66th ANNUAL EIS CONFERENCE

APRIL 24–27
2017
THE DISEASE DETECTIVES

SCIENCE THAT MAKES A DIFFERENCE

Anticipating the *"So What?"*

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

66th Annual Epidemic Intelligence Service (EIS) Conference

April 24–27, 2017

Agenda-at-a-Glance

Monday

WELCOME AND CALL TO ORDER ..... 8:15–8:30 am
SESSION A: Stephen B. Thacker Opening Session ..... 8:30–10:15 am
CONCURRENT SESSION B1: Vaccine-Preventable Diseases ..... 10:45 am–12:10 pm
CONCURRENT SESSION B2: Chronic Disease Prevention and Health Disparities ..... 10:45 am–12:10 pm
LUNCH (on your own) ..... 12:15–1:30 pm
SESSION C: J. Virgil Peavy Memorial Award Finalists ..... 1:45–3:30 pm
EIS Recruitment Information Session ..... 3:30–4:30 pm
SESSION D1: Zoonotic Diseases ..... 3:45–5:10 pm
SESSION D2: Reproductive Health ..... 3:45–5:10 pm
SESSION D3: Global Health: Treatment and Safety ..... 3:45–5:10 pm
EIS Alumni Association Meeting (private event sponsored by EISAA — EIS officers and alumni are welcome) ..... 5:15–7:00 pm

Tuesday

CONCURRENT SESSION E1: STDs and HIV ..... 8:30–9:55 am
CONCURRENT SESSION E2: Occupational Safety and Health ..... 8:30–9:55 am
SESSION F: Donald C. Mackel Memorial Award Finalists ..... 10:15 am–12:00 pm
LUNCH (on your own)/SPECIAL SESSION 1: Epidemiologic Investigations of Environmental Exposures ..... 12:05–1:20 pm
POSTER SYMPOSIUM I ..... 1:30–2:45 pm
SESSION G: Laboratory Leadership Service Presentations ..... 1:30–2:45 pm
CONCURRENT SESSION H1: Global Health: Epidemiology and Disease Prevention ..... 3:00–4:45 pm
CONCURRENT SESSION H2: Notes from the Field ..... 3:00–4:45 pm
PREDICTION RUN ..... 6:00 pm
SESSION I: FETP International Night – Poster Presentations ..... 6:00–8:30 pm

Wednesday

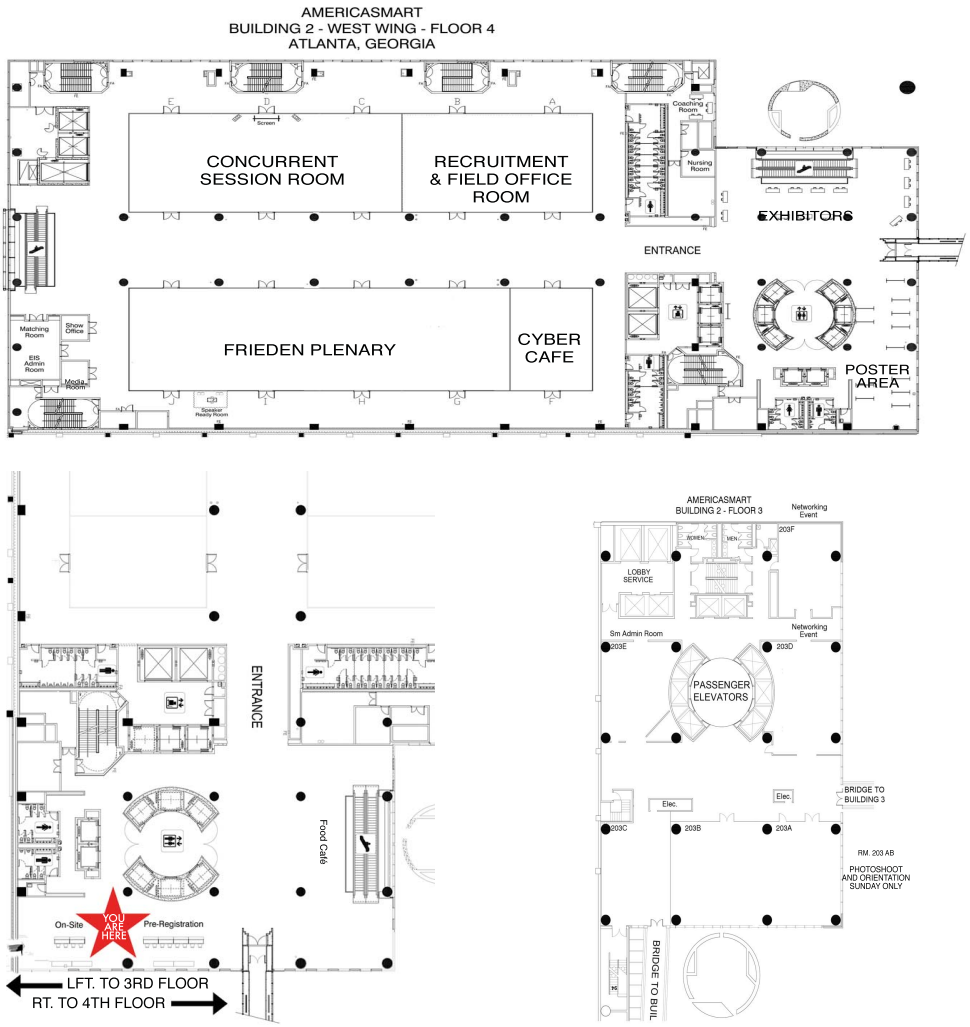
CONCURRENT SESSION J1: Emerging Infections ..... 8:30–10:15 am
CONCURRENT SESSION J2: Injury ..... 8:30–10:15 am
POSTER SYMPOSIUM II ..... 10:30–11:45 am
LUNCH (on your own)/SPECIAL SESSION 2: Zika Virus Infection ..... 11:50 am–1:05 pm
CONCURRENT SESSION K1: Healthcare-Associated Outbreaks ..... 1:15–3:00 pm
CONCURRENT SESSION K2: Environmental Health ..... 1:15–3:00 pm
CONCURRENT SESSION L: Alexander D. Langmuir Lecture ..... 3:15–4:45 pm
EIS CAREER NETWORKING NIGHT ..... 5:15–7:00 pm
SESSION M: FETP International Night – Oral Presentations ..... 6:30–9:00 pm

Thursday

CONCURRENT SESSION N1: Respiratory Diseases ..... 8:30–9:55 am
CONCURRENT SESSION N2: Hepatitis and Tuberculosis ..... 8:30–9:55 am
CONCURRENT SESSION O1: Foodborne Outbreaks ..... 10:15 am–12:00 pm
CONCURRENT SESSION O2: Child Health ..... 10:15 am–12:00 pm
LUNCH (on your own) ..... 12:05–1:30 pm
CONCURRENT SESSION P1: Drug-Related Illness ..... 1:35–3:20 pm
CONCURRENT SESSION P2: Water-Related Illness ..... 1:35–3:20 pm
SESSION Q: Awards and Late-Breaking Reports ..... 3:35–5:15 pm
CLOSING REMARKS AND ADJOURNMENT ..... 5:15–5:25 pm
POSTCONFERENCE EIS SATIRICAL REVIEW ..... 7:30 pm

Awards presented during session.

Atlanta Convention Center at AmericasMart
Floor Plan



Name Tags Color Key

- EIS Alumni
- Current EIS Officers
- Incoming EIS Officers
- Current LLS Fellows
- Incoming LLS Fellows
- Conference Participants
- Interested EIS/LLS Applicant
- Conference Staff
- Field EIS Alumni
- Recruiters
- Media

SAVE THE DATE

67th ANNUAL EIS CONFERENCE

EPIDEMIC INTELLIGENCE SERVICE

April 16–19, 2018

Centers for Disease Control and Prevention
Atlanta, Georgia

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Contents

Awards presented during session.

Awards presented during session.

Preface

Dear Colleagues,

Welcome to the 2017 annual Epidemic Intelligence Service (EIS) conference.

So what?

I think many of you will appreciate that this year's conference theme is, Science That Makes a Difference: Anticipating the, "So What?" CDC takes pride in its pledge to use the highest quality scientific data to directly inform decisions to protect our communities. With this theme in mind, we welcome you to continually challenge the EIS presentations this year with your practical questions of "So what?" As an EIS community, your comments help our officers think in actionable, impactful, and policy-relevant ways. I also urge you to review our annual EIS update, which highlights more examples of how the work of our EIS officers makes an impact and is critical to generating key actions that protect health and save lives.

No one exemplifies a focus on making sure that work is impactful and policy-relevant more than this year's Langmuir lecturer, Dr. Sandro Galea! Sandro Galea is a physician, epidemiologist, and dean at the Boston University School of Public Health. He has long championed the tenets of "consequential epidemiology" to emphasize the importance of ensuring that our work focuses on questions that lead directly to actions to improve population health. He was named one of TIME magazine's epidemiology innovators and listed by Thomson Reuters as one of the "world's most influential scientific minds" for the Social Sciences category. The "So what?" concept of his talk will have us thinking about how we move from conducting epidemiologic studies to making broad impacts in quantitative population health science. Mark your calendars, as the Alexander D. Langmuir lecture will take place on Wednesday from 3:15 p.m.–4:45 p.m.

I also encourage you to attend our Laboratory Leadership Service (LLS) presentations. LLS is modeled after the EIS program. LLS officers have made a substantial impact in improving the operational effectiveness, quality and safety of our laboratories and in helping coordinate laboratory and epidemiologic work through their involvement in multiple field investigations. Please attend this session as they work to communicate the importance of their findings to an epidemiologically-oriented audience, and to further build bridges between laboratory and epidemiology sciences at CDC. The LLS presentations will take place on Tuesday from 1:25 p.m.–2:40 p.m.

Two special sessions are being held this year; the first is on using advanced molecular tools to direct public health action (Tuesday, 12:05 p.m.–1:20 p.m.) and the second is on the Zika virus outbreak (Wednesday, 11:50 a.m.–1:05 p.m.).

As we have done since I became the chief of the EIS program, in the past year we focused heavily on our internal strategic planning and incorporating your comments and suggestions to continually improve this legacy fellowship. This new conference venue, with its improved space for recruitment and networking, was selected as a result of your prior feedback. We welcome your feedback as we continue to learn, grow, and improve the EIS conference experience.

I again encourage you to take a good look at the annual EIS update, which includes a description of the very talented incoming EIS class, as well as details on the amazing work of our current EIS officers. You will also find examples of how the EIS program works to

Preface *(continued)*

continually improve its processes. I am extremely proud of the behind-the-scenes dedication and effort of the operational and scientific staff in the Epidemiology Workforce Branch. None of this would happen without them. Please seek us out with any comments or questions that you might have—they are most welcome!

I also want to thank all of you for your support and advice the past three conferences. I treasure my experience as lead for the EIS program and working in the Center for Surveillance, Epidemiology, and Laboratory Services—it is truly a place where promising young (and not so young) scientists receive full support from leadership to pursue their personal dreams and undertake work that has meaningful impact on public health workforce development.

CAPT Joshua A. Mott, EIS '98
Chief, EIS Program
DSEPD, CSELS, CDC
United States Public Health Service
"Supposing is good, but finding out is better."
— Mark Twain

EIS Alumni Association

The EIS Alumni Association (EISAA) represents more than 3,000 alumni working on the front lines of public health at local, state, federal, and global levels, both public and private sectors. The association was first established in the 1960s by a group of alumni interested in fostering a sense of loyalty to the EIS program through various activities, including sponsoring several prestigious awards, hosting alumni networking events, and carrying-on treasured EIS traditions throughout conference week.

EISAA supports the ***Alexander D. Langmuir Prize***, named in honor of the beloved founder of the EIS Program and awarded to an outstanding manuscript completed during EIS; the ***Distinguished Friend of EIS Award*** honoring an individual who has provided exceptional mentoring and support to EIS Officers; the ***Donald C. Mackel Memorial Award*** recognizing the EIS investigation that best exemplifies collaborative work between epidemiology and laboratory science; the ***J. Virgil Peavy Memorial Award*** named in honor of a distinguished CDC statistician and EIS mentor and recognizing the investigation that most effectively uses innovative statistics and epidemiologic methods; and the ***EIS Champion Award*** initiated in 2013 in honor of ***Dr. Steven B. Thacker***, an inspirational leader who championed the EIS program and its officers throughout his career. Each year, EISAA also provides competitive travel scholarships for prospective applicants to attend the EIS Conference through the ***David J. Sencer Scholarship Award***. This year, EISAA had the pleasure of receiving more than 50 applications and awarding 8 travel scholarships. EISAA also provides funding for food and beverages between scientific sessions and helps support EIS Conference events such as the ***Prediction Run*** and ***Satirical Review***.

We are grateful to the de Beaumont Foundation for a grant received last year to help strengthen EISAA and mobilize our alumni base. Their support is allowing us this year to launch a **new, user-friendly website** (www.eisalumni.org) and alumni portal that will allow EIS alumni, officers, and potential recruits to find each other and connect based on geographic location or interest. The interactive database and improved communication infrastructure will provide a platform for alumni to network, share career experiences, advocate for important public health issues, promote public health events, and provide feedback on how to improve the EISAA. The grant has also allowed EISAA to **mobilize broader recruitment support** for the EIS program by assisting with the development of new recruitment materials, sponsoring regional recruitment events, and utilizing our diverse alumni pool to speak at local residencies, academic institutions, and national conferences.

If you haven't already made a contribution to EISAA this year, please consider doing so TODAY! Your support can help your EIS class achieve victory in our competitive class competition. Here's how you can get involved:

- **Join Now!** Renew your membership or make a contribution online (http://www.eisalumni.org) or at the EISAA table.
- **Stay Connected!** Look for alumni portal launch information coming soon. This information will guide you on how to log-on to our new website (http://www.eisalumni.org) alumni portal and update your contact information and alumni profile.
- **Learn More!** Join us at our Annual meeting on Monday, April 24 at 5:15 p.m. on Floor 203 Room AB and stop by the EISAA table in the main reception area of the Conference.

EISAA is driven by an important purpose — to bring alumni and friends together to connect professionally and personally. We hope you will join us in building our alumni community and supporting the premier public health training program in the world!

Sincerely,

Steve Waterman, MD, MPH
President, EIS Alumni Association, EIS '10

Diana Robelotto
Director of Alumni Affairs/EISAA Liaison, CDC Foundation

Scientific Program Committee

Co-Chair: Tracie Gardner, Center for Surveillance, Epidemiology, and Laboratory Services

Co-Chair: Michael Jhung, National Center for Immunization and Respiratory Diseases

Center for Global Health ..... Susan Chu
National Center on Birth Defects and Developmental Disabilities ..... Cheryl Broussard
National Center for Chronic Disease Prevention and Health Promotion ..... Andrea Sharma
National Center for Emerging and Zoonotic Infectious Disease ..... Brett Petersen and Isaac See
National Center for Environmental Health/Agency for Toxic Substances and Disease Registry ..... Suzanne Beavers
National Center for Health Statistics ..... Tala Fakhouri
National Center for HIV/AIDS, Viral Hepatitis, STD and TB Prevention ..... Bob Kirkcaldy
National Center for Immunization and Respiratory Diseases ..... Lindsay Kim
National Center for Injury Prevention and Control ..... Katherine Fowler
National Institute for Occupational Safety and Health ..... Candice Johnson
Center for Surveillance, Epidemiology and Laboratory Services ..... Jennifer Wright and Stacey Bosch

Back row:

Bob Kirkcaldy, Jennifer Wright, Andrea Sharma, Candice Johnson, Susan Chu, Brett Petersen, Tracie Gardner, Michael Jhung

Front row:

Cheryl Broussard, Katherine Fowler, Stacey Bosch, Tala Fakhouri, Isaac See, Suzanne Beavers, Lindsay Kim

General Information

Program Production

EIS Program
M. Paul Reid
RWD Consulting LLC

Acknowledgments/Disclaimers

The EIS Program extends a special thank you to the EIS Alumni Association and the Council of State and Territorial Epidemiologists for their generous support of the 66th Annual EIS Conference. The EIS Program gratefully acknowledges the valuable assistance and cooperation of the editorial and support staff of all CDC administrative units participating in the EIS Conference.

Abstracts in this publication were edited and officially cleared by the respective national centers. Therefore, the EIS Program is not responsible for the content, internal consistency, or editorial quality of this material. Use of trade names throughout this publication is for identification only and does not imply endorsement by the U.S. Public Health Service or the U.S. Department of Health and Human Services.

The findings and conclusions in these reports are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Purpose Statement

The primary purpose of the EIS Conference is to provide a forum for EIS officers to give scientific presentations (oral or poster), increase their knowledge of recent investigations and the significance to public health, and maintain and increase their skills in determining the appropriateness of epidemiologic methods, presenting and interpreting results clearly, and developing appropriate conclusions and recommendations.

Overall Conference Goals

- To provide a forum for EIS officers, alumni, and other public health professionals to engage in the scientific exchange of current epidemiologic topics.
- To highlight the breadth of epidemiologic investigations at CDC.
- To provide a venue for recruitment of EIS graduates into leadership positions at CDC and state and local departments of health.

Registration and Information

Staff are available at the conference registration desk. Check-in and onsite registration are available Monday–Wednesday, 7:00 am–5:00 pm. Please wear your conference badge at all times during the conference. Conference staff are wearing purple badges and are available to assist if you need additional information or misplace your badge.

Cyber Café/Message Center

All participants are welcome to drop by the complimentary Cyber Café to check emails, conduct meetings and prep for conference activities throught the conference week. Please limit computer time to 10 minutes per session to allow other conference attendees an opportunity to use the system as well. The Cyber Café will be open Monday–Wednesday, 8:00 am–5:30 pm and Thursday from 8:00 am–4:00 pm.

Environmental Considerations

Smoking is not permitted in any of the conference sessions, hallways, or meeting rooms. As a courtesy to presenters and all meeting attendees, please mute cellular phones during conference sessions. Please limit use of cellular phones to public areas outside the meeting rooms.

Lactation Room

Please visit the EIS information table near the registration area to sign up for lactation room access. A schedule and key will be available at the table Monday–Thursday, 8:00 am–5:00 pm.

Communications App

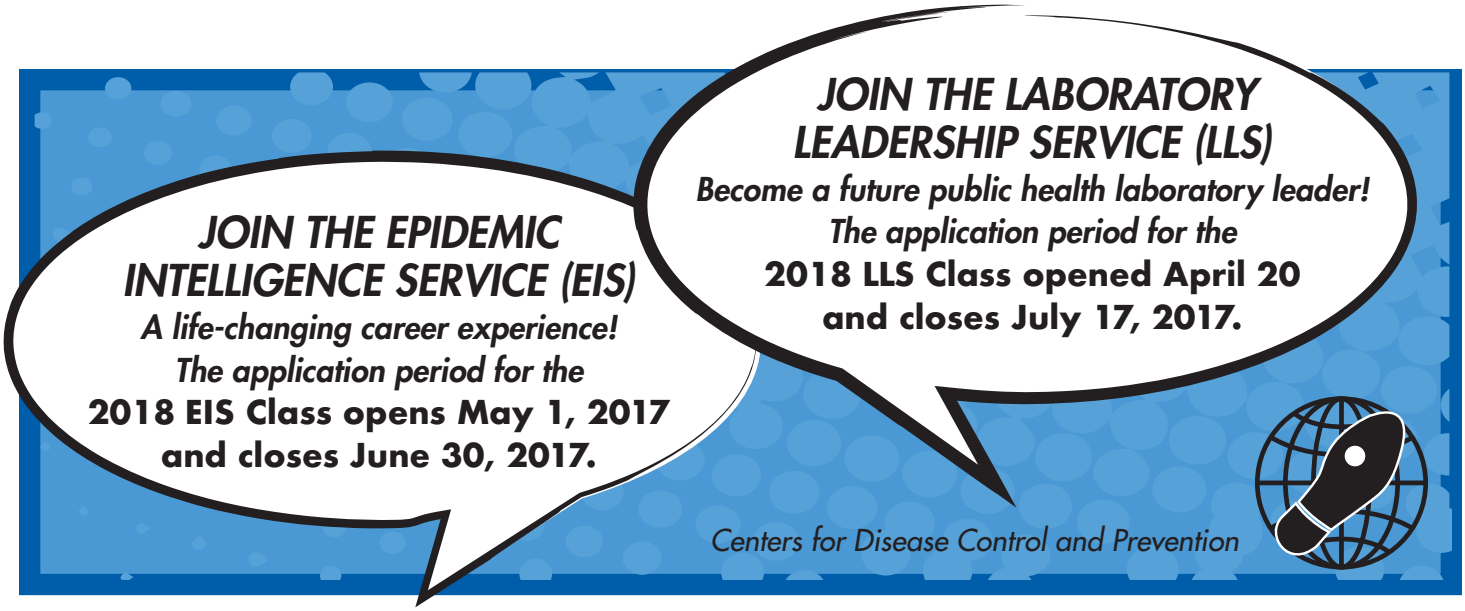
Preregistered attendees have immediate access to find, communicate, and network with other conference participants, speakers and staff. You can also upload a picture of yourself to facilitate easy identification. Please see conference staff for assistance if you have any questions about the Communications App.

How to Obtain Continuing Education

Continuing Education for this conference is only available through the CDC Training and Continuing Education Online system (CDC TCEO). Please follow the instructions provided below. You must complete the online evaluation by May 29, 2017 to receive your Continuing Education or your certificate of completion.

To complete online evaluation:

- Go to CDC TCEO at https://www.cdc.gov/tceonline/. Select **Participant Login** to login. If you are new to TCEO, select **New Participant** to create a user ID and password.
- Once logged on to CDC TCEO, the **Participant Services** page will display. Select the **Search and Register** link. Select the **CDC Courses** link at the bottom right of the search page.
- The next page will ask for the **CDC Center/Course Code**. The code for this course is **EISCONF17**. Enter the course code and select **View**.
- Click on the conference name, and the conference information page will display. Scroll down to **Register Here**. Select the type of CE that you would like to receive and then select **Submit**.
- The next page requests demographic information. New participants are required to answer the demographic questions. Returning participants please verify this information and select **Submit**.
- A message will display thanking you for registering for the conference. You will then be prompted to select the sessions that you would like to attend.
- After attending your selected conference sessions return to CDC TCEO. Select **Participant Login** to login.
- The **Participant Services** page will display. Select the **Evaluations and Tests** link. Select **Conferences**. The conference will be listed with the sessions you selected. You may **Add/Edit Sessions** until you have completed the evaluation for a particular session. After completing all of the session evaluations you will be prompted to complete the overall conference evaluation.
- A record of your conference completion and your CE certificate will be posted in the **Transcript and Certificate** section, located on the **Participant Services** page.
- If you have any questions or problems, please contact the CDC TCEO learner support help desk at https://www2a.cdc.gov/TCEOnline/comments.



66th Annual EIS Conference Schedule

Monday, April 24, 2017

7:00 **Registration Desk Opens**

8:15 **Welcome and Call to Order ..... Frieden Plenary**
Moderator: Joshua Mott
Presentation of Stephen B. Thacker EIS Champion Award

8:30–10:15 **SESSION A: Stephen B. Thacker Opening Session ..... Frieden Plenary**
Moderators: Anne Schuchat and Michael Iademarco

- **8:35** Prevalence of Human Papillomavirus Before and After Vaccine Introduction — National Health and Nutrition Examination Surveys, United States, 2003–2014. *Sara Elizabeth Oliver*
- **8:55** Raw Deal: Multistate Outbreak of *Salmonella* Virchow Infections Linked to a Powdered Meal Replacement Product — United States, 2015–2016. *Kelly Gambino-Shirley*
- **9:15** Sexual Orientation Discordance and Suicidal Ideation and Suicide Attempt Among U.S. High School Students — United States, 2015. *Francis Annor*
- **9:35** Knowledge, Attitudes, and Practices Rapid for Assessment To Improve Yellow Fever Vaccine Uptake Among Men During an Outbreak — Luanda, Angola, 2016. *Mariel Asbury Marlow*
- **9:55** Special Education Outcomes Among Children Born with Neonatal Abstinence Syndrome — Tennessee, 2008–2011. *Mary-Margaret Anne Fill*

10:15 **BREAK**

10:45–12:10 **CONCURRENT SESSION B1: Vaccine-Preventable Diseases ..... Fri eden Plenary**
Moderators: Nancy Messonnier and Sam Posner

- **10:50** Epidemiology of a Mumps Outbreak in a Highly Vaccinated University-Affiliated Setting and Use of a Third Dose of Measles-Mumps-Rubella Vaccine (MMR) for Outbreak Control — Iowa, July 2015–May 2016. *Minesh Pradyuman Shah*
- **11:10** Measles Outbreak at a United States Immigration and Customs Enforcement Facility — Arizona, May–June 2016. *Heather Venkat*
- **11:30** Impact of Sociodemographic Factors on Implementation of the Standards for Adult Immunization Practice — United States, 2016. *Neil C. Murthy*
- **11:50** Risk Factors for Meningococcal Disease Among Adults Experiencing Homelessness in Boston — Massachusetts, 2016. *John O. Otshudiema*

10:45–12:10 **CONCURRENT SESSION B2: Chronic Disease Prevention and Health Disparities .....Concurrent Session Room**
Moderators: Ursula Bauer and Tala Fakhouri

- **10:50** Cardiovascular Disease Risk Factors by Level of Active Transportation Among U.S. Adults, 2011–2014 *Marissa L. Zwald*
- **11:10** Comparison of Inactivity Among Adults with Disabilities by Using Two Disability Measures — National Health Interview Survey, 2011–2015. *Dana Olzenak McGuire*
- **11:30** Racial Differences in Survival of Pediatric Patients with Brain and Central Nervous System Cancer — United States, 2001–2012. *David A. Siegel*

Awards presented during session.

11:50 Trends in Hospitalization Rates for Patients with Myocardial Infarction by Race/Ethnicity Among Kaiser Permanente Southern California Members — Southern California, 2000–2014. *Gloria Chi*

12:15–1:30 LUNCH

1:45–3:30 SESSION C: J. Virgil Peavy Memorial Award Finalists ..... Frieden Plenary
Moderators: Jennifer Parker and Byron Robinson

1:50 A Novel Approach to Analysis of Cryptosporidiosis and Giardiasis Surveillance in the United States, 2005–2015. *Katharine Benedict*

2:10 Power Law Analysis of Foodborne Outbreaks — United States, 1998–2015. *Julie Lynn Self*

2:30 HIV, Serostatus Knowledge, and Viral Load Suppression Among Female Sex Workers in Kampala, Uganda, 2012 — A Respondent-Driven Sampling Survey. *Reena H. Doshi*

2:50 Impact of HIV Sequence Reporting Completeness on Detection of Growing HIV Transmission Clusters — Michigan, 2012–2014. *Sharoda Dasgupta*

3:10 Spatial Clustering of Suicide and Area-Level Characteristics at Census Block Group Level — Idaho 2010–2014. *Ahmed Magdy Kassem*

3:30–4:30 EIS RECRUITMENT INFORMATION SESSION ..... 3rd Floor R oom 203E

3:45–5:10 CONCURRENT SESSION D1: Zoonotic Diseases ..... Frieden Plenary
Moderators: Casey Barton Behravesh and Brett Petersen

3:50 No Kidding: Large Outbreak of Human *Escherichia coli* O157 Infections Linked to a Goat Dairy Farm — Connecticut, 2016. *Kelly Gambino-Shirley*

4:10 A Comparison of Three Statistical Thresholds to Trigger a Public Health Response to Monkeypox — Democratic Republic of the Congo, 2011–2013. *Sarah Guagliardo*

4:30 Q Fever Endocarditis — United States, 1999–2015. *Anne Straily*

4:50 Northern Trajectory of Human Tularemia — United States, 1965–2013. *Natalie Anne Kwit*

3:45–5:10 CONCURRENT SESSION D2: Reproductive Health .....Concurrent Session Room
Moderators: Wanda Barfield and Cheryl Broussard

3:50 Intracytoplasmic Sperm Injection (ICSI) Use Among States With and Without Insurance Coverage for Infertility Treatment — United States, 2000–2014. *Ada Dieke*

4:10 Antiviral Treatment Among Hepatitis B Virus–Infected Pregnant Women — New York City and Michigan, 2013–2015. *Ruth Link-Gelles*

4:30 Distribution of Severe Maternal Morbidity by Comorbidity Status Among Delivery Hospitalizations — Massachusetts, 1998–2013. *Nicholas Somerville*

4:50 Attention-Deficit Hyperactivity Disorder Medication Use During Pregnancy and Risk for Birth Defects — United States, 1997–2011. *Kayla Anderson*

3:45–5:10 CONCURRENT SESSION D3: Global Health: Treatment and Safety..... 3rd Floor Room 203 AB
Moderators: Rebecca Martin and Wences Arvelo

3:50 Efficacy of Artemether-Lumefantrine for Treatment of Uncomplicated *Plasmodium falciparum* Malaria — Cruzeiro do Sul, Brazil, 2016. *Megumi Itoh*

4:10 Effect of Mass Drug Administration Regimen on *Schistosoma mansoni* Morbidity Among School-Aged Children Over a 5-Year Period — Kenya, 2010–2015. *Anita Devi Sircar*

4:30 Improving Injection Safety in Cambodia: A Public Health Response to the 2014–2015 HIV Outbreak in Roka Commune. *Ugonna C. Ijeoma*

4:50 Misuse of Antibiotics for Childhood Diarrhea Case Management — Western Kenya, 2009–2016. *Chulwoo Rhee*

5:15–7:00 **EIS ALUMNI ASSOCIATION MEETING ..... 3rd Floor Room 203 AB**

Tuesday, April 25, 2017

8:30–9:55 **CONCURRENT SESSION E1: STDs and HIV .... Frieden Plenary**
Moderators: Gail Bolan and Bob Kirkcaldy

8:35 Syphilis Screening Among Pregnant Women — Guam, 2014. *Susan Cha*

8:55 Prevention of Mother-to-Child Transmission of HIV Service Utilization Among Adolescents and Young Women — Zimbabwe, 2013. *Amanda Burrage*

9:15 Infant HIV Diagnosis and Testing Turnaround Time — Malawi, 2012–2015. *Hammad Ali*

9:35 Factors Associated with Condomless Anal Sex Among Black Men Who Have Sex with Men — New York City, 2012. *Erica Dawson*

8:30–9:55 **CONCURRENT SESSION E2: Occupational Safety and Health ..... Concurrent Session Roo m**
Moderators: John Gibbins and Candice Johnson

8:35 Respiratory and Ocular Symptoms Among Employees at an Indoor Waterpark Resort — Ohio, 2016. *Sophia Chiu*

8:55 Respiratory Morbidity Among U.S. Coal Miners — States Outside of Central Appalachia, 2005–2015. *Laura Reynolds*

9:15 Occupational and Take-Home Lead Exposure Associated with a Lead Oxide Manufacturing Plant — North Carolina, 2016. *Jessica Lynn Rinsky*

9:35 Occupational Distribution of Campylobacteriosis and Salmonellosis Cases — Maryland, Ohio, and Virginia, 2014. *Chia-Ping Su*

10:15–12:00 **SESSION F: Donald C. Mackel Memorial Award Finalists .... Frieden Plenary**
Moderators: Gregory Armstrong and Reynolds Salerno

10:20 Acute Zika Virus Infection as a Risk Factor for Guillain-Barré Syndrome — Puerto Rico, April–December 2016. *Emilio Dirlikov*

10:40 Unusual Source of Gram-Negative Bloodstream Infections in Hemodialysis Patients — Illinois and Missouri, 2015–2016. *Shannon A. Novosad*

11:00 Integrating Epidemiologic and Molecular Data During an Outbreak of a Rare Strain of *Shigella* Among Men Who Have Sex with Men — Southern California, 2016. *Megan C. Dillavou Jarashow*

11:20 Hospital-Associated Outbreaks of Multidrug-Resistant *Candida auris* — Multiple Cities, Colombia, 2016. *Paige Armstrong*

11:40 Unusual Pathogen Associated with Nonbiting Flies in a Person with Bacteremia — Washington State, 2016. *Jesse Bonwitt*

12:05–1:20 **LUNCH**

SPECIAL SESSION 1: Epidemiologic Investigations of Environmental Exposures ..... 3rd Floor Room 203 AB

1:30–2:45 **POSTER SYMPOSIUM I ..... Concurrent Session Room**

Moderators: Douglas Hamilton and Michael King

During the first 30 minutes of the poster symposium, the following authors will each give a 2-minute oral presentation at the podium in front of a seated audience in the Concurrent room. Afterward, the authors will stand with their posters for the remaining session time in the poster area. The audience is encouraged to view the individual posters and engage in direct discussion with the author.

P1.1 Mental Health and HIV-Related Sexual Risk Behaviors Among Adolescent Sexual-Minority Males — Chicago, New York City, and Philadelphia, 2015. *Christine B. Agnew-Brune*

P1.2 Characteristics and Predictors of Inflammation Among Infants Aged 6–23 Months — Nepal, 2012. *Victor Akelo*

P1.3 U.S. Zika Pregnancy Registry Evaluation — United States, 2016. *Meng-Yu Chen*

P1.4 Correlates of Blood Lead Testing and Test Results in Young Children — Southern California, 2008–2015. *Gloria C. Chi*

P1.5 Prevalence and Factors Associated with Local Herb Use by Pregnant Women — Kigoma, Tanzania, 2014. *Rena Fukunaga*

P1.6 Epidemiology of Railway Suicide Deaths: National Violent Death Reporting System, 18 States — United States, 2003–2014. *Amanda Garcia-Williams*

P1.7 Novel Data Source for the Northwest Tribal Registry Project — Washington, 2016. *Sarah M. Hatcher*

P1.8 Comparison of Vaccination Coverage Among U.S.-Born and Foreign-Born Adolescents Aged 13–17 Years — United States, 2012–2014. *Jessica M. Healy*

P1.9 Assessment of Property and Health Effects of a Drought Emergency — Mariposa County, California, 2016. *Rebecca L. Laws*

P1.10 Seoul Searching: Outbreak of Seoul Virus among Ratteries and Pet Owners — Illinois, 2017. *Janna Kerins*

P1.11 Suspected Illicitly Manufactured Fentanyl-Related Overdose Death Characteristics — Massachusetts, 2014–2015. *Julie K. O'Donnell*

P1.12 Under-Five Mortality Reporting Following the Ebola Virus Disease Epidemic — Sierra Leone, 2015–2016. *Amanda Wilkinson*

1:30–2:55 **SESSION G: Laboratory Leadership Service Presentations ..... 3rd Floor Room 203 AB**

Moderators: Conrad Quinn and Xin Liu

1:35 *Legionella* Prevalence and Diversity in Cooling Towers — United States, Summer 2016. *Anna C. Llewellyn*

1:55 Emergence of 23S Mutations Associated with Macrolide Resistance in Group B *Streptococcus* — Georgia, 2015. *Jessica N. Ricaldi*

2:15 Comparative Risk Assessment of Laboratory Response Network (LRN) Methods to Process Potable Water Samples for Detection of Bioterrorism Threat Agents. *Diana Riner*

2:35 Understanding Antimicrobial Resistance in *Neisseria gonorrhoeae*: An Epigenetic Approach. *Brunilís White*

3:00–4:45 **CONCURRENT SESSION H1: Global Health: Epidemiology and Disease Prevention ..... Frieden Plenary**

Moderators: Kimberley Fox and Susan Chu

3:05 Ascertaining Infant Measles Mortality and Risk Factors During a Prolonged Nationwide Measles Outbreak — Mongolia, 2015–2016. *Christopher Lee*

3:25 Epidemic Cholera and Micronutrient Deficiency — Grande Saline, Haiti, 2011. *Sae-Rom Chae*

3:45 Measles-Rubella Vaccination Campaign Coverage and Use of Campaign-Related Mobile Phone Message Reminders — Kenya, 2016. *Saleena Subaiya*

4:05 Sustained Use of Portable Handwashing and Drinking Water Stations in Health Care Facilities — Siaya County, Kenya, 2016. *William Davis*

4:25 Immunogenicity of Type 2 Monovalent Oral and Inactivated Poliovirus Vaccines — Bangladesh, 2016. *Michelle Morales*

3:00–4:45 **CONCURRENT SESSION H2: Notes from the Field ..... Concurrent Session Room**
Moderators: Joseph McLaughlin and Kris Bisgard

3:05 Burden of Extrapulmonary Nontuberculous Mycobacterial Disease and Utility of Statewide Surveillance — Oregon, 2014–2016. *David Shih*

3:25 Shiga Toxin-Producing *Escherichia coli*. Convalescent Testing by Using Multiplex Polymerase Chain Reaction Panel and Culture Methods — Kansas, 2016. *Jessica Nadeau Tomov*

3:45 Zika-Related Birth Defects Surveillance — Texas, 2016. *Noemi Hall*

4:05 Evidence of Health Care Transmission of *Candida auris*: An Investigation of 2 Cases — Chicago, Illinois, 2016. *Janna Kerins*

4:25 Food-Related Anaphylactic Deaths — New York City, 2000–2014. *Eugenie A. Poirot*

6:00 **Prediction Run ..... Piedmont Park**
Sponsored by the EIS Alumni Association
Self transport to venue; carpooling is encouraged

6:00–8:30 **SESSION I: FETP International Night — Poster Presentations ..... Concurrent Session Room**

Wednesday, April 26, 2017

8:30–10:15 **CONCURRENT SESSION J1: Emerging Infections ..... Frieden Plenary**
Moderators: Christopher Braden and Michael Gronostaj

8:35 Zika Virus Infection in a Patient with No Known Risk Factors — Utah, 2016. *Elisabeth Raquel Krow-Lucal*

8:55 Prediction of the Zika Virus Infection Burden in Puerto Rico Using Bayesian Methods, November 2015–October 2016. *Jessica M. Healy*

9:15 Care of Ebola Survivors at ELWA Clinic in Monrovia, Liberia. *Annabelle de St. Maurice*

9:35 It's Not Polio! Acute Flaccid Myelitis — United States, August 2014–October 2016. *Tracy Ayers*

9:55 The First Eight Reported Cases of *Candida auris*, an Emerging, Multidrug-Resistant Yeast — New York, 2013–2016. *Sharon Tsay*

8:30–10:15 **CONCURRENT SESSION J2: Injury ..... Concurrent Session Room**
Moderators: Debra Houry and Katie Fowler

8:35 Mental Health Related Emergency Department Visits After a Noncasualty Terrorist Event — New Jersey, September 2016. *Faye Rozwadowski*

8:55 Risk and Protective Factors for Driving After Five or More Alcoholic Drinks Among College Students — Fall National College Health Assessment, United States, 2011–2014. *Alexis Peterson*

9:15 Fatal Injuries in the Alaska Logging Industry, 1991–2014. *Yuri Paris Springer*

9:35 Investigation of Fatal and Nonfatal Suicidal Behavior, Ages 10–24 — Santa Clara County, California, 2016. *Amanda Garcia-Williams*

9:55 Adherence of Media Reporting of Suicides to Suicide Reporting Guidelines — Santa Clara County, California, 2008–2015. *Julie K. O'Donnell*

10:30–11:45 POSTER SYMPOSIUM II ..... Concurrent Session Room

Moderators: Tim Jones and Dianna Carroll

During the first 30 minutes of the poster symposium, the following authors will each give a 2-minute oral presentation at the podium in front of a seated audience in the Concurrent room. Afterward, the authors will stand with their posters for the remaining session time in the poster area. The audience is encouraged to view the individual posters and engage in direct discussion with the author.

P2.1 Multistate Epidemiologic Description of Histoplasmosis in the United States, 2011–2014. *Paige Alexandria Armstrong*

P2.2 Adaptation of the County-Level Vulnerability Assessment for Rapid Dissemination of HIV or Hepatitis C Virus Infections Among Persons Who Inject Drugs — Colorado, 2011–2015. *Alexis Burakoff*

P2.3 Risk Factors for Zika Virus Infection Identified Through Household Cluster Investigations — Puerto Rico, 2016. *Rachel Burke*

P2.4 Characteristics of Persons with Repeat Syphilis Infection — Idaho, 2011–2015. *Ahmed Magdy Kassem*

P2.5 *Streptococcus equi* Subspecies *zooepidemicus* Fatal Infection Associated with Equine Exposure — King County, Washington State, 2016. *Vance Morio Kawakami*

P2.6 Antimicrobial Resistance Among Pediatric Central Line–Associated Bloodstream Infections Reported to the National Healthcare Safety Network, 2011–2014. *Jason Lake*

P2.7 Gastrointestinal Illness Surveillance in Peace Corps Volunteers: An Evolving Epidemiologic Surveillance System, 2013–2016. *Jarred McAteer*

P2.8 Assessment of the Sensitivity of Group A Streptococcal Necrotizing Fasciitis Surveillance from Alaska's Laboratory-Based Surveillance System, 2015–2016. *Emily Mosites*

P2.9 Evaluating Interest in an H5N1 Vaccine Among Highly Pathogenic Avian Influenza Laboratory Workers in the United States. *Kate Russell*

P2.10 High Rates of Active Tuberculosis Among Immigrants from the Philippines — Hawaii, 2010–2014. *Kristine Marie Schmit*

P2.11 Healthcare-Associated Legionnaires' Disease — United States, 2014. *Elizabeth Soda*

P2.12 Evaluation of the Case Definition for Suspected Yellow Fever Deaths in an Outbreak Setting — Angola, 2016. *Anna Yaffee*

11:50–1:05 LUNCH

11:50–1:05 SPECIAL SESSION 2: Zika Virus Infection ..... 3rd Floor Room 203 AB

Moderators: Steve Monroe and Robert Tauxe

1:15–3:00 CONCURRENT SESSION K1: Healthcare-Associated Outbreaks ..... Frieden Plenar y

Moderators: Mike Bell and Isaac See

1:20 Careful of the Wound: Group A *Streptococcus* Outbreak in a Skilled Nursing Facility — Chicago, 2015–2016. *Sana Shireen Ahmed*

1:40 Fungal Bloodstream Infections Associated with Substandard Compounding Practices at an Outpatient Oncology Practice — New York City, 2016. *Amber Marie Vasquez*

2:00 Nontuberculous Mycobacteria Infections Among Breast Plastic Surgery Patients — Hospital A, South Carolina, 2014–2016. *Kimberly Skrobarcek*

2:20 Cluster of Pseudomonas Infections Among Neonatal Intensive Care Unit Patients — Maryland, 2016. *Mark Weng*

2:40 *Burkholderia cepacia* Bloodstream Infections Among Skilled Nursing Facility Residents — United States, 2016. *Richard Benjamin Brooks*

1:15–3:00 **CONCURRENT SESSION K2: Environmental Health ..... Concurrent Session Room**
Moderators: Patrick Breysse and Suzanne Beavers

1:20 My Old Kentucky Home: Arsenic Contaminated Soil in a Kentucky Neighborhood and Response, 2016. *Anna Yaffee*

1:40 Project Coyote Water: Assessment of Unregulated Drinking Water on Tribal Lands Within the United States — January 2015–March 2016. *Gamola Z. Fortenberry*

2:00 Secondhand Exposure to E-Cigarette Aerosol in Public Places: Findings from the 2015 National Youth Tobacco Survey. *Teresa Wei Wang*

2:20 The Burden of Asthma: Healthcare Utilization Patterns and Asthma Triggers — Puerto Rico, 2013. *Lillianne M. Lewis*

2:40 Community Assessment for Public Health Emergency Response (CASPER) After the Flint Water Crisis — Flint, Michigan, 2016. *Alice Wang*

3:15-4:45 **SESSION L: Alexander D. Langmuir Lecture ..... Frieden Plenary**
Presentation of Alexander D. Langmuir Award and Distinguished Friend of EIS Award
Moving from Epidemiology to Quantitative Population Health Science
Moderator: Patricia Simone
Speaker: *Sandro Galea, MD, MPH, DrPH*

5:15–7:00 **EIS CAREER NETWORKING NIGHT ..... 3rd Floor Prefunction Space and Room 203 D and F**

6:30–9:00 **SESSION M: FETP International Night — Oral Presentations ..... Concurrent Session Room**

Thursday, April 27, 2017

8:30–9:55 **CONCURRENT SESSION N1: Respiratory Diseases ..... . Frieden Plenary**
Moderators: Mark Pallansch and Lindsay Kim

8:35 Neighborhood-Level Poverty, Poverty-Associated Factors, and Severe Outcomes Among Adults Hospitalized with Influenza — United States, 2012–2015. *Rebekah Stewart Schicker*

8:55 Influenza-Associated Pediatric Deaths in the United States, 2010–2016. *Mei Shang*

9:15 Epidemic Keratoconjunctivitis Outbreak Due to Human Adenovirus Type 8 — U.S. Virgin Islands, 2016. *Marie Killerby*

9:35 Differences in Pneumococcal Carriage and Serotype Distribution Between Children With and Without Pneumonia — Maputo, Mozambique, 2014–2016. *Tolulope Adebanjo*

8:30–9:55 **CONCURRENT SESSION N2: Hepatitis and Tuberculosis ..... Concurrent Session Room**
Moderators: Carla Winston and Larry Cohen

8:35 Hepatitis A Outbreak from Imported Frozen Strawberries — 9 States, 2016. *Megan Hofmeister*

8:55 Increased Incidence of Acute Hepatitis B in a Rural County — Alabama, 2012–2015. *Charlene Siza*

9:15 Hepatitis C-Associated Mortality Rates Among American Indian/Alaska Natives — Washington, 2009–2014. *Sarah Hatcher*

9:35 Demographic and Clinical Characteristics Associated with Tuberculosis/HIV Comorbidity — United States, 2011–2015. *Kristine Marie Schmit*

10:15–12:00 **CONCURRENT SESSION O1: Foodborne Outbreaks ..... Frieden Plenary**
Moderators: Robert Tauxe and Michael Jhung

10:20 Botulism Outbreak at a Federal Correctional Facility — Mississippi, 2016. *Lindsey Sarah McCrickard*

Awards presented during session.

