“Hang Up Your Pocketbook” — An Easy Intervention for the Granny Syndrome: Grandparents as a Risk Factor in Unintentional Pediatric Exposures to Pharmaceuticals

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Context: Although the circumstances are not well studied, grandparents’ medications account for 10% to 20% of unintentional pediatric intoxications in the United States. Objectives: To characterize circumstances leading to and outcomes from pediatric pharmaceutical exposures. To identify preventable risk factors associated with this pattern of injury, referred to as the “granny syndrome.” Design, Setting, and Participants: Retrospective review of records of telephone calls made to a certified regional poison control center in the United States. Records were analyzed for all calls concerning children aged 6 years or younger who were exposed to grandparents’ medication(s). For statistical analysis, regression and χ² analysis as well as Fisher exact tests were used. The sample size provided 80% power to detect a 10% difference at the 5% level of significance. Statistical significance was set at P <= .05.

Main Outcomes Measured: Use of child-resistant containers (CRCs), the location of pharmaceuticals prior to pediatric ingestion, and drug classes involved (eg, analgesics, cardiovascular drugs).

Results: Of the 200 incidents analyzed, 90 (45%) cases involved CRCs, and 110 (55%) involved containers that were not child resistant. For these incidents, the average age of the child was 18.8 months; the grandparent was aged on average 58.7 years. Most medications had been placed on tables or countertops (91 [46%]), low shelves (57 [29%]), or in pocketbooks (34 [17%]). The type of container in which the pharmacologic agent was stored (CRC vs non-CRC) was not statistically significant (P > .1). Ease of access to medication, regardless of the type of container used, was the only statistically significant outcome (P < .001). In the present study, accidental pediatric exposures most frequently involved cardiovascular (90 [45%]), analgesic (84 [42%]), and psychotropic (32 [16%]) medications.

Conclusion: Pediatric exposure to pharmaceutical agents is a preventable cause of injury. Physicians have an important opportunity to assist in preventing pediatric pharmaceutical exposures by instructing parents and grandparents on how to better limit children’s access to medications as an essential component to enhance child safety.

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Report of Case

A 3-year-old boy was brought to the emergency department by his mother and grandmother after he had ingested an unknown quantity and assortment of medications. The child was anxious and crying, but appeared well overall. The patient’s vital signs were within the normal range. Medical history was unremarkable as confirmed by consultation with the patient’s pediatrician.

On inquiry into the history of injury, it was learned that the grandmother came over to bake cookies with her grandson. She placed her pocketbook on the sofa “for just a moment” while she went into the kitchen to place the groceries on the counter. When she returned to the living room, she discovered that her grandson had opened her purse and was playing with her pills. He looked up at her and said, “M&M’s, Nana,” referring to the well-known chocolate candy.

The child’s mother called the local poison control center and was instructed to take the boy to the nearest emergency department. They arrived at the emergency department within 1 hour of ingestion. When asked what the ingested medications were and how many were swallowed by the boy, the grandmother responded that she was taking “a water pill, some other pill for blood pressure, a sugar pill, and one for my heart.” She stated that she carries a couple days’ worth of each pill in a sandwich bag because it is easier for her to open than a pill bottle. Nevertheless, the grandmother was uncertain exactly how many pills were available to her grandson or how many were ingested by him.

In consultation with the grandmother’s geriatrician, we determined that she was taking an ACE (angiotensin con-
Original Contribution

Verting enzyme) inhibitor, a diuretic, a sulfonamide, and a β-adrenergic blocker. Given the respective toxicologic profiles of each drug class represented and the time elapsed since ingestion, we determined that one dose of activated charcoal should be initiated. The child’s serum glucose levels were monitored and intravenous hydration therapy with 5% dextrose in normal saline was implemented. The patient’s vital signs remained stable. The patient was observed and monitored for several hours. After remaining clinically stable during this time, he was sent home in his parent’s care with specific instructions. His mother was instructed to monitor the child for any change in alertness, mental status, pallor, or onset of new symptoms (e.g., lethargy, nausea, vomiting), in which case she was instructed to contact the poison control center immediately. In addition, the child’s mother was reassured that the child should have a good outcome and should be encouraged to eat at his next meal time. Normal activities could be resumed the next day.

