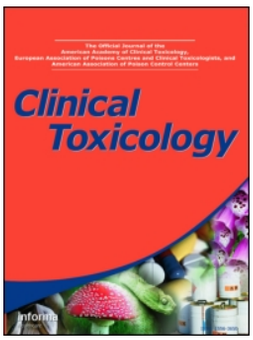

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POISON CENTRE RESEARCH

# Pesticide-related poison center exposures in children and adolescents aged ≤19 years in Texas, 2000–2013

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**ABSTRACT**

**Context:** Although national poison center data show that pesticides were the 8th most commonly reported substance category (3.27%) for children aged ≤5 years in 2014, there is limited information on childhood and adolescent pesticide exposures.

**Objective:** This study assessed pesticide-related poison center exposures in children and adolescents aged ≤19 years from 2000–2013 in Texas to characterize the potential burden of pesticides.

**Materials and methods:** Pesticide-related poison center exposures among children and adolescents aged ≤19 years reported to Texas poison centers were identified. The distribution of exposures was estimated by gender, age category, medical outcome, management site, exposure route, and pesticide category.

**Results:** From 2000 to 2013, there were 61,147 pesticide-related poison center exposures in children and adolescents aged ≤19 years. The prevalence was highest among males at 864.24 per 100,000 population. The prevalence of unintentional exposures was highest among children aged ≤5 years at 2310.69 per 100,000 population, whereas the prevalence of intentional exposures was highest among adolescents aged 13–19 years at 13.82 per 100,000 population. A majority of medical outcomes reported were classified as having no effect (30.24%) and not followed, but minimal clinical effects possible (42.74%). Of all the exposures, 81.24% were managed on site. However, 57% of intentional exposures were referred to or treated at a health-care facility. The most common routes of exposure were ingestion (80.83%) and dermal (17.21%). The most common pesticide categories included rodenticides (30.02%), pyrethrins/pyrethroids (20.69%), and other and unspecified insecticides (18.14%).

**Discussion:** The study found differences in the frequency of exposures by intent for sex and age categories, and identified the most common medical outcomes, management site, exposure route, and pesticide category.

**Conclusion:** Through characterizing pesticide-related poison center exposures, future interventions can be designed to address groups with higher prevalence of exposure.

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Adolescents; children; pesticides; poison center

## Introduction

Under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), pesticides include substances that prevent, destroy, repel, or mitigate pests; they are used as a plant regulator, defoliant, or desiccant; or they are used as a nitrogen stabilizer.[1] The specific health effects experienced due to pesticide exposure depend on the pesticide and dose, and can include, but are not limited to, nausea, headaches, rashes, and asthma.[2] Two recent publications that reviewed existing literature regarding residential pesticide exposures found that residential pesticides were associated with childhood cancers.[3,4] For example, a pooled analyses of 12 case-control studies found residential pesticide exposure is significantly associated with acute lymphoblastic leukemia (ALL) and acute myeloid leukemia (AML) in children.[4]

The 2014 Annual Report of the American Association of Poison Control Centers' National Poison Data System (AAPCC NPDS) found pesticides were the 9th most common substance category involved in human exposures (3.22% of all exposures).[5] For children aged ≤5 years, pesticides were the 8th most common substance category involved in human exposures (3.27% of all exposures).[5] This was an increase from 2009 when pesticides were the 10th and 9th most common reported category for human exposures and for children aged ≤5 years, respectively.[6]

In addition, there have been a limited number of studies that have examined pesticide exposures in children and adolescents in the United States.[7–11] A 2012 literature review characterized childhood pesticide exposures and associated health effects.[10] A recent study described adolescent pesticide exposures reported to poison centers in comparison to adults in Texas.[11] The purpose of the present study is to characterize pesticide-related poison center exposures involving children and adolescents aged ≤19 years in Texas during 2000–2013.

