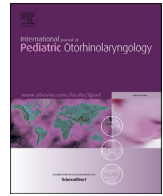




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The public health resource utilization impact of airway foreign bodies in children



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ABSTRACT

Objective: Quantify the resource utilization associated with airway foreign bodies in children in the United States using a national database and report observed trends over time. Study type: Cross-sectional analysis of national inpatient database with weighted estimates.

Data source: The KID database (2000–2009).

Methods: ICD-9-DM codes for foreign body aspiration were used to identify patients to be included for investigation. Admission rates and charges were aggregated and compared among geographic region, location, and teaching hospital status. These factors were then also trended over time.

Results: From 2000 to 2009, airway foreign body diagnoses in children accounted for an estimated 4000 to 5000 admissions, resulting in a mean admission rate of 6.6 per 10,000 pediatric patients annually. Charges related to airway foreign bodies in children rose from a total of \$93 million to \$486 million in the observed period. There is an increasing trend over time of total charges per patient. Charges appear to be higher in urban locations and teaching hospitals.

Conclusions: The public health and economic burden of pediatric airway foreign bodies appears to be rising. Further investigation may be helpful to examine factors that may be contributing to increasing charges and creating strategies to improve cost effectiveness, as well as why there seems to be increased resource utilization in urban locations and teaching hospitals.

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1. Introduction

Aspiration of foreign bodies in children, though rare represent a significant public health issue that is associated with a surprisingly high mortality rate [1]. Food foreign bodies are the most common items identified in choking events, and boys less than five years of age may be at the highest risk [2]. Lack of private insurance has also been associated as a risk factor for foreign body aspiration in children; this may be related to a potential lack of anticipatory guidance and caretaker education [3]. Many different types of aspirated foreign bodies in children have been described in the literature, but a recent experience of airway foreign bodies in children by Sink

et al. reported that almost half of the causative agents were fragments of seeds and nuts [4]. The American Academy of Pediatrics (AAP) has recently communicated that introduction of peanuts earlier in childhood may help to prevent peanut food allergies in high risk infants [5,6]. This may present an opportune and appropriate time to review potential resource utilization associated with foreign body aspiration in children, as well as to identify patterns over time regarding the incidence of this clinical problem. It may be important to look at this trend over time, so that we may better understand utilization of resources and identify if there is a need to formulate targeted educational awareness programs, anticipatory guidance for at-risk pediatric patient populations, or more cost effective management strategies.

For this investigation, we used the Kids' Inpatient Database (KID) to quantify resource utilization associated with airway foreign bodies in children in the United States and to report observed trends over time.

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2. Methods

The Kids' Inpatient Database (KID) is a pediatric inpatient care database in the United States included in the Healthcare Cost and Utilization Project (HCUP) family, which started publishing data in 1997. It is the only all-payer, pediatric-specific database in the United States. The database is updated every three years and multiple data sets are available. We combined the 2000, 2003, 2006 and 2009 editions of KID, which contain 2.5, 3.0, 3.1 and 3.4 million pediatric discharges, respectively. When weighted per KID recommendations, they represent a total population of more than 34 million pediatric discharges. This data set conforms to Health Information Privacy and Portability Act (HIPPA), and institutional review board (IRB) was obtained prior to this investigation.

We included all pediatric patients aged 18 years and under. The KID database contains a searchable field for associated admitting diagnoses (DX1-DX25) and was queried for entries with a diagnosis of one of the following ICD-9-DM codes: 933.1 – foreign body in larynx; 934.1 – foreign body in main bronchus; 934.8 – foreign body in other specific parts bronchus and lung; 934.9 – foreign body in respiratory tree, unspecified. For identified cases, the variables extracted and recorded can be found in Table 1. The 1997 and 2012 editions of KID were not used because not all data elements were available in 1997; in 2012, by contrast, the method in which data was coded changed and only allowed for cross-sectional

analysis. Records were analyzed looking at resource utilization over time associated with pediatric airway foreign bodies.

