Do Family Physicians Make Good Sentinels for Influenza?

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Objective: To determine whether volunteer family physician reports of the frequency of influenza–like illness (ILI) usefully supplement information from other influenza surveillance systems conducted by the Centers for Disease Control and Prevention.

Design: Evaluation of physician reports from five influenza surveillance seasons (1987-88 through 1991-92).

Setting: Family physician office practices in all regions of the United States.

Participants: An average of 140 physicians during each of five influenza seasons.

Interventions: None.

Outcome Measures: An office visit or hospitalization of a patient for ILI, defined as presence of fever (temperature ≥37.8°C) and cough, sore throat, or myalgia, along with the physician's clinical judgment of influenza. A subset of physicians collected specimens for confirmation of influenza virus by culture.

Results: Physicians attributed 81 408 (5%) of 1 672 542 office visits to ILI; 2754 (3%) patients with ILI were hospitalized. Persons 65 years of age and older accounted for 11% of visits for ILI and 43% of hospitalizations for ILI. In three of five seasons, physicians obtained influenza virus isolates from a greater proportion of specimens compared with those processed by World Health Organization laboratories (36% vs 12%). Influenza virus isolates from sentinel physicians peaked from 1 to 4 weeks earlier than those reported by World Health Organization laboratories. Physicians reported peak morbidity 1 to 4 weeks earlier than state and territorial health departments in four of five seasons and 2 to 5 weeks earlier than peak mortality reported by 121 cities during seasons with excess mortality associated with pneumonia and influenza.

Conclusions: Family physicians provide sensitive, timely, and accurate community influenza morbidity data that complement data from other surveillance systems. This information enables monitoring of the type, timing, and intensity of influenza activity and can help health care workers implement prevention or control measures.

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DESPITE PREVENTIVE measures such as vaccination and the use of the antiviral medication amantadine hydrochloride, influenza remains a major cause of morbidity and mortality in the United States. It has been estimated that more than 10 000 excess deaths occurred in each of seven influenza epidemics from 1977 to 1988, with more than 40 000 excess deaths in each of two of these (1984-85 and 1985-86).[1] A moderate epidemic of influenza has been estimated to result in an average of 172 000 excess hospitalizations at a cost of more than $300 million.[2,3] Because influenza viruses continue to evolve, new strains, to which the population has relatively little immunity, emerge frequently.[4] Often, multiple influenza strains circulate during a single season, contributing to differences in the occurrence, distribution, and impact of influenza infection in different geographic regions. Because

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BACKGROUND AND METHODS

Annually between October and May, CDC monitors influenza activity in the United States through four formal surveillance systems, as well as through sporadic voluntary reports of outbreaks and unusual illnesses.

STATE AND TERRITORIAL HEALTH DEPARTMENT EPIDEMIOLOGISTS

Since 1981, influenza outbreak activity, as assessed by state and territorial epidemiologists, has been reported each week in the following categories: none, sporadic (sporadically occurring cases of influenza–like illness [ILI] or culture-confirmed influenza, with no outbreaks detected), regional (outbreaks of ILI or culture-confirmed influenza in counties having a combined population of less than 50% of the state's total population), or widespread (outbreaks of ILI or culture-confirmed influenza in counties having a combined population of at least 50% of the state's total population).

WORLD HEALTH ORGANIZATION (WHO) COLLABORATING LABORATORIES

International surveillance of influenza viruses has been conducted by WHO since its formation in 1947.[4] This program expanded following the 1957 outbreak of Asian influenza and again in 1976 as part of a plan to monitor the appearance of swine influenza–like viruses among humans. Since 1976, WHO collaborating laboratories in the United States (the majority from state or local health departments, with some university or hospital laboratories also participating) have reported to CDC the weekly total number of specimens received for respiratory virus testing as well as the number and type of influenza viruses isolated. Cultures may be obtained for a variety of suspected respiratory pathogens. Since 1985, from 53 to 64 laboratories have participated each season.

CDC MORTALITY REPORTING SYSTEM

Since 1961, the vital statistics offices of 121 cities have reported to CDC the total number of death certificates filed each week, regardless of cause, and the percentage of those for which pneumonia was identified as the underlying cause of death or for which influenza was mentioned anywhere on the death certificate. These data are graphed against a seasonal baseline calculated by using a procedure in which a periodic regression model was applied to observed percentages of such deaths since 1983. An "epidemic threshold" for each season is 1.645 SDs above the seasonal baseline. These data provide an index to measure the impact of influenza on mortality.

