Children in household	
Mean number of children	1.9 (1.8–2.0)
Children in both age groups, %	22.4 (18.1–26.7)
Only younger children, %	25.9 (21.0–30.8)
Only older children, %	51.7 (46.5–56.9)

Survey weights were applied to account for survey sampling design.

<sup>a</sup> Remaining respondents had used OPRs at some point within past year but were not currently using at the time they completed the survey.

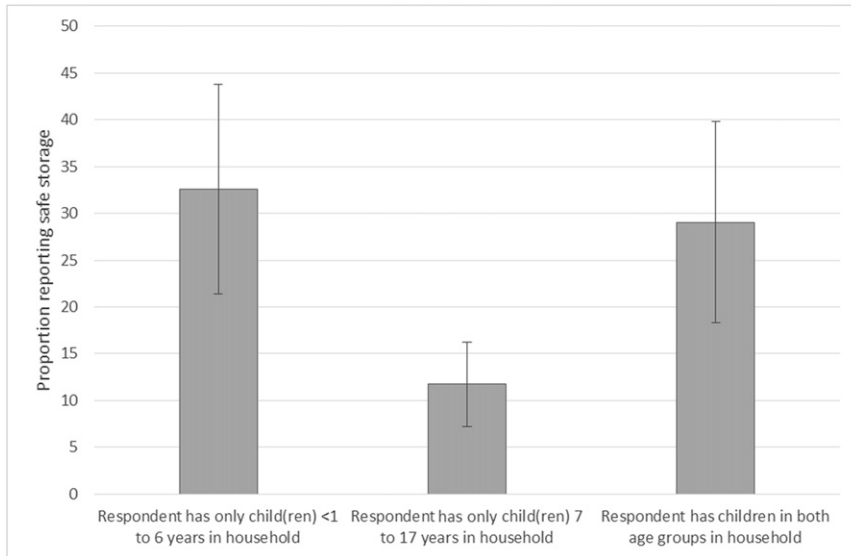
<sup>b</sup> This category included legal guardians and adults who had some other relationship with the child(ren) living in the household (eg, grandparent).

(Cronbach's  $\alpha = .82$ ), and perceived barriers scale (Cronbach's  $\alpha = .83$ ). Factor analysis did not indicate that items assessing respondents' level of worry about child's OPR access, self-efficacy related to safe storage of OPRs (eg, confidence in their ability to safely store OPRs), and cue to action (eg, awareness of a child's death caused by OPRs) loaded onto a factor shared with other items. These items were retained as individual measures.

The safe storage practice outcome variable was measured with a 7-point Likert scale that assessed the frequency (always to never) with which OPRs were kept in a locked location or in a latched location. For

respondents with only a younger child (<1–6 years) in the home or randomly assigned to think about a younger child when responding to questions about their OPR beliefs, we defined safe storage as locking or latching the medication always or almost always. Among respondents with only an older child (7–17 years) in the home or randomly assigned to think about an older child, we defined safe storage as locking the medication always or almost always.

Using Stata (Stata Corp, College Station, TX),<sup>14,26</sup> we calculated descriptive statistics (frequencies, means, and proportions) and used  $\chi^2$  tests to assess differences in prevalence of safe storage practices among those



**FIGURE 1** Proportion of respondents with safe storage of opioid pain relievers. Safe storage is defined as locked or latched always or almost always among respondents with only children ages <1 to 6 in the household, locked always or almost always among respondents with only children ages 7 to 17 in the household, and locked always or almost always among respondents with children in both age groups in the household. Survey weights were applied to account for survey sampling design.

with only young children, those with only older children, and those with children in both age groups. Next, we used descriptive statistics to examine responses to the health belief items and *t* tests to assess differences between respondents who were instructed to think about their younger compared with their older child (regardless of whether they had children in both age groups in their homes).

