



Effects of Diphtheria-Tetanus-Pertussis or Tetanus Vaccination on Allergies and Allergy-Related Respiratory Symptoms Among Children and Adolescents in the United States

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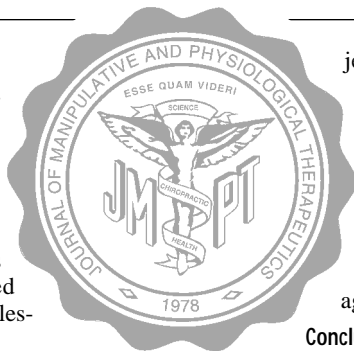
ABSTRACT

Background: Findings from animal and human studies confirm that diphtheria and tetanus toxoids and pertussis (DTP) and tetanus vaccinations induce allergic responses; associations between childhood vaccinations and subsequent allergies have been reported recently.

Objective: The association of DTP or tetanus vaccination with allergies and allergy-related respiratory symptoms among children and adolescents in the United States was assessed.

Methods: Data were used from the Third National Health and Nutrition Examination Survey on infants aged 2 months through adolescents aged 16 years. DTP or tetanus vaccination, lifetime allergy history, and allergy symptoms in the past 12 months were based on parental or guardian recall. Logistic regression modeling was performed to estimate the effects of DTP or tetanus vaccination on each allergy.

Results: The odds of having a history of asthma was twice as great among vaccinated subjects than among unvaccinated sub-



jects (adjusted odds ratio, 2.00; 95% confidence interval, 0.59 to 6.74). The odds of having had any allergy-related respiratory symptom in the past 12 months was 63% greater among vaccinated subjects than unvaccinated subjects (adjusted odds ratio, 1.63; 95% confidence interval, 1.05 to 2.54). The associations between vaccination and subsequent allergies and symptoms were greatest among children aged 5 through 10 years.

Conclusions: DTP or tetanus vaccination appears to increase the risk of allergies and related respiratory symptoms in children and adolescents. Although it is unlikely that these results are entirely because of any sources of bias, the small number of unvaccinated subjects and the study design limit our ability to make firm causal inferences about the true magnitude of effect. (*J Manipulative Physiol Ther* 2000; 23:81-90)

Key Words: Vaccination; Immunization; Asthma; Allergic Rhinitis; Sinusitis; Allergic Hypersensitivity

INTRODUCTION

The prevalence of allergic disorders has increased 50% to 100% among adults and more than doubled among children during the past 20 years.¹⁻⁴ Asthma and other allergies currently affect 30 to 50 million persons in the United States.^{5,6} An estimated 17.3 million persons had symptomatic physician-diagnosed asthma in 1998.⁷ Asthma and allergic rhinitis, accounting for 9.1 and 8.4 million office visits, respectively, in 1996, are 2 of the 20 most common principal diagnoses given to patients of office-based physicians.⁸ Asthma is also one of the primary reasons for visiting a hospital outpatient department,⁹ with 900,000 visits. Chronic sinusitis, which is often associated with asthma and allergic rhinitis, is the most common chronic condition in the United States,¹⁰ resulting in 14.3 million office visits per year.⁸ Allergic rhinitis, sinusitis, and asthma are 3 of the 5 most common principal diagnoses given to children and adolescents (aged 15 years and younger) in ambulatory care, accounting for 9.4 million visits annually and 5.8% of all visits.¹¹ The total cost of asthma care alone was estimated as

\$6.21 billion in 1990.¹² Although there is speculation about the causes of the increased prevalence of asthma and other allergic conditions,¹⁻⁴ no agent or set of agents has been shown to be responsible for the increase. In addition, the upward trend is probably not entirely a result of the increased public recognition of allergies, diagnostic coding, measurement error, or other nonclinical factors.^{1,3,4}

Studies in animals and human beings have demonstrated that components of diphtheria and tetanus toxoids and pertussis (DTP) and tetanus vaccines have adjuvant effects¹³⁻¹⁵ and are associated with elevated levels of total and specific immunoglobulin E antibodies.¹⁶⁻¹⁸ There is evidence that these components cause a Th1 to Th2 shift in CD4 cells,^{19,20} resulting in interleukin-4 (IL-4) production and greater stimulation of mast cells, subsequent release of histamine and other inflammatory mediators, and allergic symptomatology.²¹ Pertussis and DTP vaccines have also been shown to enhance rodents' and human beings' sensitivity to histamine.^{22,23}

The biologic plausibility of a causal vaccination-allergy association is bolstered by cases of anaphylaxis immediately after immunization with the DTP and tetanus vaccines (2 cases per 100,000 injections or 6 per 100,000 children given 3 doses of DTP)²⁴ and the high incidence of local immediate hypersensitivity reactions to tetanus toxoids,²⁵⁻²⁸ diphtheria,²⁹ and the development of IgE antibodies after tetanus and diphtheria toxoids vaccinations.^{30,31} Two committees convened by the Institute of Medicine (the Committee to Review the Ad-

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