



# An outbreak of adult measles by nosocomial transmission in a high vaccination coverage community



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## SUMMARY

**Objectives:** The aims of this study were to determine the mechanism of an outbreak of measles in adults and to provide scientific measures for putting forward a measles elimination program.

**Methods:** We performed a cross-sectional investigation during the measles outbreak to identify a possible communication link.

**Results:** From November 1, 2011 to January 26, 2012, the town reported 11 cases of measles in total. The case study identified an obvious propagation chain, which showed ordered and intimate exposure between cases.

**Conclusions:** Hospital exposure 1–2 weeks before infection with measles was the main cause of the measles outbreak. We must be fully aware of the possibility of nosocomial infection in an outbreak of measles; controlling nosocomial infections is a vital step in the prevention and control of the propagation of measles.

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## 1. Introduction

With the implementation of accelerated measles elimination strategies, including maintaining high coverage rates of measles-containing vaccine (MCV), employing a sensitive and specific disease surveillance system, and responding rapidly to outbreaks, the incidence of measles in Xiaoshan County has decreased drastically. It dropped to the lowest historical level in 2010 (2.82/100 000 population; the incidence was 17.29% that of 2008, which was 16.31/100 000 population), especially for children under 15 years of age. However, measles transmission has not stopped in Zhejiang Province, China.<sup>1</sup> Moreover, the susceptible population now includes infants under 8 months of age who are too young to receive the MCV and adults over 20 years old. This is despite a high MCV coverage rate among children as a result of the expanded program on immunization (EPI); the reported coverage rate for the first MCV dose has been >95% since 1999.<sup>2</sup>

We report a hospital-associated measles outbreak occurring among adults in a community of Xiaoshan County, Zhejiang

Province, China. In this study we sought to identify the source and mode of transmission of measles.

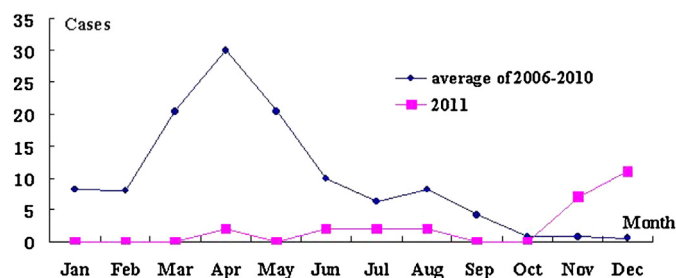
## 2. Methods

All suspected measles cases reported to the Xiaoshan County Center for Disease Control and Prevention from October 15, 2011 to January 15, 2012 were investigated using standard measles case-reporting forms. A suspected case was defined as a person with a rash and a fever of at least 37.5 °C, and with a cough, coryza, or conjunctivitis. The patient's vaccination history was checked by inspecting the registered records in their pediatric health handbooks.

All of the medical institutions in Xiaoshan were asked to enhance surveillance of cases with a fever or rash. Any suspected case was immediately reported and isolated in hospital A; a serum specimen was collected and sent to the Hangzhou Center for Disease Control and Prevention for laboratory diagnosis.

Measles was confirmed in laboratory tests by serum IgM antibody titers. Serum IgM was determined by ELISA. Serological tests were performed at the measles laboratory of the Xiaoshan Center for Disease Control and Prevention, which meets the

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**Figure 1.** Monthly measles incidence in 2011 compared to the average monthly incidence for 2006–2010, Xiaoshan County.

accreditation criteria for World Health Organization (WHO) national measles laboratories.

