Disclosures. **All authors:** No reported disclosures.

1062. Pertussis-Associated Persistent Cough in Previously Vaccinated Children

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Background. Persistent cough is a very distressing condition. It may be due to infectious agents, including *Bodetella pertussis*. In this case, associated symptoms are frequently different from typical pertussis (PT) cases and diagnosis is difficult and delayed. In this study, the role of *B. pertussis* infection as cause of persistent cough in school-children and adolescents and the protective role of previously administered PT vaccine doses was evaluated.

Methods. Healthy 7- to 17-year-old children with cough lasting from 2 to 8 weeks were enrolled. Excluded were the patients who had received the preschool booster (PSB) PT vaccine less than one year before the cough onset. At enrollment, a nasopharyngeal swab and an oral fluid sample were obtained to seek pertussis infection by detection of *B. pertussis* DNA in the nasopharynx using PCR and/or an elevated titer of anti-pertussis toxin IgG in oral fluid using an IgG antibody-capture enzyme-linked immunosorbent assay. Saliva determination of anti-PT toxin IgG was used because it acts as a surrogate for anti-PT toxin IgG serology.

Results. Among 96 patients, pertussis was diagnosed in 18 (18.7%; 95% CI 11.5–28.0). In 2 children with cough lasting 2 weeks, confirmation was based on the detection of *B. pertussis*; in 13 cases, with cough lasting 4–7 weeks, PT was diagnosed because there were high anti-PT IgG titers in oral fluid; and in 3 cases, with cough lasting 3 weeks, PT was diagnosed due to positivity for both tests. In 15 children, the disease occurred despite PSB administration. In 2 cases, PT diagnosis was made only 16 and19 months after booster injection, whereas in other 13 cases infection emerged after a longer period. However, in eight cases disease occurred less than 5 years after vaccine administration.

Conclusion. This study demonstrates that about 20% of persistent cough in children is due to PT. In case of persistent cough, this has to be considered to prescribe an effective therapy. Moreover, the study confirms that protection evoked by PT vaccine rapidly wanes and that schoolchildren may return to be PT susceptible after few year of the officially recommended PSB dose. If confirmed, these findings might lead to anticipate presently recommended PT vaccine dose for adolescents.

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1063. Mapping Pediatric Tetanus Cases in Central Pennsylvania and Analyzing Hospital Costs Associated with Treatment

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Background. Pennsylvania is home to Amish and Mennonite communities with an estimated combined population of over 90,000 people. Under-immunization is common with vaccine preventable diseases, including tetanus, periodically presenting among children from these communities. Nearly 20% of nationally reported pediatric tetanus cases in the past 10 years were treated at our institution, the tertiary care center which serves these unique populations. We characterize demographics and costs of treating this rare, but largely preventable infection.

Methods. Chart review based on ICD-9 codes for tetanus infection in patients aged 0–17 years treated for clinically diagnosed tetanus infection between January 2006 and December 2015. Cost data were extracted from Horizon Business Insight software and analyzed in Microsoft Excel. Cases were mapped using UDS Mapper.

Results. Four cases of pediatric tetanus infection were identified with 100% occurring in unimmunized patients and 3 of 4 (75%) in Amish individuals. Treatment costs amounted to $121,170 with estimated payment of $80,664 resulting in a net loss to the hospital of $40,506 over the course of 10 years. Each case treated resulted in a median loss of $4,402 to the hospital.

Conclusion. The costs of treating this vaccine preventable disease for both hospitals and under-immunized Amish and Mennonite communities, who tend to pay out-of-pocket, should be emphasized in targeted outreach and education programs at the population level.

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1064. Reported History of Measles and Long-term Impact on Antibody to Tetanus in Children 6–59 Months of Age Receiving DTP in the Democratic Republic of Congo

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Background. Recent studies suggest a measles-induced immune amnesia that could have long-term immunosuppressive effects via preferential depletion of memory B and T CD150+ lymphocytes.