To test the relationship between respondents' health beliefs and their odds of engaging in safe storage behaviors, we estimated logistic regression models. In the first model, we included only health beliefs as covariates. In the second model, we added respondent characteristics that could be potential confounders, including age, sex, educational attainment, whether respondent lived with partner or spouse, race and ethnicity, household income, residence in metropolitan statistical area, region of country, current use of OPR at time of survey, number of children, age of child about which respondent was thinking when answering health beliefs items, and

whether respondent was parent or guardian of child. Separate models were estimated for respondents randomly assigned to answer about their younger or older child, and we included a variable indicating whether there were children in both age groups in the household. Survey weights were applied to all analyses to account for sampling design and nonresponse.

## RESULTS

Among 4836 adults sampled, 67.8% were screened for past-year OPR use; 97.8% of those eligible (*N* = 1055) completed the survey (*N* = 1032), and 681 had children in the home. We display the characteristics of the study sample, adults with past-year OPR use and children in the home, in Table 1. The mean number of children in respondents' household was 1.9 (95% confidence interval [CI], 1.8–2.0).

Safe storage of OPRs was reported among 32.6% (95% CI, 21.4%–43.8%) of respondents with only young children, 11.7% (95% CI, 7.2%–16.2%) among those with only older children,

and 29.0% (95% CI, 18.3%–39.8%) among those with children in both age groups (Fig 1). Respondents considering a younger child had a significantly higher mean perceived threats scale score (6.2; 95% CI, 6.1–6.4 vs 5.7; 95% CI, 5.5–5.8) compared with respondents considering an older child (Table 2). Although 72.6% of all respondents agreed with the statement, "Children can overdose on OPRs more easily than adults," those considering a younger compared with an older child had a significantly higher mean score on this item (6.3; 95% CI, 6.0–6.5 vs 5.8; 95% CI, 5.6–6.0). Although three-quarters of all respondents agreed that "Children who take an adult's OPRs can suffer serious health consequences," those considering a younger versus older child scored significantly higher on this item (6.4; 95% CI, 6.2–6.6 vs 6.0; 95% CI, 5.8–6.2). A slight majority (59.1%) of all respondents agreed, "Even a small amount of OPRs could kill my child," although again, respondents thinking about a younger versus an older child had a significantly higher mean score (6.0; 95% CI, 5.8–6.2 vs 5.2; 95% CI, 4.9–5.4).

For perceived benefits of safe storage, respondents considering younger versus older children had a significantly higher scale score (6.0; 95% CI, 5.8–6.3 vs 5.5; 95% CI, 5.5–5.7). Almost 70% of all respondents agreed that storing OPRs in a locked place "is a good way to keep my child from getting the medication" and "would prevent my child's friends from getting the medication"; only the first of these items differed significantly between the 2 groups, with respondents thinking about a younger versus an older child having a higher mean score (6.2; 95% CI, 5.9–6.4 vs 5.6; 95% CI, 5.4–5.9). Overall, 56.6% agreed that storing OPRs in a locked place would give them peace of mind about their child's safety, with respondents considering their younger child versus older child

scoring significantly higher (5.8; 95% CI, 5.6–6.1 vs 5.1; 95% CI, 4.8–5.3).

The mean scale scores for perceived barriers to safe storage were significantly lower for those thinking about a younger child compared with an older child (2.9; 95% CI, 2.6–3.2 vs 3.5; 95% CI, 3.2–3.7). Overall, few respondents agreed that storing OPRs in a locked place “is more trouble than it’s worth” (15.2%), “would make it too hard to use the medication” (15.7%), and “takes too much time” (16.9%). “Neutral” responses to these 3 barrier questions were reported by 38% to 44% of respondents (Table 2). Among the single-item scales, only worry significantly differed between those thinking about younger versus older children (3.0; 95% CI, 2.7–3.4 vs 2.4; 95% CI, 2.2–2.7).