SENTINEL PHYSICIANS

In 1982, a surveillance program was undertaken by CDC and the Ambulatory Sentinel Practice Network of North America. Approximately 150 members of the American Academy of Family Physicians were recruited to report patient visits

of these unique features of influenza epidemics, surveillance systems must provide rapid, sensitive, and accurate estimates of where, when, and what type of influenza is occurring. This information can assist the public health community in rapidly implementing measures to prevent or control epidemics.

To monitor US influenza activity, the Centers for Disease Control and Prevention (CDC) conducts nationwide influenza surveillance through several different systems. In 1982, CDC instituted a surveillance system to monitor influenza through a network of sentinel family physicians located throughout the United States. This report evaluates 5 years of epidemiologic and laboratory surveillance data received by CDC from 130 to 153 family physicians who voluntarily participated in the sentinel physician network each year between 1987 and 1992.

RESULTS

An average of 140 (from 130 to 153) physicians from an average of 42 states voluntarily participated in the sentinel physician network each season from 1987 through 1992, with a mean of 88 (63%) reporting each week. On average, 117 physicians reported during 10 or more weeks each season. Approximately 80% of physicians continued from one season to the next. Physicians who reported fewer than 10 weeks during a particular season were usually not asked to participate the following season. Aside from these physicians, the majority of volunteers who chose to discontinue the program did so because they were retiring from clinical practice. Reporting rates varied by week of the surveillance season, with a mean response rate of less than 50% in early October (calendar weeks 40 and 41, the start of the surveillance season), a mean peak of just over 80% during the first half of December (weeks 48, 49, and 50), a slight decrease during the winter holiday season (weeks 51, 52, and 1), and decreasing to below 50% by early April (week 15 and thereafter) (**Figure 1**).

An average of 85 (61%) sentinel physicians participated each season in the laboratory component of the system (**Table 1**). Although WHO collaborating laboratories process more specimens and isolate more influenza virus, a mean of 36% of specimens submitted by the sentinel physicians yielded influenza isolates each season compared with a mean of only 12% of WHO laboratory specimens. Compared with influenza virus isolates processed by WHO laboratories, isolations of influenza viruses from

and hospitalizations for ILI to CDC. Subsequently, efforts to maintain this number of volunteers and a wide geographic representation have included recruiting by advertisement in American Academy of Family Physicians publications, telephone recruitment by CDC personnel, and referral by currently participating physicians. Since 1986, a subgroup of physicians have collected nasopharyngeal specimens from selected patients and submitted them for virus culture by a CDC-contracted laboratory.

The goal of this volunteer sentinel physician system is to provide systematic community-based morbidity data to complement information received from other surveillance systems that rely on outbreak reporting, culture activity, and mortality. It was hoped that family physicians, who see patients of all ages, might provide earlier, more sensitive, and more representative information than the other systems.

Information from these four surveillance systems is summarized by geographic region each week during the surveillance season and disseminated via CDC's telephone information line and publications, including the *Morbidity and Mortality Weekly Report*.[5-16] Participating sentinel physicians receive additional summary updates two to three times during the season.

METHODS

To determine whether family physicians can efficiently provide useful data to supplement those of other surveillance systems used by CDC, we evaluated reports of volunteer physicians from five influenza surveillance seasons, 1987-88 (the first season that the current contract laboratory began receiving clinical specimens for influenza testing) through 1991-92. Weekly reports were submitted by postcard or telephone for a 33-week period from October through May of each season. Each physician's office reported the total number of office visits for any reason and the number of visits attributed to ILI (defined as fever with a temperature of ≥37.8°C and cough, sore throat, or myalgia, as well as clinical judgment of influenza) by age group. Age was divided into four groups during the 1987-88 season and into six groups during subsequent seasons. Physicians also reported the number of patients hospitalized as a result of ILI by age group.

