◇Patient Safety Authority
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Accidental Choking Among Hospitalized Patients in Pennsylvania

A 15-Year Retrospective Review

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Choking occurs when a foreign body becomes lodged in the airway and obstructs respiration. In the United States, over 5,000 deaths were attributed to choking in 2015. Among older adults, food is the most common cause of choking, and the death rate for choking events involving food is seven times higher among older adults than young children. We queried the Pennsylvania Patient Safety Reporting System (PA-PSRS) and identified 545 events related to accidental choking on food, beverages, medications, or other foreign bodies reported from 2004 to 2019. Patients who experienced a choking event were more often female (56%; 306 of 545), and they ranged in age from 6 months to 102 years, with a median patient age of 70 years (interquartile range = 54 to 83 years). Among choking events that specified the substance involved, food was the most common (80%; 424 of 528 events). The most common foods that patients choked on were meat or fish (n=77), sandwiches (n=38), and breads or cakes (n=31). Abdominal thrusts were the most common immediate response described in event reports, attempted in more than half of events (56%; 306 of 545). Prevention of accidental choking may involve timely assessment of risk factors that predispose a patient to choking, including age older than 60 years, tooth loss and presence of dentures, and underlying psychiatric or neurologic illness.

Keywords: *choking, foreign body, food bolus, airway obstruction, abdominal thrusts, patient safety*

Choking occurs when a foreign body becomes lodged in the airway and obstructs respiration. Choking most often affects young children and older adults.[1] In 2015, 5,051 individuals in the United States choked to death, and more than half (57%; 2,858) were over 74 years old.[2] Among older adults, food is the most common cause of choking.[1] From 2007 through 2010, the death rate for choking events involving food was seven times higher among patients 65 years and older than among children 1 to 4 years old.[3] Older adults may be predisposed to food-related choking death due to underlying health conditions that affect chewing and swallowing of food.[3]

Choking deaths, especially those involving food, are considered preventable, which makes this an important patient safety topic.[3] We queried the Pennsylvania Patient Safety Reporting System (PA-PSRS)* to identify patient safety events related to choking that have occurred in Pennsylvania. The purpose of this analysis was to gain a better understanding of choking events that occur within healthcare facilities and to identify potential risk factors for choking, prevention strategies, and treatment options.

Methods

We queried PA-PSRS for events that occurred from May 1, 2004, through December 31, 2019. We searched free-text fields (i.e., Event detail, Event Recommendation, Event Comments, and Event Type Subtype Other) for the keyword "chok," which was intended to capture all conjugations of the verb "choke." Each event was reviewed by a patient safety analyst to determine inclusion or exclusion in the analysis.

An event was included in the analysis if it described accidental or unintentional choking on food, beverage, or medication. An event was also included if it described choking on an inedible foreign body, such as a bone, stem, or denture, if the ingestion was accidental or unintentional (e.g., a bone present in a piece of meat).

Events were excluded for the following reasons:

