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Influenza-associated Hospitalization in Children Younger Than 5 Years of Age in Suzhou, China, 2011–2016

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Abstract

Background: Studying the burden and risk factors associated with severe illness from influenza infection in young children in eastern China will contribute to future cost-effectiveness analyses of local influenza vaccine programs.

Methods: We conducted prospective, severe acute respiratory infection (SARI) surveillance at Suzhou University–Affiliated Children's Hospital to estimate influenza-associated hospitalizations in Suzhou University–Affiliated Children's Hospital by month in children younger than 5 years of age from October 2011 to September 2016. SARI was defined as fever (measured axillary temperature ≥ 38°C) and cough or sore throat or inflamed/red pharynx in the 7 days preceding hospitalization. We combined SARI surveillance data with healthcare utilization survey data to estimate and characterize the burden of influenza-associated SARI hospitalizations in Suzhou within this age group in the 5-year period.

Results: Of the 36,313 SARI cases identified, 2,297 from respiratory wards were systematically sampled; of these, 259 (11%) were influenza positive. Estimated annual influenza-associated SARI hospitalization rates per 1,000 children younger than 5 years of age ranged from 4 (95% confidence interval [CI], 2–5) in the 2012–2013 season to 16 (95% CI, 14–19) in the 2011–2012 season. The predominant viruses were A/H3N2 (59%) in 2011–12, both A/H1N1pdm09 (42%) and B (46%) in 2012–13, A/H3N2 (71%) in 2013–14, A/H3N2 (55%) in 2014–15 and both A/H1N1pdm09 (50%) and B (50%) in 2015–16. The age-specific influenza-associated SARI hospitalization rates for the 5-year period were 11 (95% CI, 8–15) per 1,000 children 0–5 months

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of age; 8 (95% CI, 7–10) per 1,000 children 6–23 months of age and 5 (95% CI, 4–5) per 1,000 children 24–59 months of age, respectively.

Conclusions: From 2011 to 2016, influenza-associated SARI hospitalization rates in children aged younger than 5 years of age in Suzhou, China, were high, particularly among children 0–5 months of age. Higher hospitalization rates were observed in years where the predominant circulating virus was influenza A/H3N2. Immunization for children > 6 months, and maternal and caregiver immunization for those < 6 months, could reduce influenza-associated hospitalizations in young children in Suzhou.

Keywords

influenza; hospitalization rates; children; China

Influenza-associated hospitalizations in children lead to significant burden and economic cost for families and society.[1–4] Although both the World Health Organization and the Chinese Center for Disease Control and Prevention (China CDC) recommend annual seasonal influenza vaccination for all populations at greatest risk of developing severe illness and complications from influenza infection including young children,[5] estimated influenza vaccine coverage in children younger than 5 years of age in China between 2009 and 2012 was 22–32%,[6] and these were likely overestimates. Studying the burden and risk factors associated with severe illness from influenza infection in young children in China may inform local seasonal influenza vaccine policy and implementation.

One previous study in Suzhou found that the average annual hospitalization rate attributed to influenza-associated pneumonia was 25 (95% confidence interval [CI], 24–26) per 1,000 children < 5 years of age during 2005–2011.[7] However, this was a retrospective study that relied upon hospital discharge diagnoses. Another study conducted in central China showed that during 2010–2012 the annual influenza-associated severe acute respiratory infection (SARI) rate was approximately 22 per 1,000 children < 5 years of age.[8] This estimate did not account for healthcare utilization patterns, such as the proportion of the population within the study hospitals' catchment area who sought care in nonstudy hospitals. Data on influenza-associated SARI hospitalizations in young children in China within the past 5 years are lacking. Updated, prospectively collected data that account for healthcare utilization behavior to estimate influenza disease burden would contribute to new influenza vaccine technical guidelines, seasonal influenza vaccine program cost-effectiveness analyses and targeted seasonal influenza vaccine promotion in this high-risk group.

Previous surveillance data have demonstrated that Suzhou often experiences 2 influenza seasons each year: a winter influenza season that usually begins in December and lasts until April, and a summer influenza season from July to September.[9] In this study, we combined prospective hospital-based influenza surveillance following the national year-round surveillance period that begins in October[10] with healthcare utilization survey data[11] to estimate and characterize the burden of influenza-associated SARI hospitalizations in Suzhou in children < 5 years of age from October 2011 to September 2016.

