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In touch but not up-to-date: Ambulatory visits and vaccination status in a cohort of young Swiss children☆

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ABSTRACT

Objective: Incomplete and delayed vaccination is a barrier to individual and population protection from vaccine-preventable diseases. We aimed to assess visit frequency and pattern in relation to vaccination status in a Swiss cohort of 2-year-old children in order to review opportunities for completion of scheduled immunizations.
Method: A retrospective dynamic cohort study design involving children insured with a single health insurer in Switzerland was chosen. Time-to-event analysis was used to evaluate timing of defined immunizations of interest from submitted invoices. Diphtheria, tetanus, acellular pertussis (DTaP) and measles, mumps and rubella (MMR) immunizations administered to children registered with this health insurer were assessed. The specified vaccines are recommended at 2, 4, 6 and 15-24 months, and 12 and 15-24 months of age, respectively.
Results: 21,588 children born between January 1st, 2006 and June 30th, 2008 and registered with the health insurer from no later than 4 weeks of age were included. Only 40.9% of the cohort was up-to-date for both vaccines (DTaP and MMR) at 2 years of age. The average number of visits made during up to 2 years of age was 14.7 (95% CI: 15.9-16.3). Less than 5% of children made fewer than 5 visits, the minimum number required to complete all recommended immunizations by 2 years of age. Although number of visits varied by final vaccination status, more than 90% of the cohort made sufficient visits to complete the specified courses, even when contraindications were assumed to be present at up to half the visits.
Conclusion: Swiss children who are not fully immunized at 2 years of age make fewer visits to ambulatory health care up to that age, but they have more than sufficient opportunities to complete immunizations as scheduled. Ambulatory healthcare providers in Switzerland have ample opportunity to promote and administer vaccinations in a timely manner.

1. Introduction

Immunization is an effective and successful element of population management of vaccine-preventable diseases (VPD) [1,2]. Low vaccination levels result in both inadequate individual protection and herd immunity [1,3]. Delays to immunization are an important factor undermining the success of immunization programmes [4–7]. Incurred at any point in the vaccination process, delays are associated with incomplete immunization later on in life [8] with consequent, suboptimal individual and population protection [4,6,9].

To minimize the impact of VPD on individual patients in the age groups with the highest morbidity and mortality, vaccination programmes are often targeted primarily at infants and young children, leading to an accumulation of vaccine doses in the first 2 years of life in many national schedules [10]. In addition to the optimal schedule from a public health point of view, immunization programmes must also take into account acceptability to practitioners and patients alike [2].

Several separate groups of children who do not receive immunizations on time may exist. There are families with little contact with healthcare services thus not having any opportunities for counselling and immunization. Such suboptimal engagement with healthcare services has been shown to be associated with poor

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and untimely childhood immunization uptake [7,11–14]. There are children with regular contact with healthcare services, but intentionally vaccinated according to an alternative immunization schedule. Today the use of so-called alternative immunization schedules is widespread [15–17], potentially in response to more crowded and complex immunization schedules. Finally there may be children with regular contact with healthcare services, who unintentionally incur delays or miss vaccinations. In general, visits may represent acute contacts, well-child visits or, most likely, a mixture of both. Visits made when a child is acutely sick may not be fully utilized as opportunities for immunization.

We undertook a large scale study in a high-resource setting analyzing statutory health insurance data for children up to 2 years of age to describe ambulatory visit patterns in relation to vaccination status in early childhood. The main objective of the study was to assess ambulatory health care visit frequency and pattern in a Swiss cohort of children in relation to whether children were up-to-date (UTD) for specific vaccines at 2 years of age. Such an analysis may help to identify the proportion of children who did not have sufficient opportunities to complete immunizations with defined vaccines of interest by 2 years of age.

2. Methods

Children born between January 1, 2006 and June 30, 2008 and insured from no later than 4 weeks of age with a single insurer providing statutory healthcare insurance in Switzerland (Helsana insurance group (HI)) were considered. Health insurance data has previously been shown to be a reliable source of information on immunizations in a setting with statutory healthcare insurance [18,19].

For the purposes of this analysis, children were selected from the above cohort if they were at least 25 months old at the end of the observation period on June 30th, 2010. Children were excluded if they died, changed health insurer or if there was erroneous billing of vaccine visit (identical invoices within 10 days of a vaccine visit) before 2 years of age.

