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Session: 278. Pneumococcal and Pertussis Vaccines
Saturday, October 7, 2017: 2:00 PM

Background. *Streptococcus pneumoniae* causes an estimated 826,000 deaths of children in the world each year and many health facility visits. To reduce the burden of pneumococcal disease, many nations have added pneumococcal conjugate vaccines to their national immunization schedules. Nicaragua was the first country eligible for funding from the GAVI Alliance to introduce the 13-valent pneumococcal conjugate vaccine (PCV13), provided to infants at 2, 4, and 6 months of age. The goal of this study was to evaluate the population impact of the first five years of the program.

Methods. Numbers of visits for pneumonia, pneumonia-related deaths, bacterial meningitis, and infant deaths between 2008 and 2015 were collected from all 107 public health facilities in León Department. Vital statistics data provided additional counts of pneumonia-related deaths that occurred outside health facilities. Adjusted incidence rates and incidence rate ratios (IRRa) in the vaccine (2011–2015) and pre-vaccine periods (2008–2010) were estimated using official population estimates as exposure time.

Results. The IRRa for pneumonia hospitalizations was 0.70 (95% confidence interval [CI]: 0.66, 0.75) for infants, and 0.92 (95% CI: 0.85, 0.99) for one year olds. The IRRa for post-neonatal infant mortality was 0.56 (95% CI: 0.41, 0.77). In the population as a whole, ambulatory visits and hospitalizations for pneumonia, as well as pneumonia-related mortality and rates of bacterial meningitis were lower in the vaccine period.

Conclusion. Five years following program introduction, reductions were observed in health facility visits for pneumonia in immunized age groups and infant mortality, which would be hard to achieve with any other single public health intervention. Future study is warranted to understand whether the lack of a booster dose (e.g.,, at 12 months) may be responsible for the small reductions in pneumonia hospitalizations observed in one year-olds as compared with infants.

Disclosures. **S. Becker-Dreps**, Pfizer: Consultant and Grant Investigator, Consulting fee and Research grant; **D. J. Weber**, Pfizer: Consultant and Speaker's Bureau, Consulting fee and Speaker honorarium

2496. A population-based Study of Recurrent Symptomatic *Bordetella pertussis* Infections in Children in California, 2010–2015

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Session: 278. Pneumococcal and Pertussis Vaccines
Saturday, October 7, 2017: 2:00 PM

Background. Natural infection with *Bordetella pertussis* is thought to result in 4–20 years of immunity against subsequent symptomatic pertussis infection. However, these estimates are based on studies in unvaccinated or whole-cell vaccinated children. We conducted a population-based study of pertussis infection and reinfection during a 5-year period in California in an exclusively acellular-pertussis vaccinated cohort.

Methods. California surveillance data were reviewed to identify all children with two reported incidents of pertussis with symptom onset from January 1, 2010 through December 31, 2015. Case investigation reports were reviewed and children with at least two episodes of symptomatic pertussis infection that met the case definition were included.

Results. Of 26,259 pertussis cases reported in children <18 years, 27 children met the inclusion criteria. Recurrent cases occurred among children of all ages, and the median age for the first and second pertussis episodes were 3.5 years (range, 1.3 months-14 years) and 6.5 years (range, 5.2 months–16.3 years) respectively. The median duration of time between initial infection and reinfection was 1.3 years (range, 2.9 months–4.4 years). Twenty-one children (78%) had received ≥3 doses of DTaP vaccine at the time of their first pertussis infection, 1 (4%) had received 1 dose, and 5 (19%) were unvaccinated.

Conclusion. Recurrent cases of pertussis infection are very rare. Contrary to previous reports that natural infection with *B. pertussis* results in 4–20 years of sterilizing immunity, we demonstrate that symptomatic reinfection with pertussis can occur as soon as 89 days following the first infection. More research is needed to understand the immune response to *B. pertussis* infection in children vaccinated with acellular-pertussis vaccines.

