LATE SEASON, LIGHT SEASON:
Los Angeles County Influenza Surveillance and Elementary School Outbreaks 2001-2002

In Los Angeles County (LAC), as in other areas across the US, influenza surveillance presents a unique challenge since most people affected by the disease do not seek medical care, and even if they did, individual cases are not reportable or counted by health departments. Tracking individual cases would overwhelm any health department because so many people are susceptible and infected yearly; during a mild season it is estimated about 10% to 15% of the population becomes infected, in a more severe season, 20% or more of the population can suffer from influenza. In light of the high morbidity and mortality due to influenza, the impact it can have on our health system, and the need to identify new strains of the ever-changing virus, influenza surveillance remains an important public health responsibility.

ACDC employs a variety of strategies to determine the seasonal impact of influenza in LAC. These methods can be classified under three major categories of surveillance: 1) direct methods which include tracking viral isolates and investigating community outbreaks, 2) indirect methods which monitor the secondary consequences of influenza (e.g., pneumococcal and influenza mortality rates), and 3) comparisons to state-wide and national findings.

The following summarizes the major events which occurred during the 2001-2002 influenza season as well as surveillance efforts which detail the seasons' occurrence and impact of influenza.

EVENT SUMMARY

There were several events that potentially influenced the onset, acceleration and duration of influenza during the 2001-2002 season. First, similar to the previous season, the 2001-2002 season began with a delay in vaccine distribution and an initial shortage of supply. However, the previous season (2000-2001) was fraught with problems associated with vaccine shortages and delays (i.e., clinics were deluged with patients requesting vaccinations causing session cancellations due to exhausted supplies, and ultimately, the shortage lasted well into the season). In sharp contrast, during fall of 2001, the shortages and delays were not as severe, plus methods for staggering vaccine distribution were well publicized allowing high-risk individuals first priority. As a result, during 2001-2002, there were no major problems immunizing county residents.

The two most significant characteristics of the 2001-2002 season were how mild it turned out to be (as illustrated by the comparison of viral isolates below), and how long it lingered beyond a typical season, culminating with a surge in type B infections during late March (described in the elementary school outbreaks below). While it is impossible to pinpoint a definitive cause to account for the season's dramatic decrease in severity, there are several potential contributing factors:

1. <u>An unexpected consequence of the September 11 terrorist attacks and anthrax scare</u>:
   There are several reasons why the terrorist attacks and anthrax scare may have contributed to a reduction in the incidence of influenza during the 2001-2002 season. First, the plane highjackings led to dramatic restrictions in travel – numerous flights were canceled and trips were postponed. Thus while, early in the season, there were pockets of high influenza activity across the US, infection did not successfully spread beyond those areas. But more than canceled travel, during Fall 2001, people weren't socializing in general – attending parties and going out seemed inappropriate following the attacks; many

events were canceled and stores and other venues reported significant drops in attendance. This, again, likely limited the spread of influenza infection. Finally, although largely anecdotal, the anthrax scares may have prompted the public to be more conscientious about good hygiene and health habits (e.g., washing hands, covering mouth when coughing/sneezing, etc.).