METHODS AND MATERIALS

Study Site

This study was conducted in Suzhou, a city with a population of approximately 12 million people, located in Jiangsu Province, southeast China. Suzhou consists of 5 municipal districts and 5 county-level cities. Suzhou University–Affiliated Children's Hospital (SCH), located in the municipal district of Gusu, is the only tertiary children's hospital in Suzhou. We defined the catchment area of SCH as the 5 municipal districts using previously reported methods.[11] In brief, we determined the catchment area of SCH by reviewing the records of enrolled SARI patients from influenza surveillance in children younger than 5 years of age at SCH during April 2011 to March 2013; 67.2% of SARI patients who sought care at SCH lived within Suzhou's 5 municipal districts. We defined these districts as SCH's catchment area. Children included in the burden estimation were those who resided in a district within the defined SCH catchment area for at least the past 6 months.

We also reviewed the discharge records for all healthcare facilities that provided inpatient services in Suzhou City in 2011. The proportion of all-cause pediatric admissions to SCH among the total pediatric admissions for children < 5 years of age within the catchment area was 67.7%. We assume our study also captured 67.7% of all SARI patients < 5 years of age in the catchment area.

SARI Surveillance

Children were eligible for inclusion in SARI surveillance if they were younger than 5 years of age and presented to SCH with a SARI episode defined as the presence of fever (measured axillary temperature ≥ 38°C) and cough or sore throat/inflamed or red pharynx in the 7 days preceding hospitalization. We conducted daily surveillance in the respiratory department, which admitted a large proportion of SARI patients in SCH. In all other nonrespiratory medical wards, we screened SARI patients 1 day every month and obtained the total number of admissions for the wards for the entire month from the hospital information section. To identify SARI patients in the PICU, we conducted an annual review of discharge records and used the criteria described above to identify SARI patients from these records (Fig. 1). In the respiratory department, trained physicians collected nasopharyngeal aspirates within 24 hours of admission from all eligible SARI patients whose parents/guardians provided verbal informed consent. Specimens were transported every 2 days to the National Influenza Surveillance Network Laboratory of Suzhou CDC according to the standard national influenza surveillance protocol. Viral RNA was extracted using High Pure Viral RNA Kits (Roche, Shanghai, China), according to the manufacturer's instructions. For influenza virus testing, we performed real-time reverse transcription polymerase chain reaction using influenza virus A/B dual fluorescent quantitative RT-PCR kits (BioPerfectus Technology Co., Jiangsu, China). Influenza A virus subtyping identification was performed using influenza A virus seasonal H1N1, H3N2 and H1N1pdm09 real-time RT-PCR kit (ZJ Bio-Tech Co., Shanghai, China). Influenza epidemic periods were defined as months when the proportion of samples testing positive for influenza exceeded 10%.[12]

Estimating the Number of Influenza-associated SARI Patients in the Respiratory Department and PICU

The year-round daily SARI surveillance aimed to screen, enroll and collect respiratory specimens from all eligible SARI patients in the respiratory department, including screening of patients admitted during the weekend. SARI patients in the PICU were identified through record review as described above. For the burden calculations, we removed PICU SARI patients who had already been enrolled as SARI patients from the respiratory ward surveillance. Among respiratory department SARI patients with no respiratory specimens collected and SARI patients admitted to the PICU, we assumed that the proportion of influenza infections ($p1_m$) was the same as among SARI patients from the respiratory department with respiratory specimens collected and tested every month. Therefore, the estimated number of influenza-associated SARI patients in the respiratory department ($n1_m$) and the PICU ($n2_m$) each month were:

$$n1_m = \text{total number of eiligible SARI patients in the respiratory department in month} \times p1_m$$

$$n2_m = \text{total number of eiligible SARI patients in the PICU in month} \times p1_m$$

and

$$p1_m = \frac{\text{number of influenza positive SARI patients in month}}{\text{total number of SARI patients tested for influenza virus in month}}$$

The number of annual influenza-associated SARI patients admitted to the respiratory department or PICU was calculated by adding the monthly values ($n1_m$ or $n2_m$) from October of one year to September of the next year.

Estimating the Number of Influenza-associated SARI Patients in Nonrespiratory Medical Wards

One day each month, we screened all inpatients in nonrespiratory medical wards by chart review to identify SARI patients hospitalized in nonrespiratory medical wards. We also obtained the total number of admissions to these wards on that day, and we calculated the proportion of SARI patients among admissions to each medical ward ($p2_i$) for our review day, as:

$$p2_i = \frac{\text{number of SARI patients in each medical ward on review day}}{\text{total number of inpatients in each medical ward on review day}}$$

For each month, we assumed the proportion of SARI patients among all hospitalized patients in each medical ward was the same as the proportion calculated on our review day. We obtained the monthly total number of admissions for nonrespiratory medical wards from

the hospital information system, and estimated the total number of SARI patients from nonrespiratory medical wards (t) for each month as:

$$t = \sum(\text{total number of inpatients in each medical ward of the month} \times p2_i)$$

We assumed that the proportion of influenza-positive cases among SARI patients from nonrespiratory medical wards was the same as the proportion of influenza-positive cases among SARI patients from the respiratory department. The total number of influenza-associated SARI patients from nonrespiratory medical wards ($n3_m$) each month was estimated as: $n3_m = t \times p1_m$. Annual influenza-associated SARI patients admitted to nonrespiratory medical wards were calculated by adding the monthly values ($n3_m$) from October of one year to September of the next year.

