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Assessing scarlet fever re-emergence from notifiable disease surveillance in Hong Kong

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Objective

This study examined the epidemiology of scarlet fever in Hong Kong based on notifiable disease surveillance data, in a period where a 10-fold upsurge in scarlet fever incidence occurred. High risk groups and important factors associated with scarlet fever transmission were identified.

Introduction

Scarlet fever is a notifiable disease in Hong Kong for over 40 years. There was relatively low activity of scarlet fever until an outbreak in mid-2011 which resulted in two deaths and more than 1,500 cases. Scarlet fever incidence remained elevated since then with >10-fold increase comparing to that before the upsurge (1, 2). Reemergence of scarlet fever was also reported in China in 2011 and the United Kingdom in 2014 (3). We analyzed the patterns in scarlet fever incidence in Hong Kong using the notifiable disease surveillance data from 2005–2015.

Methods

We analyzed 7,266 scarlet fever cases aged 14y or younger from 2005-2015, who were notified to the Department of Health. Hierarchical multivariable negative binomial models were fitted to the data to study the effects of age, sex, school holidays, and other meteorological parameters, accounting for autocorrelation, seasonal and long-term trend. Separate models were fitted to the data before and after the upsurge in 2011, excluding data in 2011 to allow for a 1-year window period.

Results

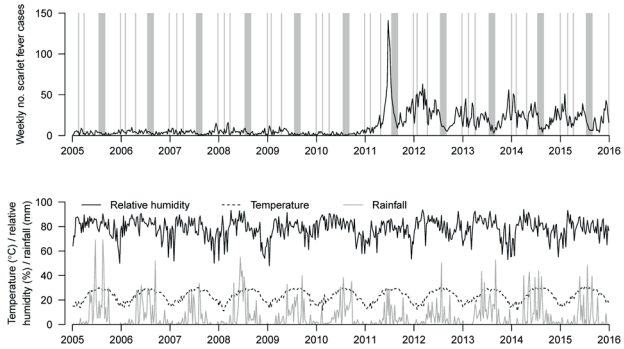
We observed seasonal pattern throughout the study period (Figure). Among children aged ≤5y, the average scarlet fever incidence was 3.3 per 10,000 children in 2005-2010, which increased substantially to 18.1 per 10,000 children in 2012-2015.

The final model included age, sex, school holidays in the preceding week, temperature, relative humidity, rainfall, long-term and bimodal seasonal trend. Based on the model, we identified no significant long-term trend before the upsurge in 2011, but there was a mild decreasing trend of about 8% (95% CI=6-11%) per year after the upsurge. A major peak was identified in December to January, with a milder peak in May to June.

We found that the most affected groups were kindergarten students (3-5y), followed by primary school students (6-11y). Comparing to girls aged 0-2y, boys had significantly higher risk than girls except for the 0-2y age group, and boys aged 3-5y had the highest risk (adjusted incidence rate ratio (IRR)=1.47, 95% CI=1.32-1.65). School holidays were significantly associated with lower incidence of scarlet fever, with an adjusted IRR of 0.58 (95% CI=0.51–0.65) after the upsurge in 2011. Temperature was found to be negatively associated with scarlet fever incidence (adjusted IRR=0.963, 95% CI=0.940-0.987) after the upsurge.

Conclusions

Our study showed that elevated activity of scarlet fever was sustained for more than 5 years after the upsurge in 2011. We found that younger children who started schools, especially for boys aged 3-5 years, had a higher risk of scarlet fever, and there was significant effect of school holidays in reducing scarlet fever incidence. Combining these findings, school-based control strategy is likely to be effective. Sustained and consistent surveillance of scarlet fever allows continued monitoring of potential change in high risk group to drive updated and effective control strategy.



Weekly number of notified scarlet fever cases, Hong Kong, 2005–2015. Gray bars indicate periods of school holidays (top). Weekly average of temperature, relative humidity, and rainfall (bottom).

Keywords

scarlet fever; re-emergence; children; school holiday

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