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Characterizing risk factors for pediatric lamp oil product exposures

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Abstract

Poisonings—from lamp oil ingestion continue to occur worldwide among the pediatric population despite preventive measures such as restricted sale of colored and scented lamp oils. This suggests that optimal prevention practices for unintentional pediatric exposures to lamp oil have yet to be identified and/or properly implemented.

Objective—To characterize demographic, health data, and potential risk factors associated with reported exposures to lamp oil by callers to poison centers (PCs) in the US and discuss their public health implications.

Study design—. This was a two part study in which the first part included characterizing all exposures to a lamp oil product reported to the National Poison Data System (NPDS) with regard to demographics, exposure, health, and outcome data from 1/1/2000 to 12/31/2010. Regional penetrance was calculated using NPDS data by grouping states into four regions and dividing the number of exposure calls by pediatric population per region (from the 2000 US census). Temporal analyses were performed on NPDS data by comparing number of exposures by season and around the July 4th holiday. Poisson regression was used to model the count of exposures for these analyses. In the second part of this project, in order to identify risk factors we conducted a

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Declaration of interest

The authors report no declarations of interest. The authors alone are responsible for the content and writing of the paper. The findings and conclusions are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry.

telephone-based survey to the parents of children from five PCs in five different states. The 10 most recent lamp oil product exposure calls for each poison center were systematically selected for inclusion. Calls in which a parent or guardian witnessed a pediatric lamp oil product ingestion were eligible for inclusion. Data on demographics, exposure information, behavioral traits, and health were collected. A descriptive analysis was performed and Fisher's exact test was used to evaluate associations between variables. All analyses were conducted using SAS v9.3.

Results—Among NPDS data, 2 years was the most common patient age reported and states in the Midwestern region had the highest numbers of exposure calls compared to other regions. Exposure calls differed by season ($p<0.0001$) and were higher around the July 4th holiday compared to the rest of the days in July (2.09 vs. 1.89 calls/day, $p<0.002$). Most exposures occurred inside a house, were managed on-site and also had a "no effect" medical outcome. Of the 50 PC-administered surveys to parents or guardians, 39 (78%) met inclusion criteria for analysis. The majority of ingestions occurred in children that were 2 years of age, that were not alone, involved tiki torch fuel products located on a table or shelf, and occurred inside the home. The amount of lamp oil ingested did not appear to be associated with either the smell ($p = 0.19$) or the color of the oil ($p = 1.00$) in this small sample. Approximately half were asymptomatic ($n = 18$; 46%), and of those that reported symptoms, cough was the most common ($n = 20$, 95%) complaint.

Conclusions—Lamp oil product exposures are most common among young children (around 2 years of age) while at home, not alone and likely as a result of the product being in a child-accessible location. Increasing parental awareness about potential health risks to children from these products and teaching safe storage and handling practices may help prevent both exposures and associated illness. These activities may be of greater benefit in Midwestern states and during summer months (including the period around the July 4th holiday).

Keywords

Lamp oil; Lamp oil products; Hydrocarbons

Introduction

Lamp oil is made of paraffin, a low-viscosity hydrocarbon that is poorly absorbed from the gastrointestinal tract after ingestion. The primary health risk from lamp oil ingestion is from unintentional aspiration due to lamp oil's low viscosity.[1] Significant pulmonary injury including chemical pneumonitis, respiratory distress, and death is possible following aspiration.[2–4] Related products such as tiki torch fuel (a predominantly petroleum-based product) and other hydrocarbons can produce similar health effects as lamp oil. Since 2001, an estimated 18,000 exposures to lamp oil products were reported to poison centers (PCs). Of these, four resulted in fatality among children 5 years of age and younger.[5] According to data collected by PCs from 2001 to 2009 and uploaded to the national PC reporting database known as the National Poison Data System (NPDS), the majority of lamp oil exposure calls concerned children 5 years of age or younger ($n = 17,967$; 84%).[5] The true pediatric morbidity and mortality rates associated with lamp oil and associated products, such as citronella and tiki torch fuels, in the United States (US) are unknown.

