Delay in diphtheria, pertussis, tetanus vaccination is associated with a reduced risk of childhood asthma

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Background: Early childhood immunizations have been viewed as promoters of asthma development by stimulating a T_H2-type immune response or decreasing microbial pressure, which shifts the balance between T_H1 and T_H2 immunity.

Objective: Differing time schedules for childhood immunizations may explain the discrepant findings of an association with asthma reported in observational studies. This research was undertaken to determine whether timing of diphtheria, pertussis, tetanus (DPT) immunization has an effect on the development of childhood asthma by age 7 years.

Methods: This was a retrospective longitudinal study of a cohort of children born in Manitoba in 1995. The complete immunization and health care records of cohort children from birth until age 7 years were available for analysis. The adjusted odds ratio for asthma at age 7 years according to timing of DPT immunization was computed from multivariable logistic regression.

Results: Among 11, 531 children who received at least 4 doses of DPT, the risk of asthma was reduced to ½ in children whose first dose of DPT was delayed by more than 2 months. The likelihood of asthma in children with delays in all 3 doses was 0.39 (95% CI, 0.18-0.86).

Conclusion: We found a negative association between delay in administration of the first dose of whole-cell DPT immunization in childhood and the development of asthma; the association was greater with delays in all of the first 3 doses. The mechanism for this phenomenon requires further research.

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Key words: DPT combination vaccine, childhood asthma, retrospective birth cohort, administrative health data

Abbreviations used
DaPT: Diphtheria, acellular pertussis, tetanus
DPT: Diphtheria, pertussis, tetanus
ICD-9: International Classification of Diseases, Ninth Revision
MIMS: Manitoba Immunization Monitoring System
MHSIP: Manitoba Health Services Insurance Program
OR: Odds ratio

Childhood asthma is one of the most common childhood diseases in the developed world. The rising prevalence of asthma in many industrialized countries over the last quarter century has occurred alongside improvements in hygienic standards. The hygiene hypothesis postulates that growing up in a more hygienic environment with less microbial exposure may enhance atopic (T_H2) immune responses, whereas microbial exposure would drive the response of the immune system—which is skewed in the atopic T_H2 direction during fetal life—toward a balanced T_H1 and T_H2 immunity. In this context, many early childhood vaccinations have been viewed as promoters of asthma development, directly by stimulating a T_H2-type immune response, or indirectly by decreasing the microbial pressure; both effects would shift the cytokine balance away from T_H1 and T_H2 immunity.[1,2] What is the evidence that early childhood immunizations promote the development of asthma? An IgE response to vaccine antigens is commonly detectable in the sera of children vaccinated with diphtheria/tetanus, and the IgE response to vaccine antigens is more pronounced among atopic individuals.[3,4]

The epidemiologic evidence linking diphtheria, pertussis, tetanus (DPT) immunizations to childhood asthma or atopy is mixed, with studies showing an increased[4-9] or decreased risk[10-12] of developing asthma, or no association.[13-19] These studies have primarily addressed the question of whether asthma is more likely to develop in vaccinated versus unvaccinated children. As most children are vaccinated, it is difficult to obtain numbers adequate to examine the vaccination-asthma relationship, and unvaccinated children are usually a highly selected and atypical group.[20,21]

Recent evidence indicates that the association with childhood asthma is dependent on the timing of exposure to microbes.[22] Different schedules for immunization may explain the discrepant findings of an association with asthma reported in observational studies of vaccinated children. This research was undertaken to determine whether timing of DPT vaccination has an influence on the development of childhood asthma by age 7 years.

METHODS

This was a retrospective longitudinal study of a cohort of children who were born in Manitoba in 1995 and remained in Manitoba until at least age 7 years (13,980 children). The complete immunization and health care records of cohort children from birth until age 7 were available for analysis.

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