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Summary

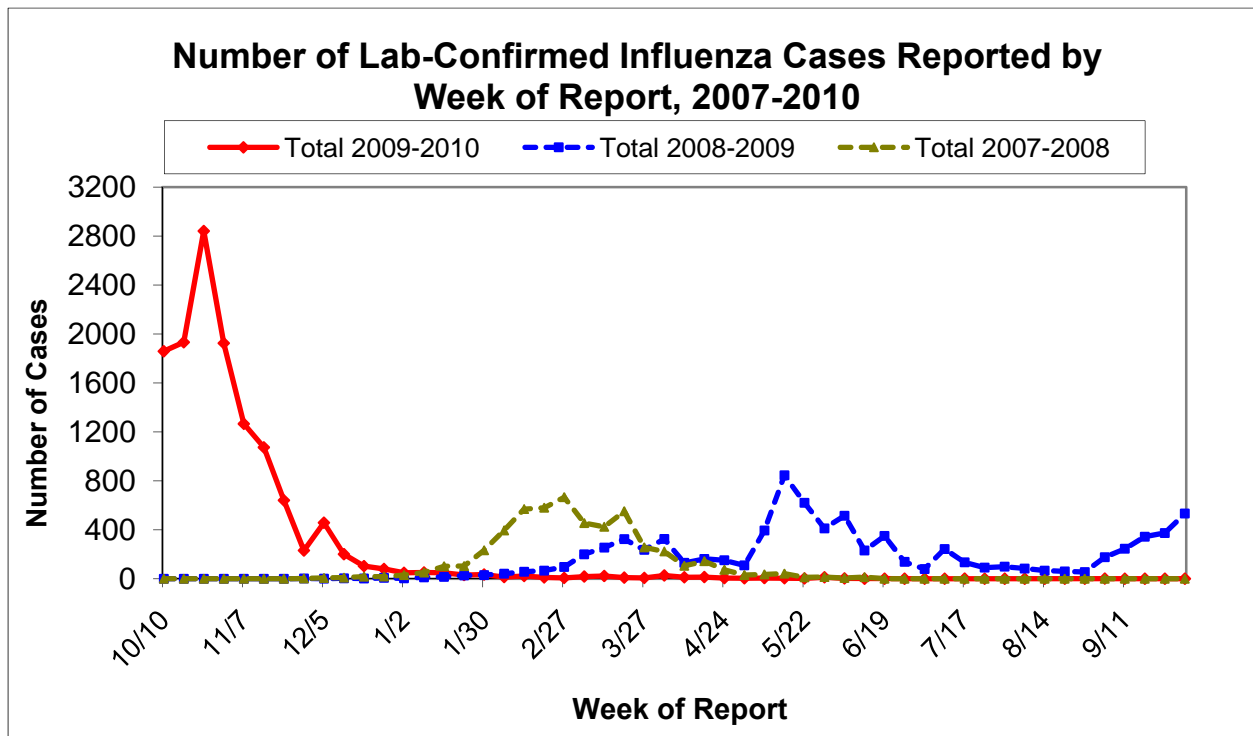
The 2009-2010 influenza season included the second wave of the 2009-2010 pandemic of the influenza A virus known as 2009 H1N1. The 2009-2010 influenza season is defined for the purposes of this report as October 4th, 2009, through September 25th, 2010. The first half of the report mostly summarizes influenza surveillance information for this period, although some indicators are shown back to April 2009 to illustrate the changes over the entire pandemic period (April 2009 through the summer of 2010). The second half of the report summarizes the information for cases laboratory-confirmed for the H1N1 virus. The pandemic virus was responsible for the vast majority of influenza cases during the pandemic period, which we know from the work done by our state health laboratory, which identified very few co-circulating virus types. However, the analysis of the H1N1 cases examines only those cases confirmed by a validated test to have the 2009 H1N1 virus.

2009-2010 Influenza Season

Laboratory-Confirmed Influenza Activity by Season, 2007-2010

Positive influenza tests are reported to ADHS by laboratories under the Arizona Administrative Code. This reporting includes many types of tests, such as rapid antigen tests, direct fluorescent antigen tests, viral cultures, or molecular testing. Many of these cannot distinguish different types of influenza, but do provide information about changes in level of influenza activity in the population.

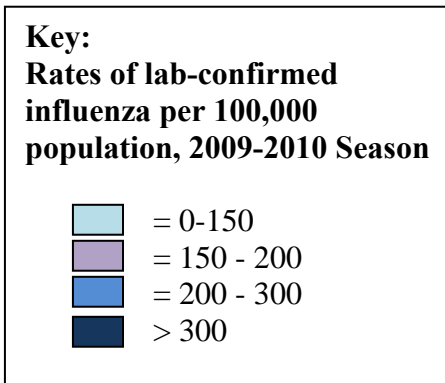
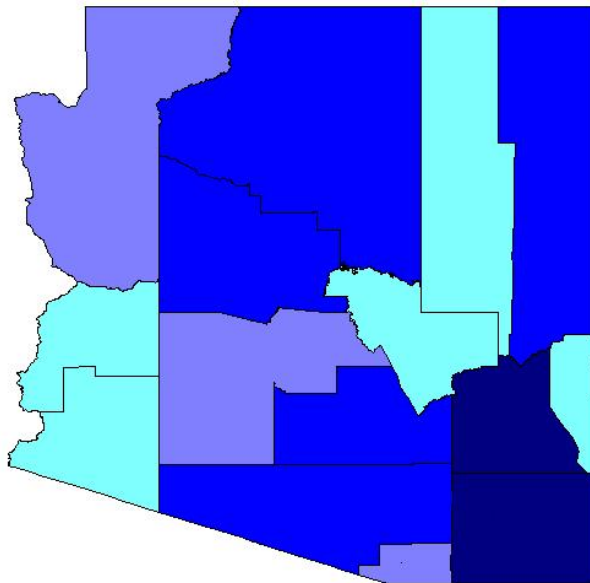
During the second wave of the pandemic, influenza cases were reported in record numbers that dwarfed previous influenza seasons.