10:40 Undetermined Source of *Salmonella* Infantis Infections Among Detention Center Inmates — South Carolina, 2016. *Sarah Luna*

11:00 Fluoroquinolone-Resistant *Campylobacter jejuni* Infections Associated with Unpasteurized Milk from a Dairy Cow Herdshare — Colorado, 2016. *Alexis Burakoff*

11:20 *Salmonella* Javiana Infections Linked to a Restaurant in Maricopa County — Arizona, 2016. *Heather Venkat*

11:40 *Salmonella* Typhimurium Outbreak Associated with Cheese from a Local Creamery — North Carolina, 2016. *Jessica Lynn Rinsky*

10:15–12:00 CONCURRENT SESSION O2: Child Health ..... Concurre nt Session Room
Moderators: Georgina Peacock and Andrea Sharma

10:20 Acute Flaccid Myelitis in Pediatric Patients — Maricopa County, Arizona, 2016. *Sally Iverson*

10:40 Worsening Childhood Health in Conflict-Affected Areas of Borno State — Northeastern Nigeria, October–November 2016. *Erin Tromble*

11:00 How Infants Die in Ohio: Comparison of Two Methods to Ascertain Cause of Death, 2009–2013. *Martha Montgomery*

11:20 Breastfeeding and Autism Spectrum Disorder in Preschool Children Enrolled in the Study to Explore Early Development — United States, 2008–2011. *Gnakub Norbert Soke*

11:40 Epidemiology and Trends of Pertussis Among Infants — United States, 2000–2015. *Catherine Bozio*

12:05–1:30 LUNCH

1:35–3:20 CONCURRENT SESSION P1: Drug-Related Illness ..... Fr ieden Plenary
Moderators: Debbie Dowell and Andrea Winquist

1:40 Qualitative Description of Suspected Illicitly Manufactured Fentanyl-Related Overdose — Massachusetts, 2016. *Nicholas Jacob Somerville*

2:00 Fentanyl Overdose Deaths in New Mexico During 2015–2016. *Nicole Anna Middaugh*

2:20 Deaths Associated with Opioid Use and Possible Infectious Disease Etiologies Among Persons in the Unexplained Death (UNEX) Surveillance System — Minnesota, 2006–2015. *Victoria Hall*

2:40 Electronic Surveillance System for the Early Notification (ESSENCE) for Marijuana-Associated Visits to One Hospital Emergency Department — Denver, Colorado, 2016. *Grace E. Marx*

3:00 Marijuana Use Among Persons with Select Health Conditions — United States, 2011–2014. *Amy Seitz*

1:35–3:20 CONCURRENT SESSION P2: Water-Related Illness ..... Concurrent Session Room
Moderators: Michael Beach and Stacey Bosch

1:40 *Shigella sonnei* Outbreak Investigation in the Setting of a Municipal Water Crisis — Genesee and Saginaw Counties, Michigan, 2016. *Robert Paul McClung*

2:00 *Shigella sonnei* Outbreak Among Homeless Persons After Substantial Rainfall — Oregon, 2015–2016. *Jonas Hines*

2:20 Postflooding Leptospirosis — Louisiana, 2016. *Alean Frawley*

2:40 Access to Safe Water in Haiti: Have We Made Progress? *Alaine Kathryn Knipes*

3:00 Cryptosporidiosis Associated with Recreational Water — Maricopa County, Arizona, 2016. *Sally Iverson*

3:35–5:15 **Awards and Late-Breaking Reports**

3:35 **Presentation of Awards ..... Frieden Plenary**
Moderator: Tracie Gardner

- Outstanding Poster Presentation Award
- Donald C. Mackel Memorial Award
- J. Virgil Peavy Memorial Award
- Paul C. Schnitker International Health Award
- Iain C. Hardy Award
- James H. Steele Veterinary Public Health Award
- Mitch Singal Excellence in Occupational and Environmental Health Award

3:50 **SESSION Q: Late-Breaking Reports**
Moderators: Stephen Redd and Tracie Gardner

3:55 Evaluating the Utility of rRT-PCR Testing in Whole Blood Compared to Other Specimens and IgM Testing to Optimize the Diagnosis of Zika Virus Infection among Asymptomatic Pregnant Women — Puerto Rico, 2016. *Asher Yoel Rosinger*

4:05 Identification of Cat-to-Human Transmission During an Outbreak of Influenza A (H7N2) Among Cats in an Animal Shelter — New York City, 2016. *Christopher T. Lee*

4:15 Investigation of *Salmonella Enteritidis* Harboring the *mcr-1* Resistance Gene — Connecticut, 2017. *Vivian H. Leung*

4:25 Investigation of a Nationally Distributed Contaminated Organ Transplant Preservation Solution — United States, 2016–2017. *Matthew J. Stuckey*

4:35 Mumps Outbreak — Colorado, 2017. *Grace E. Marx*

4:45 Shiga Toxin-Producing *Escherichia coli* O157:H7 Infections After Attendance at a Cider Festival — Kansas, 2016. *Jessica Nadeau Tomov*

4:55 Immune Response Following Reactive Vaccination Campaign Using Fractional Dose Yellow Fever Vaccine — Kinshasa, Democratic Republic of Congo, 2016. *Rebecca M. Casey*

5:05 Determining the End Date of Routine Screening of Asymptomatic Pregnant Women for Zika Virus Infection — American Samoa, 2016–2017. *Ruth Link-Gelles*

5:15–5:25 **CLOSING REMARKS AND ADJOURNMENT ..... F rieden Plenary**
Patricia Simone

POSTCONFERENCE ACTIVITY

7:30 **EIS Satirical Review ..... Frieden Plenary**
Presentation of Philip S. Brachman Award

Awards presented during session.

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Awards Descriptions and Committee Members

Alexander D. Langmuir Prize Manuscript Award

The Alexander D. Langmuir Prize, established in 1966 by the EIS Alumni Association, recognizes a current EIS officer or recent alumnus (1 year) for excellence in a written report or an epidemiologic investigation or study.

2017 Committee Members: Steve Waterman (Chair), Neil Gupta, Douglas Hamilton, Art Liang, Laurene Mascola, Christina Mikosz, Christina Tan

Philip S. Brachman Award

The Philip S. Brachman Award, sponsored by the graduating class of EIS officers, recognizes excellence in teaching epidemiology to EIS officers.

2017 Committee Members: 2015 EIS Class

Distinguished Friend of EIS Award

The Distinguished Friend of EIS Award, sponsored by the EIS Alumni Association, recognizes an individual for contributions to the health, welfare, and happiness of EIS officers and the EIS Program.

2017 Committee Members: Douglas Hamilton (Chair), Tegan Boehmer, Danice Eaton, Art Liang, Christina Mikosz, Kimberly Porter.

Iain C. Hardy Award

The Iain C. Hardy Award, sponsored by the National Center for Immunization and Respiratory Diseases, recognizes a current EIS officer or alumnus (within 5 years) who has made an outstanding contribution to the control of vaccine-preventable diseases.

2017 Committee Members: Sam Posner (Chair), Eric Mast, John Modlin, William Schaffner, Melinda Wharton, Cynthia Whitney

J. Virgil Peavy Memorial Award

The J. Virgil Peavy Memorial Award, established in 2003 by the EIS Alumni Association, recognizes a current EIS officer for the oral presentation that best exemplifies the effective and innovative application of statistics and epidemiologic methods in an investigation or study.

2017 Committee Members: Katie Fowler (Chair), Tala Fakhouri, Andrea Sharma, Glen Satten, Anindye De

Donald C. Mackel Memorial Award

The Donald C. Mackel Memorial Award, sponsored by the EIS Alumni Association, recognizes a current EIS officer for the oral presentation that best exemplifies the effective application of a combined epidemiology and laboratory approach to an investigation or study.

2017 Committee Members: Jennifer Wright (Chair), Suzanne Beavers, Serena A. Carroll, Robert D. Kirkcaldy, Brandi Limbago

Outstanding Poster Presentation Award

The Outstanding Poster Presentation Award is presented by the EIS Scientific Program Committee to a current EIS officer for the poster that best exemplifies scientific content, including originality, study design and analysis; public health impact; and presentation effectiveness.

2017 Committee Members: Brett Petersen (Chair), Candice Johnson, Sue Chu, Kimberley Folkman, Isaac Evans

Paul C. Schnitker International Health Award

Paul C. Schnitker, MD, passed away in a plane crash in Nigeria in 1969. He was en route to serve as a public health officer in the response to famine and other public health problems resulting from the Biafra Civil War in Nigeria. He is the only person who has died while serving as an EIS officer. The Paul C. Schnitker International Health Award, sponsored by the Schnitker family, recognizes a current EIS officer or alumnus (1 year) who has made a significant contribution to international public health.

2017 Committee Members: Ezra Barzilay (Chair), Roodly Archer, Tom Handzel, Nancy Messonnier, Diana Morof, Kevin Clarke

James H. Steele Veterinary Public Health Award

The James H. Steele Veterinary Public Health Award, sponsored by CDC veterinarians, recognizes a current EIS officer or alumnus (within 5 years) who has made outstanding contributions in the field of veterinary public health through outstanding contributions in the investigation, control, or prevention of zoonotic diseases or other animal-related human health problems.

2017 Committee Members: Casey Barton Behravesh (Chair), Fred Angulo, Barbara Knust, Kirk Smith, Kendra Stauffer

Mitch Singal Excellence in Occupational and Environmental Health Award

The Mitch Singal Excellence in Occupational and Environmental Health Award, co-sponsored by the National Institute for Occupational Safety and Health and the National Center for Environmental Health/Agency for Toxic Substances and Disease Registry, was established in 2010. The Mitch Singal Award recognizes a current EIS officer for excellence in an oral presentation that best exemplifies the effective application of public health epidemiology to an investigation in the area of occupational or environmental health.

2017 Committee Members: Kanta Sircar (Chair), Candice Johnson (Co-Chair), Cammie Chaumont Menendez, Timothy Dignam, Tim Jones, Michael King, Alexandre Macedo de Oliveira

Stephen B. Thacker EIS Champion Award

The Stephen B. Thacker EIS Champion Award, established in 2013 by the EIS Alumni Association, recognizes an individual who inspires the EIS community through deep and unwavering commitment to the EIS Program, officers, and alumni.

2017 Committee Members: Art Liang (Chair), Rachel Avchen, Larry Cohen, Jonetta Mpofu, Maria Thacker

Awards Presented at the 2016 EIS Conference

Alexander D. Langmuir Prize Manuscript Award
Tushar Singhr

Philip S. Brachman Award
Diana Bensyl

Distinguished Friend of the EIS Award
Sally Brown

Iain C. Hardy Award
Eugene Lam

J. Virgil Peavy Memorial Award
Christopher Lee

Donald C. Mackel Memorial Award
Isaac Benowitz

Outstanding Poster Presentation Award
Charnetta Williams

Paul C. Schnitker International Health Award
José E. Hagan

James H. Steele Veterinary Public Health Award
Colin Basler and Neil Vora

Mitch Singal Excellence in Occupational and Environmental Health Award
Megan Casey

Stephen B. Thacker EIS Champion Award
Polly A. Marchbanks

Alexander D. Langmuir Lectures, 1972–2016

The Langmuir Lecture is the preeminent public health lecture in the United States. The first lecture was given in 1972, and it has been a highlight of the annual EIS Conference each year since then. The lecture is named for Alexander D. Langmuir, MD, MPH (1910–1993), a public health visionary and leader who established the Epidemiology Program at what was then called the Communicable Disease Center in 1949; he remained as CDC's chief epidemiologist until his retirement in 1970.

Notably, Dr. Langmuir founded EIS, established national disease surveillance for the United States, and brought the *Morbidity and Mortality Weekly Report* to CDC. Langmuir Lecture speakers have included Abraham Lilienfeld, Sir Richard Doll, Geoffrey Rose, Jonas Salk, and many other prominent public health thinkers and researchers.

1972 Prevention of Rheumatic Heart Disease — Fact or Fancy.
Charles H. Rammelkamp

1973 Cytomegaloviral Disease in Man: An Ever Developing Problem.
Thomas H. Weller

1974 Hepatitis B Revisited (By the Non-Parenteral Route).
Robert W. McCollum

1975 Origin, Spread, and Disappearance of Kuru: Implications of the Epidemic Behavior of a Disease in New Guineans for the Epidemiologic Study of Transmissible Virus Dementias.
D. Carleton Gajdusek

1976 The Future of Epidemiology in the Hospital.
Paul F. Wehrle

1977 The Historical Evolution of Epidemiology.
Abraham Lilienfeld

1978 The Biology of Cancer: An Epidemiological Perspective.
Sir Richard Doll

1979 The Epidemiology of Antibiotic Resistance.
Theodore C. Eickoff

1980 Health and Population Growth.
Thomas McKeown

1981 The Pathogenesis of Dengue: Molecular Epidemiology in Infectious Disease.
Scott B. Halstead

1982 The Epidemiology of Coronary Heart Disease: Public Health Implications.
Henry W. Blackburn, Jr.

1983 Sexually Transmitted Diseases — Past, Present, and Future.
King K. Holmes

1984 Poliomyelitis Immunization — Past and Future.
Jonas E. Salk

1985 An Epidemiologist's View of Postmenopausal Estrogen Use, or What to Tell Your Mother.
Elizabeth Barrett-Connor

1986 Hepatitis B Virus and Hepatocellular Carcinoma: Epidemiologic Considerations.
Robert Palmer Beasley

1987 Environmental Hazards and the Public Health.
Geoffrey Rose

1988 Lymphotropic Retroviruses in Immunosuppression.
Myron E. (Max) Essex

1989 Aspirin in the Secondary and Primary Prevention of Cardiovascular Disease.
Charles H. Hennekens

1990 Epidemiology and Global Health.
William H. Foege

1991 Public Health Action in a New Domain: The Epidemiology and Prevention of Violence.
Garen J. Wintemute

1992 *Helicobacter pylori*, Gastritis, Peptic Ulcer Disease, and Gastric Cancer.
Martin J. Blasér

1993 Diet and Health: How Firm Is Our Footing?
Walter C. Willett

1994 Alexander D. Langmuir: A Tribute to the Man.
Philip S. Brachman and William H. Foege

1995 Epidemiology and the Elucidation of Lyme Disease.
Allen C. Steere

1996 50 Years of Epidemiology at CDC.
Jeffrey P. Koplan

1997 Public Health, Population-Based Medicine, and Managed Care.
Diana B. Petitti

1998 Pandemic Influenza: Again?
Robert Couch

1999 The Evolution of Chemical Epidemiology.
Philip J. Landrigan

2000 Does *Chlamydia pneumoniae* Cause Atherosclerotic Cardiovascular Disease? Evaluating the Role of Infectious Agents in Chronic Diseases.
Walter E. Stamm

2001 Halfway Through a Century of Excellence.
J. Donald Millar

2002 Public Health Response to Terrorism: Rising to the Challenge.
Marcelle Layton

2003 Alex Langmuir's Somewhat Quiet Legacy: Epidemiology, Sexual Health, and Personal Choices.
Willard (Ward) Cates, Jr.

2004 HIV, Epidemiology, and the CDC.
James W. Curran

2005 Killin' Time: Alcohol and Injury.
Alexander C. Wagenaar

2006 Measuring Malaria.
Brian Greenwood

2007 Implications of Tuberculosis Control on Evidence-Based Public Health Practice.
Thomas R. Frieden

2008 Physical Activity and Public Health: Does the Environment Matter?
Ross C. Brownson

2009 Epidemiology, Public Health, and Public Policy.
Jim Marks

2010 Community Heal*th Rankings*—Epidemiology in Action.
Pat Remington

2011 Skirmishes, Battles, and Wars: Tracking Infection Control Success in the Age of Social Networks.
Robert A. Weinstein

2012 Prevention of Teen Pregnancy: What Do We Know? Where Do We Go?
Robert Blum

2013 The Role of EIS in Communities of Solution: Using GIS and Epidemiology to Activate Health Partnerships.
Robert Phillips

2014 EIS in an Era of Data, Technology, and Urban Transformations.
Martin-J. Sepulveda

2015 Large-Scale Machine Learning and Its Application to Public Health.
Jeff Dean

2016 From Antibiotic Resistance to Zika: Reflections on Working at the Intersection of Science and Public Health Politics.
Margaret Hamburg

Alexander D. Langmuir Prize Manuscripts, 1966–2016

1966 Complications of Smallpox Vaccination: I. National Survey in the United States, 1963. N Engl J Med 1967;276:125–32.
J.M. Neff, J.M. Lane, J.H. Pert, R. Moore, J.D. Millar, D.A. Henderson

1967 An Outbreak of Neuromyasthenia in a Kentucky Factory—The Possible Role of a Brief Exposure to Organic Mercury. Am J Epidemiol 1967;86:756–64.
G. Miller, R. Chamberlin, W.M. McCormack

1968 Salmonellosis from Chicken Prepared in Commercial Rotisseries: Report of an Outbreak. Am J Epidemiol 1969;90:429–37.
S.B. Werner, J. Allard, E.A. Ager

1969 Outbreak of Tick-Borne Relapsing Fever in Spokane County, Washington. JAMA 1969;210:1045–50.
R.S. Thompson, W. Burgdorfer, R. Russell, B.J. Francis

1970 Tularemia Epidemic: Vermont, 1968—Forty-Seven Cases Linked to Contact with Muskrats. N Engl J Med 1969;280:1253–60.
L.S. Young, D.S. Bicknell, B.G. Archer, et al.

1971 Tomato Juice-Associated Gastroenteritis, Washington and Oregon, 1969. Am J Epidemiol 1972;96:219–26.
W.H. Barker Jr., V. Runte

1972 *Salmonella* Septicemia from Platelet Transfusions: Study of an Outbreak Traced to a Hematogenous Carrier of *Salmonella cholerae-suis*. Ann Intern Med 1973;78: 633–41.
F.S. Rhame, R.K. Root, J.D. MacLowry, T.A. Dadisman, J.V. Bennett

1973 Outbreak of Typhoid Fever in Trinidad in 1971 Traced to a Commercial Ice Cream Product. Am J Epidemiol 1974;100:150–7.
A. Taylor Jr., A. Santiago, A.Gonzales-Cortes, E.J. Gangarosa

1974 Oyster-Associated Hepatitis: Failure of Shellfish Certification Programs To Prevent Outbreaks. JAMA 1975;233:1065–8.
B.L. Portnoy, P.A. Mackowiak, C.T. Caraway, J.A. Walker, T.W. McKinley, C.A. Klein Jr.

1975 Staphylococcal Food Poisoning Aboard a Commercial Aircraft. Lancet 1975;2:595–9.
M.S. Eisenberg, K. Gaarslev, W. Brown, M. Horwitz, D. Hill

1976 Nursery Outbreak of Peritonitis with Pneumoperitoneum Probably Caused by Thermometer-Induced Rectal Perforation. Am J Epidemiol 1976;104:632–44.
M.A. Horwitz, J.V. Bennett

1977 Epidemic *Yersinia entercolitica* Infection due to Contaminated Chocolate Milk. N Engl J Med 1978;298:76–9.
R.E. Black, R.J. Jackson, T. Tsai, et al.

1978 Measles Vaccine Efficacy in Children Previously Vaccinated at 12 Months of Age. Pediatrics 1978;62: 955–60.
J.S. Marks, T.J. Halpin, W.A. Orenstein

1979 An Outbreak of Legionnaires' Disease Associated with a Contaminated Air-Conditioning Cooling Tower. N Engl J Med 1980;302:365–70.
T.J. Dondero Jr., R.C. Rendtorff, G.F. Mallison, et al.
and
Risk of Vascular Disease in Women: Smoking, Oral Contraceptives, Noncontraceptive Estrogens, and Other Factors. JAMA 1979;242:1150–4.
D.B. Petitti, J.Wingerd, J. Pellegrin, et al.

1980 Injuries from the Wichita Falls Tornado: Implications for Prevention. Science 1980;207:734–8.
R.I. Glass, R.B. Craven, D.J. Bregman, et al.

1981 Respiratory Irritation due to Carpet Shampoo: Two Outbreaks. Environ Int 1982;8:337–41.
K. Kreiss, M.G. Gonzalez, K.L. Conright, A.R. Scheere
and
Toxic-Shock Syndrome in Menstruating Women: Association with Tampon Use and *Staphylococcus aureus* and Clinical Features in 52 Cases. N Engl J Med 1980;303:1436–42.
K.N. Shands, G.P. Schmid, B.B. Dan, et al.

1982 Risk Factors for Heatstroke: A Case-Control Study. JAMA 1982;247:3332–6.
E.M. Kilbourne, K. Choi, T.S. Jones, S.B. Thacker

1983 Epidemic Listeriosis C—Evidence for Transmission by Food. N Engl J Med 1983;308:203–6.
W.F. Schlech III, P.M. Lavigne, R.A. Bortolussi, et al.

1984 Unexplained Deaths in a Children's Hospital: An Epidemiologic Assessment. N Engl J Med 1985;313: 211–6.
J.W. Buehler, L.F. Smith, E.M. Wallace, C.W. Heath, R. Kusiak, J.L. Herndon
and
Medication Errors with Inhalant Epinephrine Mimicking an Epidemic of Neonatal Sepsis. N Engl J Med 1984;310:166–70.
S.L. Solomon, E.M. Wallace, E.L. Ford-Jones, et al.

1985 The Use and Efficacy of Child-Restraint Devices: The Tennessee Experience, 1982 and 1983. JAMA 1984;252:2571–5.
M.D. Decker, M.J. Dewey, R.H. Hutcheson Jr., W.S. Schaffner

1986 The Role of Parvovirus B19 in Aplastic Crisis and Erythema Infectiosum (Fifth Disease). J Infect Dis 1986;154:383–93.
T.L. Chorba, P. Coccia, R.C. Holman, et al.

1987 Oral Contraceptives and Cervical Cancer Risk in Costa Rica: Detection Bias or Causal Association? JAMA 1988;259:59–64.
K.L. Irwin, L. Rosero-Bixby, M.W. Oberle, et al.

1988 A Day-Care–Based Case-Control Efficacy Study of *Haemophilus influenzae* B Polysaccharide Vaccine. JAMA 1988;260:1413–8.
L.H. Harrison, C. Broome, A.W. Hightower, et al.

1989 Group A Meningococcal Carriage in Travelers Returning from Saudi Arabia. JAMA 1988;260:2686–9.
P.S. Moore, L.H. Harrison, E.E. Telzak, G.W. Ajello, C.V. Broome
and
Transmission of *Plasmodium vivax* Malaria in San Diego County, California, 1986. Am J Trop Med Hyg 1990;42:3–9.
Y.A. Maldonado, B.L. Nahlen, R.R. Roberta, et al.

1990 An Outbreak of Surgical Wound Infections due to Group A *Streptococcus* Carried on the Scalp. N Engl J Med 1990;323:968–72.
T.D. Mastro, T.A. Farley, J.A. Elliott, et al.

1991 An Investigation of the Cause of the Eosinophilia-Myalgia Syndrome Associated with Tryptophan Use. N Engl J Med 1990;323:357–65.
E.A. Belongia, C.W. Hedberg, G.J. Gleich, et al.

1992 An Outbreak of Multidrug-Resistant Tuberculosis Among Hospitalized Patients with the Acquired Immunodeficiency Syndrome. N Engl J Med 1992;326:1514–21.
B.R. Edlin, J.I. Tokars, M.H. Grieco, et al.

1993 Comparison of Pr evention Strategies for Neonatal Group B Streptococcal Infection: A Population-Based Economic Analysis. JAMA 1993;270:1442–8.
J.C. Mohle-Boetani, A. Schuchat, B.D. Plikaytis, J.D. Smith, C.V. Broome
and Retrospective Study of the Impact of Lead-Based Hazard Remediation on Children's Blood Lead Levels in St. Louis, Missouri. Am J Epidemiol 1994;139:1016–26.
C. Staes, T. Matte, C.B. Copley, D. Flanders, S. Binder

1994 A Massive Outbreak in Milwaukee of *Cryptosporidium* Infection Transmitted Through the Public Water Supply. N Engl J Med 1994;331:161–7.
W.R. Mac Kenzie, N.J. Hoxie, M.E. Proctor, et al.

1995 A Multistate Outbreak of *Escherichia coli* 0157:H7-Associated Bloody Diarrhea and Hemolytic Uremic Syndrome from Hamburgers: The Washington Experience. JAMA 1994;272:1349–53.
B.P. Bell, M. Goldoft, P.M. Griffin, et al.

1996 A Multistate Outbreak of *Salmonella* Enteritidis Infections Associated with Consumption of Schwan's Ice Cream. N Engl J Med 1996;334:1281–6.
T.W. Hennessy, C.W. Hedberg, L. Slutsker, et al.
and
Passenger to Passenger Transmission of *Mycobacterium tuberculosis* Aboard Commercial Aircraft During Transoceanic Travel. N Engl J Med 1996;334:993–8.
T.A. Kenyon, S.E. Valway, W.W. Ihle, I.M. Onorato

1997 Epidemic Meningococcal Disease and Tobacco Smoke: A Risk Factor Study in the Pacific Northwest. Pediatr Infect Dis J 1997;16:979–83.
M.A. Fisher, K. Hedberg, P. Cardosi, et al.

1998 Suicide After Natural Disasters. N Engl J Med 1998;338:373–8.
E.G. Krug, M. Kresnow, J.P. Peddicord, et al.

1999 Legalized Physician-Assisted Suicide in Oregon—The First Year's Experience. N Engl J Med 1999;340:577–83.
A.E. Chin, K. Hedberg, G.K. Higginson, D.W. Fleming

2000 Infantile Hypertrophic Pyloric Stenosis After Pertussis Prophylaxis with Erythromycin: A Case Review and Cohort Study. Lancet 1999;354:2101–5.
M.A. Honein, L.J. Paulozzi, I.M. Himelright, et al.

2001 *Salmonella* Typhimurium Infections Transmitted by Chlorine-Pretreated Clover Sprout Seeds. Am J Epidemiol 2001;154:1020–8.
J.T. Brooks, S. Rowe, P. Shillam, et al.

2002 *Serratia liquefaciens* Bloodstream Infections from Contamination of Epoetin Alfa at a Hemodialysis Center. N Engl J Med 2001;344:1491–7.
L.A. Grohskopf, V.R. Roth, D.R. Feikin, et al.

2003 Transmission of West Nile Virus from an Organ Donor to Four Transplant Recipients. N Engl J Med 2003;348:2196–203.
M. Iwamoto, D.B. Jernigan, A. Guasch, et al., the West Nile Virus in Transplant Recipients Investigation Team

2004 Risk of Ba cterial Meningitis in Children with Cochlear Implants. N Engl J Med 2003;349:435–45.
J. Reefhuis, M.A. Honein, C.G. Whitney, et al.

2005 Changes in Invasive Pneumococcal Disease Among HIV-Infected Adults Living in the Era of Childhood Pneumococcal Immunization. Ann Intern Med 2006;144:1–9.
B.L. Flannery, R.T. Heffernan, L.H. Harrison, et al.

2006 Case-Control Study of an Acute Aflatoxicosis Outbreak, Kenya, 2004. Environ Health Perspect 2005;113:1779–83.
E. Azziz-Baumgartner, K.Y. Lindblade, K. Gieseker, et al., and the Aflatoxin Investigative Group

2007 Methamphetamine Use Is Independently Associated with Risky Sexual Behaviors and Adolescent Pregnancy. J Sch Health 2008;78:641–8.
L.B. Zapata, S.D Hillis, P.M. Marchbanks, K.M. Curtis, R. Lowry

2008 Characteristics of Perpetrators in Homicide-Followed-by-Suicide Incidents: National Violent Death Reporting System—17 US States, 2003–2005. Am J Epidemiol 2008;168:1056–64.
J. Logan, H.A. Hill, A.E. Crosby, D.L. Karch, J.D. Barnes, K.M. Lubell

2009 Epidemiologic Investigation of Immune-Mediated Polyradiculoneuropathy Among Abattoir Workers Exposed to Porcine Brain. PLoS ONE. 2009;5:e9782.
S.M. Holzbauer, A.S. DeVries, J.J. Sejvar, et al.

2010 Increasing Compliance with Mass Drug Administration Programs for Lymphatic Filariasis in Orissa, India, 2009—Impact of an Education and a Lymphedema Management Program. PLoS Negl Trop Dis. 2010;201;4:e728.
P.T. Cantey, J. Rout, G. Rao, J. Williamson, L.M. Fox

2011 Effect of Rota virus Vaccine on Healthcare Utilization for Diarrhea in US Children. N Engl J Med 2011;365;12:1108–17.
J. Cortes, A. Curns, J. Tate, M. Cortese, M. Patel, F. Zhou, U. Parashar

2012 Multistate Outbreak of *Escherichia coli* O157:H7 Infections Associated with In-Store Sampling of a Raw-Milk Gouda Cheese, 2010.
J. McCollum, N. Williams, S. W. Beam, et al.

2013 Necrotizing Cutaneous Mucormycosis After a Tornado in Joplin, Missouri, in 2011. N Engl J Med 2012;367;2214–25.
R. Fanfair, K. Benedict, J. Bos, et al.

2014 Raccoon Rabies Virus Variant Transmission Through Solid Organ Transplantation. JAMA 2013;310:398–407.
N.M. Vora, S.V. Basavaraju, KA Feldman, et al.

2015 New Delhi metallo-beta-lactamase-producing carbapenem-resistant *E. coli* associated with exposure to duodenoscopes. JAMA. 2014;312(14):1447-1455
L. Epstein, J. Hunter, M.A. Arwaddy, et al.

2016 Exposure to Advertisements and Electronic Cigarette Use Among U.S. Middle and High School Students.
T. Singh, I.T. Agaku, R.A. Arrazola, K.L. Marynak, L.J. Neff, I.T. Rolle, B.A. King

Philip S. Brachman Awards, 1983–2016

1983 Philip Brachman

1984 Michael Gregg

1985 Howard Ory

1986 J. Lyle Conrad

1987 Andrew G. Dean

1988 Richard C. Dicker

1989 Carl W. Tyler, Jr.

1990 Richard C. Dicker

1991 Richard C. Dicker

1992 Jeffrey J. Sacks

1993 J. Lyle Conrad and Michael Toole

1994 Willard (Ward) Cates and Robert Breiman

1995 John Horan

1996 Polly Marchbanks

1997 William Mac Kenzie

1998 Laura A. Coker

1999 Christine Zahniser

2000 Jeffrey J. Sacks

2001 Douglas H. Hamilton

2002 Marcelle Layton, Steve Weirsma, James L. Hadler, Eddy Bresnitz, Elizabeth Barrett, Robert B. Stroube, Ross J. Brechner, David S.B. Blythe, Larry Siegel, Karyn Berry, Sherri Adams, John Eisold, and Greg Martin

2003 Deborah W. Gould

2004 Jim Alexander

2005 Julie Magri

2006 Ralph Henderson

2007 Joshua Mott and Peter Cegielski

2008 Lisa Pealer

2009 C. Kay Smith and Julie Magri

2010 Betsy Gunnels

2011 William Schaffner

2012 Rachel N. Avchen

2013 Stephen B. Thacker

2014 Douglas H. Hamilton

2015 Julie Magri

2016 Diana Bensyl

Distinguished Friend of EIS Awards, 1984–2016

1984 Virgil Peavy

1985 William Schaffner

1986 Mary Moreman

1987 James Chin

1988 Frances H. Porcher

1989 Not Awarded

1990 J. Lyle Conrad

1991 Alexander D. Langmuir

1992 Laurence R. Foster

1993 Kenneth L. Herrmann and William Roper

1994 Louise McFarland

1995 Mike Osterholm

1996 Jim Curran and Larry Schonberger

1997 Patsy Bellamy

1998 John Horan

1999 Not Awarded
2000 James Hadler
2001 Barbara R. Holloway and William R. Jarvis
2002 Patricia Fleming and Stephen B. Thacker
2003 Paul Blake
2004 David Sencer
2005 Not Awarded
2006 Robert Tauxe and Kashef Ijaz
2007 Dixie Snider
2008 Denise Koo
2009 Arjun Srinivasan
2010 Robert Quick
2011 Thomas Peterman
2012 Jeffrey P. Davis
2013 Douglas H. Hamilton
2014 William Keene
2015 David B. Callahan
2016 Sally Brown

Iain C. Hardy Awards, 1996–2016

1996 Peter Strebel
1997 D. Rebecca Prevots
1998 Beth P. Bell
1999 Charles R. Vitek
2000 Linda Quick and Nancy Rosenstein
2001 Orin S. Levine
2002 Umesh D. Parashar
2003 Karen A. Hennessey
2004 Tim Uyeki and Montse Soriano-Gabarro
2005 Julie Jacobson-Bell
2006 Gustavo Dayan
2007 Brendan Flannery
2008 Mona Marin
2009 Amanda Cohn and Rosalyn O'Laughlin
2010 Amy Parker Fiebelkorn
2011 Jacqueline E. Tate
2012 Preeta Kutty
2013 James L. Goodson
2014 Catherine Yen
2015 Minal K. Patel
2016 Eugene Lam

J. Virgil Peavy Memorial Awards, 2003–2016

2003 Danice Eaton
2004 Lori A. Pollack
2005 Andrea Sharma
2006 Andrea Sharma
2007 Abhijeet Anand and David Lowrance
2008 Katherine Ellingson
2009 Michael L. Jackson
2010 Erin Murray
2011 Matthew Willis
2012 Noha H. Farag
2013 Alison Laufer
2014 Matthew Maenner
2015 Jin Qin
2016 Christopher Lee

Donald C. Mackel Memorial Awards, 1987–2016

1987 Fatal Parathion Poisoning—Sierra Leone.
Ruth A. Etzel

1988 Multistate Outbreak of Legionnaires' Disease Involving Tours to Vermont.
Margaret Mamolen

1989 Nosocomial Outbreak of Legionnaires' Disease Associated with Shower Use: Possible Role of Amoebae.
Robert F. Breiman

1990 Legionnaires' Disease Outbreak Associated with a Grocery Store Mist Machine.
Frank J. Mahoney

1991 Nosocomial Outbreak of Isoniazid- and Streptomycin-Resistant Tuberculosis Among AIDS Patients, New York City.
Brian R. Edlin

1992 Bacillary Angiomatosis, New Infectious Disease: Epidemiology, Clinical Spectrum, and Diagnostics.
Janet C. Mohle-Boetani

1993 Hepatitis B Virus Transmission Associated with Thoracic Surgery, Los Angeles.
Rafael Harpaz

1994 Schistosomiasis and Lake Malawi: A New Site of Transmission Posing a Serious Risk to Expatriates and Tourists.
Martin S. Cetron

1995 Use of Urinary Antigen Testing To Detect an Outbreak of Nosocomial Legionnaires' Disease in Connecticut, 1994.
Lisa A. Lepine

1996 International Outbreak of *Salmonella* Infections Caused by Alfalfa Sprouts Grown from Contaminated Seed.
Barbara E. Mahon
and
Malassezia pachydermatis Fungemia in Neonatal Intensive Care Unit Patients: There's a [New] Fungus Among Us!
Huan Justina Chang

1997 Epidemic of Deaths from Acute Renal Failure Among Children in Haiti.
Katherine L. O'Brien

1998 And Weighing in at 25 Million Pounds—A Multistate Outbreak of *Escherichia coli* 0157:H7 Infections and the Largest Ground Beef Recall in United States History.
Kate Glynn

1999 Clinical Mismanagement of Community Outbreak? The Contribution of DNA Finger-Printing to the Analysis of Chronic, Drug-Resistant Tuberculosis in Buenaventura, Colombia, 1998.
Kayla F. Laserson

2000 *Serratia liquefaciens* Bloodstream Infections and Pyrogenic Reactions Associated with Extrinsically Contaminated Erythropoietin—Colorado.
Lisa Grohskoph

2001 When Beauty Is More Than Skin Deep: An Outbreak of Rapidly Growing Mycobacterial Furunculosis Associated with a Nail Salon—California, 2000.
Kevin L. Winthrop

2002 Dances with Cows? A Large Outbreak of *E. coli* O157 Infections at Multi-Use Community Facility—Lorain County, Ohio, September 2001.
Jay K. Varma

2003 Hepatitis C Virus Transmission from an Antibody-Negative Organ and Tissue Donor.
Barna D. Tugwell

2004 Multiple Hepatitis A Outbreaks Associated with Green Onions Among Restaurant Patrons—Tennessee, Georgia, and North Carolina, 2003.
Joseph J. Amon

2005 Case-Control Study of an Acute Aflatoxicosis Outbreak.
E. Azziz-Baumgatner

2006 Delayed Onset of *Pseudomonas fluorescens* Group Bloodstream Infections After Exposure to Contaminated Heparin Flush—Michigan and South Dakota.
Mark Gershman

2007 Epidemiologic and Molecular Investigation of an Outbreak of Hepatitis C Viral Infection at Hemodialysis Unit—Richmond Virginia, 2006.
Nicola Thompson

2008 Multistate Measles Outbreak Associated with an International Youth Sporting Event—Pennsylvania, Michigan, and Texas, August–September 2007.
Tai-Ho Chen

2009 Cardiac Events and Deaths in a Dialysis Facility Associated with Healthcare Provider—Texas, 2008.
Melissa K. Schaefer

2010 Fatal Case of Laboratory-Acquired Infection with an Attenuated *Yersinia pestis* Strain of Plague—Illinois, 2009.
Andrew Medina-Marino

2011 Outbreak of Nosocomial Listeriosis—Texas, 2010.
Noha H. Farag

2012 Pyrrolizidine Alkaloid Toxicity as the Cause of Unknown Liver Disease—Tigray, Ethiopia, 2007–2011.
Danielle E. Buttke

2013 Active Surveillance for Variant Influenza Among Swine, the Environment, and Employees at Live Animal Markets—Minnesota, 2012.
Mary J. Choi

2014 Two Cattle Herdsmen Infected With a Novel Species of Orthopoxvirus—Georgia (county), 2013.
Neil Vora

2015 Molecular Epidemiology of Mycoplasma Pneumoniae (Mp) During an Outbreak of Mp-Associated Stevens-Johnson Syndrome.
Louise Francois Watkins

2016 Legionnaires' Disease Caused by a Cooling Tower — New York City, 2015.
Isaac Benowitz

Outstanding Poster Presentation Awards, 1986–2016

1986 Gender Gap in the Diaper Set: A Closer Look at Differences in Sex-Specific Mortality.
Ray Yip

1987 Socioeconomic Differences in Smoking Behavior in Selected States.
Thomas E. Novotny

1988 Late-Stage Diagnosis of Breast Cancer Among Women in Low Socioeconomic Groups, Connecticut, 1984–1985.
Thomas A. Farley

1989 Malaria Infection in Early Infancy, Malawi.
Laurence Slutsker

1990 Seroprevalence of Human Immunodeficiency Virus Type I Among College Students, United States.
Brian R. Edlin

1991 Diarrheal Outbreak Associated with a Cyanobacteria (Blue-Green Algae)-Like Body, Chicago.
Philip P. Huang

1992 Response to One Dose of Inactivated Poliovirus Vaccine after Three Doses of Oral Poliovirus Vaccine, Abidjan, Côte d'Ivoire.
Bernard J. Moriniere

1993 Cholera Outbreak in Rumonge, Burundi.
Maureen E. Birmingham

1994 Salivary Testing as an Epidemiologic Tool During an Outbreak of Hepatitis A in an Amish Community in Indiana.
Edmundo Muniz

1995 Longitudinal Predictors of Initiation of Smokeless Tobacco Use.
Scott L. Tomar

1996 Nonvenomous Animal-Related Fatalities in the U.S. Workplace, 1992–1994.
Constance C. Austin

1997 Multidrug-Resistant Pneumococcal Meningitis in a Day Care Center—Tennessee.
Allen Craig

1998 Beliefs About the Tobacco Industry and Opinions About Anti-Tobacco Policies: How Tight is the Link?
Arthur E. Chin

1999 Cold Breakfast Cereal: A New Vehicle Implicated in a Multistate Outbreak of *Salmonella* Agona Infections.
Thomas Breuer

2000 Hurricane—Puerto Rico, 1998.
Dan O'Leary

2001 Counting Crows: Crow Mortality as a Sentinel for West Nile Virus Disease in Humans—Northeastern United States, 2000.
Kathleen G. Julian

2002 Outbreak of Echovirus 18 Meningitis at a Summer Camp—Alaska, 2001.
Joseph B. Mclaughlin

2003 Surveillance for Chlamydia in Women—South Carolina, 1998–2001.
Wayne A. Duffus

2004 Hospitalizations Associated with Rotavirus Diarrhea—United States, 1996–2000.
Myrna Charles

2005 Risk of Secondary Transmission from Imported Lassa Fever—New Jersey, 2004.
Ester Tan

2006 Risk Factors for *Helicobacter pylori* in a Rural Community—Montana, 2005.
Elizabeth Melius

2007 Outbreak of *Escherichia coli* 0157 Associated with Packaged Spinach—Wisconsin, 2006.
Authur M. Wendel

2008 The Power of Combining Routine Molecular Subtyping and Specific Food Exposure Interviews During *Escherichia coli* O157:H7 Outbreak—Minnesota, 2007.
Stacy M. Holzbauer

2009 Seroprevalence of Herpes Simplex 2—National Health and Nutritional Examination Surveys, United State, 2005–2006.
Sara E. Forhan

2010 Travelers' Impressions of 2009 H1N1 Influenza National Health Messaging Campaign.
Emily Jentes

2011 *Vibrio mimicus* Infection After Consumption of Crayfish—Spokane, Washington, 2010.
Meagan K. Kay

2012 Associations Between *Salmonella* Serotypes and Particular Food Commodities—United States, 1998–2008.
Brendan R. Jackson

2013 A Spicy Catch: *Salmonella* Bareilly and Nchanga Infections Associated with Raw Scraped Tuna Product—United States, 2012.
W. Thane Hancock

2014 Two Fish, One Fish: Decreasing Number of Outbreaks Attributed to Fish—United States, 1998–2011.
Jolene Nakao

2015 Ebola Infection in a Maternity Ward—Tonkolili, Sierra Leone, 2014.
Angela Dunn

2016 Increased Cases of Syphilis Among Pregnant Women and Infants—United States, 2012–2014
Charnetta Williams

Paul C. Schnitker International Health Awards, 1995–2016

1995 Leslie F. Roberts

1996 Peter Kilmarx

1997 Alexander K. Rowe and Eric L. Mouzin

1998 Etienne G. Krug

1999 Kayla F. Laserson

2000 John MacArthur and Peter Salama

2001 Valerie D. Garrett

2002 Robert D. Newman and Lorna E. Thorpe

2003 Puneet Dewan, Lisa Nelson, and Pratima Raghunathan

2004 Tracy Creek

2005 Oleg Bilukha

2006 Kevin Cain

2007 Avid Reza

2008 Sapna Bamrah and David Lowrance

2009 Rinn Song

2010 Andrew Auld

2011 W. Roodly Archer

2012 Sudhir Bunga and Janell A. Routh

2013 Kevin R. Clarke

2014 Eugene Lam and Miriam Shiferaw

2015 Edna Moturi and Raina Phillips

2016 José E. Hagan

James H. Steele Veterinary Public Health Awards, 1999–2016

1999 Fred Angulo and Jordan Tappero

2000 David Ashford

2001 Kate Glynn

2002 Kirk Smith

2003 Mike Bunning

2004 Jennifer McQuiston

2005 John Crump

2006 Katherine Feldman and James Kile

2007 Jennifer Wright

2008 John Dunn

2009 Casey Barton Behravesh and Stacy Holzbauer

2010 Kendra Stauffer

2011 Jennifer Adjemian and Adam Langer

2012 Barbara Knust

2013 Maho Imanishi and Megin Nichols

2014 Danielle Buttke

2015 Ryan Wallace

2016 Colin Basler and Neil Vora

Mitch Singal Excellence in Occupational and Environmental Health Awards, 2010–2016

2010 Surveillance and Prevention of Occupational Injury Deaths—Wyoming, 2003–2007.
Paul Anderson

2011 Unprecedented Outbreak of Acute Childhood Lead Poisoning—Zamfara State, Nigeria, 2010.
Carrie A. Dooyema

2012 Pyrrolizidine Alkaloid Toxicity as the Cause of Unknown Liver Disease—Tigray, Ethiopia (2007–2011).
Danielle E. Buttke

2013 Impact of Aerial Insecticide Spraying on West Nile Virus Disease—North Texas, 2012.
Duke J. Ruktanonchai

2014 Workplace Secondhand Smoke Exposure Among Nonsmoking Women of Reproductive Age—United States, 2010.
Candice Johnson

2015 Parking Prices and Walking and Bicycling to Work in U.S. Cities.
Geoffrey Whitfield

2016 Cleanliness is Next to Brea thlessness: Asthma and Other Health Problems Related to a New Cleaning Product Among Hospital Staff—Pennsylvania, 2015.
Megan Casey

Stephen B. Thacker EIS Champion Awards, 2013–2016

2013 Stephen B. Thacker

2014 Lyle Conrad

2015 Douglas H. Hamilton

2016 Polly A. Marchbanks

Monday, April 24, 2017

SESSION A: Stephen B. Thacker Opening Session

8:30–10:15 AM

Frieden Plenary

Moderators: Anne Schuchat and Michael Iademarco

8:35 Prevalence of Human Papillomavirus Before and After Vaccine Introduction — National Health and Nutrition Examination Surveys, United States, 2003–2014

Authors: Sara E. Oliver, E.R. Unger, R. Lewis, D. McDaniel, J. Gargano, M. Steinau, L.E. Markowitz

Background: Human papillomavirus (HPV) vaccine was recommended in mid-2006 for routine vaccination of females aged 11–12 years, through age 26 years, for the prevention of cervical and other HPV-associated cancers. Most vaccine used through 2014 was quadrivalent vaccine (4vHPV), which prevents HPV-6, -11, -16, and -18 infection. Vaccine impact on cancers will not be observed for decades, but vaccine-type infection can be monitored to assess early impact. We evaluated HPV prevalence among females using cross-sectional National Health and Nutrition Examination Surveys (NHANES) data.

