When fish are not refrigerated or frozen immediately after they are caught, spoilage bacteria can proliferate and cause a breakdown of the fish’s tissue with a buildup of histamine. Histamines are heat-resistant; therefore, illness can occur even with fish that is properly canned or cooked. Typically, healthy fish have histamine levels of 0.1mg histamine per 100g fish, while fish that cause histamine poisoning can have 200—500 times more histamine (20-50mg histamine per 100g fish). Histamine in people is familiar as a cellular mediator of allergies; ingestion can result in a systemic inflammatory-like response, the clinical syndrome of scombroid.

Eating fish with high levels of histamine can cause symptoms within two minutes to two hours after consumption. Symptoms of scombroid can include rash, diarrhea, facial flushing or redness, sweating, headache, vomiting, burning/swelling of the mouth, abdominal pain or a metallic taste. Fish with high levels of histamine can taste peppery, metallic or bitter, but low levels of histamine can be tasteless and still cause symptoms.

Initial notification
In 2013, a Pennsylvania child care center reported a suspected outbreak of scombroid among students and staff members. The child care center consists of six age-grouped classes, ranging from infants to kindergarten. The child care center served tuna salad sandwiches to approximately 30 students in only four of the classes, as well as to a few staff members. Within 15 minutes of meal service, the child care center had identified an outbreak.

Food handling
For lunch, the child care center served tuna salad sandwiches made from pouch tuna, mayonnaise and sliced bread, which were consumed within 30 to 60 minutes of preparation. In addition, canned and fresh fruit, a salad with Ranch dressing, and milk were served, though none of these items were identified as associated with illness. The tuna salad was made from chunk light tuna in water, which was sold in 2.1-lb pouches, six pouches to a case, and was a product of a country in Central America. No leftover tuna from the pouch suspected of causing illness was available for testing.
Reported symptoms
Within five-15 minutes of consumption, 6 students and three staff members reported symptoms of scombroid. A seventh student reported symptoms after seven hours and visited the emergency department complaining of hives and diarrhea, was diagnosed with scombroid, but was not admitted. Figure 1 shows an epidemic curve of all identified cases. All ill students were in one of the four classes in which the tuna salad sandwiches were served. The most commonly reported symptoms among ill individuals are shown in Table 1 and included redness/swelling around the mouth (70 percent) and facial flushing (40 percent). All patients recovered; none died or were hospitalized.

The child care center immediately recognized the outbreak and identified tuna as the most likely source because it was common between all of the exposed ill persons. The child care center prevented further service of the associated lot of tuna. No illness was reported among students in unexposed classes.

Laboratory testing
One remaining unopened pouch from the case was submitted to the supplier for testing. Analysis found < 5 ppm histamine in the unopened pouch of tuna. The United States Food and Drug Administration reported that regulatory action can be taken at a level of 200 ppm for pouch tuna products or 50 ppm for whole fish.

Marine toxin poisoning
Approximately 30 cases of marine toxin poisoning every year are reported to the Centers for Disease Control and Prevention. However, the true number of illnesses each year may be higher because health care providers are not required to report these illnesses to public health. Also, because the symptoms can be mild and typically resolve on their own, some ill persons may never visit their health care providers.

Other forms of marine toxin poisoning include ciguatera fish poisoning and several types of shellfish poisoning. Ciguatera fish poisoning is typically associated with carnivorous fish living around coral reefs: barracuda, grouper, moray eel, amber jack, sea bass, or sturgeon. Ciguatera poisoning occurs when dinoflagellates, small algae-like marine organisms that live around coral reefs and can contain a toxin, are eaten by reef fish. The toxins become concentrated as they

| Table 1: Summary of most commonly reported outcomes and symptoms among cases |
|---|---|---|
| Outcome | N | Percent |
| Ill cases | 10 | 100% |
| Students | 7 | 70% |
| Staff | 3 | 30% |
| Recovered | 10 | 100% |

<table>
<thead>
<tr>
<th>Symptom</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset within 15 minutes</td>
<td>8</td>
</tr>
<tr>
<td>Facial flushing</td>
<td>4</td>
</tr>
<tr>
<td>Mouth redness</td>
<td>7</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>1</td>
</tr>
<tr>
<td>Nausea</td>
<td>1</td>
</tr>
</tbody>
</table>
are passed up the food chain from smaller fish to the top predator fish, like barracuda. Ciguatera fish poisoning can cause nausea, vomiting and diarrhea in one to three hours and neurological symptoms like teeth pain, metallic taste and blurred vision in three—72 hours.

