of age (VE 61%, 95% CI 14, 82). VE was 26% (95% CI −58, 65%) against serotype 3 and 67% (95% CI 11, 88%) against other PCV13-types (+6C). PCV13 was not effective against nonvaccine types.

Conclusion. PCV13 was effective in preventing IPD caused by PCV13 types when excluding type 3; no effectiveness was demonstrated against serotype 3.

Disclosures. **W. Schaffner**, Merck: Member, Data Safety Monitoring Board, Consulting fee. Pfizer: Member, Data Safety Monitoring Board, Consulting fee. Dynavax: Consultant, Consulting fee. Seqirus: Consultant, Consulting fee. SutroVax: Consultant, Consulting fee. Shionogi: Consultant, Consulting fee.

152. Protective Antibody Levels 7.5 Years After Primary Vaccination in Adolescence With a Recombinant, 4-Component, Meningococcal Serogroup B Vaccine (4CMenB) and Response to a Booster Dose in Adolescents and Young Adults: Phase IIIb Clinical Findings

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Background. 4CMenB has been shown to be immunogenic with an acceptable safety profile in infants and young adolescents. However, no data on long-term persistence after primary vaccination in adolescents are available. This is the first study to assess antibody persistence, booster response, and safety of 4CMenB in adolescents and young adults up to 7.5 years following the primary vaccination in adolescence.

Methods. This phase 3b, open-label, extension study (NCT02446743) assessed the antibody persistence and booster response at 4 years (Canada and Australia, NCT01423084) or 7.5 years (Chile, NCT00661713) after primary vaccination with 4CMenB (following 0 + 1-, 0 + 2-, or 0 + 6-month schedules), compared with vaccine-naïve (VN), healthy controls. Chilean follow-on (FO) and VN participants aged 18–24 years received either a booster dose of 4CMenB 7.5 years postprimary series (Group FO, N = 131) or 2 primary doses, 1 month apart (Group VN, N = 150). Immunogenicity was measured using human serum bactericidal antibody assay (hSBA) against antigen-specific strains. Immune response was evaluated 1 month post-booster vaccination and compared with VN controls at 1 month post-first dose. Kinetics of antibody responses were measured at 3, 7, and 30 days post-vaccination. Safety was assessed.

Results. Antibody levels waned at 7.5 years postprimary vaccination in Group FO, but were higher than in Group VN at baseline, for all antigens except NHBA (table). At 1 month post-booster/post-first dose, 93–100% (Group FO) and 62–93% (Group VN) of participants had hSBA titres ≥4; GMTs ranged between 41 and 1,951 (Group FO) and 9.43–46 (Group VN) (table). The percentages of FO participants with hSBA titres ≥4 remained similar to prebooster for all 4 antigens at 3 days, increased at 7 days, and remained unchanged or increased further 30 days post-booster. The reactogenicity of 4CMenB was consistent with previous observations in this age group; no safety concerns were identified during the study.

Table. Antibody persistence and response to a booster (Group FO) or first dose (Group VN)

Antigen	Day	Group FO			Group VN		
		N	hSBA titres ≥4 % (95% CI)	GMT value (95% CI)	N	hSBA titres ≥4 % (95% CI)	GMT value (95% CI)
fHbp	1	131	44 (35.6; 53.2)	4.51 (3.57; 5.69)	150	13 (7.8; 19.1)	1.52 (1.23; 1.90)
	31	127	100 (97.1; 100)	269 (206; 351)	149	81 (73.3; 86.6)	24 (19; 31)
NadA	1	120	84 (76.4; 90.2)	31 (23; 42)	139	24 (16.9; 31.7)	2.30 (1.75; 3.04)
	31	102	100 (96.4; 100)	1951 (1425; 2671)	137	84 (76.7; 89.7)	31 (24; 41)
PorA	1	129	29 (21.1; 37.3)	2.56 (2.07; 3.17)	148	14 (9.0; 20.9)	1.50 (1.23; 1.84)
	31	120	93 (87.3; 97.1)	41 (30; 56)	148	62 (53.8; 70.0)	9.43 (7.15; 12)
NHBA	1	131	81 (73.1; 87.3)	22 (16; 29)	150	79 (72.0; 85.5)	18 (14; 24)
	31	127	99 (95.7; 99.98)	113 (90; 142)	149	93 (87.2; 96.3)	46 (37; 57)

Group FO, follow-on participants; **Group VN**, vaccine-naïve participants; **N (%)**, number (percentage) of participants with hSBA titres ≥4; **hSBA**, human serum bactericidal assay; **GMT**, geometric mean titre; **CI**, confidence interval; **Day 1**, pre-booster timepoint for Group FO and pre-vaccination for Group VN; **Day 31**, 1 month post-booster for Group FO and 1 month post-first dose for Group VN; **fHbp**, factor H binding protein; **NadA**, *Neisseria* adhesin A; **PorA**, Porin A; **NHBA**, neisserial heparin binding antigen.