Methods: We analyzed NHANES demographic and self-reported vaccination data, and HPV DNA from self-collected cervicovaginal specimens from females aged 18–24, 25–29 and 30–34 years. We estimated 4vHPV-type prevalence in pre-vaccine (2003–2006), early vaccine (2007–2010) and recent vaccine (2011–2014) eras. Using weighted logistic regression models adjusted for race and poverty, we estimated adjusted prevalence ratios (aPRs) comparing recent vaccine to pre-vaccine eras, overall and by vaccination status (≥1 vaccine dose).

Results: Among 18–24 year olds in 2011–2014, ≥1 dose coverage was 45%. 4vHPV-type prevalence was 18.8% in the pre-vaccine and 16.9% in the early vaccine era, declining to 7.1% in the recent vaccine era (aPR: 0.35; 95% confidence interval [CI]: 0.23–0.52). In the recent vaccine era, 4vHPV-type prevalence was 1.9% in vaccinated females (aPR: 0.09; 95% CI: 0.04–0.21) and 11.8% in unvaccinated females (aPR: 0.60; 95% CI: 0.38–0.97). No significant decreases were observed among older age groups.

Conclusions: HPV vaccine-type prevalence decreased 65% among 18–24 year-olds overall, with a 91% decrease among vaccinated females through 2014. Herd protection may explain the 40% decrease among unvaccinated females, despite <50% vaccination coverage.

Awards presented during session.

8:55 Raw Deal: Multistate Outbreak of *Salmonella* Virchow Infections Linked to a Powdered Meal Replacement Product — United States, 2015–2016

Authors: Kelly J. Gambino-Shirley, C. Schwensohn, A. Tesfai, B. Tolar, C. Burnett, D. Eikmeier, J. Stone, J. Hines, S. Viazis, M. Wise, K. Nei

Background: *Salmonella* causes an estimated 1 million foodborne illnesses and 400 deaths in the United States annually. In January 2016, PulseNet, the national laboratory network for foodborne disease surveillance, detected a multistate outbreak by a novel strain of *Salmonella* Virchow. We investigated to identify the source and prevent additional illnesses.

Methods: : A case was defined as infection with the pulsed-field gel electrophoresis outbreak pattern of *Salmonella* Virchow occurring between 12/5/2015 and 4/12/2016. Patients were interviewed to identify common exposures, and results were compared with healthy people in the 2006–2007 FoodNet Population Survey. We investigated product and supplier information to identify a common source of ingredients and inspected production facilities. Samples of the suspected product and its ingredients were cultured for *Salmonella*.

Results: Thirty-five cases from 24 states were identified; 6 hospitalizations and no deaths were reported. Thirty-one (94%) of 33 patients reported consuming powdered supplements in the week before becoming ill, which is significantly higher than the 4% of healthy people in the FoodNet Survey (P<.001); 30 of 31 patients reported consuming Brand A, a raw organic powdered shake product consumed as a meal replacement. Laboratory testing identified the *Salmonella* Virchow outbreak strain from leftover Brand A products collected from two patients' homes and from moringa leaf, an ingredient in Brand A imported from South Africa.

Conclusions: This is the first reported salmonellosis outbreak linked to a raw meal replacement powder. Company A issued a voluntary recall and reformulated the product to exclude moringa leaf. As this product has a long shelf-life, the recall likely prevented additional illnesses. This investigation identified a novel outbreak-related food and highlighted a potential risk with similar ready-to-eat products.

9:15 Sexual Orientation Discordance and Suicidal Ideation and Suicide Attempt Among U.S. High School Students — United States, 2015

Authors: Francis B. Annor, S. Irving, L. Gilbert

Background: Suicide is the second leading cause of death among U.S. youth aged 10-24 years. Adolescents experiencing sexual orientation discordance (i.e., their sexual identity is discordant with their sexual contacts), may be at increased risk of negative health outcomes such as stress, depression, and substance use. Because these factors are associated with suicidal ideation and attempts, this study examined the relationship between sexual orientation discordance and suicidal ideation and attempts among high school students.

Methods: Data are drawn from the 2015 Youth Risk Behavior Survey. The sexual identity and sex of sexual contacts items were used to create a two-level sexual discordance variable; concordant and discordant. A three-level suicidal risk variable was also created using items on suicidal ideation and suicide attempt: low (no ideation/attempt), medium (ideation, no attempt) and high (ideation and attempt). The association between suicide risk and sexual orientation discordance was assessed using ordinal logistic regression, adjusting for demographic variables and other covariates.

Results: The analytic sample size was 5,551. Approximately 4.0% of participants reported sexual orientation discordance. After adjusting for known risk factors of suicidal ideation and attempt, sexual orientation discordant youth had significantly higher prevalence odds of medium (adjusted odds ratio (AOR) =3.1; 95% CI:1.9-5.2) and high (AOR=2.6; 95% CI:1.7-4.0) suicide risk compared to those reporting sexual orientation concordance. Conference of Governmental Industrial Hygienists' Threshold Limit Value in three employees working in material handling, automated polishing, and laminating.

Conclusions: Sexual orientation discordance was associated with suicidal ideation and attempt among U.S. high school students. The finding highlights the complex relationship between sexual identity-related characteristics and suicidal ideation and attempts. Adolescents reporting discordant sexual orientation may have different challenges and risk factors that should be considered when developing and implementing suicide interventions for them.

9:35 Knowledge, Attitudes, and Practices Rapid Assessment To Improve Yellow Fever Vaccine Uptake Among Men During an Outbreak — Luanda, Angola, 2016

Authors: Mariel A. Marlow, M. Pambasange, R. Hall, M. Ghiselli, C. Francisco, M. Soares, S. Silva, C. Navarro-Colorado, E. Zielinski-Gutierrez

Background: In January 2016, the Angola Ministry of Health reported a yellow fever (YF) outbreak and initiated mass vaccination campaigns. In April, field teams reported low numbers of men attending vaccination sites; about 70% of confirmed case-patients were male. We developed a rapid assessment to identify and address barriers to vaccination among men.

Methods: From April 23–25, 2016, a knowledge, attitudes, and practices (KAP) rapid assessment was administered to men at public sites across four municipalities in Luanda. Based on results, targeted messaging was distributed in all municipalities; off-hours campaigns and new vaccination sites were implemented in Kilamba Kiaxi. We conducted a second KAP from July 30–31, 2016.

Results: In April, we observed lowest coverage in Kilamba Kiaxi (52%, 48/92). Coverage in other municipalities was 68% (41/60) in Cacuaco, 78% (46/59) in Cazenga, and 70% (64/91) in Viana. The most common reasons reported for non-vaccination were lack of time or vaccination conflicting with working hours (25%, 26/199), thinking the vaccine was dangerous (21%, 22/199), and not wanting to wait in line (20%, 21/199). Following modified vaccination activities, we observed 22% higher coverage in Kilamba Kiaxi (74%, 57/77) in July. Coverage was lower in Cacuaco (62%, 57/92) and Cazenga (75%, 67/89) and higher in Viana (74%, 68/92). Kilamba Kiaxi was the only municipality to have fewer men reporting fear of the vaccine, decreasing from 36% in April to 5% in July.

Conclusions: The KAP rapid assessment was a useful tool for informing vaccination efforts during the response. The YF campaign was not well adapted to men's time and information needs. Targeted interventions taken from KAP recommendations helped increase vaccine uptake among men.

9:55 Special Education Outcomes Among Children Born with Neonatal Abstinence Syndrome — Tennessee, 2008–2011

Authors: Mary-Margaret A. Fill, A. Miller, R. Wilkinson, M. Warren, S. Patrick, J. Dunn, W. Schaffner, T. Jones

Background: Neonatal abstinence syndrome (NAS) is a postnatal drug withdrawal syndrome that commonly occurs after intrauterine opioid exposure. Tennessee experienced a 15-fold increase in NAS incidence during 2002–2012. Adverse neurobehavioral outcomes are documented in infants born with NAS; however, educational outcomes have not been examined. We analyzed Tennessee data to more fully understand educational outcomes of infants born with NAS.

Methods: Using Tennessee Medicaid data, infants born in Tennessee during 2008–2011 with a history of NAS were matched (1:3) to infants born during 2008–2011 without a history of NAS. The groups were matched on sex, race, ethnicity, kindergarten cohort, and public health region of residence at birth. These data were linked to a Tennessee Department of Education database (1/2004–11/2016) to assess select special education outcomes during early childhood (age ≥3 years).

Results: A total of 1,815 children with and 5,441 children without a history of NAS were included in the study. Children with a history of NAS were significantly more likely to be referred for disability evaluation (351/1,815 [19.3%] versus 745/5,441 [13.7%]; P <0.0001) and meet criteria for a disability (284/1,815 [15.6%] versus 634/5,441 [11.7%]; P <0.0001). A significantly higher proportion of children with a history of NAS had special education exceptionalities of developmental delay (84/1,815 [4.6%] versus 170/5,441 [3.1%]; P = 0.002) and speech or language impairment (181/1,815 [10.0%] versus 434/5,441 [8.0%]; P = 0.008).

Conclusions: In this novel analysis linking health and education datasets, children with NAS were significantly more likely to have certain disabilities than children without NAS. Thus, efforts to reduce intrauterine opioid exposure and NAS might also reduce the risk of developmental disabilities in these children.

CONCURRENT SESSION B1: Vaccine-Preventable Diseases

10:45 AM–12:10 PM

Frieden Plenary

Moderators: Nancy Messonnier and Sam Posner

10:50 Epidemiology of a Mumps Outbreak in a Highly Vaccinated University-Affiliated Setting and Use of a Third Dose of Measles-Mumps-Rubella Vaccine (MMR) for Outbreak Control — Iowa, July 2015–May 2016

Authors: Minesh Shah, P. Quinlisk, A. Weigel, J. Riley, L. James, J. Patterson, C. Hickman, P. Rota, R. Schicker, N. Clemmons, N. Kalas, C. Cardemil

Background: In response to a mumps outbreak at the University of Iowa, a setting with 22,000 undergraduates and mandatory 2-dose measles-mumps-rubella vaccination (MMR) policy, a 3rd MMR dose campaign targeting students <25 years was held. Over 4,500 doses were administered. We characterize the outbreak before and after the vaccination campaign.

Methods: Students meeting the Council of State and Territorial Epidemiologists mumps case definition were interviewed and had medical charts abstracted to determine demographics, clinical symptoms and complications. Vaccination status was verified with university and state immunization records. Case count was examined pre-campaign (start of outbreak on July 13, 2015 through one mumps incubation period after the final 3rd dose clinic on December 10, 2015) versus post-campaign (December 11, 2015-May 13, 2016). Cases among persons <25 vs. ≥25 years old were compared pre- and post-campaign using Fisher's exact test.

Results: Of 301 mumps cases in students from July 13 2015 through May 13 2016, 190 (63%) were lab-confirmed. Cases were primarily undergraduates (91%) and highly vaccinated (98% had ≥2 MMR doses). Cases were ill for a median of 8 (inter-quartile range [IQR] 6-10) days and self-isolated for a median of 6 (IQR 5-7) days. Complications included meningitis (n=1), hearing loss (n=3), orchitis (n=14) and mastitis (n=2). Fewer cases occurred post-campaign (75, 25%) compared to pre-campaign (226, 75%), and cases in the targeted age group declined from 98% to 91% (p=0.01).

Conclusions: Despite high 2-dose MMR coverage, a large mumps outbreak occurred at the University of Iowa. After a 3rd MMR dose campaign, fewer cases occurred overall and in the target population. Further studies are needed to determine if this decline is due to the campaign.

11:10 Measles Outbreak at a United States Immigration and Customs Enforcement Facility—Arizona, May–June 2016

Authors: Heather Venkat, A. Kassem, C. Su, S. Mercader, S. Bae Sowers, G. Briggs, C. Hill, E. Timme, K. Komatsu, R. Sunenshine, M. Patel, D. Elson, C. Hickman, P. Gastañaduy, S. Brady

Background: The first documented measles outbreak in an Immigration and Customs Enforcement facility in the United States was identified in Arizona in May 2016. We sought to describe cases, implement outbreak control measures, and study attack rates to assess transmission patterns.

Methods: Cases were defined as having laboratory-confirmed measles infection, or an acute febrile rash illness and epidemiological link to a laboratory-confirmed case. Measles-specific immunoglobulin G (IgG) was measured to assess immunity levels, and IgG-avidity testing was performed to distinguish between primary and secondary antibody responses. We compared attack rates among detainees and staff, seronegative and seropositive detainees, and by detainee housing unit and sex.

Results: We identified 29 measles cases (20 detainees, 9 staff); rash onsets were during May 6–June 26. Sera from 205 detainees revealed that 186 (91%) had detectable IgG. Five (83%) of 6 confirmed cases had high avidity antibody titers, indicating a secondary immune response to measles. Attack rates were not significantly different among detainees and staff (1.40% versus 1.77%, P=0.56), or among seronegative and seropositive detainees (10.53% versus 3.37%, P=0.21), but were significantly higher among unit A detainees, compared with the aggregate for units B–F (6.61% versus 0.42%; P<0.001), and among male, compared with female detainees (2.11% versus 0.19%; P<0.01). Control measures included measles vaccination for 1,424 of 1,425 detainees, verification of immunity or vaccination for 445 (87%) of 510 staff, case isolation, and quarantining of affected housing units.

Conclusions: Although attack rates were low, measles outbreaks can occur in intense exposure settings despite high immunity levels. We highlight the importance of preemptive high immunization coverage and containment in limiting measles transmission in these settings.

11:30 Impact of Sociodemographic Factors on Implementation of the Standards for Adult Immunization Practice — United States, 2016

Authors: Neil C. Murthy, A. O'Halloran, R. Fink, W.W. Williams, C. Bridges, D. Kim, A.P. Fiebelkorn

Background: Vaccine-preventable diseases cause substantial morbidity and mortality among adults. However, U.S. adult vaccination rates are low. The Standards for Adult Immunization Practice (the "Standards"), recommend healthcare providers (HCPs) conduct vaccination assessments, recommendations, offers, and/or referrals for needed vaccines at every clinical encounter. We surveyed U.S. adults to assess differences in reported implementation of the Standards by sociodemographic factors.

Methods: We conducted an internet panel survey using a nationally representative sample of U.S. adults. We calculated weighted proportions of respondents who reported receiving vaccine needs assessment, recommendation, offer and referral from their HCPs during their most recent visit in the past year by sociodemographic factors. T-tests and chi square tests were used to test the significance of comparisons (p<0.05).

Results: Vaccine needs assessments were reported more frequently among adults aged ≥65 (56.1%) and 50-64 years (47.5%) versus 19-49 years (37.7%), and adults with at least some college education (48.5%) versus high school or less (39.0%). Vaccine recommendations were reported more frequently among adults aged ≥65 (28.1%) and 50-64 years (27%) versus 19-49 years (18.1%), and among employed (22.4%) versus unemployed (9.3%). Vaccine offers were reported more frequently among adults aged ≥65 years (24.2%) versus 19-49 years (13.3%), and among employed (17.2%) versus unemployed (5.9%). Among adults aged ≥65 years, 50-64, and 19-49, those who reported receipt of at least one vaccine was 14.4%, 9.8%, and 4.2%, respectively.

Conclusions: Large gaps in implementation of the Standards were found among persons of all ages, but differed by age group, education status, and employment status. These findings can help HCP and healthcare systems prioritize changes to improve standards implementation and avoid missed opportunities for vaccination.

11:50 Risk Factors for Meningococcal Disease Among Adults Experiencing Homelessness in Boston — Massachusetts, 2016

Authors: John O. Otshudiema, M. Patton, N. Westercamp, N. Aliabadi, A. DeMaria, L. Madoff, M. Burns, S. Lett, D. De Las Nueces, C. Léon, P. Bhalla, A. Barry, J. Gunn, S. Martin, J. MacNeil, A. Acosta

Background: Between January and March 2016, five cases of meningococcal disease were reported among adults experiencing homelessness in Boston. Reports of meningococcal disease in this population are rare. We aimed to evaluate factors contributing to increased risk for meningococcal disease among adults experiencing homelessness in Boston.

Methods: We conducted a matched case-control evaluation. A case was defined as laboratory-confirmed *Neisseria meningitidis* with illness onset on or after May 1, 2015, in an adult experiencing homelessness in the Boston-metro area. Five controls were matched to each case by sex, age-group, and use of the same emergency shelter facility during the case's infectious period. Participants were interviewed and their medical records reviewed to identify risk factors. Univariate conditional logistic regression was used to calculate exact matched odds ratios (eMOR) and 95% confidence intervals (CI).

Results: Five cases and 25 controls were enrolled. Compared to controls, a higher proportion of cases were black (80% vs. 44%) or experienced homelessness for less than one year (60% vs. 32%). During the infectious period, a higher proportion of cases had >1 kissing partner (60% vs. 32%) or slept in an emergency shelter room with ≥50 people (40% vs. 20%). None of these differences were statistically significant. The only factor significantly associated with disease was history of any immunosuppressive condition (HIV, lupus, or diabetes) (eMOR: 10.57; 95% CI: 1.79–∞; p = 0.02).

Conclusions: While history of immunosuppressive condition was significantly associated with meningococcal disease among adults experiencing homelessness, other typical risk factors such as crowding and kissing multiple partners were not. Sample size limited this analysis; enhancing meningococcal disease surveillance by collecting homeless status will allow for more robust evaluation.

CONCURRENT SESSION B2: Chronic Disease Prevention and Health Disparities

10:45 AM–12:10 PM

Concurrent Session Room

Moderators: Ursula Bauer and Tala Fakhouri

10:50 Cardiovascular Disease Risk Factors by Level of Active Transportation Among U.S. Adults, 2011–2014

Authors: Marissa L. Zwald, L. Akinbami, T. Fakhouri, G. Whitfield, C. Fryart

Background: Regular physical activity (PA) decreases the risk of cardiovascular disease (CVD), the leading cause of death in the U.S. Morbidity and mortality from CVD continue to impose a health and economic burden to Americans. Active transportation (walking or bicycling) represents one way individuals can alter their lifestyle to incorporate recommended PA levels. We examined associations between active transportation and selected CVD risk factors, including hypertension, high total and low high-density (HDL) cholesterol, diabetes, and obesity.

Methods: Analysis included a representative sample of 8605 U.S. adults aged 20 years and over from the 2011-2014 National Health and Nutrition Examination Survey. Using the WHO Global PA Questionnaire, participants reported PA as part of travel to and from destinations in a typical week. Active transportation was categorized as none (0-9 minutes/week); low (10-149 minutes/week); or high (≥150 minutes/week). Multivariable logistic regression was used to examine associations for each CVD risk factor, controlling for age, sex, race, education, poverty, smoking, and PA for work and leisure. SUDAAN was used to account for complex survey design.

Results: Most adults (71%) reported no active transportation. Compared to no active transportation, high levels of active transportation were associated with lower odds of high total cholesterol (aOR=0.74; 95% CI=0.55-0.99), low HDL cholesterol (aOR=0.69; 95% CI=0.55-0.87), diabetes (aOR=0.73; 95% CI=0.57-0.95), and obesity (aOR=0.65; 95% CI=0.54-0.78). Similar findings were observed comparing no active transportation to low levels, but not all differences were significant.

Conclusions: TActive transportation is beneficially associated with CVD risk factors. These findings may inform the development and implementation of PA interventions, including those outlined in CDC's Guide to Community Preventive Services and the Surgeon General's Call to Action to Promote Walking.

11:10 Comparison of Inactivity Among Adults with Disabilities by Using Two Disability Measures — National Health Interview Survey, 2011–2015

Authors: Dana Olzenak McGuire, K. Watson, D. Carroll, E. Courtney-Long, S. Carlson

Background: Measuring disability is key to understanding the health risks and disparities experienced by people with disabilities, as well as to identifying areas that need improvement through program efforts. However, different measures ascertain different people, yielding varying disability prevalence estimates. Little is known about how prevalence of health behaviors varies by disability measure. Our study compares prevalence and patterns of physical inactivity by using two different disability measures.

Methods: Data from the 2011–2015 National Health Interview Survey were analyzed for adults aged 18 years or older. Disability prevalence was examined for two measures: (a) Basic Actions Difficulty (BAD) questions (5 domains measuring vision, hearing, cognition, movement, and emotion); and (b) American Community Survey (ACS) standard disability questions (6 questions assessing vision, hearing, cognition, mobility, self-care, and independent living). Physical inactivity meant reporting no leisure time physical activity during the past week. Demographic differences and trends in inactivity prevalence were assessed by using pairwise t-tests and orthogonal polynomial contrasts.

Results: Disability prevalence was 31.1% (BAD) and 17.5% (ACS). For both measures, inactivity prevalence was higher among adults with disability (BAD: 42.9%, ACS: 52.5%) than those without (BAD: 24.3%, ACS: 26.2%). Inactivity patterns among adults with disability were consistent for both measures: increased with age; decreased with higher education level; and highest among non-Hispanic black and Hispanic adults.

Conclusions: Although inactivity patterns were consistent for demographic characteristics, inactivity prevalence was higher among adults with disability, as defined by using ACS than BAD. Understanding who is ascertained by different measures could lead to improved public health strategies for better health of adults with disabilities.

11:30 Racial Differences in Survival of Pediatric Patients with Brain and Central Nervous System Cancer — United States, 2001–2012

Authors: David A. Siegel, J. Li, S. Singh

Background: Brain and central nervous system (CNS) cancer is the second most common childhood cancer and is the leading cause of cancer death among children and adolescents. Despite improvements in survival during the past 40 years, some data suggest a racial disparity for survival. Our study describes survival by race by using national data to better understand the effects of demographic and clinical factors.

Methods: Data from the National Program of Cancer Registries were used to evaluate relative survival (RS) (cancer survival in the absence of other causes of death) among children and adolescents aged 0-19 years diagnosed with brain and CNS cancer during 2001-2012. Data were from 29 states and covered 66% of the U.S. population. Overall and specific to black and white races, RS was stratified by sex, age, cancer stage, anatomic site, histology, U.S. Census region, and county economic status.

Results: We identified 16,675 primary brain and CNS cancer cases during 2001-2012, with a 5-year RS of 75.5% (95% confidence interval [CI]: 75.0-76.5). White patients had a significantly higher 5-year RS (76.5%; 95% CI: 75.7-77.3) than black patients (70.8%; 95% CI: 68.6-72.9). The racial difference remained significant at 1 and 3-year RS, for both sexes, among children and adolescents, and in the South Census region. Cancer stage, primary anatomic site, histology, and economic status also affected racial differences for survival.

Conclusions: This study highlights brain and CNS cancer survival differences between black and white pediatric patients and identifies potential contributing sociodemographic and clinical factors. Future investigation of access to care, socioeconomic status, and host genetic factors may explain why race is a marker for survival and could help guide public health planning.

11:50 Trends in Hospitalization Rates for Patients with Myocardial Infarction by Race/Ethnicity Among Kaiser Permanente Southern California Members — Southern California, 2000–2014

Authors: Gloria C. Chi, K. Reynolds, B. Li, L. Qian, T. Harrison, S. Jacobsen, R. Scott, M. Kanter

Background: Acute myocardial infarction (AMI) is a common presentation of heart disease, the leading cause of mortality in the United States. AMI rates differ by race/ethnicity, and studies examining changes to AMI incidence among diverse adult populations are needed. We examined trends in hospitalized AMI by race/ethnicity during 2000–2014 among Kaiser Permanente Southern California members aged ≥35 years.

Methods: Hospitalization for AMI each year was identified by using diagnosis codes from hospital discharge records and billing claims. We calculated age- and sex-standardized annual incidence rates by race/ethnicity (Hispanic, non-Hispanic Asian or Pacific Islander, non-Hispanic black [NHB], and non-Hispanic white [NHW]). We estimated incidence rate ratios (IRRs) among race/ethnicity groups by using Poisson regression adjusting for age and sex. We compared trends among race/ethnicity groups by including interaction terms between year (continuous) and race/ethnicity in regression models.

Results: We identified 45,331 AMI hospitalizations during 2000–2014. AMI incidence decreased in each race/ethnicity group (all P <0.001). NHBs, but not other groups, experienced a significantly smaller decline in AMI incidence than NHWs (P = 0.04). During 2000–2014, standardized AMI incidence (per 1,000 person-years) declined from 3.82 (95% confidence interval [CI]: 3.65–3.99) to 1.92 (95% CI: 1.82–2.02) for NHWs and from 3.54 (95% CI: 3.17–3.91) to 2.03 (95% CI: 1.81–2.25) for NHBs. In 2000, NHBs had a lower AMI incidence than NHWs (IRR: 0.90; 95% CI: 0.85–0.96), but 2014 rates were similar (IRR: 1.00; 95% CI: 0.95–1.06).

Conclusions: AMI hospitalization incidence declined substantially during 2000–2014 for all race/ethnicity groups. Convergence of NHB and NHW AMI incidence rates suggests that disparities have narrowed between these two groups in Southern California.

SESSION C: J. Virgil Peavy Memorial Award Finalists

1:45–3:30PM

Frieden Plenary

Moderators: Jennifer Parker and Byron Robinson

1:50 A Novel Approach to Analysis of Cryptosporidiosis and Giardiasis Surveillance in the United States, 2005–2015

Authors: Katharine M. Benedict, S. Collier, E. Marder, M. Hlavsa, K. Fullerton, J. Yoder

Background: Traditionally, population-based case-control studies have been used to identify risk factors for cryptosporidiosis and giardiasis. However, these studies are expensive and include controls with characteristics that likely differ from reported cases since they are selected from the general population while only a relatively small proportion of cases of cryptosporidiosis and giardiasis are reported to public health authorities. In this analysis, we use a variation of the case-control analysis wherein reported cases of a different disease are used as a comparison group to identify potential risk factors for cryptosporidiosis and giardiasis.

Methods: Surveillance data from the National Notifiable Disease Surveillance System (NNDSS) were accessed through the NNDSS Data Availability Project (NDAP). Exposures reported for cryptosporidiosis and giardiasis case-patients were compared to exposures of salmonellosis case-patients reported by 16 states (2005–2015). Odds ratios adjusted for age and reporting state (aOR) and 95% confidence intervals (95% CI) for exposures were calculated using SAS 9.3.

Results: A total of 14,996 cryptosporidiosis, 22,595 giardiasis, and 123,180 salmonellosis cases were reported. When compared to cases of salmonellosis, exposure to treated recreational water (aOR: 5.3; 95% CI: 5.0-5.6) and livestock (aOR: 2.8; 95% CI: 2.5-3.1) were risk factors for cryptosporidiosis, and exposure to untreated drinking (aOR: 5.8; 95% CI: 5.3-6.4) or recreational water (aOR: 3.4; 95% CI: 3.2-3.7) and prior travel (aOR: 2.5; 95% CI: 2.4-2.7) were risk factors for giardiasis.

Conclusions: Risk factors for cryptosporidiosis and giardiasis identified through national surveillance data were comparable to those identified in outbreak investigations or population based case-control studies. Case-case analyses can be used to better understand disease epidemiology and more efficiently identify risk factors to guide the development of prevention and control measures.

2:10 Power Law Analysis of Foodborne Outbreaks — United States, 1998–2015

Authors: Julie L. Self, M. Hoekstra, K. Wong, C. Pilewski, R. Tauxe, B. Bruce

Background: Large foodborne outbreaks are rarer than small outbreaks, but the mathematical relationship between outbreak size and frequency is unknown. If size and frequency have an inverse linear relationship on a log-log plot then they follow a power law, and we can better understand how often we expect to observe outbreaks of different sizes. We assessed whether outbreak data follow a power law and how certain outbreaks may deviate from it.

Methods: Using foodborne outbreaks reported to the Foodborne Disease Outbreak Surveillance System during 1998–2015, we used bootstrapping (3,000 samples) to assess whether outbreaks fit a power law using the Kolmogorov-Smirnov statistic and determined the slope of outbreak size versus frequency on a log-log scale. We also compared multistate and single-state outbreaks.

Results: We identified 8,037 outbreaks (296 multistate; 7,741 single-state). Their size-frequency relationship was consistent with a power law (slope: 2.21; 90% credible interval [CI]: 2.17–2.26) although outbreaks with <5 or ≥200 cases were rarer than expected. The slope for single-state outbreaks (2.13, 90% CI: 1.95–2.37) was significantly smaller than for multistate outbreaks (2.47, 90% CI: 2.39–2.57), indicating that larger single-state outbreaks were rarer than larger multistate outbreaks.

Conclusions: Foodborne outbreak data show that intermediate-sized outbreaks follow a power law that predicts how often they should be observed. Small outbreaks are rarer than expected, suggesting relative under-detection; large outbreaks are also rarer than expected, which may reflect successful public health interventions. This method, which can be customized to single-state or multistate outbreaks, can be a useful tool to estimate how many small outbreaks are missed and to evaluate the impact of new technologies and policies on controlling large outbreaks.

2:30 HIV, Serostatus Knowledge, and Viral Load Suppression Among Female Sex Workers In Kampala, Uganda, 2012 — A Respondent-Driven Sampling Survey

Authors: Reena H. Doshi, E. Sande, M. Ogwal, H. Kiyingi, J. Kusiima, A. McIntyre, W. Hladik

Background: The Joint United Nations Programme on HIV and AIDS (UNAIDS) set global targets for 2020, aiming for 90% of people living with HIV to know their serostatus and for 73% to have viral load suppression (VLS). We investigated progress towards these targets among female sex workers (FSW) in Kampala, Uganda, who bear a disproportionate burden of HIV.

Methods: Between April and December 2012, FSW, defined as women, 15-49 years, residing in greater Kampala, and selling sex for money in the last 6 months, were recruited using respondent-driven sampling (RDS). Venous blood was collected for HIV testing according to Uganda's national serial rapid test algorithm and for VL testing (VLS defined as <50 copies/mL). We collected data using audio computer-assisted self-interviews. Weighted population estimates were calculated using RDS Analyst software.

Results: Sampling was initiated with 4 respondents; 1,487 FSW were enrolled over 25 recruitment waves; median age was 27 years (interquartile range: 23 to 32). HIV seroprevalence was 31.4% (95% confidence interval [CI]: 28.7-34.0%). Among HIV-positive FSW, serostatus knowledge was 26.5% (95% CI: 21.7-31.4%) and VLS was 21.6% (95% CI: 16.2-27.0%). Assuming that all FSW with VLS know their serostatus yielded a corrected serostatus knowledge estimate of 37.5% (95% CI: 32.4-42.6%).

Conclusions: HIV prevalence among Kampala FSW is high, whereas serostatus knowledge and VLS are far below UNAIDS population-level targets. The high population prevalence of unsuppressed VL suggests substantial risk of transmission to partners and clients. FSW in Kampala are in need of intensified and targeted control efforts, including pre-exposure prophylaxis, frequent HIV screening, and improved linkage to treatment services.

2:50 Impact of HIV Sequence Reporting Completeness on Detection of Growing HIV Transmission Clusters — Michigan, 2012–2014

Authors: Sharoda Dasgupta, A. France, M. Brandt, M. Ocfemia, T. Zhang, N. Pannee, A. Hernandez, A. Oster

Background: HIV nucleotide sequence data, collected through surveillance, can help identify clusters of persons infected with genetically similar strains suggesting transmission that warrants public health investigation. Because the percentage of HIV diagnoses with a reported genetic sequence (completeness) varies by jurisdiction, we assessed the association of completeness with ability to detect growing HIV transmission clusters.

Methods: Using HIV surveillance data for Michigan, whose 69% completeness was highest among states in 2012–2014, we calculated genetic distance between all possible sequence pairs to determine clusters of highly similar HIV strains. We identified the total number of growing transmission clusters, each with highly similar HIV strains with ≥3 cases diagnosed in 2014. We simulated variation in completeness by taking 100 random samples of the full data set with replacement with a range of 5%–65%, in increments of 5%. We reported the median number of growing clusters and 5% and 95% quantiles, and calculated the sensitivity for each completeness level by comparing the number of growing clusters in each sample with the full data set.

Results: Among 1614 cases with a sequence reported during 2012–2014, 15 growing clusters were identified. As completeness declined, the number of growing clusters decreased from 15 to a median of 8 (5%–95%: 4–12) at 50% completeness and to 1 (5%–95%: 0–4) at 25% completeness. Sensitivity decreased from 100% to 37% at 50% completeness and to 7% at 25% completeness.

Conclusions: Reduced HIV sequence data completeness lowers the sensitivity for detecting growing transmission clusters, resulting in missed opportunities for public health intervention. To ensure detection of growing clusters, jurisdictions should expand efforts to maximize sequence completeness.

3:10 Spatial Clustering of Suicide and Area-Level Characteristics at Census Block Group Level — Idaho, 2010–2014

Authors: Ahmed M. Kassem, K. Carter, C. Johnson, P. Harder, C. Hahn

Background: In 2014, suicide was the eighth leading cause of death in Idaho and tenth nationwide. Limited data are available about characteristics of areas with high suicide rates. We sought to identify and characterize spatial clusters of Idaho suicides.

Methods: We analyzed Idaho Division of Public Health`s death certificate data on deaths occurring among Idaho residents during 2010–2014 and used *International Classification of Diseases,* Tenth Revision codes X60.0–X84.9, Y87.0, U03.0, and U03.9 to identify suicides; we geocoded residential addresses to census block groups (CBGs). We obtained population data from the 2010 Census and the 2010–2014 American Community Survey. We used a discrete Poisson model in SaTScan™, with P <0.10 cutoff for programmatic considerations, to identify nonoverlapping, high-rate spatial clusters of suicide. Logistic regression was used to examine associations between suicide clustering and CBG-level population characteristics (comparing highest quartile with lowest 3 quartiles); P <0.05 cutoff for inclusion in multivariable modeling.

Results: During 2010–2014, deaths by suicide occurred in 1,501 Idaho residents. We identified 2 clusters of suicide in distinct regions as follows: a 25-CBGs cluster (age- and sex-adjusted relative risk [aRR] = 1.94) and a 6-CBGs cluster (aRR = 3.61). CBGs within the identified clusters were positively associated with the following CBG-level population characteristics: median age ≤31.1 years (multivariable-adjusted odds ratio [aOR] = 2.41; P = 0.041), >53% female (aOR = 2.69; P = 0.011), >1% American Indian or Alaska Native (aOR = 2.92; P = 0.006), and >30% never married (aOR = 3.43; P = 0.004).

Conclusions: We identified suicide clustering in Idaho and associations with CBG-level characteristics. Idaho suicide prevention programs should consider using results to target prevention efforts.

CONCURRENT SESSION D1: Zoonotic Diseases

3:45–5:10PM

Frieden Plenary

Moderators: Casey Barton Behravesh and Brett Petersen

3:50 No Kidding: Large Outbreak of Human *Escherichia coli* O157 Infections Linked to a Goat Dairy Farm — Connecticut, 2016

Authors: Kelly J. Gambino-Shirley, M. Laughlin, P. Gacek, Q. Phan, L. Stevenson, A. Mercante, J. Razeq, M. Cartter, M. Nichols

Background: Zoonotic transmission of shiga-toxin producing *Escherichia coli* (STEC) causes an estimated 5,960 annual U.S. infections. Young children with STEC infections can develop hemolytic uremic syndrome (HUS), a potentially life-threatening complication. In March 2016, 7 people with STEC infections were reported to Connecticut Department of Public Health (CTDPH); of these, 6 visited the same goat dairy farm (Farm X) before illness onset. We investigated to determine sources of STEC infection at Farm X and develop public health recommendations.

Methods: A case-control study was conducted; cases and controls were recruited via a press release encouraging Farm X visitors to report to CTDPH. Cases were defined as laboratory-confirmed infection with outbreak strains of STEC O157 or physician-diagnosed HUS, with illness onset during March–April 2016. Controls were without gastrointestinal symptoms after visiting Farm X in March 2016. Environmental and animal samples collected from Farm X were cultured; isolates were compared with patient isolates using pulsed-field gel electrophoresis.

Results: Thirty-eight cases and 73 controls were identified. Three (9%) case-patients developed HUS; 23 (61%) were aged <5 years. Case-patients were significantly more likely than controls to use hand sanitizer after leaving a barn at Farm X (odds ratio: 2.4; 95% confidence interval: 1.0–5.5). No handwashing stations were noted. Of 44 environmental samples and 17 goat fecal samples, 28 (64%) and 16 (94%), respectively, yielded STEC outbreak strains.

Conclusions: Environmental contamination and excreting of STEC by goats at Farm X was extensive, and exclusive use of hand sanitizer was ineffective in preventing this outbreak. Farms open to the public should provide handwashing stations with soap and running water, education, and consider limiting access of young children to animal areas.

4:10 A Comparison of Three Statistical Thresholds to Trigger a Public Health Response to Monkeypox — Democratic Republic of the Congo, 2011–2013

Authors: Sarah Anne J. Guagliardo, M. Reynolds, R. Lushima, O. Wemakoy, A. McCollum

Background: Endemic to the Democratic Republic of the Congo (DRC), monkeypox is a zoonotic disease that causes smallpox-like illness in humans. Observed fluctuations in the number of reported cases over time raises questions about when it is appropriate to mount a public health response, and what specific actions should be taken. Here, we evaluate three different thresholds to differentiate between baseline and heightened incidence of disease, and propose a tiered approach to public health action.

Methods: Confirmed monkeypox cases occurring in Tshuapa Province from 2011-13 were used to calculate three different statistical thresholds (Cullen, C-sum, and a World Health Organization method) based on monthly incidence. When the observed cases exceeded the threshold for a given month, that month was considered to be an 'aberrant' month. The number of aberrant months detected was summed by year for each approach.

Results: There was notable variation in the number of aberrant months for each method. The Cullen approach, based on the mean incidence + 2*standard deviation, did not detect any aberrant signals over the period of consideration (0/36 months). The C-sum method, calculated as the ratio of past to present cases, was the most sensitive, resulting in 18/36 aberrant months. The WHO method, involving the upper 3rd quartile of data from past cases, resulted in 11/36 aberrant months.

Conclusions: A single threshold for triggering public health action may be insufficient for monkeypox and other diseases that are endemic yet relatively rare. We propose instead that multiple thresholds be considered to allow responses of varying intensity: 1) an alert threshold prompting further investigation/ intervention beyond routine surveillance, and 2) an epidemic threshold, which may entail contact tracing and community education.

4:30 Q Fever Endocarditis — United States, 1999–2015

Authors: Anne Straily, F.S. Dahlgren, C. Paddock

Background: Q fever is a worldwide zoonosis caused by *Coxiella burnetii.* In patients with pre-existing valvular heart disease, *C. burnetii* infection can manifest as a life-threatening endocarditis. Limited information exists on Q fever endocarditis in the United States. We summarized national Q fever surveillance data to better characterize the epidemiology of Q fever endocarditis in the United States.

Methods: We reviewed Q fever case report forms (CRFs) submitted to CDC during 1999–2015 to identify patients with endocarditis. Cases were categorized as confirmed or probable according to laboratory criteria defined by the Council for State and Territorial Epidemiologists. Demographic, laboratory, and clinical data were reported as frequencies. Tests of comparison were conducted using Chi-square and Fisher's exact tests.

Results: Of 991 CRFs submitted, 46 confirmed and 11 probable cases of Q fever endocarditis were identified. The majority of patients were male (79%) and the median age was 57 years (range: 22–87 years). Fifty-five patients (84%) were hospitalized; four deaths (7%) were reported. Thirty-four patients (60%) had previous history of valvulopathy; where the affected valve was identified (n = 7), six (85.7%) had stenosis or replacement of the aortic valve. The most frequently reported symptoms included fever (30, 53%), malaise (27, 47%), and myalgia (22, 39%).

Conclusions: Q fever endocarditis is a rare but serious and life-threatening complication of Q fever infection. This case series represents the largest description of Q fever endocarditis in the United States to date. However, Q fever is historically underreported in the United States, and the true burden of disease may be much greater. Improved surveillance is necessary to better understand the magnitude of Q fever endocarditis.