Diphtheria, tetanus and acellular pertussis combination vaccines (DTaP1–DTaP4) and measles, mumps and rubella vaccines (MMR1 and MMR2) were defined as the immunizations of interest. In Switzerland, DTaP doses are recommended at 2, 4, 6 and 15-24 months of age, and MMR doses at 12 and 15-24 months. Information for other immunizations was not available from the HI database for this project.

The date of vaccination was calculated from the invoice date for vaccine administration. Age-appropriate immunization was assessed to have taken place if the relevant vaccine dose was administered within 30 days of the recommended age [4,5,7]. Face-to-face visits to office physicians and vaccinations received between 30 days and 760 days of age were also determined from submitted invoices. Specifically, visits during 6-month intervals from 1 month to 25 months of age were evaluated to assess the spread of contacts. Child healthcare in Switzerland is provided by office paediatricians and general practitioners [20] and all ambulatory healthcare services relevant to this study including vaccinations are charged according to a fixed tariff [21].

Time-to-event analysis was used to evaluate immunization status. Statistical analyses were carried out using R Version 2.14.0 (R Foundation for Statistical Computing, Vienna, Austria). Confidence intervals were obtained using the bootstrap percentile method with replacement with a sample size of 80% of all observations and 10,000 samples. As HI has a variable market share in different regions of Switzerland all data presented here are adjusted for this and gender distribution to yield representative Swiss data. As required by Swiss data protection laws all information was fully anonymized at the stage of data extraction.

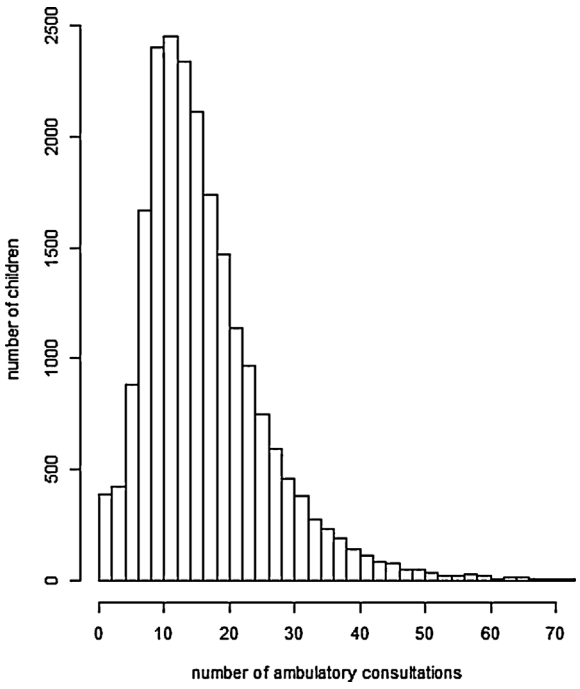

Fig. 1. Overall visits in the first 2 years of life. $n = 21{,}588$ Swiss children insured with single health insurer.

3. Results

3.1. Description of cohort and vaccination status at 25 months of age

For this study, 21,588 children fulfilled the inclusion criteria. Less than 0.01% of administered doses were invalid for both DTaP and MMR immunizations. These were not counted as vaccine doses for subsequent analyses.

At 25 months of age only 8826 children (40.9%) children were UTD for the required 4 DTaP and 2 MMR vaccinations. An additional 32.9% ($n = 7112$) of the cohort had received at least MMR1 and up to and including DTaP3. Of these 2782 (12.9% of cohort) were MMR1 and DTaP4 vaccinated, 2462 (11.4%) MMR2 and DTaP3 vaccinated and 1868 (8.7%) MMR1 and DTaP3 vaccinated. Only 6.6% ($n = 1422$) of the cohort had not received any vaccinations by 25 months of age.

3.2. Cumulative visits during the first 2 years of life and vaccination status

Overall, the mean number of ambulatory visits during the first 25months of life was 14.7 (95% CI: 14.6-14.8) (Fig. 1). Only around 10%of children had very low (<5) or very high (>30) cumulative numbers of visits. Conversely and regardless of immunization status, the majority of children had between 5 and 20 visits during the first 25 months of life.

Cumulative visit frequencies differed by immunization status for DTaP and MMR at 25 months of age (Table 1). Variation was seen when DTaP and MMR status were considered separately, but was even more pronounced when the combined DTaP and MMR status was considered (Table 1 and Fig. 2). Thus, 25 month-olds UTD for both vaccines of interest made a mean of 16.1 visits (95% CI: 15.9-16.3). Children missing one DTaP dose at 25 months of age made 15.9 visits (95% CI: 15.5-16.3), while children missing one DTaP and one MMR dose made 14.6 visits (95% CI: 14.2-15.1).