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## Materials and methods

### Data collection

This research was deemed exempt by the Texas A&M Institutional Review Board (IRB) (Study #2015-0563M) and by the Texas Department of State Health Services (DSHS) IRB (IRB #14-064). The study used Texas Poison Center Network (TPCN) data from 2000 to 2013 through a data agreement with the Texas DSHS. The TPCN consists of six poison centers that serve Texas.[12] An electronic database, Toxicall, is used to collect data which ensures data consistency between centers.[13] As per the AAPCC, exposure refers to someone who has had contact with the substance, but not all exposures are poisonings.[5] Poison centers may not receive calls about all exposures, and the data do not represent the complete incidence of exposures.[5] Population data for children and adolescents aged ≤19 years were obtained from the 2010 decennial census.[14]

For this study, pesticide-related poison center exposures were defined as all calls pertaining to children and adolescents aged ≤19 years in Texas from 2000 to 2013, with a pesticide reported as an exposure. Pesticide calls were pulled using 71 pesticide-related generic Poisindex codes (see Appendix A). Poisindex is a database that contains information on over 400,000 products which groups poisindex codes for related substances (e.g., pesticides) into a common generic code.[15] Pesticide categories were defined based on the provided substance description. Pesticide categories were selected based on existing ICD-9-CM and E-code pesticide-related codes in order to use a standard classification system. Pesticide categories used to classify pesticide-related poison center exposures included fumigants, fungicides, herbicides, mixtures of insecticides, organochlorines, organophosphates/carbamates, other and unspecified insecticides, and rodenticides. Categories were added to the ICD-9-CM and E-code categories in order to better classify pesticides that would otherwise be classified as other, these categories included pyrethrins/pyrethroids, natural pesticides (e.g., citronella oil), not a pesticide (e.g., Diurex), not a chemical pesticide (e.g., glue trap), synergists only reported, and unable to classify were created to better classify the substances reported. There were more substances reported than exposures, due to the fact that exposures could involve multiple substances.

This study did not examine the effects of varying doses of specific pesticides because dose information was not available in many cases. In addition, the exact formulation of the pesticide that the individual was exposed to was not known in many cases. As such, it was not possible to relate specific pesticide ingredients and dose to health outcomes.

Intent was defined as unintentional or intentional based on the reported exposure reason (see Appendix B for codes used to define intent). Pesticide-related poison center exposures were excluded for those aged ≥20 years. Variables included in the study were intent (unintentional or intentional), age, gender, medical outcome, management site, exposure route, and pesticide category. Age categories were defined using AAPCC groupings, including children ≤5 years, children 6–12 years, and adolescents 13–19 years.

Medical outcome was classified into the following categories based on reported symptoms: no effect (no symptoms due to exposure), minor effect (some minimally troublesome symptoms), moderate effect (more pronounced, prolonged symptoms), major effect (symptoms were life-threatening or caused significant disability), and death.[5] Specific symptoms for each case was not available in the dataset; thus, all information for medical outcome is based on reported categories. Expected outcomes for exposures that were not followed to a final medical outcome included: not followed but judged as nontoxic exposure (symptoms not expected), not followed but minimal symptoms possible (no more than minor symptoms possible), unable to follow but judged as a potentially toxic exposure.[5]

### Data analysis

Microsoft Access/Excel and STATA 14 were used for data management and analysis (Microsoft Corporation, Redmond, WA; StataCorp LP, College Station, TX). The frequency, prevalence, and 95% confidence intervals (CIs) of pesticide-related poison center exposures were calculated by intent (e.g., unintentional or intentional) for sex and age categories. The frequency of medical outcome, management site, exposure route, and pesticide category was also calculated.

## Results

During 2000–2013, there were a total of 95,611 pesticide-related poison center exposures among all ages. Of those, there were 61,147 pesticide-related poison center exposures among children and adolescents aged ≤19 years reported to the TPCN. A total of 224 calls were excluded due to undefined intent (e.g., other or unknown). The annual average number of pesticide-related poison center exposures was 4367, with a range of 3253–5300.

Table 1 shows the frequency and prevalence of pesticide-related poison center exposures by demographics and intent. The prevalence of pesticide-related poison center exposures for Texas was 802.27 per 100,000 population (95% CI = 795.94, 808.61). The gender-specific prevalence was different with an estimated 864.24 per 100,000 male population (95% CI = 855.05, 873.42) versus 732.31 per 100,000 female population (95% CI = 723.65, 740.97). Age-specific prevalence for children aged ≤5 years was the highest (2315.06 per 100,000 population; 95% CI = 2295.69, 2334.42).

Of the pesticide-related poison center exposures, 60,527 were due to unintentional exposures, with a prevalence of 794.14 per 100,000 population (95% CI = 787.84, 800.44). The gender-specific prevalence differed with 855.39 per 100,000 male population (95% CI = 846.25, 864.53) and 725.08 per 100,000 female population (95% CI = 716.46, 733.70). Children aged ≤5 years had the highest prevalence of unintentional pesticide-related poison center exposures, with a prevalence of 2310.69 per 100,000 population in this age group (95% CI = 2291.34, 2330.04) (Table 1).