4:50 Northern Trajectory of Human Tularemia — United States, 1965–2013

Authors: Natalie A. Kwit, P. Mead

Background: Tularemia is an uncommon but debilitating arthropod-borne zoonosis caused by *Francicella tularensis*. Although human infection occurs sporadically throughout the continental United States, historically, cases have been concentrated in the south central states of Louisiana, Arkansas, and Missouri. We used two methods to assess changes in the geographic distribution of human tularemia cases reported to CDC through the Nationally Notifiable Diseases Surveillance System during 1965–2013.

Methods: Reported cases were geocoded to centroids for the county of patient residence. A linear model was fit comparing latitude and longitude of all cases by year, adjusted for population using annual, county-level U.S. Census estimates. To further evaluate geographic trend, a spatial scan cluster detection method based on log likelihood ratio [LLR] tests was used to identify the location of the highest risk spatial cluster of cases for each of nine 5-year intervals.

Results: During 1965–2013, mean latitude of human tularemia cases in the lower 48 states moved northward 444 km, from 37°N to 41°N (P <.0001), with no change in mean longitude (P =.5). Overall, spatial scan methods identified an area 668 km in diameter centered over northwestern Arkansas as the area of greatest risk (LLR: 6663; P <.0001). When evaluated in 5-year intervals, the centroid for this cluster moved from 35°N in 1965–1969 to 39°N in 2005–2009, also a change of 444 km.

Conclusions: The distribution of human tularemia cases in the United States has moved progressively northward since 1965. This trajectory suggests areas of likely emergence where educational efforts may be most needed. The trend is independent of changes in population and may reflect shifts in environmental factors or arthropod vector abundance.

CONCURRENT SESSION D2: Reproductive Health

3:45–5:10PM

Concurrent Session Room

Moderators: Wanda Barfield and Cheryl Broussard

3:50 Intracytoplasmic Sperm Injection (ICSI) Use Among States With and Without Insurance Coverage for Infertility Treatment — United States, 2000–2014

Authors: Ada Dieke, A. Mehta, D. Kissin, A. Nangia, L. Warner, S. Boulet

Background: Intracytoplasmic sperm injection (ICSI), an *in vitro* fertilization (IVF) procedure involving single sperm injection into an egg to address male factor infertility, is increasingly used for non-male factor indications without notable benefits, despite evidence of potential risks to offspring. ICSI use may increase among states with insurance mandates that require IVF reimbursement. We examined recent trends in ICSI usage among 8 states with an insurance mandate for IVF versus remaining states without such mandates.

Methods: : Data were analyzed from the 2000–2014 National Assisted Reproductive Technology Surveillance System. We used linear regression to assess trends in ICSI use among fresh (unfrozen) IVF cycles conducted among states with and without an insurance mandate during the study period, stratified by male factor infertility. For 2010–2014, we compared ICSI use by mandate status and used log-binomial regression to calculate adjusted rate ratios (aRR) for associations between ICSI use and insurance mandates, accounting for clustered clinic outcomes with generalizing estimating equations. P-values below .05 were significant.

Results: During 2000–2014, ICSI use in non-male factor infertility cycles increased more within non-mandate (34.6% to 71.4%) compared with mandate states (39.5% to 62.3%), ($P < .0001$). From 2010–2014, ICSI use was higher in non-mandate than mandate states for cycles without non-male factor infertility (68.4% vs. 59.6%, aRR 0.86; 95% CI, 0.75-0.99, $P = .04$) and those with male factor infertility (94.5% vs. 90.9%, aRR 0.96; 95% CI, 0.93-1.00, $P = .03$).

Conclusions: In non-male factor cycles, the increase in ICSI use was greater for states without an IVF insurance mandate than those with one. During 2010–2014, mandates were associated with decreased ICSI use, suggesting that reimbursement may affect IVF treatment decisions.

4:10 Antiviral Treatment Among Hepatitis B Virus–Infected Pregnant Women — New York City and Michigan, 2013–2015

Authors: Ruth Link-Gelles, A. Koneru, J. Lazaroff, P. Fineis, N. Nelson, S. Schillie

Background: Individuals with chronic hepatitis B virus (HBV) infection are at increased risk for cirrhosis and hepatocellular carcinoma. Chronic HBV infection develops in 90% of infants infected at birth. Although postexposure prophylaxis prevents up to 95% of perinatal HBV infections, breakthrough infections occur, especially among infants born to women with high viral loads (VLs). Maternal antiviral treatment during pregnancy can reduce perinatal HBV transmissions by 70% above the effect of infant postexposure prophylaxis alone. We assessed factors associated with maternal antiviral treatment in a cohort of HBV-infected pregnant women with high VL.

Methods: During 2013–2015, the U.S.-funded Supplemental Perinatal Hepatitis B Prevention Program collected demographic, clinical, and maternal antiviral treatment information from medical charts of HBV-infected pregnant women in Michigan and New York City. We included only the first birth from multiparous women. We assessed the association of demographic and clinical factors with maternal antiviral treatment, with Fisher's exact tests of significance at $p<0.05$.

Results: Among 1,610 women with maternal antiviral treatment and VL data, 138 (8.8%) had high VL (>200,000 IU/mL). Among 138 women with high VL 33.3% received antiviral treatment. Among women with high VL, 46 (35.1%) of 131 Asian/Pacific Islanders and 0 of 7 women of other races were treated ($P=0.10$). Receipt of treatment was not associated with insurance type, pregnancy length, or infant birth weight.

Conclusions: No factor assessed was significantly associated with antiviral treatment among women with high VL. Because two-thirds of women with high VL did not receive antiviral treatment during pregnancy, opportunities to reduce perinatal HBV transmission were missed.

4:30 Distribution of Severe Maternal Morbidity by Comorbidity Status Among Delivery Hospitalizations — Massachusetts, 1998–2013

Authors: Nicholas J. Somerville, T. Nielsen, H. Diop, S. Manning

Background: Limited information is available about the burden of severe maternal morbidity (SMM) among low-risk pregnancies, which has prevention implications. We assessed proportion of SMM by comorbidity status among Massachusetts delivery hospitalizations to describe how distribution of risk changed over time.

Methods: The Massachusetts Pregnancy to Early Life Longitudinal (PELL) data system links infant birth certificates and fetal death records to the corresponding maternal and infant hospital discharge records for Massachusetts resident mothers during 1998–2013. SMM was identified from PELL delivery-related hospital discharge records by using CDC's SMM algorithm; blood transfusion was excluded because of concerns about specificity. PELL deliveries were assigned a comorbidity score (range: 0–45) on the basis of maternal age and *International Classification of Disease,* Ninth Edition clinical modification codes by using a validated index that predicts maternal morbidity. Mean yearly comorbidity score and overall proportions of SMM by comorbidity score were calculated.

Results: A total of 1,185,182 delivery hospitalizations and 5,325 SMM occurred in Massachusetts during 1998–2013. A total of 687,406 (58%) delivery hospitalizations and 1,358 (26%) SMM had a comorbidity score of zero. Rate of SMM/10,000 delivery hospitalizations increased from 50 in 2008 to 65 in 2013; the mean yearly comorbidity score increased from 0.58 ($\sigma = 0.95$) in 1998 to 0.78 ($\sigma = 1.14$) in 2013. Rate of SMM/10,000 delivery hospitalizations by comorbidity score ranged from 20 (score = 0) to 1,942 (score ≥10).

Conclusions: Approximately one quarter of SMM occur among deliveries without comorbidities in Massachusetts, indicating that all levels of birth facility need to anticipate SMM occurrences. The increasing mean delivery comorbidity score during 1998–2013 is consistent with the increasing statewide SMM rate.

4:50 Attention-Deficit Hyperactivity Disorder Medication Use During Pregnancy and Risk for Birth Defects — United States, 1997–2011

Authors: Kayla N. Anderson, A. Arth, C. Broussard, S. Farr, J. Lind, S. Visser, J. Reefhuis, S. Tinker

Background: Attention-deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder affecting individuals across the lifespan, including an estimated 10 million adults. Given increasing diagnosis and treatment of ADHD, rates may be increasing among pregnant women. Little is known about ADHD medication safety during pregnancy. Analysis objectives were to assess prevalence of overall ADHD medication use (i.e., psychostimulant and non-stimulant medications) at any time during pregnancy and estimate associations between early pregnancy use (one month before through third month of pregnancy) and specific birth defects.

Methods: We analyzed data from the National Birth Defects Prevention Study (1997–2011), a U.S. population-based multicenter case-control study. Birth defects surveillance systems were used to identify cases (n=32,000); controls were randomly-sampled live-born infants without major defects representing the same geographic regions (n=11,892). Mothers of cases and controls completed a computer-assisted telephone interview. We calculated prevalence of ADHD medication use anytime during pregnancy and used logistic regression to estimate the association between early pregnancy ADHD medication use and 14 birth defects. For gastroschisis, we adjusted for maternal age.

Results: Overall, 0.2% of women reported any ADHD medication use during pregnancy, and 20 control mothers and 65 case mothers reported early pregnancy use. Early pregnancy ADHD medication use was associated with gastroschisis (odds ratio [OR]: 3.24; 95% confidence interval [CI]: 1.32–7.92), omphalocele (OR: 3.99; 95% CI: 1.18–13.47), and transverse limb deficiency (OR: 3.23; 95% CI: 1.10–9.49) in infants.

Conclusions: ADHD medication use during pregnancy was rare, but early use was associated with 3 of 14 birth defects investigated. Additional research is needed to confirm observations and help clinicians provide appropriate counseling to women of reproductive age who use ADHD medications.

CONCURRENT SESSION D3: Global Health: Treatment and Strategy

3:45–5:10 PM

3rd Floor Room 203 AB

Moderators: Rebecca Martin and Wences Arvelo

3:50 Efficacy of Artemether-Lumefantrine for Treatment of Uncomplicated *Plasmodium falciparum* Malaria — Cruzeiro do Sul, Brazil, 2015

Authors: Megumi Itoh, S. Valle, S. Farias, T. Souza, G. Viana, N. Lucchi1, P. Marchesini, M. Póvoa, A. Santelli, A. Macedo de Oliveira

Background: Brazil has the highest number of malaria cases in the Americas and adopted artemisinin-based combination therapy in 2006 for the treatment of *Plasmodium falciparum* malaria. The World Health Organization recommends routine monitoring of antimalarial efficacy. We conducted a therapeutic efficacy study of artemether-lumefantrine (AL) for uncomplicated *P. falciparum* malaria in Cruzeiro do Sul, Brazil during December 2015–May 2016.

Methods: Febrile patients ≥5 years old with microscopically confirmed *P. falciparum* monoinfection and asexual parasitemia 250–200,000 parasites/μ were treated with a supervised 3-day course of AL. Clinical and parasitological response was monitored for 28 days. Treatment failure, called recrudescence, was differentiated from reinfection by microsatellite genotyping. We calculated treatment success rates with and without microsatellite correction. Additionally, molecular analysis for K13 gene mutations, associated with artemisinin resistance, was conducted.

Results: Out of 131 patients offered participation, 80 were enrolled and 75 completed Day 28 follow-up. One patient had recurrent infection with low-level parasitemia on Day 28. The associated parasite was not isolated on molecular testing; therefore, this patient was excluded from the microsatellite-corrected analysis. The uncorrected and microsatellite-corrected AL efficacy was 98.7% (74/75) (95% confidence interval: 93.2–100%) and 100% (74/74) (95% confidence interval: 95.4–100%), respectively. Although no treatment failure was detected before Day 28, 5 patients (6%) remained parasitemic on Day 3, which may suggest artemisinin resistance. No K13 mutations were identified.

Conclusions: AL remains efficacious for falciparum malaria in Cruzeiro do Sul. Day 3 parasitemia rate was higher than expected, raising concern for delayed parasite clearance, but remains <10%, the threshold for suspected artemisinin resistance. Routine monitoring of *in vivo* drug efficacy and molecular surveillance of drug resistance markers remain critical.

4:10 Effect of Mass Drug Administration Regimen on *Schistosoma mansoni* Morbidity Among School-Aged Children Over a 5-Year Period — Kenya, 2010–2015

Authors: Anita D. Sircar, P. Mwinzi, I. Onkanga, W. Secor, S. Montgomery, R. Wiegand

Background: Schistosomiasis results from exposure to contaminated freshwater and predominantly affects school-aged children. Pathology is associated with parasite eggs in tissue and is controlled by mass drug administration (MDA) with praziquantel. The study objective was to compare MDA strategies for reducing Schistosoma mansoni infection-associated morbidity.

Methods: Stunting, wasting, anemia and presence and intensity of infection were assessed in village cohorts of 7-9 year old children at baseline. Communities were randomized to either four years of annual community-wide MDA (4CWT) or biennial school-based MDA (2SBT). Measures were repeated at year 5 to compare impact of MDA approaches.

Results: 802 children were enrolled at baseline; 512 (64%) remained at year 5 with population migration responsible for loss to follow-up. *S. mansoni* prevalence and morbidity was similar between MDA cohorts at baseline. In the 4CWT cohort, year 5 prevalence was significantly reduced compared to baseline (OR 0.2, 95% CI: 0.2, 0.4). Prevalence of high intensity infections (≥ 400 eggs per gram per stool slide) was also significantly reduced by 4CWT at year 5 (OR 0.19, 95% CI: 0.08, 0.47). By contrast, 2SBT did not significantly decrease overall prevalence or high intensity infections (OR 0.86, 95% CI: 0.55, 1.34) and (OR 0.59, 95% CI: 0.30, 1.17) respectively. Stunting [adjusted odds ratio (aOR): 1.64 (0.69-3.89)], wasting [(aOR): 1.32 (0.49-3.57)] and anemia [(aOR): 0.842 (0.45-1.57)] were not significantly different between cohorts at year 5 when adjusted for age and sex.)

Conclusions: Significant infection reduction occurred within the 4CWT cohort but not with 2SBT. However, morbidity at 5 years was similar for children in both groups. In this study, less frequent, less expensive, school-based MDA, achieved similar health outcomes as yearly CWT.

4:30 Improving Injection Safety in Cambodia: A Public Health Response to the 2014–2015 HIV Outbreak in Roka Commune

Authors: Ugonna C. Ijeoma, S. Samson, S. Sok, H. Vannara, S. Sanith, T. Sopheap, R. Newman, L. Vanthy, A. Saadani, A. Moffitt, M. Chevalier, B. Drammeh, D. Selenic

Background: From December 2014-February 2015, an outbreak of 242 new cases of HIV occurred in Roka Commune, Battambang province, Cambodia. Results from the subsequent EPI-AID identified unsafe injection practices by unlicensed practitioners as the likely source, highlighting the potential for unsafe injection practices to contribute to the spread of HIV in Cambodia. In September 2016, we conducted a rapid assessment to identify existing gaps in injection safety knowledge and practices among licensed healthcare workers (HCW).

Methods: We conducted a cross-sectional study at 15 government healthcare facilities in Battambang and Pursat provinces. We utilized a World Health Organization (WHO) standardized injection practices assessment tool to interview and observe injection administration by 39 licensed HCWs (physicians, nurses and laboratory technicians). We calculated descriptive statistics using EpiInfo 7.2.0.1.

Results: Preliminary analysis demonstrated that 111/115 (96.5%) observed injection events were administered with needles/syringes taken from unopened, sterile packs; 52/105 (49.5%) of available sharps containers for needle disposal were not appropriately placed within arm's length of the HCW. During most injection events, 91/115 (79%), hand hygiene was not performed prior to injection administration and 66/104 (63.5%) of the needles were recapped after use; 33/66 (50%) of which were recapped with two hands. All 39 HCWs interviewed knew HIV could be transmitted through unsafe injection practices, but fewer were aware of hepatitis B (80%) and hepatitis C (62%) transmission through this route. Finally, 11/39 (28%) reported ever experiencing a needle stick injury and 19/39 (48.7%) reported ever receiving formal injection safety training.

Conclusions: There are existing gaps in injection practices in Cambodia, particularly in hand hygiene and safe disposal of needles. Intensive training for HCWs is needed to address these gaps.

4:50 Misuse of Antibiotics for Childhood Diarrhea Case Management — Western Kenya, 2009–2016

Authors: Chulwoo Rhee, G. Aol, A. Ouma, S. Muema, J. Auko, G. Odongo, R. Wiegand, J. Montgomery, Widdowson, G. Bigogo, J.R. Verani

Background: Antibiotics are essential treatment for many childhood infections; however overuse contributes to antimicrobial resistance. For childhood diarrhea, the Integrated Management of Childhood Illness (IMCI) guidelines recommend antibiotics only for dysentery (bloody diarrhea). We evaluated the appropriateness of antibiotic treatment for childhood diarrhea case management in western Kenya.

Methods: We analyzed data from the Population Based Infectious Disease Surveillance system in a rural, malaria-endemic setting in western Kenya (Asembo); participants receive free care for acute illness at a surveillance clinic. We examined records of children <5 years with diarrhea (≥3 loose stools in 24 hours) from August 2009 to May 2016. After excluding those with non-diarrheal IMCI guidelines recommendations for antibiotic use, we examined antibiotic misuse including overuse (antibiotic prescription for non-dysentery) and underuse (no antibiotic prescription for dysentery) using multivariate logistic regression with generalized estimating equations.

Results: Of 2,826 diarrheal visits, 2,702 (95.6%) were non-dysentery; there was antibiotic overuse in 1,426 (52.8%). Of 124 (4.4%) dysentery visits, there was antibiotic underuse in 33 (26.6%). In non-dysentery patients, overuse was associated with gastroenteritis diagnosis (adjusted odds ratio [aOR]: 7.08, 95% confidence interval [95%CI]: 3.28–15.3); appropriate use was associated with malaria diagnosis (aOR: 0.36; 95%CI: 0.24–0.53) and oral rehydration solution treatment (aOR: 0.51, 95%CI: 0.36–0.73). In dysentery patients, underuse was associated with malaria diagnosis (aOR: 1.83, 95%CI: 1.06–3.16) and vomiting (aOR 4.43, 95%CI: 1.99-9.84).

Conclusions: Antibiotic misuse was common in childhood diarrhea management in Asembo, likely contributing to antimicrobial resistance; efforts are needed to promote rational use. Interventions to improve antibiotic use for diarrhea should consider the influence of malaria diagnosis on clinical decision-making and address both overuse and underuse.

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CONCURRENT SESSION E1: STDs and HIV

8:30–9:55 AM

Frieden Plenary

Moderators: Gail Bolan and Bob Kirkcaldy

8:35 Syphilis Screening Among Pregnant Women — Guam, 2014

Authors: Susan Cha, T. Malik, B. Schumann, W. Abara, M. DeSimone, A. Santos, V. Aguon, E. Mallada, M. Klemme, T. Peterman, M. Kamb

Background: U.S. guidelines recommend early prenatal screening for syphilis because untreated infections can lead to adverse perinatal outcomes. In Guam, a 385% increase in primary and secondary syphilis rates among women from 2010 to 2013, and an unexpected case of congenital syphilis in 2013 prompted an assessment of syphilis screening and maternal characteristics of inadequate screening.

Methods: We reviewed medical records for a randomly selected sample of mothers with 966 live births at Guam Memorial Hospital in 2014. We excluded 101 records without prenatal or laboratory information on gestational age at syphilis screening. We defined "late" syphilis screening after 24 weeks' gestation and "very late" screening after 32 weeks. We abstracted sociodemographic, prenatal care, delivery, and laboratory data from the records. We calculated prevalence of syphilis screening among pregnant women and conducted bivariate analysis using Poisson regression and chi-square significance tests to determine factors associated with very late or no prenatal screening.

Results: Overall, 809 women (93.5%) received syphilis screening: 232 (26.8%) were screened late; 110 (12.7%) were screened very late. Among women who received prenatal care (N = 773), records included risk factors for very late or no syphilis screening: uninsured (28.9% vs. 8.5% insured; P <.0001) and unemployed (14.3% vs. 5.5% employed; P = .0003). More women with public prenatal providers had very late or no syphilis screening (16.7%) than did those with private providers (5.8%), P <.0001.

Conclusions: Although the majority of women received prenatal care, many were not tested or not tested early enough to prevent potential adverse perinatal outcomes caused by syphilis. Improved prenatal care and earlier syphilis screening are needed for all pregnant women, especially unemployed or uninsured women.

8:55 Prevention of Mother-to-Child Transmission of HIV Service Utilization Among Adolescents and Young Women — Zimbabwe, 2013

Authors: Amanda B. Burrage, A. Mushavi, R. Shiraishi, B. Tippett Barr, G. Shambira, J. Nyakura, S. Balachandra, P. Kilmarx, T. Dinh

Background: Vertical transmission accounts for 90% of pediatric HIV cases. Prevention of mother-to-child HIV transmission (PMTCT) services include antenatal care (ANC), HIV testing, and provision of maternal and infant antiretroviral medication (ARV). HIV vertical transmission is higher in adolescents than older mothers. We assessed uptake of PMTCT services in adolescents (age ≤19) and young women (ages 20–24) in Zimbabwe.

Methods: A PMTCT evaluation used multistage sampling to recruit a nationally-representative sample of 6051 mothers and their 4–12-week-old infants from 151 immunization clinics from February to August 2013. We analyzed data collected from maternal interviews, child-health cards, and infant HIV test results. An HIV-positive mother was defined by (1) maternal self-report and ANC documentation, or (2) presence of infant HIV antibody. Findings were weighted and adjusted for complex survey design and non-responses and analyzed with STATA 14.1.

Results: Among mothers, 16.3% were adolescents and 29.8% were young women. HIV prevalence was 7.5% (95% confidence interval [CI]: 6.1–9.3) and 14.8% (95% CI: 12.8–16.9), respectively. Across all ages, 95% of mothers had ≥1 ANC visit, 97% had ≥1 HIV test, and 99% knew their HIV status. No difference in gestational age at first ANC visit was found. HIV-positive adolescents, compared to HIV-positive young women, reported no ARV use during pregnancy (20.6%, 95% CI: 12.6–31.7 vs. 13.5%, 95% CI: 9.9–18.1). Infant ARV prophylaxis did not differ between the maternal groups (95%).

Conclusions: Conclusions: Uptake of maternal ARVs is lower in adolescents than young mothers. Targeted approaches to increase uptake of ARVs could reduce vertical transmission and pediatric HIV cases among adolescents. CDC Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention. Sources of Support: This evaluation was primarily supported by the President's Emergency Plan for AIDS Relief (PEPFAR) under a Cooperative Agreement between Centers for Disease Control and Prevention (CDC) and the University of Zimbabwe through Department of Community Medicine (U2GGH00315-01). CDC assisted with protocol development, managing the study, data analysis, and manuscript writing.

9:15 Infant HIV Diagnosis and Testing Turnaround Time — Malawi, 2012–2015

Authors: Hammad Ali, P. Minchella, G. Chipungu, J. Nkengasong, A. Kim, M. Swaminathan, D. Singer

Background: Globally, 50% of human immunodeficiency virus (HIV) infected children were not receiving antiretroviral treatment (ART) in 2015. Without treatment, many perinatally infected children die within first year. Implementation of 'Test and Start' (starting ART upon diagnosis) requires increasing uptake of testing to identify undiagnosed infants. Delayed turnaround time (TAT) in testing delays initiation of ART leading to poorer health outcomes. Using Malawi's national Laboratory Information Management Systems (LIMS), we examine trends and factors associated with HIV-positivity in infants, and summarize TAT.

Methods: We conducted a retrospective analysis of routinely collected LIMS data including patient demographics, sample transportation and test outcomes. HIV-positivity was assessed among infants aged 0–18 months via virologic testing based on detection of HIV nucleic acid. TAT was defined as time between dried-blood-spot collection to dispatch of results from laboratory. Data were de-duplicated using various patient IDs. Logistic regression was used to identify factors associated with HIV-positivity.

Results: Between 2012 and 2015, 76,001 samples from HIV-exposed children were tested. HIV-positivity decreased from 5.86% in 2012 to 3.15% in 2015. Multivariable analyses identified older age at testing (>3 months), being female, infant not on ART at birth, infants with presumed severe HIV disease, and residing in central or southern regions as factors associated with HIV-positivity. Median TAT was 19 days (IQR:12-31) in 2012 but increased to 34 days (IQR:18-51) in 2015; despite, volume of testing not increasing.

Conclusions: HIV-positivity among infants decreased by 46%; whereas TAT increased by 79%. Factors associated with HIV-positivity identify the need for testing of exposed and immediate treatment for infected infants. Reducing the TAT will lead to earlier availability of results enabling potential earlier start of ART.

9:35 Factors Associated with Condomless Anal Sex Among Black Men Who Have Sex with Men — New York City, 2012

Authors: Erica L. Dawson, M. Mendoza, Z. Gaul, K. Buchacz, M. Sutton

Background: Among 955,081 persons living with HIV infection in the United States (2014), black men who have sex with men (MSM) are disproportionately affected. The New York City metropolitan area (NYC) has the second highest HIV prevalence nationally (695.1 per 100,000). Among 2,718 new HIV diagnoses in NYC (2014), 59.6% were among MSM, including black MSM. Condomless anal sex (CAS) is the primary risk factor for HIV transmission among MSM. The capacity to recover quickly from difficulties (resilience) may be protective against HIV risk but has been understudied for black MSM. We assessed the association between resilience and CAS to inform HIV prevention efforts..

Methods: We analyzed data from a 2012 cross-sectional study that examined behavior and health among sexually active black MSM (aged 18–35 years) in NYC. Participants who reported sex with a man in the past 60 days were assessed on the Connor Davidson Resilience Scale (CDRS) (lowest to highest, 0–100). We used modified Poisson regression to estimate adjusted prevalence ratios (aPRs) and 95% confidence intervals (CIs), indicating the association between resilience and CAS (outcome variable), adjusted for number of sex partners.

Results: Among 228 black MSM (mean age: 25 years; mean CDRS score: 74.4), 127 (56.7%) reported CAS (past 60 days), and 134 (58.8%) reported >1 sex partner. CAS was associated with >1 sex partner (aPR: 1.49; CI: 1.15–1.94) but not with resilience (aPR: 0.99; CI: 0.99–1.00).

Conclusions: After adjustment for number of sex partners, greater resilience did not have a protective effect on engagement in CAS for this sample. HIV prevention tools that support condom use and decreased numbers of sex partners are warranted for black MSM.

SESSION E2: Occupational Safety and Health

8:30–9:55 AM

Concurrent Session Room

Moderators: John Gibbins and Candice Johnson

8:35 Respiratory and Ocular Symptoms Among Employees at an Indoor Waterpark Resort — Ohio, 2016

Authors: Sophia K. Chiu, N. Burton, K. Dunn, M. de Perio

Background: Employees and patrons of the 192 indoor waterparks nationwide might be exposed to disinfection byproducts that can cause respiratory and ocular symptoms. While investigating patron complaints, a municipal health department requested CDC assistance to evaluate symptoms and etiologies among employees at an indoor waterpark resort.

Methods: We surveyed resort employees about symptoms and work in January 2016. We defined a case as an employee with ≥3 symptoms in the past 4 weeks that began at and improved away from work: cough, wheeze, shortness of breath, chest tightness, nose irritation, eye irritation, sore throat. We used log-binomial regression to identify factors independently associated with illness. We measured area air concentrations of chlorine and chloroform (a disinfection byproduct) and air temperature and relative humidity. We assessed the waterpark's ventilation system.

Results: Of 112 resort employees, 91 (81%) participated; 45 (49%) worked in the waterpark area; 46 (51%) in other resort areas. Median age was 19 years (range: 15–65). Eye irritation (37%), cough (31%), and nose irritation (29%) were most commonly reported. Twenty-nine (32%) employees met the case definition. Working in the waterpark (vs. other areas) was independently associated with illness (adjusted prevalence ratio: 3.7; 95% confidence interval: 1.4–11.4). Although low air chlorine and chloroform concentrations were detected, temperature was below and relative humidity above recommended ranges. Five of six air handling units were not functioning properly.

Conclusions: Employees' symptoms were consistent with disinfection byproduct exposures. Suboptimal ventilation and air quality conditions likely contributed to the higher rate of illness among employees working in the waterpark. A properly functioning ventilation system is important to protecting millions of employees and patrons in this rapidly expanding industry.

8:55 Respiratory Morbidity Among U.S. Coal Miners — States Outside of Central Appalachia, 2005–2015

Authors: Laura E. Reynolds, D. Blackley, A. Laney, C. Halldin

Background: Inhalation of coal mine dust causes lung function impairment and coal workers' pneumoconiosis (CWP), a chronic, occupational lung disease. The Enhanced Coal Workers' Health Surveillance Program (ECWHSP) monitors respiratory disease among U.S. coal miners. Recent published research focuses on coal miners in central Appalachia (Kentucky, Virginia, West Virginia), an area of concentrated coal mining, yet 57% of coal miners work outside of this region. We analyzed ECWHSP data from active underground and surface coal miners working in the eastern (excluding Central Appalachia), interior, and western regions of the U.S. to characterize respiratory morbidity by region.

Methods: Active coal miners working outside of central Appalachia who received chest radiographs and spirometry through ECWHSP during 2005–2015, were included. Chest radiographs were classified according to International Labour Office standards for pneumoconioses and spirometry was interpreted using American Thoracic Society guidelines. Prevalence of CWP and lung function impairment (obstructive, restrictive, or mixed patterns), were compared by geographic region.

Results: Of 4,985 coal miners, 103 (1.2%) had evidence of CWP on chest radiograph. Prevalence of CWP differed by region (P <.0001), with the highest prevalence in the eastern region (3.4%) and the lowest in the interior region (0.8%). Lung function impairment was found in 9.3% of miners. The interior region had the highest prevalence of an obstructive pattern (4.2%) and the eastern region had the highest prevalence of restrictive (6.3%) and mixed patterns (1.0%).

Conclusions: CWP is an entirely preventable disease, but remains an urgent public health problem outside of Central Appalachia, particularly in the eastern region. Efforts to control respirable dust must be maintained or improved to prevent CWP and lung function impairment in U.S. coal miners.

9:15 Occupational and Take-Home Lead Exposure Associated with a Lead Oxide Manufacturing Plant — North Carolina, 2016

Authors: Jessica L. Rinsky, P. Lauffer, K. Gaetz, S. Higgins, K. Squires, G. Dang, K. Musolin, J. Gibbins, A.T. Fleischauer

Background: Lead exposure is associated with adverse health effects among adults and developmental delays among children. In May 2016, state surveillance coordinators noted elevated blood lead levels (BLLs) among most employees of a lead oxide manufacturer (Company A) and two of their children. We investigated to identify risk factors associated with occupational and take-home lead exposures.

Methods: We defined an elevated BLL as ≥5 µg/dL. We reviewed routine BLL surveillance records for Company A employees during 2012–2016. We visited Company A, reviewed policies, and interviewed employees about their work, personal hygiene, and children. We matched reported children to surveillance data.

Results: Eighty-four of 92 (91%) persons ever employed at company A during 2012–2016 had ≥1 elevated BLL. Employees' median BLLs increased from 19 (range: 4–40) µg/dL in 2012 to 37 (range: 9–53) µg/dL in 2016. Site visits identified inadequate exposure controls, including open lead sources, no routine line maintenance, and inadequate training and monitoring of personal protective equipment (PPE) use and hygiene. Eighteen of 22 current manufacturing employees were interviewed; 17 (94%) reported always wearing an air-purifying respirator, but 13 (72%) did not consistently clean their respirator. All 18 employees changed clothes, boots and showered after each shift in plant areas considered clean; however, these areas were visibly contaminated. All employees reported bringing personal items home. Eight children (<1–8 years old) had elevated BLLs (range: 7–40 µg/dL).

Conclusions: Inadequate exposure controls and widespread lead contamination at Company A resulted in increased lead exposure to employees and their families. North Carolina Public Health is working with Company A to implement more effective engineering controls and enhanced PPE and hygiene policies.

9:35 Occupational Distribution of Campylobacteriosis and Salmonellosis Cases — Maryland, Ohio, and Virginia, 2014

Authors: Chia-Ping Su, M. de Perio, K. Fagan, M. Smith, E. Salehi, S. Levine, K. Gruszynski, S. Luckhaupt

Background: *Campylobacter* and *Salmonella* are leading causes of bacterial gastroenteritis nationwide with >1 million cases annually. These pathogens are primarily transmitted through consumption of contaminated food; animal-to-human or human-to-human transmission can also occur. Occupational transmission has been reported, but patterns of disease by occupation have seldom been explored. We analyzed case reports to describe their occupational distribution and identify potentially high risk occupations.

Methods: We obtained data for confirmed, probable, and suspect campylobacteriosis and salmonellosis cases in 2014 among Maryland, Ohio and Virginia residents ≥16 years old from state notifiable diseases surveillance systems. We assigned a Standard Occupational Classification code to each employed case. The American Community Survey was used to estimate the employed civilian population. We calculated risk ratios (RR) and 95% confidence intervals (CI) for associations between each occupational group and each disease, contrasting each group with all other occupations.

Results: Of 2,977 campylobacteriosis and 2,259 salmonellosis cases, 973 (33%) and 797 (35%) were employed and had codable occupation, respectively. Farming, fishing, and forestry occupations (RR: 10.0 [CI: 7.0–14.4] and 3.2 [CI: 1.6–6.4]) and healthcare/technical occupations (RR: 1.5 [CI: 1.2–1.9] and 2.0 [CI: 1.6–2.5]) were at increased risk for both campylobacteriosis and salmonellosis. The food preparation/serving-related occupations (RR: 1.6 [CI: 1.2–2.0]) and personal care/service occupations (RR: 1.5; [CI: 1.1–2.1]) were also at higher risk for salmonellosis.

Conclusions: Workers in agriculture, healthcare, food, and personal care occupations appear at increased risk of enteric infection. Targeting education and prevention strategies, including proper hygiene techniques at work, could help reduce disease. Collecting occupational information systematically in disease surveillance systems provides a better understanding of the extent of occupationally-acquired diseases.

SESSION F: Donald C. Mackel Award Finalists

10:15 AM–12:00 PM

Frieden Plenary

Moderators: Gregory Armstrong and Reynolds Salerno

10:20 Acute Zika Virus Infection as a Risk Factor for Guillain-Barré Syndrome — Puerto Rico, April–December 2016

Authors: Emilio Dirlikov, C. Major, N. Medina, D. Matos, R. Lugo-Robles, M. Garcia, M. Olivero-Segarra, G. Malave, M. Beltran, C. Colon, J.L. Munoz-Jordan, D. Thomas, C.A. Luciano, J. Sejvar, T. Sharp, B. Rivera-Garcia

Background: Guillain-Barré syndrome (GBS) is an uncommon autoimmune disorder characterized by progressive bilateral weakness and sensory abnormalities following an infection or vaccine. During local Zika virus (ZIKV) transmission in 2016, the Puerto Rico Department of Health (PRDH) reported 66 GBS cases with laboratory evidence of ZIKV infection. A prospective case-control study was conducted to identify GBS risk factors, including ZIKV infection.

Methods: Case-patients were defined as suspected GBS patients reported to PRDH admitted at nine hospitals; GBS diagnosis was confirmed using standardized diagnostic criteria following chart review. Controls were matched 1:2 by case-patient's residence and age group. Questionnaires and serum, urine, and saliva specimen collection were conducted within 1 month of case-patients being reported. Acute ZIKV infection was defined as positive by reverse transcription-polymerase chain reaction (RT-PCR) in any specimen; evidence of ZIKV infections was defined as positive by RT-PCR or immunoglobulin M (IgM) enzyme-linked immunosorbent assay (ELISA). Matched odds ratio (MOR) with 95% confidence intervals (95% CI) were calculated.

Results: During April–December 2016, 42 case-patients and 84 controls were enrolled; 33 pair units had complete ZIKV testing. Risk factors for GBS were acute ZIKV infection (8 [24%] cases vs. 3 [5%] controls, MOR: 14.0 [95% CI: 1.8–106.5]), evidence of ZIKV infection (19 [58%] cases vs. 11 [17%] controls, MOR: 7.8 [2.7–22.0]), and reporting an acute illness within previous 2 months (29 [88%] cases vs. 15 [23%] controls, MOR: 15.3 [4.8–49.3]).

Conclusions: Prospective reporting and enrollment of case-patients provided the first identification of acute ZIKV infection as a risk factor for GBS. During ZIKV outbreaks, clinical suspicion of GBS should be elevated to improve patient prognosis through prompt diagnosis and treatment.

10:40 Unusual Source of Gram-Negative Bloodstream Infections in Hemodialysis Patients — Illinois and Missouri, 2015–2016

Authors: Shannon A. Novosad, J. Lake, E. Soda, H. Moulton-Meissner, K. Seiber, M. Pho, L. Bepo, N. Gualandi, M. Arduino, G. Turabelidze, D. Nguyen, J. Layden, P. Patel

Background: Approximately 29,000 bloodstream infections (BSIs) occur in hemodialysis patients yearly; gram-negative bacteria are an uncommon cause. In November 2016, we investigated an unusually large cluster of gram-negative BSIs at 3 outpatient hemodialysis facilities (A, B, and C) owned by the same company.

Methods: We conducted a case-control investigation, infection control review, and collected environmental samples. A case was ≥1 gram-negative organism isolated from blood during July 1, 2015–November 11, 2016, in Facility A, B, or C patients. Controls were patients without BSIs and matched 1:1 to cases by facility and treatment date. We calculated matched odds ratios (mORs) and 95% confidence intervals (CIs). Patient and environmental isolates were compared using pulsed-field gel electrophoresis (PFGE).

Results: Fifty-eight cases occurred [Facility A (n=33), B (n=19), and C (n=6)]; 48 (83%) required hospitalization. The predominant organisms were *Serratia marcescens* (n=21) and *Pseudomonas aeruginosa* (n=12). Cases were more likely than controls to use a central venous catheter (CVC) for dialysis (85% vs. 13%; mOR: 52.6; 95% CI: 7.1–390.0). Facility staff reported pooling of water in recessed wall boxes that house connections between dialysis machines and facility water. Environmental samples revealed *S. marcescens* and *P. aeruginosa* in dialysis treatment areas, including the wall boxes. S. marcescens from a wall box at Facility C was indistinguishable, by PFGE, from a case-patient isolate. We identified opportunities for healthcare workers' hands to contaminate CVCs with water from the wall box connections.

Conclusions: Wall boxes were identified as a unique source of water contamination in this multi-facility BSI outbreak that particularly affected patients with CVCs. The company is working with public health officials to remediate wall boxes and improve infection control practices.

11:00 Integrating Epidemiologic and Molecular Data During an Outbreak of a Rare Strain of *Shigella* Among Men Who Have Sex with Men — Southern California, 2016

Authors: Megan C. Dillavou Jarashow, A. Kimura, G. Inami, R. Mukhopadhyay, F. Arroyo, R. Reporter, M. Garcia, M. Shiozaki, A. Bicknese, N. Green, V. Chaturvedi, D. Vugia, B. Schwartz

Background: Multidrug resistant *Shigella* outbreaks among men who have sex with men (MSM) have increased. In July 2016, the California Department of Public Health (CDPH) notified Los Angeles County of 7 *Shigella flexneri* cases, caused by serotype 7 (provisional 88-893), an uncommon strain. We investigated to find additional cases, determine risk factors and molecular relatedness of isolates, provide clinical guidance, and prevent additional cases.

Method: Locally nontypable *S. flexneri* isolates were serotyped at CDPH's microbial disease laboratory. Cases were defined as persons with confirmed *S. flexneri* serotype 7 in Southern California with onset during March–October 2016. Patients were interviewed about risk factors and medical records abstracted. Six isolates were tested for antimicrobial susceptibilities. Pulse-field gel electrophoresis and whole genome sequencing (WGS) were conducted. Kruskal-Wallis and Fisher exact tests were used to compare isolate subclusters.

Results: Of 34 patients identified, 13 required hospitalization; 1 died. All were male (median age 36 years); 97% self-identified as MSM; 80% (24/30) with known HIV status were positive, of whom 54% were not taking antiretrovirals consistently. All isolates were nonsusceptible to azithromycin and trimethoprim-sulfamethoxazole, and 83% to amoxicillin. WGS of 28 isolates revealed all were ST-245 sequence type; 27 were clustered with 2-45 single-nucleotide polymorphisms (SNP) difference. Three subclusters were identified and differed by isolate date ($P < 0.001$) and local health jurisdiction ($P < 0.04$).

Conclusions: This outbreak, caused by an uncommon *Shigella* strain, provides important data on genetic relatedness of *Shigella* isolates in a cluster with high selective pressure. Investigators may want to consider molecular testing to identify clusters and help guide investigation of risk factors and transmission. Treatment guidance to clinicians should be determined by antimicrobial susceptibility testing.

11:20 Hospital-Associated Outbreaks of Multidrug-Resistant *Candida auris* — Multiple Cities, Colombia, 2016

Authors: Paige A. Armstrong, P. Escandon, D.H. Caceres, N. Chow, S. Rivera, MJ. Stuckey, C. Hilbert, J. Díaz, A. Gomez, N. Vélez, CM. Parra-Giraldo, I. Berrio, C. Varón, Grupo de Investigación en Enfermedades "GREINMIL", N. Villalobos, A. Ramírez, P. López, E. Berkow, L. Gade, R. Welsh, A. Litvintseva, O. Pacheco, S. Lockhart, R. Fagan, J. Díaz, A. Espinosa, T. Chiller, C. Duarte, B. Jackson

Background: The emerging multidrug-resistant fungus, *Candida auris,* has caused hospital-associated outbreaks with high mortality in several countries. Reported cases of *C. auris* infection in Colombia increased in 2016, prompting concern for further spread. We investigated to elucidate transmission mechanisms and inform infection control.

Methods: A case was defined as isolation of *Candida auris* from a patient's blood with confirmation by molecular identification, isolated from a patient's blood. We abstracted medical records and sampled patients, healthcare workers, and hospital surfaces. We performed antifungal susceptibility studies and whole genome sequencing (WGS) on isolates.

Results: We identified 40 cases at 4 hospitals in 3 cities. In-hospital mortality was 56%. Nearly half (45%) of patients were infants. All patient had a central venous catheter, two-thirds had recent surgery, and half received parenteral nutrition during their stay. The median time from admission to collection of blood culture yielding *C. auris* was 22 days. *C. auris* was isolated from 44 (14%) of 325 environmental samples, including from transport equipment and rooms without a known case-patient present for up to 6 months. Of the 6 patients sampled, *C. auris* was cultured from either the groin or axilla of 4. Samples from 2 nurses' hands yielded *C. auris.* Nine (23%) of 40 isolates were resistant to fluconazole and 7 (18%) of 40 were resistant to amphotericin B; all isolates were highly related by WGS.

Conclusions: *C. auris* caused outbreaks of invasive disease, predominantly in young children, with high mortality in several Colombian hospitals. *C. auris* was found on patient and healthcare worker skin and on hospital surfaces, suggesting that assiduous infection control practices are needed to limit the spread of this emerging pathogen.

11:40 Unusual Pathogen Associated with Nonbiting Flies in a Person with Bacteremia — Washington State, 2016

Authors: Jesse Bonwitt, E. Dykstra, M. Tran, K. Eckmann, J. Zambito, M. Bell, M. Sixberry, S. Lindquist, W. Glover

Background: *Wohlfahrtiimonas chitiniclastica* is a rarely reported cause of bacterial infection associated with skin lesions and sepsis. It has been isolated in nonbiting flies that can cause myiasis (fly larvae infestation); however, it has neither been isolated from fly larvae on patients with *W. chitiniclastica* infection, nor from insects in the Americas. In August 2016, a man was hospitalized in Washington State with necrosis of the foot, myiasis, and *Wohlfahrtiimonas* spp. bacteremia. We investigated to determine exposure source.

Methods: We attempted to collect live and dead insects (including fly eggs and larvae) from the patient and patient's home and culture them for *Wohlfahrtiimonas* spp. at different lifecycle phases. Pulsed-field gel electrophoresis (PFGE) was performed on isolates to assess relatedness. Recent patient travel history was obtained through proxy interviews.

