

# Study identifies geographic clusters of underimmunization in Northern California

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Researchers used spatial analysis software and electronic medical records to identify clusters of underimmunization and vaccine refusal among Kaiser Permanente members in Northern California, according to a study published today in the journal *Pediatrics*.

Children are considered to be underimmunized when they miss one or more recommended vaccine doses before age three, while vaccine refusal means not allowing a child to receive any vaccines.

The study reviewed the immunization records of more than 154,000 Kaiser Permanente Northern California members between birth and 3 years old. All the children were born between 2000 and 2011 and were covered continuously by Kaiser Permanente, which provides health care for about 40 percent of the insured population in 13 Northern California counties. To identify the clusters of underimmunization and vaccine refusal, researchers used sophisticated spatial analysis software, which allowed them to examine health factors in relation to geography.

The Centers for Disease Control's immunization schedule recommends a minimum of 17 separate injections during a child's first two years of life, including for hepatitis A and B, diphtheria, tetanus, pertussis, influenza, polio, measles, mumps, rubella, and pneumococcal virus. Underimmunization is associated with elevated risk of vaccine-preventable disease, while nonmedical immunization exemption and refusal have been associated with increased community risk of measles and pertussis.

"This research confirms anecdotal reports of underimmunization clusters," said Tracy A. Lieu, MD, MPH, the study's lead author, a Kaiser Permanente pediatrician, and director of the Kaiser Permanente Division of Research. "In addition, we found clusters in places we hadn't anticipated."

Dr. Lieu noted that this study will be useful for targeting outreach efforts in particular areas, although it was not designed to figure out why children in some areas are less likely to be fully immunized.

"Everyone in the Kaiser Permanente health care system has access to vaccines, and since childhood vaccination is covered by insurance, financial barriers are not an issue," Dr. Lieu said. "Our findings raise awareness that there may be communities where parents have more vaccine hesitancy and may be interested in more information or more in-depth conversations with their children's doctors."

Underimmunization ranged from 18 percent to 23 percent within clusters, compared with 11 percent outside clusters. Between 2010 and 2012, geographic clusters of underimmunization were found in:

- the East Bay (Richmond to San Leandro);
- Sonoma and Napa counties;
- a small area of east Sacramento;
- northern San Francisco and southern Marin counties; and
- a small area of Vallejo.

"Shot limiting," in which parents limit the number of injections or antigens that children receive during a pediatric visit to two or fewer, was found to [cluster](#) in similar areas.

Vaccine refusal ranged from 5.5 percent to 13.5 percent within clusters, compared with 2.6 percent outside clusters. Between 2010 and 2012,

geographic clusters of vaccine refusal were found in:

- the East Bay (El Cerrito to Alameda);
- Marin and southwest Sonoma counties;
- northeastern San Francisco;
- northeastern Sacramento County and Roseville; and
- a small area south of Sacramento

"Kaiser Permanente's electronic medical record system is among the richest in the world," Dr. Lieu said. "This is the first time that spatial analysis techniques have been applied to real-time vaccine data."

Provided by Kaiser Permanente

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