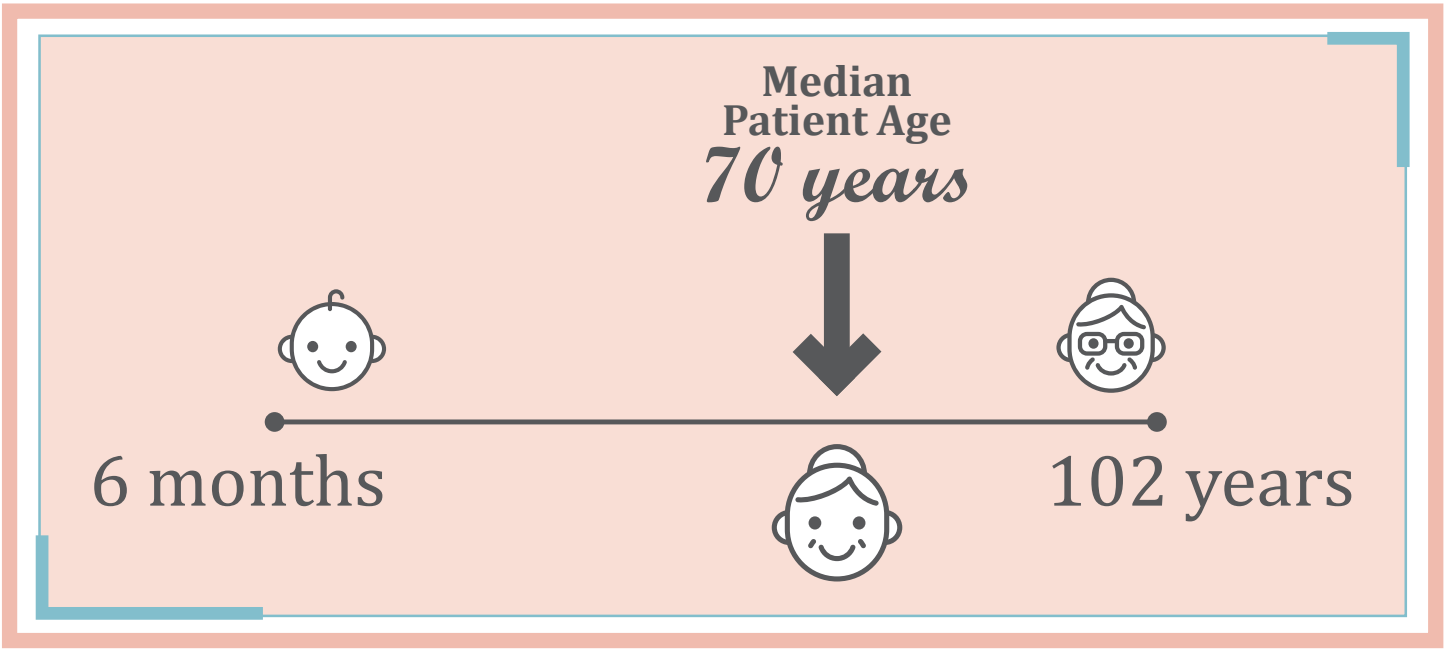
- Event described choking on a bodily fluid, such as blood or mucus.
- Event described seizure activity without any actual choking.
- Event described strangulation, including self-strangulation (intentional or unintentional), strangulation of one patient by another patient, or strangulation of a healthcare provider.
- Event described an unplanned self-extubation which resulted from a patient experiencing the sensation of choking while intubated.
- Event described an adverse drug reaction which resulted in the throat closing and the patient experiencing respiratory distress as a result.
- Event described coughing and choking in an adult that did not result in blockage of the airway.
- Event described a choking event reported by the patient but not witnessed by any healthcare provider.
- Event described coughing and/or choking in a newborn patient who had difficulty clearing the airway of secretions.
- Event included the keyword "chok" in another context.

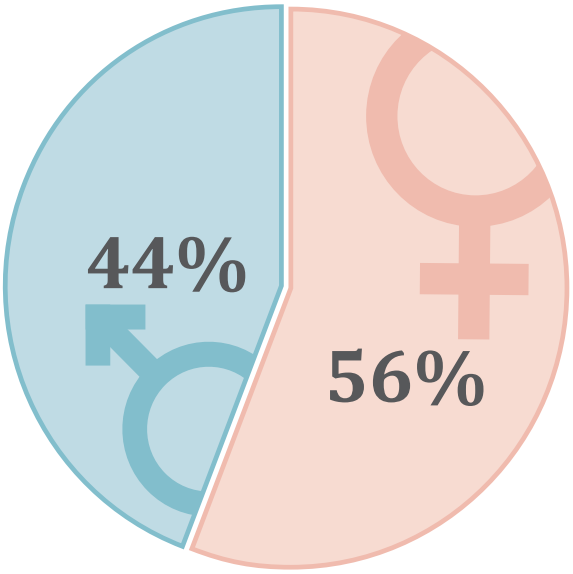
A descriptive analysis was performed to characterize trends in patient age, patient gender, event harm, facility type, and care area group. A qualitative analysis was also conducted to identify the specific substance on which the patient choked, whether there was a deviation from the prescribed diet, the response and remedies employed by the healthcare team, any transfers to a higher level of care that were required, and whether the patient expired as a result of the choking event.