Results: We collected 8 insect species from inside the patient's home. Although larvae present on the patient when hospitalized were unavailable for testing, *Wohlfahrtiimonas* spp. was isolated from larvae collected from the carpet where the patient was found by emergency responders. These larvae were not taxonomically identified. *Wohlfahrtiimonas* spp. was also isolated from larvae hatched from eggs of a green bottle fly (*Lucilia sericata*) caught inside the home. PFGE results are pending. No travel outside of Washington was reported.

Conclusions: We report the first isolation of *Wohlfahrtiimonas* spp. in insects in the Americas and a previously undescribed vector, the green bottle fly. Our investigation provides further evidence of fly larvae as vectors for human infection. Green bottle fly larvae are a common cause of myiasis; patients with myiasis should be considered at risk for *Wohlfahrtiimonas* spp. infection.

SPECIAL SESSION 1: Epidemiologic Investigations of Environmental Exposures

12:05–1:20 PM

3rd Floor Room 203 AB

CIO Sponsor: National Center for Environmental Health

This session highlights biomonitoring in environmental assessments and will discuss two examples of CDC-led environmental investigations which likely saved many children's lives in India and Nigeria. This will be a presentation of how the investigations started, the coordination between lab and field staff, and lessons learned.

Relevance and Appropriateness for the EIS conference: A number of recent investigations have involved close communication and collaboration between epidemiologists in the National Center for Environmental Health and the laboratorians at the Division of Laboratory Science. Epidemiologic investigations often require collection of blood or urine of affected individuals in order to test for biomarkers of exposure. However, the utility of a biomarker in such investigations requires careful sample collection, labeling, transport, storage, and analysis. If any of these factors are compromised, the epidemiology results could lead to the null or worse.

Speakers:

- Session overview (5 minutes)
  Jerry Thomas, MD
- Outbreak of Fatal Childhood Lead Poisoning Related to Artisanal Gold Mining in Northwestern Nigeria, 2010 (20 minutes)
  Tony Neri, MD, MPH
  Kathy Caldwell, PhD
- Association of Acute Toxic Encephalopathy With Litchi Consumption in an Outbreak in Muzaffarpur, India, 2014: A Case-Control Study (20 minutes)
  Josh Schier, MD
  Melissa Carter, PhD
- Q&A session with the panel members and speakers (20 minutes)
  Carrie Dooyema, MPH, MSN, RN
  Padmini Srikantiah, MD, Center for Global Health

POSTER SYMPOSIUM I

1:30–2:45 PM

Concurrent Session Room

Moderators: Douglas Hamilton and Michael King

P1.1 Mental Health and HIV-Related Sexual Risk Behaviors Among Adolescent Sexual-Minority Males — Chicago, New York City, and Philadelphia, 2015

Authors: Christine B. Agnew-Brune, D. Broz, B. Hoots, A. Wise, J. Smith, G. Paz-Bailey, A. Balaji

Background: Adolescent sexual-minority males (ASMM) in the United States are disproportionally affected by HIV and mental health problems. However, the strength of the association between mental health problems and HIV sexual risk behaviors in this population is unknown. To inform HIV prevention interventions, we assessed the association between mental health problems and sexual risk behaviors among ASMM in 3 cities.

Methods: For the 2015 National HIV Behavioral Surveillance pilot project, we interviewed ASMM, defined as males aged 13–18 years who reported ever having sex with another male, gay/bisexual identity, or same-sex attraction. Participants were asked about ever attempting suicide. Anxiety and depression were measured by using the 4-item Patient Health Questionnaire-4 (PHQ-4) scale; a score of ≥3 indicates probable depression and anxiety. We used log-linked Poisson regression to calculate adjusted prevalence ratios for associations between mental health problems and past-year sexual risk behaviors: ≥4 sex partners and condomless anal sex (CAS). Models were adjusted for age, race/ethnicity, and city.

Results: Of 548 ASMM, 22% reported ever attempting suicide (mean PHQ-4 score: 3.06; standard deviation = 2.7; range: 0–12). Twenty-nine percent reported ≥4 sex partners, and 39% reported CAS. Ever attempting suicide was associated with ≥4 sex partners and CAS (adjusted prevalence ratio [aPR]: 1.71, confidence interval [CI]: 1.31–2.21; aPR: 1.31; CI: 1.06–1.63, respectively). For each 1-point increase in the PHQ-4 score, prevalence of CAS increased 4% (aPR: 1.04; CI: 1.02–1.07).

Conclusions: Anxiety, depression, and suicide attempts are common among ASMM and are associated with sexual risk behaviors. Including mental health in comprehensive HIV prevention for ASMM could reduce HIV risk in this population.

P1.2 Characteristics and Predictors of Inflammation Among Infants Aged 6–23 Months — Nepal, 2012

Authors: Victor Akelo, R. Whitehead Jr., Z. Mei1, S. Chitekwe, P. Dahal, N. Paudyal, R. Pokharel, Y. Addo, M. Jefferds

Background: Inflammation from immune response can mask micronutrient deficiencies. Population-based micronutrient surveys often exclude or adjust data among subjects with inflammation. However, the best method for defining inflammation is under debate. We compared prevalence and predictors of inflammation by definition.

Methods: A population-based representative micronutrient survey conducted among 2,549 children aged 6–23 months in 2 districts of Nepal assessed acute and chronic inflammation by using elevated C-reactive protein (CRP >5 mg/L) and α-1-acid glycoprotein (AGP >1 g/L), respectively. A 4-stage inflammation variable was calculated as follows: (a) normal CRP and normal AGP (noninflamed; referent); (b) high CRP and normal AGP (incubation); (c) high CRP and high AGP (acute); and (d) normal CRP and high AGP (chronic). Stepwise-adjusted, generalized logistic regression models, weighted and accounting for complex survey design, were used to examine predictors of inflammation in 4 models: (a) elevated CRP or AGP; (b) only elevated CRP; (c) only elevated AGP; and (d) the 4 stages of inflammation.

Results: Inflammation prevalence was 43% by CRP or AGP, 18% by only CRP, 39% by only AGP, and 42% by the 4 stages, and distributed as follows: 3% incubation; 15% acute; and 24% chronic. In all models, anemia and fever (past 2 weeks) predicted inflammation. Other predictors varied by model with underweight and recent deworming predicting acute inflammation, whereas underweight, lower paternal education, and lower household wealth rank predicted chronic inflammation. In addition, underweight and lower household wealth rank predicted inflammation by CRP or AGP.

Conclusions: Among infants in Nepal, prevalence of any inflammation was high. Chronic inflammation varied by definition, which may affect estimates of micronutrient deficiency. Understanding predictors of inflammation may help target interventions.

P1.3 U.S. Zika Pregnancy Registry Evaluation — United States, 2016

Authors: Meng-Yu Chen, J. Williams, L. Yeung, K. Newsome, K. Brinker, A. Flores, E. Petersen, M. Honein, D. Meaney Delman

Background: Zika virus (ZIKV) infection during pregnancy can cause microcephaly and serious brain abnormalities. As part of the public health response to Zika, CDC established the US Zika Pregnancy Registry (USZPR) in collaboration with state/local health departments to monitor pregnancy and infant outcomes following ZIKV infection during pregnancy. We evaluated this new surveillance system.

Methods: The outcome measures, based on CDC guidelines, included usefulness, simplicity, flexibility, data completeness, acceptability, sensitivity, representativeness, timeliness, and stability of the system. We conducted document reviews, stakeholder interviews with CDC leadership (n=9) and state/territorial health officials (n=4), focus group discussions (n=3) with USZPR staff, and analysis of data reported to USZPR.

Results: As of October 6, 2016, USZPR included 969 pregnant women with laboratory evidence of possible recent ZIKV infection. All 63 jurisdictions participated. USZPR provides important information to update clinical guidance, is flexible and accommodates evolving needs in the response, but does collect complex information. Data completeness varied; highest for laboratory data (complete information of specimen type, collection date, results, 872/969 [90%]) and lowest for infant data (follow-up information at two months of age, 30/220 [14%]). Reporting timeliness for eligible pregnant women (median time from symptom onset/exposure to reporting to USZPR) improved: from 84 to 72 days before and after July 1, 2016.

Conclusions: USZPR provides critical population-based surveillance of pregnant women with possible recent ZIKV infection and informs national public health guidance for clinical management of pregnant women and infants affected by ZIKV. CDC and other stakeholders continue to improve data collection and reporting to USZPR. Achieving more complete follow-up of infants of mothers registered in USZPR is essential to fully characterize the outcomes of congenital ZIKV infection.

P1.4 Correlates of Blood Lead Testing and Test Results in Young Children — Southern California, 2008–2015

Authors: Gloria C. Chi, S. Tartof, L. Chen, J. Slezak, J. Lawrence

Background: Targeted testing of young children at risk for lead exposure can aid primary prevention efforts. California requires lead testing for children with Medicaid. We examined associations between sociodemographic characteristics, blood lead testing, and elevated blood lead levels (EBLLs). We defined EBLLs to be ≥4.5 μg/dL, which when rounded up per California's criteria is consistent with the Centers for Disease Control and Prevention's recommended reference level of 5 μg/dL.

Methods: We identified Kaiser Permanente Southern California members aged 6–30 months during 2008–2015, their characteristics, and their lead tests from electronic health records. We used multivariable log-binomial regression to assess associations with testing and logistic regression to assess associations with EBLLs. Models included birth year, sex, race/ethnicity, Medicaid status, and neighborhood deprivation index (NDI).

Results: We identified 292,235 children. Approximately half were female, and one-fifth received Medicaid. Among 169,064 children tested, 158,840 (94.0%) had blood lead levels <2 μg/dL, 8,968 (5.3%) had blood lead levels between 2–4.4 μg/dL, and 1,256 (0.7%) had EBLLs. Compared with not receiving Medicaid, receiving Medicaid was associated with testing (67.6% versus 54.4%, relative risk [RR]: 1.12; 95% confidence interval [CI]: 1.11–1.13) and EBLLs (0.9% versus 0.7%, odds ratio [OR]: 1.16; 95% CI: 1.02–1.32). Compared with being in the lowest NDI quartile (least deprived), being in the highest quartile was associated with testing (65.4% versus 48.3%, RR: 1.18; 95% CI: 1.17–1.19) and EBLLs (0.9% versus 0.4%, OR: 1.56; 95% CI: 1.29–1.88).

Conclusions: The positive association between Medicaid and EBLLs supports California's requirement of testing Medicaid-insured children. Residence in disadvantaged neighborhoods is associated with EBLLs and can guide targeted lead-screening programs for young children.

P1.5 Prevalence and Factors Associated with Local Herb Use by Pregnant Women — Kigoma, Tanzania, 2014

Authors: Rena Fukunaga, D. Morof, C. Blanton, A. Ruiz, G. Maro, F. Serbanescu

Background: In Tanzania, the use of locally-grown herbs during pregnancy is common. Some herbs used during pregnancy have been found to cause uterine contractions, which may increase pregnancy, delivery, and postpartum complications. The prevalence of use and characteristics of women in Kigoma who use herbs during pregnancy is unknown.

Methods: We analyzed the 2014 Kigoma Tanzania Reproductive Health Survey, a regionally representative, population-based survey of reproductive age women (15–49 years) about fertility, contraception, and maternal and newborn health. We conducted weighted descriptive analyses of herb use and reasons for use during pregnancy. We used multivariable logistic regression to calculate adjusted odds ratios (aOR) and 95% confidence intervals (CI) for factors associated with use of local herbs during pregnancy.

Results: Of 2,408 parous women who responded, 14.8% (CI: 12.3–17.8) reported use of local herbs during their last pregnancies. Women reported taking local herbs for stomach pain (40.7%) and to avoid miscarriage (25.8%). Controlling for residence, age, and household wealth, women reporting any primary education (aOR: 1.4, CI: 1.0–1.9) and home delivery at last birth (aOR: 1.7, CI: 1.2–2.3) had higher odds of local herb use during pregnancy than women without education and women delivering in a facility. Local herb use was significantly lower (aOR: 0.6, CI: 0.4–0.8) among multiparous women with greater than 3 children.

Conclusions: In Kigoma, approximately one in seven women reported using local herbs during their last pregnancy; use was associated with education level, home delivery, and parity. To help guide potential public health prevention efforts, future research is needed to uncover any associations between local herb usage and specific pregnancy, delivery or postpartum complications.

P1.6 Epidemiology of Railway Suicide Deaths: National Violent Death Reporting System, 18 States — United States, 2003–2014.

Authors: Amanda G. Garcia-Williams, D. Stone, K. Holland, B. Bartholow, S. Gabree, J. Reed

Background: In 2014, 42,766 individuals, 10 years of age and older, died by suicide in the United States. Approximately 270 individuals, of any age, used train as the method of suicide in 2014. Railway suicide impacts individuals, families, and communities; however, limited information about circumstances precipitating these deaths are available. We examined characteristics and precipitating circumstances of railway suicide to inform suicide prevention strategies.

Methods: Data from 18 states from the National Violent Death Reporting System from 2003–2014 were used. Although no ICD-10 code for train as method of suicide is available, railway suicide cases were identified using a combination of narrative word searches and hand coding. Demographic characteristics were examined using chi-square tests. Odds ratios (OR) and 95% confidence intervals (CI) were calculated using logistic regression to compare precipitating circumstances among railway and non-railway suicide decedents.

Results: A total of 846 railway suicide decedents, 10 years of age and older, were identified. Railway suicide decedents were more likely than non-railway suicide decedents to be aged 15 to 24 and never married. Railway suicide decedents were more likely to have been homeless (OR: 6.4; CI: 4.6–8.9) and to have a known history of suicide attempts (OR: 1.3; CI: 1.1–1.5) than non-railway decedents. Railway decedents were less likely to have a depressed mood prior to death (OR: 0.5; CI: 0.5–0.7), to have left a suicide note (OR: 0.5; CI: 0.4–0.6), or to have known job problems (OR: 0.6; CI: 0.5–0.8).

Conclusions: Differences in railway and non-railway suicide decedents suggest populations to focus railway suicides prevention efforts, including adolescents and young adults, the homeless, and those with a history of suicide attempt.

P1.7 Novel Data Source for the Northwest Tribal Registry Project — Washington, 2016

Authors: Sarah M. Hatcher, S. Joshi, T. Weiser

Background: The Northwest Tribal Registry (NTR) is a database of American Indian/Alaska Native (AI/AN) patients treated by Indian Health Service (IHS), Tribal, and Urban Indian Health clinics in Idaho, Oregon, and Washington. NTR is compiled by using IHS Resource and Patient Management System (RPMS) electronic health record (EHR) data. Because Tribal clinics can adopt non-RPMS EHRs, NTR is less able to detect racial misclassification in state databases, including death certificate data. Underestimation of disease in the AI/AN population affects prioritization of health concerns, prevention efforts, and funding allocation. We assessed whether updating NTR by using the IHS General Data Mart (GDM), which contains user population data from IHS, Tribal, and Urban Indian Health clinics regardless of which EHR is used, improves accuracy of AI/AN race classification in Washington state death certificates.

Methods: To identify death certificates with misclassified AI/AN race, we conducted 2 probabilistic record linkages with 2012–2014 Washington state death certificate data; 1 with the RPMS-generated NTR and 1 with the GDM-generated NTR. We compared number of sites and records, linkage matches, and percent misclassification of AI/AN race.

Results: The GDM-generated NTR included more sites (46 versus 34) and more AI/AN persons (231,060 versus 180,794) than the RPMS-generated NTR. The GDM-generated NTR resulted in more linkage matches, compared with the RPMS NTR (243 versus 183) and identified more records with misclassified race among Washington state death certificates, compared with the RPMS-compiled NTR (7.4% [243/3,270] versus 5.7% [183/3,210]).

Conclusions: The GDM-generated NTR might increase reporting accuracy for AI/AN race and AI/AN morbidity and mortality in state databases. We recommend the IHS GDM be considered as the source of NTR updates.

P1.8 Comparison of Vaccination Coverage Among U.S.-Born and Foreign-Born Adolescents Aged 13–17 Years — United States, 2012–2014

Authors: Jessica M. Healy, A. Rodriguez-Lainz, H.A. Hill, D. Yankey, L.D. Elam-Evans, S. Reagan-Steiner

Background: Healthy People 2020 seeks to increase vaccination coverage among U.S. adolescents. Although coverage increases were reported during 2012–2014, unbiased estimates of coverage among potentially vulnerable subgroups (e.g., foreign-born adolescents) do not exist. We estimated and compared coverage among U.S.-born and foreign-born adolescents to potentially identify disparities.

Methods: Deidentifed data from the National Immunization Survey-Teen collected during 2012–2014 were combined to assess percent coverage among adolescents aged 13–17 years for recommended dosages of tetanus-diphtheria-acellular-pertussis (Tdap), meningococcal (MenACWY), measles-mumps-rubella (MMR), varicella, human papillomavirus (HPV), and hepatitis B (HepB) vaccination. Coverage of U.S.-born and foreign-born adolescents were calculated, along with adjusted prevalence ratios (aPRs), after adjusting for factors related to access to care and demographics.

Results: Results after adjustment no significant difference was reported in vaccination coverage between foreign-born and U.S.-born adolescents for Tdap, MenACWY, MMR or HepB. Both female and male foreign-born adolescents were at least 21% more likely to receive the HPV vaccine than were U.S.-born adolescents (female aPR: 1.23 [95% CI: 1.13, 1.34] for ≥1 dose, 1.21 [1.08, 1.36] for ≥2 doses, and 1.06 [0.9, 1.25] for ≥3 doses; male aPR:1.37 [1.17, 1.61] for >1 dose, 1.46 [1.18, 1.81] for ≥2 doses, and 1.69 [1.25, 2.28] for ≥3 doses). Foreign-born adolescents were less likely to receive the varicella vaccine (aPR: 0.89 [0.84, 0.93] for ≥1 dose and 0.91 [0.84, 0.98] for ≥2 doses).

Conclusions:: Foreign-born adolescents have similar vaccination coverage rates compared with U.S.-born adolescents for 4 of 6 recommended vaccines, have higher coverage for HPV, and lower coverage for varicella vaccination. Analyses incorporating country-specific incidence and vaccination rates might identify reasons for reported discrepancies in HPV and varicella vaccination coverage.

P1.9 Assessment of Property and Health Effects of a Drought Emergency — Mariposa County, California, 2016

Authors: Rebecca L. Laws, A. Schnall, S. Burrer, A. Hanchey, J. Wurster, T. Bayleyegn, S. Smorodinsky, J. Wilken, G.C. Windham, D. Tafoya, E. Sergienko

Background: California is in its fifth year of the most severe drought in its recorded history. In 2014, the governor proclaimed a state of emergency and convened interagency Drought and Tree Mortality Task Forces to address environmental, economic, and health effects of water shortages. In Mariposa County, a forested and rural county, drought has depleted surface and ground water and caused tree deaths, resulting in economic losses. We assessed drought-associated effects concerning property and chronic disease exacerbation to guide response and recovery efforts.

Methods: In October 2016, we used the Community Assessment for Public Health Emergency Response (CASPER) methodology to conduct household surveys. CASPER is a 2-stage cluster sampling with probability of selection proportional to the number of housing units. Our goal was to interview 210 of Mariposa County's 7,693 housing units. Frequencies and confidence intervals (CIs) were weighted to account for the sampling design.

Results: Of 189 surveyed households, 67% (95% CI: 50%–74%) reported dead or dying trees on their property, and 19% (95% CI: 12%–27%) reported drought had negatively affected their finances. Twenty-one percent (95% CI: 14%–28%) reported decreased well water production during the past year, and 20% (95% CI: 11%–30%) reported problems with the quality of their tap water. Fifteen percent (95% CI: 8%–22%) reported a worsening of ≥1 chronic health condition because of drought, most commonly asthma, allergies, and hypertension.

Conclusions: Drought is a complex, prolonged disaster that can exacerbate chronic diseases and result in negative economic effects from property damage, particularly tree mortality. Mariposa County might consider facilitating tree removal and well assistance and expanding health services to drought-affected persons.

P1.10 Seoul Searching: Outbreak of Seoul Virus among Ratteries and Pet Owners — Illinois, 2017

Authors: Janna L. Kerins, A. de St. Maurice, L. Purpura, J. Klena, A. Straily, S. Genzer, C. Tansey, E. Jackson, G. Langham, D. Weiss, C. Austin, J. Layden, M. Choi, E. Ervin, T. Shoemaker, C. Manning, J. McQuiston, J. Kazmierczak, S. Nichol, B. Knust, P. Rollin

Background: Human Seoul virus infections (SVIs) rarely occur in the United States, despite documented outbreaks in wild Norway rats. Pet rat ownership in the U.S. has not previously been associated with SVIs. In December 2016, a Wisconsin rattery owner hospitalized with febrile illness tested positive for acute SVI. Initial trace-out investigations implicated three ratteries; two were Illinois facilities. Further investigation aimed to identify additional human and rat cases.

Methods: Rat facilities (i.e. rattery breeder or private pet owner) were considered confirmed if recent human or rat SVI was identified and suspect if rats were received from/sent to confirmed facilities. In confirmed and suspected facilities, blood samples were obtained from rats and human contacts (i.e. possible cases) and analyzed using RT-PCR and ELISA serology. Trace-forward and trace-back investigations of rat movements from confirmed facilities were performed to identify additional suspected facilities throughout the U.S. and Canada.

Results: In Illinois, the investigation identified 33 facilities (10 ratteries and 23 pet homes); of those, 6 (60%) ratteries and 3 (13%) pet homes were confirmed. Among possible human cases in confirmed facilities, Seoul virus attack rates were 87.5% (7/8) for ratteries and 0% (0/8) for pet homes. Human infections were significantly higher in ratteries than pet homes ($\chi 2=12.4$, $p=0.0004$). Trace-out investigations identified over 60 suspected facilities in 16 states and Canada, with 16 recent human infections.

Conclusions: To date, the source of this outbreak remains unknown. Frequent trade and sale of rats led to widespread Seoul infection, making outbreak control challenging. Higher infection rates among rattery owners might indicate elevated risk in that environment. Pet rat breeders should be aware of SVI risks and take appropriate control measures.

P1.11 Suspected Illicitly Manufactured Fentanyl-Related Overdose Death Characteristics — Massachusetts, 2014–2015

Authors: Julie K. O'Donnell, M. Younkin, N. Somerville, R. Gladden, J. Zibbell, A. DeMaria, H. Babakhanlou-Chase, S. Ruiz, T. Green, B. Callis, M. Shang, A. Walley

Background: Opioid-related overdose deaths in Massachusetts more than doubled from 698 during 2012 to an estimated 1,747 during 2015, in part, attributable to the introduction of illicitly manufactured fentanyl (IMF). Medical examiner charts were reviewed to describe opioid-related overdose death characteristics, focusing on identifying IMF-related overdose characteristics and identifying opportunities for targeted interventions to help prevent deaths.

Methods: Charts were reviewed for unintentional opioid poisoning deaths that occurred during October 1, 2014–March 31, 2015, for decedents who overdosed, died, or resided in 3 high-burden counties in southeastern Massachusetts (Barnstable, Bristol, and Plymouth Counties). Deaths were classified as fentanyl-related, heroin or morphine-related (no fentanyl), or other opioid-related, on the basis of postmortem toxicology. Death scene evidence, such as absence of prescription fentanyl, was used to classify fentanyl source as suspected IMF. Demographic and overdose characteristics were analyzed by drug classifications.

Results: During the investigation period, 196 overdose deaths occurred in the 3 counties; 64% of overdose deaths were fentanyl-related, and 82% of fentanyl-related deaths had evidence of IMF. Among fentanyl-related decedents, the majority (86%) overdosed in their home or another private residence, 77% were alone at time of overdose, 36% had signs of rapid unresponsiveness after using fentanyl, and 90% had no pulse when emergency medical services arrived. Six percent of deaths had evidence of bystander administration of naloxone, an opioid overdose antidote.

Conclusions: During a surge of opioid-related overdose deaths, IMF contributed to a substantial portion of overdose deaths in southeastern Massachusetts. Enhancement of harm reduction strategies to address IMF-related overdose characteristics, including messaging to avoid using opioids while alone and widespread community naloxone distribution and education, might help save lives in Massachusetts.

P1.12 Under-Five Mortality Reporting Following the Ebola Virus Disease Epidemic — Sierra Leone, 2015–2016

Authors: Amanda L. Wilkinson, N. Houston-Suluku, A. Kamara, U. Kamara, M. Jalloh, P. Raghunathan, D. Blau, B. Kamara, A. Jambai, R. Kaiser

Background: Sierra Leone has among the highest estimated under-five years-of-age child mortality rates (U5MR) globally (120/1000 live births). Due to limited vital registration and inconsistent mortality surveillance, the 2014-2015 Ebola Virus Disease (EVD) epidemic in Sierra Leone necessitated rapid establishment of death reporting mechanisms that are maintained post-outbreak. We assessed ascertainment of stillbirths and under-5 years-of-age (U5) deaths through multiple data sources to prepare for implementation of a Child Health a nd Mortality Prevention Surveillance (CHAMPS) site – a network currently in seven countries to determine etiologies of child mortality.

Methods: Documented deaths in Bombali Sebora chiefdom between January 1st, 2015 and November 25th, 2016 were retrospectively reviewed. The catchment area included approximately 160,000 persons, an overestimate due to unclear delineation of Makeni town between two chiefdoms. Using Sierra Leone's U5MR, 1209 deaths were expected. Data were abstracted into Excel spreadsheets from three sources: eight health facilities' (HF) inpatient registers, district vital records, and a community-based telephonic death notification system established during the EVD epidemic. Cases were defined as U5 deaths and stillbirths.

Results: Overall, 930 U5 deaths were identified (77% of expected deaths), with 98 deaths identified in >1 source: 250 from HF registers, 103 from vital records, and 683 from telephone notifications. Overall, 172 stillbirths were identified, with 11 identified by >1 source: 62, 4, and 117, via the respective source. All data sources had periods of incomplete and/or inconsistent reporting.

Conclusions: Death reporting data sources were minimally overlapping. HF and vital records incompletely captured U5 mortality in Bomabli Sebora, but telephone notifications markedly improved completeness of death recording. To increase U5M ascertainment, CHAMPS Sierra Leone should employ multiple death reporting mechanisms, including community-based systems.

SESSION G: Laboratory Leadership Service Presentations

1:30–2:55 PM

3rd Floor Room 203 AB

Moderators: Conrad Quinn and Xin Liu

1:35 Legionella Prevalence and Diversity in Cooling Towers — United States, Summer 2016

Authors: Anna C. Llewellyn, C. Lucas, S. Roberts, E. Brown, B. Raphael, J. Winchell

Background: Legionnaires' disease (LD) is a severe pneumonia caused by *Legionella* bacteria, which are commonly transmitted via aerosols from inadequately managed cooling towers (CTs). The rate of reported cases of LD increased 286% from 2000 to 2014. During this time, CTs were the source of several large LD outbreaks. This study aimed to determine the geographic prevalence of *Legionella* in CTs in the United States (US).

Methods: Water from cooling towers in 196 sites representing eight of the nine continental U.S. climate regions were screened for *Legionella* DNA using multiplex real-time polymerase chain reaction (PCR). Samples positive for *Legionella* DNA were cultured. Resulting *Legionella* isolate species (spp.) and serogroup (sg) were characterized using PCR, antibody testing, and gene sequencing.

Results: PCR identified *Legionella* DNA in 164 (84%) CT waters, including samples from every region studied. *Legionella* was isolated from 79 (48%) PCR-positive samples, 37 (47%) of which had more than one type of *Legionella*. Overall, 144 unique *Legionella* isolates were recovered; 76 (53%) were *Legionella pneumophila* (Lp) and 51% of these were Lp sg 1 (Lp1), the most commonly detected cause of LD. Sixty-eight isolates (47%) were non-Lp spp., including *L. anisa* (50%), *L. feeleii* (12%), and *L. rubrilucens* (6%), all of which cause LD.

Conclusions: In this study, the largest *Legionella* CT survey to date, pathogenic *Legionella* spp. were detected in and isolated from samples from diverse regions, indicating the ubiquity of this pathogen in U.S. CTs. These results underscore the potential for LD outbreaks to occur throughout the U.S. and the need for public health laboratory, epidemiological, and environmental health strategies to help prevent and respond to outbreaks from a CT source.

1:55 Emergence of 23S Mutations Associated with Macrolide Resistance in Group B *Streptococcus* — Georgia, 2015

Authors: Jessica N. Ricaldi, S. Chochua, B. Metcalf, M.M. Farley, L. McGee, G. Langley, B. Beall

Background: Group B *Streptococcus* (GBS) is a leading agent of newborn sepsis and a rising cause of severe infections in elderly and immunocompromised adults. Concurrently, resistance to first-line antibiotics for this pathogen (macrolides and clindamycin) is increasing. To characterize the GBS genetic diversity associated with this resistance, we investigated strains that showed high-level resistance to macrolides (>32) and clindamycin (≥8) by phenotypic testing but were negative for known determinants of resistance recognized by our Whole Genome Sequencing (WGS) pipeline.

Methods: In 2015, clinical isolates were obtained from 2257 invasive GBS cases. Antibiotic resistance was assayed using two simultaneous approaches: 1) phenotypic test via liquid-based Minimum Inhibitory Concentration and Etest and 2) genetic resistance determinants detection via our WGS pipeline. Isolates that exhibited antibiotic resistance but that were not identified by our WGS pipeline were characterized by manual genetic analyses.

Results: Out of 520 highly resistant isolates, we identified 3 phenotypically resistant strains without a pipeline-predicted resistance mechanism. Two contained a mutation in position 2062 of the 23S gene (A2062G). Modification at this methylation site blocks antibiotic binding, conferring resistance as previously reported in S. pneumoniae and other pathogens. Both strains were from the state of Georgia, and shared the same multilocus sequence type (ST8) and serotype (Ib), but they were not closely related phylogenetically. We have not identified a resistance mechanism for the third strain.

Conclusions: We report the emergence of a mutation in the 23S gene in two GBS strains, undetected by our current pipeline. To our knowledge, this mutation has not previously been detected in GBS, highlighting the value of joint phenotypic and WGS testing for timely detection of emerging resistance-associated mutations.

2:15 Comparative Risk Assessment of Laboratory Response Network (LRN) Methods to Process Potable Water Samples for Detection of Bioterrorism Threat Agents

Authors: Diana Riner, J. Turner, M. Mattioli, J. Murphy, V. Hill

Background: Laboratory Response Network (LRN) Method 1114 was developed by CDC for following a biothreat-associated drinking water incident. LRN laboratories received and processed up to 100 L of potentially contaminated water via ultrafiltration. In response to concerns involving potential exposure while handling large volumes in the biosafety cabinet, a revised method was developed with ultrafiltration occurring at the event site. LRN laboratories would then receive smaller volume samples (filters or concentrates); collection of 1 L samples was also included. A risk assessment was conducted to compare the two methods.

Methods: Methods were divided into three components: primary concentration, secondary concentration and sequential filtration. Using a new tool, a risk score (likelihood x consequence) was calculated for each step in a component, with risks classified as low, moderate, high, or extreme. For each method, risk scores were summed per component and component scores summed to give a total risk score allowing comparison between methods.

Results: The original method received a higher total risk score due to the number of steps and high risk steps required during primary water concentration. The revised method total risk score was lower due to the removal of handling large volumes of water in the BSC and a reduction in overall number of steps. Mitigations around sharps usage were proposed for both methods to reduce risk scores.

Conclusions: The risk assessment indicates that the revised method reduces risks posed to LRN laboratorians by eliminating the handling of large volumes of contaminated water. However, that risk is ultimately transferred to first responders, highlighting the need for a future integrated risk assessment to maximize the worker safety at each step of the response process.

2:35 Understanding Antimicrobial Resistance in *Neisseria gonorrhoeae*: An Epigenetic Approach

Authors: Brunilís White, A.J. Abrams, J. Cartee, S. Johnson, D. Trees

Background: Gonorrhea, caused by *Neisseria gonorrhoeae* (Ng), is the second most commonly reported infectious disease in the United States, and Ng has progressively developed resistance to prescribed drugs. Antimicrobial resistance (AMR) in Ng is an urgent public health threat, and AMR has historically been associated with the accumulation of mutations in various chromosomal genes. The mosaic form of the penA gene is thought to be responsible for Ng treatment failures with various cephalosporins, including ceftriaxone, which is prescribed in combination with azithromycin as the recommended treatment.

Methods: To understand AMR mechanisms in Ng, 10 penA mosaic strains, including 1 ceftriaxone susceptible parental and 9 isogenic mutants with varying degrees of ceftriaxone resistance, were selected for genomic examination. The methylation patterns of the penA parental and isogenic mutants were analyzed using PacBio base modification detection to elucidate potential resistance mechanisms.

Results: Whole genome analyses of the isogenic mutants did not result in the identification of shared novel genomic mutations. Thus, genomic mutations alone did not fully explain the observed resistance patterns. Methylation analyses revealed that the isolates contained several methylated sites. Additionally, the number of detected methylated sites increased as ceftriaxone resistance increased, and novel methylation patterns were identified. The methylated sites were associated with genes involved in transcription, translation, putative restriction-modification systems, membranes, piliation, and phase variation.

Conclusions: Data from the isogenic mutants suggest that methylation might play a role in AMR. Methylation patterns of clinical isolates with varying degrees of AMR are currently in progress. Future steps include transcriptomic analyses to better understand if methylated sites correspond to changes in gene expression. These results will help elucidate the role of epigenetics in AMR.

CONCURRENT SESSION H1: Global Health: Epidemiology and Disease Prevention

3:00–4:45 PM

Frieden Plenary

Moderators: Kimberley Fox and Susan Chu

3:05 Ascertaining Infant Measles Mortality and Risk Factors During a Prolonged Nationwide Measles Outbreak — Mongolia, 2015–2016

Authors: Christopher T. Lee, J. Hagan, B. Jantsansengee, A. Samdan, B. Yadamsuren, S. Demberelsuren, C. Tserendorj, O. Munkhtogoo, D. Badarch, J.L. Goodson

Background: A prolonged measles outbreak in Mongolia, with ~50,000 suspected cases, started in March 2015. Measles surveillance data suggested a substantial increase in case fatality ratio (CFR) in 2016 and health care-associated infection as a possible risk factor for mortality. As part of the outbreak response, we enhanced mortality ascertainment and conducted a case-control study to identify risk factors for measles death.

Methods: We linked national vital records with surveillance data of clinically confirmed (fever, maculopapular rash, and cough, coryza, or conjunctivitis) or laboratory-confirmed (positive measles immunoglobulin M antibody) infant measles cases (aged <12 months) during March 2015–June 2016 using probabilistic record linkage. We abstracted charts of 96 fatal measles cases and 276 nonfatal control subjects, with rash onset after October 1, 2015, matched by sex and date of birth. We used conditional logistic regression, adjusting for age, sex, and preexisting conditions, to calculate adjusted matched odds ratios (aMORs) and 95% confidence intervals (CIs) for risk factors.

Results: Infant case fatality increased from 8 deaths among 2,641 cases (CFR: 0.3%) in 2015 to 108 deaths among 4,467 cases (CFR: 2.4%) in 2016 (P <.001). Inpatient admission 7–21 days before rash onset (measles incubation period) (aMOR: 5.0; CI: 2.3–10.9) and hospitalization in provinces versus the capital city (aMOR: 2.8; CI: 1.0–7.8) were significantly associated with mortality.

Conclusions: We successfully used vital records linkage to verify a significant CFR increase among Mongolian infants in 2016. Measles mortality was associated with hospitalization outside the capital and health care-associated infection. We recommended measures to standardize care and strengthen infection prevention and control practices to the Mongolian Ministry of Health to reduce infant measles mortality.

3:25 Epidemic Cholera and Micronutrient Deficiency — Grande Saline, Haiti, 2011

Authors: Sae-Rom Chae, J. Boncy, A. J. Gerard, P. S. Suchdev, S. Kim, E. D. Mintz, B. R. Jackson

Background: Epidemic cholera typically affects poor communities with unsafe water and inadequate nutrition. Most *Vibrio cholerae* infections are asymptomatic, and risk of symptomatic cholera is thought to increase with micronutrient deficiencies. Following introduction of cholera into Haiti in October 2010, we conducted a cross-sectional seroepidemiologic survey in Grande Saline, Haiti, to assess risk factors for cholera, including micronutrient deficiencies, to guide future responses.

Methods: We tested sera of participants ≥2 years of age for ferritin, a marker of iron deficiency; retinol-binding protein (RBP), a marker of vitamin A deficiency; and C-reactive protein (CRP) and alpha-1-acid glycoprotein (AGP), markers of inflammation. We adjusted ferritin and RBP for CRP and AGP using a previously-described regression model to account for potential confounding effects of inflammation. We used multivariable logistic regression to examine associations between micronutrient deficiencies and both self-reported cholera diagnosis and *V. cholerae* seropositivity (using antibodies as markers of past infection), adjusting for age, sex, and education.

Results: Of 772 participants tested (age range 2–90 years; 19% <5 years), 150 (21%) reported a cholera diagnosis during October 2010–April 2011; 466 (60%) were seropositive. Low ferritin was found in 19%; 3% had low RBP. No associations between cholera diagnosis and micronutrient-deficiency measures were observed. Participants with low ferritin, but not low RBP, had higher odds of seropositivity than those with normal measures (odds ratio 2.1; P <0.001).

Conclusions: Iron and vitamin A deficiencies were common but not associated with cholera diagnosis. Although we adjusted for education, residual confounding from socioeconomic status may explain associations between iron deficiency and seropositivity. Improved access to nutritious foods and safe water are needed in impoverished communities.

3:45 Measles-Rubella Vaccination Campaign Coverage and Use of Campaign-Related Mobile Phone Message Reminders — Kenya, 2016

Authors: Saleena Subaiya, C. Tabu, S. Khamati, A. Styczynski, S. Thuo, H. Gary, R. Kaiser, S. Chu, S. Mahugu, H. Scobie

Background: In May 2016, the Kenya Ministry of Health conducted a measles-rubella (MR) supplementary immunization activity (SIA) targeting 18.9 million children aged 9 months–14 years, with a goal of ≥95% vaccination coverage. We evaluated the impact of mobile phone short message service reminders (SMSR) on coverage, a topic not previously studied.

Methods: We sent 35.5 million SMSR to mobile subscribers in 22 of 47 counties and conducted a national multi-cluster household survey to evaluate vaccination coverage and SMSR acceptability. Accounting for survey design, we calculated point estimates and 95% confidence intervals (95% CI) for outcomes from 20,011 children in 8,253 households and used logistic regression to calculate odds ratios (ORs).

Results: Overall, 89% (95% CI: 88%-90%) of caregivers had mobile phone access. Twenty-nine percent (95% CI: 27%–30%) reported receiving SMSR; fewer caregivers (P<.001) in high-risk groups (e.g., pastoralists, low socioeconomic status) reported receiving SMSR. Out of those who received SMSR, 90% (95% CI: 88%–91%) reported them useful in deciding to vaccinate their child. National MR vaccination coverage was 95% (95% CI: 94%–96%); coverage was higher among children whose caregiver reported receiving SMSR (OR: 1.88; 95% CI: 1.32–2.70). After controlling for other factors, we detected a significant interaction between relative wealth quintile and receipt of SMSR, with higher odds of vaccination associated with receiving SMSR among the second (OR: 2.58; 95% CI: 1.06-6.25) and third (OR: 2.15; 95% CI 1.05-4.41) lowest quintiles.

Conclusions: In Kenya, mobile phone access and the acceptability of receiving SIA-related SMSR were high. SMSR might be useful to improve coverage in SIAs, particularly among children living in middle wealth quintile households.

4:05 Sustained Use Of Portable Handwashing And Drinking Water Stations In Health Care Facilities — Siaya County, Kenya, 2016

Authors: William W. Davis, A. Odhiambo, J. Oremo, R. Otieno, S. Faith, A. Mwaki, R. Quick

Background: Data from 54 middle and low income countries showed that 38% of health care facilities (HCFs) lacked improved water supplies and 35% lacked handwashing facilities, increasing the risk of healthcare-associated infections. To address this problem in Siaya County, Kenya, portable handwashing and drinking water stations were provided, along with soap and sodium hypochlorite for water treatment, to all 109 HCFs in 2005. We evaluated this program in 2016 to assess acceptability and use of these interventions.

Methods: We interviewed staff and conducted observations in 28 randomly-selected HCFs on water sources; use and maintenance of handwashing and drinking water stations; and water treatment practices. We tested water from each facility's source and one drinking water storage container for chlorine residuals and *E. coli.*

Results: HCF water supplies included rainwater (53.6%), boreholes (35.7%), and public taps (10.7%). Of 28 HCFs, 26 (92.9%) had functioning handwashing and drinking water stations. Among responding HCFs, 17/27 (63.0%) had replaced broken taps, and 11/18 (61.1%) had replaced broken containers. No source water was chlorinated. Of 28 source water samples, 13 (46.4%) tested positive for *E. coli*; 15 (53.6%) had no detectable contamination. Of 28 stored water samples, 7 (25%) had detectable chlorine residuals. Overall, 26 (92.9%) stored water samples had no detectable *E. coli*, including all 15 obtained from uncontaminated sources and all 7 with detectable chlorine residual.

Conclusions: After 12 years, water stations were maintained and used in all but 2 HCFs. Evidence of chlorination was observed in 25% of stored water samples; no treated samples yielded *E. coli*. Untreated water from uncontaminated sources stored in drinking water stations remained free of *E. coli*, but chlorination is recommended.

4:25 Immunogenicity of Type 2 Monovalent Oral and Inactivated Poliovirus Vaccines — Bangladesh, 2016

Authors: Michelle Morales, K. Zaman, M. Yunus, C. Estivariz, C. Snider, H. Gary, S. Wassilak, M. Pallansch, M.S. Oberste, W. Weldon, A. Anand

Background: After removal of poliovirus type 2 from oral poliovirus vaccine (OPV) in May 2016, monovalent OPV type 2 (mOPV2) and inactivated poliovirus vaccine (IPV), which contains all three poliovirus serotypes, will be used to respond to type 2 poliovirus outbreaks. This study assessed immunogenicity of mOPV2 with shortened intervals between mOPV2 doses (at 1 and 2 weeks compared to the standard 4 weeks) and co-administration of IPV.

Methods: An open-label, non-inferiority, four-arm, randomized controlled trial was conducted in Bangladesh. Healthy infants aged 6 weeks were recruited and randomized to receive 2 mOPV2 doses beginning at age 6 weeks at a 1, 2, or 4 week interval with or without IPV administered at age 6 weeks. Serum antibody titers against poliovirus type 2 were determined from blood collected pre- and post-vaccination.

Results: Of 760 infants randomized, 737 (97%) completed all study visits and were included in the analysis. Seroconversion following two mOPV2 doses was 93% (95% CI: 88%-96%), 95% (95% CI: 91%-98%), and 97% (95% CI: 94%-99%) at 1, 2, and 4 week intervals, respectively. Seroconversion was 91% following one mOPV2 dose (95% CI: 86%-95%), and 91% following one mOPV2 dose with IPV (95% CI: 86%-95%). Seroconversion was 97% following two mOPV2 doses at a 4 week interval (95% CI: 94%-99%), and 97% following two mOPV2 doses at a 4 week interval with IPV (95% CI: 93%-99%).

Conclusions: mOPV2 has high type 2 immunogenicity at varying intervals between doses. IPV co-administration did not improve immunogenicity. Based on these results, type 2 outbreak response guidelines could be modified to reduce the number of mOPV2 campaigns and limit the use of IPV.

CONCURRENT SESSION H2: Notes from the Field

3:00–4:45 PM

Concurrent Session Room

Moderators: Joseph McLaughlin and Kris Bisgard

3:05 Burden of Extrapulmonary Nontuberculous Mycobacterial Disease and Utility of Statewide Surveillance — Oregon, 2014–2016

Authors: David C. Shih, M. Cassidy, P. Cieslak, R. Leman

Background: Nontuberculous mycobacteria (NTM), ubiquitous in soil and water, comprise >100 species. Multiple species can infect the lungs, skin, bone, joints, and lymphatic system. Trauma, surgeries, and tattooing can inoculate NTM into soft tissue, potentially resulting in substantial morbidity and death. Eight states, including Oregon, require NTM reporting. We sought to characterize extrapulmonary NTM infection burden and assesses usefulness of Oregon's NTM surveillance system in detecting outbreaks.