Context

Most physicians can recall a similar situation at least one time in their clinical careers. In fact, accidental pediatric ingestions of pharmacologic substances are daily events. Unintentional medication and toxicant exposures involving young children are a common occurrence and a public health concern. Toddlers are at the greatest risk to be injured by their environment because their inherent curiosity is accompanied by an ever-increasing ability to interact with their surroundings as they learn to crawl and walk. The Association of American Poison Control Centers (AAPCC)1-8 estimates that children younger than 6 years account for over 50% of toxicant exposures. Of the more than 2 million pharmaceutical exposures reported annually from 1997 through 2004, 52% involved children younger than 6 years—rates that have remained stable since the early 1990s. For this nearly decade-long period, more than 80% of all pharmaceutical exposures were classified by the AAPCC as unintentional.

It is generally recognized that most unintentional exposures usually result in mild symptoms or no symptoms, and that less than 10% of unintentional exposures involving toddlers result in significant symptoms.1,9 Nonetheless, there are certain common medicines and substances that may place a child at greater risk for fatality, such as antidepressants, prenatal iron supplements, and salicylates, all of which have been reported to cause severe toxicity in toddlers.1,2,10,11

From an injury-prevention perspective, children involved in unintentional toxicant exposures who present to a healthcare facility—depending on the potential risk associated with that specific incident—are at risk for additional and more serious poisonings.12

Although the causes for such exposures are multifactorial,11,13 unintentional pharmaceutical exposure suggests that the child’s environment has not been properly “child-proofed.” One cause of such exposures is improper storage of controlled substances, an occurrence that is regrettably common and has resulted in the creation of child-resistant containers (CRCs). Often, parents, grandparents, and other adults forget that children are natural explorers, are able to move quickly, are determined to investigate their environments, and will generally put anything and everything into their mouths that they can get their hands on.11 Finally, toddlers are well-known imitators.13 They may have observed adults taking their medications in the past, and therefore seek to imitate that “grown-up” behavior.13 Because of their stage of cognitive development, however, children—and especially those younger than 3 years—are unable to discriminate safe from unsafe products.14 In a child’s eyes, pills resemble candy. A toxic amount can be ingested before taste aversion leads to discontinuing exploratory consumption.

In a study of children younger than 6 years that examined the potential for toxicity from tricyclic antidepressants, researchers had an incidental finding that demonstrated that almost half of the patients in the case series ingested medications that belonged to a non-parent adult, mostly grandmothers.15 This finding encouraged that set of investigators to conduct a new study designed to characterize the circumstances contributing to the 27,209 calls involving children younger than 6 years placed to a regional poison control center during the years 1997 and 1998.13,16,17 The authors’ results suggested that the presence of a grandparent is a risk factor for unintentional pediatric exposure to pharmaceuticals.

To improve the efficacy of public marketing and prevention messages, in the present study, we refer to this risk factor as the “granny syndrome.”16-19 An interesting and unexpected finding of these studies was that many of the substances involved in the exposure incidents were kept in CRCs, which apparently did not confer a substantial safety advantage.

To prevent unintentional pediatric exposures, and to reduce unnecessary visits to healthcare facilities—as well as the significant psychological and emotional morbidity associated with this pattern of injury—we designed the present study to characterize the circumstances that contribute to this pattern of injury.

Methods

This prospective, survey-based study was conducted during a 4-month period at the Long Island (NY) Regional Poison and Drug Information Center (LIRPDIC), a certified regional poison control center and member of the AAPCC (http://www.lirpdic.org/). All poison information specialists at the LIRPDIC have obtained certification according to the requirements of the AAPCC, and are fully trained to interview callers and elicit critical information.

