

# Under covered? Cohort changes in time to vaccination among California schoolchildren

Alison M. Buttenheim, Population Studies Center and School of Nursing, University of Pennsylvania  
Malia Jones, Applied Population Laboratory, University of Wisconsin

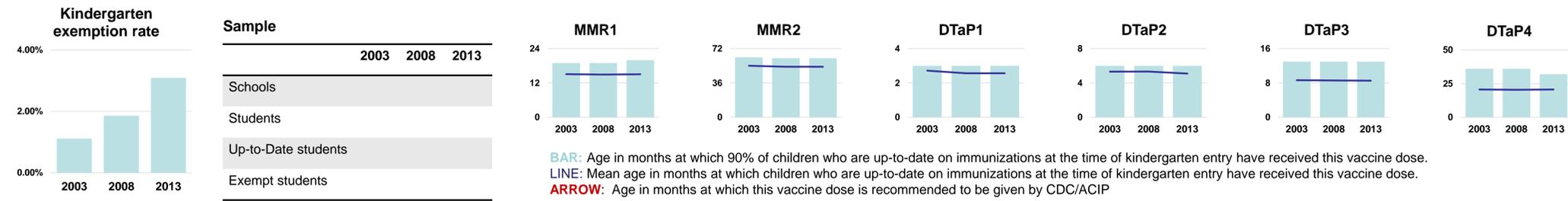
## Background

- Recent outbreaks of measles and pertussis associated with intentionally unvaccinated children suggest compromised herd immunity.
- Increasing numbers of parents request delayed, spaced or alternative immunization schedules.
- Each person-month spent unimmunized undermines herd immunity at the population level.
- Little is known about changes in the epidemiological patterns of delayed vaccination over successive cohorts of schoolchildren in the United States over the past two decades.
- Understanding the tempo of vaccination is critical to providing accurate estimates of outbreak risk and evaluating interventions to improve timely vaccination.

## Objectives

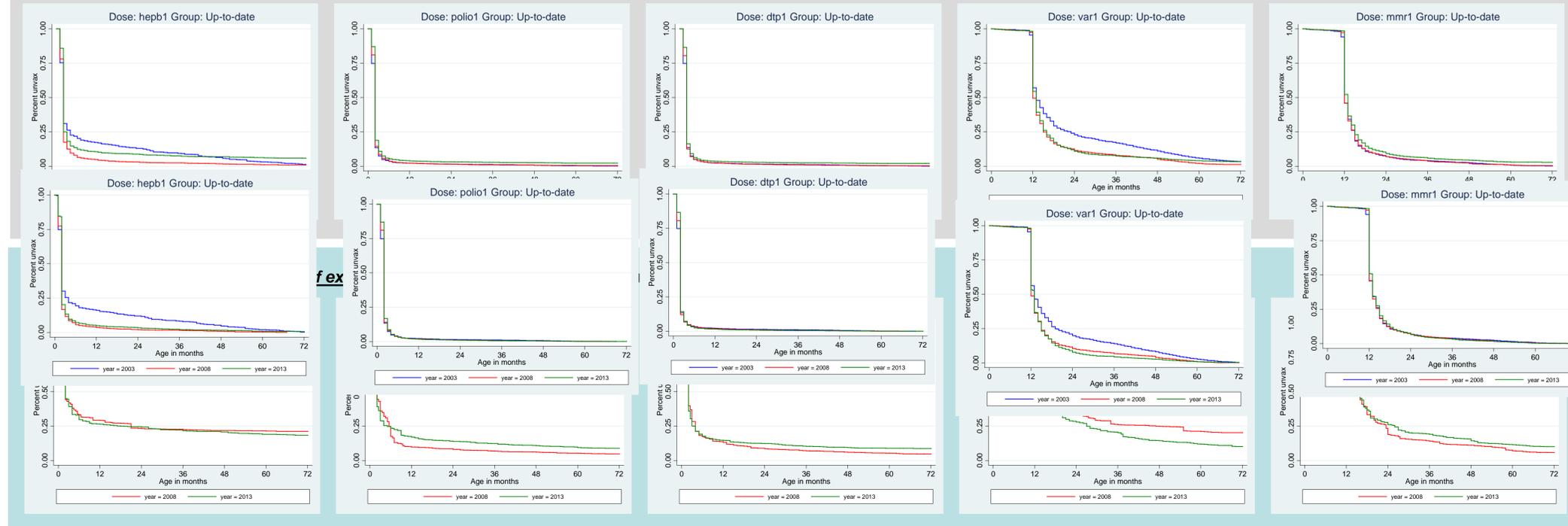
- To examine cohort trends in time to vaccination in California schoolchildren born in 1997-8, 2002-3, and 2007-8.
- To describe cohort patterns of delayed vaccination by specific vaccine (MMR, DTaP, etc.), child characteristics (Up-to-date vs. personal belief exemption).
- To quantify cohort changes in the incidence of delayed schedules and in time spent “undercovered” by the recommended child immunization schedule.

