

2007-2008 Virginia Influenza Season Summary Report
Virginia Department of Health, Office of Epidemiology
Division of Surveillance and Investigation

Virginia Influenza Surveillance

Influenza is an acute respiratory disease caused by influenza type A or B viruses. It is a common and highly contagious disease with well-defined seasonal variation. Typical features of influenza include abrupt onset of fever and respiratory symptoms such as cough and sore throat, as well as systemic symptoms such as headache, muscle aches, and fatigue. The clinical severity of infection can range from asymptomatic illness to primary viral pneumonia and death. On average, 5 to 20 percent of the population of the United States contracts influenza each year.¹ More than 200,000 people are hospitalized from complications resulting from influenza illness, and approximately 36,000 people die from influenza each year.

Influenza surveillance is undertaken to determine when and where influenza activity is occurring, track influenza-related illnesses, determine which types of influenza viruses are circulating, detect changes in influenza viruses, and measure the impact of influenza on morbidity and mortality. Laboratory characterization is important because influenza viruses undergo constant antigenic change. Such information aids the selection of optimal influenza vaccine components each year.

The Virginia Department of Health (VDH) uses multiple sources of information to perform influenza surveillance activities each season. For the 2007-2008 influenza season, these data sources included: information on patients presenting to hospital emergency departments or urgent care centers with influenza-like-illness (ILI), laboratory reports of influenza positive specimens, information from outbreak investigations, reports of influenza-associated deaths in the pediatric population, and data on over-the-counter medication sales. A combination of these data were used to determine weekly influenza activity levels, summarize the length and severity of the influenza season, and characterize the prevalence of influenza types and strains throughout the season.

Weekly Influenza Activity Levels

Each week during the influenza season, counts of patient visits to hospital emergency departments and urgent care centers for ILI, laboratory reports of influenza, and influenza outbreak surveillance data were used to classify influenza activity as sporadic, local, regional or widespread.² Local activity began during the week ending November 24, 2007, corresponding to week 47 (Appendix A, Graphs 1a). The activity level increased directly from no activity to local activity, skipping over sporadic activity. Regional activity was reached the week ending January 12, 2008 (week 2), and widespread activity was observed from weeks 3 through 12 (weeks ending January 19 through March 22, 2008).

¹ CDC. Coordinating Center for Infectious Disease. <http://www.cdc.gov/flu/>

² For a more detailed explanation of activity levels, see: <http://www.vdh.virginia.gov/Epidemiology/Surveillance/Influenza/index.htm>

VDH ILI Surveillance

To assess influenza-like-illness (ILI) activity, the chief complaints of patients visiting emergency departments and urgent care centers was used. This information is sent to VDH in automated daily transmissions from facilities around the state to allow for the monitoring of emerging disease syndromes. Seventy-three sentinel facilities participated in the Virginia ILI surveillance system during the 2007-2008 influenza season, although only 62 provided data consistently each week. The distribution of participating facilities around the state is shown on Map 1 (Appendix B). Patients presenting with complaints of fever and cough or fever and sore throat were classified as having influenza-like-illness.³ This method of ILI surveillance is significantly different from that used in previous years to monitor influenza trends in Virginia. Previously, data was collected primarily from physicians' offices, and local health department personnel actively called the providers each week to obtain numbers of patients presenting with ILI in the preceding week.

ILI data from week 28 through week 38 (July 8, 2007 through September 16, 2007) were used to determine the baseline in Virginia for each of the five planning regions. Thresholds were calculated by multiplying the average baseline value by 2.5. During the rest of the season, levels over this threshold were considered elevated and contributed to determination of the activity level within the state. An overlay of weekly ILI counts in Virginia with the reported activity level illustrates that the weekly activity level correlated well with trends in ILI count activity (Graph 1b).

Graphs 2a and 2b illustrate the weekly surveillance ILI counts and percentages by region. Similarly, Graphs 3a and 3b summarize overall ILI activity by week for the 2007-2008 compared to the 2006-2007 influenza seasons in Virginia. For the 2007-2008 season, peak ILI activity occurred during the week ending February 16, 2008 (week 7). The percentage of visits due to ILI peaked at 2.76% during this week. Significantly, this peak occurred approximately three weeks earlier compared to the previous two years. For both the 2005-2006 and 2006-2007 influenza seasons, peak ILI activity occurred during week 10. It is interesting to note that in previous years these peaks were determined using sentinel provider surveillance data from physicians' offices, and that if emergency department and urgent care chief complaint data from the 2006-2007 season were used instead, the peak would have been identified slightly later, in week 11.

CDC ILI Surveillance

Data from the ILI sentinel facility surveillance system in Virginia were sent to the Centers for Disease Control and Prevention (CDC) United States Influenza Sentinel Provider Surveillance System. Several physician practices also independently entered data directly into the CDC sentinel surveillance system, although only three were regular reporters. Data reported included number of ILI cases seen by age group, as well as the total number of patients seen for any reason by week. Based on these data, the proportion of visits due to ILI peaked during week 7 (the week ending February 16, 2007) at 3.39% in Virginia (Graph 4). Note that this percentage is slightly higher than that reported above. The reason for this discrepancy is because the physician practices that entered data directly into the CDC system were not included in Virginia's ILI estimates. Nationally, based on CDC's sentinel provider system, the percentage of

³ Fever defined as temperature greater than or equal to 100 degrees F (38.8 degrees C).

visits due to ILI peaked during week 7 at 5.94%. In contrast, the peak of 2.76% observed by the Virginia ILI surveillance system was much lower than these national estimates, which may reflect differences in the patient populations captured by each system.

Similar to last year, the 5-24 year old age group comprised the greatest proportion of ILI visits, followed by the 25-64 year old age group (Graph 5). It is also interesting to note that the 0-4 year old age group appears to have a bimodal distribution of ILI activity, with two distinct peaks observed, corresponding roughly to week 52 of 2007 and week 7 of 2008.

Influenza Outbreaks

A total of 55 outbreaks of influenza were reported to the Virginia Department of Health during the 2007-2008 season. Of these, 31 were laboratory confirmed outbreaks and 24 were suspected outbreaks. The first confirmed outbreak was reported on January 17, 2008 (week 3), and the last on April 4, 2008 (week 14). The first suspected outbreak was reported November 27, 2007 (week 48), and the last on May 22, 2008 (week 21). Graph 6 illustrates the temporal distribution of reported outbreaks for the influenza season.

These confirmed and suspected influenza outbreaks were reported from a variety of facilities. Thirty-six (65.5%) occurred in nursing homes or other long-term care facilities, 8 (14.6%) occurred in assisted living facilities, and 1 (1.8%) in other medical facilities. Of the remaining outbreaks, 4 (7.3%) were reported from colleges or universities and K-12 schools, while 6 (10.9%) were reported from all other facilities. Regarding geographical distribution, there were 11 outbreaks reported from the central region (20.0%), 17 in the eastern (30.9%), 4 in the northern (7.3%), 13 in northwestern (23.6%) and 10 in the southwestern region (18.2%). The average number of cases identified in the outbreaks was 32, with numbers ranging from 2 to 593. For the 31 laboratory confirmed outbreaks reported, the etiologic agents identified were as follows: 22 were influenza type A, 6 were influenza type B, and 3 were untyped.