Methods: Confirmed cases are culture-confirmed extrapulmonary NTM infections involving a wound or abscess, lymph node, or normally sterile site (e.g., blood or spinal fluid). Using surveillance data collected through laboratory reporting, patient interview, and chart review, we assessed demographic, risk, and clinical characteristics of Oregon extrapulmonary NTM cases and reviewed investigation of data-identified clusters.

Results: Of 117 confirmed extrapulmonary NTM cases (0.98 cases/100,000 persons annually), 53% were female; median age was 49 years. Commonly identified species included *Mycobacterium avium* complex (46%), *Mycobacterium fortuitum* (15%), and *Mycobacterium chelonae* (8%). Reported exposures included potting soil (30%), surgery (24%), trauma (19%), and infusions (19%). Wounds or abscesses were reported in 68% of patients; 31% were hospitalized; 14% were septic; and 1 died. Three clusters by time, place, and mycobacterial species were identified; subsequent investigation identified common exposures leading to public health action, including 4 cases associated with artificial joints from a common supplier, 2 with use of unsterile tattoo diluent at a single venue, and 2 with abdominoplasty at a single venue.

Conclusions: Extrapulmonary NTM infections cause substantial morbidity in Oregon. NTM surveillance proved useful in detecting NTM outbreaks amenable to public health action. States should investigate the utility of NTM surveillance for outbreak detection.

3:25 Shiga Toxin-Producing *Escherichia coli.* Convalescent Testing by Using Multiplex Polymerase Chain Reaction Panel and Culture Methods — Kansas, 2016

Authors: Jessica Nadeau Tomov, L. Webb, C. Robertson, C. Masters, C. Hunt

Background: Kansas regulations exclude persons with Shiga toxin-producing *Escherichia coli* (STEC) infection from delivering health care, handling food, and providing or attending daycare until 2 consecutive negative convalescent stool culture results are obtained. Increasingly, laboratories use multiplex polymerase chain reaction (PCR) panels to detect presence of STEC instead of classic biochemical culture methods. Use of PCR to confirm absence of STEC in convalescent specimens has not been assessed. We compared culture with PCR for testing convalescent specimens to determine the potential effect of PCR use on persons excluded from work or daycare ("excluded persons").

Methods: Required convalescent stool specimens collected ≥48 hours after symptom resolution from excluded persons (previously diagnosed by any method) and submitted during August–November 2016 were evaluated. Specimens were tested for STEC using classic biochemical culture and PCR. Specimens from excluded persons were collected and tested until 2 consecutive negative cultures were obtained and the exclusion was lifted.

Results: Seven excluded persons submitted 26 specimens; 46% (12/26) were culture and PCR positive; 19% (5/26) were culture and PCR negative; and 35% (9/26) were culture negative and PCR positive. Among each person's last 2 culture-negative specimens, PCR test results were both negative (n=2), positive followed by negative (n=1), and both positive (n=4).

Conclusions: PCR detected Shiga toxin nucleic acid targets in a majority of culture-negative convalescent specimens. If PCR was used instead of culture, 5 of 7 exclusions would not have been lifted. PCR can detect Shiga toxin nucleic acid in non-viable bacteria, thus culture remains the preferred method for STEC testing on convalescent specimens in Kansas. As laboratory capacity for PCR increases further evaluation of PCR use for convalescent testing is warranted.

3:45 Zika-Related Birth Defects Surveillance — Texas, 2016

Authors: Noemi B. Hall, P. H. Langlois, K. Broussard, N. Evert, M. Canfield

Background: Zika virus infection during pregnancy has been linked to adverse pregnancy outcomes. To better understand the burden of Zika in pregnancy, the Texas Department of State Health Services (DSHS) established enhanced surveillance to identify pregnancy outcomes with congenital anomalies among women with laboratory evidence of Zika virus infection during pregnancy since January 1, 2016.

Methods: As part of routine surveillance, arboviral disease case investigation forms, laboratory testing results, and other relevant epidemiologic information are collected and reviewed by the DSHS Zoonosis Control Branch. As part of the enhanced surveillance, data on pregnant women with laboratory evidence of Zika virus infection and their offspring are shared with the DSHS Birth Defects Epidemiology and Surveillance Branch (BDESB). BDESB staff then review neonatal medical records for documented congenital anomalies. Additionally, within 3 months of delivery, BDESB staff review hospital discharge data using *International Classification of Diseases*, Tenth Revision codes to identify neonates with birth defects consistent with Zika virus infection during pregnancy (e.g. brain abnormalities with and without microcephaly, neural tube defects, and arthrogryposis).

Results: Between January 1 and November 30, 2016, 103 pregnant women with laboratory evidence of Zika virus infection were identified. All infections were travel-associated. Of the 30 pregnancies where delivery outcomes are known, 2 neonates presented with microcephaly and additional congenital anomalies; one with intraventricular hemorrhage and the other with holoprosencephaly and severe lower limb deformities. Both had laboratory evidence of Zika virus infection at delivery.

Conclusions: Through surveillance, we identified 2 neonates with Zika-related congenital anomalies and laboratory confirmed Zika virus infection. To assist in targeting resources for neonates affected by Zika virus infection and their families, continued enhanced surveillance is needed.

4:05 Evidence of Health Care Transmission of *Candida auris*: An Investigation of 2 Cases — Chicago, Illinois, 2016

Authors: Janna L. Kerins, S. Kemble, M. Pacilli, R. Welsh, N. Chow, L. Gade, S. Tsay, S. Vallabhaneni, A. Kallen, E. Landon, J. Ridgway, R. Marrs, D. Pellegrini, B. Jackson, S. Lockhart, A. Litvintseva, T. Patel, J. Lepinski, S. Black

Background: *Candida auris* is an emerging, multidrug-resistant yeast causing invasive infections globally but not reported in the United States before 2016. In August 2016, the Chicago Department of Public Health was notified of 2 patients with *C. auris* infections who were treated at the same acute care hospital (ACH) and long-term acute care hospital (LTACH). We investigated possible health care transmission to guide control measures.

Methods: Cases were defined as *C. auris* isolated from clinical cultures. We reviewed medical records to identify overlaps in time and location; sampled patients' rooms; and screened patients, ACH ward mates, and LTACH patients for colonization. Isolates were analyzed using whole genome sequencing (WGS).

Results: *C. auris* was isolated from Patient 1's bloodstream in May and Patient 2's urine in July. These patients had 3 overlapping ACH admissions during March–July, but wards differed. In April, 3 days separated their hospitalizations on the same LTACH ward. In August, we detected *C. auris* colonization of index patients' skin, nares, vagina, and rectum. *C. auris* was present on mattress, bed rail, chair, table, and window ledge surfaces in Patient 1's hospital room. Three (6%) of 50 sampled LTACH patients, hospitalized on the same ward as both index patients, exhibited *C. auris* colonization; no ACH ward mates were colonized. All available patient isolates were highly related (<10 single nucleotide polymorphisms) by WGS.

Conclusions: Nearly indistinguishable *C. auris* strains were isolated from patients exposed to a single Chicago LTACH ward, indicating likely health care-associated transmission. Persistent colonization of patients, health care environment contamination, and ward mate colonization necessitate ongoing patient and environmental surveillance, strict adherence to Standard and Contact Precautions, and thorough environmental decontamination to control spread.

4:25 Food-Related Anaphylactic Deaths — New York City, 2000–2014

Authors: Eugenie A. Poirot, H. Gould, J. Hadler

Background: Food-induced anaphylaxis is potentially fatal, but preventable. Considerable public health attention has been given to preventing anaphylaxis from nut exposure among school-aged children. We characterized food-related anaphylactic fatalities in New York City (NYC) and examined changes in incidence during 2000–2014, beginning four years before NYC started supplying epinephrine auto-injectors to schools in 2004.

Methods: We identified food-related anaphylaxis deaths by using death certificates. A case was defined as a death in a NYC resident during 2000–2014 with an ICD-10 code or literal text indicating mortality attributable to food. To obtain further details regarding circumstances leading to death, we reviewed medical examiner reports. Rates were calculated by using U.S. Census Bureau annual population estimates and compared by using Poisson regression.

Results: Twenty-four food-related deaths were reported among NYC residents during 2000–2014, an average of 1.6/year (range: 0–5); rate of 2.0/10 million person-years. Seafood was the most common cause (9 deaths), followed by nuts (5). Other foods were milk, eggs, chickpeas, and chocolate (1 death each); food was unknown in 6 reports. All seafood-related deaths occurred among persons aged ≥18 years (median age 65 years). Of 5 nut-related deaths, 3 were among persons aged <18 years, including 1 where exposure occurred at school. Rates of fatal anaphylaxis did not differ with regard to time period, age, sex, race/ethnicity, or nativity (U.S. versus non-U.S.).

Conclusions: Preliminary results indicate that deaths from food-related anaphylaxis in NYC are rare, with no substantial rate change during the 15-year span studied. In NYC, prevention of anaphylaxis deaths in adults with seafood allergies should become a focus of public health efforts to help further reduce food-related anaphylaxis deaths.

SESSION I: FETP International Night — Poster Presentations

6:00–8:30 PM

Concurrent Session Room

Agenda provided during session

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CONCURRENT SESSION J1: Emerging Infections

8:30–10:15 AM

Frieden Plenary

Moderators: Christopher Braden and Michael Gronostaj

8:35 Zika Virus Infection in a Patient with No Known Risk Factors — Utah, 2016

Authors: Elisabeth R. Krow-Lucal, A. Dunn, S. Novosad, C. Brent, H. Savage, D. Peterson, A. Dibbs, B. Vietor, K. Christensen, J. Laven, M. Godsey, B. Beyer, M. Cortese, A. Panella , M. Rubin, S. Fridkin, J.E. Staples, A. Nakashima

Background: In 2016, a 73-year-old male patient (index patient) died of Zika virus disease following travel to an area with ongoing transmission. After his death, an adult male family contact (Patient A) developed Zika virus disease despite having no known risk factors. An investigation was launched to define Patient A's exposures and source of infection.

Methods: We asked family contacts and healthcare personnel about types, timing, and duration of contact with the index patient. We surveyed community members living near the index patient's residences about exposures and symptoms of Zika. Samples were obtained and tested for evidence of Zika virus infection. Mosquito traps were placed at Patient A's and the index patient's households.

Results: Of 19 family contacts identified, all reported similar exposures to the index patient; only Patient A had evidence of recent Zika virus infection. Of 86 healthcare personnel with direct contact with the index patient, 57 (66%) reported 128 separate encounters with body fluids, including 10 without personal protective equipment. No healthcare personnel tested positive. Eighty-nine (40%) of 226 households in the community participated, representing 218 individuals; 132 (61%) provided a sample. Twenty-eight (13%) reported having Zika virus-like symptoms in the prior month. None had confirmed evidence of recent Zika virus infection. Of 5,875 adult mosquitoes collected, none were the primary vectors of Zika virus and all tested negative for Zika virus.

Conclusions: The mechanism of Zika virus transmission to Patient A remains unknown but was likely person-to-person from the index patient. Because there was no transmission to other close contacts, healthcare personnel, or community members, contacts of Zika patients should follow current recommendations as they are likely sufficient to prevent transmission.

8:55 Prediction of the Zika Virus Infection Burden in Puerto Rico Using Bayesian Methods, November 2015–October 2016

Authors: Jessica M. Healy, D.M. Rodriguez Vargas, E. Dirlikov, B. Rivera, B. Greening, Jr., S. Waterman, M.A. Johansson

Background: Bayesian methods offer rapid, cost-effective ways to estimate infection burden during an outbreak when a population-level serosurvey may be infeasible. During November 2015–October 2016, the Puerto Rico Department of Health (PRDH) reported 31,464 confirmed Zika virus (ZIKV) infections. Since ~80% of ZIKV infections are asymptomatic and mildly symptomatic individuals might not seek care, the infection burden is unknown. We used Bayesian methods to estimate the infection burden in the general and pregnant populations, and the rate of microcephalic births expected during the outbreak in Puerto Rico.

Methods: Weekly ZIKV surveillance data for arboviral diseases, Guillain-Barré syndrome (GBS), and blood donations were sourced from PRDH. These data and published rates of ZIKV infections per clinical or GBS case informed weekly distributions of ZIKV infection probability during November 2015–October 2016. To estimate infections during pregnancy over time, weekly infection probability was applied to simulated pregnancy cohorts based on the 2015 birth rate in Puerto Rico. Published trimester-specific microcephaly risk estimates were applied to the simulated infected pregnancies to temporally predict microcephalic live-births.

Results: During November 2015–October 2016, we estimated 440,000–1,100,000 (interquartile range [IQR]) ZIKV infections to have occurred and 2,900–4,100 (IQR) pregnant women were presumed to be infected. We predicted one microcephalic live-birth would occur per week starting in late August 2016.

Conclusions: Using Bayesian statistical methods which incorporate uncertainty and variability in the data to reduce bias, we estimated the infection burden during the ZIKV outbreak in Puerto Rico to be 15–37 times the number of reported infections, thus providing more realistic estimates to inform the public health response, including the planning for ZIKV-associated birth defects.

9:15 Care of Ebola Survivors at ELWA Clinic in Monrovia, Liberia

Authors: Annabelle de St. Maurice, R. Orone, J. Fankhauser, J. Brown, D. Williams, K. Dokubo, P. Rollin, M. Choi, B. Knust

Background: Following the 2014–16 Ebola virus disease (EVD) epidemic, thousands of EVD survivors have sought care for sequelae. Located in Monrovia, Liberia, The ELWA clinic provides free, comprehensive primary/specialty care to EVD survivors. We describe the demographics, symptoms, and care costs of EVD survivors at ELWA clinic.

Methods: Medical records of EVD survivors visiting ELWA clinic from January 2015–June 2016 were abstracted; symptoms and diagnoses were categorized by organ system. Symptom frequencies were documented on a per-patient basis. Descriptive analysis was performed using STATA 13.

Results: 305 EVD survivors were seen at ELWA clinic for a total of 728 visits and per patient mean of 2.4 visits; 59% were female, and mean age was 33 years (range 1-85). Median days from ETU discharge to first recorded clinic visit was 281 (range 4-680). EVD survivors most commonly experienced the following symptoms by organ system: neurologic: headache (46%) and insomnia/fatigue (28%); gastrointestinal: abdominal pain (37%) and appetite loss (30%); musculoskeletal: arthralgia (27%) and myalgia (26%); ophthalmologic: visual changes (15%) and decreased visual acuity (8%); and reproductive: amenorrhea (5%), and erectile dysfunction (3%). EVD survivors also frequently developed malaria (23%) and UTI (11%) which were unlikely related to survivor status. Total monthly indirect and direct costs for all the patients cared for at the ELWA clinic were estimated to be $6,625.

Conclusions: EVD survivors continued to seek care at ELWA clinic for a variety of complaints beyond 6 months after ETU discharge, and support of these patients was done with a limited budget. Considering the symptoms reported, EVD survivors may benefit from specialty ophthalmologic, rheumatologic, or neurologic care.

9:35 It's Not Polio! Acute Flaccid Myelitis — United States, August 2014–October 2016

Authors: Tracy Ayers, A. Lopez, A. Kambhampati, A. Lee, S. Rogers, W.A. Nix, M.S. Oberste, M. Pallansch, J. Routh, J. Sejvar, M. Patel

Background: Acute flaccid myelitis (AFM) is a serious but rare condition characterized by sudden onset of limb weakness or paralysis. In August 2014, reports of this mysterious polio-like illness occurring concurrently with outbreaks of severe respiratory illness caused by enterovirus D68 prompted establishment of surveillance under a standardized case definition. After a decrease in 2015, AFM cases increased during 2016 raising concerns of a resurgence. We compared clinical and laboratory profiles of cases in 2014 and in 2016.

Methods: Confirmed cases were defined as acute flaccid limb weakness and spinal cord gray matter lesions on magnetic resonance imaging (MRI). Cases >21 years of age were excluded because of changes in case definition in 2015. Clinical and laboratory characteristics of cases from August – December 2014 and January – October 2016 were compared using Wilcoxon rank sum and Fisher's exact test.

Results: A total of 311 confirmed AFM cases have been reported: 120, 21, and 96 cases for August – December 2014, 2015, and January – October 2016, respectively. Cases in 2016 had a lower median age (5 vs 7 years; $p<0.001$), were more likely to present with altered mental status (AMS) (26% vs 11%; $p=0.01$), have more than two limbs affected (48% vs 32%; $p=0.02$), and require mechanical ventilation (33% vs 20%; $p=0.04$) compared to cases in 2014. Despite extensive testing since 2014, no consistent etiology has been identified to date.

Conclusions: AFM cases in 2016 tended to be younger and had more severe clinical presentations compared to those in 2014. Continued surveillance and reporting of suspected AFM cases remain critical to further understand and characterize this disease. Testing protocols have shifted to explore both infectious and non-infectious causes.

9:55 The First Eight Reported Cases of *Candida auris*, an Emerging, Multidrug-Resistant Yeast — New York, 2013–2016

Authors: Sharon Tsay, E. Poirot, N. Chow, S. Chaturvedi, J. Greenko, R. Fernandez, K. Southwick, E. Lutterloh, M. Quinn, L. Gade, R. Welsh, E. Berkow, B. Jackson, S. Lockhart, A. Litvintseva, T. Chiller, A. Kallen, S. Vallabhaneni, E. Adams

Background: *Candida auris* is a globally emerging, multidrug-resistant yeast that has caused hospital-associated outbreaks of invasive infections with high mortality. CDC issued a clinical alert to U.S. healthcare facilities in June 2016 requesting notification of *C. auris* cases. As of September 2016, eight of twelve U.S. cases reported were from New York, prompting investigation to determine risk factors and assess relatedness of cases to limit transmission.

Methods: A case was defined as *C. auris* isolated from any patient specimen at a NY healthcare facility before October 2016. We reviewed clinical records, characterized isolates, examined infection control practices at affected facilities, and swabbed case-patients, their rooms, and ward mates.

Results: Eight cases occurring during May 2013–October 2016 were identified at six healthcare facilities. Case-patients had multiple indwelling devices, including urinary catheters (75%), gastrostomy tubes (63%), tracheostomy tubes (63%), and central venous catheters (63%). All had ≥3 healthcare facility encounters within 90 days of diagnosis; two patient pairs had overlapping stays at two different facilities. Three (38%) died within 28 days of diagnosis. Most isolates were highly related by whole-genome sequencing and 5 (63%) were resistant to two antifungal drug classes. Three of four patients sampled had *C. auris* colonization in multiple body sites weeks after first positive culture; *C. auris* was also found in patient rooms and colonizing a ward mate. Inadequate Contact Precaution adherence was found at some involved long-term care facilities.

Conclusions: Epidemiologic and laboratory evidence suggest that multidrug-resistant *C. auris* may have been transmitted within NY healthcare facilities. To curb further spread, adherence to recommended infection control practices, particularly in long-term care facilities, coupled with public health surveillance and rapid response, are urgently needed.

CONCURRENT SESSION J2: Injury

8:30–10:15 AM

Concurrent Session Room

Moderators: Debra Houry and Katie Fowler

8:35 Mental Health Related Emergency Department Visits After a Noncasualty Terrorist Event — New Jersey, September 2016

Authors: Faye M. Rozwadowski, S. Dietz, S. Tsai, T. Hamby, C. Tan

Background: Two pipe bombs exploded in September 2016 in 2 separate New Jersey (NJ) locations and were linked to domestic terrorism; no physical injuries were sustained. Because the purpose of terrorism is to invoke physical harm and fear, psychological distress after an event can potentially increase mental health visits to local emergency departments (EDs) in the absence of physical injuries. We sought to determine if an increase occurred.

Methods: Reports of ED chief complaints by patients meeting validated mental health key word groups residing in the same zip codes as the bombings were analyzed. Cases from September 2016 and 2015 were obtained from the NJ Department of Health's syndromic surveillance system. T-tests were used to compare the same weekend in 2016 to 2015. A moving median and interquartile range (IQR) was calculated for each date in September 2016. Daily observed counts were compared against the expected moving median.

Results: Mental health ED visits increased an average 1.2% (95% confidence interval: 0.17%–2.23%; P = 0.031) from 2015 to 2016, of the same weekend. We observed an increase outside the expected IQR 2 days after the first bombing with a count (n = 7) that is 2.3 times higher than the moving median for that day (median = 3). This count is the only statistical outlier in September 2016 (IQR = 2).

Conclusions: On the basis of the significant t-test and observed increase over the expected median, ED visits for mental health symptoms increased <48 hours after these terrorist events. This finding supports the needs for health departments and hospitals to have adequate mental health preparatory responses and action plans when such events occur.

8:55 Risk and Protective Factors for Driving After Five or More Alcoholic Drinks Among College Students — Fall National College Health Assessment, United States, 2011–2014

Authors: Alexis B. Peterson, B. West, E. Sauber-Schatz

Background: In 2015, 2,684 persons aged 18–28 died in alcohol-impaired motor vehicle crashes. This study's purpose was to determine the prevalence and associated risk and protective factors for driving after binge drinking among college students.

Methods: National College Health Assessment data from 2011–2014 were used. Undergraduate college students aged ≤28 were asked to report drinking any alcohol within the previous month, binge drinking (five or more alcoholic drinks in one sitting) within the last two weeks, and driving after binge drinking in the previous month. Adjusted odds ratios (aOR) and 95% confidence intervals (CI) were calculated using multivariable logistic regression for the outcome driving after binge drinking, adjusting for gender, year in school, race/ethnicity, and school region.

Results: Overall, 2.5% (n=1,012) of 40,502 alcohol using students drove after binge drinking. Compared with those not reporting any binge episodes within the last two weeks, the odds of driving after binge drinking were higher among respondents who reported 1–2 (aOR: 6.4; CI: 4.9–8.4) and ≥3 binge drinking episodes (aOR: 12.4; CI: 9.3–16.5). Drinking on ≥10 days increased the odds of driving after binge (aOR: 1.26; CI: 1.1–1.5), compared with drinking 1–5 days. Odds of driving after binge drinking were lower among those "always" using a seat belt (aOR: 0.8; CI: 0.7–0.9) and a designated driver (aOR: 0.06; CI: 0.05–0.08), compared with "less than always".

Conclusions: There are clear risk and protective factors for driving after binge drinking among college students, including alcohol use frequency. Results suggest the application of proven strategies including sobriety checkpoints, enforcement of 0.08% blood alcohol concentration laws, and liability for retail alcohol establishments are warranted.

9:15 Fatal Injuries in the Alaska Logging Industry, 1991–2014

Authors: Yuri P. Springer, D. Lucas, L. Castrodale, J. McLaughlin

Background: During 2006–2014, the fatality rate for the U.S. logging industry was 23 times the national all-occupations rate. Alaska has among the highest work-related fatality rates across multiple industries; logging injuries have not been examined since the early 1990s. We investigated fatalities in the Alaska logging industry during 1991–2014 to assess industry safety.

Methods: To estimate annual fatality rates, we used fatality data from the Alaska Occupational Injury Surveillance System and workforce data from the Alaska Department of Labor and Workforce Development (ADLWD). We estimated rates as fatalities/100,000 positions (individual jobs) and calculated 5-year moving averages of annual rates to examine trends. Fatality characteristics were analyzed.

Results: During 1991–2014, a total of 51 fatalities were reported among an annual average of 840 positions. Annual fatality rate range was 0/100,000–717/100,000 positions. A plot of the 5-year moving average of annual fatality rates by year was parabolic, decreasing from 1993 (341.6/100,000 positions) to 2005 (0/100,000 positions), then increasing to a high in 2010 (383.2/100,000 positions). Analyses of fatality characteristics including source, event, nature, and affected body part(s) did not indicate a mechanism for this rate reversal.

Conclusions: After declining during 1991–2005, Alaska logging industry fatality rates rose during 2006–2014; rate for this 9-year period was twice the U.S. logging industry rate and 42 times the national all-occupations rate. In response, the Alaska Division of Public Health is collaborating with ADLWD and the University of Alaska–Anchorage to develop a safety education program; our investigation findings will be used to guide recommendations. Changes in size, structure, and operation of Alaska logging companies will be examined as potential contributors to the rate reversal.

9:35 Investigation of Fatal and Nonfatal Suicidal Behavior, Ages 10–24 — Santa Clara County, California, 2016

Authors: Amanda G. Garcia-Williams, J. O'Donnell, E. Spies, X. Zhang, A. Azofeifa, K. Vagi, R. Young

Background: Suicide is the second leading cause of death for youth age 10-24 in Santa Clara County (SCC). Suicide is a preventable cause of death. To inform ongoing suicide prevention efforts in SCC, we examined characteristics of youth suicide decedents, and risk and protective factors for nonfatal suicidal behavior.

Methods: Suicide among SCC youth, age 10-24, was examined using vital statistics data, and precipitating circumstances for suicide were characterized using medical examiner reports. Nonfatal suicidal behavior, and associated factors, was examined among SCC high school students using self-reported youth survey data. Odds ratios (OR) and 95% confidence intervals (CI) were calculated to identify factors associated with past year suicidal ideation using bivariate logistic regression.

Results: From 2003-2015 there were 196 deaths by suicide among youth aged 10-24 in SCC. Decedents tended to be male (75.0%); 38.3% were white, non-Hispanic; 28.6% were Hispanic, of any race; and 26.5% were Asian, non-Hispanic. Common methods of suicide were hanging/suffocation (47.6%) and use of a firearm (21.0%). Known precipitating circumstances for suicide included recent crisis (52.6%), mental health problems (47.4%), and a history of suicidal thoughts (37.1%). Risk factors for past year suicidal ideation included depressive symptoms (OR: 11.3; CI: 10.2–12.6); lesbian, gay or bisexual orientation (OR: 4.4; CI: 3.8–5.1); and victim of psychological bullying (OR: 3.5; CI: 3.2–3.8). Protective factors included perceiving that a teacher or adult cares (OR: 0.6; CI: 0.5–0.7) and school connectedness (OR: 0.4; CI: 0.3–0.4).

Conclusions: Results suggest multiple factors are related to fatal and nonfatal suicidal behavior among youth in SCC. Use of comprehensive, coordinated approaches that focus on multiple risk and protective factors could help prevent suicide.

9:55 Adherence of Media Reporting of Suicides to Suicide Reporting Guidelines — Santa Clara County, California, 2008–2015

Authors: Julie K. O'Donnell, A. Garcia-Williams, E. Spies, A. Azofeifa, K. Vagi

Background: In Santa Clara County (SCC), California, 128 youth suicides were reported during 2008–2015, garnering considerable media attention. Elements of media reporting of suicide are recognized suicide risk factors, and the American Foundation for Suicide Prevention (AFSP) developed guidelines for safe reporting of suicide in 2001. We retrospectively examined how closely media reporting of suicides in SCC followed these guidelines to guide ongoing local suicide prevention strategies.

Methods: Media articles, published during 2008–2015, were identified from print and online sources by using search terms for *suicide* and SCC, with source selection recommended by SCC public health officials. Articles that reported on specific suicide deaths or attempts in SCC or surrounding counties were systematically scored on the basis of AFSP reporting guidelines. Positive and negative reporting characteristics included in articles were quantified.

Results: Two hundred forty-six articles were scored. Only 8 articles were published in 2008; these were included in overall analyses but excluded from comparisons across years. Articles included a mean of 4.3 (range: 0–11) negative characteristics. Common negative characteristics included descriptions of suicide methods (93%) and locations (83%). Proportion of articles with a sensational headline declined from 40% in 2009 to 21% in 2015. Proportion including any suicide hotline number increased from 4% in 2009 to 40% in 2015. Inclusion of strong language and provocative photographs, which are negative reporting characteristics, fluctuated over time.

Conclusions: Media reporting of suicides in SCC during 2008–2015 deviated from suicide reporting recommendations. Ongoing partnership with media outlets, to encourage continuation of positive reporting trends and to work to improve negative trends, can be part of a more effective suicide prevention strategy in SCC.

POSTER SYMPOSIUM II:

10:30–11:45 AM

Concurrent Session Room

Moderators: Tim Jones and Dianna Carroll

During the first 30 minutes of the poster symposium, the following authors will each give a 2-minute oral presentation at the podium in front of a seated audience in the Concurrent room. Afterward, the authors will stand with their posters for the remaining session time in the poster area. The audience is encouraged to view the individual posters and engage in direct discussion with the authors.

P2.1 Multistate Epidemiologic Description of Histoplasmosis in the United States, 2011–2014

Authors: Paige A. Armstrong, K. Benedict, D. Haselow, V. Fields, C. Austin, M. Ireland, K. Signs, V. Fialkowski, R. Patel, C. Pedati, P. Iwen, J. Anderson, T. Dobbs, S. Gibbons-Burgener, K. Warren, S. Davidson, M. McIntyre, J. Midla, N. Luong, B. Jackson

Background: Histoplasmosis is one of the most common endemic mycoses in the United States. It is reportable in 10 states and Puerto Rico; however, a standardized case definition is not used, and incidence and distribution nationwide remain poorly understood. This study summarizes available state surveillance data to better understand the epidemiologic features of histoplasmosis.

Methods: Thirteen states provided de-identified data. Contributing states included 10 (Arkansas, Delaware, Illinois, Indiana, Kentucky, Michigan, Minnesota, Nebraska, Pennsylvania, Wisconsin) in which histoplasmosis is currently reportable, 2 (Alabama, Mississippi) in which it was previously reportable, and 1 (Ohio) in which it is not reportable. We examined epidemiologic data during 2011–2014 (years for which data were available in all states), and calculated county-specific mean annual incidence rates. Some data elements were only available from certain states. Cases were included if they were classified as a confirmed or probable case by the state.

Results: A total of 3,409 cases were reported. Median patient age was 49 years (IQ range: 33–61), and 2,079 (61%) patients were male. Of 1,729 patients for which race data was available, most were white (62%) or unknown (26%) race. Common symptoms reported by patients were cough (74%), shortness of breath (65%), and fever (56%). Thirty percent of 1,154 patients were immunocompromised and 57% of 2,218 patients were hospitalized. County incidence ranged from zero to 39 per 100,000.

Conclusions: The large proportion of hospitalized patients in this sample suggests that current surveillance underestimates the true burden of histoplasmosis. County-level incidence data enhances our understanding of endemic regions in the United States. Expanding reporting to additional states would allow for more comprehensive knowledge of histoplasmosis in the United States.

P2.2 Adaptation of the County-Level Vulnerability Assessment for Rapid Dissemination of HIV or Hepatitis C Virus Infections Among Persons Who Inject Drugs — Colorado, 2011–2015

Authors: Alexis W. Burakoff, A. Rosenthal, B. McNair, D. Shodell

Background: After a 2015 HIV outbreak among persons who inject drugs (PWID) in Scott County, Indiana, a 2016 CDC study used national data to identify indicators to predict a county-level risk for nonsterile injection drug use (IDU) and vulnerability for HIV or hepatitis C virus (HCV) outbreak. One Colorado county (Crowley) was identified as highly vulnerable. We sought to replicate CDC's model for all 64 Colorado counties with state-level data to identify counties at highest risk.

Methods: We collected data from the Colorado Department of Public Health and Environment and other local, state, and national agencies to create a set of 43 possible indicators. We used zero-inflated Poisson regression to model effects of these indicators, selected by using backwards elimination, on county rates of acute HCV diagnosis during 2011–2015 to approximate IDU. A common zero-inflation rate was estimated across all counties. We ranked counties on the basis of their vulnerability according to these indicators.

Results: Nine indicators were included as follows: drug overdose deaths, per capita income (median), percent Native American, uninsured population, households with access to a vehicle, proximity to an interstate highway, rate of heroin possession offense, high prescription rates of opiates, and presence of a syringe exchange program. The 5 most at-risk counties in Colorado were Montezuma, Douglas, Denver, Jefferson, and Gilpin.

Conclusions: Methods from a vulnerability assessment can be used at the state level to guide public health action and help identify at-risk counties to focus future prevention efforts. The difference in results from the original study might be attributable to differing demographics of PWID, as reflected in our state-level data.

P2.3 Risk Factors for Zika Virus Infection Identified Through Household Cluster Investigations — Puerto Rico, 2016

Authors: Rachel M. Burke, M. Lozier, J. Muñoz-Jordan, J. López, A. Jara, J. Read, B. Rivera-García, T. Sharp

Background: The first locally acquired case of Zika virus (ZIKV) disease in Puerto Rico was detected in November, 2015. As of December 2, 2016, the Puerto Rico Department of Health (PRDH) had reported 33,752 laboratory-positive ZIKV cases. We used household investigations to estimate the proportion of asymptomatic ZIKV infections and identify risk factors for ZIKV infection.

Methods: We offered participation to residents of all households within a 100-meter radius of the residences of a convenience sample of 19 laboratory-positive ZIKV disease cases reported to PRDH ("index participants"; 12 interviewed). Participants answered a questionnaire and provided serum and urine. Current and recent ZIKV infection were preliminarily defined by detection of ZIKV nucleic acid by RT-PCR or anti-ZIKV IgM by ELISA. ZIKV infection status was regressed on covariates using generalized estimating equations to account for clustering.

Results: Of 446 households contacted, 242 (54.2%) accepted. Of 462 present individuals, 379 (82.0%) participated. Among 367 non-"index participants," 113 (30.8%) had evidence of ZIKV infection. Of these 113, 57 (50.4%; vs. 19.7% of uninfected participants; P <.001) reported having rash, fever, arthralgia, or conjunctivitis in the past 6 months; among these, 33 (57.9%) sought care. Never leaving doors or windows open was negatively associated with ZIKV infection (adjusted odds ratio [aOR]: 0.32; 95% confidence interval [CI]: 0.14–0.71]). Reporting daily mosquito bites was a risk factor for ZIKV infection (aOR: 2.87; CI: 1.10–7.51). No demographics were significant.

Conclusions: At most half of ZIKV infections we detected were symptomatic. Preliminary results demonstrated the importance of mosquito avoidance to prevent ZIKV infection. Residents of and visitors to Puerto Rico should keep windows and doors closed or ensure intact screens.

P2.4 Characteristics of Persons with Repeat Syphilis Infection — Idaho, 2011–2015

Authors: Ahmed M. Kassem, J. Bartschi, K. Carter

Background: During 2011–2015, Idaho's syphilis incidence rate increased from 2.65/100,000 persons to 6.16/100,000 persons. Since January 2015, southwestern Idaho has been experiencing a syphilis outbreak, with 3 persons having repeat infections during 2015. We sought to characterize persons with repeat syphilis infection in Idaho.

Methods: We analyzed sexually transmitted disease (STD) surveillance data maintained by the Idaho Division of Public Health. We defined repeat cases as having ≥2 early syphilis infections (primary, secondary, or early latent stages), and nonrepeat cases as having 1 early syphilis infection reported during 2011–2015. To reduce misclassification, we excluded one person who had early syphilis infection during 2006–2011 from persons with nonrepeat cases. We reviewed demographic, clinical, and epidemiologic information collected during syphilis investigations. We used Median and Fisher's exact tests to describe and compare characteristics of persons with repeat and nonrepeat cases.

Results: During 2011–2015, early syphilis infections were reported in 193 Idaho residents, including 14 (7%) repeat cases. Among persons with repeat cases, 100% were male, 93% were white, 85% [11/13] were non-Hispanic, and 91% [10/11] had male sex partners. Compared with nonrepeat cases, persons with repeat cases more likely had secondary or early latent syphilis (93% [13/14] versus 64% [114/179]; P = 0.037), were HIV-positive (85% [11/13] versus 30% [39/129]; P <0.001), and had a history of STD (82% [9/11] versus 39% [51/132]; P = 0.009). No persons with repeat cases were incarcerated or exchanged sex for drugs or money.

Conclusions: Repeat syphilis infection in Idaho was associated with HIV infection and history of STD. These characteristics could be used to enhance STD/HIV testing, interview, and partner services to prevent syphilis reinfection.

P2.5 *Streptococcus equi* Subspecies *zooepidemicus* Fatal Infection Associated with Equine Exposure — King County, Washington State, 2016

Authors: Vance Kawakami, K. Rietberg, B. Lipton, K. Eckmann, M. Watkins, H. Oltean, M. Kay, J. Duchin

Background: *Streptococcus equi* subspecies *zooepidemicus* (*S. zooepidemicus*) is an opportunistic commensal bacterium in horses that rarely causes human illness. In March 2016, Public Health—Seattle & King County (PHSKC) was notified of 2 *S. zooepidemicus* infections, 1 fatal, in persons with horse contact at a King County horse facility (Facility A). PHSKC investigated to determine outbreak magnitude, identify risk factors, and prevent further illnesses.

Methods: We interviewed Facility A owner who was 1 of 2 index patients, facilitated nasal swab collection from all 6 horses on-site, and identified other Facility A patrons with horse contact during February–March 2016. A standardized questionnaire concerning horse contact and throat culture collection was conducted among patrons. Pulsed-field gel electrophoresis (PFGE) analysis was performed on all human and horse *S. zooepidemicus* isolates, including both index cases. We analyzed the association between contact with a particular horse and a positive *S. zooepidemicus* culture by using Fisher's exact test.

Results: Of 33 patrons, 16 (48%) completed questionnaires and provided a throat culture; 3 (19%) grew *S. zooepidemicus*; one of three indicated a sore throat 2.5 weeks before culture collection. Four of 6 (67%) horses grew *S. zooepidemicus*. *S. zooepidemicus* isolates from 3 patrons, both index patients, and 2 horses had an indistinguishable PFGE pattern. Close contact to a particular horse was not significantly associated with a positive *S. zooepidemicus* culture (P >0.1).

Conclusions: Epidemiologic and laboratory evidence linked a fatal *S. zooepidemicus* infection to close horse contact. Although zoonotic transmission risk factors and illness spectrum of human *S. zooepidemicus* infection are largely unknown, consistently practicing hand washing after contact with horses, a standard preventative measure, might help prevent disease.

P2.6 Antimicrobial Resistance Among Pediatric Central Line–Associated Bloodstream Infections Reported to the National Healthcare Safety Network, 2011–2014

Authors: Jason G. Lake, L. Weiner, I. See, S. Magill

Background: Approximately 15% of the 30,000 central line–associated bloodstream infections (CLABSIs) that occur annually in U.S. hospitals affect pediatric patients. Because children are usually cared for by different providers in different locations than adults, pediatric-specific antimicrobial resistance (AR) data are needed to inform infection control and antimicrobial stewardship priorities. We describe and compare CLABSI AR in different pediatric locations.

Methods: We used CDC's National Healthcare Safety Network 2011–2014 CLABSI surveillance data from four pediatric locations: neonatal and pediatric intensive care units (NICUs and PICUs), oncology units, and wards. Hospitals reported CLABSIs and AR using standard surveillance definitions. Chi-squared and Fisher's exact tests were used to compare the proportion resistant or nonsusceptible (%NS) for NICU vs non-NICU, and between non-NICU locations.

Results: Overall, 15538 pediatric location CLABSIs were reported. AR for *Enterococcus faecalis, Escherichia coli, Enterobacter,* and *Klebsiella pneumoniae/oxytoca* was significantly lower in NICUs compared to other locations, and similar between remaining locations. For example, *Klebsiella pneumoniae/oxytoca* %NS to extended-spectrum cephalosporins was 5% (NICU), 16% (PICU), 17% (oncology), and 12% (ward) (NICU vs non-NICU, P<.0001; P=.33 across non-NICU locations). AR was significantly higher in wards for some pathogens, including *Pseudomonas aeruginosa* where %NS to piperacillin/tazobactam was 7% (NICU), 16% (PICU), 15% (oncology) and 32% (ward) (NICU vs non-NICU, P<.0001; P=.02 across non-NICU locations).

Conclusions: AR was lower in NICUs for many CLABSI pathogens. For some pathogens, AR was highest in wards, which was unexpected as extensive healthcare exposures and antimicrobial use are typically more prevalent in critical care and oncology locations. These findings demonstrate the value of pediatric-specific AR data and suggest a need for increased attention to preventing CLABSI AR in pediatric wards.

P2.7 Gastrointestinal Illness Surveillance in Peace Corps Volunteers: An Evolving Epidemiologic Surveillance System, 2013–2016

Authors: Jarred B. McAteer, G. Appiah, C.E. O'Reilly, L. Deng, R. Bishop, R. Ferguson, D. Murphy, S. Poe, E. Mintz, S. Henderson, P. Jung.

Background: Since implementation of the Epidemiologic Surveillance System (ESS) in 1985, the Peace Corps has monitored health and morbidity trends of volunteers. Gastrointestinal (GI) conditions have the highest reported yearly incidence. Peace Corps transitioned to a new electronic surveillance system in November, 2015. ESS data from 2013 through June, 2016 were analyzed to identify reporting challenges with the new system.

Methods: We analyzed monthly GI illness trends across all Peace Corps countries using data from the paper-based (2013–2015) and electronic ESS (January–June, 2016). Case counts for reportable conditions were stratified by region, month, and diagnosis. We electronically surveyed 131 Peace Corps Medical Officers (PCMO) in all 66 current Peace Corps countries to assess reporting practices, system acceptability, and usefulness.

Results: Surveillance data from 2016 show reported GI illness counts were highest for the Africa region. Compared with averages from 2013–2015, global data on 1,592 reported cases of GI illness in 2016 showed a 26% decrease (231 vs. 311) for January, and 24% decrease for February (223 vs. 291). Case counts for these months fall outside the normal range for 2013–2015 data (mean +/- 2SD). From January–June, 2016, viral diarrhea counts fall above, while giardiasis counts fall below the normal ranges. Of survey respondents, 20 (27%) of 77 (59%) reported being very familiar with GI surveillance codes, and 18% reported codes are definitely easy to apply.

Conclusions: Variability in the new ESS reflects imprecise surveillance codes and knowledge gaps among users. The ESS is an evolving surveillance system that, with refinement, could identify priority diseases among a unique population of long-term international travelers, and inform targeted prevention measures, including water treatment and improved empiric therapy.

P2.8 Assessment Of The Sensitivity Of Group A Streptococcal Necrotizing Fasciitis Surveillance From Alaska's Laboratory-Based Surveillance System, 2015–2016

Authors: Emily Mosites, A. Frick, T. Zulz, L. Castrodale, J. McLaughlin, M. Bruce, T. Hennessy, P. Gounder

Background: Compared to the rest of the United States, Alaska has a high incidence of Group A *Streptococcus* necrotizing fasciitis (GAS-NF), a severe invasive bacterial disease. Laboratory surveillance for invasive disease in Alaska relies on sterile site (e.g. blood, cerebrospinal fluid, or an internal site) isolation of the pathogen. However, a GAS-NF case is defined as either a positive GAS isolate from a sterile site or a non-sterile wound culture in a patient diagnosed with NF. The objective of this study was to evaluate the sensitivity of Alaska's laboratory surveillance for capturing GAS-NF cases.

Methods: We requested a list of patients with discharge diagnosis codes for both GAS and NF from July 2015 through October 2016 from all Alaska hospitals. We compared this list to the list of GAS-NF cases in the laboratory surveillance system over the same time period. We estimated the number of expected cases in the catchment area to calculate the sensitivity of laboratory surveillance for detecting GAS-NF.

Results: Of 22 hospitals contacted, 15 responded to identify 4 cases of GAS-NF. Seven cases of GAS-NF were identified in laboratory surveillance and 2 cases were common to both data sources. Twelve cases were estimated to have occurred in the catchment area of these hospitals (95% confidence interval: 7–19 cases), yielding a sensitivity of 56%. The two cases missed by laboratory surveillance had positive wound cultures but no positive sterile site cultures.

Conclusions: Alaska's laboratory surveillance had low sensitivity for GAS-NF cases, which may lead to an underestimate of the burden of disease. The sensitivity could be improved with standardized guidance to laboratories for reporting GAS-NF cases according to the case definition.