Shellfish poisoning can be caused by several different types of shellfish, like mussels, oysters, clams or scallops. Usually these shellfish have eaten dinoflagellates or diatoms, small marine organisms which contain toxins. Paralytic shellfish poisoning is most common and can cause numbness of the face, lips, tongue, arms or legs, as well as headache, nausea, vomiting or diarrhea. Very large doses of the toxin can lead to more severe outcomes like involuntary muscle movements, trouble swallowing, altered mental status, flaccid paralysis or respiratory failure. Other forms of shellfish poisoning include gastrointestinal symptoms like nausea, vomiting and diarrhea, plus other symptoms: mild neurologic symptoms (neurotoxic shellfish poisoning), chills (diarrhetic shellfish poisoning), or neurologic symptoms that may be severe (amnesic shellfish poisoning).

How are scombroid and other marine toxin poisonings treated?
Patients experiencing these symptoms should discuss treatment options with their health care provider. Treatment of marine toxin poisoning is typically supportive. For scombroid, some patients benefit from antihistamines or, rarely, epinephrine. Anecdotally, oral antihistamines taken immediately when symptoms begin can prevent or markedly reduce symptom progression.

How can marine toxin poisoning be prevented?
CDC provides specific advice for avoiding marine toxin poisoning:
1. “Keep fresh tuna, mackerel, grouper, and mahi mahi refrigerated to prevent development of histamine. Don't believe that cooking spoiled or toxic seafood will keep you safe. These toxins are not destroyed by cooking.
2. Do not eat barracuda, especially those from the Caribbean.
3. Check with local health officials before collecting shellfish, and look for Health Department advisories about algal blooms, dinoflagellate growth or "redtide" conditions that may be posted at fishing supply stores. Do not eat finfish or shellfish sold as bait. Bait products do not need to meet the same food safety regulations as seafood for human consumption.”  (http://www.cdc.gov/ncidod/dbmd/diseaseinfo/marinetoxins_g.htm)

Conclusions
This report summarizes a suspected outbreak of scombrototoxic fish poisoning in an unusual setting, with a relatively high attack rate of 30 percent. Though laboratory results were inconclusive, the symptoms reported by affected students and staff are consistent with scombroid. Proper post-harvest refrigeration and time/temperature holding of finfish can prevent bacterial spoilage and scombroid. Finally, this outbreak serves as a reminder that scombroid can sometimes be caused by commercial canned or pouch tuna, not just by “fresh” (uncanned) fish.

References
1. CDC: Marine Toxins http://www.cdc.gov/ncidod/dbmd/diseaseinfo/marinetoxins_g.htm
3. Histamine Toxicity from Fish http://emedicine.medscape.com/article/1009464-overview#aw2aab6b2b2
4. Scombroid Fish Poisoning (MN DOH) http://www.health.state.mn.us/divs/idepc/diseases/scombroid/
Foodborne Outbreaks and Food Safety

Background
Nationally, each year foodborne illness causes 47.8 million illnesses, 127,839 hospitalizations and 3,037 deaths. In Pennsylvania, 4000 to 6700 cases of foodborne illness are reported each year with incidences ranging from 31 to 49 cases per 100,000 persons (Fig 1). The actual number of cases of foodborne illness is likely much higher, as the reported cases are those in which the ill person was ill enough to seek care; or if care was sought laboratory testing was not performed.