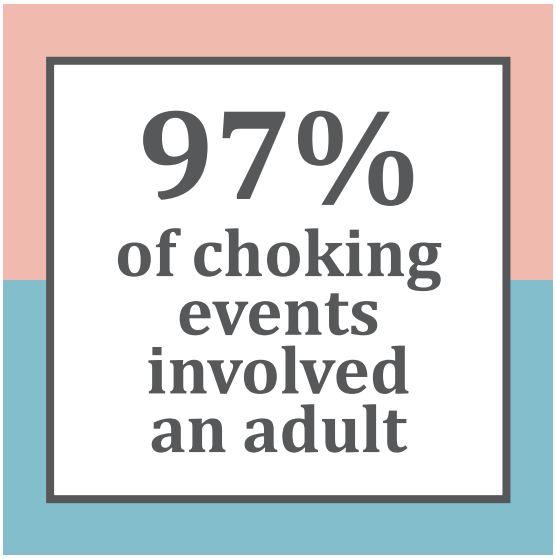
Results

The query returned 1,543 events submitted to PA-PSRS from May 1, 2004, through December 31, 2019. A total of 545 unique events were identified for inclusion in the analysis. The most common reasons for event exclusion were coughing or choking in a newborn resulting from excess secretions, strangulation events, adverse drug reactions, choking on a bodily fluid, and a sensation of choking that led to self-extubation.

*PA-PSRS is a secure, web-based system through which Pennsylvania hospitals, ambulatory surgical facilities, abortion facilities, and birthing centers submit reports of patient safety–related incidents and serious events in accordance with mandatory reporting laws outlined in the Medical Care Availability and Reduction of Error (MCARE) Act (Act 13 of 2002).[4] All reports submitted through PA-PSRS are confidential and no information about individual facilities or providers is made public.





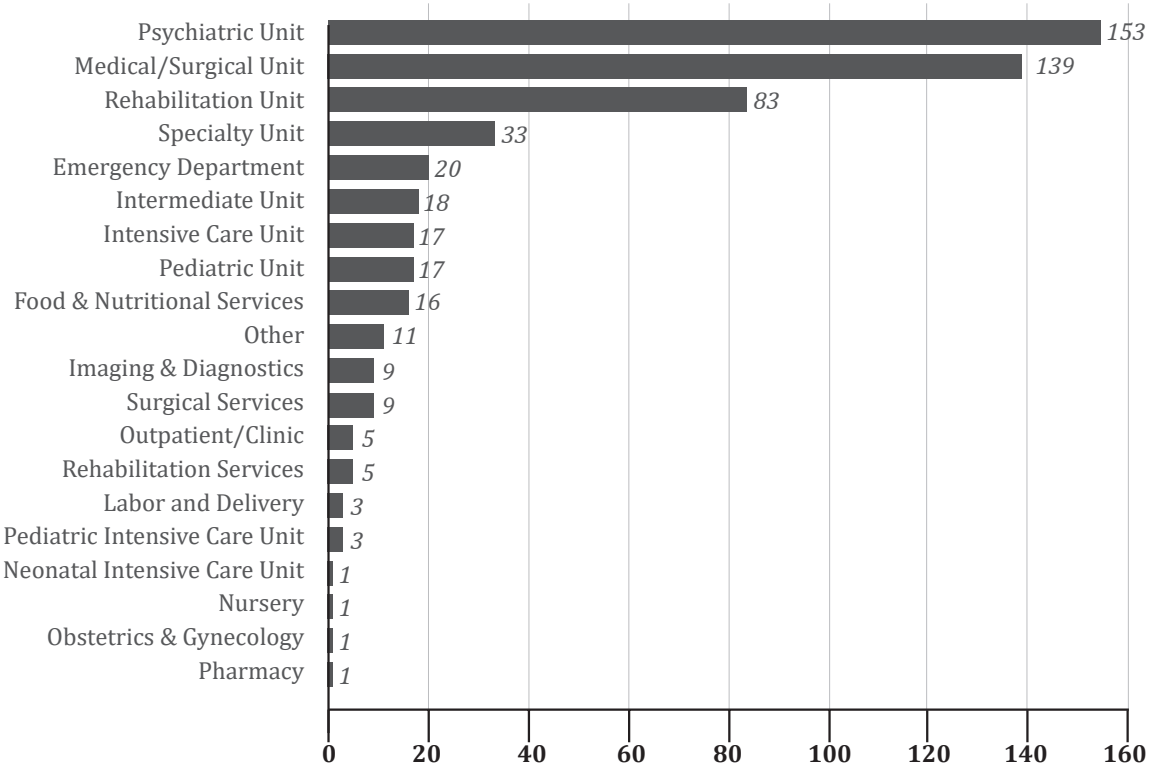


Descriptive Analysis

Patients who experienced a choking event were more often female (56%; 306 of 545) than male (44%; 239 of 545). Patients ranged in age from six months to 102 years. The median patient age was 70 years (interquartile range = 54 to 83 years). Most events (97%; 526 of 545) involved an adult (age 18 years or older). Based on the assessment of the reporting facility, 90% (491 of 545) of events did not result in harm to the patient. Of events that resulted in harm to the patient, the harm was usually temporary (6%; 35 of 545). The reporting facility specified that 14 events (3%; 14 of 545) contributed to or resulted in the death of the patient.