Among respondents considering a younger child, none of the health belief measures were significantly associated with likelihood of reporting safe storage practices in adjusted regression analyses (Table 3). Among respondents considering an older child, the odds of reporting safe storage were reduced by half as perceived barrier scale scores increased (0.505; 95% CI, 0.369–0.692), increased twofold as self-efficacy increased (2.112; 95% CI, 1.390–3.210), and increased (1.728; 95% CI, 1.374–2.174) as worry increased in the adjusted regression analyses.

## DISCUSSION

Results from this study indicate that the majority of homes with children where OPRs were used in the past year are reporting unsafe storage. One-third (32.6%) of respondents with children ages ≤6 years in the household reported storing their OPRs in a place that locked or latched, and only 11.7% of those with children ages 7 to 17 stored them in a locked place. These results are only slightly better than the 9% of

**TABLE 2** Comparison of Beliefs About Safe Storage Practices Reported by Respondents With Past-Year OPR Use Living With Younger and Older Children in the Household, 2015

Health Belief Variable	Mean (95% CI)			P
	Proportion of Respondents Who Agree or Disagree, <sup>a</sup> N = 681	Respondents Considering Younger Children Ages <1–6 in the Home, <sup>b</sup> N = 222	Respondents Considering Older Children Ages 7–17 in the Home, <sup>b</sup> N = 459	
Perceived Threats Scale, <sup>c</sup> Cronbach's $\alpha$ = .66		6.2 (6.1–6.4)	5.7 (5.5–5.8)	<.001
Children can overdose on OPRs more easily than adults.	Agree 72.6% Neutral 22.1% Disagree 5.3%	6.3 (6.0–6.5)	5.8 (5.6–6.0)	.013
Even a small amount of OPRs could kill my child.	Agree 59.1% Neutral 33.5% Disagree 7.3%	6.0 (5.8–6.2)	5.2 (4.9–5.4)	<.001
Children who take an adult's OPRs can suffer serious health consequences.	Agree 75.3% Neutral 23.5% Disagree 1.1%	6.4 (6.2–6.6)	6.0 (5.8–6.2)	.001
Perceived Benefits Scale, <sup>c</sup> Cronbach's $\alpha$ = .82		6.0 (5.8–6.3)	5.5 (5.3–5.7)	.002
Storing OPRs in a locked place is a good way to keep my child from getting the medication.	Agree 69.5% Neutral 24.5% Disagree 6.0%	6.2 (5.9–6.4)	5.6 (5.4–5.9)	.004
Storing OPRs in a locked place would prevent my child's friends from getting the medication.	Agree 69.9% Neutral 22.8% Disagree 7.4%	6.1 (5.8–6.4)	5.7 (5.5–6.0)	.072
Storing OPRs in a locked place would give me peace of mind about my child's safety.	Agree 56.6% Neutral 32.9% Disagree 10.5%	5.8 (5.6–6.1)	5.1 (4.8–5.3)	<.001
Perceived Barriers Scale, <sup>c</sup> Cronbach's $\alpha$ = .83		2.9 (2.6–3.2)	3.5 (3.2–3.7)	.008
Storing OPRs in a locked place is more trouble than it's worth.	Agree 15.2% Neutral 38.0% Disagree 46.7%	2.7 (2.3–3.0)	3.5 (3.2–3.7)	<.001
Storing OPRs in a locked place would make it too hard for me to use the medication.	Agree 15.7% Neutral 37.6% Disagree 46.7%	2.9 (2.5–3.2)	3.4 (3.1–3.7)	.021
Putting my OPRs in a locked place after I use it every time takes too much time.	Agree 16.9% Neutral 44.0% Disagree 39.1%	3.3 (2.9–3.6)	3.5 (3.3–3.8)	.235
Self-efficacy				
How sure are you that you can store OPRs in a locked place all the time?	Sure 51.8% Neutral 34.6% Unsure 13.6%	5.3 (4.9–5.7)	4.9 (4.7–5.2)	.118
Worry				
I worry about my child getting access to my OPRs.	Agree 13.2% Neutral 26.6% Disagree 60.2%	3.0 (2.7–3.4)	2.4 (2.2–2.7)	.008
Cues to action				
Have you heard about children who have died of getting into their parents' OPRs?	Yes 54.2% No 45.8%	53.5 (45.1–62.0)	54.8 (48.1–61.4)	.820

Survey weights were applied to account for survey sampling design.