Each season, a subset of physicians who consistently reported in the previous year was invited to obtain specimens from selected patients for influenza virus isolation and strain surveillance. At the start of each season, the contract laboratory gave each participant two complete kits for collecting and transporting throat and nasopharyngeal specimens. The CDC paid for this service, with no charge to the patient or the physician. Because the laboratory was contracted to culture a limited number of specimens (400 beginning in 1989), physicians were advised to select patients who were likely to have early symptoms of influenza (within 3 days of symptom onset), especially early or late in the season, or likely to have illness associated with an outbreak in the community. Specimens were transported by overnight mail and inoculated within 1 working day. Influenza A or B type-specific antigens were detected at 72 hours using monoclonal antibodies provided by CDC. Both CDC and the physician were notified of positive test results by telephone within 24 hours and by mail within 72 hours.

specimens submitted by sentinel physicians peaked between 1 and 4 weeks earlier during each of the three seasons from 1987 to 1990 and peaked the same week during the two seasons from 1990 to 1992. The proportion of influenza virus types isolated by either source was similar.

Unlike WHO laboratory isolates, influenza A isolates from the sentinel physicians were not routinely subtyped. Thus, the sentinel physician laboratory component did not yield information on the relative circulation of influenza A(H1N1) vs A(H3N2) subtypes.

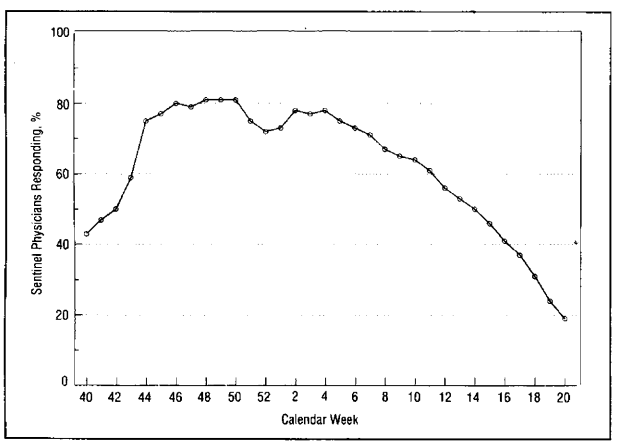

Figure 1. *Average response rate of 140 sentinel physicians, by calendar week, 1987 through 1992.*

For all five seasons, physicians attributed 81 408 (5%) of 1 672 542 office visits to ILI, of which 2754 (3%) resulted in hospitalization. Of 6394 persons 65 years of age and older seen for ILI during four seasons (1988-89 through 1991-92), 961 (15%) were hospitalized with their illness. Rates of hospitalization for ILI of persons in other age groups ranged from 1% among persons 5 to 24 years of age to 4% among persons younger than 1 year and among those 45 to 64 years of age. Persons 65 years of age and older accounted for 10% of ILI office visits between 1988 and 1992 (11% for all five seasons), but they accounted for 42% of those hospitalized with ILI (43% for all five seasons) (**Table 2**).

During the 1987-88 influenza season, the percentage of office visits attributed to ILI first exceeded a baseline rate of between 2% and 4% during week 51, peaked (8%) during week 7, and returned to baseline by week 14 (**Figure 2**, A). During the four subsequent seasons, the proportion of visits attributed to ILI exceeded baseline earlier (from 3 to 5 weeks), peaked earlier (from 1 to 7 weeks), and returned to baseline earlier (from 1 to 8 weeks)

Table 1. Laboratory Surveillance by Sentinel Physicians and WHO Collaborating Laboratories, October-May 1987-1992*

Season	Total No. of Sentinels	No. (%) of Sentinels Collecting Specimens for Culture	Total No. of Specimens	No. (%) of Influenza Isolates	No. of WHO Laboratories	Total No. of Specimens	No. (%) of Influenza Isolates
1987-88	150	96 (64)	419	119 (28)	53	26 732	2532 (10)
1988-89	153	105 (69)	477	207 (43)	53	28 700	5119 (18)
1989-90	136	86 (63)	318	113 (36)	63	30 059	3408 (11)
1990-91	132	70 (53)	221	58 (26)	64	25 595	2032 (8)
1991-92	130	69 (53)	239	101 (42)	64	28 967	3664 (13)
Average	140	85 (61)	335	120 (36)	59	28 011	3351 (12)

*WHO indicates World Health Organization.

than during the 1987-88 influenza season. The number of weeks that the percentage of office visits for ILI remained above baseline ranged from 12 weeks during the 1991-92 season to 18 weeks during the 1990-91 season.