Several factors have been theorized to contribute to unintentional pediatric lamp oil exposures. These include inadequate adult supervision, improper storage techniques such as storing in unlabeled easy-to-open containers placed within the child ' s reach, and physical properties such as a colored liquid appearing like juice or an odor resembling a pleasant fragrance.[4,6–7] A United States study noted an increased frequency of pediatric lamp oil exposure calls during certain Jewish holidays when the use of oil-based lamps is more frequent than during non-holidays.[8] European countries have been attempting to reduce the morbidity and mortality from lamp oil ingestions in young children for years with mixed results.[9–11] The optimal exposure prevention techniques likely have yet to be identified and/or properly implemented.[9] Our objectives were to characterize demographic, exposure, health, and outcome data associated with lamp oil product exposures reported to PCs in the US and discuss their public health implications.

Methods

Characterization of NPDS lamp oil product exposures

NPDS is a national database and data management system owned by the American Association of Poison Control Centers (AAPCC). It receives information on calls made by the public to the 57 PCs across the US in near, real-time. We used a cross-sectional study to identify all pediatric lamp oil product exposures reported to PCs from 1/1/2000 to 12/31/2010 by reviewing NPDS data. PC and NPDS data use a system of codes and standardized outcome categories (Table 1) to track potentially hazardous exposures. We defined a lamp oil product exposure as any reported exposure with the AAPCC generic code for lamp oil exposures (201031). Aggregate data on daily exposure call count, age, gender, state where exposure occurred, date of exposure, site of exposure, medical outcome, management site, clinical effects, and therapies were collected and analyzed using Microsoft (MS) Excel 2010 and SAS 9.3. PC records/notes were not available for review. PC penetrance describes the rate of exposures called to PCs of the implicated substance per year per unit population. This measure was used to compare regions of the country and determine which areas have higher reported exposures given a standard population. For the regional penetrance analyses, states were first grouped into four major regions according to the US census (Fig. 1): Northeast (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, and New Jersey); Midwest (Wisconsin, Michigan, Illinois, Indiana, Ohio, Missouri, North Dakota, South Dakota, Nebraska, Kansas, Minnesota, and Iowa), South (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Mississippi, Alabama, Oklahoma, Texas, Arkansas, and Louisiana) and West (Idaho, Montana, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico, Alaska, Washington, Oregon, California, and Hawaii). We then compared lamp oil product exposure call volume among regions. Next, region-specific PC penetrance was determined by dividing the total number of region-specific lamp oil product exposures by the corresponding region's total estimated pediatric population (<5 years of age) from 2000 to 2010, multiplied by 10,000.[12] A chi-square analysis was conducted to investigate the association between penetrance and region. Seasons were defined as: Winter (December, January, and February), Spring (March, April, and May), Summer (June, July, and August), and Fall (September, October, and

November). The number of lamp oil product exposure calls occurring in each season from 2000 to 2010 was then determined. Poisson regression was used to model the count of exposures per day by season. The number of exposures occurring the day before, on, and after Independence Day (July 4th) from 2000 to 2010 was compared to the count during the remaining days in July also using Poisson regression. All analyses were conducted using SAS v9.3.