Methods. We examined the association between past measles and tetanus antibody levels among children participating in the 2013–2014 Democratic Republic of Congo (DRC) Demographic and Health Survey (DHS). Our sample consisted of 833 children aged 6–59 months whose mothers were selected for interview. Mothers reported (via recall) history of measles within the lifetime of the child. Classification of children who previously had measles was completed using maternal recall and measles immunoglobulin G (IgG) serostatus obtained via dried blood spot (DBS) analysis. A multiplex chemiluminescent immunoassay platform was used to obtain serologic results and Assay Score (AS) was calculated as a ratio to a positive control included in each run. Tetanus serostatus was categorized as being above or below the sample median serology AS value. Tetanus vaccination status was obtained via dated vaccination card and limited to children receiving the complete 3-dose vaccination series.

Results. The median AS for tetanus serology among the entire sample of 833 children was 0.085, while children with history of measles had a median AS of 0.053 ($N = 41$) and children with no history of measles had a median AS of 0.088 ($N = 792$), chi-square P-value < 0.05. A random intercept logistic regression model was used to examine the association between previous measles disease and odds of having below median levels of tetanus antibody. Controlling for potential confounding variables, the odds of a child with past history of measles having less than the median level of tetanus antibody was 3.86 (95% CI: 1.70, 8.78) among children fully vaccinated for tetanus.

Conclusion. The results suggest that, among children 6–59 months in DRC, measles may have a long-term impact on levels of pre-existing, vaccine-induced immunity to tetanus. These findings suggest the need for laboratory studies examining measles' impact on pre-existing, vaccine-induced immunity and underscore the need for continued evaluation and improvement of DRC's measles vaccination program.

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1065. Cord Blood Antibody Seroprevalance Against Diphtheria, Pertussis, Measles, Mumps and Rubella among Term Healthy Indian Newborns

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Background. The resurgence of vaccine preventable diseases in young infants is a matter of concern worldwide. The aim of our study was to determine the seroprevalance of protective antibodies against diphtheria, pertussis, measles, mumps and rubella antigens in cord blood among term Indian newborns, at birth.

Methods. Apparently healthy term newborns, delivered at a tertiary care hospital in Northern India, over two year period (Apr 15-March 17) were enrolled after taking informed written consent from their parents; and their cord blood sample was collected. Ethical clearance was obtained from Institute Ethics committee, before enrolling subjects. Cord blood samples were tested for antibodies using commercial ELISA kits IMMUNOLAB IgG.

Results. A total of 160 newborns (M:F = 86:74) were enrolled. In our study, antibodies (IgG) against diphtheria toxin (DT) were > 0.1 IU/mL in 44.4% (71/160), 0.01 to 0.1 IU/mL in 53.1% (85/160) and < 0.01 IU/mL in 2.5% (4/160). None of their mothers received Tdap vaccine in past. Antibodies (IgG) against pertussis toxin (PT) > 40 U/mL were seen in 41.2% (66/160). Out of these 66 children, 23 had titres > 100 U/mL. Total of 58.8% (94/160) children had antibodies < 40 U/mL. Out of these 94 children, 48 had titers < 20 U/mL.

Antibodies (IgG) against measles antigen were > 12 IU/mL in 88.8% (142/160). A total of 11.2 (18/160) had titers below 12 IU/mL. Out of these 18 children, 5 had titers < 6 IU/mL. Antibodies (IgG) against mumps antigen were > 12 IU/mL in 83.1% (133/160). A total of 16.9% (27/160) had titers below 12 IU/mL. Out of these 27 children, 12 had titers < 6 IU/mL. Antibodies (IgG) against rubella antigen were > 12 IU/mL in 83.7% (134/160). A total of 16.3% (26/160) had titers below 12 IU/mL. Out of these 26 children, 22 had titers < 6 IU/mL.