To determine subject eligibility for the study, we assessed the records for all telephone calls related to medication exposure that involved patients aged 6 years or younger. Patients were included in the study if the toxicant belonged to a grandparent. Patients were excluded from this investigation if the ingestion was determined by LIRPDIC staff to be intentional,
if the child was in the care of a parent at the time of the ingestion, or if the toxicant belonged to either a parent or the child. We felt that characterizing the precursors to exposure might assist in identifying additional opportunities for prevention.

For each potential study subject, the LIRPDIC certified poison information specialist asked questions that are standard for poison control center intake. The answers to these questions assist poison information specialists in characterizing the events leading up to an exposure.

As noted, the staff at LIRPDIC who participated in this study were certified poison information specialists. All LIRPDIC staff were blinded to all study end points and objectives. Evaluation for eligibility in the present study was performed during the initial emergency telephone call to LIRPDIC. Information gathered included patient and grandparent demographics, the location of the toxicant at the time the child gained access to it, the class and name of the toxicant(s), the method of storage (CRC or non-CRC), and medication dose—though the latter variable was not an outcome measured in the present study.

This investigation was granted exempt status by the Winthrop University Hospital committee on research involving human subjects.

End Points
There were three end points for the present study:
1. To determine if CRCs confer a significant safety advantage when compared with non-CRC packaging (eg, plastic bags, daily “pill minders”).
2. To establish the circumstances or location(s) of toxicant(s) prior to pediatric exposure. (Any location that occurred from the floor to 3 feet above the ground, or in direct proximity to the child, was classified as being in an “easy access” location.)
3. To identify the medications involved in the incident.

For statistical analysis of the first study end point, we determined that a sample size of 200 was required to provide 80% power in detecting a 10% difference between the CRC and non-CRC groups at the 5% level of significance (two-tailed t test; \( P = .05 \)). Given the epidemiology of childhood exposures to medications, a 10% difference would represent a sizable population and an opportunity for clinical intervention. Statistical analysis for the study’s major events (ie, medication access and storage) was performed using regression and \( \chi^2 \) analysis as well as Fisher exact tests (Power and Precision; Biostat Inc, Englewood, NJ).

Results
From January 2000 through December 2000, a total of 21,518 telephone calls were made to LIRPDIC regarding various toxicant exposures. Of these, 10,674 (50%) incidents involved children younger than 6 years.

During the 4-month study period from May 2000 through August 2000, 222 patients were identified as potential subjects. Of these patients, 200 (90%) met inclusion criteria and were not disqualified for study through exclusion criteria. In our study, when children had pharmaceutical exposures that were the result of access to medications belonging to their grandparents, the average age of the grandparent was 58.7 years (range, 43–78 y). The majority of grandparents in this group were aged between 50 and 60 years. The pediatric patient was, on average, aged 18.8 months (range, 10–69 mo).

The majority of patients (6206 [49%]) were aged between 13 and 58.7 years (range, 43–78 y). The majority of grandparents in this study were certified poison information specialists. All LIRPDIC staff were blinded to all study end points and objectives. Evaluation for eligibility in the present study was performed during the initial emergency telephone call to LIRPDIC. Information gathered included patient and grandparent demographics, the location of the toxicant at the time the child gained access to it, the class and name of the toxicant(s), the method of storage (CRC or non-CRC), and medication dose—though the latter variable was not an outcome measured in the present study.

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Nevertheless, cardiovascular medications have the potential for significant toxicity when ingested by young children (Table).20–23

Comment

Few clinicians have not had the experience of treating a child who was exposed to medications belonging to a grandparent. The typical scenario involves the grandmother arriving at the home of her son or daughter to visit a grandchild. The grandmother places her pocketbook or handbag on the floor or sofa, and leaves the room “for just a moment.” She returns to find the pocketbook empty with the child surrounded by pills and cosmetics—and holding an empty pill bottle. Did the child ingest anything? And, how much was consumed? A visit to the emergency department is not uncommon.