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2497. Effectiveness of Prenatal Tdap Immunization in the Prevention of Infant Pertussis in the United States

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Session: 278. Pneumococcal and Pertussis Vaccines
Saturday, October 7, 2017: 2:00 PM

Background. The Centers for Disease Control and Prevention recommends that all pregnant women in the United States receive tetanus-diphtheria-acellular pertussis (Tdap) immunization to prevent infant pertussis. While the vaccine may be administered at any time during pregnancy, the recommendations define administration at 27 to 36 weeks of gestation as optimal timing to prevent infant pertussis. These recommendations were primarily based on immunogenicity studies. The objective of this study was to examine the clinical effectiveness of prenatal Tdap, and to understand whether effectiveness varies by gestational age at immunization.

Methods. We performed a nationwide cohort study of pregnant women with deliveries in 2010–2014 and their infants. Commercial insurance claims data were used to identify receipt of Tdap immunization in the pregnant women, and hospitalizations and outpatient visits for pertussis in their infants until 18 months of age. To address the difficulties in diagnosing pertussis, we also employed a "probable pertussis" definition, as an inpatient or outpatient diagnosis of pertussis, plus antibiotic treatment with a macrolide or trimethoprim/sulfamethoxazole within 7 days of diagnosis. Pertussis occurrence was compared between infants of mothers who received prenatal Tdap (overall, and stratified by gestational age at administration) and infants of unvaccinated mothers.

Results. There were 675,167 mother–infant pairs included in the cohort. Among infants whose mothers received Tdap at any time during pregnancy, the rate of pertussis hospitalization was 50% lower (adjusted hazards ratio (HR) = 0.50, 95% CI: 0.23, 1.09), and the rate of probable pertussis was 42% lower (HR = 0.58, 95% CI: 0.38, 0.89) than infants of unimmunized mothers. Pertussis rates were also lower for infants whose mothers received prenatal Tdap during the third trimester. Infants whose mothers received Tdap before the third trimester also tended to have lower rates of pertussis, but these estimates were imprecise.

Conclusion. Infants of mothers who received prenatal Tdap experienced half the rate of pertussis as compared with infants of unimmunized mothers. Our results do not provide evidence to support changing the currently recommended timing of Tdap administration in pregnancy.

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2498. Cervical Adenocarcinoma in Situ in the United States: Results from Population-based Laboratory Surveillance, 2008–2014

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Session: 279. STIs - Diagnostics and Therapy
Saturday, October 7, 2017: 2:00 PM

Background. Cervical cancer screening methods are more effective for detection of squamous cell carcinoma precursor lesions (cervical intraepithelial neoplasia; CIN2 and 3) than for less-common adenocarcinoma precursors (adenocarcinoma in situ; AIS). Primary prevention through human papillomavirus (HPV) vaccination is expected to impact both CIN and AIS, although less data exist about the HPV types associated with AIS. We analyzed HPV types detected in AIS and CIN identified through population-based surveillance.

Methods. The Centers for Disease Control and Prevention and partners conduct surveillance for CIN2, CIN3, and AIS (CIN2+) among women aged ≥18 years in five locations in the United States. Specimen blocks for women aged 18–39 are sent to CDC for HPV typing using L1 consensus PCR. We analyzed cases with AIS only, AIS with CIN2 or 3 (AIS+CIN), and CIN3 only, the highest grade squamous cell precursor. We used chi-square tests to compare HPV types by histology. Types evaluated were HPV16 and 18 (high-risk (HR) types targeted by all HPV vaccines), 5 additional HR types targeted by the 9-valent vaccine (31/33/45/52/58; "additional 9vHPV"), and 7 other HR non-vaccine types (35/39/51/56/59/66/68).