## Results



**Kaplan-Meier survival curves showing time to vaccination for the first dose of the five vaccines mandated for school entry in California by kindergarten cohort.**  
Data from the California Department of Public Health Immunization Branch Kindergarten Retrospective Survey, 2004, 2009, 2014 (Fall 2003, Fall 2008, Fall 2013).

Children who are up-to-date on immunizations at the time of kindergarten entry.



Notes: 1. Age in months at receipt of vaccine dose is recorded on the California School Immunization Record, with high rates of missingness for children with personal belief exemptions. To provide a conservative estimate time spent uncovered by mandated vaccines, children with exemptions with missing age at vaccination for any dose were assumed to have received the dose at the median age of vaccination among exempted children at the same school. If there were no other exempted children at the school with a reported age at vaccination for the same dose, or age at vaccination was reported to be higher than 72 months, then the child was assigned an age at receipt of vaccination for that dose of 72 months. 2. Stratified Mantel-Haenszel log-rank tests of cohort differences in the survivor function are significant for all doses of all vaccines for both up-to-date and exempted children in the sample. 3. The school-level sampling strategy for the Kindergarten Retrospective Survey 2004 did not allow for an analysis of exempted children. The 2009 and 2014 KRS included a separate stratum of schools with high rates of personal belief exemptions.

## Data and methods

- Data: Routine surveillance data from the California Department of Public Health Kindergarten Retrospective Survey (KRS) from 2004, 2009, and 2014.
- Key outcomes of interest: age in completed months at which the child received each vaccine dose mandated for kindergarten entry in California.
- Main predictor variable: Kindergarten cohort.
- Methods: Kaplan-Meier estimator in nonparametric survival analysis to compare time to vaccination across three kindergarten cohorts by vaccine. We test hypotheses of cohort differences in the survivor function using stratified Mantel-Haenszel log-rank tests. We calculate mean and 90% “survival times” (age at vaccination) to compare length of the time not optimally covered by specific vaccines.

## Conclusions and implications

- Blah
- Blah
- Blah

This research was supported by the Eunice Kennedy Shriver Institute for Child Health and Human Development (R03XXXXXXXX, PI Buttenheim). Contact: abutt@nursing.upenn.edu

# OLD VERSION Under covered? Cohort changes in time to vaccination among California schoolchildren

Alison M. Bittenheim, Population Studies Center and School of Nursing, University of Pennsylvania  
 Malia Jones, Applied Population Laboratory, University of Wisconsin

## Background

- Recent outbreaks of measles and pertussis associated with intentionally unvaccinated children suggest compromised herd immunity.
- Increasing numbers of parents request delayed, spaced or alternative immunization schedules.
- Each person-month spent unimmunized due to delayed or spaced vaccination undermines herd immunity at the population level.
- Little is known about changes in the epidemiological patterns of delayed vaccination over successive cohorts of schoolchildren in the United States over the past two decades.
- Understanding the tempo of vaccination is critical to providing accurate estimates of outbreak risk and evaluating interventions to improve timely vaccination.

## Objectives

- To examine cohort trends in time to vaccination in California schoolchildren born in 1997-8, 2002-3, and 2007-8.
- To describe cohort patterns of delayed vaccination by specific vaccine (MMR, DTaP, etc.), child characteristics, and school/communities.
- To quantify cohort changes in the incidence of delayed schedules and in time spent “undercovered” by the recommended child immunization schedule.