Multi-center study of risk factors for lamp oil product ingestions

The PCs of Utah, Wisconsin, New Jersey, Kentucky, and Cincinnati, Ohio each obtained approval from their Institutional Review Board (IRB) to participate in telephone survey component of the study. A lamp oil product was defined as a product that is used as fuel for lamp oil-based lamps, which was verified by reviewing the call narrative. The PC-based co-investigators used the following codes to identify potential lamp oil product ingestions: lamp oil (0201031), other types of hydrocarbons (0039510), and miscellaneous essential oils (0077360). PC staff then selected the 10 most recent calls from the study period of 1/1/2007 to 12/31/2008. Each PC enrolled callers beginning with the latest call, until 10 eligible calls had been consented for participation. The same questionnaire was administered by all the PCs and is available upon request. Inclusion criteria for study enrollment included: (1) age ≤5 years; (2) an exposure to lamp oil or associated product (e.g, tiki torch fuel); and (3) an exposure route of ingestion (including aspiration). De-identified results were provided to CDC co-investigators for analysis. Data were analyzed using SAS v9.3.

Results

Characterization of NPDS lamp oil product exposures

From 2000 to 2010, 23,536 pediatric exposure calls about lamp oil products were reported to NPDS. A mean of six exposure calls per day was reported across all PCs (range: 1–19). The mean age of exposed children was 2 years, median 20 months, and range 13 days to 5 years. Most reported exposures involved males (n = 13,758; 59%). Table 2 illustrates the frequency distributions for exposure site, management site, medical outcome, clinical effects, (e.g., signs, symptoms, laboratory abnormalities, etc.) and therapies used according to standard NPDS classifications.[13] The most common site of exposure was the patient's home (n = 21,510; 91%) and most did not require medical treatment in a health-care facility (n = 14,506; 62%). Most had either no or minimal clinical symptoms (nausea, vomiting, etc.) as a result of the exposure (n = 19,739; 84%). The proportion of pediatric lamp oil product exposure calls reporting death as the outcome in NPDS data for the study period was 0.03% (7 deaths) and the proportion that developed symptoms was 45%. The most common reported adverse health effect was cough/choke (n = 8,027; 34%). The most common therapy given was dilute/irrigate/wash (n = 15,179; 64.5%). The number of lamp oil product exposures reported to NPDS differed significantly by region (p value < 0.0001). The Midwest had observed exposure frequencies that were 20.5% higher than expected on the basis of the null hypothesis of no association between region and exposures and the Northeast had observed frequencies that were 22.6% lower than expected. Observed frequencies in the South and West were 0.58% and 2.2% lower than expected, respectively.

The Midwest had the highest penetrance of all the regions (1.08 exposures per 10,000 population). The Northeast had the lowest of the regions (0.69 exposures per 10,000).

The mean count of reported lamp oil product exposures per day by season from 2000 to 2010 was as follows: Fall, 6.0; Summer, 6.4; Spring, 5.7; and Winter, 5.6. When comparing the daily seasonal mean values, there was a statistically significant difference ($p < 0.001$) for every comparison except between Spring and Winter ($p = 0.30$). The number of reported lamp oil product exposures around July 4th was significantly higher (2.09 vs 1.89 calls/day, $p < 0.002$) compared to the number of exposures for the rest of the month of July.

Multi-center study of risk factors for lamp oil product ingestions

Ten telephone surveys were completed from each PC for a total of 50 surveys. However, 11 surveys for ingestional exposures to air fresheners, herbal medications, perfumes, stove fuels, lubricants, and furniture grease were excluded from the analysis. Demographic information is summarized in Table 3. The median age was 2 years. Most patients were male ($n = 22$; 56%). Exposure information and circumstances surrounding ingestion can be found in Table 4. When asked about place of ingestion, more than half of the respondents reported the ingestions occurred in the child's house ($n = 22$; 56%). The remainder of ingestions took place on a deck/patio/porch (23%), backyard (15%), public place (2%), or garage (2%). The majority of the children were not alone at the time of ingestion ($n = 30$; 77%) and reportedly drank less than a mouthful ($n = 24$; 62%). Most ingestions occurred in the afternoon (defined as between 12:00 and 17:59; $n = 15$, 38%) and evening (defined as between 18:00 and 23:59; $n = 15$, 38%).