About three-quarters of events (73%; 396 of 545) occurred at an acute care hospital. The remaining events occurred at a rehabilitation hospital (12%; 66 of 545), a psychiatric hospital (5%; 28 of 545), a long-term acute care hospital (4%; 21 of 545), a critical access hospital (3%; 18 of 545), a children's hospital (2%; 13 of 545), and an ambulatory surgery facility (1%; 3 of 545). The most common care area groups where a choking event took place were a psychiatric unit (28%; 153 of 545) and a medical/surgical unit (26%; 139 of 545). The care area groups where each choking event occurred are summarized in **Figure 1**.

Figure 1. Number of Events by Care Area Group Where Event Occurred, Assigned by Reporting Facility, N=545



Qualitative Analysis

Each event report was reviewed to identify pertinent trends, including the substance involved in the choking event, the response enacted by the healthcare team, and transfers to a higher level of care. A subgroup analysis of events that caused or contributed to the patient's death was also performed.

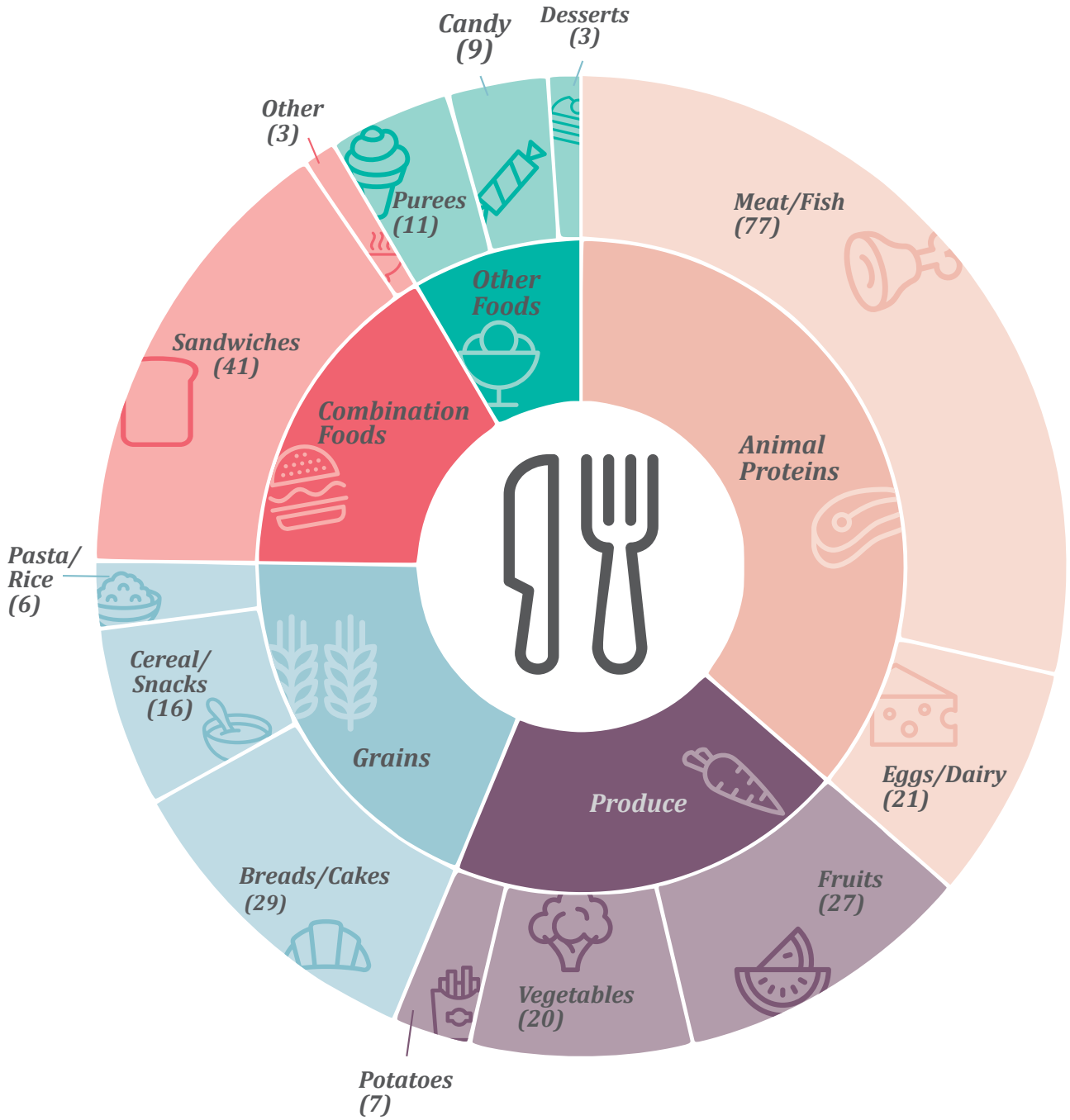
Substances Implicated in Choking Events

Events were classified according to whether the substance implicated in each choking event was a food, beverage, medication, or another foreign body. The specific substance was noted if that detail was included in the event report. The substance implicated in each choking event was identified in 528 events, while the other 17 events did not specify the substance. Choking events involving food were by far the most common, with food being mentioned in 80% (424 of 528) of events. Among 424 events that specified the patient choked on food, 262 events included information about the specific food or food group, and 6 of those events each involved two foods, for a total of 268 specific foods (summarized in **Figure 2**). The single most common food that patients choked on was chicken (n=24). Other common foods were eggs (n=19) and mashed potatoes (n=7). The most common food groups were meat or fish (n=77), sandwiches (n=38), and breads or cakes (n=31).

Patients were reported to have received the wrong diet in 59 events. Among these events, the wrong diet was supplied by the food services department or a staff member caring for the patient in 48 events and by a family member in 8 events; the patient obtained food from another source, such as from another patient's food tray, in 3 events.