Table 1. Pesticide-related poison center exposure frequency and age-specific and sex-specific prevalence for children and adolescents aged ≤19 years in Texas, 2000–2013[a].

| | No. of exposures | Percentage of exposures | Prevalence per 100,000 | 95% CI[b] |
|---|---|---|---|---|
| Pesticide-related poison center exposures ($N = 61,147$) | | | | |
| Males | 33,701 | 55.11 | 864.24 | 855.05, 873.42 |
| Females | 27,258 | 44.58 | 732.31 | 723.65, 740.97 |
| <=5 years old | 53,615 | 87.68 | 2315.06 | 2295.69, 2334.42 |
| 6–12 years old | 4425 | 7.24 | 165.15 | 160.29, 170.01 |
| 13–19 years old | 2700 | 4.42 | 102.80 | 98.92, 106.68 |
| Unintentional pesticide-related poison center exposures ($N = 60,527$) | | | | |
| Males | 33,356 | 55.11 | 855.39 | 846.25, 864.53 |
| Females | 26,989 | 44.59 | 725.08 | 716.46, 733.70 |
| <=5 years old | 53,514 | 88.41 | 2310.69 | 2291.34, 2330.04 |
| 6–12 years old | 4283 | 7.08 | 159.85 | 155.07, 164.64 |
| 13–19 years old | 2337 | 3.86 | 88.98 | 85.37, 92.59 |
| Intentional pesticide-related poison center exposures ($N = 620$) | | | | |
| Males | 345 | 55.65 | 8.85 | 7.91, 9.78 |
| Females | 269 | 43.39 | 7.23 | 6.36, 8.09 |
| <=5 years old | 101 | 16.29 | 4.36 | 3.51, 5.21 |
| 6–12 years old | 142 | 22.90 | 5.30 | 4.43, 6.17 |
| 13–19 years old | 363 | 58.55 | 13.82 | 12.40, 15.24 |

[a]There were 188 exposures with unknown gender and 407 with unknown age.
[b]95% confidence interval.

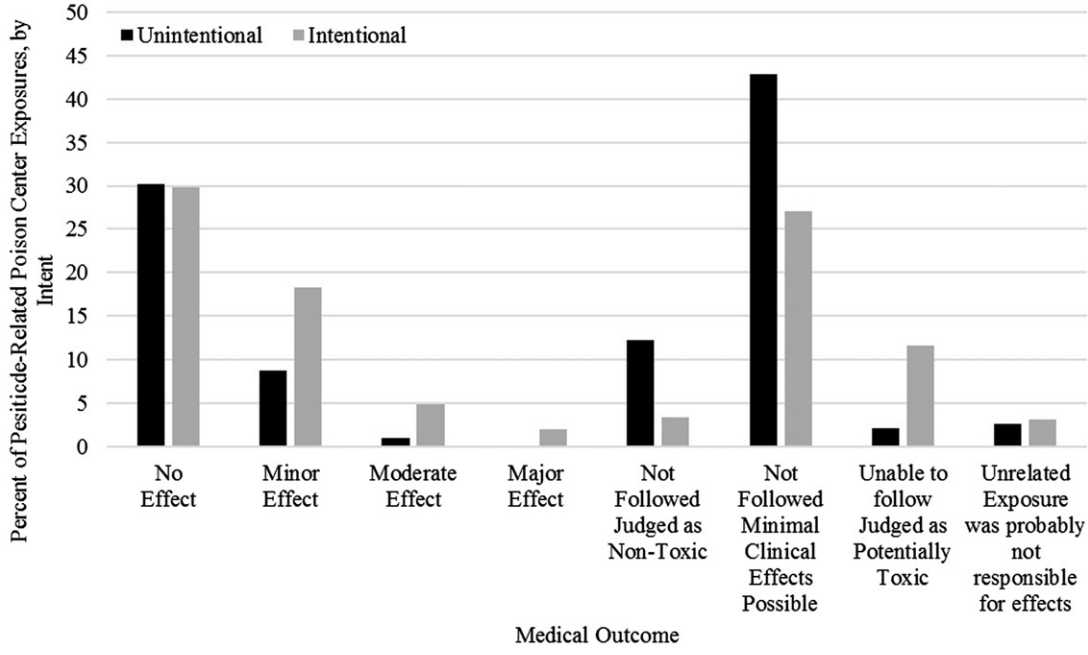


Figure 1. Medical outcomes for pesticide-related poison center exposures in children and adolescents aged ≤19 years by Intent, 2000–2013.