Influenza-Associated Childhood Deaths

Three influenza-associated pediatric deaths were reported to VDH during the 2007-2008 season. The first report was received the week ending February 23, 2008, and involved a young school age child (5-12 years) from the Eastern region. The following two deaths occurred in residents of the Southwest region, and involved a teenage child (13-17 years) and a preschool age child (0-4 years) respectively. All three deaths occurred in the month of February (between weeks 7 and 9). Nationwide, CDC received a total of 72 reports of influenza-associated pediatric deaths during the 2007-2008 season.

Over-the-Counter Sales

Over-the-counter (OTC) pharmacy sales, as reported by two major pharmacy chains in Virginia, were also monitored during the 2007-2008 influenza season. Trends in sales potentially related to alleviation of influenza-like symptoms were assessed to determine utility of using such data to supplement ILI surveillance. OTC products in the flu, cold, cold/flu, fever, sore throat, and cough categories were included. Some product types were excluded, including vaporizers, thermometers, and lip balm. Sales were stratified by whether they were on a store promotion at the time of sale. Several distinct peaks were observed in the stratified sales of

influenza-related OTC products (Graph 7). The promotional sales peaked in weeks 51 of 2007 and 7 of 2008, while the non-promotional sales reached their highest peak during weeks 1 and 2 of 2008.

When promotional and non-promotional sales were combined, the peak week of activity was identified as week 6, the week ending February 9, 2008. Note that this is one week earlier than the peak identified by the hospital and urgent care facility ILI surveillance. An earlier, slightly lower, peak was also observed between weeks 51 and 1, possibly an indication of a bimodal trend in OTC sales. The trends observed when all sales, regardless of category or type, were included in this analysis were virtually identical to when only influenza-related categories were included.

Virginia Laboratory Surveillance

Laboratory surveillance in Virginia was conducted by combining data from three sources: specimens from sentinel physicians and outbreaks that are analyzed at the Virginia Division of Consolidated Laboratory Services (DCLS), reports from routine patient diagnostic specimens that are tested by DCLS and private laboratories, and data from the CDC's National Respiratory and Enteric Virus Surveillance System (NREVSS). During the influenza season, sentinel providers throughout Virginia submitted samples from patients with ILI to the Virginia Division of Consolidated Laboratory Services (DCLS) for analysis. These specimens were requested by VDH to detect the seasonal emergence and decline of influenza throughout the state. As part of routine disease reporting, laboratories including DCLS, Lab Corp, Quest Diagnostics, and ARUP Laboratories submitted positive influenza reports to VDH. In addition, data from influenza laboratory reports sent to NREVSS from Virginia Commonwealth University Medical Center and the University of Virginia Clinical Virology Laboratory were considered. The following laboratory testing procedures were considered sufficient for classification of influenza: DFA (direct fluorescent antibody), PCR (polymerase chain reaction), and viral culture.

During the 2007-2008 season, VDH received reports of a total of 527 specimens with detectable influenza virus. One hundred thirty (25%) of these reports came from DCLS, while 99 (19%) were reported by other laboratories and 298 (57%) were reported by NREVSS. Of the influenza positives reported, 415 (79%) were type A and 112 (21%) were type B. Of the type A viruses reported, 310 (75%) were of unknown subtype, 96 (23%) were subtype A/H3, and 9 (2%) were subtype A/H1.

Each year DCLS submits influenza isolates from Virginia to CDC for antigenic characterization, which is carried out by the World Health Organization Collaborating Center for Surveillance, Epidemiology and Control of Influenza. For the 2007-2008 season, antigenic characterization was conducted for a total of six influenza isolates from Virginia. Three of these isolates were A/Brisbane/10/2007-like (H3N2), while two were A/Wisconsin/67/2005-like (H3N2). The final isolate was characterized as A/Solomon Islands/03/2006-like (H1N1). A/Wisconsin/67/2005-like was the 2007-2008 A(H3N2) vaccine component, and A/Solomon Islands/3/2006-like was the A(H1N1) vaccine component. However, A/Brisbane/10/2007-like (H3N2) did not match the 2007-2008 A(H3N2) vaccine component, A/Wisconsin/67/2005-like, but was a recent variation of it.

Graph 8 provides a summary of laboratory reported isolates by influenza type, overlaid with ILI activity. The numbers of positive laboratory isolates reported corresponded closely with the trends in both ILI numbers and percent ILI out of all patient visits. There was also a notable

temporal trend in type of influenza virus isolated, with reports of type B peaking later in the season than type A. Graph 9a provides a comparison of the laboratory surveillance data from 2006-2007 and 2007-2008. As can be observed, these data are not comparable between years as the numbers of laboratory isolates recorded in the previous year were substantially fewer than for the 2007-2008 influenza season. This difference is due not only to the inclusion of NREVSS data, but also the inclusion of additional laboratory reports from private laboratories (illustrated in Graph 9b). Previously, only laboratory reports from DCLS were counted.

National Laboratory Surveillance

Nationally, viral data reported to the World Health Organization (WHO) and NREVSS laboratories in the United States during the 2007-2008 influenza season through May 17, 2008 indicated that influenza A and B viruses accounted for 71.2% and 28.8% respectively of influenza viruses characterized in the United States.⁴ Of influenza A viruses subtyped, 26.3% were influenza A (H1N1) viruses, and 73.7% were influenza A (H3N2) viruses. Influenza A (H3N2) viruses predominated starting in January. In the final weeks of the season, however, the majority of influenza viruses isolated were influenza B viruses.

Antigenic characterization of a subset of these viruses by CDC indicated that 68% of A (H1N1) viruses were A/Solomon Islands/3/2006-like, the 2007-2008 A (H1N1) vaccine component. Twenty-seven percent of A(H1N1) viruses were A/Brisbane/59/2007-like. Twenty-one percent of influenza A (H3N2) viruses identified were characterized as A/Wisconsin/67/2005-like, which was the A (H3N2) vaccine component. However, 65% of A (H3N2) viruses were A/Brisbane/10/2007-like, a recent antigenic variant of the A/Wisconsin/67/2005-like viruses. This strain first appeared in Australia in February of 2007, and predominated in Europe and the southern hemisphere during their last influenza season. In addition, 97% of antigenically characterized B viruses were B/Florida/04/2006-like viruses belonging to the B/Yamagata lineage. This lineage is antigenically distinct from the B/Malaysia/2506/2004-like component of the 2007-2008 vaccine, which belongs to the B/Victoria lineage.

The effectiveness of annual influenza vaccination is typically lower during influenza seasons when there is a suboptimal match between the vaccine strains and circulating influenza strains. However, the assessment of the clinical effectiveness of influenza vaccines cannot be determined solely by laboratory evaluation of the degree of antigenic match between vaccine and circulating strains. Interim results from a case-control study carried out in Wisconsin found that despite the suboptimal match between two of three vaccine strains and circulating influenza strains, overall vaccine effectiveness in the study population during January 21-February 8, 2008, was 44%.⁵ Vaccine effectiveness against circulating influenza A (H3N2) viruses was found to be 58%. No vaccine effectiveness against influenza B viruses was found, and no data were available on influenza A (H1N1) effectiveness. These interim results suggest that vaccination provided substantial protection against H3N2 influenza-associated medically

⁴ CDC, Coordinating Center for Infectious Diseases, Influenza Division. FluView, 2007-2008 Influenza Season Week 20, ending May 17, 2008. <http://www.cdc.gov/flu/weekly/>

⁵ CDC. Interim within-season estimate of the effectiveness of tivalent inactivated influenza vaccine – Marshfield, Wisconsin, 2007-08 Influenza Season. MMWR 2008; 57(15):393-398. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5715a1.htm>

attended illness in the study population. Final results from the case-control study should be available later this year.