Number and Rates of Laboratory-Confirmed Cases Reported, by County, 2009-2010 Influenza Season

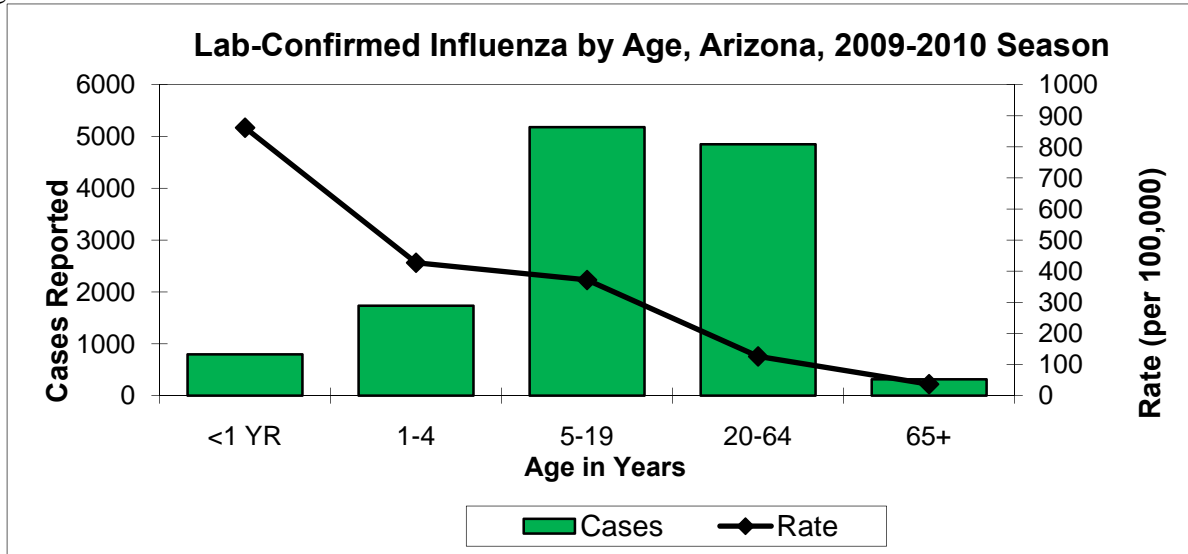
The table below includes all reported laboratory-confirmed influenza reports, regardless of subtype or testing method. While Maricopa and Pima Counties have the most cases, Graham and Cochise Counties reported the highest rates per population. Differences in rates may reflect not only differences in the level of influenza virus circulating in the community, but also testing and reporting practices.

County	Number of Laboratory-Confirmed Cases	Rate per 100,000 population
Apache	184	240
Cochise	518	365
Coconino	316	228
Gila	65	109
Graham	600	1508
Greenlee	3	35
La Paz	8	37
Maricopa	6978	176
Mohave	352	172
Navajo	121	105
Pima	2339	230
Pinal	723	221
Santa Cruz	75	158
Yavapai	461	203
Yuma	287	140
Total	13,030	198



Influenza Activity by Age

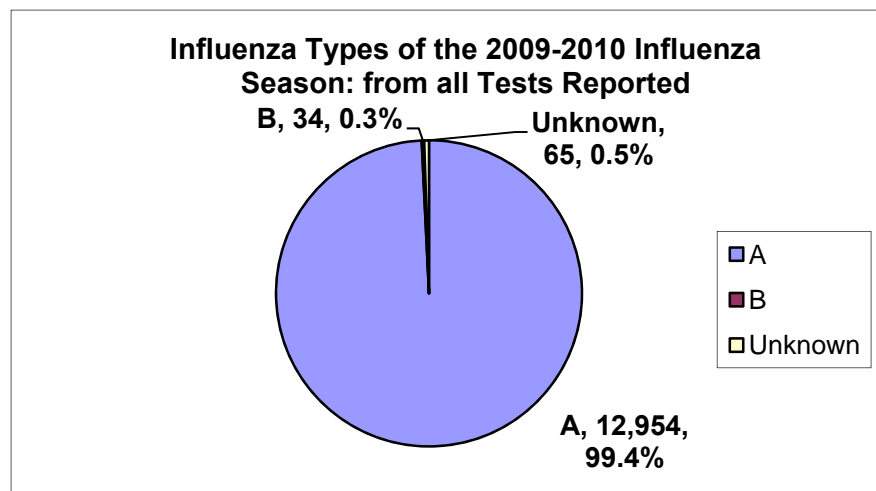
While the greatest number of cases occurred in the 5-19 and 20-64 year age groups, the rate of reported influenza cases was highest in children less than one year of age and decreased with age.



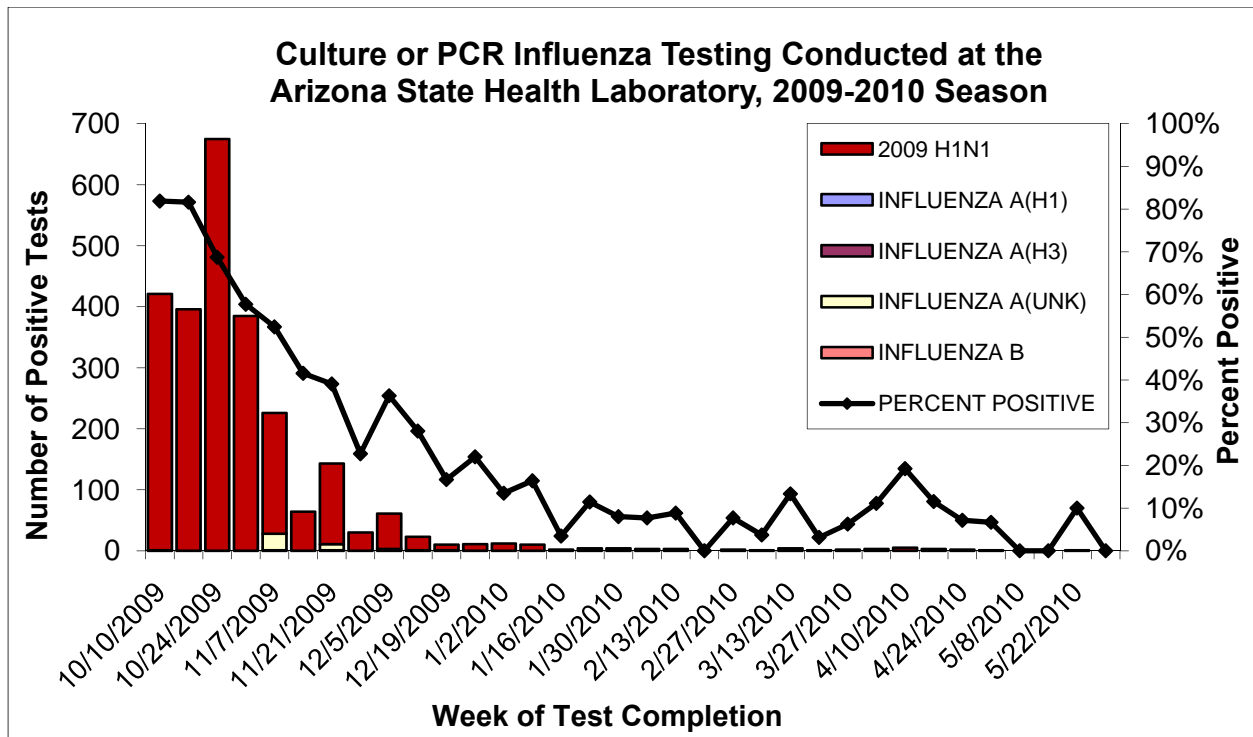
Influenza Types and Subtypes

There are two main types of influenza – Type A and Type B – that cause illness in people. Influenza A viruses can be further divided into subtypes such as A/H1, or A/H3. While most tests can distinguish between influenza A and B, only specialized testing such as that done at the Arizona State Health Laboratory and a few other labs around the state can differentiate subtypes. Knowing the type and subtype of the influenza viruses circulating can help health professionals make the best treatment and vaccination decisions.

