

Epidemiological Report

Evaluation of the Japanese School Health Surveillance System for Influenza

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(Received January 10, 2001. Accepted March 8, 2001)

SUMMARY: In order to evaluate the Japanese nationwide school absenteeism surveillance system for pediatric influenza in comparison with the national sentinel surveillance for influenza, we used surveillance guidelines (Centers for Disease Control and Prevention, 1998) to determine the efficacy of the school health surveillance system (SHSS). Data regarding school absenteeism (age 4-15 years old) was compared with data regarding influenza-like illness (ILI) per sentinel sites during the second to the 11th weeks of 1998 and 1999. Despite the system's high simplicity and acceptability, telecommunication costs were estimated at US\$ 490,000 (1998). Representativeness of schoolchildren was very accurate, but ILI for pre-school children (4-6 years) remained uncountable. Sensitivity, specificity, and positive predictive value of the SHSS compared to sentinel surveillance were calculated as 80%, 100%, and 100%, respectively ($P=0.004$). Although the SHSS was found to provide accurate surveillance data during periods of high influenza activity, non-influenza virus infections (e.g., adenovirus, rotavirus, and Norwalk virus, etc.) may become mixed in the SHSS data. Evaluation using this system should be continued employing a new case definition excluding gastrointestinal symptoms.

INTRODUCTION

Mass vaccination of a school-aged population has been reported to have considerable effect in reducing the magnitude of an influenza epidemic (1), and future institution of mass vaccination of the pediatric population is being vigorously discussed in the United States (US) (2). In Japan, mass influenza vaccination was recommended to schoolchildren in 1962, and universal influenza vaccination of children aged between 7-15 years was implemented as a national immunization policy in 1976 (3). However, in 1987, this policy was reduced to voluntary vaccination because of a lack of data supporting the effectiveness of universal influenza vaccination (4), and mass influenza vaccination to schoolchildren was eventually stopped in 1994.

The importance of pediatric influenza surveillance is under-emphasized. Improved influenza surveillance is essential to understanding the disease burden, as well as to assessing the effectiveness of the vaccination of schoolchildren against influenza.

The school health surveillance system (SHSS) is the sole notifiable surveillance system in Japan for pediatric influenza. The SHSS has been run by the Ministry of Education, Science, Sports and Culture (MOE) and Ministry of Health and Welfare (MOH) since the school health law was enacted in 1958. The objective of the SHSS is to measure the magnitude of influenza among schoolchildren. If absenteeism exceeds 20% as reported to the SHSS, the school principal and teachers discuss closure of a class or school to prevent further absenteeism.

The SHSS has not been evaluated in its role as a communicable disease surveillance system. According to the National Epidemiological Surveillance of Infectious Diseases program,

influenza activity increased substantially during the 1997-1998 and 1998-1999 seasons (5,6). We evaluated the effectiveness of the SHSS in measuring the impact of the influenza epidemic in Japan.

METHODS

We compared the effectiveness of the SHSS with the Influenza Sentinel Surveillance System (ISSS) conducted in the National Epidemiological Surveillance for Infectious Diseases program using data from these two severe influenza seasons. In Japan, the ISSS is the primary influenza surveillance system. The accuracy of those data are assured by ~10% sampling for virological tests (Fig. 1).

Guidelines for surveillance evaluation (Centers for Disease

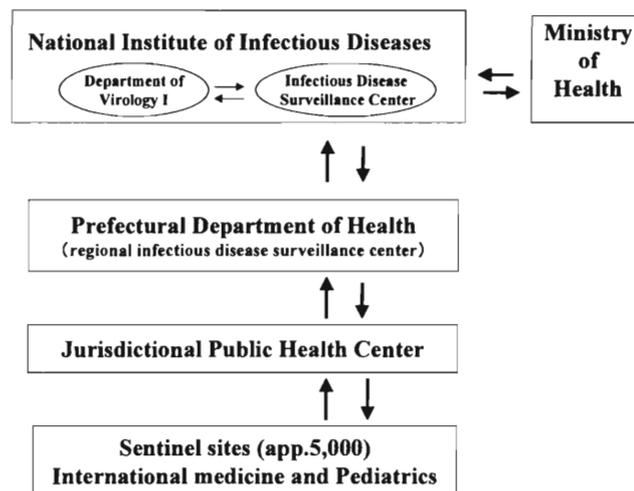


Fig. 1. Structure of the National Influenza Sentinel Surveillance System.

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Control and Prevention [CDC]) were employed for the study (7). Since we focused on influenza trends in schoolchildren, data from children aged 4-15 years old were compared.