Influenza Vaccine

For the 2007-2008 season, six manufacturers were licensed to produce vaccine for the United States, and they produced a record number of approximately 140 million doses.⁶ This is approximately 20 million more doses than was produced in the previous season. The trivalent influenza vaccine for the 2007-2008 season included A/Solomon Islands/3/2006-like (H1N1), A/Wisconsin/67/2005-like (H3N2), and B/Malaysia/2506/2004-like viruses.

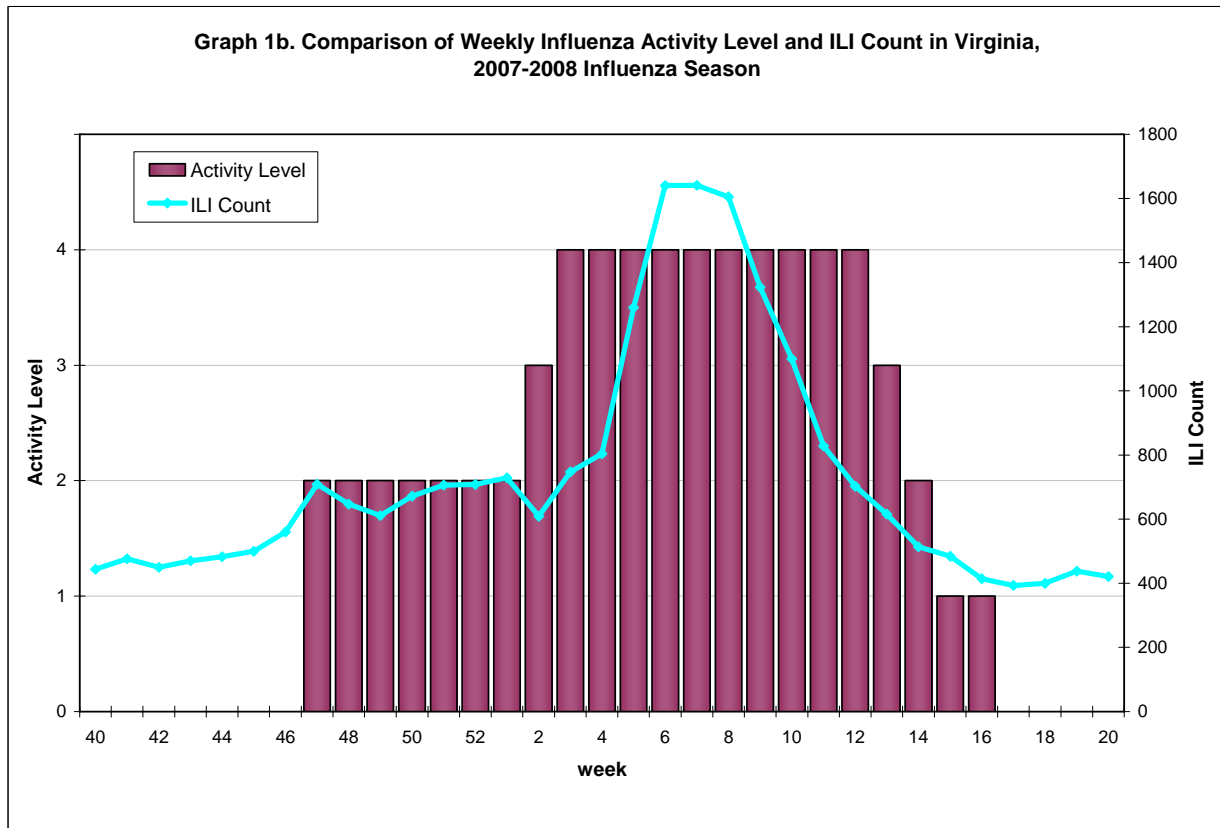
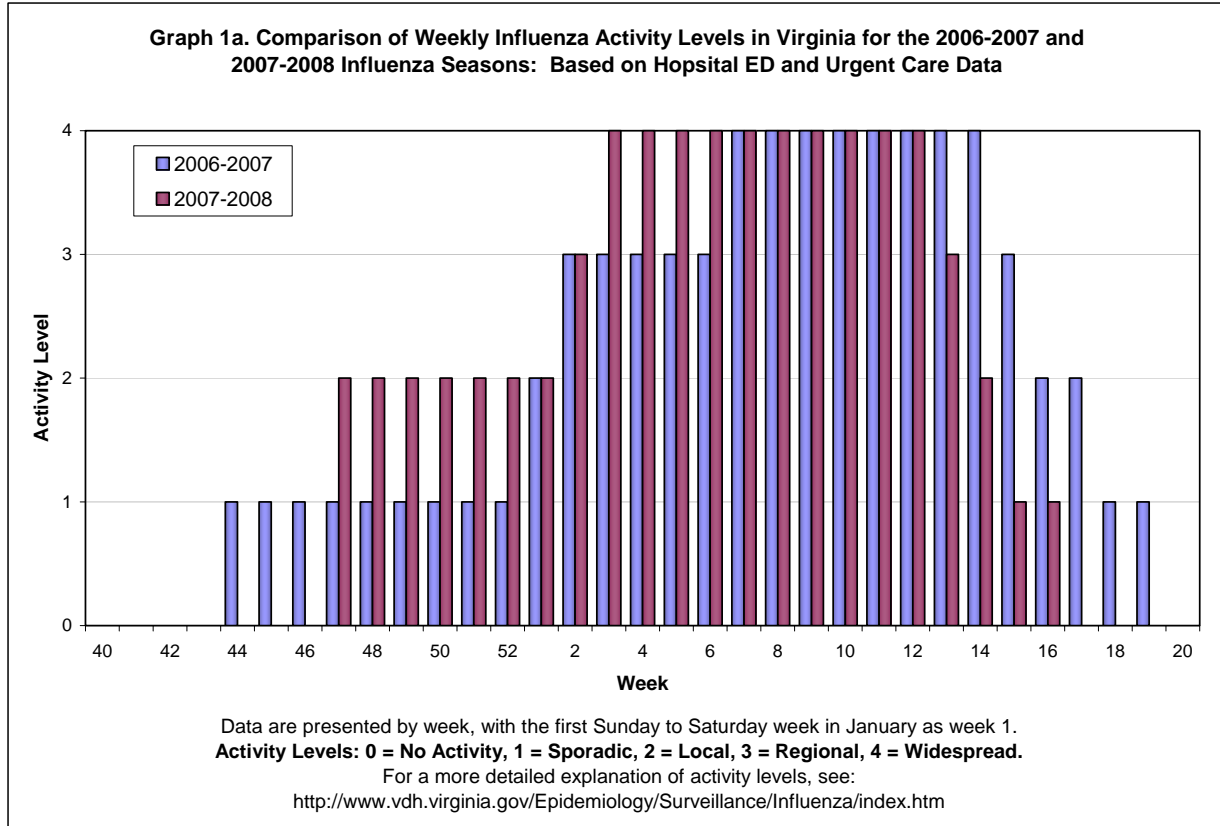
While the annual supply and timing of the influenza vaccine cannot be guaranteed in any year, vaccine manufacturers are currently projecting that at least as many doses of influenza vaccine will be available in the United States for the 2008-2009 influenza season as were produced for 2007-2008. However, CDC's Advisory Committee on Immunization Practices (ACIP) recently voted to expand the annual influenza recommendations to include healthy children and adolescents 5 to 18 years of age. Therefore the amount of influenza vaccine produced for the 2008-2009 season might be expected to increase because of these expanded immunization recommendations.