Results. Between 2008 and 2014, 18,394 women were diagnosed with CIN2+. Of those, 517 (2.8%) had AIS (283 AIS only, 234 AIS+CIN) and 5,766 (31%) had CIN3

only. Median ages at diagnosis for AIS, AIS+CIN, and CIN3 were 37, 32, and 31 years, respectively. HPV typing results were available for 89 AIS, 99 AIS+CIN, and 2,923 CIN3 cases; HPV was detected in nearly all specimens (99% AIS, 100% AIS+CIN, 98% CIN3), and 21% of positive specimens had >1 HPV type identified. HPV16 (AIS: 51%, AIS+CIN: 64%, CIN3: 59%; $p \leq 0.001$) and HPV18 (AIS: 39%, AIS+CIN: 31%, CIN3: 5%; $P \leq 0.001$) were most common. Additional 9vHPV types (AIS: 3%, AIS+CIN: 12%, CIN3: 26%; $P \leq 0.001$), and HR non-vaccine types (AIS: 6%, AIS+CIN2+: 2%, CIN3+: 9%; $P \leq 0.001$) were detected less frequently.

Conclusion. HPV types differed by histology, with AIS having a greater proportion of HPV 18 and a lower proportion of additional 9vHPV and HR non-vaccine types. This report on the largest sample of genotyped AIS cases to date provides data for vaccine impact monitoring, and suggests a high opportunity for vaccine prevention of AIS.

Disclosures. **M. R. Griffin**, MedImmune: Grant Investigator, Grant recipient

2499. Trends in *Neisseria Gonorrheae* Antimicrobial Susceptibility in California, 2005–2016

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Session: 279. STIs - Diagnostics and Therapy
Saturday, October 7, 2017: 2:00 PM

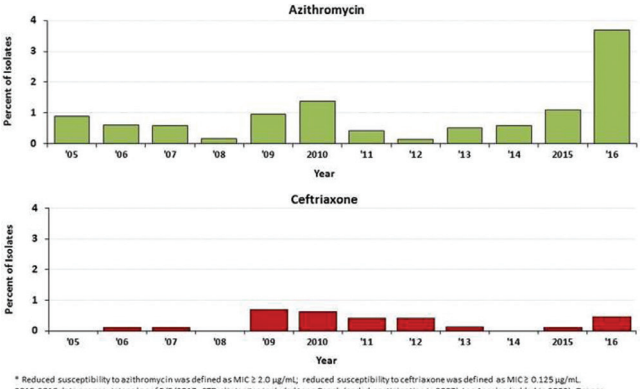
Background. Resistant *Neisseria gonorrheae* (NG) is a growing concern in California, nationally, and globally. Since 1987, California has participated in the Gonococcal Isolate Surveillance Project (GISP), a Centers for Disease Control and Prevention-funded project to monitor trends in antimicrobial susceptibility in sentinel STD clinic sites throughout the United States. We sought to describe trends in California NG susceptibility to ceftriaxone (CRO) and azithromycin (AZI), recommended therapy for NG, for 2005–2016.

Methods. Per GISP protocol, cultures are collected from the first 25 men presenting with NG urethritis each month at GISP clinic sites in California, and antimicrobial susceptibility testing (AST) is performed via agar dilution at GISP regional laboratories. Reduced susceptibility (RS) to CRO was defined as minimum inhibitory concentration (MIC) ≥0.125 µg/ml and AZI MIC ≥2 µg/ml. Demographics and MIC trends over time were examined.

Results. Between 2005 and 2016, there were 9,692 NG isolates submitted in California GISP clinics. There were 24 (0.25%) isolates with RS to CRO and 92 (0.96%) isolates with RS to AZI. There was a higher proportion of isolates from men who have sex with men with RS to AZI (but not CRO) compared with men who have sex with women (chi-squared *P*-values: AZI = 0.0015; CRO = 0.70). In 2016, the percent of isolates demonstrating RS to AZI increased to 3.69% ($n = 32$), compared with 0.69% of isolates with RS to AZI in 2005–2015 (chi-squared *P*-value < .0001); there was no significant difference in the percent of isolates with RS to CRO in 2016 compared with prior years (Figure 1). Figures 2 and 3 demonstrate the distribution of AZI MICs and CRO MICs, respectively, from 2005–2016. There have been no isolates to date in California GISP with RS to both ceftriaxone and azithromycin.