The vast majority of tests reported in the 2009-2010 season were influenza A.

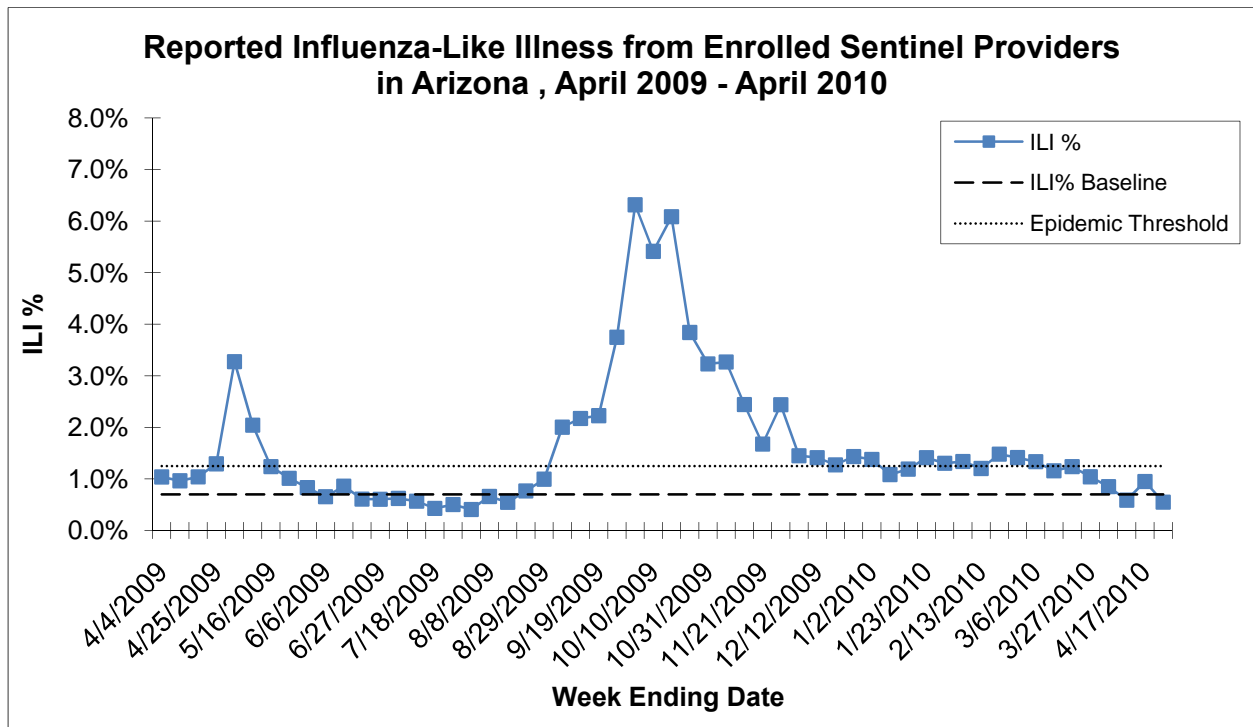


Viral isolation, or culture, is currently the “gold standard” for diagnosis of influenza virus infections. The influenza subtype can be determined by a test called hemagglutination inhibition (HI) using viral isolates. Polymerase chain reaction (PCR) can also be used to confirm and identify influenza B and the hemagglutinin (H) component of influenza A. PCR tests were used to differentiate 2009 H1N1 influenza from other subtypes. Another indicator used to evaluate the level of influenza activity is the percent of specimens submitted for influenza testing that are positive for influenza; during the peak of an influenza season, high percentages of specimens are positive.



Influenza-Like Illness (ILI) Surveillance from Sentinel Providers

ILI is defined as a fever of at least 100°F plus either a cough or a sore throat. Approximately 50 sentinel providers around the state report weekly the number of outpatient visits to their offices and the number of visits for ILI. We use the percentage of visits for ILI as our indicator of likely influenza activity. In early May, 2009, the percentage of visits spiked, followed by a much larger peak in September and October. The state ILI baseline is 0.69% and the epidemic threshold is 1.25%. The baseline is defined as the mean of the state ILI% in weeks in the 2007-2010 flu seasons when <10% of specimens were positive at the Arizona State Laboratory. The epidemic threshold is defined as the mean plus two standard deviations.