Based on recommendations from the ACIP, the trivalent influenza vaccine for the 2008-2009 season will include the following virus strains: A/Brisbane/59/2007-like (H1N1), A/Brisbane/10/2007-like (H3N2), and the B/Florida/4/2006-like antigens.⁷ The influenza vaccine composition recommended for use in the 2008-2009 influenza season in the United States is identical to that recommended by the World Health Organization on February 14, 2008 for the Northern Hemisphere's 2008-2009 influenza season. All three strains are different from the 2007-2008 Northern Hemisphere influenza vaccine.

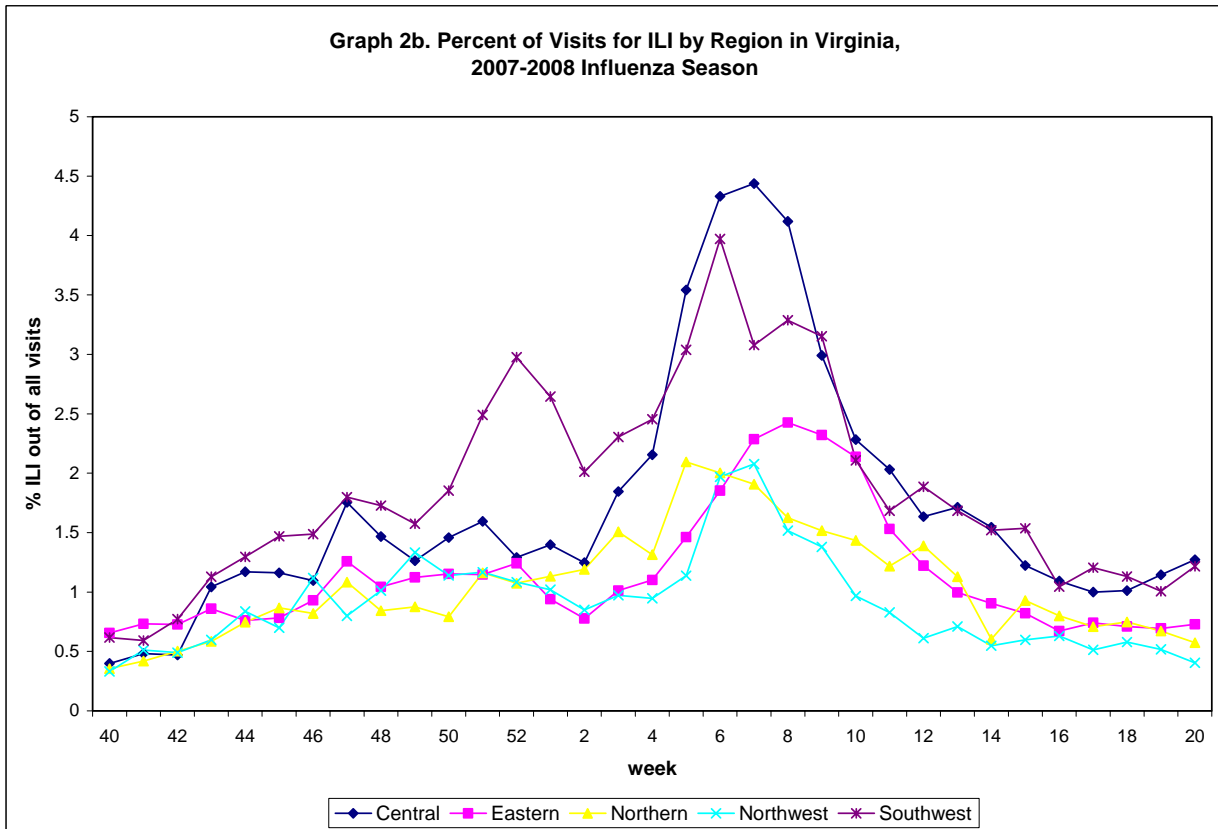
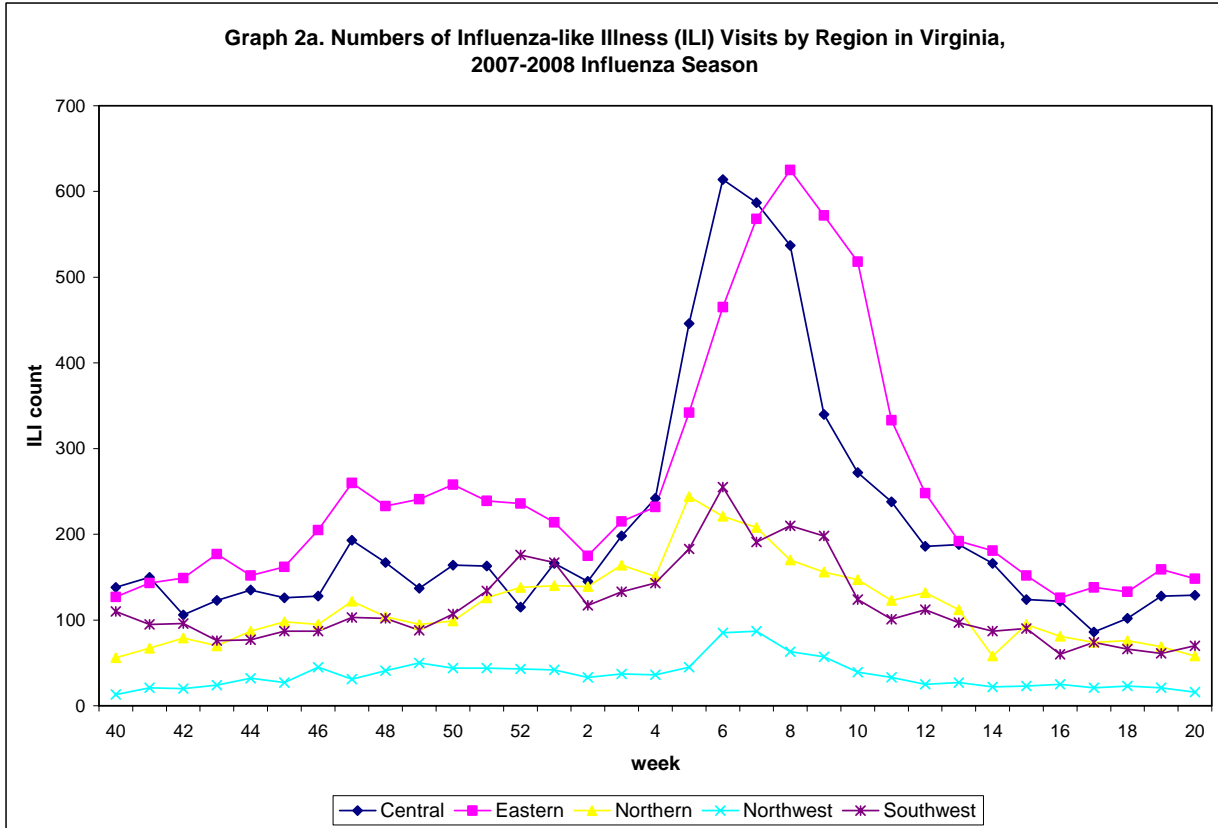
⁶ CDC. Update: influenza activity---United States, September 30, 2007--April 5, 2008, and composition of the 2008-09 influenza vaccine. MMWR 2008;57:404--9. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5715a4.htm>

⁷ CDC. Prevention and Control of Influenza: Recommendations of the Advisory Committee on Immunization Practices (ACIP),2008. MMWR 2008;57. July 17, 2008. <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr57e717a1.htm>.