During the seasons in which influenza types A(H1N1) and B codominated (1988-89) or influenza type B predominated (1990-91) (Figure 2, D), the percentage of office visits attributed to ILI remained above a 4% baseline on average 3 weeks longer (mean, 17 weeks) than during three seasons in which influenza A(H3N2) predominated (mean, 14 weeks). The proportion of visits attributed to ILI at the peak of each season, however, did not differ substantially between seasons, regardless of type of influenza predominating (peaks 8% and 11% for 1990-91 and 1988-89, respectively; peaks ranging from 9% to 11% for the other seasons).

When compared with state and territorial health department epidemiologists' reports of influenza activity (Figure 2, B), reports from sentinel physicians showed peak activity either the same week (1987-88) or earlier (by 4 weeks in 1989-90 and by 1 week in the remaining three seasons).

During the 1987-88 season, the proportion of deaths attributed to pneumonia and influenza reported by the

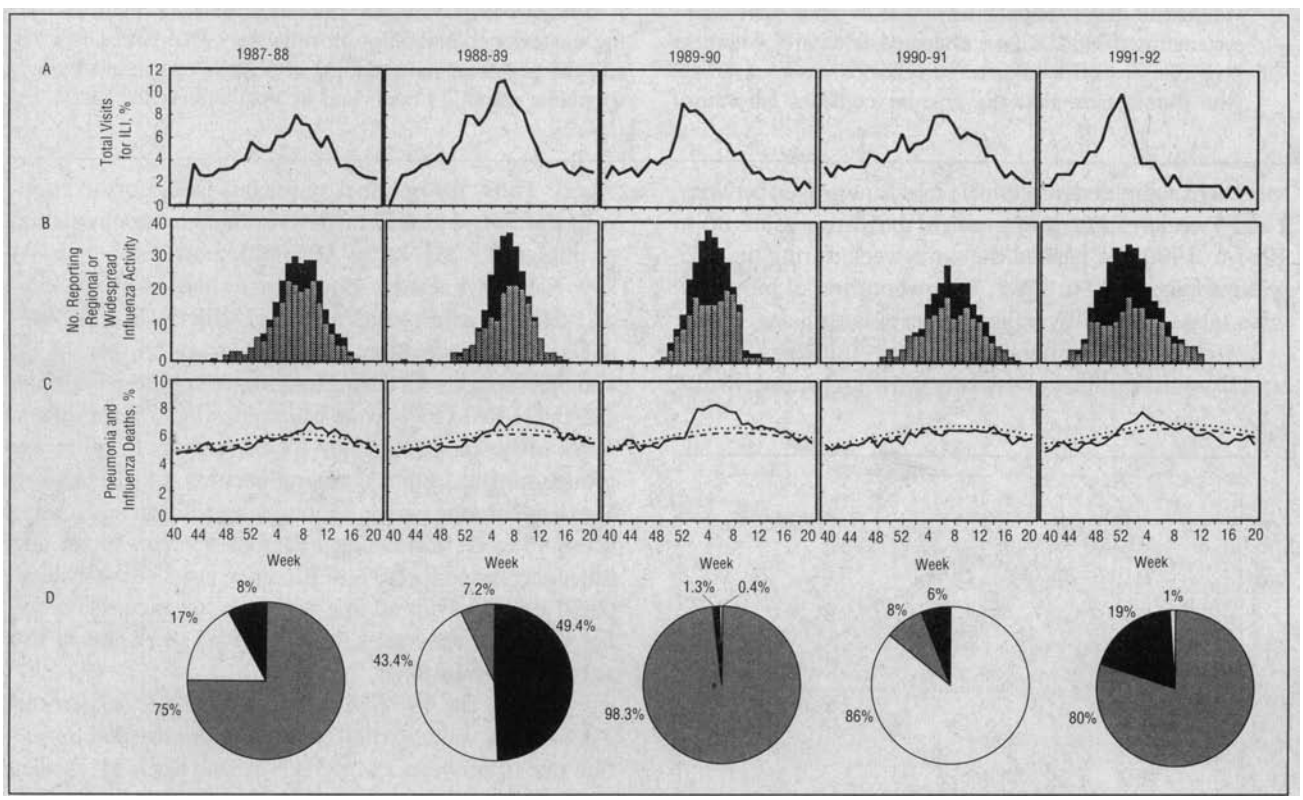

Figure 2. *Results of information from influenza surveillance systems conducted by the Centers for Disease Control and Prevention (CDC), by season and calendar week, October (week 40) through May (week 20), 1987 through 1992. A, Sentinel physician reports. ILI indicates influenza–like illness. B, State and Territorial Health Department Epidemiologists reports. Number of epidemiologists reporting regional (shaded bars) or widespread (solid bars) influenza activity (see "Background and Methods" section for definitions). C, CDC Mortality Reporting System of 121 cities. Dashed lines indicate baseline; dotted lines, epidemic threshold; and solid lines, actual reported deaths. D, Proportion of influenza B (open sector), influenza A(H3N2) (shaded sector), and influenza A(H1N1) (solid sector) isolated during the season by World Health Organization collaborating laboratories.*