Population Data from Catchment Area

Annual population estimates for the following age groups (0—5, 6—23, 24—59 months) were obtained from the Suzhou Center for Disease Control and Prevention (Suzhou CDC) immunization program database, which covers all residents within these age groups living in Suzhou. For each year, the population of children < 5 years of age living in the catchment area (P_N) was calculated as:

$$\mathbf{P}_N = \sum(\text{the total population of each age group}$$

Estimating Influenza-associated SARI Hospitalization Rates

The total influenza-associated SARI patients (N) in SCH were the influenza-associated SARI patients in the PICU, respiratory and nonrespiratory departments ($N = \Sigma\, n1_m + \Sigma\, n2_m + \Sigma\, n3_m$).

The total number of influenza-associated SARI patients (N) in the catchment area (C_N) was calculated as:

$$C_N = N \times \frac{1}{67.7\,\%}$$

The estimated influenza-associated SARI hospitalization rate (R) was calculated as:

$$\mathbf{R} = \frac{C_N}{\mathbf{P}_N} \times 1000$$

We calculated the pooled rate across a national surveillance year for all ages as an average rate across the season. We calculated 95% CIs using binomial distributions which account for the variance in each of the multipliers.[13]

Estimating Influenza-associated SARI Hospitalization Rates by Influenza Types and Subtypes

The estimated influenza-associated SARI hospitalization rates caused by different influenza virus was calculated as:

$$\mathbf{R}_{\mathrm{H1N1}} = \frac{\text{the number of H1N1pdm09 postive patients}}{\text{total number of influenza positive patients}} \times \mathbf{R}$$

$$\mathbf{R}_{\mathrm{H3N2}} = \frac{\text{the number of H3N2 postive patients}}{\text{total number of influenza positive patients}} \times \mathbf{R}$$

$$\mathbf{R}_{\mathrm{B}} = \frac{\text{the number of influenza B postive patients}}{\text{total number of influenza positive patients}} \times \mathbf{R}$$

Ethics Statement

This study was approved by the Institutional Review Board (IRB) of the School of Public Health, Fudan University (reference: #IRB#2010-09-0237) and received a non-research determination from the US Centers for Disease Control and Prevention (CDC).

RESULTS

General Characteristics of SARI Patients

From October 2011 to September 2016, we enrolled 3,125 children younger than 5 years of age who were admitted to the respiratory department with SARI, of which 2,297 (73.5%) were sampled and tested for influenza virus. During this period, there were 998 SARI patients identified in the PICU, and we estimated 21,304 SARI patients were hospitalized on nonrespiratory medical wards (Fig. 1, Table 1).

Among 3,125 SARI patients from the respiratory department, 1,851 (59%) were male; 447 (14%) were < 6 months of age, 1,458 (47%) were 6 months – 23 months of age and 1,216 (39%) were 24 months – 59 months of age. 2,407 (77%) had radiographically confirmed pneumonia, 222 (7%) had sinusitis, and 8% had some other complication such as septicemia, febrile convulsions and impaired liver function. Only 5 (0.2%) received oxygen treatment and 28 (0.9%) were referred to the PICU.

Virologic Surveillance and Seasonality of Influenza

From October 2011 to September 2016, we collected and tested 2,297 nasopharyngeal aspirates for influenza virus from SARI patients admitted to SCH's respiratory department. Among these, 259 were laboratory-confirmed influenza virus infections, (11%; 95% CI, 10–13) (Table 2). The proportion of SARI patients testing positive for influenza varied by season and was 19% (95% CI, 15–22%) (103/551) during October 2011 to September 2012, 6% (95% CI, 3–8%) (24/429) during October 2012 to September 2013, 14% (95% CI, 10–17%) (59/436) during October 2013 to September 2014, 8% (95% CI, 5–10%) (33/439)

during October 2014 to September 2015, and 9% (95% CI, 6–12%) (40/442) during October 2015 to September 2016 (Fig. 2).