Conclusion. Antibody levels in adolescents and young adults declined at 7.5 years after a 2-dose primary series of 4CMenB, but were higher than baseline levels in VN controls. An additional dose of 4CMenB elicited strong anamnestic responses—substantially higher than 1 dose in VN controls.

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153. The Effect of Timing of Tetanus–Diphtheria and Pertussis Vaccine Administration in Pregnancy on The Avidity of Pertussis Antibodies

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Background. Tetanus–diphtheria–pertussis (Tdap) vaccination in pregnancy is currently recommended in many countries. The optimal timing of pertussis immunization in pregnancy is not well established, leading to different recommendations. We aimed to determine the effect of timing of vaccination with Tdap in pregnancy on the umbilical cord avidity of antipertussis toxin (PT) immunoglobulin G (IgG).

Methods. Avidity of anti-PTIgG was assessed using ammonium thiocyanate (NH_4SCN) at concentrations between 0.25 M (to measure low avidity antibodies) and 3 M (to measure high avidity antibodies). Anti-PT IgG levels achieved at each NH_4SCN concentration were calculated. *T*-tests were used to compare anti-PT IgG levels between newborns of women vaccinated in early (28–32 weeks gestation) and late (33–36 weeks gestation) third trimester. Pearson correlation assessed the relationship between the timing of vaccination and anti-PT IgG levels.

Results. Newborns of women vaccinated with Tdap in early third trimester (n = 43) had higher anti-PT IgG levels at 1 M and 2 M NH_4SCN concentrations compared with newborns of women vaccinated in late third trimester (n = 47), 2.4 international units (IU)/mL vs. 1.9 IU/mL (P = 0.0073) and 2.3 IU/mL vs. 1.7 IU/mL (P = 0.0354), respectively, after adjustment for gestational age at birth. There was a negative association between later timing of vaccination in third trimester and anti-PT IgG levels achieved at 0.5 M, 1 M, 1.5 M, and 2 M NH_4SCN (all $P \leq 0.02$). There was a positive association between increasing time between vaccination and delivery and anti-PT IgG levels achieved at 0.5 M, 1 M, 1.5 M, and 2 M NH_4SCN (all $P \leq 0.02$).

Conclusion. Vaccination against pertussis during early third trimester results in higher levels of high avidity antibodies compared with vaccination in late third trimester. High avidity antibodies may confer greater protection to the neonate supporting recommendations for vaccination at 28–32 WG vs. 33–36 WG.

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

154. Diagnosis and Genotyping of *Coxiella burnetii* Causing Endocarditis in a Patient With Prosthetic Pulmonary Valve Replacement (PVR) Using Next-Generation Sequencing (NGS) of Plasma

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Background. Identification of *Coxiella burnetii*, the etiologic agent of Q Fever, in culture-negative endocarditis (CNE) remains challenging, and strain-level information is typically unavailable through conventional testing. We used a novel next-generation sequencing (NGS) assay on plasma cell-free DNA to facilitate rapid diagnosis and genotyping in a patient with *C. burnetii* CNE.

Methods. NGS was performed on plasma by Karius, Inc. (Redwood City, California). Human reads were removed and remaining sequences were aligned to a curated database of over 1,000 pathogens. Organisms present above a predefined significance threshold were reported. For *C. burnetti* strain-typing, alignments to different *Coxiella* strains in the pathogen database were compared by BLAST bit-score to determine the most closely related strain to the infecting organism. *C. burnetii* genotype group was also determined by *in silico* analysis of polymorphic ORF deletion markers known to distinguish groups I–VI.