In the ISSS, epidemic influenza status is defined as exceeding 10 influenza-like illness (ILI) patients per sentinel site per week. For the SHSS, we defined epidemic status as greater than 100 absentees per 100,000 persons. Age-stratified population census was obtained from the Summary of the National Census, 1998 (8).

RESULTS

The usefulness of the SHSS was evaluated in terms of simplicity, flexibility, representativeness, and timeliness according to the CDC's evaluation guideline.

Simplicity and flexibility: Because the SHSS is a symptom-based surveillance system, teachers and school nurses simply count the number of children presenting with ILI symptoms in their class/school. No extra staff are employed for information collection. Because the teachers and nurses have to call each absentee's home during the observation period, some telecommunication cost is incurred (approximately US\$ 490,000 in the 1998-1999 season). The SHSS has long been used as a decision-making tool for class/school closure and is also highly acceptable for infectious disease surveillance.

Representativeness: Since schools are distributed throughout Japan, and all ILI cases are counted, representation of the incidence of disease is assumed to be very accurate. However, of the school-attending population, children with ILI aged between 4-6 years are not always included. Kindergarten education is not compulsory in Japan and not a few children stay home or attend part time.

Timeliness: The surveillance period for the SHSS is from October to April each season. Data are not available during the 52nd week to the 1st week because of New Year's break. It takes 2 weeks for the data to be gathered completely at the Ministry level, and an additional 1-2 weeks are needed to summarize and feedback the results through the National Infectious Disease Surveillance Center website (Fig. 2).

We first checked rise, peak, and fall of epidemic curve for ILI from the SHSS during the period of 1976 to 1999. Twenty-one out of 23 influenza epidemic peaks occurred during the 2nd to the 11th week of these years (Fig. 3). We then checked the correlation of data from the ISSS and the SHSS of these weeks in 1998 and 1999. We observed a strong positive relation (Fig. 4).

Sensitivity, specificity, and positive predictive value: The number of children with ILI per sentinel site and number of absent children per 100,000 are summarized in Table 1. For the 20 weeks in the two seasons, epidemics were observed during 12 weeks by both the ISSS and SHSS. Sensitivity, specificity, and positive predictive value of the SHSS compared to ISSS are calculated as 80% (12 out of 15 weeks), 100% (12/12 weeks), and 100% (5/5 weeks), respectively (Fisher's exact test, $P = 0.004$).

DISCUSSION

In the mid-1970s in some areas in the US, use of school-based absenteeism was validated after sustained excess school absenteeism was found to be an adequate indicator of the presence and extent of influenza (9,10). Ours is the first study for evaluation of the nationwide school health surveillance system for influenza compared to laboratory-assisted sentinel

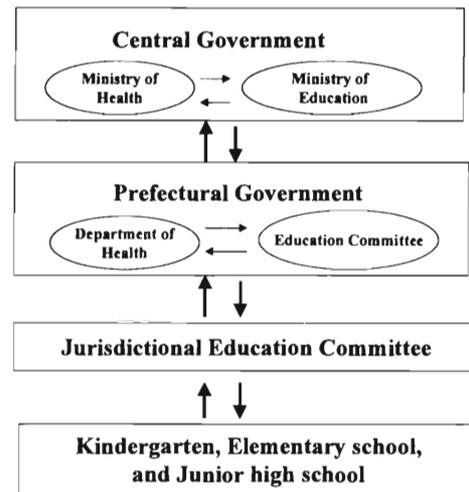


Fig. 2. Structure of the National School Health Surveillance System.

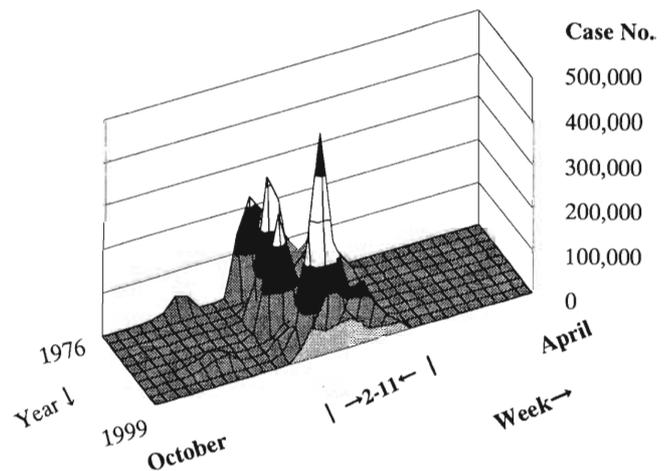


Fig. 3. Weekly number of influenza-like illness among 4-15 year-olds in Japan, 1976-1999.