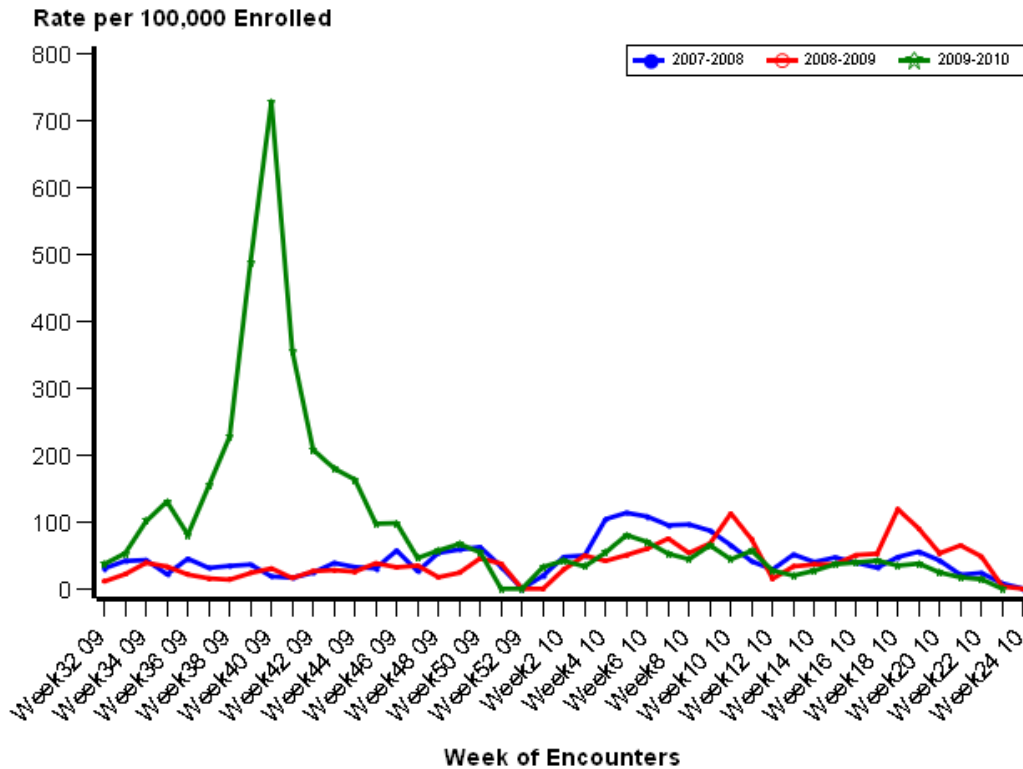


Influenza-Like Illness (ILI) Surveillance from Participating Arizona Schools

School nurses in more than 300 Arizona schools around the state use specific software (the Child Health Indicator Program) for electronic management of student health records. The graph below presents the weekly trend of ILI syndromes reported among students during the school years of 2007-2008, 2008-2009, and 2009-2010. The number of school nurse encounters are not diagnosed cases of communicable diseases but are based on the nursing codes that school nurses enter to track student conditions. The numbers in the graph are only from schools that used CHIP during the school year.

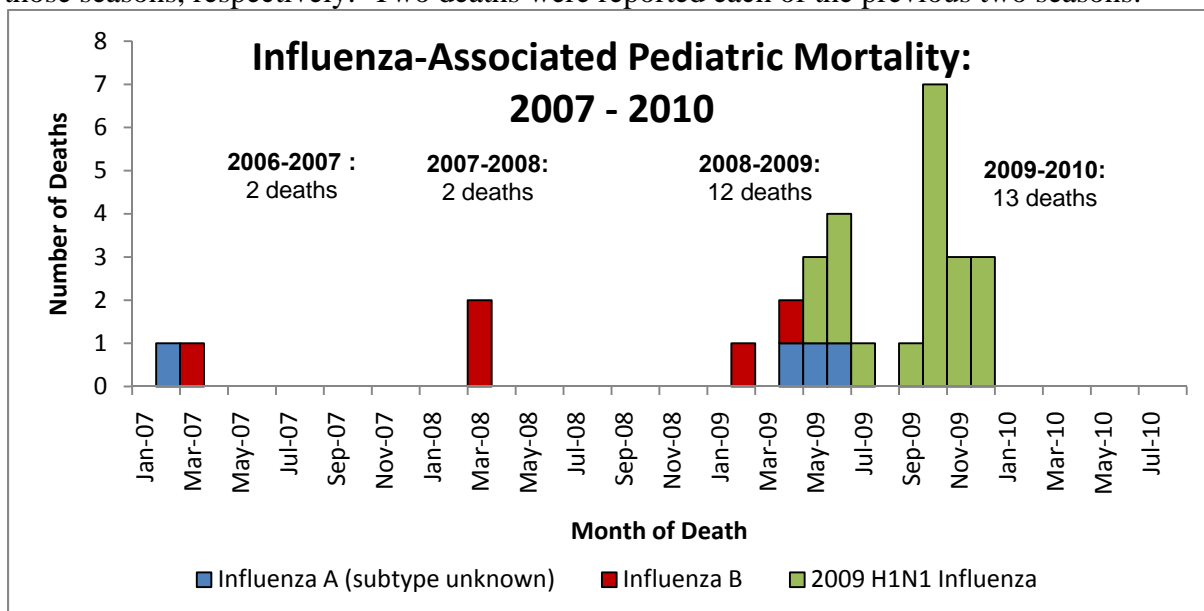
The peak in ILI among school children in September and October of 2009 coincides with the second wave of the pandemic and dwarfs any other period since this surveillance started.

Influenza-Like Illness Per School Enrollment in Arizona (per 100,000)



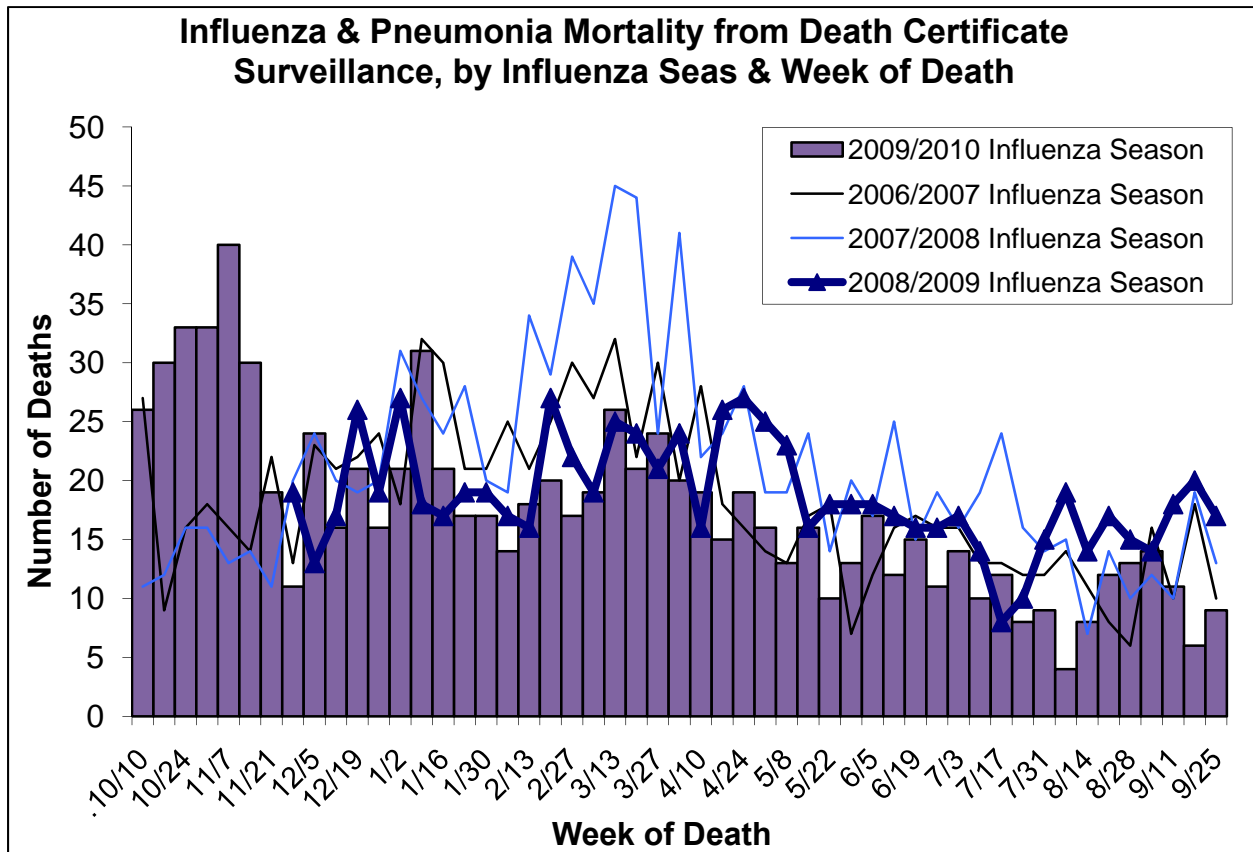
Influenza-Associated Pediatric Mortality