A univariate logistic regression model was used to model the probability of receiving a patient with foreign body aspiration as a function of time. A simple linear regression model was fit to assess the temporal trend of total charges per pediatric patient admission with foreign body aspiration. The complex survey sample design involving stratification, clustering, and unequal weighting was taken into account for all statistical inferences. In all cases, the threshold for assessing statistical significance was set to level $\alpha = 0.05$, thus p-values > 0.05 were considered non-significant. Statistical analysis was performed using SAS software (SAS Institute Inc., 2015, Cary, NC).

3. Results

Table 2 reports the estimated admissions annually of airway foreign body diagnoses in children, which translated to a mean admission rate of 6.6 per 10,000 pediatric patients annually, from 2000 to 2009, 95% CI: [6.2, 7.1] (Fig. 1). The absolute total number of foreign body aspiration cases significantly increased from 2000 to 2009. The incidence of airway foreign bodies does not seem to significantly increase from 2000 to 2003 or 2006 but significantly increased in 2009, relative to the baseline, $p = 0.0004$ (Table 3). Note that this result is not adjusted by the yearly increase of the

Table 1
Clinical factors examined for resource utilization.

1. HOSP_LOCATION (location of the hospital: urban or rural)
2. HOSP_REGION (geographic region of the hospital: Northeast, Midwest, South, or West)
3. HOSP_TEACH (teaching status of the hospital: non-teaching or teaching)
4. TOTCHG_X (cleaned total charges)

Table 3
Logistic regression of pediatric patients with foreign body aspiration as a function of survey year.

Year	Odds ratio	95% CI	Pr > t
2003 vs 2000	1.145	[0.968, 1.353]	0.1135
2006 vs 2000	1.139	[0.974, 1.332]	0.1033
2009 vs 2000	1.354	[1.144, 1.602]	0.0004

Table 2
Mean and total charges for pediatric patients (per inpatient admission) with the diagnosis of an airway foreign body from years 2000–2009.

Year	Total Cases	Standard error of total cases	Mean [95% CI]	Total charges
2000	4172	222.2	\$24,425 [\$20,151, \$28,699]	\$93,304,054
2003	4853	360.3	\$32,040 [\$28,628, \$35,451]	\$152,686,162
2006	4925	329.9	\$44,187 [\$39,275, \$49,098]	\$214,271,584
2009	5707	428	\$86,677 [\$76,896, \$96,458]	\$485,767,513
Total	19,656	686.5	\$49,689 [\$46,077, \$53,300]	\$946,029,312

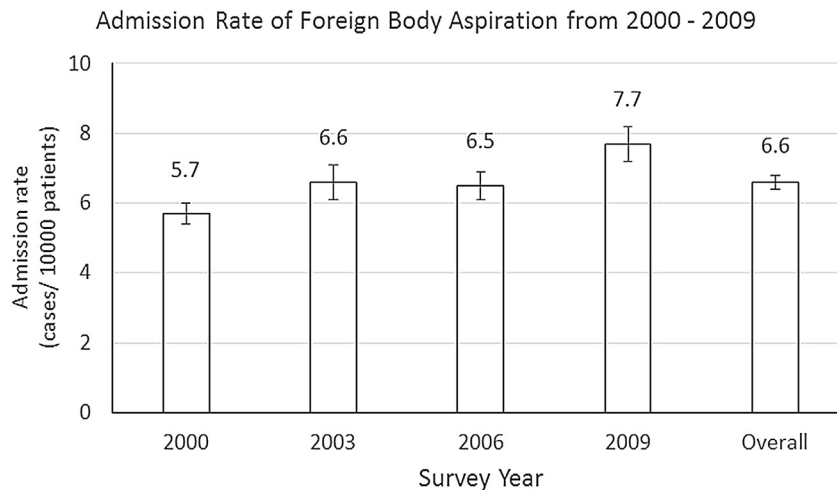


Fig. 1. Admission rate of pediatric patients with airway foreign bodies (cases per 10,000 patients) from 2000 to 2009.

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