Influenza A/H3N2 virus was predominant in the 2011–2012 season (59% of all influenza-positive specimens), the 2013–2014 season (71%) and the 2014–2015 season (55%). Influenza B virus and influenza A/H1N1pdm09 virus were co-circulating in the 2012–2013 season (46% and 42% of all influenza-positive specimens). During the 2015–2016 season, 50% of the influenza-positive specimens were influenza A/H1N1pdm09 virus, while 50% were influenza B virus (Table 2).

During our study period, there were 1 or 2 influenza epidemic periods per year in Suzhou. During the 2011–2012 season, the first epidemic period was from December 2011 to March 2012, and the second was from July to August 2012. During the 2012–2013 season, the epidemic periods were from November 2012 to January 2013 and from March to May 2013. During the 2013–2014 season, the epidemic periods were from October 2013 to February 2014 and July to August 2014. During the 2014–2015 season, the epidemic periods were from February to April 2015 and from July to August 2015. During the 2015–2016 season, only 1 long epidemic period was observed from January to May 2016 (Fig. 2).

Estimated Influenza-associated SARI Hospitalizations

From 2011 to 2016, the estimated annual influenza-associated SARI hospitalization rate per 1,000 children < 5 years of age was 7 (95% CI, 6–7). The season-specific estimates were 16 (95% CI, 14–19) during the 2011–2012 seasons; 4 (95% CI, 2–5) in the 2012–2013 season; 7 (95% CI, 6–9) in the 2013–2014 season; 4 (95% CI, 3–5) in the 2014–2015 season; and 5 (95% CI, 4–6) in the 2015–2016 season (Table 3). The annual rate of influenza-related SARI was the highest in the 2011–2012 season when the predominant virus circulating was influenza A/H3N2 (Fig. 3). The age-specific influenza-associated SARI hospitalization rates over the 5-year period were 11 (95% CI, 8–15) per 1,000 children 0–5 months of age; 8 (95% CI, 7–10) per 1,000 children 6–23 months of age; and 5 (95% CI, 4–5) per 1,000 children 24–59 months of age (Fig. 4).

DISCUSSION

This study demonstrates that influenza virus infection is an important contributor to hospitalizations in children < 5 years of age in Suzhou, China. The highest rates of influenza-associated hospitalizations were in children < 6 months of age. The substantial burden of influenza-associated hospitalizations in children < 5 years of age in Suzhou suggests the value of influenza prevention and control measures targeting this age group.

The average estimated influenza-associated SARI hospitalization rate of 7 (95% CI, 6–7) per 1,000 children < 5 years of age from 2011 to 2016 was higher than the hospitalization rates described in other areas such as Rwanda (1.7 per 1,000 children < 5 years of age) during 2012–2014,[14] Zambia (1.9 per 1,000 children < 5 years of age) during 2011–2014[15] and Central America (1.1 per 1,000 children < 5 years of age) during 2009–2012.[16] The higher rate may, in part, be explained by differences in health utilization practices. Children in low-income settings may not be hospitalized for acute respiratory illness as often as children in

more developed settings. In addition, the high population density of Suzhou City may contribute to higher influenza-associated SARI hospitalization rates. Seasonal variation likely also contributes to different influenza-associated SARI hospitalization rates.

The overall hospitalization rate in our study was 3-fold lower than that observed in a study in Jinzhou, China, which estimated 22 influenza-associated hospitalizations per 1,000 children less than 5 years of age during 2010–2012. However, when comparing findings between the 2 studies just for the 2011–2012 season, the influenza-associated SARI hospitalization rates among children < 5 years of age were similar; in our study, it was 16 per 1,000 children < 5 years of age and in the Jinzhou study it was 23 per 1,000 children < 5 years of age, suggesting that the difference in the overall finding between the studies may be explained, in part, by seasonal and regional variation in influenza activity. Indeed, in our study, the substantial differences in hospitalization rates over the 5-year study period (16 per 1,000 children < 5 years at the highest to 4 per 1,000 children < 5 years at the lowest) further highlight the variability in influenza activity and associated severity of illness by season.[17]

The differences in the circulating influenza virus subtypes from season to season may contribute to different hospitalization rates over the 5 study years. During our study from 2011 to 2016, rates of influenza-associated hospitalization in children < 5 years of age were higher in seasons where the influenza A/H3N2 virus was the predominant circulating virus. Our findings were similar to studies in the United States[18] and Spain,[19] which also demonstrated that influenza A/H3N2 may cause more hospitalizations than other influenza virus types/subtypes in children < 5 years of age. Another study in Jinzhou, China, found higher rates of hospitalization associated with influenza B compared with influenza A/H3N2 in children < 5 years of age during 2011–2012,[8] suggesting that circulating strains may have different characteristics across regions in China.[20]