The most common foodborne illnesses reported in Pennsylvania are salmonellosis, campylobacteriosis, giardiasis, cryptosporidiosis and shigellosis (Fig 2). Norovirus is the most common cause of foodborne outbreak in the United States. Although any outbreaks of enteric illness are legally reportable to the Pennsylvania Department of Health (DOH), individual norovirus cases are not; therefore, it is difficult to accurately determine how many norovirus cases occur in Pennsylvania each year.

Common symptoms of foodborne illness include diarrhea, nausea, vomiting, fever, chills and fatigue. More severe symptoms may cause hospitalization and even death. Although collectively identified as foodborne, these illnesses may be caused by contaminated food or water or by direct transmission from person-to-person or animal-to-person. More than 50,000 cases of foodborne illness have been reported to the DOH in the last 10 years. Of these, nearly 5000 or 10 percent have been associated with an outbreak.

Case studies of foodborne outbreaks
In September 2006, a nationwide outbreak of E. coli O157 associated with bagged spinach occurred. E. coli infections may cause diarrhea, bloody diarrhea, abdominal pain and vomiting. Hemolytic uremic syndrome (HUS) may result from five to 10 percent of E. coli infections. HUS affects the kidneys and requires hospitalization; three to five percent of HUS cases result in death. This outbreak included 205 cases from 26 states, including 10 cases in Pennsylvania. One hundred and four hospitalization and four deaths were reported in this outbreak.

In July 2004, multiple cases of a specific serotype of Salmonella were reported to the DOH. The cases were linked to a delicatessen chain prevalent throughout

*Food poisoning is a general category which may include pre-formed toxins such as from Bacillus cereus and Staphylococcus aureus, or no specific etiology determined.
Pennsylvania and neighboring states. *Salmonella* causes diarrhea, vomiting and abdominal cramps. Most persons recover from *Salmonella* infections; however, in infants, the elderly and in persons with compromised immune systems, hospitalization and death may occur. A total of 429 cases were reported from nine states with the heaviest disease burden in Pennsylvania with 313 cases. Roma tomatoes were identified as the most likely vehicle of *Salmonella* transmission in this outbreak.4,5

In early 2012, *Campylobacter* cases were reported to the DOH. These cases were linked to consuming raw milk from a dairy in southcentral Pennsylvania. *Campylobacter* infection causes diarrhea, abdominal pain and fever. Most persons with *Campylobacter* infection recover fully. However, rarely, a severe paralysis resulting from an autoimmune response to the antecedent *Campylobacter* infection, may occur. A total of 80 cases were reported from four states; 70 of the cases were from Pennsylvania. Nine persons were hospitalized.6,7

### Seasonality

Although foodborne illness occurs throughout the year, summer is traditionally the time of year when foodborne illnesses peak (Fig 5). As the weather becomes warmer and events are held outdoors, it can be difficult to maintain optimal temperatures to inhibit bacterial growth. Most foodborne bacteria begin multiplying at 40°F and grow fastest between 90 and 110°F. In addition, food is also often not cooked in ovens or on stoves where food can more readily be cooked thoroughly to appropriate safe temperatures. Above 140°F, most foodborne bacteria cannot survive.8

### Avoiding Foodborne Illness8

- Wash your hands and food preparation surfaces often.
- Don’t cross-contaminate. Do not use plates or utensils used with raw ingredients for cooked ingredients. Do not allow raw meat juices to be in contact with already cooked foods or foods which are not intended to be cooked.
- Cook food to safe temperatures and check with a food thermometer.
- Refrigerate leftover food promptly; avoid holding food at temperatures between 40 and 140°F.
Influenza, or the “flu,” is a respiratory virus which is easily spread from person to person. Common symptoms include fever, cough, sore throat, runny nose, body or muscle aches, headache, and fatigue. Although some persons may experience vomiting and diarrhea, the flu is unrelated to gastrointestinal viruses which cause vomiting and diarrhea and are mistakenly referred to as the “stomach flu.”