<sup>a</sup> Respondents' agreement with each item was measured on a 7-point Likert scale anchored by 7, *strongly agree* and 1, *strongly disagree*. Responses 6 and 7 were collapsed as *agree*, 3–5 as *neutral*, and 1 and 2 as *disagree*.

<sup>b</sup> When respondents had only young (<1–6 y) or older (7–17 y) children, they were instructed to think about that child when responding to survey questions. Respondents with children in both age groups were randomly assigned to think about either their youngest or oldest child when answering these questions.

<sup>c</sup> Scales were derived from combined individual items for perceived benefits, perceived barriers, and perceived threats, and mean scale scores were calculated.

**TABLE 3** Regression Results Examining the Association Between Health Beliefs and Safe Storage Practices Among Respondents Reporting Past-Year OPR Use Living in Households With Children, 2015

Health Beliefs	Odds of Safe Storage <sup>a</sup> Among Respondents Considering Younger Child Age <1–6 y, N = 214		Odds of Safe Storage <sup>a</sup> Among Respondents Considering Older Child Age 7–17 y, N = 444	
	Odds Ratio (95% CI)		Odds Ratio (95% CI)	
	Model 1	Model 2 <sup>b</sup>	Model 1	Model 2 <sup>b</sup>
Threats	0.863 (0.615–1.210)	0.792 (0.550–1.142)	1.846 (0.906–3.759)	1.548 (0.860–2.788)
Benefits	0.88 (0.535–1.449)	0.962 (0.627–1.475)	1.463 (0.854–2.500)	1.575 (0.972–2.552)
Barriers	0.771 (0.590–1.009)	0.808 (0.593–1.100)	0.634** (0.458–0.878)	0.505** (0.369–0.692)
Efficacy	1.082 (0.874–1.340)	1.13 (0.891–1.432)	1.702* (1.045–2.773)	2.112** (1.390–3.210)
Worry	1.066 (0.887–1.279)	1.117 (0.929–1.343)	1.376** (1.089–1.739)	1.728** (1.374–2.174)
Cue to action	1.265 (0.595–2.690)	1.491 (0.680–3.265)	1.128 (0.486–2.617)	0.939 (0.382–2.308)

Separate logistic regression models were estimated for each model. Survey weights were applied to account for survey sampling design.

<sup>a</sup> Safe storage of opioid pain relievers was defined as always or almost always storing the medication in a place that is locked or latched for those responding about a young child (<1–6 y) and as always or almost always storing the medication in place that is locked for those responding about an older child (7–17 y).

<sup>b</sup> Model 2 adjusts for respondents' age, sex, educational attainment, whether living with partner or spouse, race and ethnicity, household income, residence in metropolitan statistical area, region of country, whether respondent was still using OPR at time of survey, number of children, age of child about which respondent was thinking when answering health belief questions, whether the respondent is parent or guardian of the child, and whether there are both younger and older children in the household. Characteristics were entered into the model under the same categorization as in Table 1.

\*  $P < .05$ ; \*\*  $P < .01$ .

all households that reported safely storing OPRs in our larger survey that included households with and without children.<sup>15</sup> Our current results also found that respondents thinking about older versus younger children consistently reported lower perceptions of threats, benefits, and worry and higher perceptions of barriers. Taken together, these results allow us to accept our hypothesis that respondents with older children have less protective beliefs and practices compared with those with younger children. We also hypothesized, and our results confirmed for those referring to an older child, that safe storage was associated with lower perceptions of barriers and higher perceptions of self-efficacy and worry. This association was not seen for those responding about younger children. Knowledge of a child's death due to OPRs was unrelated to storage practices; therefore, we rejected our hypothesis that assumed an association between them.