The remaining 620 pesticide-related poison center exposures were due to intentional exposures for the time period which resulted in a prevalence of 8.13 per 100,000 population (95% CI 7.49, 8.77). The gender-specific prevalence was 8.85 per 100,000 males (95% CI = 7.91, 9.78) and 7.23 per 100,000 females (95% CI = 6.36, 8.09). Adolescents aged 13–19 years had the highest prevalence of intentional pesticide-related poison center exposures, with a prevalence of 13.82 per 100,000 in this age group (95% CI = 12.40, 15.24) (Table 1).

Figure 1 presents medical outcomes for pesticide-related poison center exposures by intent for children and adolescents aged ≤19 years. The majority of exposures were classified as having no effect ($n = 18,490$; 30.24%) or not followed, but minimal clinical effects possible ($n = 26,135$; 42.74%). This was similar for unintentional and intentional exposures, but intentional exposures had higher exposures that were deemed to be moderate, major, or unable to follow, but judged as potentially toxic. In addition, there were two deaths that were deemed unintentional (data not shown).

Next, management site was analyzed to determine if pesticide exposures were managed on site, or referred to or treated at a health-care facility (data not shown). Of all pesticide-related poison center exposures, a majority ($n = 49,673$; 81.24%) of calls were managed on site. For all exposures, 15.27% ($n = 9338$) were in route to a health-care facility when the poison center was called, and 2.95% ($n = 1803$) were referred to a health-care facility by the poison center. This was similar for unintentional exposures; however, for intentional exposures, 40.81% ($n = 253$) of exposures were managed on site, 45.00% ($n = 279$) were in route to a health-care

Table 2. Frequency of pesticide categories for pesticide-related poison center exposures in children and adolescents aged ≤19 years in Texas, 2000–2013.

| Pesticide category | No. of exposures | Percentage of responses ($N = 61,777$) | Percentage of exposures ($N = 61,147$) |
|---|---|---|---|
| Fumigants | 28 | 0.05 | 0.05 |
| Fungicides | 264 | 0.43 | 0.43 |
| Herbicides | 1957 | 3.17 | 3.20 |
| Mixtures of insecticides | 2487 | 4.03 | 4.07 |
| Natural pesticides | 3550 | 5.75 | 5.81 |
| Not a pesticide | 100 | 0.16 | 0.16 |
| Not a chemical pesticide | 579 | 0.94 | 0.95 |
| Organochlorines | 736 | 1.19 | 1.20 |
| OPs/carbamates | 3267 | 5.29 | 5.34 |
| Other and unspecified insecticides | 11,091 | 17.95 | 18.14 |
| Pyrethrin/pyrethroids | 12,654 | 20.48 | 20.69 |
| Rodenticides | 18,355 | 29.71 | 30.02 |
| Synergists only reported | 106 | 0.17 | 0.17 |
| Unable to classify | 6603 | 10.69 | 10.80 |

Sum of percentages of exposures are greater than *N* for all categories because some exposures reported more than one route of exposure.

facility when the poison center was called, and 12.42% ($n = 77$) were referred to a health-care facility by the poison center. The remaining exposures had other or unknown management site. Next, pesticide-related poison exposures were analyzed to determine common routes of exposure (data not shown). Common exposure routes were ingestion ($n = 49,428$; 80.83%) and dermal ($n = 10,523$; 17.21%). This was similar for unintentional exposures; however, for intentional exposures, the most common exposures routes were ingestion ($n = 435$; 70.16%), dermal ($n = 145$; 23.39%), and inhalation ($n = 68$; 10.97%).

Lastly, Table 2 shows the frequency of exposure to specific pesticide categories for pesticide-related poison center exposures in children and adolescents aged ≤19 years. The three largest categories for all exposures were other and unspecified insecticides ($n = 11,091$; 18.14%), pyrethrins/pyrethroids ($n = 12,654$; 20.69%), and rodenticides ($n = 18,355$; 30.02%). It is important to note 10.80% ($n = 6603$) of exposures were not classifiable because product information could not be identified from the substance description that had been provided; however, based on the substance description, these were identified as pesticides.