The majority of callers reported that the ingested product was not stored close (within 1–3 feet) to food ($n = 35$; 90%). None of the 39 children could read at the time the ingestion occurred and only one was able to recognize warning symbols. Most of the children drank the lamp oil product from the original container ($n = 23$; 59%) and most of the original containers did not have a child-resistant closure ($n = 14$; 61%). For the 16 in which the exposure was associated with a non-original container, the lamp oil or related product was stored in either a lamp, candle, or tiki torch.

Among all lamp oil products, tiki torch fuel was the most commonly ingested product type ($n = 13$; 33%). A table or counter was the most commonly reported storage location ($n = 6$; 15%). When asked about lamp oil color, 18 (46%) reported a presence of a color and out of these, yellow or gold was the most common color reported ($n = 12$; 67%). Only 9 (23%) described the products' smell as pleasant. The majority of children ($n = 24$; 62%) ingested less than a mouthful, and 3 (8%) ingested more than a mouthful. Of these three, none described the product's smell as pleasant. The amount of lamp oil ingested did not appear to be associated with either the smell of the oil ($p = 0.19$) or the presence of color ($p = 1.00$) in this small sample. One child had a previous history of pica and approximately one-third of the children had a previous history of eating non-food items ($n = 15$; 38%). Eleven (28%) callers reported previous contact with their PC or their doctor because their child had eaten a non-food item on a previous occasion. None of the children who had previously reported non-food item ingestions were able to recognize warning or hazard symbols. Approximately half ($n = 5$; 45%) of these children had a non-food eating habit as reported by the

respondent. Approximately half of the children who ingested a lamp oil product had no symptoms after ingestion (*n* = 18; 46%). The maximum number of symptoms reported was six. All of the children who reported symptoms after exposure developed at least one symptom within 4 h. In two of these instances, however, the initial symptoms reported were choking and/or vomiting with more serious symptoms (cough and fever) occurring 5–12 h after the ingestion. The local PC was the agency/healthcare provider most often notified first after an ingestion (*n* = 33; 85%). Of those that initially called an agency/healthcare provider (*n* = 36), approximately half reported no symptoms (*n* = 17; 44%). Among all children, 12 (31%) sought care at a healthcare facility (HCF) defined as a hospital emergency department (ED), pediatrician's office, or urgent care center. Two children sought care though they were asymptomatic. Most of the children who did not seek care drank less than a mouthful (*n* = 19; 49%). Of those who sought care, half drank a mouthful or more (*n* = 6; 50%) and most eventually went to the local ED (*n* = 9; 75%).

Of the 12 children who sought care at a HCF, ten (83%) received treatment or diagnostic studies and therapies described in Table 5. The average length of stay in the ED reported by survey respondents was 3.1 h (range: 0–8 h; mode: 2 h). Of these ten, three (30%) were eventually admitted. The mean length of admission reported was 1.7 days (range: 1–2 days). Thirty three of those surveyed provided answers regarding current health status of the affected child. Two (6%) had a history of asthma. Five (15%) had a previous history of breathing problems. One (3%) reported chronic breathing problems after lamp oil exposure and one (3%) reported development of a persistent cough that had resolved by the time of this survey. Three (10%) children were placed on medication(s) by a physician as a result of lamp oil or related product-related illness after the acute event. These medications included albuterol inhaler, steroid inhaler, dexamethasone, and antibiotics. It is unknown whether these medications were given in the inpatient or outpatient settings. At the time of the survey, none of the children required continued treatment with any of these medications.