Pediatric care providers are uniquely positioned to use these findings to guide anticipatory guidance and

patient education. General pediatric poison prevention anticipatory guidance is well established and includes recommending that medicines and other household poisons be locked up.<sup>27</sup> The high proportion of "neutral" responses to many of the HBM items we observed suggests that a large number of parents have not yet formed opinions about OPRs and the need for safe storage. Although more study is warranted, there is an urgent need for more or better public information, including age-specific anticipatory guidance. For households with older children, our results suggest that safe storage practices increase when the perceived barriers to doing so are reduced. Pediatricians' anticipatory guidance should address perceptions of barriers to safe storage while reinforcing adults' efficacy to safely store OPRs. As has been shown with other safety products, making storage devices available through clinic- or hospital-based safety resource centers is an effective method for increasing adoption of them.<sup>28</sup>

Although the OPRs reported in our sample belonged to the adult,

their presence in the home and how they are stored are relevant data for pediatricians. A recent study<sup>29</sup> reported a 165% increase in hospitalizations for prescription opioids among those ages 1 to 19 years between 1997 and 2012; the study did not document whether the prescription was for the hospitalized child or some other household member. Some adolescents believe that because a doctor prescribes OPRs, they are safe for nonmedical use.<sup>30</sup> Both adults and adolescents need to be educated about the association between nonmedical prescription drug use and risk of opioid use disorder.<sup>4,31</sup> Pediatricians can educate adults with older children about the addiction and overdose risks of access to their OPRs for nonmedical use by their children or their friends. Existing materials may be helpful for these discussions,<sup>32,33</sup> although more research is needed to demonstrate the impact of such interventions on behavioral and health outcomes.

The present findings should be interpreted in the context of the study's limitations. Approximately one-third of those screened into the study reported OPR use in the past year, which is higher than the national average of 4% to 6%.<sup>34</sup> We relied on self-reported storage practices; therefore, our findings could be subject to social desirability bias. However, this would mean that our results overestimate the proportion of households safely storing OPRs, making our results even more concerning. Social desirability could also influence reported beliefs, although our concern about this bias is lessened by the large proportion of "neutral" responses, the variability in responses, and the relationships between beliefs and behaviors that were found for those with older children. Another potential limitation is our construction of the younger and older age groupings of children

to assess health beliefs. This grouping may not accurately reflect how adults with children in the home determine OPR storage practices. Our age cutoff point was based on both sample size considerations and children's developmental capabilities related to accessing medications. Because we used the more conservative definition (ie, locked) of safe storage in all our HBM items, we may not have accurately assessed beliefs among the respondents reporting on younger children (where latching OPRs was also considered safe). Our research was not intended to fully explain all the factors influencing parents' safe storage practices but rather to describe current storage practices and salient beliefs to

help inform public education and anticipatory guidance. There may well be additional barriers that we did not assess, and more research is warranted to better understand what influences adults' OPR storage beliefs and practices.

## CONCLUSIONS

OPRs are pervasive in US households, including among households with children, and storage practices in these homes are suboptimal. Unsafe OPR storage contributes to the potential for children of all ages to be harmed, either through unintentional poisoning by younger children or nonmedical use raising the risk of

addiction or overdose among older children. Public health campaigns and pediatric anticipatory guidance should address perceived barriers related to safe storage while emphasizing how it may reduce unintentional and intentional exposure to OPRs among children. More research is needed to identify the most effective means of storing OPRs and of promoting their adoption in homes with children of all ages.