Choking events involving medications were the second most common, with medication being mentioned in 13% (73 of 528) of events. Among 41 events that mentioned a specific medication, the most frequently implicated medications were potassium (n=7), acetaminophen (n=5), barium (n=4), cough lozenges (n=4), opioid/acetaminophen combinations (n=4), gas crystals (n=3), and docusate (n=2). Other medications specified in event reports included clopidogrel, ibuprofen, lorazepam, oxycodone, prednisone, sucralfate, and tramadol. In some cases, the medications were tablets that had been split in half, and in other cases the patient attempted to swallow two or more pills at once.

Figure 2: Foods Identified in Choking Events, N=268



Other foreign bodies were specified in 3% (17 of 528) of events. The most common other foreign bodies were bones (n=5), presumably from meat or fish; dentures (n=3); and plastic (n=3). Several foreign bodies implicated in choking events were the inedible parts of fruits or vegetables, such as a fruit pit, a stem, and a leaf. In most cases, these other foreign bodies were mixed in with food and not visible to the patient. Beverages were specified in 3% (15 of 545) of choking events. The most common beverage involved in choking events was water (60%; 9 of 15); other beverages included juice, coffee, and formula.

Response to Choking Events

Many events included details about the response or responses enacted by the healthcare team. These responses ranged from encouraging the patient to cough in order to move the foreign body out of the throat to calling for an internal or external emergency response team. In 44 event reports, the patient was able to expel the foreign body without the intervention of a healthcare provider by coughing, gagging, and/or vomiting. The most common immediate response described in event reports was the administra-

Most Common Responses to Choking:

- Heimlich maneuver
- Suctioning
- Back blows
- Finger sweeps

tion of abdominal thrusts (commonly referred to as the Heimlich maneuver[5]), which was attempted in more than half of events (56%; 306 of 545). Details about the individual(s) who administered abdominal thrusts were specified in 180 event reports, and these included healthcare providers or staff members (n=172), another patient (n=6), or a visitor or family member (n=2). In 3 events, a visitor or another patient started abdominal thrusts until a healthcare provider or staff member was able to take over. Nurses were the most common healthcare provider (n=77) to administer abdominal thrusts to the patient. Other immediate responses included suctioning (n=47), back blows (n=23), and finger sweeps (n=14).

A code, condition, or rapid response was called to assist in the treatment of 108 patients. Seventy-six patients were transferred to a higher level of care, either within the same facility or at an outside hospital. Chest X-rays were ordered in 32 event reports to determine if the patient aspirated or sustained an injury as a result of treatment.