Most persons with the flu will recover in a few days to a couple of weeks with rest; however, some persons may experience complications, including death. Complications may include pneumonia, bronchitis, sinus infections and ear infections. Complications are more common in small children, persons with certain chronic conditions (like asthma, diabetes or heart disease), pregnant women, and the elderly.

The flu season typically begins around October of each year and lasts until May of the following year. The 2013-2014 flu season has been a moderately severe flu season (Figure 1). While it has not been as severe as the pandemic H1N1 2009-2010 flu season or the severe 2012-2013 season, Pennsylvania has still seen a high number of flu cases this season. The 2013-2014 season appears to have peaked in late January of 2014, slightly earlier than when flu season peaks typically occur.
Through April 22, 2014, over 26,000 cases of flu have been reported in Pennsylvania. However, the reported flu cases are only a fraction of the total flu cases in the population, as many persons do not see a physician when ill with milder cases of the flu. Even if care is sought, flu tests are not always performed. Only laboratory-confirmed flu cases are legally required to be reported to the DOH; individual cases diagnosed clinically are not. Therefore, the total number of flu cases is likely much higher than the number of reported cases.

The dominant flu strain seen this year is the Influenza A/pH1N1 strain (Figure 2). About 8 percent of persons with flu have been hospitalized and 101 deaths have been reported (about 0.4 percent of all flu cases). One hundred flu outbreaks have been reported this season, primarily in long-term care facilities. There were significantly fewer outbreaks this season compared to the severe 2012-2013 flu season, in which over 500 flu outbreaks were reported. It should also be noted that the criteria for identifying a flu outbreak was changed in the 2013-2014 flu season. In previous seasons, just one case in a long-term care facility was identified as an outbreak; however, in the 2013-2014 flu season, two or more cases were required to be considered an outbreak.

The highest levels of hospitalization are typically seen in the older population (over 65 years of age). However, this flu season has been unusual in that higher levels of hospitalization were seen in the 18- to 64-year age group. In Pennsylvania, 55 percent of hospitalizations were in this age group, while 36 percent were in the 65 years of age and older age group. This is likely due to the fact that the dominant strain this year was the pH1N1 strain, which has been shown to be more severe in a younger population.²
This season’s vaccine has been shown to be a good match to the strains circulating this year; the vaccine effectiveness was substantial. The CDC published a report in February 2014 showing that the overall vaccine effectiveness (VE) for the 2013-2014 season is over 60 percent across all age groups. Vaccination is an important component in flu prevention. Vaccination does provide some protection and there is some evidence that flu in vaccinated persons is less severe than flu in unvaccinated persons.

Figure 3: Influenza incidence by age group, Pennsylvania, 2013-2014 flu season

Figure 4: Influenza incidence by county, Pennsylvania, 2013-2014 flu season

References
1. [http://www.cdc.gov/flu/about/disease/symptoms.htm](http://www.cdc.gov/flu/about/disease/symptoms.htm)
## Disease Reporting

Health care practitioners, health care facilities and clinical laboratories are required to report certain diseases to the Pennsylvania Department of Health. In addition to the diseases on the list, all disease outbreaks and/or unusual occurrences of disease are reportable within the commonwealth. In most cases, reporting must be done electronically via Pennsylvania's version of the National Electronic Disease Surveillance System (PA-NEDSS). To request a PA-NEDSS account, health care providers may email PA-NEDSS@pa.gov; please include your contact information and the name and address of the facility for which you will be reporting.

### Cases of select notifiable diseases in Pennsylvania *

(as of 7/26/14)

<table>
<thead>
<tr>
<th>Disease</th>
<th>Total cases reported for previous 5 years</th>
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<td>2014 †</td>
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<tr>
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<td>Pertussis (whooping cough)</td>
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<tr>
<td>Cryptosporidiosis</td>
<td>83</td>
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<tr>
<td>Shigellosis</td>
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</tr>
</tbody>
</table>

* Confirmed cases only
† Case counts for 2014 are provisional and subject to change. Counts for earlier years are for complete years.

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For employment opportunities, visit the Pennsylvania State Civil Service Commission website.

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**Pennsylvania Epi Notes**

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