In our study, younger children, especially those less than 6 months, had the highest influenza-associated hospitalization rates in all age groups in 3 of the 5 study seasons. The highest influenza-associated SARI hospitalization rate (26 per 1,000 persons) occurred in children < 6 months when influenza A/H3N2 was predominant during 2011–2012, while the lowest hospitalization rate (2 per 1,000 person) also occurred in the youngest age group during 2012–2013, when influenza B predominated. These results demonstrate that influenza infection can result in a substantial hospitalization burden in children < 6 months of age, and that burden varies by circulating influenza subtype. While our findings suggest the importance of targeting influenza prevention measures in young children, according to the Suzhou Planning Immunization Platform, in 2011 the influenza vaccination rate of registered children less than 6 years old was 11.3%, while the rate in children 6–23 months of age was even lower at 4.6%.[21] Influenza vaccines are not licensed for use in children < 6 months of age. Low influenza vaccine coverage in Suzhou is in part because seasonal influenza vaccine, a category 2 vaccine in China, is not within the national immunization program, and recipients must request and pay for the vaccine (at 10–15 USD). Increasing influenza vaccination coverage among young children in Suzhou would reduce influenza-associated hospitalizations in this age group, while immunizing pregnant women and caregivers of children < 6 months would reduce influenza-associated hospitalizations among young infants.

Our study has several limitations. First, although we selected Suzhou's only tertiary care children's hospital as our surveillance site to estimate influenza-associated SARI hospitalizations, there are other general hospitals in Suzhou where approximately 32% children seek inpatient care. We were not able to compare the characteristics of children who seek care in the study hospital with those who seek care in other hospitals, and this may have decreased the accuracy of our influenza-associated SARI hospitalization estimate. Given China's size and its distinct seasonality patterns across regions, findings from this study may not be generalizable to other areas of China.[20] Second, in our study, we assumed that the influenza illness rate among SARI patients admitted to nonrespiratory medical wards was the same as the influenza infection rate among SARI patients in the respiratory department. The proportion of patients testing positive for influenza in the respiratory wards might be higher than the other wards, even among SARI cases. Therefore, this assumption may have overestimated the influenza-associated hospitalization rates. Further, in our study, we systematically tested SARI patients for influenza virus only, and therefore we did not identify patients who were co-infected with influenza and other respiratory pathogens. In addition, we only screened for SARI patients in the 5 nonrespiratory medical wards on 1 day each month to estimate the number of SARI patients for the entire month; not having exact SARI case numbers from the nonrespiratory medical wards also decreased the accuracy of our estimates, given that the estimated number of SARI patients in the other medical wards was larger than the total number of SARI patients identified in the respiratory ward. Third, due to multiple reasons, including parental refusal for sample collection, and reluctance of physicians to collect specimens after initiation of antiviral treatment, we only collected respiratory specimens on 74% of SARI patients identified in the respiratory ward. It is possible that the proportion of influenza-positive cases among SARI patients not tested was different than among tested patients. Finally, our enrollment criteria may have underestimated the influenza-associated hospitalization rates among infants; as many as 5% of young children with influenza might not present with fever, and 10% might not present with both fever and cough.[2] Thus, the burden of influenza-associated SARI hospitalizations among young children presented here is only a subset of the entire severe influenza illness disease burden in this age group.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention

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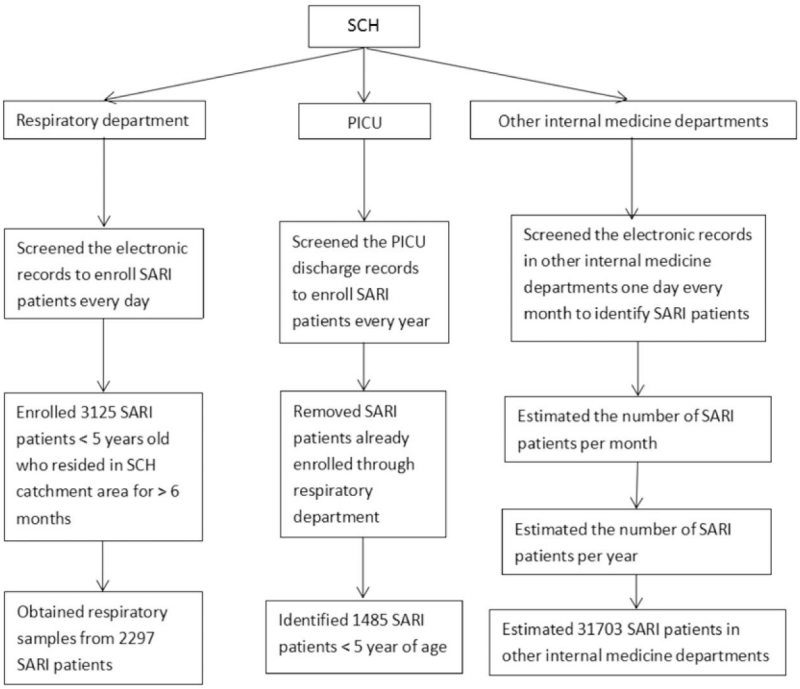

FIGURE 1.
Screening and enrollment of SARI patients in SCH, 2011–2016.