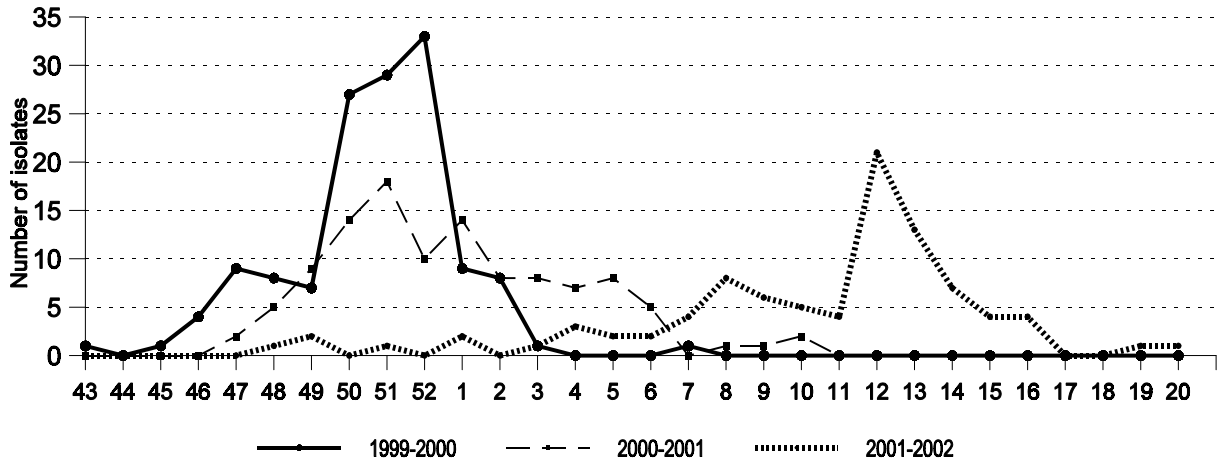
2. Similar Type A viral strains in circulation:
   Another reason for the mild influenza season can be linked to the type of viral strains that have been in circulation. Aside from a novel type B strain that emerged late in the season (which caused widespread elementary school outbreaks described below), the type A strains have been fairly consistent over the past few years. Thus, it is likely that much of the public have already developed immunity, either naturally through past exposure, or by vaccination, which closely matched the strains that circulated during 2001-2002.

VIRAL ISOLATE COLLECTION -- LATE SEASON, LIGHT SEASON

In order to assess the seasonal pattern of influenza activity in LAC, during the winter months, influenza viral isolates are reported weekly to ACDC from Kaiser Permanente, Children's Hospital and Cedars Sinai laboratories. When combined with clinical information from the community, these isolate reports are a valuable resource since they effectively describe the onset, peak and duration of influenza activity. In addition, since this surveillance method is fairly consistent from season to season, it provides a practical means of comparing seasons.

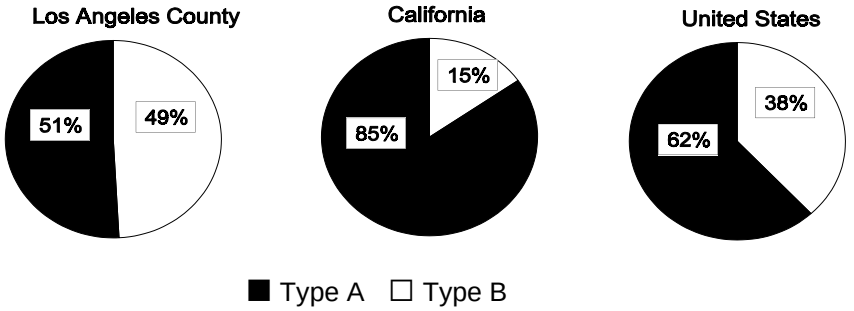
Comparing the weekly total number of influenza viral isolates reported over the past three seasons, the differences are evident (Figure 1). 2001-2002 was clearly a late season – the first reported case did not occur until early December, nearly two months later than the previous two seasons. In addition, during 2001-2002, there was no substantial peak in isolates around the new year (late December to early January), when influenza typically increases in LAC. Instead, activity peaked during late March (weeks 12-13), and this increase was due entirely to outbreaks of type B influenza. Overall, 2001-2002 was also a light season; there were 20% fewer isolates than reported in 2000-2001, and 35% fewer than reported in 1999-2000.

Figure 1: Weekly influenza viral isolate totals, 1999-2002 (all viral types)



Another distinguishing feature of the 2001-2002 season was the high proportion of type B influenza activity nationally and *especially* locally (Figure 2). During the 2001-2002 season, nearly half of the isolates reported to ACDC were type B (49%), across California, 15% of the reported isolates were type B, and nationally, more than a third of the isolates (38%) were type B. During the previous season (2000-2001), an even greater proportion of the isolates were identified as type B – 58% identified from LAC surveillance, 38% from the California state-wide surveillance and 27% from the national surveillance.