Influenza-associated pediatric deaths are reportable to the public health departments in Arizona. The 2008-2009 and 2009-2010 seasons showed an increase in influenza-associated deaths in children, related to the circulation of the 2009 H1N1 virus, with 12 and 13 deaths reported in those seasons, respectively. Two deaths were reported each of the previous two seasons.



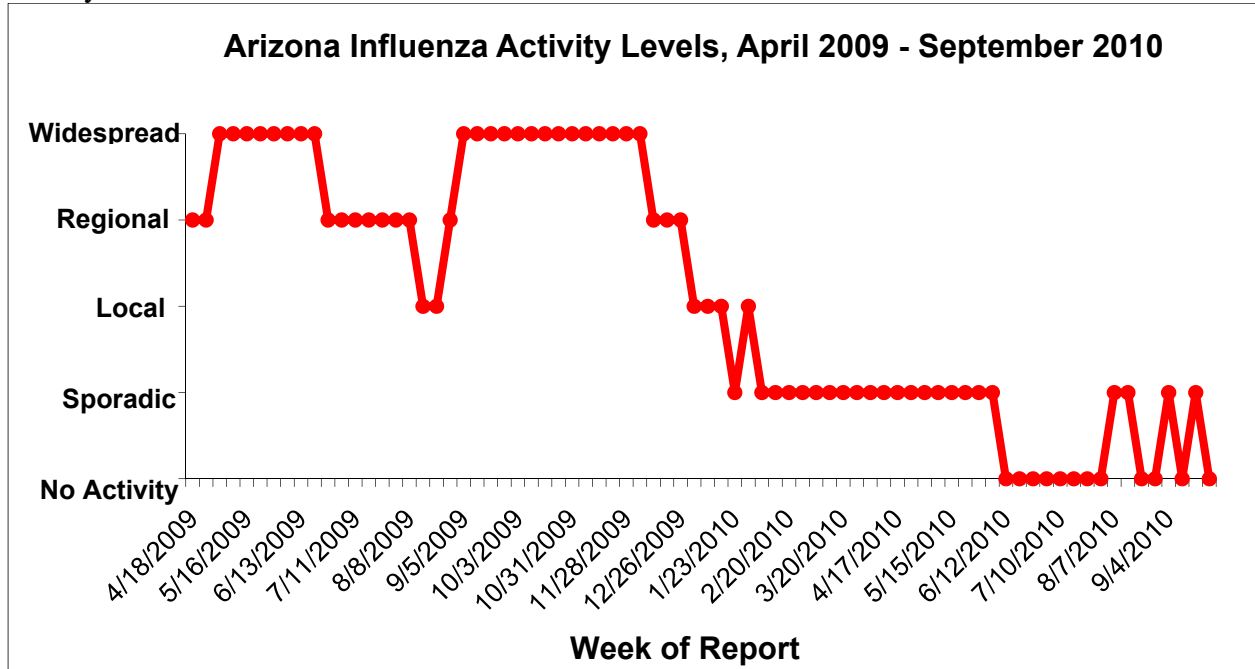
Pneumonia and Influenza Mortality from Death Certificates

Influenza-associated deaths in adults are not reportable in Arizona, and thus the number of laboratory-confirmed deaths each year is not available. Many influenza-related deaths are due to complications of influenza infection, including pneumonia, and influenza may not be listed as the cause of death on death certificates. Influenza mortality surveillance often uses the category of “pneumonia and influenza” (P & I) from death certificates as an indicator of the severity of an influenza season or of the trends within a season, even though not all pneumonias are associated with influenza. See the CDC website for more information http://www.cdc.gov/flu/about/disease/us_flu-related_deaths.htm



Arizona Influenza Activity Levels

Each week ADHS reports an influenza activity level to CDC. (See definitions at the end of this report.) Usually, Arizona is most likely to report widespread activity sometime during January through March, though the exact weeks of the influenza peak vary year to year. Notice in the chart below that Arizona's widespread activity this year was during May and June and then again in September, October and November, all months when Arizona often only sees sporadic activity.



