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ORIGINAL ARTICLE

Incidence of respiratory viral infections and associated factors among children attending a public kindergarten in Taipei City

Chun-Yi Lu, Li-Min Huang, Tsui-Yien Fan, A-Ling Cheng, Luan-Yin Chang*

Departments of Pediatrics, National Taiwan University Hospital, College of Medicine, National Taiwan University, Taipei, Taiwan

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KEYWORDS

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Background: Kindergarteners frequently encounter various infectious diseases, so surveillance of viral infectious diseases would provide information for their health promotion.

Methods: We enrolled kindergarten attendees, age 2–5 years, during the academic years of 2006 and 2007 in a Taipei City kindergarten. Daily monitoring of illness and regular biweekly physical examinations were undertaken. Multiple infections were defined as one child having two or more laboratory-confirmed viral infections with different viruses or different serotypes during one academic year.

Results: The overall laboratory-confirmed incidence rate of respiratory viral infection was 239 per 100 person–years in the 2006 academic year and 136 per 100 person–years in the 2007 academic year. The attack rate for seasonal influenza was 17% in the 2006 academic year and 27% in the 2007 academic year. Boys and children with allergies had significantly higher risks to get multiple viral infections [odds ratio (OR) 1.81, 95% confidence interval (CI) 1.20–2.75; OR 1.56, 95% CI 1.00–2.39, respectively]. Boys also tended to get enterovirus infections (OR 1.56, 95% CI 1.02–2.38) while children with allergies tended to acquire adenovirus infections (OR 1.71, 95% CI 1.12–2.66).

Conclusion: Boys and children with allergies were more susceptible to multiple viral infections, so they should be more cautious about viral infections.

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Conflicts of interest: There were neither financial ties to products nor potential/perceived conflicts of interest in the study.

* Corresponding author. 8, Chung Shan South Road, Taipei 10041, Taiwan.

E-mail address: lychang@ntu.edu.tw (L.-Y. Chang).

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Introduction

Viral infection is extremely common among young children,^{1–4} who have not developed the necessary protective immunities.⁵ In the USA, approximately 25 million patients with upper respiratory tract infection are treated in the outpatient medical care setting annually.¹ In a survey among Canadian toddlers, the average proportion of time with colds, diarrhea, or vomiting was 23.4% during fall and winter.²

Children get infections whether or not they attend child care centers or kindergartens. However, children in child care centers or kindergartens tend to get more infections than children who are cared for in their own homes.^{3,4} Day-care or kindergarten attendance was associated with a significantly increased risk of both upper respiratory tract infection and acute ear infection for children younger than 5 years³ and children cared for at daycare or kindergartens exhibited a 2–3 times greater risk of acquiring infections.⁴ In addition to immature immune system,⁵ children in group settings come in contact with many children, share toys and touch each other during play, so they have a much greater chance of getting an infection from another child or toys. Furthermore, many children have not yet learned how to use the toilet properly or the importance of hand-washing.

Despite the above-mentioned facts, there is growing use of daycare and preschool education nowadays. We thus investigated and monitored respiratory viral infectious diseases among kindergarten attendees to estimate the incidence rates and determine the risk factors associated with viral infections among them. We hope that the results will provide information to set up the strategy on the prevention of respiratory viral infections among preschool children.

Methods

Study area and study population

In Taipei City, the population was about 2,629,000 people with 137,479 preschool children during our study period (September 2006 to June 2008). We enrolled children from one public kindergarten in Taipei city. There were six classes: one class for 2-year-old children, two for 3-year-old children, two for 4-year-old children, and one for 5-year-old children. Each class had 20–35 preschool children. Overall, there were 193 kindergarten attendees during the 2006 academic year (from September 2006 to June 2007) and 202 kindergarten attendees during the 2007 academic year (from September 2007 to June 2008).

After written informed consent was obtained from parents or guardians, the parents or guardians completed self-administered questionnaires on behalf of their children in the beginning of the academic year. The questionnaires sought information about the child's age, sex, past medical history and vaccination history. A history of allergic conditions, such as atopic dermatitis, asthma, allergic rhinitis, and allergic conjunctivitis was also solicited. Study nurses would check the questionnaire later, verified the contents, and did a telephone interview to complete it if essential data were missing.

Ethical consideration

The institutional review board of National Taiwan University Hospital approved this study and the education bureau of Taipei City agreed to this study. When the academic year began, pediatricians and study nurses would meet with guardians or parents of the kindergarten attendees and would explain the purpose, the methods, the potential benefit of this study and the discomfort of sampling. Guardians or parents of the kindergarten attendees gave their written informed consent after the meeting. We gave the results of the viral workup to the guardians or parents of the kindergarten attendees but did not provide any treatment for children found infected by viruses.

Data collection

In this public kindergarten, a full-time nurse was responsible for measurement of participating children's daily body temperature by infrared tympanic thermometers, examination for signs of oral ulcer and/or viral exanthema and aseptic care of their trauma. If any child had fever, respiratory symptoms such as cough, rhinorrhea and wheeze, enterovirus-like illness such as herpangina or hand, foot, and mouth disease or viral exanthema, study nurses from National Taiwan University Hospital would take throat swabs from the ill children for viral isolation and specific polymerase chain reaction (PCR). Fever was defined as ear temperature over 38°C.

Pediatricians from National Taiwan University Hospital did physical examinations for every participating child once every 2 weeks. If there were abnormal physical signs such as fever, injected throat, exudate of the tonsil, congested eardrum, oral ulcer, skin rash, or abnormal breathing sounds, the abnormal physical signs would be recorded and appropriate swabs would be taken for viral isolation and real-time PCR for specific viruses such as enteroviruses, adenovirus, and influenza virus. If group A streptococcal tonsillitis was suspected, bacterial culture of the throat swabs would be performed. Because the winter vacation was in February and the summer vacation in July and August, we did not monitor their viral infections in February, July, and August.

Overall, there were 35 instances of regular clinical examination by pediatricians and 81 study nurse visits which were for taking samples from ill children during the 2 years of the study. A total of 2335 swabs including 2299 throat swabs, 11 rectal swabs, 11 conjunctival swabs, two nasopharyngeal swabs for viral isolation and PCR, and 12 throat swabs for group A streptococcal screen were sampled during the 2 years of the study. All the samples with appropriate transport medium were transported to the labs of National Taiwan University, and viral isolation and PCR were performed on the day of collection.

Laboratory methods

Throat swabs, rectal swabs, conjunctival swabs, or nasopharyngeal swabs were submitted for virus isolation to the virology laboratory of National Taiwan University Hospital.

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