## ABBREVIATIONS

CI: confidence interval  
HBM: Health Belief Model  
OPR: opioid pain reliever

---

**POTENTIAL CONFLICT OF INTEREST:** The authors have indicated they have no potential conflicts of interest to disclose.

---

## REFERENCES

1. Substance Abuse and Mental Health Services Administration. Results from the 2012 National Survey on Drug Use and Health: summary of national findings. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2013. NSDUH Series H-46, HHS publication no. (SMA) 13-4795
2. Centers for Disease Control and Prevention. Opioid painkiller prescribing. Atlanta, GA: CDC; July 2015. Available at: [www.cdc.gov/vitalsigns/opioid-prescribing/](http://www.cdc.gov/vitalsigns/opioid-prescribing/). Accessed May 10, 2016
3. Center for Behavioral Health Statistics and Quality. Behavioral health trends in the United States: results from the 2014 National Survey on Drug Use and Health. Rockville, MD: Substance Abuse and Mental Health Administration. HHS publication no. SMA 15-4927, NSDUH Series H-50. Available at: [www.samhsa.gov/data/](http://www.samhsa.gov/data/). Accessed April 22, 2016
4. Compton WM, Jones CM, Baldwin GT. Relationship between nonmedical prescription-opioid use and heroin use. *N Engl J Med*. 2016;374(2):154–163
5. Centers for Disease Control and Prevention. Drug poisoning deaths in the United States, 1980–2008. 2011. Available at: [www.cdc.gov/nchs/data/databriefs/db81.pdf](http://www.cdc.gov/nchs/data/databriefs/db81.pdf). Accessed March 28, 2016
6. Burghardt LC, Ayers JW, Brownstein JS, Bronstein AC, Ewald MB, Bourgeois FT. Adult prescription drug use and pediatric medication exposures and poisonings. *Pediatrics*. 2013;132(1):18–27
7. Lovegrove MC, Mathew J, Hampp C, Governale L, Wysowski DK, Budnitz DS. Emergency hospitalizations for unsupervised prescription medication ingestions by young children. *Pediatrics*. 2014;134(4). Available at: [www.pediatrics.org/cgi/content/full/134/4/e1009](http://www.pediatrics.org/cgi/content/full/134/4/e1009)
8. Walton W. An evaluation of the Poison Prevention Packaging Act. *Pediatrics*. 1982;69(3):363–370
9. McDonald EM, Girasek DC, Gielen AC. Home injuries. In: Liller KD, ed. *Injury Prevention for Children and Adolescents: Research, Practice and Advocacy*. 2nd ed. Washington, DC: APHA; 2012:149–188
10. Institute of Medicine. Forging a poison prevention and control system. Washington, DC: The National Academies Press; 2004
11. National Safety Council. Practice safety at home with opioid painkillers. 2014. Available at: [www.nsc.org/RxDrugOverdoseDocuments/Rx%20community%20action%20kit%202015/CAK-practice-safety-at-home.pdf](http://www.nsc.org/RxDrugOverdoseDocuments/Rx%20community%20action%20kit%202015/CAK-practice-safety-at-home.pdf). Accessed August 1, 2016
12. Wilson MH, Baker SP, Teret SP, Shock S, Garbarino J. *Saving Children: A Guide to Injury Prevention*. New York, NY: Oxford University Press; 1991
13. Achana FA, Sutton AJ, Kendrick D, et al. The effectiveness of different interventions to promote poison prevention behaviours in households with children: a network meta-analysis. *PLoS One*. 2015;10(3):e0121122
14. Children's Health Evaluation Research Unit. Narcotics in the medicine cabinet: provider talk is key to lower risk. *C.S. Mott Children's Hospital National*