2009 H1N1 Pandemic Data

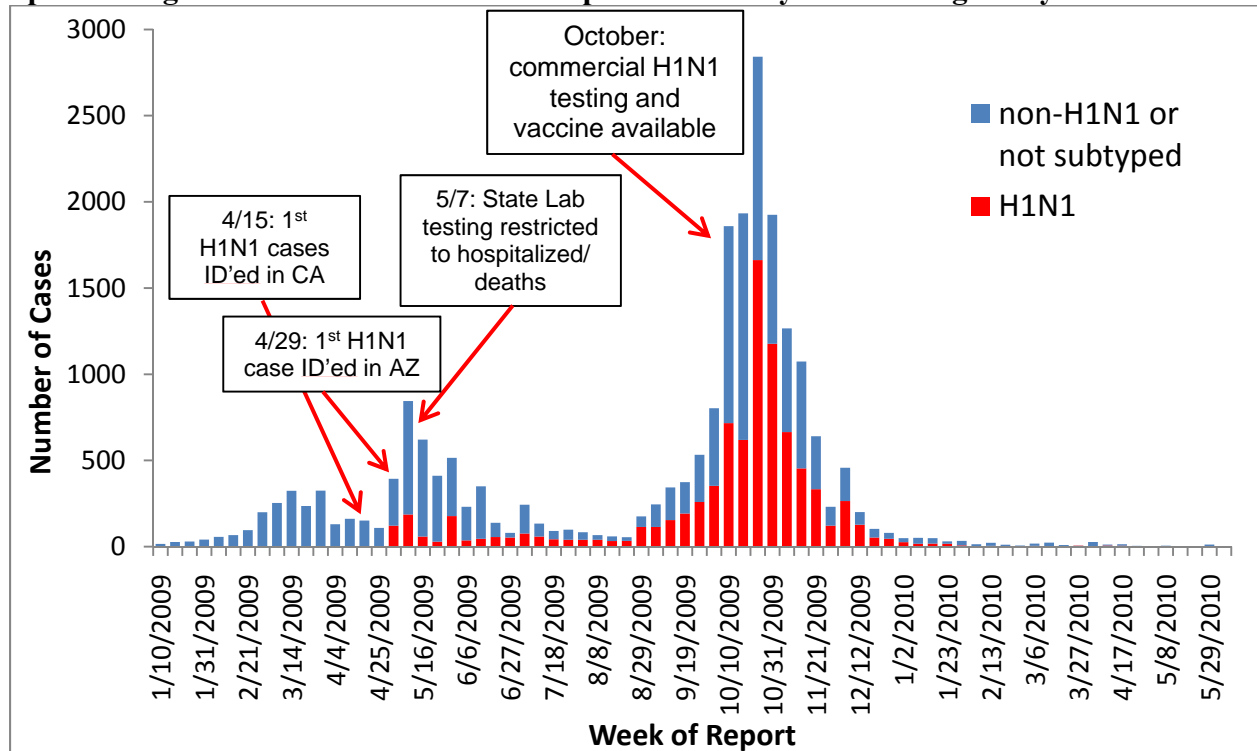
This section of the report focuses on laboratory-confirmed 2009 H1N1 influenza cases. The first cases were identified in southern California in mid-April, 2009. State laboratories around the country quickly sent any influenza A viruses that could not be subtyped to CDC for additional testing. During the last week in April, Arizona received results from CDC confirming our initial cases of 2009 H1N1 influenza.

CDC provided PCR testing protocols and primers to state laboratories, and designed a validation procedure so that 2009 H1N1 testing could be performed in-state. The Arizona State Health Laboratory was validated the first week in May. However, the demand for testing was so great that testing was soon restricted to hospitalized cases and deaths. This testing requirement was relaxed during the summer months when the demand for testing decreased, but imposed again in the fall with the second pandemic wave.

Two important factors occurred in October, 2009: several commercial laboratories began to offer H1N1 testing, and the pandemic-strain vaccine became available. Many disease measures showed increases in the fall months as described in the section above, indicating high levels of morbidity in the second wave, but the huge number of cases confirmed as 2009 H1N1 must be partly attributed to the availability of additional testing, especially for the outpatient population.

The graph below shows the epidemiological curve of influenza cases reported from January, 2009, through May, 2010, and the timing of key events mentioned above. The H1N1 cases, shown in red, are the focus of the rest of this report.

Epidemiologic curve for influenza cases reported January 2009 through May 2010:



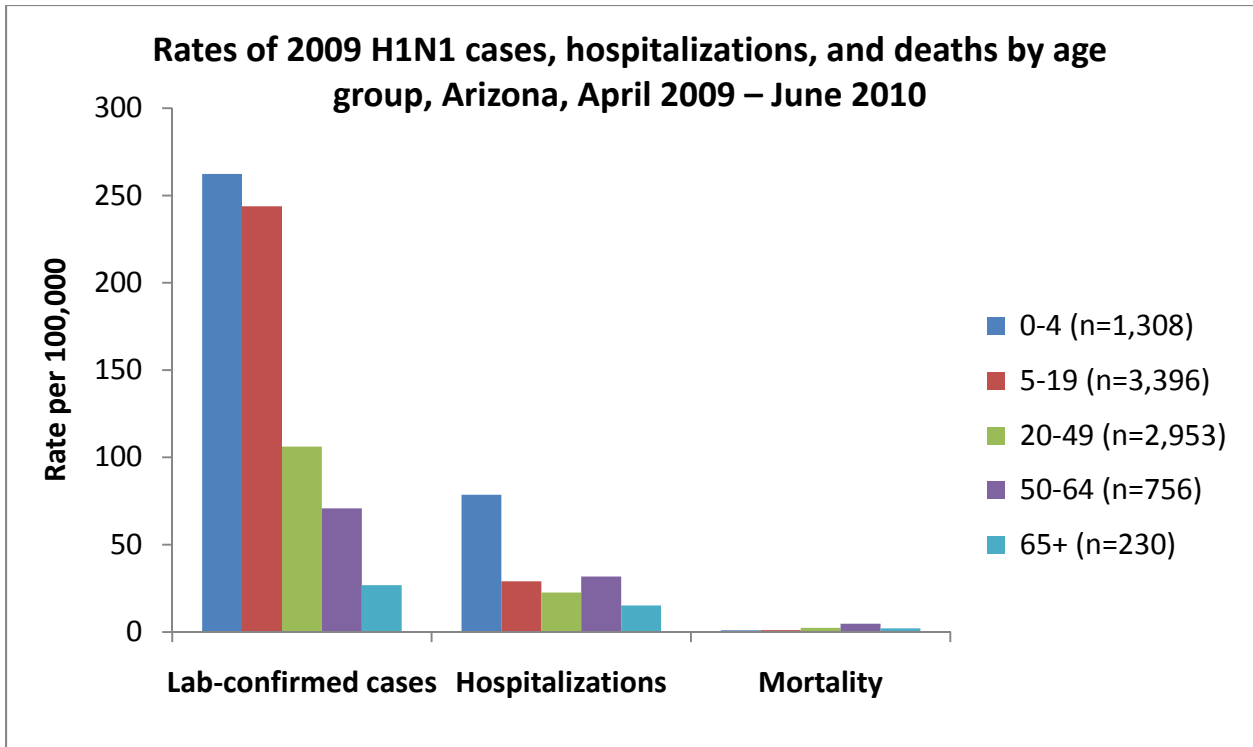
Usually, the public health departments in Arizona only investigate a few influenza cases a year: the first confirmed cases of the season, pediatric influenza-associated deaths, and other unusual occurrences. During the pandemic, however, public health officials investigated many of the 2009 cases in order to better understand the morbidity caused by the new virus, monitor for changes in severity, and identify particular groups at risk. The focus of the investigations varied over the course of the pandemic but generally included the most severe cases (deaths and hospitalizations) and groups of special interest (such as pregnant women or health care workers).