Comorbid Health Conditions

One or more comorbid conditions were mentioned in 95 event reports, and these were diverse and affected every body system. The most frequently mentioned comorbid conditions were neurological disorders (n=24), including stroke, seizures, Parkinson's disease, Alzheimer's disease; cardiovascular disorders (n=22), including coronary artery disease, congestive heart failure, and hypertension; psychiatric conditions (n=16), including psychosis, agitation, depression, and anxiety; and gastrointestinal disorders (n=15), including esophageal abnormalities, peptic ulcer disease, and gastrointestinal reflux disease (see **Figure 3**). Recent surgery was described in 12 event reports, including hip replacements, knee replacements, heart surgery, and amputation. Patients with underlying neurologic conditions most often had a history of stroke (n=7) or seizures (n=7). A recent history of choking, aspiration, or dysphagia was mentioned in 10 event reports. Some event reports specified that patients had partial or complete tooth loss (n=10), and most of these patients were noted to have ill-fitting or missing dentures.

Deaths Associated With Accidental Choking

As stated above, the facility specified that the event contributed to or resulted in the patient's death in 14 event reports. Two additional patient deaths were identified in the qualitative analysis, and the primary cause of death in these two cases was attributed to cardiac arrest. Among these 16 patient deaths, patients more often were male (63%; 10 of 16), and the majority (75%; 12 of 16) of patients were over the age of 60.

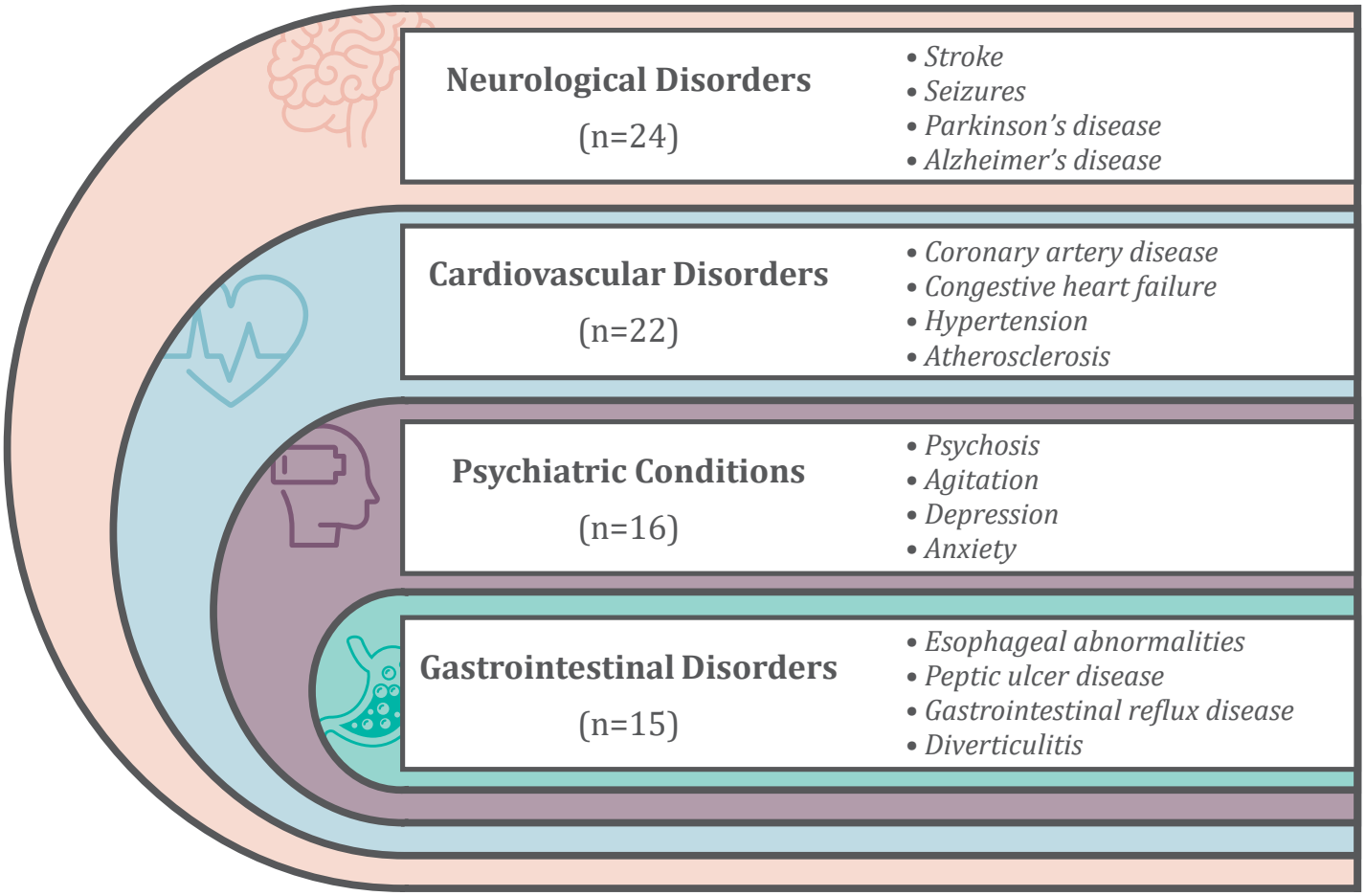
All but two deaths occurred at an acute care facility (88%; 14 of 16). The most common care area groups where a patient experienced a choking event that resulted in the death were a medical/surgical unit (38%; 6 of 16) and a psychiatric unit (31%; 5 of 16).

