The Growing Impact of Pediatric Pharmaceutical Poisoning

G. Randall Bond, MD[1,2], Randall W. Woodward[1], and Mona Ho, MS[1]

Objective To understand which medications, under which circumstances, are responsible for the noted increase in pediatric medication poisonings, resource use, and morbidity.

Study design Patient records from 2001-2008 were obtained from the National Poison Data System of the American Association of Poison Control Centers for children aged ≤5 years evaluated in a health care facility following exposure to a potentially toxic dose of a pharmaceutical agent. Pharmaceutical agents were classified as over-the-counter or prescription and by functional category. Exposures were classified as child self-ingested the medication or as therapeutic error. For the 8-year period, emergency visits, admissions, significant injuries, and trends in these events were calculated for each substance category.

Results We evaluated 453 559 children for ingestion of a single pharmaceutical product. Child self-exposure was responsible for 95% of visits. Child self-exposure to prescription products dominated the health care impact with 248 023 of the visits (55%), 41 847 admissions (76%), and 18 191 significant injuries (71%). The greatest resource use and morbidity followed self-ingestion of prescription products, particularly opioids, sedative-hypnotics, and cardiovascular agents.

Conclusions Prevention efforts have proved to be inadequate in the face of rising availability of prescription medications, particularly more dangerous medications. *(J Pediatr 2012;160:265-70)*.

See editorial, p 190

Despite a half-century of dedicated preventive efforts, poisoning remains a common childhood injury. Each year, >500 000 children aged ≤5 years are exposed to pharmaceuticals in a potential poisoning event.[1] More than 50 000 seek emergency department (ED) care and that number is rising.[1-4] Calls to poison centers about pediatric pharmaceutical exposures (per 1 million population served) fell continuously from 1990-2000 but rose from 2001-2008.[5] As of 2005, ED visits by young children for medication poisonings exceeded those for motor vehicle occupant injuries.[4,6]

If we are to make progress in reducing childhood injury from pharmaceutical poisoning, we need to better understand the epidemic. To appropriately focus efforts, we need to know the medications that are the most consequential—those that contribute the most ED visits, hospitalization, and harm. Our objective was to understand which medications, under which circumstances, are responsible for the increase in pediatric medication poisonings, resource use, morbidity, and mortality so that investigators and policy makers can most effectively assess and revise preventive efforts.

Methods

The National Poison Data System (NPDS) is the electronic database of all calls to any member poison center of the American Association of Poison Control Centers (AAPCC). These centers provide service throughout the United States and cover every citizen. Data from every call are recorded electronically, in real time, in a standardized format. NPDS was searched for all electronic medical records meeting the following criteria: children aged ≤5 years whose call type was an unintentional exposure to a pharmaceutical agent that involved presenting to a health care facility in 2001-2008. Because the health care facilities involved in evaluating these patients are overwhelmingly EDs, that term is used throughout this report.

Detailed analysis of these records was limited to those exposed by ingestion, to agent type (over-the-counter [OTC] or prescription), to standardized reason code Unintentional Self-Exposure or Unintentional Therapeutic Error, and those exposed to a single product. Products sold in

AAPCC	American Association of Poison Control Centers
ARCOS	Automation of Reports and Consolidated Orders System
ED	Emergency department
OTC	Over-the-counter
NPDS	National Poison Data System

From the [1]Division of Emergency Medicine, Cincinnati Children's Hospital Medical Center, and Department of Pediatrics and the [2]Drug and Poison Information Center, Cincinnati Children's Hospital Medical Center, University of Cincinnati, Cincinnati, OH

The American Association of Poison Control Centers (AAPCC; http://www.aapcc.org) maintains the national database of information logged by the country's 61 Poison Control Centers (PCCs). Case records in this database are from self-reported calls: they reflect only information provided when the public or healthcare professionals report an actual or potential exposure to a substance (eg, an ingestion, inhalation, topical exposure, etc) or request information/educational materials. Exposures do not necessarily represent a poisoning or overdose. The AAPCC is not able to completely verify the accuracy of every report made to member centers. Additional exposures may go unreported to PCCs and data referenced from the AAPCC should not be construed to represent the complete incidence of national exposures to any substance(s). The authors' opinions do not necessarily represent those of the AAPCC or its member centers.

The authors declare no conflicts of interest.

 10.1016/j.jpeds.2011.07.042

combination (eg, antihistamine/decongestant cough and cold products) were considered a single product and included in the analysis. Acetaminophen-containing combination cough and cold products were included as cough and cold products.