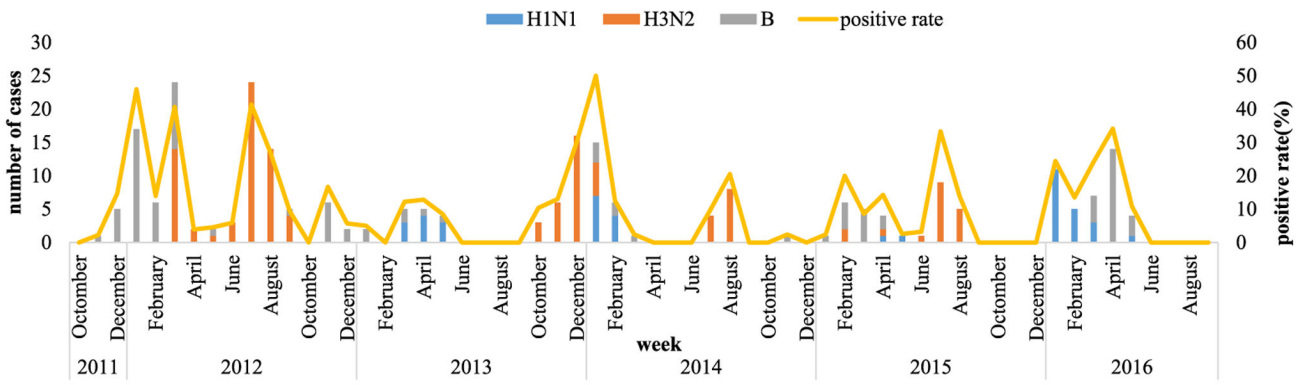

FIGURE 2.

Seasonal distribution of enrolled SARI patients positive for influenza in children younger than 5 years of age in SCH, 2011–2016.