Conclusion. Only 44.4% of studied newborns were fully protected (> 0.1 IU/mL) against diphtheria, because of maternal antibodies. As correlates of protection for pertussis are not yet defined; those having anti-PT titers >100 IU/mL i.e., 14.3% (23/160) were most protected; while those having titers < 20 U/mL i.e., 30% (48/160) were least protected. Out of studied newborns, fully protected (>12 IU/mL) against measles, mumps and rubella were 88.8%, 83.1% and 83.7% respectively.

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1066. Trends in the Burden and Seasonality of Rotavirus in the United States, 2000–2016

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Background. Before implementation of rotavirus vaccination in 2006, rotavirus caused 55,000-70,000 hospitalizations and 410,000 clinic visits annually in US children. This report examines the long-term impact of vaccine introduction on rotavirus detection and seasonality through comparison of pre (2000–2006) and post (2007–2016) vaccine seasons through the National Respiratory and Enteric Virus Surveillance System (NREVSS).

Methods. NREVSS is a passive laboratory system collecting results of weekly total and rotavirus-positive stool specimens. Seasons are defined as July through June. To characterize changes in rotavirus detection, total and positive specimens for each post vaccine season from 11 continuously reporting (≥26 weeks per season) laboratories were compared with median values for 2000–2006. Data from 20 participating laboratories were used to determine changes in season characteristics. ArcGIS software was used to document the annual geographic trend across the United States between 2000 and 2015. For season 2015–2016, data are available through April and are not included in the ArcGIS analysis.

Results. Nationally, there was a 53–93% reduction in rotavirus positivity in the post vaccine period as compared with the median in 2000–2006. Trends in rotavirus positivity declined steeply after vaccine introduction in 2006, and have remained low compared with the pre-vaccine period, with alternating years of lower and greater activity (figure). All regions had similar reductions in positive tests. ArcGIS data indicate that peak seasonal activity was largely restricted to January-April for each pre-vaccine year. In the 2006–2007 season, peak activity occurred during January-April, for 2007–2008, this shifted to March-April, for 2008–2009, the peak activity nationwide occurred at all months of the year from the reporting laboratories. This diffuse activity occurred for all subsequent years, save 2009–2010 and 2012–2013, where peak seasonal activity was again confined to January-April.

Conclusion. Rotavirus vaccine substantially and sustainably reduced the burden and changed the epidemiology of rotavirus in US children. The biennial pattern observed may be explained by accumulating unvaccinated children over two successive seasons resulting in stronger rotavirus seasons every alternate year.

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1067. Differential Gene Expression Elicited by Children in Response to the 2015–2016 Live Attenuated vs. Inactivated Influenza Vaccine

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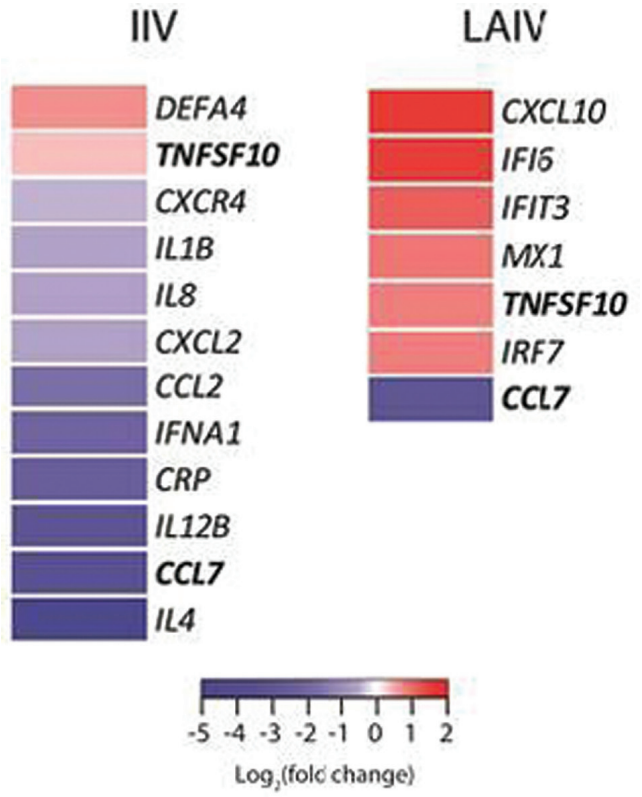
Background. In recent influenza seasons, the live attenuated influenza vaccine (LAIV) has not demonstrated the same level of vaccine effectiveness as that observed among children who received the inactivated influenza vaccine (IIV). To better understand this difference, this study compared the mRNA sequencing transcription profile (RNA seq) in children who received either IIV or LAIV.