- Poll on Children's Health*. 2016;26(4). <http://mottnpch.org/reports-surveys/narcotics-medicine-cabinet-provider-talk-key-lower-risk>. Accessed June 10, 2016
15. Kennedy-Hendricks A, Gielen AC, McDonald EM, McGinty EE, Shields W, Barry CL. Medication sharing, storage, and disposal practices for opioid medications among US adults. *JAMA Intern Med*. 2016;176(7):1027–1029
  16. Trifiletti LB, Gielen AC, Sleet DA, Hopkins K. Behavioral and social sciences theories and models: are they used in unintentional injury prevention research? *Health Educ Res*. 2005;20(3):298–307
  17. Gielen AC, Sleet D. Application of behavior-change theories and methods to injury prevention. *Epidemiol Rev*. 2003;25:65–76
  18. Janz NK, Becker MH. The Health Belief Model: a decade later. *Health Educ Q*. 1984;11(1):1–47
  19. Glanz K, Rimer BK, Viswanath K. *Health Behavior and Health Education: Theory, Research, and Practice*. 4th ed. San Francisco, CA: Jossey-Bass; 2008:45–51
  20. Becker MH, Rosenstock IM. Compliance with medical advice. In: Steptoe A, Matthews A, eds. *Health Care and Human Behavior*. London, England: Academic Press; 1984:135–153
  21. Rosenstock IM, Strecher VJ, Becker MH. Social learning theory and the Health Belief Model. *Health Educ Q*. 1988;15(2):175–183
  22. Barry CL, Kennedy-Hendricks A, Gollust SE, et al. Understanding Americans' views on opioid pain reliever abuse. *Addiction*. 2016;111(1):85–93
  23. Barry CL, Brescoll VL, Brownell KD, Schlesinger M. Obesity metaphors: how beliefs about the causes of obesity affect support for public policy. *Milbank Q*. 2009;87(1):7–47
  24. Heckman CJ, Darlow S, Manne SL, Kashy DA, Munshi T. Correspondence and correlates of couples' skin cancer screening. *JAMA Dermatol*. 2013;149(7):825–830
  25. McGinty EE, Kennedy-Hendricks A, Baller J, Niederdeppe J, Gollust S, Barry CL. Criminal activity or treatable health condition? News media framing of opioid analgesic abuse in the United States, 1998–2012. *Psychiatr Serv*. 2016;67(4):405–411
  26. StataCorp. Stata Statistical Software: Release 14. 2015
  27. American Academy of Pediatrics. Protect your child: prevent poisonings. Available at: <https://www.healthychildren.org/English/safety-prevention/all-around/Pages/Keep-Your-Home-Safe-From-Poisons.aspx>. Accessed June 19, 2016
  28. Gielen AC, McDonald EM, Wilson ME, et al. Effects of improved access to safety counseling, products, and home visits on parents' safety practices: results of a randomized trial. *Arch Pediatr Adolesc Med*. 2002;156(1):33–40
  29. Gaither JR, Leventhal JM, Ryan SA, Camenga DR. National trends in hospitalizations for opioid poisonings among children and adolescents, 1997 to 2012. *JAMA Pediatr*. 2016;170(12):1195–1201
  30. Boyd CJ, McCabe SE, Cranford JA, Young A. Adolescents' motivations to abuse prescription medications. *Pediatrics*. 2006;118(6):2472–2480
  31. McCabe SE, West BT, Morales M, Cranford JA, Boyd CJ. Does early onset of non-medical use of prescription drugs predict subsequent prescription drug abuse and dependence? Results from a national study. *Addiction*. 2007;102(12):1920–1930
  32. US Food and Drug Administration. Lock it up: medicine safety in your home. 2016. Available at: [www.fda.gov/ForConsumers/ConsumerUpdates/ucm272905.htm](http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm272905.htm). Accessed August 1, 2016
  33. Substance Abuse Mental Health Services Administration (SAMSHA). Series: tips for teens. Available at: <http://store.samhsa.gov/list/series?name=Tips-for-Teens>. Accessed August 1, 2016
  34. Frank SM, Porter KS, Paulozzi LJ. *Prescription Opioid Analgesic Use Among Adults: United States, 1999–2012*. NCHS data brief no. 189. Hyattsville, MD: National Center for Health Statistics; 2015