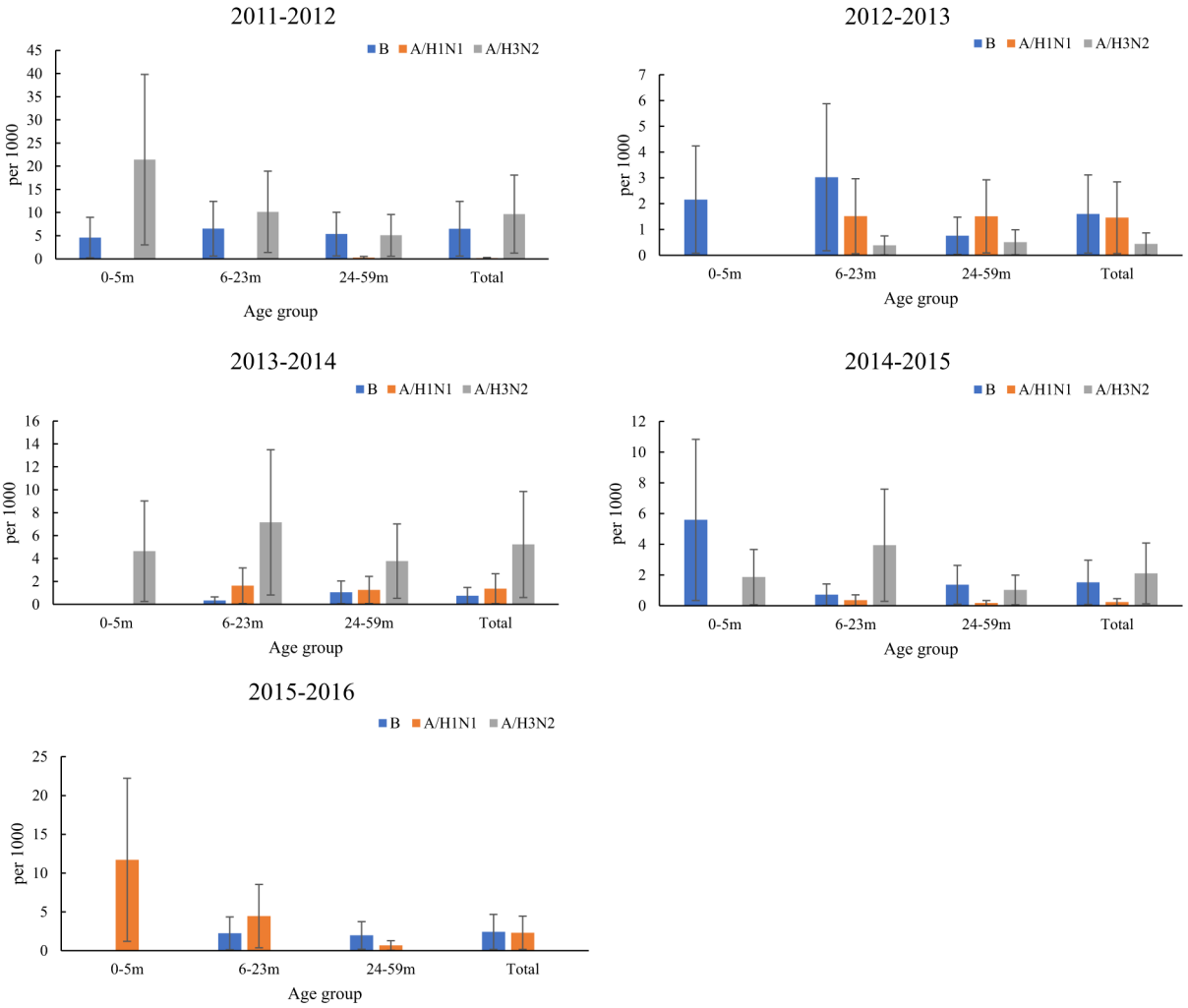

FIGURE 3.

Estimated influenza-associated SARI hospitalization rates (brackets represent 95% CIs) by age group and by influenza virus type and subtype from October 2011 to September 2016.

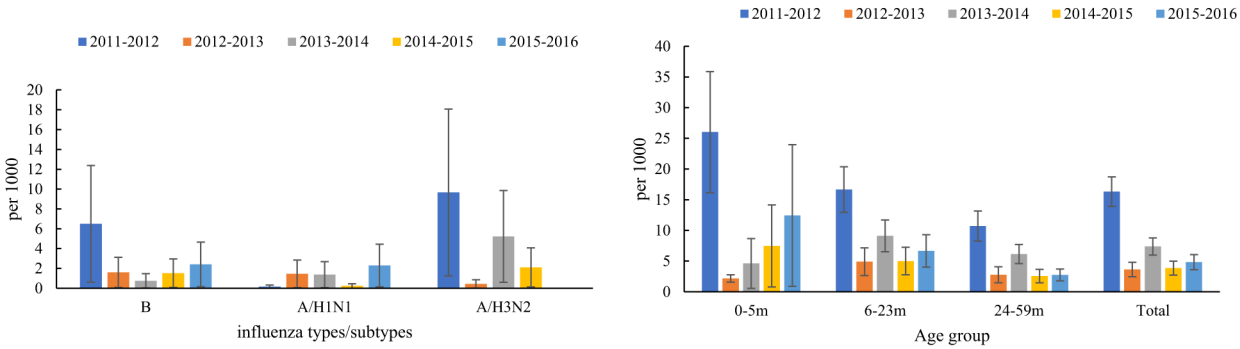

FIGURE 4.

Estimated influenza-associated SARI hospitalization rates (brackets represent 95% CIs) by age group and by influenza types/subtypes, 2011–2016.

TABLE 1.

Number of Inpatients and Identified SARI Patients Younger Than 5 Years of Age at SCH From 2011 to 2016

	Respiratory Department		PICU		Nonrespiratory Medical Wards	
Age Group (mo)	**Inpatients**	**SARI**	**Inpatients**	**SARI**	**Inpatients**	**SARI**
2011–2012						
0–5	1996	151	279	97	5430	1101
6–23	2058	328	232	91	3475	1406
24–59	1449	283	177	63	4352	1937
Total	5503	762	688	251	13257	4444
2012–2013						
0–5	1609	87	256	79	5374	1077
6–23	2048	272	211	72	4452	1761
24–59	1591	217	111	35	4456	1529
Total	5248	576	578	185	14282	4367
2013–2014						
0–5	1666	82	190	68	4478	809
6–23	2070	344	172	81	4527	1792
24–59	1193	244	115	40	3559	1310
Total	4929	670	477	189	12564	3910
2014–2015						
0–5	1849	81	296	110	4709	1012
6–23	1761	267	225	82	4131	1851
24–59	1116	197	130	46	3467	1343
Total	4726	545	651	238	12307	4207
2015–2016						
0–5	1351	46	234	63	4753	1145
6–23	1697	247	152	53	3990	1837
24–59	1398	275	102	18	3608	1396
Total	4446	568	488	134	12351	4377
2011–2016						
0–5	8471	447	1255	416	24744	5145

