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Trends in Asthma Prevalence and Recommended Number of Childhood Immunizations Are Not Parallel

To the Editor.—

The relationship between immunizations and allergic disease continues to be an area of active investigation; published studies have reported both positive^{1–6} and negative^{7–9} relationships. Because essentially all children are exposed to immunizations, studies that compare outcomes of immunized and unimmunized children are difficult. We sought to determine if time trends in both childhood asthma prevalence and the number of immunizations recommended during the first 2 years of life changed in parallel. We conducted an ecological study by comparing time trends for recommended infant immunizations from the Advisory Council on Immunization Practices (ACIP) from 1960 to 2004 and asthma prevalence in 5- to 14-year-old children from the National Health Interview Survey (NHIS).

Since 1995, the ACIP has published a consensus immunization schedule. Before 1995, the ACIP, American

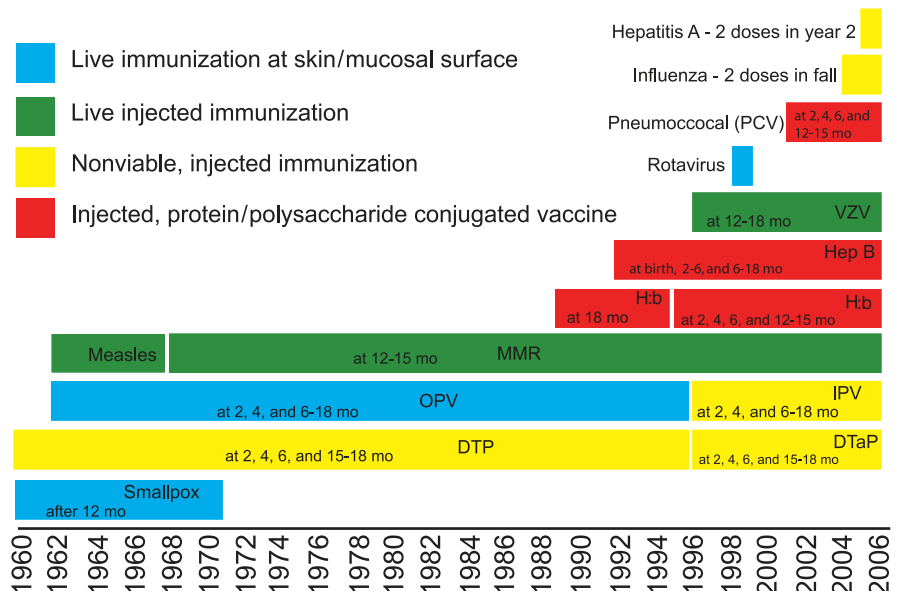
Academy of Pediatrics, and American Academy of Family Physicians each independently produced a recommended vaccine schedule. Figure 1 illustrates the development of the immunization schedule for children in the first 2 years of life from 1960 to 2003; in the years before 1995, the ACIP schedule was referenced or the schedule was inferred from vaccine availability. Asthma prevalence rates for children aged 5–14 years are from the NHIS,^{10–12} a weighted probability sample survey of the civilian, noninstitutionalized US population conducted by the National Center for Health Statistics¹³ in which parents report whether their child has had “an episode of asthma or an asthma attack” in the last 12 months.

We assumed that the average 5- to 14-year-old child was vaccinated according to the immunization schedule of the previous 10 years. We then plotted asthma prevalence rates and number of immunizations scheduled in the first 2 years of life, offsetting the x-axis by 10 years (Fig 2) to account for the child’s age at vaccination and age at the NHIS.

Asthma prevalence in 5- to 14-year-old children increased most rapidly from 1980 to 1995, at a time at which the recommended number of infant immunizations was stable (Fig 2). Conversely, the greatest increase in numbers of immunizations occurred at a time when asthma prevalence rates seemed to plateau. The population of children exposed to an increasing number of vaccines, particularly after 2000, did not have a parallel increase in asthma prevalence. The trends in asthma prevalence and recommended number of vaccines are not parallel. Overall, the rapid increase in asthma prevalence preceded the recommendation of new childhood vaccines by 10 years; therefore, data do not support a direct causal relationship between early childhood vaccinations and asthma.

FIGURE 1

Schematic drawing of the evolving immunization schedule for children <2 years of age (1960–2006). Minor changes in recommended vaccine timing, vaccine shortages, and the gradual implementation of recommendations are not shown. VZV indicates varicella-zoster virus; Hep B, hepatitis B; Hib, *Haemophilus influenzae* type b; MMR, measles-mumps-rubella; OPV, oral poliovirus vaccine; IPV, inactivated poliovirus vaccine; DTP, diphtheria-tetanus toxoids-pertussis; DTaP, diphtheria-tetanus-acellular pertussis.



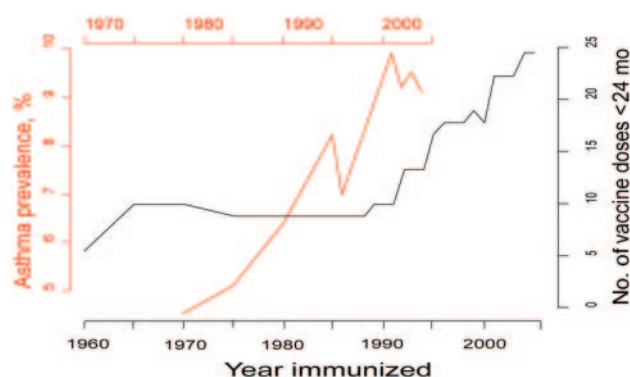


FIGURE 2

Asthma prevalence (%) among 5- to 14-year-old children from the NHIS is plotted on the upper axis (red), and the number of recommended immunizations is plotted on the lower axis (black). The horizontal axes are offset by 10 years to account for age at immunization and NHIS interview-determined asthma diagnosis.

Although not all children are vaccinated according to the ACIP schedule, in 1995 74% of children were considered completely vaccinated and 95% had received a minimum of 3 doses of diphtheria-tetanus toxoids-pertussis.¹⁴ Regardless of changing immunization rates, gradual implementation of new vaccines, and short-term changes to ACIP recommendations, large numbers of children could not have had increasing exposure to vaccinations until the mid-1990s. Infants born in these years were not 5 years old until the late 1990s, when asthma prevalence rates were beginning to attenuate.

We report ecological data that do not show associations between changes in childhood vaccine exposures and asthma prevalence. Asthmatic phenotypes seem to be determined by complex interactions between environmental exposures and genetics; these ecological data do not permit analysis of such intricate associations. Nevertheless, these data do not support a direct causal relationship between early childhood immunizations and asthma and provide reassurance to both medical professionals and health care consumers.

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The Economic Burden of All-Terrain Vehicle-Related Pediatric Deaths in the United States

To the Editor:—

The estimated average annual number of all-terrain vehicle (ATV)-related deaths has increased from 273 per year in 1985-1998 to 609 per year in 1999-2003.^{1,2} Although the overall number of deaths has been steadily increasing, fortunately the proportion of deaths in children under age 16 has decreased from ~35% in the earlier period to 22% in the later period.² The Consumer Product Safety Commission (CPSC) indicates that increases in mortality are not solely a result of increased sales and exposure.^{1,3} Fatality increases could be a function of data-collection changes and coding differences between the *International Classification of Diseases, Ninth*

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