Methods. Children 3–17 years of age receiving quadrivalent influenza vaccine were enrolled. Blood samples were collected on Day 0 prior to vaccination and again on Day 7 (range 6–10 days) following vaccination. Total RNA was isolated from PAXgene tubes and sequenced for a custom panel of 89 transcripts using the TruSeq Targeted RNA Expression method. Fold differences in normalized RNA seq counts from Day 0 to Day 7 were calculated, $\log_2$ transformed and compared between the two vaccine groups.

Results. Of 73 children, 47 received IIV and 26 received LAIV. Following IIV vaccination, 12 genes demonstrated significant differential expression at Day 7. In contrast, following LAIV vaccination, seven genes demonstrated significant differential expression at Day 7, five of which were not differentially expressed by IIV. Two genes demonstrated similar patterns of regulation in both IIV and LAIV recipients.

Conclusion. Differential regulation of genes was observed between 2015 and 2016 LAIV and IIV recipients. These results help to elucidate the immune response to influenza vaccines and might help explain the difference in vaccine effectiveness observed in recent years between LAIV and IIV.



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1068. Varicella Vaccination Coverage among Adolescents Ages 13–17 Years, United States, National Immunization Survey, 2007–2014

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Background. Varicella is typically a self-limiting disease but it can be more severe in adolescents and adults. In 2007, 2-doses of varicella vaccine were routinely recommended for children, with a catch-up second dose for persons who received 1 prior dose.

Methods. We used 2007–2014 NIS-Teen data to examine trends in ≥2 dose varicella vaccination coverage and proportions of adolescents with/without evidence of immunity to varicella. Evidence of immunity included receipt of ≥2 doses of varicella vaccine or varicella disease history. Additionally, using 2014 data, we assessed characteristics of ≥2 dose varicella vaccination coverage: 1) factors associated with ≥2 dose vaccination, 2) timing of receipt of second dose and 3) missed opportunities for second dose vaccination among adolescents who had received 1 prior dose of varicella vaccine.

Results. During 2007–2014, the proportion of adolescents with ≥2 doses of varicella vaccine increased from 8.3% to 66.9% in 13–15 year olds, and from 3.6% to 56.7% in 16–17 year olds. The proportion of adolescents with evidence of varicella immunity also increased for both age groups, from 68.0% to 84.1% in 13–15 year olds and from 78.6% to 83.4% in 16–17 year olds. Among adolescents who received ≥2 doses of varicella vaccine by 2014, a higher proportion of 13–15 year olds received their second dose at 4–6 years compared with 16–17 year olds (13.4% vs. 3.2%). Factors significantly associated with lower ≥2 dose coverage included non-Hispanic White race/ethnicity; rural residence; living at >133% of the income-to-poverty ratio; no 11- to 12-year well-child visit; not receiving an adolescent vaccine; and residence in a state with no 2-dose immunization school entry requirement. Among the 2,478 adolescents who received only 1-dose of varicella vaccine, 77.1% (1,922) had at least 1 missed opportunity to receive their second dose; potentially 2-dose coverage could have increased from 79.5% to 94.8%.

Conclusion. The ≥2-dose varicella vaccination coverage and the proportion of adolescents with evidence of immunity to varicella increased during 2007 to 2014, though 16% lacked evidence of immunity in 2014. Though catch-up campaigns