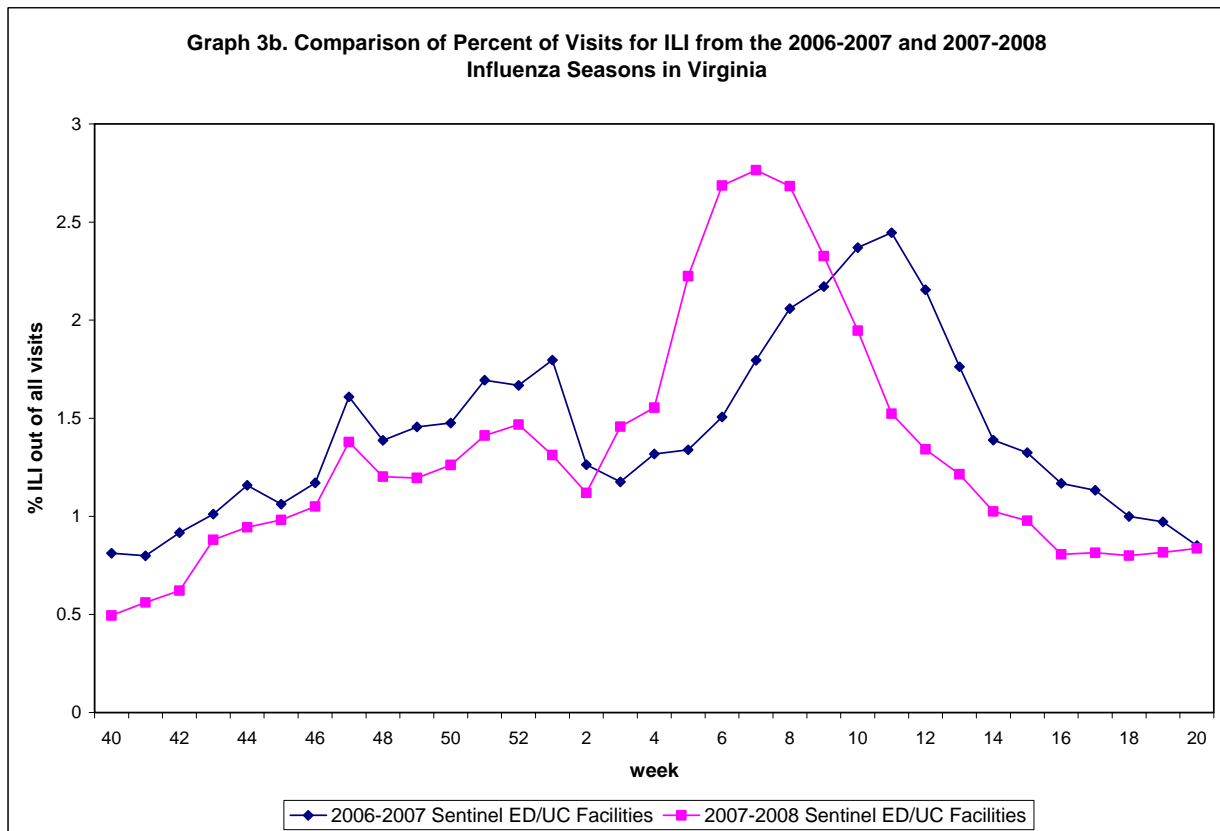
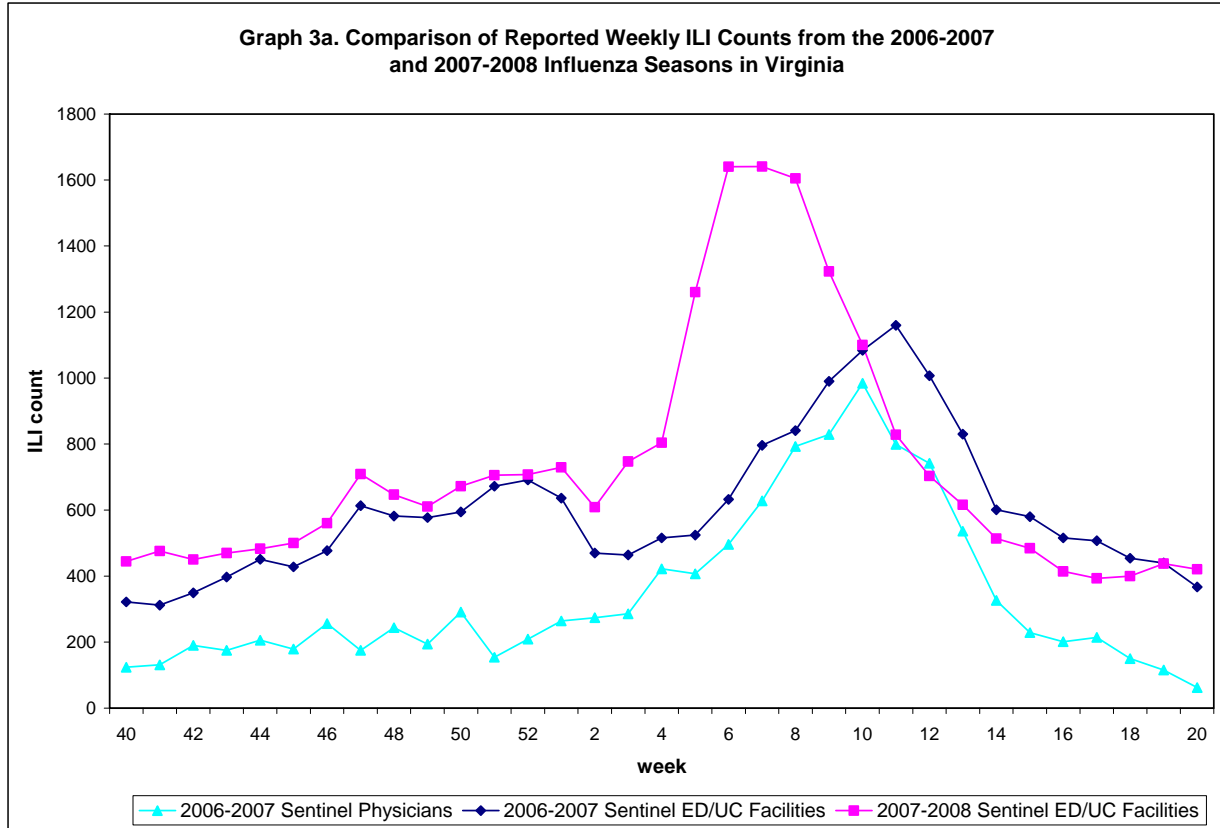
Appendix A. Graphs and Charts