### 3. Results

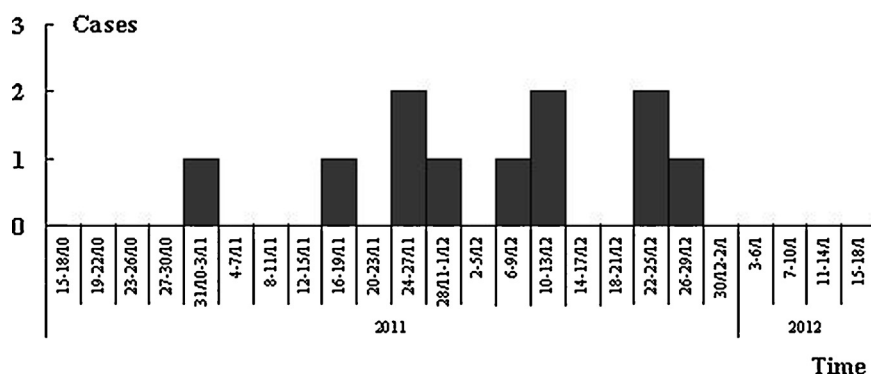
#### 3.1. Measles in Xiaoshan County

In Xiaoshan County, the average monthly incidence of measles in 2006–2010 (4.2–30 cases per 100 000 population) was higher than the monthly measles incidence in 2011 (0–2 cases per 100 000 population) for the months of January to September, and particularly March, April, and May; however in November and December, the incidence in 2011 (7 and 11 cases per 100 000 population, respectively) surpassed the average incidence for 2006–2010 (0.8 and 0.6 cases per 100 000 population, respectively). The monthly measles incidence in 2011 and the average for 2006–2010 are shown in [Figure 1](#).

#### 3.2. Outbreak investigation

On December 5, 2011, the First Hospital of Xiaoshan County (hospital A) reported that two measles cases had presented to the infection department. Both cases lived in the hamlet of Shanlian in the town of Suoqian. After active case investigation of the whole hamlet, a further four cases were identified between November 1 and 28; three of them were laboratory-confirmed by positive serologic test for measles IgM antibody, and the other was a suspected case with a fever accompanied by a maculopapular rash.

Although we took immediate measures to control the epidemic, with isolation of the patients until the 5th day after their rash, surveying the cases with fever or a rash in that hamlet, and providing emergency inoculation, an additional seven measles cases were reported in Suoqian town, with five hamlets involved. No healthcare worker was affected. The distribution of the 11 cases in this outbreak over time is shown in [Figure 2](#). Patient information for the 11 confirmed cases is given in [Table 1](#).



**Figure 2.** Distribution of the measles outbreak cases over time.

#### 3.3. Chain of infection

Using a detailed questionnaire and performing a case study, we found that there was direct or indirect contact among the 11 confirmed cases.

The index case (case A) was taking care of a member of her family who was in hospital (Sir Run Run Shaw Hospital, School of Medicine, Zhejiang University (hospital B)) during early and mid October. She had a fever on November 1 and saw a doctor and was treated with an infusion at Yucai Hospital (hospital C) on November 2, 4, and 6. Case B took his daughter to see the same doctor before or after case A in hospital C on November 6. He was treated with an infusion in hospital C on November 17 and 18. Case C talked with case B for 10 min on November 19. Case D had lunch with case B on November 19, and after measles onset, he underwent infusion treatment in hospital C on December 2 to 4. Case E took her daughter to have infusion treatment at hospital C on November 18, the same day as case B. After measles onset, she had infusion treatment in hospital C from November 29 to December 2. Case F took her son to have infusion treatment in hospital C on December 2 and 3. Case G, the son of case F, had the same situation of exposure, and had infusion treatment for fever in hospital C on December 11. Case H had onset on December 11, and he had infusion treatment in Suoqian Community Health Service Center (hospital D) on December 12 and 14 to 16. Case I had infusion treatment in hospital C on December 10 and 11. Case J had infusion treatment in hospital D on December 14 and 15. Case K visited hospital D on December 15. The contact history and chain of infection are shown in [Figure 3](#).

### 4. Discussion

Measles is an acute, highly contagious disease characterized by fever, malaise, coryza, conjunctivitis, cough, and an erythematous maculopapular rash; it often occurs in explosive epidemics.<sup>3</sup> In most cases, measles is transmitted by direct contact with infectious droplets, but the infection can also sometimes occur without face-to-face contact with a contagious person. Transmission has been demonstrated even when the contagious individual has left the room up to 2 h before the arrival of those subsequently acquiring the infection.<sup>4,5</sup>

We thought this epidemic situation in the town of Suoqian was a local outbreak of measles. Based on the incubation period of measles, the analysis of the chain of infection indicated that it was very likely a nosocomial transmission. Eight of the 10 cases had visited the same hospital, and three of the eight cases were parents who had taken their child to see a doctor. None of them had a well-defined vaccination history (four had a history of zero doses and the other six had an unknown history). We found that the Outpatient infusion rate was above 45% both in hospital C and in hospital D, (the local Government regulation of outpatient infusion rate is less than 30%), and the number of persons infused in the transfusion room reached

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