## Data and methods

- Data: Routine surveillance data from the California Department of Public Health Kindergarten Retrospective Survey (KRS) from 2004, 2009, and 2014,
- Key outcomes of interest: age in completed months at which the child received each vaccine dose mandated for kindergarten entry in California.
- Main predictor variable: Kindergarten cohort.
- Methods: Kaplan-Meier estimator in nonparametric survival analysis to compare time to vaccination across three kindergarten cohorts by vaccine. We test hypotheses of cohort differences in the survivor using stratified Mantel-Haenszel log-rank tests. We calculate median “survival times” (age at vaccination) to compare length of the time not optimally covered by specific vaccines.

## Results

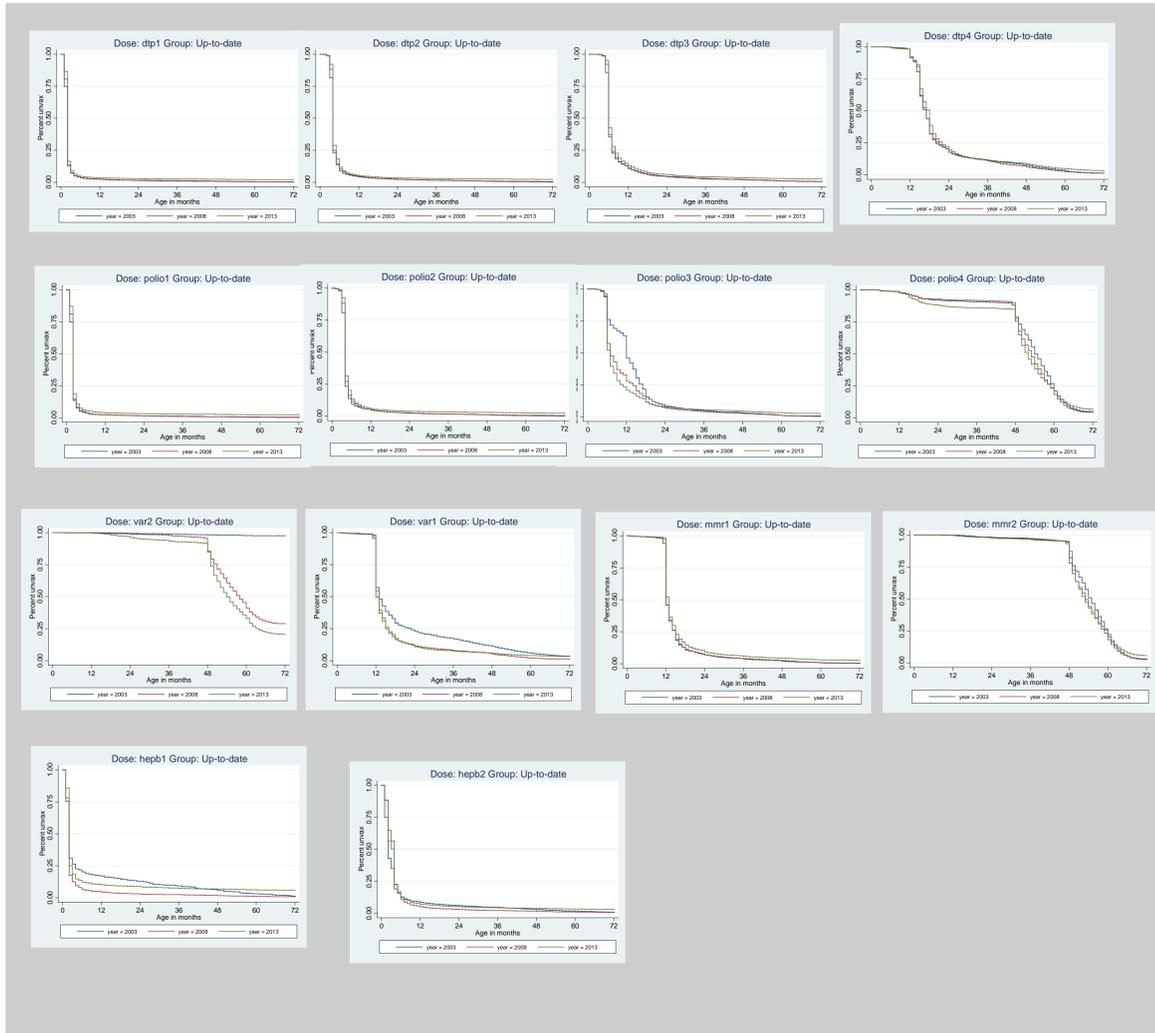
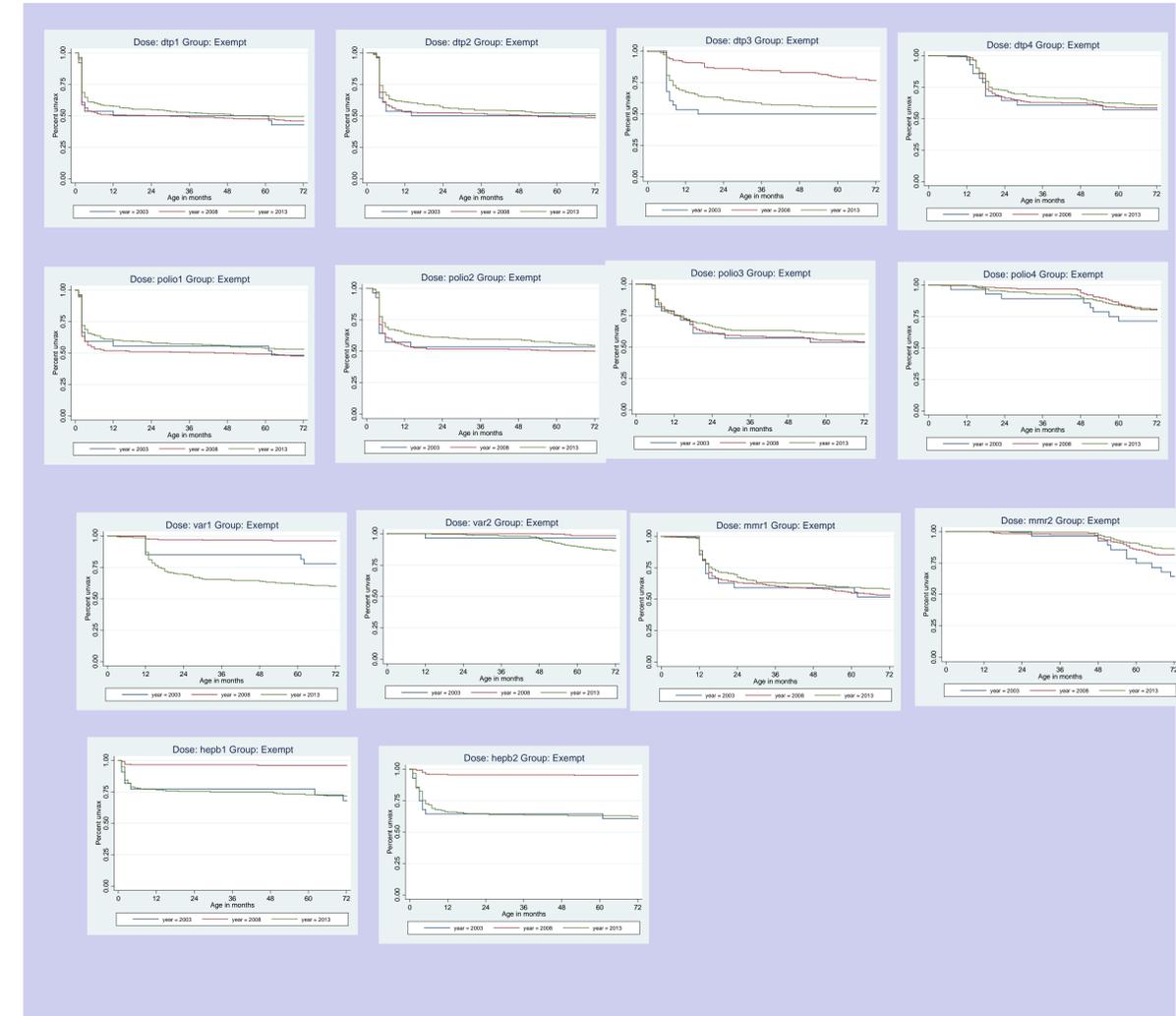


TABLE here could have median or mean time to vax by dose, year group.					



## Conclusions and implications