Demographics of confirmed 2009 H1N1 influenza cases:

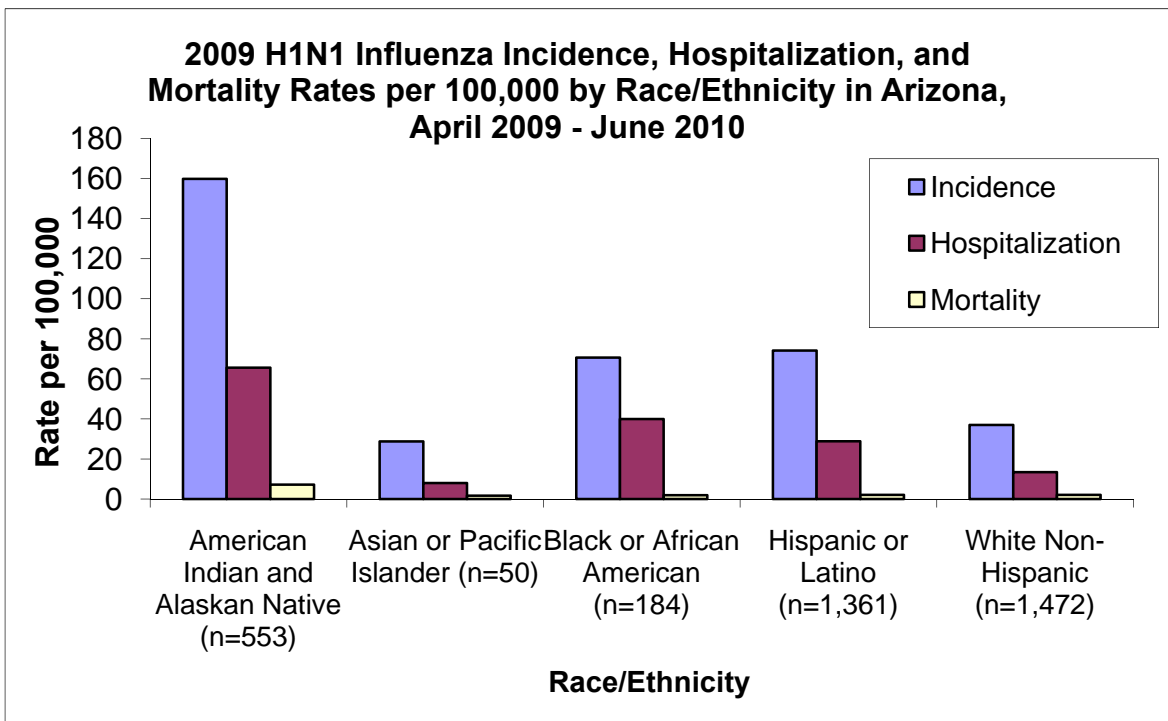
As shown in the table and graph below, children accounted for over 50% of the cases and had the highest rate of reported infection, but deaths were more common among older age groups. Very few cases were reported among those aged 65 years or older.

Age and Race/Ethnicity of confirmed 2009 H1N1 influenza cases April 2009 – June 2010:

	Total Confirmed H1N1 Cases (N=8,698)	Identified H1N1 Hospitalizations (N=1,894)	Identified H1N1- Associated Deaths (N=154)
AGE			
Mean	23 years	28 years	43 years
Median	18 years	24 years	46 years
AGE GROUP			
0 to 4 years	1,308 (15%)	392 (21%)	5 (3%)
5 to 18 years	3,396 (39%)	404 (21%)	15 (10%)
19 to 49 years	2,953 (34%)	629 (33%)	66 (43%)
50 to 64 years	756 (9%)	339 (18%)	50 (32%)
65 years or older	230 (3%)	130 (7%)	18 (12%)
Unknown age	55 (1%)	0 (0%)	0 (0%)
RACE/ETHNICITY			
American Indian or Alaskan Native	553 (6%)	227 (12%)	25 (16%)
Asian or Pacific Islander	50 (1%)	14 (1%)	3 (2%)
Black or African American	184 (2%)	104 (5%)	5 (3%)
Hispanic or Latino	1,361 (16%)	529 (28%)	38 (25%)
White Non-Hispanic	1,472 (17%)	535 (28%)	83 (55%)
Other or Unknown	5,078 (58%)	485 (26%)	0 (0%)



Also in the table above and graph below is the rate of lab-confirmed cases, hospitalizations, and deaths, by race/ethnicity. It is important to note that race/ethnicity is missing for 58% of cases and 26% of hospitalizations, but it is still evident that minorities, in particular Native Americans, were more heavily impacted in this pandemic.



Hospitalizations and Deaths among Laboratory-Confirmed 2009 H1N1 Cases

Most confirmed hospitalizations and deaths were investigated through the course of the pandemic. The goal of these investigations was to identify any changes in the severity of the disease or in groups affected by the new virus. Ultimately, investigations were conducted for 74% of hospitalizations and 99% of deaths.

Most of the deaths had pneumonia at the time of hospital admission, were admitted to the intensive care unit, and required mechanical ventilation; this was true for less than half of the hospitalized cases. (Note that individuals who were hospitalized during the course of their illness but did not survive are counted in both categories.) Most of the hospitalized cases and deaths had at least one underlying medical condition previously known to be a risk factor for influenza severity (62% and 87%, respectively).

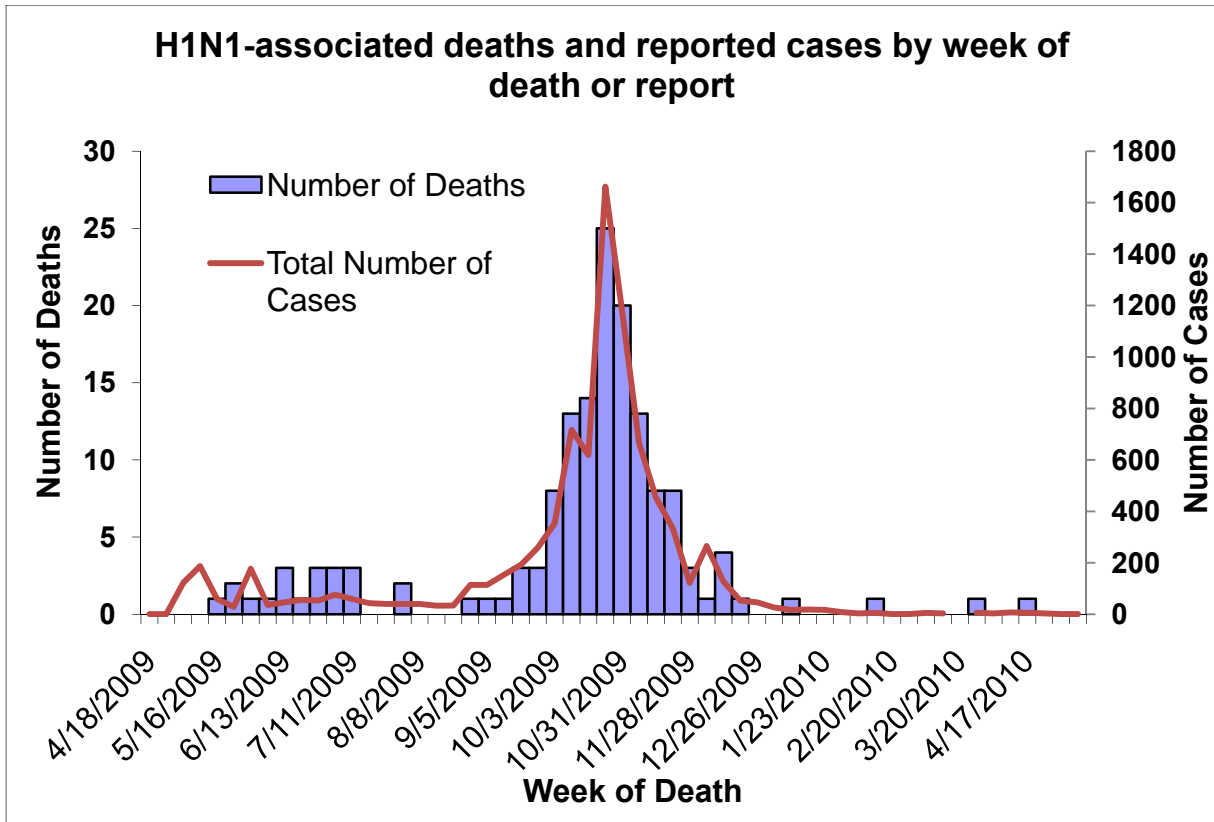
Investigated 2009 H1N1 Influenza Hospitalized Cases and Deaths: Medical progression & Underlying Conditions*