Discussion

Ingestions of lamp oil in children continue to occur according to calls reported to PCs. These findings suggest that public health education activities such as increasing parental awareness about safe handling and storage practices along with the health risks from these products are needed. Because it appears that the Midwest may have somewhat higher exposure frequencies, this region may be a good place to start such activities. The reasons for the increased prevalence of potential lamp oil exposures in this region are unclear. It is possible that these regions may have communities that use more of these types of products such as particular cultural and religious groups like the Amish[14] Perhaps the reasons for why the Northeast region has fewer exposures than expected are because the population may be less likely to call their PCs after an exposure to lamp oil or related products, may purchase fewer of these products, and/or that their regional poisoning prevention and public health campaigns are more effective. Devices using lamp oil or related products (e.g., tiki torch fuels) are more commonly used during the warmer months of summer, which likely explains the higher prevalence of exposure calls during summer months. We did find a statistically significantly increase in exposure calls nationally around 4th of July, likely reflecting an increased use of the product during this time period in the United States. This finding

associated with the national holiday of July 4th likely reflects cultural practices specific to the US and may not be generalizable to other countries. Given the mobility and inherent exploratory nature of 2 year olds, it is not surprising that this age group had the highest number of reported exposures and actual ingestions of lamp oil products in both the NPDS data review and the multi-center study. These findings are supported by other studies in the literature.[15–17]

Results from the multi-center study found that the majority of ingestions occurred when the child was not alone. This finding suggests that mere reported presence of an adult in the general area did not eliminate the risk of exposure to a lamp oil product. Historically, inadequate parental or guardian supervision was a risk factor for exposure and probably still is. The Consumer Product Safety Commission (CPSC) under the Poison Prevention Packaging Act requires products like lamp oil to be sold in child-resistant packaging.[18,19] However, our survey found that most of the lamp oil and related products that were stored in their original containers did not reportedly have child-resistant closures. An increase in the risk of pediatric lamp oil ingestion has been attributed to the practice of transferring and storing products from their original containers to those without child-resistant packaging, such as lamps, candles, or torches.[4,20] However the majority of our surveyed lamp oil ingestions reportedly drank oil from their original containers. Further studies evaluating increasing parental awareness of safer storage practices, proper use of child-safety mechanisms, and promoting effective product safety devices to industry may help reduce the number of pediatric exposures to these products.

In 2011, the CPSC was petitioned to prohibit lamp oil and related products to be sold in see-through containers. Packaging as such was deemed “unnecessarily attractive” to children.[21] European countries have been attempting to reduce the morbidity and mortality from lamp oil exposures in their youth for years. In 1997 and 1999, the European Union restricted the sale of colored and perfumed oil in an attempt to decrease the risk of aspiration during unintentional pediatric exposures. A study by a group from the Netherlands compared pediatric exposures to lamp oil before and after implementation of the guidelines to assess its impact on the frequency and severity of symptoms from lamp oil exposure. The authors did not find a statistically significant difference between the frequency of severe symptoms before and after adoption of the European Union guidelines.[9] Nevertheless, parents should be vigilant and aware of the danger these products pose to children regardless of how attractive or unattractive the lamp oil product or its packaging may appear to their children.

Most ingestions from the multi-center study were asymptomatic, suggesting that caregivers did not wait to see whether symptoms appeared but rather called the PC as soon as they discovered the exposure. Since hydrocarbon aspirations can manifest clinical and radiographic symptoms as late as 6 h after exposure, the earlier the call after exposure, the sooner proper medical evaluation can be initiated.

Limitations in our study include: the passive self-reporting nature of PC data, possibility of missing similar products not captured by the generic codes used in this study, possible inclusion of unconfirmed exposures in the characterization of NPDS exposures, the small sample size of the multi-PC part of our study relative to the number of exposures and

convenience sampling methodology (multi-center study part). Lack of a comparison group and recall bias are other potential substantial limitations since the survey was performed sometime after the exposure using available PC records. Additionally, the average ED and admission times reported were based on information supplied by survey respondents and not the medical records. Another limitation is that the population covered by the five participating PCs and even the data obtained from NPDS may not accurately reflect the demographics of the entire United States and thus, survey results may not be generalizable to all pediatric lamp oil ingestions.