All but two events involved choking on food (88%; 14 of 16). Of the 8 food-related choking deaths that mentioned a specific food, 3 events involved a sandwich. Males (n=8) were more likely to experience a food-related choking death than females (n=6).

Abdominal thrusts were attempted in half of events (50%; 8 of 16), and a code or rapid response was called in over two-thirds of events (69%; 11 of 16). In some instances, resuscitative measures were stopped due to the patient having a do not resuscitate and/or do not intubate order in place.

Underlying or preexisting conditions mentioned in event reports that resulted in death of the patient included dysphagia or a recent history of choking or aspiration, neurologic conditions (e.g., seizures and stroke), and psychiatric conditions or changes in mental status (e.g., dementia and agitation).

Figure 3: Most Common Comorbid Conditions for Patients Who Experienced a Choking Event, N=61



Discussion

Our analysis primarily identified events among adult patients, so this discussion focuses on choking events in the adult population. Investigations of accidental choking among hospitalized patients are scarce in the medical literature, and to the author's knowledge, our study appears to be the largest to date.

An analysis of 75 near-fatal choking events in both community and inpatient (e.g., hospitals and nursing homes) settings revealed that events were more common in females (59%; 44 of 75), and the median patient age was 70 years, which was similar to what we found in our study (57% of patients were female, and median patient age was 70 years).[6] A review of 2,214 food-related choking deaths in patients 65 years and older spanning a four-year period in the United States revealed that males were more likely than females to experience a food-related choking event, and the difference became more pronounced as patient age increased.[3] Fatal choking in general has been more frequently reported among males than females.[7,8] Similarly, we found that males more frequently experienced a fatal choking death in general and more specifically a fatal choking death related to food.

Identifying choking on a foreign body as the cause of death can be challenging in elderly patients with multiple and complex underlying conditions. Elderly patients may have a diminished cough reflex, and as a result, an apparent cardiac arrest may actually be the result of silent asphyxiation. The only definitive way that the cause of death can be accurately identified is via an autopsy, which may not be routinely performed in patients with underlying cardiac conditions. A small case series and a case report describe 4 events in which the cause of death was initially attributed to a cardiac arrest, but following autopsy, the patients were determined to have choked to death on food.[9,10] The results of a larger retrospective study of fatal choking in the elderly also demonstrated that an autopsy was necessary to accurately identify the cause of death as fatal choking.[7] Notably, there were two deaths in our analysis that the reporting facility attributed to cardiac arrest, and it was not clear that an autopsy was performed in either case to confirm the cause of death.

The most common treatment method employed to relieve choking in our analysis was the administration of abdominal thrusts. Studies attempting to identify a preferred technique for the treatment of choking are largely anecdotal

and retrospective in nature.[11] The most recent guidelines from the American Heart Association (AHA) indicate that an adult who is conscious and choking with signs of severe obstruction can be treated with abdominal thrusts, chest thrusts, or back blows.[11] For the sake of simplicity, AHA recommends that adults and children age one year and older who are conscious and choking be treated with abdominal thrusts applied in rapid succession. Patients who are obese or in the late stages of pregnancy should be treated with chest thrusts.[11] Healthcare providers involved in direct patient care, such as physicians and nurses, are trained to administer abdominal thrusts, and individuals in the community who take courses in basic life support and advanced cardiac life support also receive this training.[12] If the patient becomes unconscious, treatment should then progress to cardiopulmonary resuscitation.[11]

Researchers have hypothesized that screening of high-risk patients in the primary care setting is the best way to prevent choking deaths in older patients.[10] Primary care providers may consider risk factors that predispose patients to choking, which are summarized in **Table 1**. Taking this strategy a step further, healthcare providers in the acute care setting may also be able to prevent choking events within their facilities by screening patients on admission and identifying those who may be at the greatest risk.