P2.9 Evaluating Interest In An H5N1 Vaccine Among Highly Pathogenic Avian Influenza Laboratory Workers In The United States

Authors: Kate Russell, J. Bresee, J.M. Katz, S.J. Olsen

Background: Highly pathogenic avian influenza A (HPAI) viruses found in poultry and wild birds occasionally infect humans and cause serious disease. In 2014, the Advisory Committee on Immunization Practices reviewed data from one licensed influenza A(H5N1) vaccine for consideration of use in inter-pandemic periods in persons with occupational exposure. To guide vaccine policy decisions, we conducted a survey of laboratory workers to assess demand for HPAI vaccination.

Methods: We designed an anonymous web survey (EpiInfo 7.0) to collect information on demographics, work type, and interest in HPAI vaccination. The survey was exempted by a CDC institutional review board. Eligible participants were identified from 42 entities registered with United States Department of Agriculture's Agricultural Select Agent program and emailed electronic surveys. Personnel with Biosafety Level 3 enhanced (BSL-3E) laboratory access were surveyed. Descriptive analysis was performed (SAS 9.3).

Results: Overall, 131 responses were received from 33 principal investigators, 26 research scientists, 24 technicians, 15 postdoctoral fellows, 6 students, and 27 others. The response rate was 20% among the labs of responding PI's. Forty-five percent of respondents spent ≥4 hours per week in the BS-3E area. Overall, 48% were interested in receiving a H5N1 vaccine. By role, interest was highest among students (80%) and by time, among those who spent >50% of their time in a BSL-3E area (64%). Most (59%) of those who said they might or did not have vaccine interest believed it would not provide additional protection to current safety practices.

Conclusions: Half of responding laboratory workers were interested in HPAI vaccines. HPAI vaccination of laboratory workers at risk of occupational exposure could be used alongside existing safety practices to protect this population.

P2.10 High Rates of Active Tuberculosis Among Immigrants from the Philippines — Hawaii, 2010–2014

Authors: Kristine M. Schmit, R. Brostrom, A. Pyan, A. Largen, Z. Wang, S. Mase, S. Morris

Background: Immigrants to the United States undergo preimmigration evaluation for tuberculosis (TB): test for infection, chest radiograph, sputum evaluation. Immigrants whose chest radiographs are abnormal but whose cultures test negative are considered disease-free and allowed to immigrate, but are more likely to be diagnosed with disease after arrival. These immigrants are instructed to undergo postimmigration evaluation. Hawaii noted high rates of TB disease among Filipino immigrants with abnormal preimmigration screening results. We compared disease rates among such Filipino immigrants to Hawaii with national rates and assessed differences in rates of postimmigration evaluation.

Methods: Because Hawaii did not routinely report data nationally, we used local surveillance data to determine rates in Hawaii; nationwide rates (excluding Hawaii) were based on national surveillance data. For all Filipino immigrants with abnormal pre-immigration screening results during 2010–2014, we used chi-square tests to compare rates of diagnoses of TB disease ≤1 year after arrival and postimmigration evaluation.

Results: In Hawaii, TB disease was diagnosed for 44 of 1,618 (2.7%) Filipino immigrants with abnormal preimmigration screening results ≤1 year after arrival, compared with 179 of 15,232 (1.2%) nationwide (P <.001); 1,618 of 1,681 (96.3%) were evaluated ≤1 year of arrival, compared with 15,232 of 21,128 (72.1%) nationwide (P <.001). All such immigrants to Hawaii received a chest radiograph compared with 13,438 of 15,232 (88.2%) nationwide.

Conclusions: During 2010–2014, among Filipino immigrants with abnormal preimmigration screening results, rates of diagnosed TB disease ≤1 year after arrival were over twice that of similar immigrants nationwide. A significantly greater proportion of such immigrants to Hawaii received postimmigration evaluation, including chest radiograph, which suggests missed opportunities for diagnosing TB in this population outside Hawaii.

P2.11 Healthcare-Associated Legionnaires' Disease — United States, 2014

Authors: Elizabeth A. Soda, A. Barskey, P. Shah, L. Cooley

Background: *Legionella*, the bacterium causing Legionnaires' disease (LD), a severe pneumonia, can be transmitted through a building's water system. However, transmission is preventable through environmental infection control. Healthcare facilities with vulnerable populations pose known risks for *Legionella* transmission, but the burden of healthcare-associated LD is unknown. We used national reporting data to describe the burden and outcomes of potentially healthcare-associated LD.

Methods: We analyzed data from 12 states that included comprehensive exposure data for ≥95% of legionellosis cases reported to CDC in 2014. We defined confirmed cases as those meeting Council of State and Territorial Epidemiologists criteria. Potentially healthcare-associated cases reported inpatient, outpatient, visitor/volunteer, or work-related exposures to healthcare facilities during some portion of the ten days before illness onset. Case-fatality rates (CFRs) were compared using Fisher's exact test.

Results: We identified 1,181 confirmed cases (1.8/100,000 population), of which 243 (20.6%) were potentially healthcare-associated. CFR was higher for potentially healthcare-associated cases (10.3%) than for non-healthcare-associated cases (5.3%; P < .01). Among potentially healthcare-associated cases, 112 (46.1%) reported inpatient exposures (CFR 14.3%); 77 (31.7%) reported outpatient visits (CFR 9.1%); 25 (10.3%) reported visitor/volunteer visits (CFR 0.0%); and 16 (6.6%) reported employee visits (CFR 0.0%). Ten (4.1%) reported >1 type of exposure (CFR 10.0%).

Conclusions: LD in those with healthcare exposures accounted for a substantial proportion of the total reported LD burden. Among persons with potentially healthcare-associated LD, patients experienced higher mortality than non-patients. New guidance for water management practices is available to reduce the risk of *Legionella* transmission in buildings with complex water systems including healthcare facilities.

P2.12 Evaluation of the Case Definition for Suspected Yellow Fever Deaths in an Outbreak Setting — Angola, 2016

Authors: Anna Q. Yaffee, G. Appiah, E. Manuel, J. Kipela, J. Kaiywa, E. Hunsperger, R. Arthur, T. Doyle

Background: Starting in December 2015, Angola experienced an unprecedented outbreak of yellow fever (YF). Early in the outbreak, many suspected cases were reported, but true burden of YF was unclear as clinical diagnosis relied on nonspecific symptoms of fever and jaundice. Accurate YF diagnosis is challenging in settings such as Angola, where endemic diseases have similar clinical presentation (e.g., malaria) and there is limited laboratory capacity. To more fully understand true YF burden in Angola, we evaluated clinically-diagnosed YF deaths to assess feasibility of excluding patients positive for other infections from the surveillance case definition.

Methods: In March 2016, we abstracted charts for clinically-diagnosed YF deaths from 5 tertiary hospitals in Luanda Province to determine if the case met World Health Organization's (WHO) suspected YF case definition of fever and jaundice <14 days of symptom onset. We cross-referenced infectious disease testing results in hospital and Ministry of Health laboratory databases.

Results: Of all 101 clinically-diagnosed YF deaths, 86 (85%) met WHO's suspected YF case definition. Only 9 of 86 patients (10%) had YF testing; 3 (33%) were confirmed positive. Forty-eight patients were tested for malaria by smear or rapid diagnostic test; 26 (54%) were positive for malaria, and 2 were also Widal positive for typhoid. Two of 3 laboratory-confirmed YF patients were also positive for malaria.

Conclusions: Applying a more specific case definition excluding deaths laboratory-positive for other infections would have excluded confirmed YF cases from consideration as suspected cases. YF deaths with coinfections would also be missed. To capture all possible YF cases to guide outbreak response, we recommended continued use of existing WHO case definition, improved diagnostic capacity and increased YF testing.

SPECIAL SESSION 2: Zika Virus Infection

11:50 AM–1:05 PM

3rd Floor Room 203 AB

Moderators: Steve Monroe and Robert Tauxe

Sponsor: National Center on Birth Defects and Developmental Disabilities (NCBDDD), National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP), National Center for Emerging and Zoonotic Infectious Diseases (NCEZID)

This session will cover CDC's response to the Zika virus outbreak in the Americas, with a focus on the risks to pregnant women and babies.

Relevance and Appropriateness for the EIS conference

In 2016, CDC recognized the causal link between Zika virus infection during pregnancy and brain abnormalities and microcephaly, and growing evidence of an association with other birth defects, including eye abnormalities and arthrogryposis. CDC activated its Emergency Operation Center (EOC) to respond to the Zika virus outbreak on January 22, 2016, and the EOC is still activated. CDC has worked closely with state, local, tribal, and territorial partners to prevent Zika virus infections during pregnancy, to implement surveillance of pregnant women and their infants with evidence of possible Zika virus infection during pregnancy, to create and distribute innovative tests to improve diagnostics, and to respond to local transmission of Zika virus in the United States. Throughout the response, EIS officers have played a central role in rapidly responding to this public health emergency.

Speakers

- Accomplishments in the first 15 months of the Zika Response (10 min)
  Denise Jamieson, MD, Incident Manager, CDC Zika Response
- Zika virus disease: epidemiology and response (10 min)
  Susan Hills, MBBS Medical Epidemiologist, Arboviral Diseases Branch, NCEZID
- Zika and pregnancy: surveillance and research activities in the U.S. states and territories, and Colombia (20 min).
  Margaret Honein, PhD Branch Chief, Birth Defects Branch, NCBDDD, Dana Meaney-Delman, MD Medical Officer, NCEZID Co-Leads, Pregnancy and Birth Defects Task Force, CDC Zika Response
- Perspective on Zika virus response from NYC (10 min)
  Annie Fine, MD New York City Department of Health & Mental Hygiene

CONCURRENT SESSION K1: Healthcare-Associated Outbreaks

1:15–3:00 PM

Frieden Plenary

Moderators: Mike Bell and Isaac See

1:20 Careful of the Wound: Group A *Streptococcus* Outbreak in a Skilled Nursing Facility — Chicago, 2015–2016

Authors: Sana S. Ahmed, K. Diebold, J. Brandvold, W. Clegg, S. Ewaidah, R. Leidig, S. Kemble, S. Black, A. Ogundimu, B. Beall, N. Stone, C. Van Beneden

Background: Older adults living in nursing homes are vulnerable to severe group A *Streptococcus* (GAS) infections; approximately one-third of those affected die. From July 2015-January 2016, the Chicago Department of Public Health (CDPH) identified 4 severe GAS infections among residents with wounds at a skilled nursing facility. Despite use of antibiotic prophylaxis, additional infections occurred. In March 2016, CDPH requested an Epi-Aid to evaluate risks related to wound care and recommend prevention measures.

Methods: We defined cases as lab-confirmed GAS infections in residents. We conducted a case-control study among residents with wounds, matching residents without GAS infection to case-residents by age and facility stay (within 15 days from case culture); P-values were calculated using conditional logistic regression. Using direct observation, we evaluated wound care and infection control practices. We placed agar plates adjacent to 5 residents during wound care to assess possible GAS dissemination.

Results: From July 2015–March 2016, 7 resident cases were detected. Compared to controls, case-residents more often received negative pressure wound therapy (NPWT) (86% [6/7]) vs. 10% [2/21]; mOR and P=undefined), and treatment with antimicrobial wound cream (57% [4/7] vs 5% [1/14]; mOR 12.0; P=0.03). Inadequate hand hygiene following resident contact and inconsistent personal protective equipment (PPE, e.g., gowns, clean gloves) use were observed during wound care. Agar plates placed near one resident during wound care grew GAS.

Conclusions: Inadequate infection control practices and local environmental contamination with GAS during wound care likely contributed to GAS transmission, particularly among those receiving NPWT. This could result in colonization, infection, or transient hand contamination of health-workers. Reinforcing infection control practices, including hand hygiene and appropriate PPE use, may reduce wound care-associated GAS transmission.

1:40 Fungal Bloodstream Infections Associated with Substandard Compounding Practices at an Outpatient Oncology Practice — New York City, 2016

Authors: Amber M. Vasquez, N. Chow, S. Vallabhaneni, S. Ngai, C.T. Lee, K. Perkins, J. Lake, M.S. Keckler, H. Moulton-Meissner, S. Elkind, J. Haas, D. Zavasky, J. Greenko, E. Adams, A. Litvintseva, T. Chiller, J. Ackelsberg

Background: In May 2016, the New York City (NYC) Department of Health and Mental Hygiene notified CDC of four cases of *Exophiala dermatitidis* bloodstream infections (BSIs) among patients at an outpatient oncology practice (Practice A). *E. dermatiditis* is an environmental fungus and rare cause of BSI. We conducted an investigation to identify possible sources and implement prevention measures.

Methods: A case was defined as any non-*Candida* yeast or mold identified on blood or central venous catheter (CVC) culture from a patient of Practice A during January–May 2016. Case finding included microbiology, medical record review, and screening blood or CVC cultures for patients who received intravenous medications at Practice A. A cohort analysis was performed to determine risk factors for infection. Whole genome sequencing (WGS) was performed on isolates and infection control practices were assessed.

Results: Seventeen cases of *E. dermatitidis* or *Rhodotorula mucilaginosa* BSIs were identified among 38 patients exposed to intravenous medications. The only common exposure among cases was an intravenous flush solution compounded at Practice A. Case-patients received a median of 12 flushes (range=2–20) compared with four flushes for noncases (range=1–12) (p=0.004). WGS of 14 *E. dermatitidis* case-isolates showed 0-2 single nucleotide polymorphism (SNP) differences between isolates from case-patients unrelated isolates from NYC had >100,000 SNP differences from case-isolates. Substantial lapses in infection control and medication compounding standards were found.

Conclusions: The likely source of this outbreak was a contaminated compounded intravenous flush solution. Practice A ceased operations until lapses in infection control and medication preparation were corrected. This outbreak highlights gaps in knowledge of and adherence to infection control and sterile medication preparation standards in some outpatient oncology settings.

2:00 Nontuberculous Mycobacteria Infections Among Breast Plastic Surgery Patients — Hospital A, South Carolina, 2014–2016

Authors: Kimberly A. Skrobarcek, A. Vasquez, C. Margus, M. Arduino, L. Bell, I. Benowitz, L. Bullard, M. Crist, H. Houston, H. Moulton-Meissner, P. Kopp, R. Radcliffe, K. Richardson, N. Shrivastwa, J. Perz

Background: Nontuberculous mycobacteria (NTM) are environmental bacteria that have been increasingly implicated in cosmetic surgical site infections (SSIs) worldwide. In October 2016, South Carolina Department of Health and Environmental Control requested assistance identifying risk factors and control measures for an outbreak of NTM infections primarily among reconstructive breast plastic surgery (BPS) patients.

Methods: We conducted a case-control study of Hospital A patients who underwent BPS from January 2014–October 2016. Case-patients had SSIs with positive or pending NTM cultures. Controls, time-matched 3:1 to case-patients, had no or negative NTM cultures. We evaluated infection control practices (ICP) and conducted environmental assessments.

Results: We identified 17 case-patients and 51 controls. Three NTM species were identified among case-patients. Statistically significant risk factors (P<.05) included various surgery types, surgery duration (median: 5.1 hours for case-patients, 2.5 hours for controls), operating room staff number (median: 9 for case-patients, 7 for controls), and overnight admission (16/17 case-patients, 26/51 controls). In multivariable analysis, only surgery duration was significant. ICP review identified lapses in aseptic technique (e.g., breaks in sterile surgical field) and high traffic in/out of operating rooms. In hospital water, total bacterial counts were 10^3–10^6 colony-forming units (CFU)/mL, exceeding Environmental Protection Agency's drinking water standards, <500 CFU/mL. Four NTM species grew in 25/37 environmental samples; only *Mycobacterium chelonae* was common between clinical and environmental isolates.

Conclusions: Risk of NTM infection in BPS patients increased with longer surgery duration. An environmental source was likely given that SSIs involved multiple NTM species and hospital water samples yielded NTMs and elevated bacterial colony counts. Effective water management and strict adherence to ICP are needed to interrupt potential water exposure pathways and prevent SSIs.

2:20 Cluster of *Pseudomonas* Infections Among Neonatal Intensive Care Unit Patients — Maryland, 2016

Authors: Mark K. Weng, R. Brooks, J. Glowicz, M. Keckler, B. Christensen, V. Tsai, L. Wilson, R. Laxton, H. Moulton-Meissner, R. Fagan

Background: *Pseudomonas aeruginosa* (PA) is common in healthcare environments and is a leading cause of serious healthcare-associated infections in neonatal intensive care unit (NICU) settings. From March–October 2016, nine confirmed cases (two deaths) of PA occurred in a neonatal intensive care unit (NICU) at a Maryland hospital, resulting in its closure. Earlier testing showed high burden of PA in facility water. We investigated possible transmission pathways and identified potential control measures.

Methods: We interviewed hospital leadership and NICU staff and performed targeted observations of infection prevention practices in the NICU and other hospital areas. These observations guided environmental sampling in the NICU. Pulsed field gel electrophoresis (PFGE) was used to compare clinical and environmental isolates.

Results: Observed risks included staff inadequate hand hygiene and procedures for cleaning of sinks, equipment, and breast milk collection supplies in the NICU. PA was isolated from stored breastmilk, tap water post-filtration, and staff bathroom and breakroom sinks. PA isolates from two patients and two sinks in the NICU were indistinguishable by PFGE, while a breastmilk isolate was closely related to a PA isolate from a third patient.

Conclusions: PA transmission from contaminated hospital water sources to patients could have occurred via several pathways. Recommendations included improving hand hygiene, supplemental measures to decrease PA concentrations in the hospital water system, avoidance of using tap water for cleaning equipment, and revised cleaning procedures for sinks, patient care and breastfeeding equipment in the NICU. PA surveillance should be conducted prospectively to help evaluate the effectiveness of these control measures.

2:40 *Burkholderia cepacia* Bloodstream Infections Among Skilled Nursing Facility Residents — United States, 2016

Authors: Richard B. Brooks, P. Mitchell, J. Miller, M. Crist, A. Vasquez, J. Havlicek, M. Quinn, I. Daskalaki, R. Greeley, K. Ross, H. Lee, R. Perlmutter, D. Baker, A. Longenberger, C. Bicking Kinsey, J. Walrath, E. Adams, H. Moulton-Meissner, S. Watkins, D. Blythe, K. Feldman, L. Wilson

Background: On September 22, 2016, Maryland Department of Health and Mental Hygiene was notified of 4 *Burkholderia cepacia* bloodstream infections among skilled nursing facility (SNF) residents receiving intravenous therapy. Multistate notification occurred on September 28; clusters were reported in 4 additional states. We sought to determine outbreak scope, identify source, and prevent additional cases.

Methods: Cases were initially defined as blood cultures yielding *B. cepacia* in SNF residents receiving intravenous therapy after August 1. Jurisdictional health alerts were disseminated to aid case finding. We abstracted patient medical records and visited affected SNFs in 2 states in late September to identify possible infection sources. Suspect products were cultured; patient and product isolates were typed by using pulsed-field gel electrophoresis (PFGE).

Results: All patients resided at SNFs supplied by Pharmacy A, which began distributing saline flushes from Manufacturer X on September 1. By using an updated case definition requiring residence at an SNF using Manufacturer X flushes, we identified 153 cases from 57 facilities in 5 states with first positive blood cultures during September 10–November 11. On October 3, *B. cepacia* was isolated from unopened Manufacturer X saline flushes obtained from an affected facility. PFGE patterns were indistinguishable in 111/127 (87.4%) patient isolates from all 5 states and 6/7 (85.7%) product isolates. A second PFGE pattern from 1/7 (14.3%) product isolates and 8/127 (6.3%) patient isolates differed by 1 band. Implicated products were recalled on October 4.

Conclusions: Epidemiologic and laboratory evidence indicates contamination of saline flushes produced by Manufacturer X was the outbreak source. Investigation into the cause of contamination and surveillance for additional cases is ongoing.

CONCURRENT SESSION K2: Environmental Health

1:15–3:00 PM

Concurrent Session Room

Moderators: Patrick Breysse and Suzanne Beavers

1:20 My Old Kentucky Home: Arsenic Contaminated Soil in a Kentucky Neighborhood and Response, 2016

Authors: Anna Q. Yaffee, B. Scott, C. Kaelin, J. Cambron, W. Sanderson, J. Chamness

Background: Exposure to arsenic can occur through ingestion or inhalation of contaminated soil, increasing risk for cancer and other chronic health outcomes. A residential neighborhood in Kentucky located on a former lumber treatment facility site was found to have elevated levels of soil arsenic from improper disposal of lumber treatment waste. Emergency response was undertaken to conduct an exposure assessment.

Methods: To identify exposure risk factors we administered an in-person survey to all residents; parents provided response for children. Arsenic level was analyzed in washed nail clipping samples self-collected from residents and residential soil samples. We used Pearson correlation (R) and Wilcoxon-Mann-Whitney tests to assess association between arsenic level and exposures..

Results: All 84 (100%) persons in all 19 households were surveyed. Seventy-six persons provided toenail samples; among 70 who had adequate mass for analysis, median age was 25 years (range: 1–68 years). Median arsenic in toenail samples was 0.42 micrograms/gram (µg/gm) (range: 0.04–6.97 µg/gm), twice the expected level of ≤0.2 µg/gm. Age was inversely correlated (R = –0.33, P = 0.01) and mean residence soil arsenic level positively correlated (R = 0.30, P = 0.01) with elevated toenail arsenic level. Playing sports outdoors (n=37) was positively associated (P = 0.03) with higher toenail arsenic levels

Conclusions: : Living in areas with high soil arsenic contamination can lead to increased exposure; younger age, playing sports outdoors, and elevated residence soil arsenic level were associated with elevated toenail arsenic level. Correlation between younger age and higher arsenic levels is possibly attributable to soil exposure through activities. Due to ongoing remediation efforts, recommendations to residents include moving from the contaminated environment and regular health care follow-up.

1:40 Project Coyote Water: Assessment of Unregulated Drinking Water on Tribal Lands Within the United States — January 2015–March 2016

Authors: Gamola Z. Fortenberry, E. Taylor, G. Goodwin, K. Hickel, J. Temtel

Background: Approximately 30,000 American Indian/Alaska Native homes lack potable water. Consequently, tribal communities may rely more on unregulated water sources (UWS) than other communities in the United States. However, little research has been done to substantiate these estimates. To better characterize UWS use, the National Tribal Water Center and CDC's Health Studies Branch collaborated on Project Coyote Water, a survey to assess use of UWS within tribal communities, identify motivators for UWS use, and describe educational and outreach activities on tribal lands.

Methods: A targeted sample of Indian Health Service (IHS) and tribal environmental health employees from the 12 IHS areas across the United States were surveyed about tribal household UWS use, water quality concerns, and outreach activities in their area using a standardized questionnaire. Descriptive statistics were used to analyze survey data.

Results: At least one IHS and one tribal participant were interviewed in each IHS area for a total of 44 employees (18 IHS and 26 tribal organizations). UWS use among households was reported by 95% of survey participants for their area. Additionally, 57% of participants reported UWS consumption by households even when regulated water was available. Reported household motivations for UWS consumption included trust or perception of water quality (57%), inexpensive cost (35%), and culture or tradition (35%). Lastly, 60% of participants reported a local well testing program for their area.

Conclusions: Project Coyote Water found nearly all participants reported some UWS use by tribal households in their area and many reported UWS use when regulated water was available. Preliminary data allows for design of a strategic plan and additional testing to address public health concerns regarding UWS use in tribal communities.

2:00 Secondhand Exposure to E-Cigarette Aerosol in Public Places: Findings from the 2015 National Youth Tobacco Survey

Authors: Teresa W. Wang, K. Marynak, I. Agaku, B. King

Background: Although secondhand aerosol (SHA) from e-cigarettes can contain nicotine and other potentially harmful substances, the extent of exposure among U.S. youth is unknown. We assessed prevalence and correlates of exposure to SHA in public places among U.S. youth.

Methods: Data came from the 2015 National Youth Tobacco Survey, a nationally representative school-based survey of U.S. middle and high school students in grades 6–12 (n = 17,711). Self-reported SHA exposure was defined as any response other than "0 days" to the question, "During the past 30 days, on how many days did you breathe the vapor from someone who was using an electronic cigarette or e-cigarette in an indoor or outdoor public place?" Point estimates were calculated overall and by sex, race/ethnicity, school grade level, e-cigarette use, other tobacco product use, and secondhand tobacco smoke exposure. Adjusted prevalence ratios (aPRs) were calculated using multivariate Poisson regression.

Results: Overall, 24.2% (95% confidence interval: 22.5%-25.9%) of students reported SHA exposure. The likelihood of SHA exposure was lower among non-Hispanic blacks than among non-Hispanic whites (aPR: 0.75; P< .05). The likelihood was higher among: females (aPR: 1.10; P< .05); past 30-day current (aPR: 2.71) and former (aPR: 1.29) e-cigarette users than never users (P< .05); and current (aPR: 1.30) and former (aPR: 1.27) users of other tobacco products than never users (P< .05). Furthermore, SHA exposure was more likely among students who also reported secondhand smoke exposure (aPR: 3.49; P< .05).

Conclusions: Approximately 1 in 4 U.S. students (6.5 million) reported past 30-day SHA exposure. Efforts are warranted to include e-cigarettes in comprehensive smoke-free policies, and to educate parents, youths, and caregivers about the potential harms of SHA.

2:20 The Burden of Asthma: Healthcare Use Patterns and Asthma Triggers — Puerto Rico, 2013

Authors: Lillianne M. Lewis, M. Mirabelli, S. Beavers, M. Lozier, J. Morales Gonzalez, C. Kennedy, J. Shriber, D. Stearns, M. Soto Santiago, J. Irizarry Ramos, K. Sircar, B. Rivera-García, B. Bolaños

Background: Asthma carries a substantial burden of disease in Puerto Rico (PR); prevalence is 14% among children and 11% among adults. However, limited information is available concerning the public health burden of asthma-related healthcare use patterns. To better understand populations accessing emergent and ambulatory healthcare for asthma and to identify risk factors and magnitude for asthma-related healthcare use, we examined asthma claims and potential asthma triggers in PR.

Methods: By using all 2013 reported PR emergency department (ED), hospital, and outpatient asthma insurance claims (N = 550,655), we analyzed demographic characteristics associated with asthma healthcare use (primary diagnostic ICD-9-CM code 493.*). We examined associations between environmental triggers and healthcare use by using daily mold and pollen measurements from the San Juan Allergen Bureau. Descriptive statistics were performed.

Results: During 2013, 148 asthma claims/1,000 persons were reported. Regional asthma claim rates ranged from 72/1,000 persons (Ponce) to 142/1,000 persons (Caguas) with an overall rate of 108/1,000 persons across all regions. Among asthma claims, 71% were outpatient visits, 19% were hospitalizations, and 10% were ED visits. Females (63%), children aged <10 years (77% among children), and adults aged >44 years (80% among adults) accounted for a majority of asthma claims. In San Juan, 35% and 52% of mold and pollen levels, respectively, were ranked as high or very high on the location-specific allergen bureau scale. Decreases in asthma claims and pollen levels were noted from May–July.

Conclusions: This study demonstrates that females, children, and certain adults carry the highest burden of asthma-related healthcare use in PR. These findings can be used to target public health messaging and interventions to these populations, specifically in ED and hospital settings.

2:40 Community Assessment for Public Health Emergency Response (CASPER) After the Flint Water Crisis — Flint, Michigan, 2016

Authors: Alice Wang, G. Fortenberry, P. Reynolds, S. Burrer, V. Johnson-Lawrence, A. Schnall, P. Pullins, S. Kieszak, T. Bayleyegn, A. Wolkin

Background: In April 2014, Flint, Michigan changed their municipal water supply, which resulted in corrosion of distribution pipes, and leaching of lead into municipal drinking water; this prompted an official advisory not to drink unfiltered municipal water. To assist with Flint Water Crisis recovery efforts, Flint Community Resilience Group and CDC assessed physical and behavioral health concerns of the community.

Methods: In May 2016, we used a three-stage cluster sampling design to conduct a Community Assessment for Public Health Emergency Response. The questionnaire elicited information about household- and individual-level physical and behavioral health concerns since the Flint Water Crisis. Individual-level behavioral health questions were adapted from the Behavioral Risk Factor Surveillance System (BRFSS). We conducted weighted cluster analysis with 95% confidence intervals (CI), and compared individual-level results to 2014 Michigan BRFSS findings.

Results: We completed 182 questionnaires (completion rate=86.7%). Of households, 50.5% (CI: 43.4–57.5) reported worsened physical health of at least one household member. Half (50.0%, CI: 41.8–58.3) the households reported a lot of stress related to feeling overlooked by decision-makers. Of individuals, 29.6 % (CI: 21.2–38.0) self-reported depressive symptoms, and 33.7% (CI: 25.5–41.8) self-reported symptoms of anxiety. Of individuals, 38.0% (CI: 31.6–44.4) reported having poor mental health for 14 or more days within the last 30 days, compared to 12.9% (CI: 11.9–14.0) reported in the Michigan BRFSS.

Conclusions: The percentage of those reporting behavioral health concerns was approximately three times higher than reported by Michigan BRFSS. The increased percentage reporting negative quality of life indicators and considerable percentage reporting symptoms of depression and anxiety supported the addition of behavioral health interventions and follow-up surveillance to ongoing recovery efforts.

SESSION L: Alexander D. Langmuir Lecture

3:15–4:45 PM

Freiden Plenary Room

Moderator: Patricia Simone

Presentation of the Alexander D. Langmuir Prize Manuscript Award and the Distinguished Friend of EIS Award

Moving from Epidemiology to Quantitative Population Health Science

Speaker: Sandro Galea, MD, MPH, DrPH

Sandro Galea
MD, MPH, DrPH

Biography

Dr. Sandro Galea is a physician and an epidemiologist. He is the Robert A. Knox Professor and Dean at the Boston University School of Public Health. Prior to his appointment at Boston University, Dr. Galea served as the Anna Cheskis Gelman and Murray Charles Gelman Professor and Chair of the Department of Epidemiology at the Columbia University Mailman School of Public Health. He previously held academic and leadership positions at the University of Michigan and at the New York Academy of Medicine.

In his scholarship, Dr. Galea is centrally interested in the social production of health of urban populations, with a focus on the causes of brain disorders, particularly common mood-anxiety disorders and substance abuse. He has long had a particular interest in the consequences of mass trauma and conflict worldwide, including as a result of the September 11 attacks, Hurricane Katrina, conflicts in sub-Saharan Africa, and the American wars in Iraq and Afghanistan. This work has been principally funded by the National Institutes of Health, Centers for Disease Control and Prevention, and several foundations. He has published over 600 scientific journal articles, 50 chapters, and 10 books and his research has been featured extensively in current periodicals and newspapers. His latest book, co-authored with Dr. Katherine Keyes, is Population Health Science, forthcoming from Oxford University Press in 2016.

Dr. Galea has a medical degree from the University of Toronto, and graduate degrees from Harvard University and Columbia University; he has an honorary doctorate from the University of Glasgow. He was named one of TIME magazine's epidemiology innovators and has been listed by Thomson Reuters as one of the "World's Most Influential Scientific Minds" for the Social Sciences. He is past-president of the Society for Epidemiologic Research and an elected member of the National Academy of Medicine and of the American Epidemiological Society.

Dr. Galea serves frequently on advisory groups to national and international organizations. He currently serves on the Advisory Council on Minority Health and Health Disparities and has formerly served as chair of the New York City Department of Health and Mental Hygiene's Community Services Board and as member of its Health Board.

Awards presented during session.

SESSION M: FETP International Night — Oral Presentations

6:30–9:00 PM

Concurrent Session Room

Agenda provided during session

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CONCURRENT SESSION N1: Respiratory Diseases

8:30–9:55 AM

Frieden Plenary

Moderators: Mark Pallansch and Lindsay Kim

8:35 Neighborhood-Level Poverty, Poverty-Associated Factors, and Severe Outcomes Among Adults Hospitalized with Influenza — United States, 2012–2015

Authors: Rebekah S. Schicker, K. Yousey-Hindes, M. Rolfes, C. Cummings, E. Anderson, M. Bargsten, N. Bennett, S. Eckel, K. Lung, M. McMahon, L. Miller, M. Monroe, I. Risk, W. Schaffner, A. Thomas, J. Watt, S. Zansky, C. Reed, A. Fry, S. Garg

Background: Recent studies demonstrated higher influenza-associated hospitalization rates among individuals living in high-poverty neighborhoods. We explored the further impact of neighborhood-level poverty and individual, poverty-associated factors, on severe outcomes among hospitalized patients with influenza.

Methods: We linked 2012–2015 data on hospitalized adults from the influenza hospitalization surveillance network, by census tract, to American Community Survey's federal poverty estimates. High-poverty neighborhoods were census tracts with ≥20% of households in poverty and low-poverty neighborhoods, <5%. We explored univariate associations between neighborhood-level poverty and influenza vaccination, tobacco use, alcohol abuse, and extreme obesity. Using logistic regression and clustering by census tract, we examined the independent association of these factors with intensive care unit (ICU) admission and death, controlling for age, race, sex, comorbid conditions, antiviral treatment, season, and time from symptom onset to hospitalization.

Results: Among 26,106 patients, 4,194 (16%) had ICU admission and 669 (3%) died. Those who currently used tobacco, abused alcohol, were extremely obese, or unvaccinated were more likely to live in high-poverty (38%, 40%, 37%, 33%) than low-poverty neighborhoods (12%, 13%, 13%, 16%; P<.01). Living in a high-poverty neighborhood was not independently associated with ICU admission (OR: 0.97, CI: 0.87–1.10) or death (OR: 0.82, CI: 0.63–1.08). Being unvaccinated (OR: 1.24, CI: 1.15–1.35), tobacco use (OR: 1.31, CI: 1.19–1.45), and alcohol abuse (OR: 1.68, CI: 1.41–2.00) increased odds of ICU admission; extreme obesity increased odds of death (OR: 1.35, CI: 1.02–1.78).

Conclusions: Poverty-associated factors, but not neighborhood-level poverty, were independently associated with severe outcomes among patients hospitalized with influenza. Increased vaccination and reductions in tobacco use, alcohol abuse, and extreme obesity could reduce severe influenza-associated outcomes.

8:55 Influenza-Associated Pediatric Deaths in the United States, 2010–2016

Authors: Mei Shang, L. Blanton, S. Olsen, A. Fry, L. Brammer

Background: Influenza-associated pediatric deaths became a national notifiable condition in the U.S. in 2004. We described influenza-associated pediatric deaths after the 2009 pandemic, from 2010–11 through 2015–16.

Methods: Deaths in children aged <18 years with laboratory-confirmed influenza were reported to CDC on a standard case report form with data on demographic characteristics, medical conditions, laboratory testing, and clinical diagnosis. We estimated rates using population estimates from the U.S. Census Bureau and compared the characteristics of children between those with preexisting conditions and those without. We used a Wilcoxon rank-sum test to compare medians and a Chi-square test to compare proportions.

Results: From 2010–11 through 2015–16, 675 deaths were reported (annual range: 37–171). The median age was 6 years (interquartile range: 2–12). The average annual incidence rate was 0.15 per 100,000 children (95% confidence interval [CI]: 0.14–0.16) and was highest among children aged <6 months (0.66; 95% CI: 0.53–0.82), followed by children 6–23 months (0.33; 95% CI: 0.27–0.39). Only 22% (105 / 477) of children ≥6 months had evidence of full vaccination. Half of the deaths (324 / 654) were in children without preexisting condition. These children were younger (5 years), less likely to be vaccinated (17%) and to be admitted to a hospital (48%), but died quicker (4 days) than children with preexisting conditions (8 years; 27%; 77%; 7 days; P <.01 for all).

Conclusions: Influenza-associated pediatric deaths occurred in the U.S. every year. Children <2 years had the highest mortality rate. Influenza vaccination coverage was very low among children who died. Increasing influenza vaccination among pregnant women and children might decrease influenza-associated pediatric deaths.

9:15 Epidemic Keratoconjunctivitis Outbreak Due to Human Adenovirus Type 8 — U.S. Virgin Islands, 2016

Authors: Marie E. Killerby, M.J. Stuckey, I. Guendel, S. Sakthivel, X. Lu, D. Erdman, R. Fagan, M.S. Davis, J. Watson, S. Gerber, H. Biggs, E.M. Ellis

Background: Epidemic keratoconjunctivitis (EKC) is caused by human adenoviruses (HAdV); outbreaks have been linked to eye-care settings. In October 2016, increased cases were reported in St. Thomas, US Virgin Islands. We investigated factors associated with infection and provided infection control recommendations.

Methods: A case was defined as a clinical diagnosis of acute conjunctivitis by an ophthalmologist or optometrist in a patient in St. Thomas during June 1–November 10, 2016. Medical records were reviewed and conjunctival swabs from patients and environmental samples from high-contact surfaces and eye-care equipment were tested for HAdV using real-time PCR.

Results: We identified 70 patients who met the case definition; of 12 tested for HAdV, 9 (75%) were positive for HAdV type 8. Median age was 46 years (range, 9 months–90 years); 27 (39%) were male. Ocular symptoms included redness (66%), watery

Conclusions: During this community outbreak of HAdV, prior practice visits among patients and positive environmental samples from eye-care clinics suggested healthcare-associated transmission. Recommendations included implementation of strict infection control practices in healthcare settings, advising patients on HAdV infection prevention, and enhanced EKC surveillance to detect additional transmission.

9:35 Differences in Pneumococcal Carriage and Serotype Distribution Between Children With and Without Pneumonia — Maputo, Mozambique, 2014–2016

Authors: Tolulope A. Adebanjo, B. Sigauque, A. Chauque, H. Mucavele, B. Moiane, S. Massora, F. Pimenta, M.G. Carvalho, C. Whitney, F.C. Lessa

Background: Pneumococcal pneumonia causes 280,000 deaths among children aged <5 years annually in Africa. In April 2013, Mozambique introduced a vaccine targeting 10 pneumococcal capsular serotypes (PCV10) to reduce this burden. Since nasopharyngeal (NP) pneumococcal carriage is a precursor for pneumonia, we evaluated whether children with pneumonia were more likely to carry pneumococcus and vaccine-type (VT) pneumococcus compared to children without pneumonia.

Methods: From 2014–2016, we recruited from hospitals in urban and rural sites children born after December 10, 2012, with X-ray confirmed pneumonia based on World Health Organization guidelines. Children without pneumonia were recruited from the same communities and HIV clinics. For each child, we collected clinical data and an NP swab for pneumococcal detection and serotyping. We defined VT as serotypes in PCV10. Chi-square was used to compare differences in baseline characteristics and pneumococcal carriage between groups. Multivariable analyses were performed to evaluate the association of pneumonia with overall and VT-pneumococcal carriage.

Results: We enrolled 761 children with and 926 without pneumonia. Children with pneumonia had a lower proportion of pneumococcal carriage (79.1% vs 84.6%, P=.004) and higher proportion of VT-pneumococcal carriage (31.0% vs 23.0%, P=.0002) compared to children without pneumonia. Adjusting for differences in HIV status, site, vaccination status, and antibiotic exposure between the two groups, children with pneumonia had more pneumococcal [adjusted OR (aOR): 1.57, 95% CI: 0.93–2.64] and VT-pneumococcal carriage (aOR: 1.46, 95% CI: 0.93-2.29) than children without pneumonia, but the differences were not statistically significant.

Conclusions: We did not observe a definitive link between pneumococcal and VT-pneumococcal carriage and pneumonia. Other factors, such as host or environmental factors, may play a more important role in disease development.

CONCURRENT SESSION N2: Hepatitis and Tuberculosis

8:30–9:55 AM

Concurrent Session Room

Moderators: Carla Winston and Larry Cohen

8:35 Hepatitis A Outbreak from Imported Frozen Strawberries — 9 States, 2016

Authors: Megan G. Hofmeister, M. Foster, L. Bottichio, K. Neil, A. Fields, Y. Lin, G. Xia, A. Moorman

Background: Hepatitis A virus (HAV) is usually transmitted by the fecal-oral route through person-to-person contact or consumption of contaminated food. In August 2016, the Virginia Department of Health identified a cluster of HAV genotype 1B cases. Virginia, 8 other states that reported cases, the Food and Drug Administration (FDA), and CDC investigated the outbreak and took action to prevent further illness.

Methods: Outbreak-associated cases were detected through routine surveillance and active case finding. Patients completed a hypothesis-generating questionnaire focused on food exposures in the 15–50 days before illness onset. Real-time polymerase chain reaction was used to test for HAV in clinical and food specimens, and traceback was conducted to investigate food items commonly identified in questionnaire responses.

Results: As of December 2016, 139 confirmed and probable cases were identified from 9 states. Median age of case-patients was 33 years (range, 12–70); 78 (57%) were female; 55 (40%) were hospitalized; no deaths were reported. In total, 125/132 (95%) of primarily infected persons reported patronage of restaurant chain A: of these, 109 reported consumption of strawberries in fruit smoothies. Traceback identified an Egyptian supplier of the frozen strawberries, and FDA laboratory testing confirmed the presence of HAV in the frozen strawberries, leading to a voluntary recall of frozen strawberries imported from that firm since January 1, 2016, and issuance of an import alert.

Conclusions: In this fourth-largest-recorded U.S. outbreak of HAV infection, epidemiologic, traceback, and laboratory evidence implicated frozen strawberries from Egypt as the source of many illnesses and hospitalizations, resulting in a nationwide, voluntary recall of the product. New guidelines might be needed to prevent HAV infection from food imported from HAV–endemic countries.

8:55 Increased Incidence of Acute Hepatitis B in a Rural County — Alabama, 2012–2015

Authors: Charlene R. Siza, T. Mckitt

Background: Alabama's acute hepatitis B virus (HBV) infection rates have fluctuated between 1.4 and 2.8 cases/100,000 persons since 1996, despite implementation of national elimination strategies. Through routine surveillance, a rural Alabama county (County X) was identified with a higher rate of acute HBV infection compared with other counties. We conducted an investigation to characterize exposures among County X cases.

Methods: Using data reported to Alabama's National Electronic Disease Surveillance System (NEDSS) from 2012-2015 and population census data, we compared the average 4-year hepatitis B incidence rate in County X with the overall state rate and a demographically similar control county in Alabama. We estimated the prevalence of risk factors, including sexual activity, illegal drug use, exposure to blood, and drug-related arrests among reported cases, from NEDSS and other data sources.

Results: From 2012–2015, the average 4-year incidence rate in County X of 58.2 cases/100,000 persons was significantly higher than Alabama's rate of 8.0 cases/100,000 persons (risk ratio [RR]: 7.3; 95% confidence interval [CI]: 5.2–10.1), and the control county's rate of 24.4 cases/100,000 persons (RR: 2.4; CI: 1.4-4.1). Most frequently reported risk factors in County X included any illicit drug use (26.3%), injection drug use (21.1%), and receiving a tattoo (21.1%). The drug-related arrest rate was significantly higher in County X compared with the state (RR: 1.4; CI 1.2-1.6) and control county (RR: 2.9; CI: 2.2-3.9).

Conclusions: Although incidence rates of HBV infection in County X were significantly higher than the state as a whole, a well-defined cause was not evident. Based on risk factors reported, illicit drug use presents an area of concern; further efforts to understand these behaviors in County X are warranted.

9:15 Hepatitis C-Associated Mortality Rates Among American Indian/Alaska Natives — Washington, 2009–2014

Authors: Sarah M. Hatcher, S. Joshi, T. Weiser

Background: American Indian/Alaska Native (AI/AN) populations have the highest hepatitis C virus (HCV)-related mortality rate in the United States; disparity in Washington State is unknown. Accurate estimates of HCV mortality are important for resource allocation for screening and treatment. We assessed health disparities in HCV-associated mortality among AI/AN in Washington residents from 2009-2014.