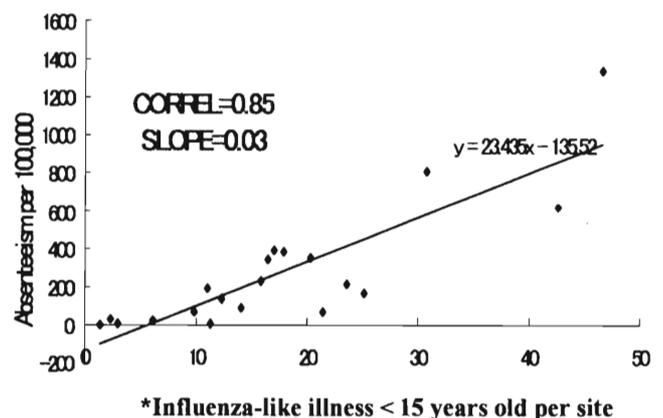


Fig. 4. Correlation between school absenteeism and ILI* per sentinel, 1997-1999, Japan.

surveillance data in Japan.

Most influenza surveys focusing on schools have been conducted on a small scale and have not observed a period longer than one season. A consistent finding with influenza in communities is that influenza occurs first among school-

Table 1. Sentinel surveillance and school absenteeism, Japan, 1997-1999

	97/98 season		98/99 season	
	Sentinel ILI/site	School absenteeism	Sentinel ILI/site	School absenteeism
Week 2	2.30	26.6	11.34	5.8
Week 3	10.98	194.3	21.35	70.0
Week 4	30.72	809.4	23.50	212.1
Week 5	46.58	1342.3	20.31	349.7
Week 6	42.62	621.0	17.86	381.6
Week 7	25.06	168.7	16.51	345.7
Week 8	14.08	87.4	17.07	386.3
Week 9	6.14	18.7	15.81	232.5
Week 10	2.99	8.8	12.33	134.6
Week 11	1.39	1.6	9.82	65.8

ILI per site: average number of children with ILI under 16 years old per sentinel site.

absenteeism: number of absent children per 100,000.

week 2: the second Monday-Friday of January of the year.

aged children, followed by spread of the virus among family members (11). Thus, an annual and school-based surveillance system such as the SHSS will be of help to understand the spread of influenza in Japan, as well as measuring the magnitude of epidemics.

A disadvantage of the SHSS is that no standardized case definition for ILI absenteeism exists. An effective influenza surveillance system is important, but a major obstacle is how to simply define the illness under scrutiny (12). Teachers often raise high fever, headache, sore throat, appetite loss, vomiting, and diarrhea as major common symptoms for ILI in the SHSS, but these can accompany other infectious diseases observed in winter. Although data reported through the SHSS and the ISSS are correlated, it remains unproven that respiratory virus infections are included in SHSS data. Adenovirus infection in particular often presents fever $>39^{\circ}\text{C}$ and its clinical and epidemiological features resemble influenza epidemics (13). In addition, absences due to gastroenteritis such as rotavirus and Norwalk virus infections might have got mixed with the SHSS data, because those diseases also reach epidemic levels during influenza season (14,15). Norwalk virus gastroenteritis is characterized by severe vomiting, though it lasts only for a day or two, and diarrhea may develop later (16). In very young children with influenza virus infection, non-respiratory symptoms can be the presenting symptoms – fever only, fever with diarrhea and vomiting – and could overlap with viral gastroenteritis infections. In order to minimize the non-influenza cases, a standardized case definition excluding vomiting and diarrhea symptoms should be developed for schoolchildren's ILI and assessed. When ILI outbreaks occur in school, beside reporting them to the SHSS, a limited number of nasopharyngeal swabs, as well as vomitus or stool specimens, should be submitted to the local public health laboratories.

We found a higher level of sensitivity, specificity, and positive predictive value in the SHSS than in the ISSS. However, it is not yet proven whether these results would be found during less severe influenza seasons. The SHSS has a disadvantage in that data are not available during New Year's break. An influenza outbreak may not be detected in a timely manner if an epidemic starts during the break.

It is unknown whether timely class/school closure can minimize influenza epidemics, not only in children, but in the general population. The well-evaluated SHSS data will be of use for scientifically based decisions. The SHSS provides

close surveillance, and further monitor for strengthening of the SHSS will contribute to improved understanding of the impact of influenza in schoolchildren and in entire communities in Japan.

ACKNOWLEDGMENTS

This study was planned and developed under support of a Japanese Ministry of Health and Welfare scientific research grant on "coordination for the national and prefectural surveillance systems" (H12-Shinko-5).

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