	Hospitalized Cases (N=1,409)	Confirmed Deaths (N=152)
Pneumonia at Time of Hospital Admission	584 (41%)	105 (69%)
Intensive Care Unit Admission	377 (27%)	124 (82%)
Mechanical Ventilation Required	241 (17%)	118 (78%)
Developed ARDS Prior to or While in Hospital	259 (18%)	104 (73%)
Asthma	321 (23%)	32 (21%)
Chronic Lung Disease (Not Including Asthma)	257 (18%)	56 (37%)
Chronic Heart or Circulatory Disease	236 (17%)	55 (36%)
Metabolic Disease (Including Diabetes)	262 (19%)	55 (36%)
Cancer in the Previous 12 Months	67 (5%)	18 (12%)
Pregnant	129 (9%)	5 (3%)
Immunosuppressive Condition (Including HIV Infection)	155 (11%)	38 (25%)
Neurological Disease	185 (13%)	32 (21%)
Other Chronic Disease	266 (19%)	55 (36%)
≥1 Underlying Medical Conditions**	882 (62%)	132 (87%)

* Pertinent data could not be collected for all identified cases, so data presented above are only for investigated cases.

**Underlying medical conditions include: asthma, chronic lung disease, chronic heart or circulatory disease, metabolic disease, cancer, pregnancy, immunosuppressive condition, neurologic disease, and other chronic diseases.

The timing of the 2009 H1N1-associated deaths approximates the timing of the confirmed cases, with a small lag. The majority of the deaths occurred in October through November, as shown in the graph below.



The underlying medical conditions among H1N1-associated deaths differed somewhat between children and adults. No children were reported to have cancer or metabolic disease, or to be pregnant. Chronic lung disease, excluding asthma, and chronic disease beyond the ones listed in the table were more likely among children. Additionally, 75% of the pediatric cases had a history of neurological disease, compared to only 13% of the adults.

Investigated 2009 H1N1 Influenza Deaths: Medical progression & Underlying Conditions, by Age Group*

	Children (≤18 Years) (N=20)	Adults (>18 Years) (N=132)
Pneumonia at Time of Hospital Admission	17 (85%)	88 (67%)
Developed ARDS Prior to or While in Hospital	17 (85%)	93 (70%)
Asthma	3 (15%)	29 (22%)
Chronic Lung Disease (Not Including Asthma)	9 (45%)	47 (35%)
Chronic Heart or Circulatory Disease	4 (20%)	51 (36%)
Metabolic Disease (Including Diabetes)	0 (0%)	55 (39%)
Cancer in the Previous 12 Months	0 (0%)	18 (14%)
Pregnant	0 (0%)	5 (4%)
Immunosuppressive Condition (Including HIV Infection)	4 (20%)	34 (26%)
Neurological Disease	15 (75%)	17 (13%)
Other Chronic Disease	13 (65%)	42 (32%)
≥1 Underlying Medical Conditions**	18 (90%)	114 (86%)

* Pertinent data could not be collected for all identified cases, so data presented above are only for investigated cases.

**Underlying medical conditions include: asthma, chronic lung disease, chronic heart or circulatory disease, metabolic disease, cancer, pregnancy, immunosuppressive condition, neurologic disease, and other chronic diseases.

Glossary of Key Terms

2009-2010 Influenza Season: The season is defined by surveillance weeks. The first day of the 2009-2010 influenza season was October 4th, 2009, or week 40 and the 2009-2010 surveillance season will continue through October 2nd, 2010, or week 39.

Activity Levels: Indicator of the geographic spread of influenza activity, reported to CDC by all states each week.

Widespread: Increased influenza-like illness from sentinel providers (ILI) in three or more regions and large numbers of laboratory-confirmed influenza cases in those regions.

Regional: Increased ILI in two regions and elevated numbers of laboratory-confirmed influenza cases in those regions.

Local: Increased ILI in one region and elevated numbers of laboratory-confirmed influenza cases in that region.

Sporadic: No increase in ILI activity and only isolated laboratory-confirmed influenza cases.

No Activity: No increase in ILI activity and no laboratory-confirmed influenza cases.

Rates: All rates described in this report are calculated using 2009 population denominators from the Vital Statistics Office at ADHS. County-, age-, or race/ethnicity-specific denominators are used when appropriate. See <http://www.azdhs.gov/plan/menu/info/pd.htm> for further information about how the denominators are calculated.

Pneumonia and Influenza Mortality: Many influenza-related deaths are due to complications of influenza infection, including pneumonia, and influenza is infrequently listed as the cause of death on death certificates. Surveillance from death certificates often uses the category of “pneumonia and influenza” as an indicator, although not all pneumonias are associated with influenza. See the CDC website for more information http://www.cdc.gov/flu/about/disease/us_flu-related_deaths.htm.

Hospitalization: A hospitalization, for purposes of 2009 H1N1 influenza investigations, is defined as a laboratory-confirmed 2009 H1N1 influenza case who has been admitted to the hospital for at least 24 hours.