Seroprevalence of *Chlamydia trachomatis* (CT) In American Children and Adolescents - Implication for Vaccine Development

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Abstract

Background: CT remains the most prevalent sexually transmitted infection in developed and developing countries**.** Prevention of infection is an ideal application for a vaccine program. Similar to the HPV vaccine, the timing of immunization for a future CT vaccine should optimally precede sexual debut. However, there are limited epidemiologic studies of CT infection in an unselected pediatric and adolescent population since universal screening and treatment of pregnant women was implemented in the U.S. in 1993.

Objective: To determine current seroepidemiology of CT infection in children in a US inner city population.

Design/Methods: Anonymized serum samples were obtained from children in 2 hospitals in Brooklyn, NY from 2012-2015. CT IgG was determined using EIA (Ani Labsystems). The following age strata were used: 11-12, 13-14, 15-16, 17-18, 19-20 y.

Results: 512 sera were included in the final analysis. Mean age 17 y. There were 192 (37.5%) males and 320 (62.5%) females. CT antibody was first detected at 16 y and 18 y for females and males, respectively. The prevalence per age-cohort were: Females: 11-14 y-0, 15-16 y- 3.64%, 17-18 y -15.9% , 19-20 y -14.75%; Males: 11-16 y- 0, 17-18 y- 8.51% , 19-20 y- 9.33%.

Conclusions: The prevalence of antibody was higher in girls than their male counterparts, mirroring national trends based on NAATs. Antibody was first detected in females at 16 y and males at 17 y, reflecting sexual debut. Prior data from this cohort found antibody in 22.2% infants < 1 y, which disappeared between 1 and 16 y. The delay in male antibody detection may be due to later exposure and/or anatomical and physiological factors between the sexes. These data are critical in informing potential CT vaccine strategies. Future studies using a larger sample size and other populations will allow more precise estimates of age and gender-specific prevalence.

Introduction

- *C. trachomatis* (CT) has been the most frequently reported notifiable disease in the U.S since 1994 (1).
- CT infection is frequently asymptomatic in adults and may go untreated leading to sequelae, such as PID and infertility.
- The USPSTF and CDC recommend annual screening of all sexually active women aged <25 y (2,3).
- Worldwide, CT incidence was estimated at ~105.7 million cases among adults 15-49 y of age in 2008; a 4.1% increase from 2005 (4).
- NHANES (2007–2012): Among sexually active females aged 14–24 y, the population targeted for routine screening, chlamydia prevalence was 4.7% overall and 13.5% among non-Hispanic black females (5).
- The prevalence of CT in the U.S. among sexually active females 14-19 y (1999-2008) has been estimated to be 6.8%. Estimated prevalence in NY in 2011 was 9% (1).
- Analysis of NHANES data estimated the prevalence of CT in males to be ~2x less than their female counterparts age 14-19 y (6).
- There are limited epidemiologic studies of CT infection in an unselected pediatric and adolescent population since universal screening and treatment of pregnant women was implemented in the U.S. in 1993 (7).

Aim

- To determine current seroepidemiology of CT infection in children and adolescents in a US inner city population

Methods

- Anonymized serum samples were collected prospectively from children in 2 hospitals in Brooklyn, NY from 2013-2015.
  - DMC serves a predominantly Caribbean and AA population.
  - LMC serves a mixture of different ethnicities.
- Serum samples were divided into the following strata: 9-10, 11-12, 13-14, 15-16, 17-18, 19-20 y.
- Anti-CT IgG was determined using EIA (Ani Labsystems).
- IgG ≥ 1:16 was considered positive.

Results

- A total of 566 serum samples were included in the analysis.
- Mean age was 16.6 y.
- CT antibody was first detected at 14 y in females and at 18 y in males.
- A significant effect of age and gender, but not institution, on CT serological status was noted (p <0.01; p <0.029, respectively).
- The age-specific prevalence of IgG antibodies by gender are shown in Table 1.

Discussion

- The prevalence of antibody was higher in girls than their male counterparts, mirroring national surveillance trends based on NAATs (1,3,6).
- Antibody was first detected in females at 14 y and males at 18 y. The delay in male antibody detection may be due to later exposure and/or anatomical and physiological factors between the sexes.
- These data may have implications for determining the age range for future CT vaccine trials.

Conclusions

• Although chlamydia screening is expanding, many women who are at risk are still not being routinely tested - reflecting, in part, the lack of awareness among some health care providers and the limited resources available to support these screenings. A CT vaccine may prove a viable alternative in future chlamydia prevention efforts.

• Similar to the HPV vaccine, the timing of immunization for a future CT vaccine should optimally precede sexual debut.

• A compartmental heterosexual transmission model has been developed to assess the health and economic outcomes of a hypothetical chlamydia vaccine for persons aged 15-24 years in the U.S.. Their analysis showed that a high-performance chlamydia vaccine could potentially eliminate chlamydia infection (if > 75% coverage) among susceptible persons before their sexual debut. They also concluded that such a vaccine would be cost-effective (9).

• However, initiation of vaccination at age 14-15 y may be too late for our population and may not be applicable globally.

• Larger epidemiologic studies are needed to confirm current CT prevalence rates in children, especially in children younger than 14 years of age.

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Table 1. Age-specific prevalence of Anti-*C. trachomatis* IgG by Gender

Age Strata (y)	Females CT +/total	Females 95% CI	Males CT+/total	Males 95% CI
9-10	0/22	0%, 0%	0/16	0%, 0%
11-12	0/18	0%, 0%	0/20	0%, 0%
13-14	1/39 (2.6%)	0%, 7.59%	0/25	0%, 0%
15-16	3/57 (5.3%)	0%, 11.12%	0/30	0%, 0%
17-18	15/88 (17%)	9.15%, 24.85%	3/47 (6.4%)	0%, 13.4%
19-20	20/128 (16%)	9.65%, 22.35%	7/76 (9.2%)	2.7%, 15.7%