To further assess the impact of each class of agent and reason for ingestion, we calculated the percent that were admitted (proxy for higher resource use) and the morbidity—the percent meeting NPDS standardized symptom-based outcome criteria for moderate effect, major effect, or death (defined in the NPDS Annual Report, Appendix B).[7] These patients were considered injured. For all deaths, one of the authors (G.B.) obtained and reviewed additional information from the published AAPCC annual reports, death reports provided by the AAPCC, and information collected for a prior study, in order to validate the nature of exposure, the reason, and the primary agent.[8] Cases were excluded if the additional information suggested the drug exposure was not related to the patient's death or exposure route was not ingestion.

To assess for the impact of outside trends on results, we compared changes in ED visits, injuries, and hospitalizations from 2001-2008 to changes in the pediatric population of the United States[6] and to all pediatric pharmaceutical exposure calls to a US poison center including those not involving a hospital.[5] To compare the rate of change in one category of medication, opioids, we used publically available data on US opioid use (distribution from manufacturers and distributors reports of Schedule II and III narcotics to US Department of Justice, Drug Enforcement Administration's Automation of Reports and Consolidated Orders System [ARCOS] requested at http://www.deadiversion.usdoj.gov/arcos/index.html).

From an SQL database of the records, summary data were compiled using Excel 2010 (Microsoft Corporation, Redmond, Washington) and imported to SAS (Statistical Analysis System v9.2; SAS Institute, Cary, North Carolina). General linear models using least squares regression analysis were used to analyze trends and trend comparisons. Comparisons of proportions were done using χ^2 tests. All statistical analyses were conducted with SAS. Comparisons were not considered significant unless $P < .05$.

Approval for data use was obtained from the AAPCC Data Access Committee and the board of directors. Data were provided to the investigators in a coded fashion to maintain blinding to the individuals and poison centers. The study was also reviewed by the institutional review board at Cincinnati Children's Hospital Medical Center and deemed exempt.

Results

In this 8-year study period, 544 133 children aged ≤5 years were exposed to pharmaceuticals and documented to have reached and received care at an ED. Of these, 453 559 ingested a single product so that the symptoms, management, and outcome could be definitively ascribed to that agent alone (Figure 1).

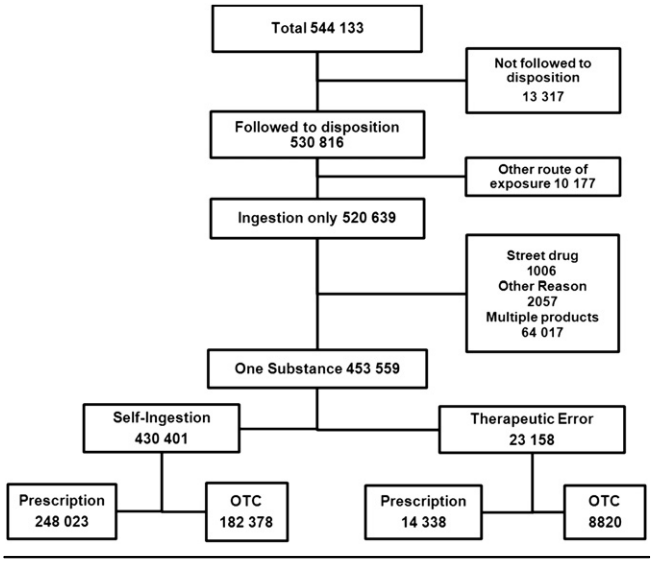

Figure 1. ED visits by children aged ≤5 years following unintentional pharmaceutical exposure 2001-2008: patient distribution.

Table I (available at www.jpeds.com) details the ages, sex, origin of poison center involvement, admission rate, and injury rate for these groups. Victims of therapeutic errors were younger, disproportionately boys, and more likely to have been identified at the hospital than were children who self-ingested medication. Overall, 48% of poison center involvement originated from the ED and 45% originated from the patient's own residence, before travel to the ED.

Child self-exposure to prescription products represented the largest health care impact, with 248 023 ED visits (55%), 41 847 admissions (76%), and 18 191 injuries (71%). Admission was to an intensive care unit in 43% of admissions following self-exposure to prescription medications and in 34%, 41%, and 35% of admissions following self-exposure to OTC medications, therapeutic errors with prescription medications, and therapeutic errors with OTC medications, respectively.

Considering the 67 080 patients who were excluded from the detailed analysis, 64 017 were excluded because the patient ingested >1 medication. Of these, 97% were from self-ingestion and 87% of these ingested at least 1 prescription product. Twenty-three percent were admitted and 8% sustained an injury. In 48% of cases, contact with the poison center was initiated after presentation to the ED. The other 3063 patients included 1006 ingestions of 1 street drug and 2057 prescription or OTC ingestions with other unintentional reasons listed.

Figure 2 shows the overall trend from baseline for exposures (including those managed at home), ED evaluations, admissions, injuries, and the US population of children aged ≤5 years. The increases (by trend analysis) reported for injury (43%), admission (36%), ED use (30% increase overall, 28% for single agents), and