Meat/fish and sandwiches were some of the most common foreign bodies implicated in accidental fatal and nonfatal choking.[6-8] In a study of the influence of both salivation and the consistency of food products on swallowing, researchers found that adding butter to food products that were hard or dry decreased the number of chewing

Strategies to Prevent Choking on Medication

One study estimated that 7% of aspirated foreign bodies are pills, compared to 13% observed in our study.[17] Even among healthy patients, swallowing medication may be difficult.[18]

Several strategies may be employed to prevent medication-related choking events, including postural adjustments, pill-swallowing aids, pill-swallowing techniques, deprescribing unnecessary medications, or changing to an alternative dosage form (e.g., changing from a tablet to a suspension).[18,19]

If these methods are not possible or are unsuccessful, alternative methods include modifying a dosage form or include mixing medications with food (e.g., yogurt or applesauce) or beverage (e.g., juice); however, these methods should be used with caution because they may impact the integrity of the medication, cause irritation of the gastrointestinal tract, or lead to interactions between a food or beverage and a medication.[18] Especially among patients with swallowing disorders, pills should be administered one at a time, and the healthcare provider should ensure that each pill had been swallowed before giving the next pill.[17]

Table 1: Risk Factors for Choking in Adults[6-8,10,13-15]

Age	>60 years of age	
Health Conditions	Parkinson's disease Dementia, including Alzheimer's disease Schizophrenia Stroke Cerebral palsy Multiple sclerosis Seizure disorder Cancer, especially of the larynx	
Dental Health	Tooth loss	*Partial* *Complete*
	Dentures	*Ill-fitting* *Missing*
Medications	Antipsychotics	*chlorpromazine* *clozapine* *lithium* *haloperidol* *olanzapine* *risperidone* *quetiapine*
	Anticholinergics/Antimuscarinics	*benztropine* *diclyclomine* *oxybutynin* *ipratropium* *tolterodine*
	Neuromuscular Blockers	*cisatracurium* *pancuronium* *rocuronium* *vecuronium*
	Antineoplastics/Immunosuppressants	*azathioprine* *cyclosporine* *paclitaxel* *daunorubicin* *vinorelbine*

> "Researchers found that adding butter to food products that were hard or dry decreased the number of chewing cycles required to swallow the food bolus."

cycles required to swallow the food bolus.[16] This is a simple technique that could be helpful for patients with underlying salivation or swallowing disorders. Alternatively, patients with dietary restrictions related to underlying health conditions (e.g., hyperlipidemia) may simply avoid foods that are hard or dry to prevent the possibility of choking.

Collaboration across the healthcare team is essential to ensure safe delivery of food and medication for patients in the inpatient setting. For patients with suspected swallowing difficulty, a speech language pathologist may be consulted to evaluate the patient's swallowing and make recommendations to alter the patient's dietary and medication orders.[20] For any proposed changes to medication delivery, the pharmacist should be consulted to ensure that a medication may be safely mixed with a food or beverage or to identify whether it is safe to split or crush a pill.[18,20]

Limitations

Despite mandatory event-reporting laws in Pennsylvania, our data are subject to the limitations of self-reporting. Because a standard taxonomy for reporting accidental choking events does not exist, we may have missed relevant event reports with our query. Other search terms were considered, including "dysphagia" and "aspiration;" however, many reports mentioned these terms only peripherally and most went beyond the scope of our study. The applicability of our findings may be limited to the inpatient setting because PA-PSRS does not collect reports of patient safety events from nursing homes.

Conclusion

Although accidental choking events occur regularly among hospitalized patients in Pennsylvania, most events are quickly addressed by clinical staff to prevent harm to the patient, and death is uncommon. Food contributed to three-quarters of accidental choking events in the hospital and all but two deaths. Common foods implicated in accidental choking events include meat/fish, sandwiches, breads/cakes, and eggs. Abdominal thrusts were utilized in more than half of events to clear the patient's airway, indicating that this remains one of the most effective tools to manage accidental choking regardless of setting. Prevention of accidental choking, specifically in the inpatient setting and also in the broader community, may involve timely assessment of risk factors that may predispose a patient to choking, including age older than 60 years, tooth loss and presence of dentures, and underlying psychiatric or neurologic illness. Future research may explore choking events that occur in other healthcare settings, such as nursing homes, as well as in other locations in community.

Notes

This analysis was exempted from review by the Advarra Institutional Review Board.

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