Author's response to reviews

Title: Vaccination coverage in children can be estimated from health insurance data

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Author's response to reviews: see over
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Author's response to reviews: see over
Dear Doctor Le Good,

Thank you for considering our manuscript for publication in your journal and for the helpful comments of Dr. Gupte which we are happy to include in the amended version. In the following we comment on the reviewer's suggestions.

Introduction:

1. Germany's specific role in vaccination issues
   We now have added a sentence pointing at Germany's specific problems with the implementation of the WHO European Strategic Plan (Introduction paragraph 1)

Methods and results:

1. Differences between Bavarian KV and other states' KVs
   In all German KV's billing for vaccination is coded by specific numbers for the different vaccines and vaccine combinations. Since the codes are not uniform in all KV's some adaptation and adjustment is required if data are combined.

2. Re-registration and restricting children to two visits (includes answers to questions 5 and 8 from methods section)
   Indeed, the selection of eligible children for the denominator is a challenge. We choose this approach – only those children contribute to the denominator who have at least one doctor's visit in the first half year of life and in the second year of life – to avoid problems related to re-registration. This is effective but excludes some children - e.g. those never

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visiting a physician - as described in results, first para. This restriction results in 111,799 compulsory insured children. Compared to the official number of children born in Bavaria in the respective birth years, the reduced KVB dataset yields 78% of Bavaria’s children. The missing 22% could be explained by those children (1) privately insured, (2) who change insurances, (3) who do not consult an outpatient physician in their first six months and in the second year of life and by those (4) moving from Bavaria (see results, first two para). The relative contribution of these subpopulations was estimated from external sources.

Restricting children to those with two visits seems to cover the population of interest widely: AOK data estimate only 1.7% of children never consulting a physician in the first two years of life and 3.1% of children not consulting a physician in both periods.

We have now inserted a new paragraph on this topic in the discussion section (discussion, para 3)

3. costs of national immunisation survey
The cost of a national immunisation survey depends on the precision of the estimate attempted. The national immunisation survey we referred to was carried out by the Institute TNS Healthcare GmbH, Munich, by applying the random digit dialling method.

The costs for the survey are very high, since the low percentage of households with children in the specific birth cohorts have to be found via a ‘random’ first telephone call. In a second telephone call, a team of trained interviewers asked parents to provide the dates of vaccination and vaccine brand names from the relevant pages of the vaccination booklet. Until now we have interviewed children from birth cohorts 1996 to 2004, with a maximum of 500 children per birth year. For example, the present costs for interviews on 500 parents with children born in 2005 and aged 2 years or older add up to 200,000 €.

We have not included this issue in the manuscript.

4. nature of migration
Migration of families occurs in both directions – in and out of Bavaria. This is mentioned in the methods section, data analysis, first para, line 8. Estimates as to how many of the families might move in and out or out and in are not available. Based on a probability of 0.03 to leave Bavaria and probability of 0.02% to move into Bavaria in the first two years of life the probabilities to move back and forth in the time frame is 0.03 * 0.02 = 0.006 assuming that these were independent events. Information from officials indicates that very few families move twice in the first two years of their children’s life (personal communication). Therefore, this issue seems not to be relevant, since the first two years of life are those we analysed in our approach. Nevertheless, it could be possible that children move twice in their first two years of life.

We tried to account for this re-registration issue – which is not only relevant for the migration issue but also for the other points mentioned in the methods, data analysis section (see also point 2) - by restricting our dataset to those children who visited a physician at least twice, in the beginning of their life and in the second year of life.

5. Did the children in the 78% really belong to the KVB insured cohort?
Yes, absolutely, because elsewise their health insurance would not have been charged by the KVB.

6. **comment on table 1 (no hard data)**
The twiddle sign gave the wrong impression of imprecise data. These estimates, however, are based on the sources quoted. These sources can be presumed to be valid. We therefore have omitted the misleading twiddle sign in the amended version of the table 1 and corrected the table by adding the exact percentages and derived number of children cited by the described sources.

7. **differences in vaccination coverage rates among the different sources (includes answers to comment 9 from methods section and comment 2 from discussion section)**
It may appear trivial that the reduced KVB dataset will yield a higher coverage because of a smaller denominator. The rationale for presenting table 2 was to depict the size of the underestimation. Survey data are indeed problematic because of only very few children in the Bavarian subsample. When restricting the data to children living in Bavaria and born in the respective birth years, only 88 children resulted. We therefore decided to omit a comparison with the national immunisation survey (but mentioned these data in the discussion, last para).

The new table 2 summarizes the former tables 2 and 3.

To allow for more precise comparison we assessed vaccination coverage in an additional group consisting of all continuously insured children of one SHI. The vaccination coverage estimates for this AOK validation dataset were almost identical to those of the AOK insured children in the reduced dataset, apart from a shift by at maximum 1.7% towards lower estimates in the AOK dataset (discussion, para 3 and 4).

Compared with other European countries, Germany has very low vaccination coverage rates in children. We commented on this in the introduction, first para.

8. **see point 2**
9. **see point 7**

**Discussion:**

1. **comment on paragraph 1 (validity of the presented approach)**
We changed the first para of the discussion and omitted the second one.

2. **see methods, point 7**

3. **the AOK validation dataset and its details**
We described the details of the AOK validation dataset in the results, para 3 (descriptives) and in para 5 (vaccination coverage estimates compared to the other datasets).

It might be argued to confine vaccination coverage estimates to children in AOK validation data sets only. Unfortunately such data are not routinely available – these were generated on special request for this study.
4. biases discussed for vaccination coverage estimates
   We now changed this paragraph (discussion, para 3)

5. implications of the findings
   We commented on the low vaccination coverage found in the discussion, last para, and
   on the usefulness of the method found in the conclusion.

We would be pleased if the amended paper would now be accepted for publication.

Yours sincerely

Dr. Helen Kalies, MPH

For all authors