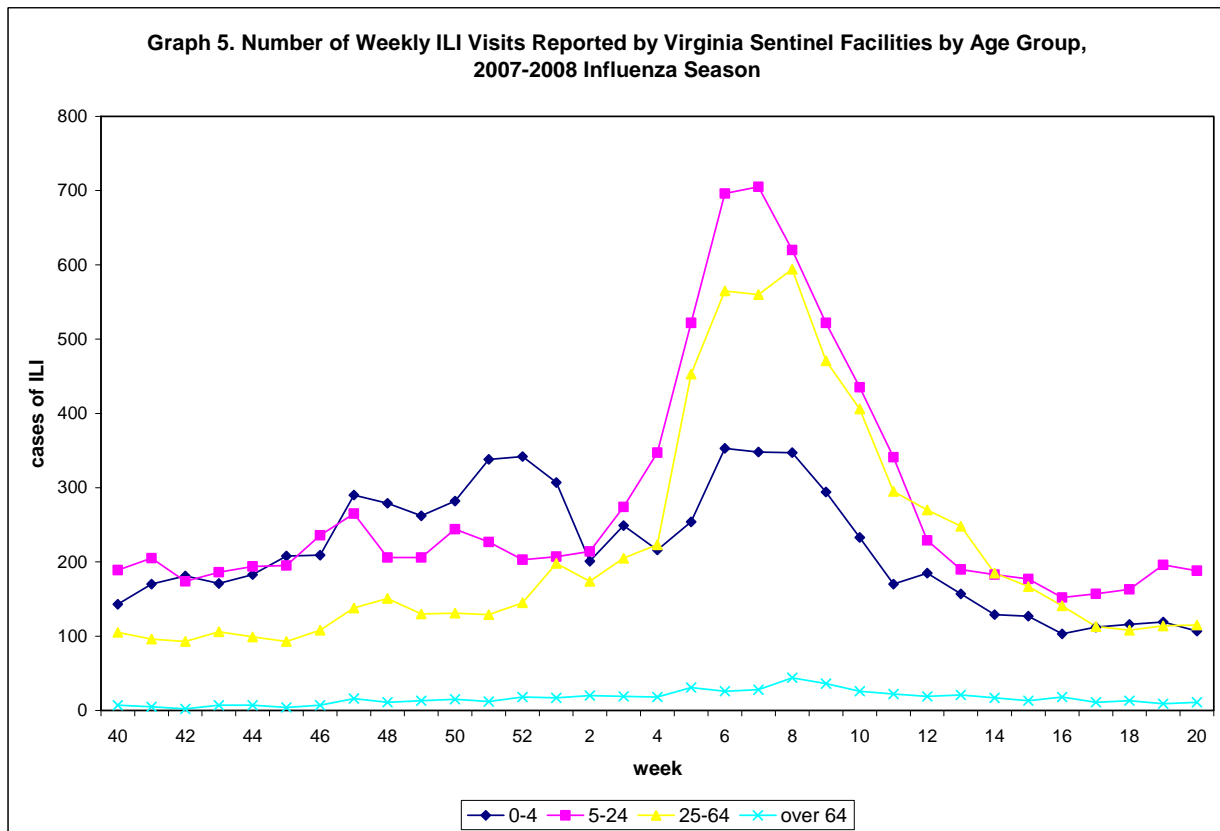
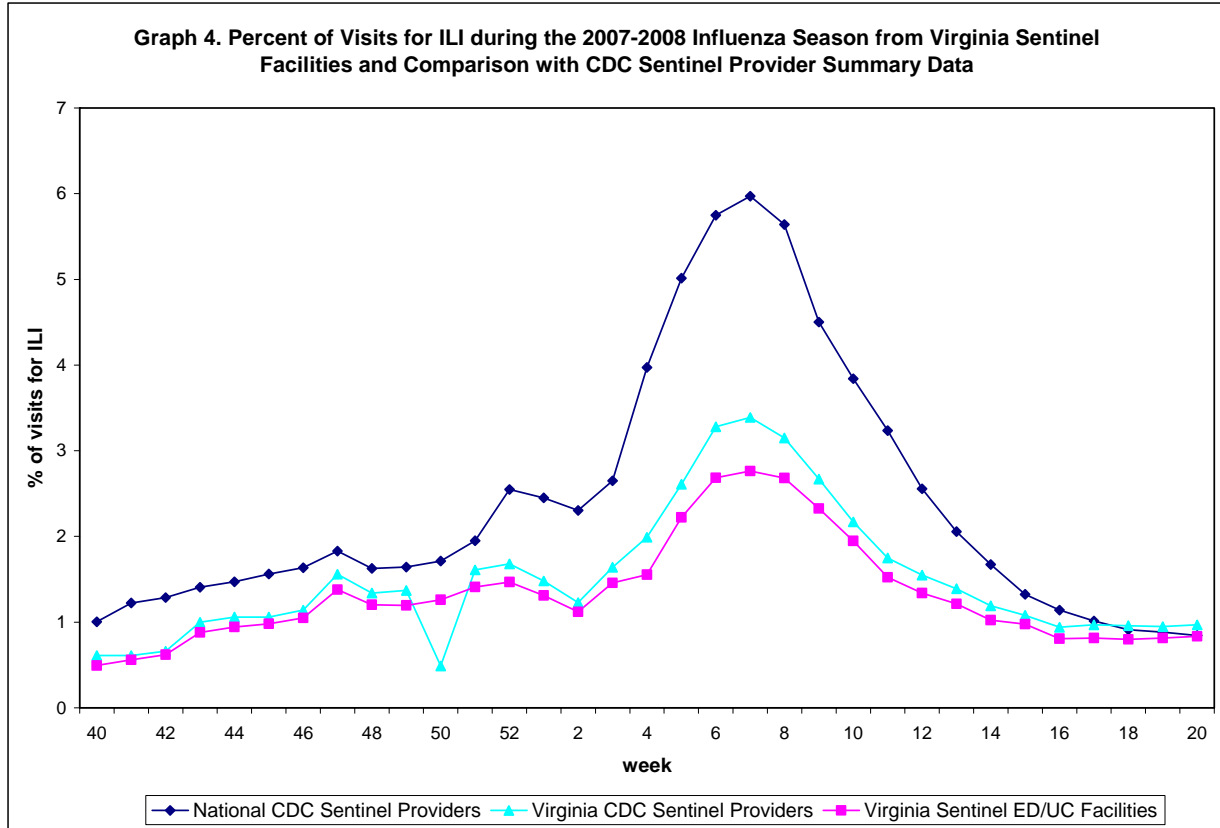
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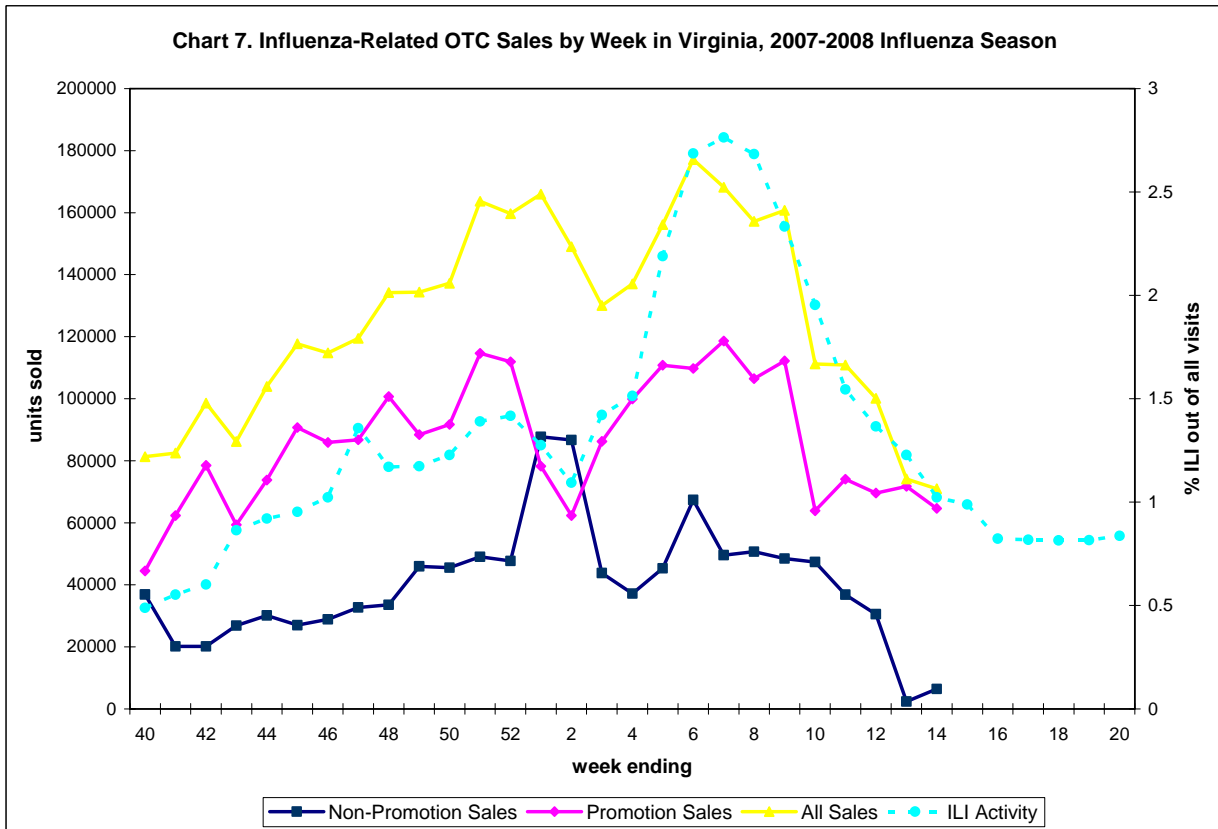
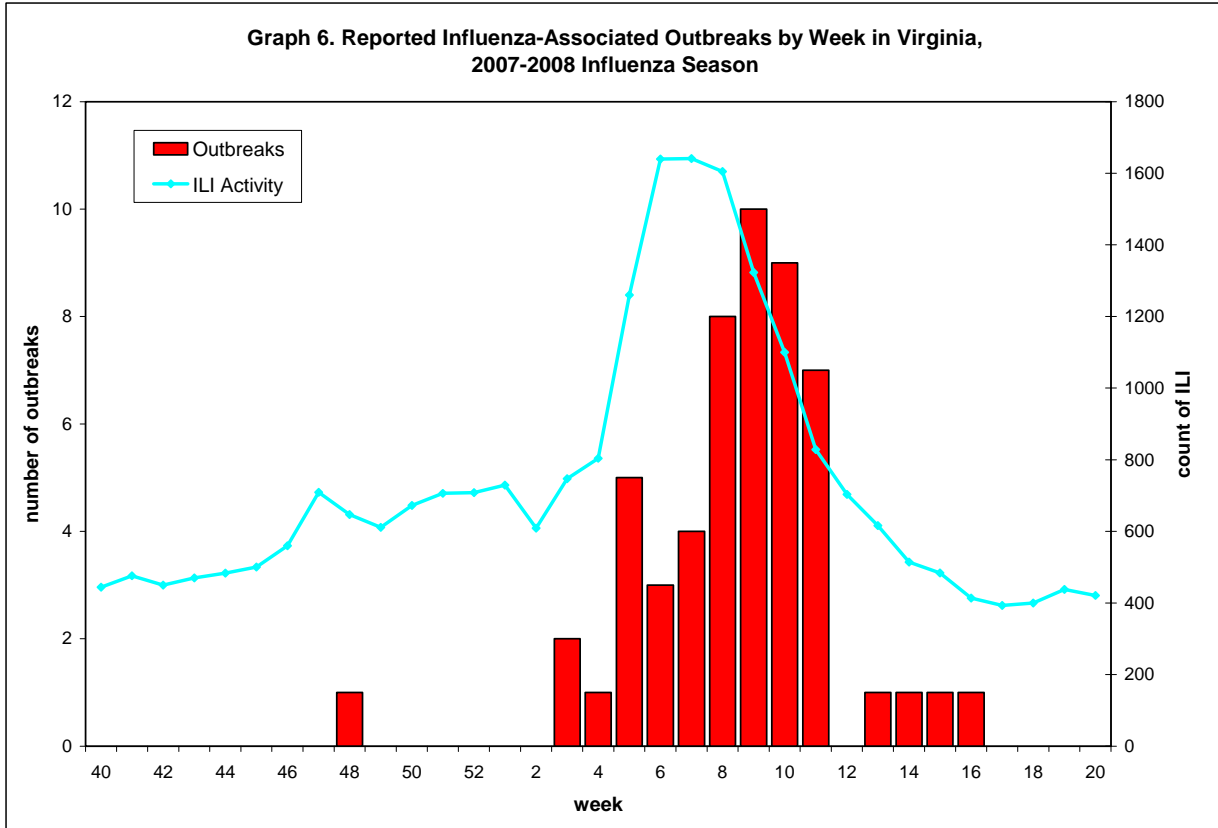