As demonstrated in this study, many senior citizens carry cosmetics, potentially toxic products, and medications in a variety of containers that are not child resistant. Consistent

Figure 1. Comparison of the impact of access and storage practices prior to pediatric pharmaceutical exposure incidents. Preincident locations are classified as “easy access” if the medications were placed in direct proximity to the child or at 3 feet above the ground or lower prior to the incident. “Secure locations” are anywhere higher than 3 feet above ground.

Figure 2. Summary of the of non-child-resistant containers in use during pediatric pharmaceutical exposure incidents (n=110).

Figure 3. Comparison of secure and easy access medication locations prior to pharmaceutical exposure incidents (n=200). In two (1%) incidents (not shown), children had access to transdermal nitroglycerin patches.
with national data, the data in this study demonstrate that pediatric pharmaceutical exposures primarily involved cardiovascular, analgesic, and psychotropic medications—including acetaminophen, aspirin, β-blockers, ACE inhibitors with calcium channel blockers, and digitals—medications that pose a moderate to significant risk potential for toddlers as a result of weight-based (ie, mg/kg) prescribing guidelines.20–23

We determined that most pediatric pharmaceutical exposures in this study were the result of proximal accessibility rather than improper storage of medication (ie, container type). Only 16 incidents involved cabinets or higher shelves (ie, ≥36 inches floor to surface), locations that are usually considered childproof or safe. Caregivers often fail to consider the possibility that some toddlers are very determined and are resourceful enough to use whatever means may be necessary to obtain what they want. Such toddlers may climb up drawer handles or may use nearby chairs as stepstools. Children are especially susceptible to this pattern of injury because they are natural explorers, mouth substances as a develop-