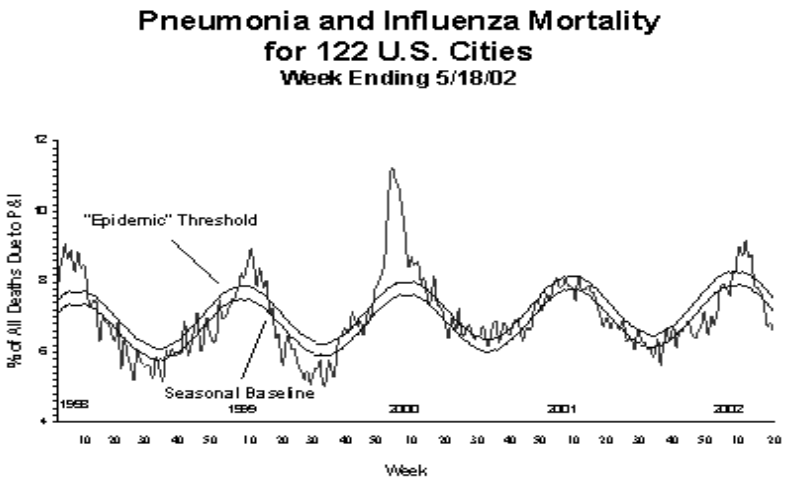
Figure 2. Influenza viral isolate types locally, statewide and nationally, 2001-2002



INFLUENZA/PNEUMONIA MORTALITY

The national pneumonia and influenza (P&I) mortality statistics also reflect how mild the 2001-2002 influenza season was (Figure 3); while there was a minor increase in the death rate during February 2002, this increase is clearly much less pronounced than what occurred during the 1999-2000 season. Last season, 2000-2001, the national (P&I) mortality rate was even smaller; the number of deaths reported never exceeded the epidemic threshold.

Figure 3: Pneumonia and influenza mortality, CDC



ELEMENTARY SCHOOL OUTBREAKS (LATE SEASON, TYPE B)

Long after influenza activity was expected to conclude for 2001-2002, LAC experienced a late-season surge of type B influenza which began in mid-March and extended into April. This illness primarily affected elementary and middle school children and accounted for substantial rates of school absenteeism, as high as 15-20%. Outbreak investigations were conducted at a total of 6 schools across LAC (1 middle school and 5 elementary schools). While it was especially unusual for influenza to occur so late in the season, cultures collected from students and faculty at four separate schools confirmed the presence of influenza type B (Table 1); of the 16 cultures collected, 9 (56%) tested positive, all for influenza type B.

Table 1: Summary of investigated school outbreaks, March 2002

School	Zip Code	Collection date	Number of specimens collected	Number (%) of positive specimens*
School A	90032	3/22	2	1 (50%)
School B	90278	3/28	5	5 (100%)
School C	91770	3/28	5	2 (40%)
School D	90037	4/4	4	1 (25%)
School E	91780	--	0	--
School F	91733	--	0	--
total			16	9 (56%)

* All cultures were positive for influenza type B.

There were several notable features of this late-season peak in activity. First, the symptoms were not always classic for influenza (Table 2). The primary common symptoms were fever (101^0-103^0), headache, sore throat, cough and fatigue; however, symptoms in some cases also included runny nose and congestion. Second, as noted above, illness predominantly affected elementary and middle school children. Some school nurses, who normally send home only a few ill children per week, reported sending home as many as 39 ill children in one day. In addition, activity was very widespread, reaching across all corners of the county and as far south as Orange County. Moreover, while the illness appeared to mostly effect school-aged children, illness often extended throughout their households; in a small survey of symptomatic children (n=51), nearly half reported other family members also ill (Table 2). Nonetheless, the illness itself was short-lived with a duration of approximately 4 days – thus while this illness had an intense immediate impact, the extent of illness subsided quickly. It appears that spring break vacation inhibited its continued spread.