## Discussion

Of the identified pesticide-related poison center exposures, males and children aged ≤5 years had the highest prevalence. Males typically have a higher prevalence of exposures which is not studied in the existing literature; however, this is believed to be a result of socialization differences.[16] The present study also found adolescents aged 13–19 years old had the highest prevalence for intentional exposures. This is supported by existing literature which shows adolescents are more susceptible to intentional poisonings; this supports that adolescents would also be more likely to be exposed overall to intentional exposures.[17] It is important to note that not every reported exposure results in poisoning. Next, the 2014 AAPCC NPDS report found that the three most common routes of exposure were ingestion (83.74%), dermal (7.01%), and inhalation/nasal (6.13%).[5] The present study had lower percentages of ingestion (80.83%) and inhalation (4.00%) exposures, whereas dermal exposure (17.21%) was higher compared to the 2014 report.

The Environmental Protection Agency (EPA) pesticide industry sales and usage 2006–2007 market estimates found the top 10 most commonly used conventional pesticide active ingredients were pyrethroids; the herbicides 2,4-dichlorophenoxyacetic acid (2,4-D), glyphosate, mecoprop (MCPP), pendimethalin, dicamba, trifluralin, pelarganoc acid; and the organophosphates/carbamates malathion and carbaryl.[18] A household pesticide inventory in South Texas found pyrethroids were the most common pesticide class.[19] The present study found the most common pesticide categories were pyrethrins/pyrethroids, rodenticides, and other and unspecified insecticides.

A limitation of using poison center data is that the data are voluntarily reported, which means callers can refuse to provide information. Also, the information for the study population is self-reported typically by a parent or guardian, which may result in missing data or reporting bias that may lead to underestimates of exposure. It is important to note that the information is based on patient or parents' reports; thus, information should not be assumed to represent medical diagnoses. In addition, the dataset only captures information about reported exposures and should not be assumed to represent all exposures to a substance.[5] Another potential limitation is misclassification of exposures reported to poison centers. This study found 0.16% of the pesticide-related poison center exposures were misclassified as a pesticide. An example is Diurex which is a diuretic, but was classified with the Poisindex generic code of "0215000". Another potential misclassification of pesticide categories could have occurred when classifying exposures based on substance description. Lastly, this study could not determine if there were multiple exposures for the same child; thus, the study treats exposures as individual reports.

Despite these limitations, this study was able to characterize childhood pesticide-related poison center exposures in Texas from 2000–2013. Children and adolescents aged ≤19 years represented 64.19% of all pesticide exposures reported to the TPCN from 2000 to 2013. In addition, this is one of the first studies to classify exposures into pesticide categories based on substance description, which describes the type of pesticides children are exposed to, as well as potential health effects due to existing knowledge of pesticide categories. The study also covered 14 years of data which allowed for analysis of potential temporal trends.

This study utilizes available poison center data, which provides a snapshot into the burden of childhood pesticide exposures in Texas. Based on the findings of this study, further research focusing on childhood pesticide exposures would be useful. Future research should focus on understanding the overall burden of childhood pesticide exposures through other available data (e.g., mortality, emergency room, hospitalization, and cancer registries). Through utilizing multiple secondary datasets including existing surveillance, the burden of childhood pesticide exposures can be understood, which can aid in prevention efforts. In addition, research is

needed to characterize the risk factors for childhood pesticide exposures, which can also guide future tailored prevention methods and policies. For example, Texas has many rural and agriculturally intensive areas which may have higher risks of pesticide exposures; thus, future research could include spatial cluster analysis and regression analyses for better understanding of pesticide exposures and associated factors.

## Conclusion

At this time, there is limited literature on the prevalence of childhood pesticide exposures in Texas and the United States as a whole. Through analyzing poison center exposures, this study begins to fill gaps in understanding the impact of acute pesticide exposures on children. The information gained from this study can be utilized for future research and interventions. For example, through understanding which groups (e.g., gender and age) have higher prevalence of pesticide-related exposures, future interventions can be designed to target each group as well as educate clinicians and public health practitioners. In addition, the information from this study can be utilized to inform parents and child-care providers about childhood and adolescent pesticide exposures, as well as those groups found to have increased prevalence of exposure (e.g., males and younger children).

## Disclosure statement

The authors report no declarations of interest.

