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Public Health

journal homepage: www.elsevier.com/puhe

Original Research

Accuracy of parent-reported measles-containing vaccination status of children with measles

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ARTICLE INFO

Article history:

Received 9 June 2016

Received in revised form

24 November 2016

Accepted 9 December 2016

Available online 11 January 2017

Keywords:

Measles

Vaccination

Electronic records

Parent recall

China

ABSTRACT

Objectives: The validity of parent-reported measles-containing vaccination history in children with measles has not been assessed. This study evaluated the accuracy of parental recall of measles-containing vaccination histories in Shenzhen, China.

Study design: A retrospective study was performed to compare the data from the electronic records with parental recall. The electronic records were regarded as accurate data about the children's measles-containing vaccination status.

Methods: We collected data from the National Notifiable Diseases Surveillance System and the Immunization Program Information Management System in Shenzhen city, China. Between 2009 and 2014, there were 163 children with measles who had electronic vaccination records; the vaccination status of these cases was reported by the parents in the field epidemiological investigation. We validated parental recall with electronic records.

Results: The agreement between parental recall and electronic records was 78.7%. The kappa value was 0.57. The parent-reported measles-containing vaccination rate was higher than the electronic record (48.5% vs 41.7%, $\chi^2 = 53.64$, $P < 0.001$). The true positive rate for parental recall was 82.4%, and the true negative rate was 75.8%. The positive predictive value was 70.9%, and the negative predictive value was 76.6%.

Conclusions: In children with measles, parental recall slightly overestimated the measles vaccination rate, and the vaccination status recalled by parents was in moderate agreement with the electronic record.

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Introduction

Measles is a highly contagious disease that causes serious illness and many deaths during early childhood in the pre-

immunization era. Due to widespread implementation of a two-dose measles vaccine program which was recommended since 1986 in China, the number of notified cases has dramatically declined, and from 1995 the incidence of measles in China was maintained at about 0.5 per million for 10 years.

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<http://dx.doi.org/10.1016/j.puhe.2016.12.013>

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Nevertheless, measles has continued to spread throughout the country in the following years; since 2005, an increasing trend in the incidence of measles in China had been observed. It was reported that in 2006, 2007, and 2008, the incidence was respectively 0.767, 0.829, 0.995 per million. Among age groups, there were two groups (age lower than 5 and age 20–34) more prone to suffer from measles than others. Low measles vaccine coverage is considered to be the main cause of the increased number of measles cases in China^{1,2}; the population with measles who had a clear history of measles vaccination only accounted for 16.62% of all measles patients. In China, outbreaks also occurred in some communities with high vaccine coverage, as also reported in other countries with high vaccine coverage such as Russia and Israel.^{3,4} The outbreaks of measles among highly vaccinated populations are putatively considered to occur because of vaccine failure.⁵

Information pertaining to measles vaccination in measles patients is important for analysis of risk factors for measles outbreak. The information is also important for assessing measles vaccine effectiveness and evaluating immunization programs and vaccination coverage.

In China, suspected measles cases have been investigated by health workers from local Centers for Disease Control and Prevention (CDC), hospitals, and other health agencies. They would collect vaccination history of children with measles from their parents' recall. The accuracy of parent recall needs to be considered, in case parent-reported vaccination status is inconsistent with young childrens' factual vaccination coverage.^{6,7} The real effectiveness of measles vaccine and the authentic cause of measles outbreak derive from factual measles vaccination coverage. However, estimate of the vaccination coverage may be misled by incorrect parent recall. In China, the accuracy of parental recall of measles vaccination status of measles cases has rarely been reported.⁸ The validity of parental recall of vaccination histories in measles cases has not yet been assessed. An Immunization Program Information Management System (IPIMS) was established in China in 2008. From then, children's vaccination information started to be recorded by the vaccinator into the system, including routine vaccination and supplementary immunization activity. In this study, we compared the parent-reported vaccination histories with the electronic record to assess the accuracy of the parental recall in Shenzhen city.

Methods

Case selection

All measles cases were reported to the National Notifiable Diseases Surveillance System in Shenzhen city. The information of the cases was collected by the health worker who worked in local Centers for Disease Control and Prevention, hospitals, and other medical agencies. They investigated information including the name of the case, name of the parents, address, birthday, disease onset time, gender, vaccination history, and how the vaccination history was obtained (parental recall, vaccination card, or medical record, including the electronic record). We selected the children who have the double history of measles vaccination from parent

recall and IPIMS. Whether one of the selected cases had received measles-containing vaccine was confirmed by the IPIMS. The vaccination status reported by the parents was interpreted as vaccinated, unvaccinated, and unknown. The vaccinated included the children who had either basis or booster immunization. The unknown were classified as the population who lacked the history of measles vaccination from the parent recall and were also excluded. The study was approved by the Medical Ethics Committee of the Guangdong Medical University.

Because the IPIMS began its functioning in 2009 in Shenzhen city, those children less than 8 months were not recorded in it. As a result, those <8 months of age were also excluded.

Analyses

The degree of accuracy was measured by the percentage of parents who were concordant with the electronic record. If both sources indicated that the case had received a measles-containing vaccine regardless of the number of doses or if both sources indicated the child had not been vaccinated, there was an agreement. We calculated the kappa scores for the comparison. We also calculated the positive predictive value as the percentage of the cases reported as vaccinated that were verified with electronic records. The negative predictive value was the percentage of cases reported to be unvaccinated and verified, as in the electronic records.

Statistical differences in vaccination coverage estimates by parental recall and electronic record was assessed with the Pearson Chi-squared test. Subgroup analyses were conducted between the cases that were reported vaccinated/unvaccinated by the parents. The difference of age between two groups was detected by Mann–Whitney U test. A *P* value < 0.05 was considered statistically significant.

Results

The median age of the 163 participants was 1.49 years old (interquartile range: 0.99–3.55) and 111 (68.1%) were males. There were 4978 measles cases notified to the National Notifiable Diseases Surveillance System in Shenzhen city between 2009 and 2015. There were 3258 cases >8 months of age. Of the 3258 cases, 613 (18.82%) had received one or more than single measles-containing vaccine doses, 817 (25.08%) were unvaccinated, and 2032 (62.37%) had an unknown vaccination status. Vaccination status (35.6% [*n* = 1161]) was obtained through parent recall, 321 of which had a vaccination history recorded in the IPIMS. Among the 321 cases, 137 were <8 months of age and 21 parents reported the vaccination status was unknown, which were excluded; 163 cases were included in the final analysis.

Agreement between parental recall and electronic records was 78.7% (the detail shown in the [Table 1](#)). The kappa value was 0.57. According to the electronic records, the measles-containing vaccination rate was 41.7%, which was lower than the coverage rate reported by parental recall (48.5%, $\chi^2 = 53.64$, *P* < 0.001). The true positive rate for the parental recall was 82.4% (56/68), and the true negative rate was 75.8% (72/95). The positive predictive value was 70.9% (56/79), and

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