Results. Twenty-nine-year-old male with history of Tetralogy of Fallot, multiple pulmonary valve replacement (PVR), and 18 months of intermittent fever and night sweats were admitted. Relevant history included travel in South and South East Asia, the use of a LivaNova 3T Heater-Cooler device during surgery (i.e., at risk for *Mycobacterium chimaera*), and drinking unpasteurized milk. Cardiac CT showed 2 pulmonary opacities concerning for septic emboli and echocardiography showed echodensity on pulmonic valve. Blood cultures were negative. NGS detected *C. burnetii*

within 48 hours of sample receipt. On the basis of these results, hydroxychloroquine and doxycycline were initiated with symptomatic improvement. Strain-typing demonstrated highest relatedness to the *CbuK_Q154* (group IV) strain typically seen in North America. Genotype group was independently confirmed by inference of a pattern of ORF deletion most similar to group IV (and highly related group VII). Serologic testing for *C. burnetii* confirmed the diagnosis. After 4 weeks of antibiotics, the patient underwent successful PVR with graft exchange.

Conclusion. NGS testing aided in diagnosis of *C. burnetii* CNE, enabling early targeted antimicrobial therapy. It also allowed inference of strain-level information, supporting further investigations regarding epidemiologic origins of this pathogen.

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155. Infective Endocarditis and Cardiac Valve Surgery During the Opioid Epidemic in North Carolina, 2007 to 2017

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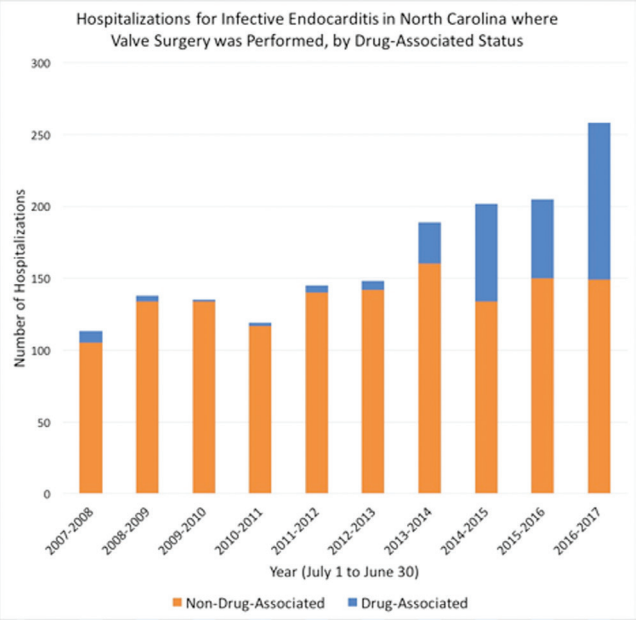
Background. Infective endocarditis (IE) associated with drug use (DA-IE) is rising nationally. North Carolina (NC), a state hard-hit by the opioid epidemic, saw an over 12-fold increase in DA-IE from 2010 to 2015. Concerns about surgery exist due to the risk of ongoing drug use and reinfection after valvuloplasty. We evaluated trends, characteristics, and outcomes of valve surgery for DA-IE, compared with IE not associated with drug use (non-DA-IE), in NC.

Methods. We analyzed the NC Discharge Database, which includes administrative data from all hospital discharges in NC. Using International Classification of Diseases codes, we identified all persons ≥18 years of age with IE from July 1, 2007 to June 30, 2017. Hospitalizations were deemed DA-IE by a diagnosis code related to illicit drug use, dependence, poisoning or withdrawal (excepting marijuana), or Hepatitis C in a person born after 1965. All others were labeled non-DA-IE. Procedure codes were queried to identify cardiac valve surgery. Year-to-year trends in surgery for IE by drug-associated status were reported. Demographics, length of stay (LOS), charges, and disposition were compared among DA-IE and non-DA-IE.

Results. A total of 22,809 hospitalizations were coded for IE. Valve surgery occurred in 1,652. Of surgical hospitalizations, 17% overall and 42% in the final study year were DA-IE. Hospitalizations for DA-IE where surgery was done increased from <10 through 2012–2013 to 109 in 2016–2017 (figure). Compared with non-DA-IE, those undergoing surgery for DA-IE were younger (median age 33 vs. 56), female (47% vs. 33%), White (89% vs. 64%), uninsured (34% vs. 11%), insured by Medicaid (39% vs. 13%), and had tricuspid valve surgery (38% vs. 11%). DA-IE had longer median LOS (27 vs. 17 days) and were less often discharged home (51% vs. 59%). For the 287 DA-IE admissions with surgery, median hospital charges were $247,524, totaling over $79,000,000. All comparisons were significant at $P < 0.0001$.