	Respiratory Department		PICU		Nonrespiratory Medical Wards	
Age Group (mo)	Inpatients	SARI	Inpatients	SARI	Inpatients	SARI
6–23	9634	1459	992	379	20575	8645
24–59	6747	1219	635	203	19442	7515
Total	24852	3125	2882	998	64761	21304

SARI, defined as fever (measured axillary temperature ≥ 38°C) and cough or sore throat/inflamed or red pharynx in the past 7 days that required hospitalization.

TABLE 2.

Number of SARI Patients in Children Younger Than 5 Years of Age Tested for Influenza, Number and Percent Positive Overall and by Influenza Subtype, Suzhou Children's Hospital, 2011–2016

Season	Sampled SARI Patients (%) (95% CI)	Influenza-positive SARI Patients		A/H3N2		A/H1N1pdm09		B	
		N	% (95% CI)	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)
2011–2012	551 (507–595)	103 (19)	19 (15–22)	61	11 (1–22)	1	0.1 (0.8–0.4)	41	8 (0.7–14.2)
2012–2013	429 (390–468)	24 (6)	6 (3–8)	3	0.7 (0.0–1.4)	10	2 (0.1–4.6)	11	3 (0.1–5.5)
2013–2014	436 (397–475)	59 (14)	14 (10–17)	42	10 (1–18)	11	2.5 (0.1–4.9)	6	1 (0.8–2.7)
2014–2015	439 (400–478)	33 (8)	8 (5–10)	18	4 (0.2–8.0)	2	0.4 (0.6–0.9)	13	3 (0.1–5.8)
2015–2016	442 (403–481)	40 (9)	9 (6–12)	0	0 (0–0)	20	5 (0.3–9.2)	20	5 (0.3–9.2)
Total	2297 (2208–2386)	259 (11)	11 (10–13)	124	5 (0.4–11.4)	44	2 (0.1–3.8)	91	4 (0.2–7.8)

TABLE 3.

Estimated Influenza-associated SARI Hospitalizations in Children Younger Than 5 Years of Age in Suzhou, 2011–2016 (Influenza-positive Rate Based on SCH)

Age Group (mo)	Age-specific Population in SCH's Catchment Area	Identified SARI Patients in Children Younger Than 5 Years of Age at SCH	Influenza-associated SARI Patients	Estimated Hospitalization Rate of Influenza-associated SARI in Suzhou (per 1,000 Person) (95% CI)
2011–2012				
0–5	11610	1349	203 (126–280)	26 (16–36)
6–23	31259	1825	350 (272–428)	17 (13–20)
24–59	64836	2283	466 (359–573)	11 (8–13)
Total	93394	5457	1024 (873–1175)	16 (14–19)
2012–2013				
0–5	12439	1243	18 (13–49)	2 (2–6)
6–23	39481	2105	130 (70–191)	5 (3–7)
24–59	70428	1781	131 (69–192)	3 (1–4)
Total	122348	5128	298 (200–396)	4 (2–5)
2013–2014				
0–5	10990	959	34 (4–73)	5 (1–10)
6–23	44127	2217	270 (193–347)	9 (6–12)
24–59	76046	1594	314 (235–394)	6 (5–8)
Total	131163	4769	650 (526–774)	7 (6–9)
2014–2015				
0–5	13349	1203	67 (7–127)	7 (1–14)
6–23	43760	2200	147 (81–213)	5 (3–7)
24–59	87759	1586	151 (86–215)	3 (1–4)
Total	144868	4990	375 (265–486)	4 (3–5)
2015–2016				
0–5	13288	1254	111 (8–213)	12 (1–24)
6–23	43562	2137	195 (118–272)	7 (4–9)
24–59	92052	1689	169 (109–229)	3 (2–4)
Total	148902	5079	483 (361–606)	5 (4–6)

Age Group (mo)	Age-specific Population in SCH's Catchment Area	Identified SARI Patients in Children Younger Than 5 Years of Age at SCH	Influenza-associated SARI Patients	Estimated Hospitalization Rate of Influenza-associated SARI in Suzhou (per 1,000 Person) (95% CI)
2011–2016				
0–5	61676	6008	470 (321–620)	11 (8–15)
6–23	202189	10483	1149 (981–1317)	8 (7–10)
24–59	376810	8937	1208 (1036–1379)	5 (4–5)
Total	640675	25427	2908 (2624–3192)	7 (6–7)