Conclusion

Pediatric exposures to lamp oil products continue to occur. Lamp oil product exposures are most common among young children (around 2 years of age) while at home, not alone and as a result of the product being in a child-accessible location. There was increased frequency of these exposures during the summer months, particularly around the July 4th holidays. In our study, we found that the Midwest region had a higher than expected frequency of exposures for unknown reasons. Increasing parental awareness about potential health risks to children from these products and teaching safe storage and handling practices may help prevent both exposures and associated illness, however further studies evaluating the efficacy of these interventions are needed.

Abbreviations

AAPCC	American Association of Poison Control Centers
CPSC	Consumer Product Safety Commission
PCs	Poison centers
PPPA	Poison Prevention Packaging Act
NPDS	National Poison Data System

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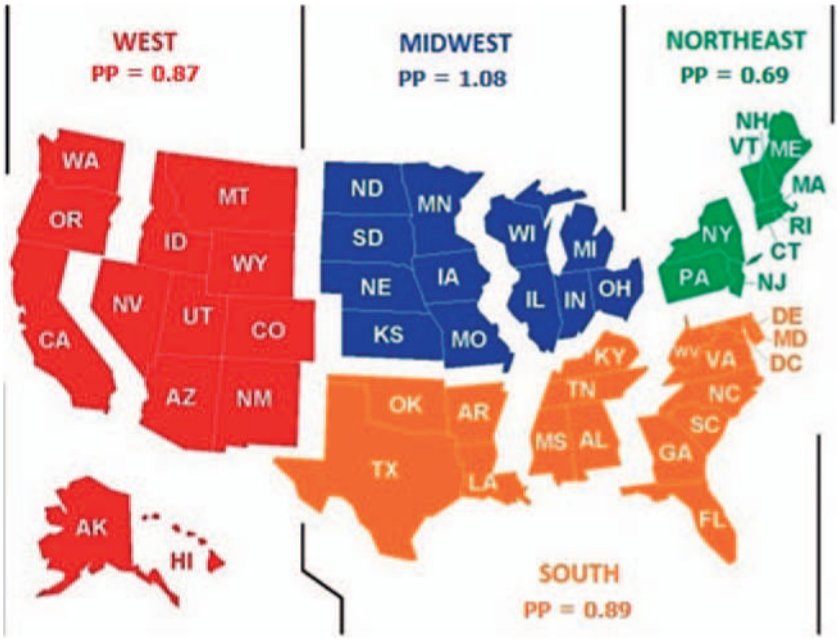

Fig. 1.

Pediatric penetrance (PP) defined as the number of exposures per 10,000 estimated pediatric population of NPDS lamp oil calls (2000–2010) by region according to US Census Bureau, 2000 (colour version of this figure can be found in the online version at www.informahealthcare.com/ctx).

Table 1

American Association of Poison Control Centers medical outcome categories.[13]

No effect	The patient did not develop any signs or symptoms as a result of the exposure
Minor effect	The patient developed some signs or symptoms as a result of the exposure, but they were minimally bothersome and generally resolved rapidly with no residual disability or disfigurement. A minor effect is often limited to the skin or mucus membranes (e.g., self-limited gastrointestinal symptoms, drowsiness, skin irritation, first-degree dermal burn, sinus tachycardia without hypotension, and transient cough)
Moderate effect	The patient exhibited signs or symptoms as a result of the exposure that were more pronounced, more prolonged, or more systemic in nature than minor symptoms. Usually, some form of treatment is indicated. Symptoms were not life-threatening, and the patient had no residual disability or disfigurement (e.g., corneal abrasion, acid-base disturbance, high fever, disorientation, hypotension that is rapidly responsive to treatment, and isolated brief seizures that respond readily to treatment)
Major effect	The patient exhibited signs or symptoms as a result of the exposure that were life-threatening or resulted in significant residual disability or disfigurement (e.g., repeated seizures or status epilepticus, respiratory compromise requiring intubation, ventricular tachycardia with hypotension, cardiac or respiratory arrest, esophageal stricture, and disseminated intravascular coagulation)
Death	The patient died as a result of the exposure or as a direct complication of the exposure. Only those deaths that were probably or undoubtedly related to the exposure are coded here
Not followed, judged as nontoxic exposure	No poison center follow-up calls were made to determine the outcome of the exposure because the substance implicated was nontoxic, the amount implicated was insignificant, or the route of exposure was unlikely to result in a clinical effect
Not followed, minimal clinical effects possible:	No poison center follow-up calls were made to determine the patient' s outcome because the exposure was likely to result in only minimal toxicity of a trivial nature (the patient was expected to experience no more than a minor effect)
Unable to follow, judged as a potentially toxic exposure	The patient was lost to PC follow-up, refused follow-up, or was not followed, but the exposure was significant and may have resulted in a moderate, major, or fatal outcome
Unrelated effect	The exposure was probably not responsible for the effect
Confirmed non-exposure	This outcome option is coded to designate cases where there was reliable and objective evidence that an exposure initially believed to have occurred actually never occurred (e.g., all missing pills are later located)