Conclusion. From 2007 to 2017, valve surgeries for DA-IE in NC rose over tenfold and are approaching half of all surgeries for IE. This phenomenon is an underappreciated and morbid component of the opioid epidemic that burdens hospital and state resources. Research into best practices for managing patients with DA-IE and addressing addiction in this setting is critically needed.



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

156. Direct Detection and Quantification of Bacterial Cell-free DNA in Patients with Infective Endocarditis (IE) Using the Karius Plasma Next Generation Sequencing (NGS) Test

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Background. The variable clinical presentation of IE requires a diagnostic tool that accurately detects a wide range of organisms, including in culture-negative (CN) scenarios. A sensitive molecular diagnostic assay that quantitates pathogen DNA could be a useful tool to diagnose IE and evaluate response to antimicrobial therapy.

Methods. We prospectively enrolled 30 hospitalized adult patients evaluated for acute IE classified using the Duke Criteria. Residual plasma samples within 24 hours and/or fresh whole blood within 48–72 hours of enrollment blood culture were collected. Additional samples were collected every 2–3 days for up to 7 time points until discharge. Samples were shipped to the Karius laboratory (Redwood City, California) for testing. Cell-free DNA was extracted and NGS was performed. Human sequences were removed and remaining sequences were aligned to a curated pathogen database of over 1,000 organisms. Organisms present above a predefined statistical threshold were reported. Quantity of DNA for each reported pathogen was expressed as molecules per microliter.

Results. Of 29 patients eligible for analysis, 18 had prosthetic valves and 7 had implanted cardiac devices. Twenty-four patients had Definite IE. Twenty patients had positive blood cultures (including *S. aureus*, *S. epidermidis*, *E. faecalis*, *S. agalactiae*, *Pantoea ananatis*, *S. sanguinis*, *C. albicans*); NGS identified the same organism isolated in all 20 patients as well as *E. cloacae* complex, and *E. faecalis* in 2 of 4 CN Definite IE patients. For 1 CN patient with Possible IE, NGS identified *E. coli*. NGS and BC were negative for 4 patients with Rejected IE. NGS identified the IE etiology in patients pretreated with antibiotics up to 20 days prior to sample collection. Pathogen DNA signal was often observed in both initial and repeat plasma samples, while repeat blood cultures remained negative.

Conclusion. This novel, cell-free pathogen quantitative NGS plasma assay accurately identified causative organisms in patients with IE, even when blood cultures were negative due to pretreatment with antibiotics. Pathogen DNA, detected in plasma longer than blood culture, is a promising biomarker to aid in the diagnosis and monitoring of IE, particularly culture-negative IE.

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157. Reducing Blood Culture Contamination Rates Through the Use of a Red Top Tube Discard

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Background. Septicemia is a major cause of death in the United States and accounts for up to $16.7 billion in annual health care expenses. Blood culture is the gold standard for laboratory diagnosis of bacteremia and resultant septicemia; however, false-positive blood cultures hinder the accurate determination of true bacteremia with often serious implications. The goal of this study was to determine the efficacy of collecting a 1 mL discard in a red tube prior to blood culture collection and to assess its effectiveness in reducing contamination rates in Hartford Hospital Emergency Department (HHED).

Methods. During the months of June to December 2017 blood cultures were collected by the phlebotomy team using ChloraPrep (chlorhexidine) as the sole disinfecting agent. Blood cultures consisted of BD BACTEC plus Aerobic/F and BD BACTEC Lytic/10 Anaerobic drawn at the same time and monitored on BD BACTEC FX instrument for 5 days. Prior to collecting blood cultures 1 mL of blood was collected in a red top tube and discarded. Monthly and overall contamination rates were then compared with 2016 in which a red top discard tube was not used.

Results. During June to December 2016, there were a total of 9,576 blood cultures collected with a total of 178 contaminants and an overall contamination rate of 1.9%. During June to December 2017, there were a total of 9,133 blood cultures collected with a total of 73 contaminants and an overall contamination rate of 0.8%. During both