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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.

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

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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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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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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