Table 2. Sentinel Physician Morbidity Data by Age Group, October-May 1987-1992*

Age Group, y†	No. (%) of Visits for ILI	No. (%) of Patients for ILI Hospitalized
<1	4186 (6)	151 (7)
1-4	10 131 (15)	183 (8)
5-24	18 081 (28)	268 (12)
25-44	16 814 (26)	309 (14)
45-64	10 092 (15)	396 (17)
≥65	6394 (10)	961 (42)
Subtotal 1988-1992	**65 698** (100)	**2268** (100)
Total‡ 1987-1992	81 408	2754

**Sentinel physicians reported 1 672 542 office visits for any reason during the five surveillance seasons (1987-1992) (data not available by age group). ILI indicates influenza–like illness.*

†These age groups are only available for four seasons (1988-1992).

‡Totals include an additional 15 710 visits and 486 hospitalizations for ILI during the 1987-1988 season.

121 cities participating in the CDC Mortality Reporting System rose above the epidemic threshold during week 7, reached a peak of 7.1% of all deaths reported in week 9, and returned to below this threshold during week 14 (Figure 2, C). In subsequent seasons, this index peaked during weeks 8 (7.4%), 5 (8.5%), 14 (6.7%), and 3 (7.8%). During seasons when the epidemic threshold was surpassed (all except the 1990-91 season), peak mortality attributed to pneumonia and influenza followed a mean of 3 weeks (range, 2 to 5 weeks) after peak activity reported by the sentinel physicians. The highest proportions of deaths attributed to pneumonia and influenza were reported during two of the three seasons in which influenza A(H3N2) was the predominant circulating virus.

COMMENT

The strength of the sentinel family physician influenza reporting system is that it provides standardized community influenza morbidity data directly from an office setting. Thus, the data may be more representative of the population than those provided by state and territorial epidemiologists, which are based on outbreak reports. Because influenza is not a nationally reportable disease and because the few people that seek a physician's care for the nonspecific signs and symptoms of infection rarely have a specimen collected for culture, true population-based influenza surveillance and morbidity data are difficult to collect. Indirect measures of morbidity (eg, time lost from work or school, purchases of medication marketed specifically for symptoms of ILI) are much more difficult to obtain than are direct measures of morbidity (eg, visits to a physician and hospitalization for ILI). Because of the simple weekly reporting system and the broad definition of ILI, family physicians provided sensitive and timely community influenza morbidity data that complemented other surveillance systems that relied on outbreak activity (State and Territorial Health Department Epidemiologists), culture (WHO collaborating laboratories), or mortality (CDC Mortality Reporting System) alone. Because the sentinel physicians collected specimens for culture from patients whom they believed to be infected with influenza virus, a consistently greater proportion of their specimens yielded influenza virus than those processed by WHO laboratories, where specimens were obtained and processed for many other respiratory pathogens. Thus, the laboratory component of the sentinel physician system had a better positive predictive value than did the larger WHO system. The consistency shown between the season-to-season variation of the sentinel physician reports and those of the other surveillance systems (eg, timing of activity, confirmation and typing of virus by culture) supports its comparable reliability.

Although influenza-associated deaths can occur early in the course of infection (eg, as with fulminant influenza A virus pneumonia), they more commonly occur several weeks later because of complications after infection, especially bacterial pneumonia and exacerbation of chronic heart and lung conditions.[17] Thus, peak mortality from pneumonia and influenza occurring from 2 to 5 weeks after peak morbidity as reported by the sentinel physicians further supports the reliability and timeliness of this volunteer surveillance system.

Data from this system provide essential timely information that can be useful at local, regional, and national levels to track influenza and ILI activity each season. This information is also important in planning for and efficiently promoting prevention and control strategies such as vaccination and use of amantadine, as recommended by the Advisory Committee on Immunization Practices.[1]

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