Table 2

Lamp oil exposure, management, outcome, and health effect data captured by NPDS from 2000 to 2010 (*n* = 23,536).

Age (years)	N (%)*
0–<1	3,838 (16.3)
1	9,588 (40.7)
2	7,368 (31.3)
3	1,768 (7.5)
4	607 (2.6)
5	367 (1.6)
Exposure site	
Own residence	21,510 (91.4)
Other residence	1,694 (7.2)
Public area	116 (0.5)
Unknown	61 (0.3)
Restaurant/food service	57 (0.2)
Other	43 (0.2)
School	31 (0.1)
HCF	13 (0.1)
Workplace	11 (<0.1)
Management site	
Managed on site (non HCF)	14,506 (61.6)
Patient already in (en route to) HCF when PCC called	4,922 (20.9)
Patient referred by PCC to HCF	3,914 (16.6)
Other	120 (0.5)
Unknown	74 (0.3)
Medical outcome	
No effect	7,608 (32.3)
Not followed, minimal clinical effects possible	4,707 (20)
Moderate effect	2,322 (9.9)
Minor effect	6,155 (26.2)
Not followed, judged as nontoxic exposure	1,269 (5.4)
Unable to follow, judged as a potentially toxic exposure	923 (3.9)
Unrelated effect	276 (1.2)
Major effect	234 (1.0)
Confirmed non-exposure	29 (0.1)
Death	7 (<0.1)
Unknown	6 (<0.1)
Top 10 clinical effects**	
None	12,843 (54.6)
Cough/choke	8,027 (34.1)
Vomiting	2,539 (10.8)

Age (years)	**N (%)***
X-ray findings	1,414 (6.0)
Fever/hyperthermia	1,133 (4.8)
Drowsiness/lethargy	820 (3.5)
Dyspnea	709 (3.0)
Hyperventilation/tachypnea	706 (3.0)
Other	661 (2.8)
Erythema/flushed	465 (2.0)
Top 10 therapies**	
Dilute/irrigate/wash	15,179 (64.5)
None	5,620 (23.9)
Other	2,044 (8.7)
Food/snack	1,959 (8.3)
Oxygen	1,295 (5.5)
Antibiotics	627 (2.7)
Bronchodilators	620 (2.6)
Fluids, IV	603 (2.6)
Fresh air	216 (0.9)
Intubation	210 (0.9)

* Percentages may not add up to 100% due to rounding.

** Clinical effects and therapies reported not mutually exclusive. Some calls reported multiple symptoms and/or received multiple therapies.

Table 3

Aggregate demographic data on pediatric patients (≤5 years) with lamp oil product ingestions from five PCs (*n* = 39).