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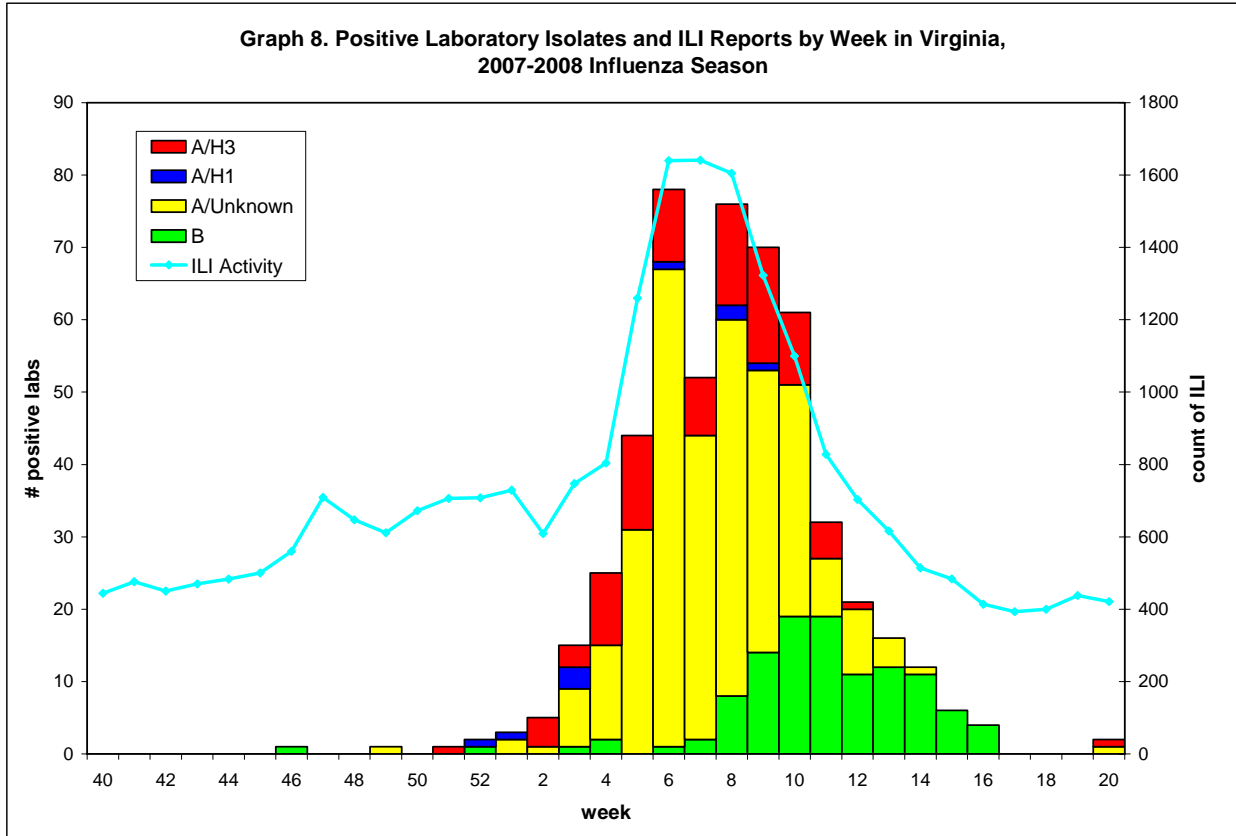
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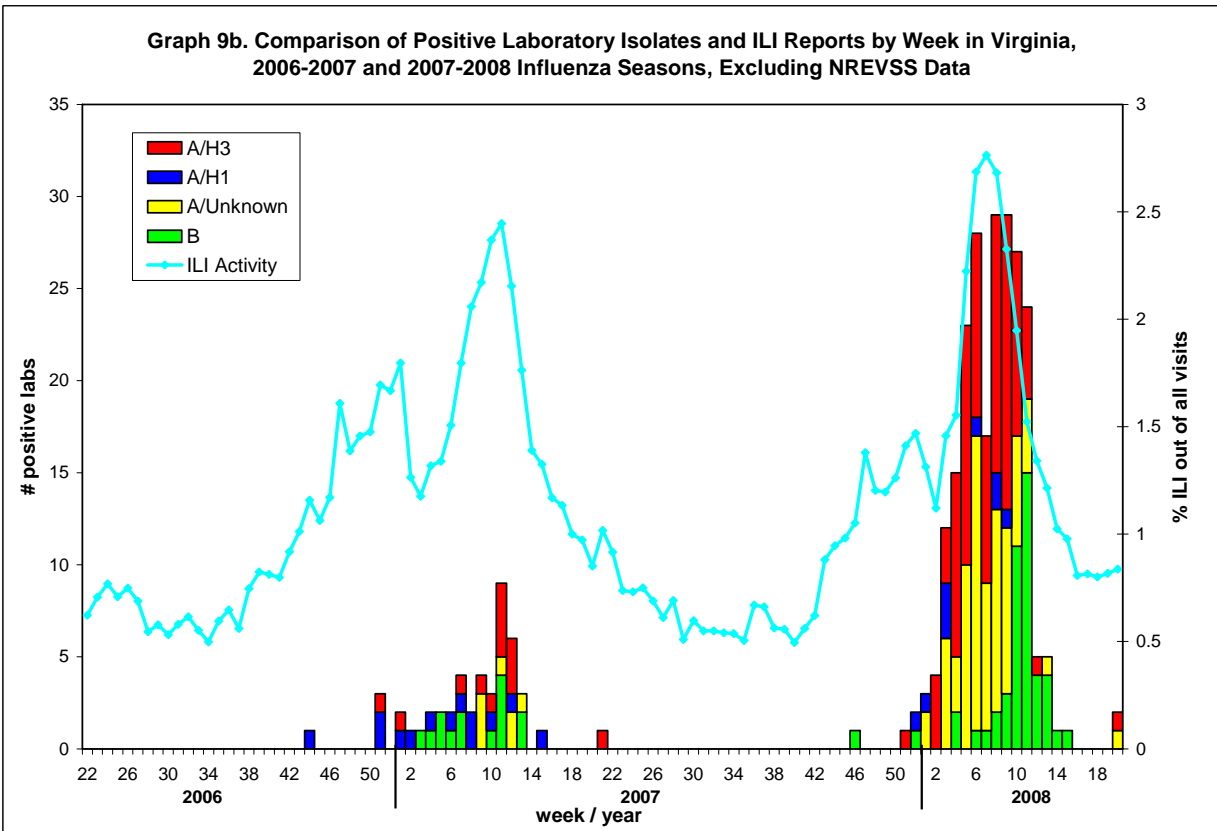