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## References

[1] United States Environmental Protection Agency. Pesticide Registration Manual: Chapter 1 – Overview of requirements for pesticide registration and registrant obligations. 2016; [Internet]; [cited 2016 Jan 19]. Available from: http://www.epa.gov/pesticide-registration/pesticide-registration-manual-chapter-1-overview-requirements-pesticide.
[2] Karr CJ, Solomon GM, Brock-Utne AC. Health effects of common home, lawn, and garden pesticides. Pediatr Clin North Am. 2007;54:63–80.
[3] Chen M, Chang CH, Tao L, et al. Residential exposure to pesticide during childhood and childhood cancers: a meta-analysis. Pediatrics. 2015;136:719–729.
[4] Bailey HD, Infante-Rivard C, Metayer C, et al. Home pesticide exposures and risk of childhood leukemia: findings from the childhood leukemia international consortium. Int J Cancer. 2015;137:2644–2663.
[5] Mowry JB, Spyker DA, Brooks DE, et al. 2014 Annual report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 32nd annual report. Clin Toxicol. 2015;53:962–1146.
[6] Bronstein AC, Spyker DA, Canilena LR, et al. 2009 Annual report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 27th annual report. Clin Toxicol. 2010;48:979–1178.
[7] Belson M, Kieszak S, Watson W, et al. Childhood pesticide exposures on the Texas-Mexico border: clinical manifestations and poison center use. Am J Public Health. 2003;93:1310–1315.
[8] Spann MF, Blondell JM, Hunting KL. Acute hazards to young children from residential pesticide exposures. Am J Public Health. 2000;90:971–973.
[9] Sumner DLR. Pediatric pesticide poisoning in the Carolinas: an evaluation of the trends and proposal to reduce the incidence. Vet Human Toxicol. 2000;42:101–103.
[10] Roberts JR, Karr CJ. Council on Environmental Health. Pesticide exposure in children. Pediatrics. 2012;130:e1765–e1788.
[11] Forrester MB, Bojes H. Adolescent pesticide exposures reported to Texas poison centers. Int J Adolesc Med Health. 2016;28:55–60.
[12] Texas Poison Control Network. Who We Are – Commission on State Emergency Communications. n.d.; [Internet]; [cited 2016 May 31]. Available from: http://poisoncontrol.org/about-us/who-we-are-commission-on-state-emergency-communications/.
[13] Texas Department of State Health Services. Texas Poison Center Network. 2016; [Internet]; [cited 2016 May 31]. Available from: https://www.dshs.state.tx.us/epidemiology/epipoison.shtm.
[14] United States Census Bureau. American Fact Finder. 2015; [Internet]; [cited 2015 Aug 5]. Available from: http://factfinder2.census.gov.
[15] American Association of Poison Control Centers. NPDS FAQS. 2015; [Internet]; [cited 2016 Feb 22]. Available from: http://www.aapcc.org/data-system/npds-faqs/#Poisindex1.
[16] Department of Violence and Injury Prevention and Disability. Geneva, Switzerland: World Health Organization.
[17] Peden M, Oyegbite K, Ozanne-Smith J, et al. World report on child injury prevention. Geneva, Switzerland: WHO Press; 2008.
[18] Grube A, Donaldson D, Kiely T, et al. Pesticides industry sales and usage: 2006 and 2007 market estimates (No. 733-R-11-001). Washington (DC): U.S. Environmental Protection Agency; 2011.
[19] Ross JA, Trueblood AB, Donnelly KC, et al. Household pesticide use in colonias in Webb and Hidalgo Counties, South Texas, as assessed using a pesticide inventory. Texas Public Health J. 2005;67:7–10.

## Appendix A. Poisindex pesticide-related codes

0004562, 0012563, 0017000, 0033000, 003800, 0038560, 0038561–0038563, 0043000, 0048563, 0048564, 0049000, 0049561, 0049562, 0050000, 0050430, 0050560, 0062562, 0070000, 0070560, 0077430, 0077431, 0077561–0077569, 0077577, 0144000, 0144001, 0145000, 0162000, 0172000, 0174000, 0176000, 0197000, 0201033–0201052, 0201180, 0208562, 0213000, 0215000, 0218000, 0243561, 0243566, 0244577, 0253000, and 0254371.

## Appendix B. Codes used to define intent

Unintentional exposures included codes for general, environmental, occupational, therapeutic error, misuse, bite/sting, food poisoning, adverse reactions, and unknown-unintentional. Intentional exposures included codes for suspected suicide, misuse, abuse, and unknown-intentional.