	N (%)
Sex	
Male	22 (56.4)
Female	17 (43.6)
Age	
1 year old	10 (25.6)
2 years old	22 (56.4)
3 years old	6 (15.4)
4 years old	1 (2.6)
Race	
White	33 (84.6)
African American	2 (5.1)
Other	4 (10.3)
Caller ’s Relationship to Child	
Mother	24 (61.5)
Father	8 (20.5)
Grandmother	5 (12.8)
Aunt	1 (2.6)
Caretaker	1 (2.6)

Table 4

Aggregate exposure data from pediatric patients (<5 years) with lamp oil product ingestions from five PCs (*n* = 39).

	N (%)
Product name	
Tiki torch fuel	13 (33.3)
Generic lamp oil	12 (30.8)
Liquid candle	7 (17.9)
Do not know	5 (12.8)
Other	2 (5.1)
Characteristics of product	
Color	
Present	18 (46.2)
Absent	17 (43.6)
Not reported	4 (10.3)
Pleasant smell	
No	25 (64.1)
Yes	9 (23.1)
Did not know	5 (12.8)
Storage location	
Table/counter	6 (15.4)
Torch/candle	5 (12.8)
Cabinet	5 (12.8)
Porch/deck/patio	5 (12.8)
Shelf	5 (12.8)
Garage	2 (5.1)
Shed	2 (5.1)
Other	9 (23.1)
Storage container	
Original container	23 (59.0)
Child-proof mechanism present	
Yes, No, Do not know	8 (34.8), 14 (60.9), 1 (4.3)
Non-original container	16 (41.0)
Time of Ingestion	
Afternoon (noon–5:59 pm)	15 (38.5)
Evening (6–11:59 pm)	15 (38.5)
Morning (7–11:59 am)	9 (23.1)
Place of ingestion	
In the house	22 (56.4)
Deck/patio/porch	9 (23.1)
Backyard	6 (15.4)
Public place	1 (2.6)

	N (%)
Garage	1 (2.6)
Adult supervision	
Child was not alone	30 (76.9)
Child was alone	9 (23.1)
Estimated amount ingested	
Less than a mouthful	24 (61.5)
Mouthful	7 (17.9)
More than a mouthful	3 (7.7)
A taste	1 (2.6)
Did not know	4 (10.3)

Table 5

Aggregate sign, symptom, and management data from patients with lamp oil product ingestions from five PCs (n = 39).

	N (%)
Number of symptoms	
None	18 (46.2)
1	8 (20.5)
2	4 (10.3)
3	5 (12.8)
4	1 (2.6)
5	1 (2.6)
6	2 (5.1)
Symptoms reported (not mutually exclusive)	
Cough	20 (51.3)
Vomiting	8 (20.5)
Difficulty breathing	7 (17.9)
Choking	6 (15.4)
Fever	4 (10.3)
Lethargy/fatigue	2 (5.1)
Skin changes	2 (5.1)
Changes in stool	1 (2.6)
Weakness/flaccid extremities	1 (2.6)
Agency/healthcare provider(s) notified of exposure*	
PC	33 (84.6)
Police/9-1-1	4 (10.3)
Pediatrician	2 (5.1)
Fire department	1 (2.6)
Hospital/emergency Department	1 (2.6)
Management sites	
Non-HCF	27 (69.2)
Hospital ED	9 (23.1)
Pediatrician’ s office	2 (5.1)
Urgent care	1 (2.6)**
Tests/treatment received	
Chest X-ray	7 (17.9)
Blood test drawn	6 (15.4)
Oxygen	5 (12.8)
No medication	3 (7.7)
Albuterol	3 (7.7)
Antibiotic	3 (7.7)
Intravenous line placed	3 (7.7)
No procedures/tests	2 (5.1)

	N (%)
Steroids	2 (5.1)
Other respiratory support	2 (5.1)
Antiemetic	1 (2.6)
Ventilator	1 (2.6)

* In three cases more than one center notified.

** Patient initially presented to urgent care clinic then referred to ED.