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### Table

**Potential Kid Killers: Medications That Are Lethal in Unintentional Pediatric Exposures**

<table>
<thead>
<tr>
<th>Drug Class and Medication</th>
<th>Pediatric Exposure Fatal Dose, mg/kg</th>
<th>Highest Dosage Available per Tablet, mg</th>
<th>Fatal Outcome, Tablets (No.)</th>
<th>Toxicidrome</th>
</tr>
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<tbody>
<tr>
<td><strong>Analgesics</strong></td>
<td></td>
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<tr>
<td>Opioids</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Codeine</td>
<td>15</td>
<td>60</td>
<td>1 tsp</td>
<td>CNS, depression, miosis, respiratory distress</td>
</tr>
<tr>
<td>- Methadone</td>
<td>5</td>
<td>10 (10 mL)</td>
<td></td>
<td>CNS, depression, miosis, respiratory distress</td>
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<tr>
<td><strong>Anesthetics</strong></td>
<td></td>
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<tr>
<td>Local/Topical</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>- Benzocaine</td>
<td>20</td>
<td>20%</td>
<td>2 mL (20%)</td>
<td>Cyanosis, brown blood, seizure</td>
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<tr>
<td><strong>Antidepressants</strong></td>
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<tr>
<td>Cyclic antidepressants</td>
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<tr>
<td>- Imipramine</td>
<td>20</td>
<td>150</td>
<td>1 (150 mg)</td>
<td>Dysrhythmia; electrocardiogram: wide QRS wave; hypotension; seizure</td>
</tr>
<tr>
<td><strong>Antihistamines</strong></td>
<td></td>
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<tr>
<td>Diphenhydramine: OTC</td>
<td>25</td>
<td>50</td>
<td>5</td>
<td>Anticholinergic; dysrhythmia; electrocardiogram: wide QRS wave; seizures</td>
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<tr>
<td>Ethanolamines</td>
<td></td>
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<td></td>
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<tr>
<td>- Dimenhydrinate</td>
<td></td>
<td>25</td>
<td>3</td>
<td>Anticholinergic, seizure</td>
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<tr>
<td><strong>Antimicrobials</strong></td>
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<tr>
<td>Antimalarial agents</td>
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<tr>
<td>- Chloroquine</td>
<td>20</td>
<td>500</td>
<td>1 (500 mg)</td>
<td>CNS, depression, dysrhythmia, seizure</td>
</tr>
<tr>
<td>- Quinine</td>
<td>80</td>
<td>300</td>
<td>2–3</td>
<td>Blindness, dysrhythmia, seizure</td>
</tr>
<tr>
<td><strong>Asthma therapies</strong></td>
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<tr>
<td>Theophylline</td>
<td>50</td>
<td>500</td>
<td>1</td>
<td>Dysrhythmia, seizure</td>
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<tr>
<td><strong>Cardiovascular drugs</strong></td>
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<tr>
<td>β-blocker</td>
<td>&gt;4</td>
<td>160</td>
<td>1–2</td>
<td>Bradycardia; breath sounds, decreased; CNS, depression; electrocardiogram: normal QRS wave, increased PR interval; hypotension; potassium levels, increased</td>
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<tr>
<td>ACE inhibitor with</td>
<td></td>
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<tr>
<td>calcium channel blockers</td>
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<tr>
<td>- Antiarrhythmic: other</td>
<td></td>
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<td></td>
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<tr>
<td>- Quinidine</td>
<td>50</td>
<td>300</td>
<td>1–2</td>
<td>Bradycardia; electrocardiogram: normal QRS wave, increased PR interval; hypotension</td>
</tr>
<tr>
<td>Clonidine</td>
<td>0.1</td>
<td>0.3</td>
<td>1 (0.3 mg)</td>
<td>Dysrhythmia; electrocardiogram: wide QRS wave; seizures</td>
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<tr>
<td><strong>Hormones and hormone antagonists</strong></td>
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<tr>
<td>Oral hypoglycemics</td>
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<tr>
<td>- Sulfonylureas</td>
<td>&lt;1</td>
<td>5</td>
<td>1–2</td>
<td>Hypoglycemia, seizure</td>
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<td><strong>Sedative/hypnotic/antipsychotics</strong></td>
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<tr>
<td>Phenothiazines</td>
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<tr>
<td>- Phenothiazine</td>
<td>20</td>
<td>200</td>
<td>1 (200 mg)</td>
<td>Seizures</td>
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<tr>
<td>- Thioridazine</td>
<td>15</td>
<td>200</td>
<td>1 (20 mg)</td>
<td>Dysrhythmias, hypotension</td>
</tr>
<tr>
<td><strong>Stimulants and street drugs</strong></td>
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<tr>
<td>Diet aids</td>
<td></td>
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</tr>
<tr>
<td>- Phenylpropanolamine</td>
<td>17</td>
<td>75</td>
<td>1–2</td>
<td>Dysrhythmias, intracranial bleeding</td>
</tr>
<tr>
<td><strong>Topical preparations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camphor</td>
<td>100</td>
<td>540 (5 mL)</td>
<td>1 tsp</td>
<td>CNS, seizure</td>
</tr>
<tr>
<td>- Methyl salicylate</td>
<td>&lt;200</td>
<td>1400 mL</td>
<td>1 tsp (7400 mg)</td>
<td>Acidosis, cardiovascular collapse, seizure</td>
</tr>
</tbody>
</table>

Abbreviations: ACE indicates angiotensin converting enzyme; CNS, (symptoms present in the) central nervous system; OTC, over-the-counter formulation.
mental behavior, cannot discriminate safe from unsafe—and they sometimes have access to potentially dangerous pharmaceutical substances.\(^\text{13}\)

Although transdermal delivery devices (ie, nitroglycerin patches) accounted for a small number of total exposures in this study, an increasing number of medications are being developed for transdermal delivery, including potent opioid analogs such as fentanyl. Even discarded patches, often carelessly “disposed” in wastebaskets, can be a source of potentially toxic pharmaceutical exposures for toddlers. Prescribing clinicians need to remind patients wearing transdermal delivery devices to exercise the same preventive cautions around children with these devices as with other toxicants and medications.