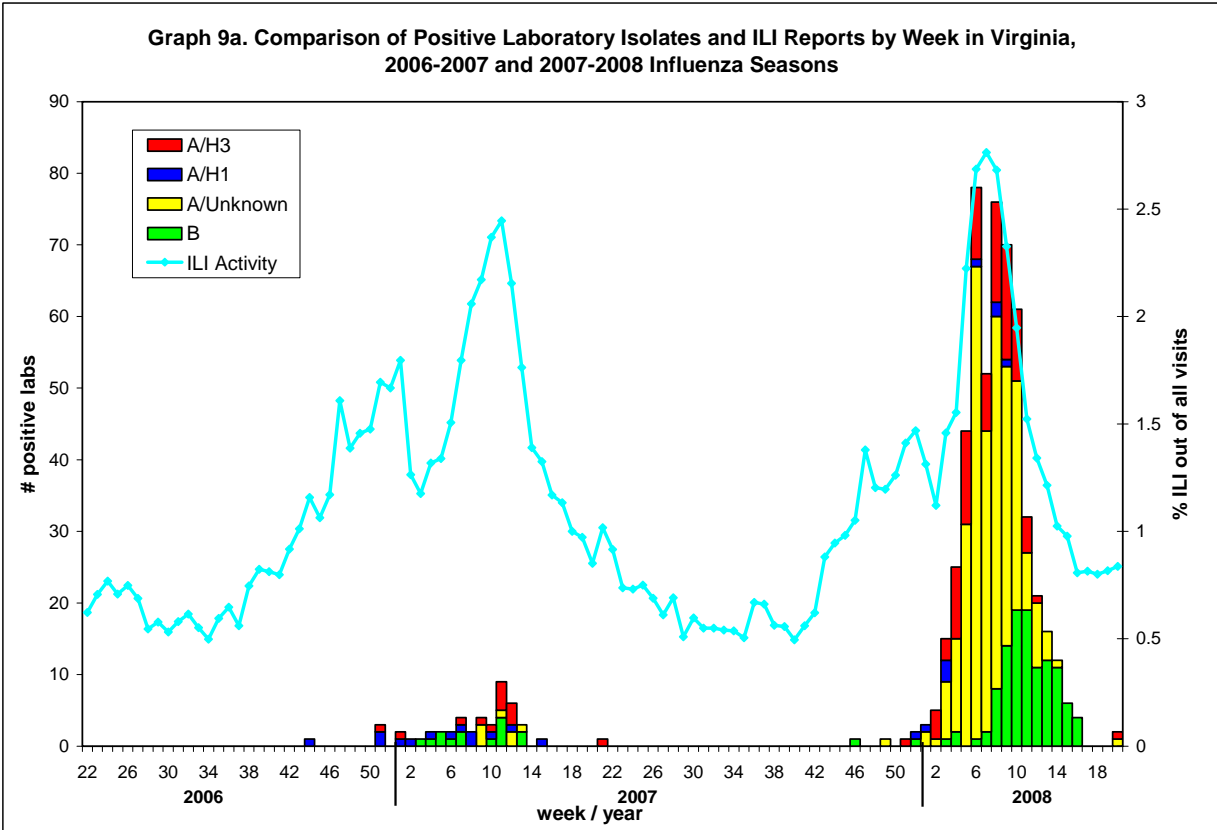
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Map 1. Distribution of Facilities Participating in ILI Sentinel Surveillance 2007-2008, and Population Density by County in Virginia