Perhaps the most significant factor of these outbreaks was the type of strain identified. Additional typing conducted by the California state laboratory identified the virus as a novel strain previously limited to Southeast Asia (B/Hong Kong/330/2001). The majority of B isolates worldwide during the 2001-2002 season were characterized as another strain (B/Sichuan/379/99). Moreover, the novel B strain which caused the late season outbreak in LAC was not included in the 2001-2002 vaccine, and the strain included was incapable of providing sufficient immunity to this new strain.

Table 2: Summary of symptoms

Symptom	School A (n=15)	School B (n=7)	School C (n=25)	School D (n=4)	Overall (n=51)	%
Fever	13	4	22	4	43	(91%)
Tired/fatigue	15	4	15	3	37	(79%)
Headache	10	5	19	1	35	(74%)
Runny nose	3	6	20	4	33	(70%)
Weakness	10	6	14	2	32	(68%)
Cough	6	6	18	0	30	(64%)
Congestion	8	4	12	3	27	(57%)
Sore throat	5	6	15	0	26	(55%)
Body ache	2	5	13	2	22	(47%)
Chills	2	6	10	3	21	(45%)
Abdominal cramps	2	1	8	3	14	(30%)
Nausea	1	2	10	0	13	(28%)
Ear pain	0	2	9	2	13	(28%)
Vomiting	0	2	9	1	12	(26%)
Diarrhea	1	1	3	1	6	(13%)
Rash	0	0	3	0	3	(6%)
Other in family sick?	5	0	15	3	23	(49%)

Important vaccination changes. The late season outbreak investigations in LAC contributed to two very important changes for the upcoming 2002-2003 influenza season. First, in order to offer immunity to the novel B strain, B/Hong Kong/330/2001 will be added to the 2002-2003 vaccine. Second, since this strain accounted for substantial (and unexpected) rates of morbidity and mortality among the very young, the Advisory Committee on Immunization Practices has modified their vaccination recommendations. Starting in the Fall of 2002, children between the ages 6 months to 23 months will now be classified as “high-risk,” thereby warranting early immunization against influenza.

CONCLUSION

The 2002-2003 season illustrates several important factors regarding influenza.

1. Influenza is very unpredictable.
   While numerous years of surveillance have identified some common influenza trends (i.e., the general time of onset and peak), these trends are not absolute – core aspects can change in a given year, often surprising even the most seasoned influenza investigators. In LAC, the 2002-2003 season was especially unpredictable; not only was activity much milder than previous years, activity began much later than

expected, it did not peak during the usual time and it continued well beyond an ordinary season.

2. Influenza can extend into the Spring.
   One unpredictable aspect of influenza is its duration. As the 2002-2003 season demonstrated, influenza activity can extend into the Spring. Consequently, clinicians should not discount influenza as a potential diagnosis simply because the season has changed.
3. The type of strain is important.
   Influenza is often discussed as if it is a disease with a single underlying cause, but as the 2002-2003 season demonstrated, that is certainly not the case and identifying the type of viral strain is critical for several reasons. First, some testing methods as well as some medications used for treatment and prophylaxis are designed solely for type A influenza. And while type A is frequently the more common circulating strain, occasionally type B strains predominate – as was the case during the last two seasons in LAC. Moreover, characterizing the virus is critical in order to distinguish novel strains and to perfect the vaccine. The high incidence of infection which occurred during March 2002 can be traced back to the fact that the strain was new and immunity (either through natural exposure or through vaccination) was not possible. ACDC's surveillance added to the body of knowledge that was used to modify the vaccine as well as to change the policy for immunization priority for the following year. These changes will likely decrease subsequent morbidity and mortality due to influenza.