Conclusion. Gonococcal surveillance data demonstrate an increase in the proportion of isolates with decreased susceptibility to azithromycin in 2016 in California compared with prior years. Although there has never been a documented treatment failure to the recommended therapy of CRO and AZI in California, clinicians should remain vigilant for treatment failures given these concerning increases.

Figure 1. Gonococcal Isolate Surveillance Project (GISP), Percent of *Neisseria gonorrhoeae* Isolates with Reduced Susceptibility to Azithromycin and Ceftriaxone, in California GISP STD Clinic Sites, 2005–2016*



* Reduced susceptibility to azithromycin was defined as MIC ≥ 2.0 µg/mL; reduced susceptibility to ceftriaxone was defined as MIC ≥ 0.125 µg/mL. 2015-2016 data are provisional as of 5/5/2017. STD clinic sites included Long Beach (ended participation in 2007), Los Angeles (added in 2003), Orange County, San Diego, and San Francisco. Figure prepared by California Department of Public Health.

Figure 2. Distribution of Azithromycin MICs (µg/mL) among GISP Isolates in California, 2005-2016

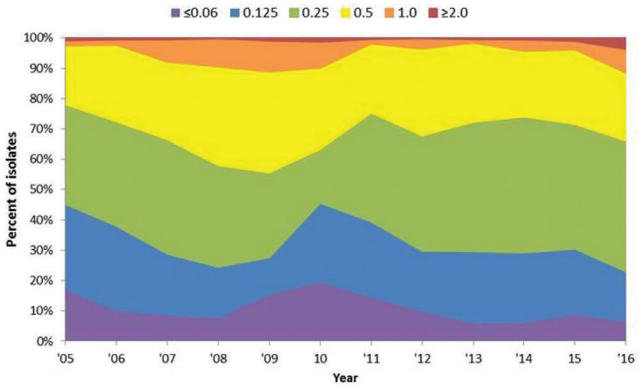


Figure prepared by California Department of Public Health.

Figure 3. Distribution of Ceftriaxone MICs (µg/mL) among GISP Isolates in California, 2005-2016

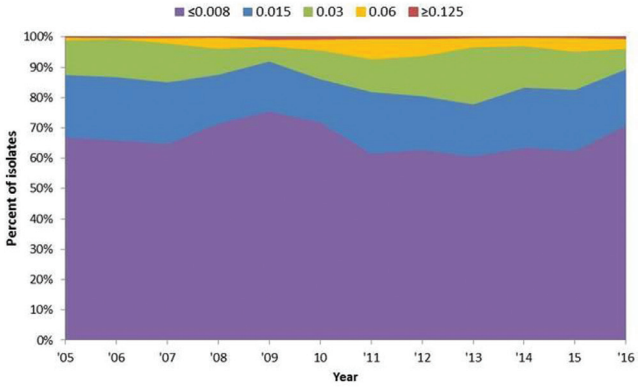


Figure prepared by California Department of Public Health.

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2500. Asymptomatic Lymphogranuloma Venereum among Nigerian Men who have Sex with Men

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Session: 279. STIs - Diagnostics and Therapy
Saturday, October 7, 2017: 2:00 PM

Background. Among men who have sex with men (MSM), lymphogranuloma venereum (LGV) has been associated with proctocolitis that can lead to chronic complications and requires a longer course of antibiotic therapy than is recommended for infections due to other serovars of *Chlamydia trachomatis* (CT). We describe the prevalence and clinical features of LGV among Nigerian MSM diagnosed with anorectal CT.

Methods. MSM were recruited into the ongoing RV368 cohort in Lagos, Nigeria, using respondent-driven sampling. Participants were screened for HIV and bacterial sexually transmitted infections (STIs) every three months for up to 18 months. HIV was diagnosed using a parallel algorithm of rapid tests on fingerstick blood samples. PCR testing for *Neisseria gonorrheae* and CTwas performed on voided urine, oropharyngeal swab, and rectal swab specimens. For this analysis, prevalent and incident cases