Because many families rely on the income of two adults, and because there are more single-parent households than in prior generations, grandparents are increasingly being called on to help care for their grandchildren. However, for most grandparents, it has been many years since they were responsible for taking care of small children. Many of the injury-proofing practices that were previously second nature to them have long since been forgotten. In addition, many older adults find themselves taking medications that were unnecessary during their active parenting years. In the intervening years, safety concerns have given way to convenience and lessening the impact of age-related accessibility and mobility restrictions. For this reason, many older adults decline the use of CRCs, which are often not easy for them to open. In addition, many older adults take such a large and potentially confusing number of medications that they need to use organizer containers, which are easier to open, but may contain a potentially toxic, possibly fatal amount of medication, should a toddler obtain access to them.

**Study Limitations**

We recommend that future research in a larger, population-based study include a comparison of the number of pediatric pharmaceutical exposures involving CRCs and non-CRCs. Although our results suggest that CRCs did not confer a safety advantage among this population, it does not mean that CRCs lack value. However, physicians should let patients know that such packaging may provide a false sense of security.

While the primary study was completed in 2000, evaluation, analysis, and subset study are ongoing. From the postulation of the granny syndrome concept,\(^\text{15}\) we have compared AAPCC data annually to that reported by the LIRPDIC. We continue to monitor cases of the granny syndrome to identify any changes in this injury pattern.

One weakness in the present study is the lack of true denominator data. We do not know how many potential exposures were, in fact, prevented by CRCs. A study of aborted pharmaceutical exposures in children would be a valuable tool in assessing the true value of CRCs. Nonetheless, the results of the present study add to the attempts of researchers to characterize childhood medication exposures and patterns of preventable injury.

**Conclusion**

Grandparents and other visitors pose a risk to children when they bring over-the-counter medications and prescribed substances into children’s home environments—or when children are brought into environments where pharmacologic agents are present and remain in locations that are defined as being within easy access. The granny syndrome is a pattern of injury in pediatric patients that represents an important opportunity for physicians to provide care to the whole patient by simultaneously providing indirect preventive care to the patient’s whole family. Unintentional pediatric pharmaceutical ingestion is a preventable injury and accounts for a significant proportion of the millions of pediatric toxicant exposures that occur annually in the United States. Non-parent adults and older adults, especially grandparents, must be counseled about the potential risks their medications pose to children with whom they come into contact.

Our analysis reveals that the granny syndrome appears to be mainly the result of a failure in patient education, which
is, of course, a correctable condition. Patients need to be made aware that access, not choice of container, has the most impact on prevention for this pattern of injury. Seventeen percent of the pediatric pharmaceutical exposures in the present study were the result of child access to pocketbooks. It appears that pocketbooks, when left on the floor in the presence of children aged 6 years or younger, constitute a potentially lethal weapon. In addition, counters and low shelves are dangerous points of child access to pharmaceutical agents.

The granny syndrome presents healthcare professionals with a vitally important intervention opportunity for poison control and injury prevention. Physicians should ask all of their patients if they have contact with small children (Figure 4). Warning stickers (Figure 5) similar to ones alerting clinicians about drug allergies can be placed on patients’ medical records and used as prompts to remind physicians to discuss drug safety and exposure prevention issues. All patients should be encouraged to carry a list of their current medications and doses. Increasingly, clinics and physicians’ offices are offering patients wallet cards to list their medications, but even a dated index card will suffice. Patients—as parents, grandparents, family members, family friends, caregivers, and visitors to homes with small children—should be reminded to keep the telephone number of their local poison information center ((800) 222-1222) near all telephones.

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McFie and Caraccio • Original Contribution