Methods: : We corrected AI/AN race in death certificates by using record linkage with the Northwest Tribal Registry (NTR) – a listing of AI/AN patients treated at Indian Health Service, Tribal, and Urban Indian Health clinics in Idaho, Oregon, and Washington. AI/AN race was classified as a record that was AI/AN on a Washington death certificate or had a match with NTR. HCV-associated deaths were classified by using *International Classification of Diseases,* Tenth Revision codes in the underlying and contributing cause of death fields. We calculated five-year aggregate age-adjusted HCV and HCV-associated mortality rates for AI/AN and non-Hispanic whites (NHW) by using National Center for Health Statistics bridged race estimates standardized to the U.S. 2000 standard population.

Results: The 2009–2014 age-adjusted HCV mortality rate was 9.2/100,000 population (95% confidence interval [CI]: 7.1, 12.2) for AI/AN and 2.7/100,000 (95% CI: 2.5, 2.9) for NHW (rate ratio [RR]: 3.4; 95% CI: 2.7, 4.3). The 2009–2014 age-adjusted HCV-associated mortality rate was 16.4/100,000 population (95% CI: 13.6, 20.1) for AI/AN in Washington, compared with 4.4 (95% CI: 4.1, 4.6) for NHW in Washington (RR: 3.8; 95% CI: 3.2, 4.5).

Conclusions: Washington AI/AN residents have a higher rate of HCV-associated mortality, compared with NHWs. The burden of HCV-associated mortality among AI/AN in Washington highlights the need to expand AI/AN access to HCV screening and treatment.

9:35 Demographic and Clinical Characteristics Associated with Tuberculosis/HIV Comorbidity — United States, 2011–2015

Authors: Kristine M. Schmit, N. Shah, S. Kammerer, S. Morris

Background: Tuberculosis (TB) is a leading cause of death among persons living with HIV (PLWH). Because PLWH with TB disease may not have typical TB symptoms, diagnosing TB through routine screening tests such as tuberculin skin test (TST), interferon gamma release assay (IGRA), and chest radiograph may be difficult, and management complicated. We assessed TB diagnosis and outcomes of TB treatment in PLWH and identified demographic and clinical characteristics associated with TB/HIV in a recent US cohort.

Methods: Data on HIV status and demographic/clinical characteristics of persons diagnosed with TB during 2011–2015 came from the National Tuberculosis Surveillance system. We used logistic regression to calculate adjusted odds ratios and 95% confidence intervals for TB/HIV status, adjusting for potential confounders, including variables previously shown to be associated with TB/HIV.

Results: HIV status was reported for 43,363/48,965 persons, 2,818 (5.4%) of whom were PLWH. Persons with TB/HIV were more likely than persons with TB/non-HIV to be non-Hispanic black (adjusted odds ratio [aOR]: 4.8; 95% confidence interval [CI]: 4.0–5.8) or Hispanic (aOR: 1.6; CI: 1.3–2.0) than to be white. Persons with TB/HIV were also more likely to have a negative TST reaction (aOR: 1.9; CI: 1.2–3.0), a negative IGRA result (aOR: 2.8; CI: 2.3–3.5), or normal chest radiograph interpretation (aOR: 1.9; CI: 1.5–2.2) but were less likely to complete treatment (aOR: 0.5; CI: 0.4–0.6).

Conclusions: Persons with TB/HIV are more likely than persons with TB/non-HIV to have negative results from TB screening tools and less likely to complete treatment, suggesting difficulty in diagnosis and management. Focusing on risk factors associated with TB/HIV comorbidity may help to improve TB diagnosis and care.

CONCURRENT SESSION O1: Foodborne Outbreaks

10:15 AM–12:00 PM

Frieden Plenary

Moderators: Robert Tauxe and Mike Jhung

10:20 Botulism Outbreak at a Federal Correctional Facility — Mississippi, 2016

Authors: Lindsey S. McCrickard, J. Self, M. Marlow, L. Francois Watkins, J. Anderson, S. Hand, K. Taylor, J. Hanson, K. Patrick, C. Luquez, J. Dykes, S. Kalb, K. Hoyt, J. Barr, R. Cox, M. Craig, J. Spurzem, J. Doherty, M. Allswede, P. Byers, T. Dobbs, K. Chatham-Stephens

Background: Botulism is a potentially fatal neuro-paralytic disease caused by toxin from *Clostridium botulinum* bacteria. On June 9, 2016, the Mississippi Poison Control Center and the Mississippi State Department of Health notified CDC of a suspected botulism outbreak in a federal correctional facility. We investigated to determine the source and scope of the outbreak and prevent future outbreaks.

Methods: We interviewed inmates and abstracted medical charts. A confirmed case was defined as cranial nerve palsy in a Prison A inmate beginning on or after June 1, 2016 and botulinum toxin or *C. botulinum* detected in a sample. Illnesses without laboratory confirmation were probable cases if cranial nerve palsy and extremity weakness were present and suspected cases if only cranial nerve palsy were present.

Results: Our investigation identified common exposure to hooch, an illicit prison-brewed alcoholic beverage, among ill inmates. We identified 31 cases (19 confirmed, 10 probable, and 2 suspected); all were men; median age was 36 years (range: 23–47 years). Thirty (97%) reported known exposure to hooch. Twenty-four required hospitalization, and 9 required intubation; duration of ventilator support ranged from 18–75 days. Twenty patients received antitoxin; eleven had mild symptoms not requiring antitoxin. Among 30 patients interviewed, 27 (90%) had never heard of botulism, and 23 (77%) did not know hooch could make them sick.

Conclusions: Hooch was the likely source of this botulism outbreak, the largest in the United States since 1978. Our investigation demonstrates the wide clinical spectrum of botulism. Educating inmates and correctional facility staff on risks associated with hooch could prevent future outbreaks.

10:40 Undetermined Source of *Salmonella* Infantis Infections Among Detention Center Inmates — South Carolina, 2016

Authors: Sarah V. Luna, S.R. Chae, J. Self, K. Waites, L. Bell, J. Chen, A. Bicknese, E. Trees, L. Francois Watkins, C. Friedman, C. Grigg

Background: The emergence of highly antimicrobial-resistant strains of foodborne pathogens is a serious public health threat. A gene conferring clinically-significant 3rd generation cephalosporin resistance, blaCTX-M-65, was identified in a strain (PFGE pattern JGGX01.0787) of *Salmonella* Infantis causing infections among U.S. patients in 2015. In July 2016, CDC was notified of an outbreak of salmonellosis with this strain affecting 126 inmates at a South Carolina detention center. We investigated to identify the source of the outbreak and determine whether this Infantis strain contained the resistance gene.

Methods: We conducted a cohort study and evaluated food handling practices in the detention center. Antimicrobial susceptibility testing and whole genome sequencing (WGS) provided phenotypic and molecular characterization of outbreak isolates, respectively.

Results: Sixty-one symptomatic inmates and 34 asymptomatic inmates were interviewed about exposures to 81 foods. Ten inmates submitted stool samples; 6 were positive for the outbreak strain. Ill inmates reported eating meal items with ground poultry compared to non-ill inmates (94% vs. 88%; P=.18). Temperature violations and inadequate sanitation were observed in the kitchen. WGS showed that inmate isolates were genetically related to the historic Infantis strain from 2012 and a retail chicken isolate, both containing blaCTX-M-65. However, the isolates from this outbreak lacked blaCTX-M-65 and were not resistant to cephalosporins.

Conclusions: Inmate interviews suggested ground poultry as a potential source of this outbreak. However, high inmate turnover limited cohort size, which, in addition to a lack of variety in food exposures, resulted in an underpowered study. None of the outbreak isolates contained blaCTX-M-65 despite grouping closely genetically with historical clinical and chicken isolates with the gene. We provided safe food handling recommendations to prevent future outbreaks.

11:00 Fluoroquinolone-Resistant *Campylobacter jejuni* Infections Associated with Unpasteurized Milk from a Dairy Cow Herdshare — Colorado, 2016

Authors: Alexis W. Burakoff, K. Brown, J. Knutsen, A. Cronquist

Background: On August 23, 2016, the Colorado Department of Public Health and Environment (CDPHE) was notified of *Campylobacter jejuni* isolation in 2 persons who reported consuming unpasteurized milk from the same herdshare dairy. Sale of unpasteurized milk is illegal in Colorado, but it can be legally distributed through a herdshare without regulatory oversight. Increased from past years, in 2014, ~27% of U.S. *Campylobacter* isolates were resistant to ciprofloxacin, a fluoroquinolone. We sought to describe outbreak magnitude and prevent additional cases.

Methods: Probable cases were defined as having diarrhea lasting ≥1 day with onset during August 1–October 7 and known consumption of herdshare unpasteurized milk or an epidemiologic link to a confirmed case; confirmed cases had *Campylobacter* isolation. Cases were identified through passive surveillance and by contacting herdshareholder households. The CDPHE laboratory cultured stool specimens from ill persons and 4 milk samples, and performed pulsed-field gel electrophoresis (PFGE) on 10 patient and 2 milk isolates. CDC performed antimicrobial susceptibility testing on 3 patient isolates.

Results: Ninety-one (53%) of 171 shareholder households responded to telephone interviews. We identified 5 probable and 12 confirmed cases; 1 patient was hospitalized. Confirmed cases were among patients aged 12–68 years (median: 58 years); 9 (75%) were male. *C. jejuni* with the outbreak PFGE pattern was confirmed in 10 patient isolates and 2 milk samples. All 3 isolates tested for antibiotic resistance were resistant to ciprofloxacin.

Conclusions: This fluoroquinolone-resistant *Campylobacter* outbreak was caused by unpasteurized milk from a dairy herdshare. CDPHE notified herdshareholders and cautioned against consuming unpasteurized milk on 3 occasions. Because unpasteurized milk remains available, public health's role is ongoing education about risks associated with unpasteurized milk consumption.

11:20 *Salmonella* Javiana Infections Linked to a Restaurant in Maricopa County — Arizona 2016

Authors: Heather Venkat, T. Sylvester, R. Klein, J. Matthews, J. Collins, N. LaMantia, M. Kellis, M. Tewell, J. Weiss, S. Zusy, P. Lumadao, M. Ricca, B. Caballero, R. Penev, S. Gower, K. Komatsu, R. Sunenshine

Background: On August 10, 2016, the Maricopa County Department of Public Health was notified of culture-confirmed *Salmonella* Javiana isolates from 2 persons who reported eating at Restaurant A. We identified 6 additional cases by August 15, and investigated to identify a source and prevent further illness.

Methods: We interviewed all persons with laboratory-reported *S.* Javiana infection. Pulsed-field gel electrophoresis (PFGE) and whole genome sequencing (WGS) of isolates were performed. A case was defined as diarrheal illness in a person during July–September 2016; confirmed cases had *S.* Javiana isolate yielding outbreak-related PFGE patterns; probable cases had an epidemiological link to a confirmed case. Case-finding was through surveillance and inquiring about ill dining companions. An unmatched nested case-control study assessed risk factors for *S.* Javiana infection. Food and environmental samples were collected and tested.

Results: We identified 50 *S.* Javiana cases (40 confirmed, 10 probable); illness onsets July 22–September 17. No restaurant workers were reported ill. Four of 5 tested isolates with outbreak-related PFGE patterns were highly related by WGS. Thirty-three (73%) of 45 patients interviewed reported eating at Restaurant A. Shrimp was delivered frozen to Restaurant A, then thawed for preparations. *S.* Javiana was isolated from prepared uncooked shrimp and halibut, and a freezer door handle. We included 25 cases and 31 controls; unfried shrimp consumption was associated with illness (odds ratio, 6.5; 95% confidence interval 1.6–33.01, P = 0.01).

Conclusions: Highly WGS-related *S.* Javiana indicates a commonly supplied food item, possibly shrimp, was the outbreak source; cross-contamination with other foods likely amplified illness among restaurant diners. We hypothesize that higher *Salmonella* loads, following preparation, likely survived the 145°F recommended shrimp cooking temperature.

11:40 *Salmonella* Typhimurium Outbreak Associated with Cheese from a Local Creamery — North Carolina, 2016

Authors: Jessica L. Rinsky, E. Berl, J. MacFarquhar, H. Dubendris, C. Harris, J. Marshall, D. Gaines, R. Converse, K. Heiman Marshall, C. Schwensohn, L. Gieraltowski, Z. Moore, A. Fleischauer

Background: Contaminated dairy products are common sources of foodborne outbreaks. In June 2016, the North Carolina Division of Public Health detected a cluster of *Salmonella* Typhimurium isolates with indistinguishable pulsed-field gel electrophoresis (PFGE) patterns. In July, a routine sample of raw milk from a local creamery (Creamery A) yielded *Salmonella* Typhimurium with an indistinguishable PFGE pattern. We investigated to identify opportunities for product contamination and prevent further illnesses.

Methods: We defined a case as isolation of the outbreak strain from a specimen collected during April 24–August 15, 2016, from a North Carolina resident or visitor. We completed outbreak questionnaires for cases identified before August and conducted an on-site visit and product sampling with the North Carolina Department of Agriculture.

Results: We identified 109 cases; 16 (15%) were hospitalized. Median patient age was 29 years (range: 1–92). We interviewed 46 of 61 (75%) patients identified before August; 26 (57%) respondents reported eating ≥1 Creamery A cheese. The creamery produced raw-milk cheeses aged ≥60 days and pasteurized cheeses in a 3-room, on-site facility. Few physical barriers existed between milking, production, and processing rooms; the same staff handled unfinished and finished products. The outbreak strain was isolated from a sample of a raw-milk cheese commonly consumed by patients (n = 21; 46%). Creamery A recalled all products on July 27 and began working with food safety experts to remediate and re-open.

Conclusions: Consumption of cheeses produced from contaminated raw milk resulted in a substantial *Salmonella* outbreak. Contamination likely resulted from a cheese aging-process failure or cross-contamination at the creamery. Physical barriers and adherence to good hygiene practices are necessary to reduce the risk for product contamination.

CONCURRENT SESSION O2: Child Health

10:15 AM–12:00 PM

Concurrent Session Room

Moderators: Georgina Peacock and Andrea Sharma

10:20 Acute Flaccid Myelitis in Pediatric Patients — Maricopa County, Arizona, 2016

Authors: Sally Ann Iverson, S. Ostdiek, S. Prasai, D. Engelthaler, M. Kretschmer, N. Fowle, H. Tokhie, J. Routh, J. Sejvar, T. Ayers, K. Komatsu, S. Brady, T. Sylvester, J. Bowers, V. Harrison, J. Heim, S. Robinson, K. Fitzpatrick, G. Ostovar, R. Sunenshine

Background: Acute flaccid myelitis (AFM) is a type of acute flaccid paralysis reported most commonly among children. In 2014, AFM was reported to be temporally associated with enterovirus (EV)-D68, but no definitive etiology has been identified. In September 2016, the Maricopa County Department of Public Health investigated a cluster of 11 suspected cases of AFM during a 6-week period to determine if cases met the standardized case definition and identify risk factors and potential etiologies.

Methods: AFM CDC patient summary forms were completed by medical record abstraction and reviewed by a clinical team. A confirmed case of AFM was defined as acute focal limb weakness with MRI revealing spinal cord lesions of gray matter at >1 spinal segments; a probable case was acute focal limb weakness and cerebrospinal fluid white blood cell count >5 cells/mm3. Interviews were conducted to determine risk factors. Clinical specimens were distributed to partner laboratories for further testing.

Results: Four cases were confirmed and 1 was probable. Among confirmed cases, illness onset was August 20–September 15; ages were 3.5–10 years and 75% were female. All 4 confirmed cases had preceding respiratory or gastrointestinal illness. Nasopharyngeal swabs were available from 6 of 11 patients; 3 confirmed cases and 1 noncase tested positive for EV-D68 by polymerase chain reaction (PCR) at Translational Genomics Research Institute. Coxsackivirus A10 was detected by PCR in stool from the remaining confirmed case.

Conclusions: No single etiology or risk factor was associated with all confirmed cases. Continued surveillance and reporting of cases is critical to better characterize this disease. Expanded testing for both infectious and noninfectious etiologies might provide further insight into the mechanism of AFM.segments; a probable case was acute focal limb weakness and cerebrospinal fluid white blood cell count >5 cells/mm3. Interviews were conducted to determine risk factors. Clinical specimens were distributed to partner laboratories for further testing.

10:40 Worsening Childhood Health in Conflict-Affected Areas of Borno State — Northeastern Nigeria, October–November 2016

Authors: Erin E. Tromble, E. Leidman

Background: Since 2012, ongoing conflict with Boko Haram has caused a humanitarian emergency, with reports of measles outbreaks and malnutrition, in northeastern Nigeria. The Nigerian government and UNICEF requested CDC assistance in assessing measles vaccine coverage and prevalence of diarrhea, acute respiratory illness, and malaria, the major causes of childhood morbidity and mortality in humanitarian emergencies.

Methods: To determine the health status among children <5 years, from October-November, 2016, we conducted a household survey using two-stage cluster sampling design in Borno State, northeastern Nigeria. For each eligible child, primary caregivers answered questions about symptoms and clinical management of fever (malaria proxy), cough with rapid breathing (pneumonia proxy), and diarrhea in the past two weeks and measles vaccination history. We conducted data analysis in Epi Info using complex sample procedures.

Results: We surveyed 627 households (491 children). Two-week prevalence of fever, cough with rapid breathing, and diarrhea among children was 27.1% (95% confidence interval [95% CI] 21.5–32.7), 8.8% (95% CI, 4.8–12.8), and 17.9% (95% CI, 10.9–24.9), respectively. Among children with fever, 5.3% (95% CI 0.7–9.8) and 28.6% (95% CI 13.2–43.9) received malaria testing and therapy, respectively. Measles vaccine coverage was 62.3% (95% CI 51.1–73.4) in children aged 9–59 months. Children aged 24–59 months had greater odds (OR=1.6; 95% CI 1.1–2.2) of vaccination versus children aged 9–23 months.

Conclusions: Based on prior survey data from northeastern Nigeria, these findings suggest a worsening in childhood health. Only a small proportion of children with fever were tested or provided treatment for malaria. Measles vaccine coverage was significantly below the 95% threshold despite ongoing campaigns. These findings indicate an urgent need for improved access to malaria treatment and laboratory services and expanded measles vaccination.

11:00 How Infants Die in Ohio: Comparison of Two Methods to Ascertain Cause of Death, 2009–2013

Authors: Martha Montgomery, J. Paulson, A. Davis, J. Mott, E. Conrey

Background: Ohio has the 11th highest infant mortality rate in the United States as of 2015. Two sources are used to ascertain how infants die in Ohio, vital statistics (VS) and child fatality review (CFR). CFR determines cause of death through a multidisciplinary board that reviews medical, law enforcement, death scene investigation, and social work records. We sought to use CFR findings to improve VS reporting.

Methods: Infant mortality was defined as a death of an Ohio resident in Ohio before age 1 year. We linked CFR and VS datasets by infant during 2009–2013 using personal identifying information. We grouped causes of death into 11 categories on the basis of CFR classification. Kappa statistic was used to measure concordance.

Results: Records were linked for 96% (4,985) of all VS infant deaths. Concordance was excellent for asphyxia (kappa 0.95), moderate for congenital anomalies (kappa 0.64), and weak (kappa <0.6) for 9 remaining categories. The largest discordance occurred where 1,100 (22%) infants were assigned prematurity by CFR and perinatal condition by VS. Cause of death was missing from 359 CFRs, compared with 0 from VS; 64% of these were coded as sudden infant death syndrome by VS.

Conclusions: Concordance between CFR and VS was low for the majority of categories. Although CFR is often considered the gold standard in Ohio, it is limited by missing data and insufficient detail for premature deaths. By using cause of death ICD-10 codes from VS additional detail on underlying causes of prematurity was added. Linking CFR and VS provides a more complete understanding of infant deaths in Ohio and may lead to improved VS reporting.

11:20 Breastfeeding and Autism Spectrum Disorder in Preschool Children Enrolled in the Study to Explore Early Development — United States, 2008–2011

Authors: Gnakub N. Soke, M. Maenner, G. Windham, E. Moody, C. DiGuiseppi, L. Schieve

Background: The prevalence estimate of autism spectrum disorder (ASD) has increased, and perinatal risk and protective factors, including breastfeeding, may relate to ASD etiology. Few studies have assessed the relationship between breastfeeding and ASD, and these have reported inconsistent findings. Most studies had small samples and other methodological limitations. We evaluated associations between breastfeeding initiation and duration and ASD.

Methods: We used data from the Study to Explore Early Development, a case-control study of children aged 2-5 years at six sites in the United States. ASD cases (n=707), recruited from clinics and schools, were classified by trained researchers using standardized developmental assessments. Controls (n=1,223) were randomly sampled from birth records. Breastfeeding initiation (yes/no), and among those who were breastfed, duration (months) were obtained through maternal interviews. Association between breastfeeding initiation and ASD was assessed using logistic regression, and association with breastfeeding duration [highest tertile (>12 months) versus lowest tertile (<=3 months)] using multinomial logistic regression. We adjusted for child and maternal characteristics (e.g., child sex, maternal race).

Results: We did not find an association between breastfeeding initiation and ASD (adjusted odds ratio [aOR]: 0.92 [95% confidence interval (CI): 0.65, 1.30]). However, breastfeeding duration was shorter in cases versus controls (aOR: 0.60 [95% CI: 0.42, 0.87]).

Conclusions: Although breastfeeding initiation was not significantly different between the two groups, its duration was shorter among cases than controls. More studies are needed to assess whether longer duration of breastfeeding is protective against ASD, or shorter duration of breastfeeding could be due to challenging behaviors that may have negatively affected breastfeeding. Nevertheless, longer duration of breastfeeding has other beneficial effects and is supported by the American Academy of Pediatrics.

11:40 Epidemiology and Trends of Pertussis Among Infants — United States, 2000–2015

Authors: Catherine Bozio, T. Skoff, T. Pondo, J. Liang

Background: Pertussis, a cyclic disease, causes greatest morbidity and mortality among infants, particularly those too young to be vaccinated. In the context of a recent resurgence of pertussis and a 2012 recommendation to vaccinate for pertussis during every pregnancy to prevent infant disease, we describe US infant pertussis trends between 2000 and 2015.

Methods: We analyzed nationally-reported infant pertussis cases (age groups: <2, 2–<4, 4–<6, and 6–<12 months) with cough onset between 2000 and 2015. Incidence (per 100,000) was calculated using National Center for Health Statistics population estimates. Proportion of affected infants hospitalized and case-fatality ratios (CFRs) were calculated using cases with known outcomes; relative percent changes were calculated. Linear trends were assessed using negative binomial regression; P<.05 was significant.

Results: From 2000–2015, 48,909 infant pertussis cases were reported, including 255 deaths; infants aged <2 months accounted for 38.7% of cases. Overall, annual incidence was highest among <2-month-olds (range: 112.7–282.1 per 100,000). The proportion of infants hospitalized decreased 47.6% overall, from 64.5% in 2000 to 33.8% in 2015 (P<.0001); cases among 4–<6 and 6–<12-month-olds had the largest annual relative decreases (-5.1% and -5.9%, respectively) while <2-month-olds had the smallest relative decline (-1.5%) (P<.0001 for all). Although the CFR was highest among <2-month-olds (1.6%), CFRs decreased significantly over time among <2 and 2–<4-month-olds (P<.05).

Conclusions: Pertussis incidence remains highest among infants aged <2 months. While declines in hospitalization and case fatality may represent a decrease in disease severity, these changes may also reflect increased reporting of non-severe cases. Ongoing monitoring of infant pertussis is needed to better understand the impact of new prevention strategies.

CONCURRENT SESSION P1: Drug-Related Illness

1:35–3:20 PM

Frieden Plenary

Moderators: Debbie Dowell and Andrea Winquist

1:40 Qualitative Description of Suspected Illicitly Manufactured Fentanyl-Related Overdose — Massachusetts, 2016

Authors: Nicholas J. Somerville, J. O'Donnell, J. Kuramoto-Crawford, S.J. Zibbell, M. Younkin, M. Shang, T. Green, M. Chan, S. Ruiz, H. Babakhanlou-Chase, M. Gladden, H. Nields, A. Walley

Background: Annual opioid-related overdose deaths in Massachusetts increased 138% during 2012–2015. Massachusetts law enforcement seizures of illicitly manufactured fentanyl (IMF), a short-acting synthetic opioid with 50x–100x the potency of morphine, increased from 16 in 2013 to 630 in 2014. We investigated factors associated with IMF use and overdose in Massachusetts through interviews with illicit opioid users during April 2016.

Methods: A purposive sample of illicit opioid users was recruited from harm reduction organizations in three Massachusetts counties with high rates of opioid overdose death. Trained team members conducted semistructured, face-to-face interviews with adults who used illicit opioids during the previous year and experienced or witnessed an opioid overdose during the previous 6 months. Investigated themes included IMF availability, overdose signs, and naloxone rescue. Interviews were audio recorded, transcribed, and thematically coded. Themes were tallied by number of respondents.

Results: Sixty-four respondents were interviewed; 28 (44%) had experienced an opioid overdose and 61 (95%) witnessed an overdose during the previous 6 months. Respondents reported that suspected IMF was sold mixed with heroin or by itself, and 56 (88%) attributed the increase in opioid-related overdose deaths to IMF. Forty-eight (75%) respondents who witnessed a suspected IMF-related overdose described it as occurring within minutes of use. Reported signs of suspected IMF-related overdose included blue discoloration of lips, rapid breathlessness, and seizure-like activity. Forty (63%) respondents reported that rescues by laypeople and health professionals required ≥2 nasal-administered doses of naloxone per suspected IMF-related overdose.

Conclusions: Suspected IMF-related overdose occurs rapidly, but can be reversed with naloxone by laypeople if quickly administered in sufficient dosage. Public health messaging about IMF is needed to educate users on its risks.

2:00 Fentanyl Overdose Deaths in New Mexico During 2015–2016

Authors: Nicole Middaugh, L.E. Tomedi, N. Greene, L. Petersen, J. Davis, H. Kastenbaum, K.B. Nolte, M. Landen

Background: Since 2013, illicitly manufactured fentanyl (IMF) has contributed to an epidemic of overdose deaths in the United States. Despite having the nation's second highest drug overdose death rate in 2014, New Mexico had not experienced a similar increase. In August 2016, after multiple IMF-related overdose deaths, the New Mexico Department of Health initiated a statewide investigation of overdose deaths in New Mexico during 2015–2016 to characterize fentanyl-related deaths.

Methods: Death data were obtained from the New Mexico Office of the Medical Investigator. A case was defined as any drug overdose death among a New Mexico resident during January 1, 2015–October 31, 2016, with fentanyl or fentanyl analogs on toxicology results. Demographic, circumstantial, and toxicological data were abstracted. Scene and toxicological information were used to classify exposures by likely type of fentanyl (IMF, pharmaceutical fentanyl [PF], or unknown fentanyl [UF]).

Results: We identified 39 cases (21 in 2015, 18 in 2016); IMF was found in 8 (21%), PF in 18 (46%), and UF in 13 (33%). All IMF cases occurred in 2016; 17/18 PF cases occurred in 2015. Approximately 80% of IMF and UF cases were among men; >50% of PF cases were among women. Median age was 23 years among IMF cases; among PF and UF cases, median age was 43 and 42 years, respectively. Half of IMF cases were white, whereas 90% of PF and UF cases were white.

Conclusions: During 2015–2016 in New Mexico, IMF overdose deaths increased, whereas PF overdose deaths decreased. While New Mexico did not experience a substantial increase in fentanyl-related overdose deaths, maintaining surveillance for fentanyl-related overdose deaths to rapidly identify potential outbreaks is essential.

2:20 Deaths Associated with Opioid Use and Possible Infectious Disease Etiologies Among Persons in the Unexplained Death (UNEX) Surveillance System — Minnesota, 2006–2015

Authors: Victoria Hall, R. Lynfield, N. Wright, L. Hiber, J. Palm, J. Christensen, K. Smith, S. Holzbauer

Background: During 2006–2015, the Minnesota Department of Health (MDH) identified 2,253 opioid toxicity deaths in Minnesota through death certificate surveillance using *International Classification of Diseases*, Tenth Edition codes (ICD-10). Research has shown opioid users are at increased risk for pneumonia. MDH's Unexplained Death surveillance system (UNEX) identifies unexplained deaths with possible infectious cause for additional pathogen testing. We described UNEX-identified deaths with toxic opioid levels found at autopsy during 2006–2015.

Methods: UNEX-identified deaths among Minnesota residents aged >12 years during 2006–2015 were reviewed for opioid toxicity identified by postmortem toxicological screening. Cause of death, clinical signs, preexisting conditions, and toxicology results were extracted from autopsy reports. Deaths with hospitalization >24 hours antemortem and those without autopsy reports were excluded.

Results: Fifty-nine (3.5%) of 1,676 UNEX deaths had evidence of opioid use. Median age was 43 years (range: 16–82 years); 31 (53%) were female. Twenty-two deaths involved toxic opioid levels, but lacked correct ICD-10 codes to be reported by statewide opioid death surveillance. Thirty-two (54%) of 59 UNEX deaths with opioid use had pneumonia. A pathogen was identified in 20 (63%) pneumonia cases, including *Streptococcus pneumoniae* (n = 6), *Haemophilus influenza* (n = 3), and influenza A (n = 2). Of 20 pneumonia cases, 9 (45%) had a drug abuse history, 6 (30%) had chronic pain, and 1 (5%) was receiving methadone drug therapy.

Conclusions: UNEX identified deaths missed by opioid death surveillance, indicating that the total burden of opioid-associated deaths was underestimated in Minnesota. The contributions of opioid toxicity, infectious disease, or their interactions to death are challenging to disentangle; understanding these interactions might inform future opioid-related mortality prevention efforts.

2:40 Electronic Surveillance System for the Early Notification (ESSENCE) for Marijuana-Associated Visits to One Hospital Emergency Department — Denver, Colorado, 2016

Authors: Grace E. Marx, Y. Chen, B. Albanese

Background: Legalization of recreational marijuana in Colorado created a need to monitor adverse outcomes from marijuana use. Syndromic surveillance by using the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) might serve to monitor trends in marijuana-associated emergency department (ED) visits. We sought to detect marijuana-associated ED visits by developing algorithms of diagnostic codes and key words and evaluated algorithm performance in ESSENCE compared with physician-performed medical record reviews.

Methods: Algorithms representing various combinations of marijuana-specific *International Classification of Diseases* Tenth Revision (ICD-10) diagnostic codes or key words were applied to ED visits submitted through the syndromic surveillance system at 1 hospital during June 1–September 30, 2016. We reviewed medical records detected by ≥1 ESSENCE algorithms and defined a case as an ED visit that met an acute marijuana-associated adverse health outcome case definition as determined by the ED physician's clinical impression. Positive predictive values (PPVs) of each algorithm were calculated by using the medical record as the ultimate standard.

Results: Of 28,446 total ED visits, ESSENCE algorithms detected 281 (1%) as potentially marijuana-associated. Two-hundred fifty (89% of 281) record reviews identified 114 cases (46% of 250) of an acute marijuana-associated adverse health outcome. Median case age was 31 (range 16–69) years; 59 (52%) were male. The ICD-10 algorithm identified 69 visits; 59 met the case definition (PPV, 86%). The key word algorithm identified 212 visits; 85 met the case definition (PPV, 40%).

Conclusions: ICD-10 code algorithms applied to ESSENCE data more accurately detected ED visits for marijuana-associated adverse health outcomes at this hospital, compared with key words. ESSENCE can be used to monitor adverse outcomes of recreational marijuana use.

3:00 Marijuana Use Among Persons with Select Health Conditions — United States, 2011–2014

Authors: Amy E. Seitz, M. Eberhardt, S. Lukacs

Background: Marijuana use in the United States has been increasing. Understanding population subgroups with increased marijuana use is of public health importance as the relationship between marijuana use and health has not been fully described. Our objective was to describe marijuana use prevalence among adults with select health conditions.

Methods: We examined data from 6,406 adults aged 20–59 years who participated in the 2011–2014 National Health and Nutrition Examination Survey (NHANES). The prevalence of self-reported marijuana use within the last 30 days is presented by demographic characteristics and by health conditions available in NHANES with known or plausible associations with marijuana use (i.e. depression, laboratory-confirmed HIV, respiratory disease, and cancer). Sample weights and design variables accounted for complex survey design, producing nationally representative prevalence estimates.

Results: Overall, 14% of persons aged 20–59 reported marijuana use within the last 30 days. Males (17%) and persons aged 20–29 (22%) were most likely to report marijuana use within the last 30 days. There was a high prevalence of marijuana use among persons with depression (23%), HIV (53%), and respiratory disease (18%). After adjusting for age and sex, persons with depression (adjusted odds ratio [aOR]: 2.5; 95% confidence interval [CI]: 1.83, 3.30), HIV (aOR: 8.4; 95% CI: 3.08, 22.68) and respiratory disease (aOR: 1.6; 95% CI: 1.18, 2.04) had higher odds of marijuana use compared to persons not reporting the condition.

Conclusions: In a nationally representative sample, 14% of adults aged 20-59 reported using marijuana within the last 30 days. Having depression, HIV, or respiratory disease was associated with marijuana use. Health care providers should be aware of increased odds of marijuana use among patients with these health conditions.

CONCURRENT SESSION P2: Water-Related Illness

1:35–3:20 PM

Concurrent Session Room

Moderators: Michael Beach and Stacey Bosch

1:40 *Shigella sonnei* Outbreak Investigation in the Setting of a Municipal Water Crisis — Genesee and Saginaw Counties, Michigan, 2016

Authors: Robert Paul McClung, C. Castillo, A. Miller, S. Brandon, S. Collier, E. Adam, H. Reses, J. Hurd, V. Morrill, D. Wagner, S. Dietrich, M. Soehnlen, S. Lyon-Callo, J. Collins, V. Hill, M. Beach, J. Yoder, K. Yates, K. Fullerton, J. McFadden, M. Karwowski

Background: On October 7, 2016, the Michigan Department of Health and Human Services (MDHHS) requested CDC assistance investigating an outbreak of *Shigella sonnei* in Genesee County (GC), including City of Flint, and Saginaw County (SC) amid public concern regarding the City of Flint municipal water system. Objectives were to characterize the outbreak, identify risk factors for transmission, and engage an array of community stakeholders.

Methods: Iterative dialogue with community stakeholders and local health officials informed design and implementation of the investigation. With this input, a hypothesis-generating questionnaire was developed to identify risk factors for acquiring shigellosis and assess secondary transmission among households containing ≥1 ill persons reported to MDHHS from March 1–October 25.

Results: We interviewed 66% (83/126) of affected households and identified 158 ill persons (56% female, 54% African-American) among 353 household residents. Ill persons were more likely to be children (P<.02) and to self-identify as African-American (P<.0001) compared to the population in each county. In the week preceding illness, 55% of household index cases wore or had direct contact with a person wearing diapers and 22% reported contact with a person with diarrhea outside the home. No point source exposure was identified. Households receiving Flint water were less likely to have consumed tap water (33%) than those from greater GC (63%; P=.03) or SC (100%; P<.0001). During the investigation, 10 stakeholder groups were engaged via 14 meetings, 10 communications products, and 2 formal presentations.

Conclusions: Preliminary findings suggest that shigellosis transmission occurred by person-to-person contact and not via a municipal water system. Early and recurrent community engagement was essential to the development, implementation, and acceptability of this investigation.

2:00 *Shigella sonnei* Outbreak Among Homeless Persons after Substantial Rainfal — Oregon, 2015–2016

Authors: Jonas Z. Hines, M. Jagger, T. Jeanne, N. West, R. Leman, K. Hedberg

Background: The largest outbreak of shigellosis in Oregon state history occurred from July 2015–June 2016. In November, the outbreak strain spread among Portland's homeless population, coinciding with onset of the wettest rainy season on record. *Shigella* transmission occurs through fecal-oral contact, and outbreaks tend to occur in overcrowded settings where personal hygiene is challenging; we hypothesized that substantial rainfall might have led to increased congregation and breakdown of hygienic conditions among homeless persons, facilitating *Shigella* transmission. We investigated whether rainfall was associated with shigellosis during this outbreak.

Methods: A case was defined as a *Shigella sonnei* infection in an Oregonian with a pulsed-field gel electrophoresis pattern indistinguishable from outbreak strain occurring 7/1/2015–6/30/2016. We interviewed patients and reviewed medical charts. Using Poisson regression, we analyzed the association between daily case count and cumulative rainfall during the period 8–14 days prior to each patient's symptom onset. We stratified by homelessness status and controlled for temperature.

Results: One-hundred and five shigellosis cases were identified during the outbreak; 79 (75%) were among men; all occurred among persons aged ≥18 years. Forty-five (43%) infections were reported among homeless persons. Among homeless persons, the risk ratio (RR) for shigellosis was 1.46 (95% confidence interval [CI] = 1.28–1.68) for each additional inch of cumulative rainfall; the association was not significant for housed persons (RR = 1.05; 95% CI = 0.88–1.26).

Conclusions: Rainfall was associated with increased reports of shigellosis among homeless persons during this outbreak. Substantial rainfall might have caused behavior changes that facilitated *Shigella* transmission. During forecasted heavy rainstorms, public health departments might take proactive measures to mitigate the spread of infectious disease among homeless persons.

2:20 Postflooding Leptospirosis — Louisiana, 2016

Authors: Alean A. Frawley, I.J. Schafer, R. Galloway, A. Artus, R. Ratard

Background: Leptospirosis is an acute febrile illness caused by infection with *Leptospira* species, a bacteria increasingly prevalent in Louisiana deer and feral swine. Infected animals can transmit Leptospira species to humans through urine-contaminated water, often during flooding. In August 2016, Louisiana experienced widespread flooding; hospital laboratories subsequently reported 2 initial leptospirosis cases in patients with flood-water exposure. We investigated to determine burden of flood-related leptospirosis in Louisiana.

Methods: We queried the Louisiana Early Events Detection System (LEEDS), a state-wide syndromic surveillance system, to identify patients with chief complaints or diagnoses clinically compatible with leptospirosis from flooded areas from 2 days after flooding onset to 30 days after water recession. We performed medical record reviews and applied the Council of State and Territorial Epidemiologists' (CSTE) case definition; patients with laboratory evidence supporting an alternate diagnosis were excluded. Patients were interviewed to determine floodwater exposure. Blood and urine specimens were tested for leptospirosis with polymerase chain reaction (PCR); serum was tested by microscopic agglutination test (MAT) for initial cases and patients with floodwater exposure.

Results: LEEDS query yielded 69 patients warranting medical record review. Of 18 patients meeting the CSTE case definition, 13 were interviewed; 4 reported floodwater exposure and submitted blood and urine specimens; however, MAT and PCR were negative for *Leptospira* infection. Initial cases were confirmed by MAT; urine PCR in 1 case identified *Leptospira kirschneri* as the infecting species.

Conclusions: No additional confirmed cases of postflooding leptospirosis were identified. However, *Leptospira* species endemicity in Louisiana wildlife and 2 laboratory-confirmed cases of leptospirosis postflooding warrants a high index of suspicion for leptospirosis in patients with compatible symptoms and exposure to untreated water, especially during flooding.

2:40 Access To Safe Water In Haiti: Have We Made Progress?

Authors: Alaine Knipes, A. Martinsen, J. Darius, T. Alerte, T. Palmer, L. Templin, T. Handzel

Background: In 2010, Haiti experienced a devastating earthquake followed by an unprecedented cholera outbreak. Despite years of interventions directed toward improving access to safe water, cholera cases have increased in 2016; with Artibonite being one of the most heavily affected departments. We conducted an assessment of access to water, sanitation, hygiene, and household water treatment (HWT) products in Artibonite, as a follow-up, and for comparison to, a 2012 CDC assessment.

Methods: In August 2016 we conducted a two-stage cluster survey among rural and urban residents in Artibonite. Data were collected on cholera knowledge and access to improved water sources, sanitation and HWT products. Water sources were tested for microbiological indicators.

Results: We surveyed 709 households (416 rural, 293 urban). Access to improved water sources was 59.1% in rural communities and 94.0% in urban communities; 56 of 131 (42.7%) improved water sources tested positive for *E. coli*. One third of rural households reported disinfecting their current drinking water, and 44.6% of those had positive free chlorine residual at the time of the visit. From 2012 to 2016, access to improved water sources in rural communities increased (43.1% to 59.1%, p=0.02), and there was no change in reported use of HWT products (p=0.37). Access to improved sanitation did not change in rural communities between 2012 and 2016 (p=0.09); however, open defecation decreased (50.9% to 24.5%, p<0.0001). A majority of respondents (80.7%) cited the role of contaminated water in cholera transmission.

Conclusions: Preliminary findings suggest that shigellosis transmission occurred by person-to-person contact and not via a municipal water system. Early and recurrent community engagement was essential to the development, implementation, and acceptability of this investigation.

3:00 Cryptosporidiosis Associated with Recreational Water — Maricopa County, Arizona, 2016

Authors: Sally Ann Iverson, N. Fowle, J. Collins, G. Epperson, S. Zusy, R. Sunenshine

Background: Cryptosporidium is the leading cause of U.S. outbreaks associated with recreational water venues (RWVs) (e.g., swimming pools) because of the parasite's extreme chlorine tolerance. Diarrheal events in RWVs are high-risk Cryptosporidium contamination events. Maricopa County's climate allows for an extended "summer" swimming season at >9,000 public RWVs. On August 3, 2016, a common RWV exposure among reported cryptosporidiosis cases was detected. Together with environmental health practitioners, epidemiologists sought to control the outbreak with efforts including identification and remediation of affected RWVs.

Methods: A confirmed case was defined as a person with onset of diarrhea, abdominal cramping, or vomiting during June 1–October 31 and laboratory-based evidence of Cryptosporidium infection; a probable case required the same clinical presentation and an epidemiologic link to a confirmed case. We interviewed patients with confirmed cases about RWV and other exposures; public RWV remediation was based on interview data.

Results: We identified 294 confirmed and 126 probable cases; patients were aged 0–75 years, and 258 (61%) were aged ≤19 years. Incidence decreased by half ~2 weeks after schools reopened in early August. Of 247 patients interviewed, 198 (80%) reported RWV exposure and 45 (18%) swam while ill with diarrhea. Patients reporting RWV exposure visited a mean of 1.4 (range: 1–5) RWVs during 2 weeks before symptom onset; 75 public RWVs were associated with confirmed cases.

Conclusions: Remediation of RWVs effectively prevents Cryptosporidium transmission; however, focal outbreaks can become communitywide outbreaks when patients experience diarrhea in and contaminate RWVs. Although the timing of school reopening precludes assessing control efforts here, investigation findings underscore the need to engage swimmers and parents of young swimmers in prevention and control efforts.

SESSION Q: Awards and Late-Breaking Reports

3:35–5:15 PM

Frieden Plenary

Presentation of Awards and Moderator: Tracie Gardner

Moderators: Stephen Redd and Tracie Gardner

- Outstanding Poster Presentation Award
- Donald C. Mackel Memorial Award
- J. Virgil Peavy Memorial Award
- Paul C. Schnitker International Health Award
- Iain C. Hardy Award\
- James H. Steele Veterinary Public Health Award
- Mitch Singal Excellence in Occupational and Environmental Health Award

3:55 Evaluating the Utility of rRT-PCR Testing in Whole Blood Compared to Other Specimens and IgM Testing to Optimize the Diagnosis of Zika Virus Infection among Asymptomatic Pregnant Women — Puerto Rico, 2016

Authors: Asher Yoel Rosinger, C. Pedati, B. Schroeder, J. Perez-Padilla, S. Ellington, C. Shapiro-Mendoza, L. Adams, R. Galang, R.M. Simeone, C. Colon, M. Goodwin, J.L. Munoz-Jordan, D. Meaney-Delman, J.S. Read, M.A. Honein, B. Rivera

Background: Zika virus (ZIKV) infection during pregnancy is a cause of microcephaly and birth defects. According to current testing guidelines, asymptomatic pregnant women in Puerto Rico are screened each trimester for ZIKV IgM antibodies in serum and, if detected, tested by real-time reverse transcription polymerase chain reaction (rRT-PCR) for confirmation. Preliminary reports suggested rRT-PCR whole blood testing may detect ZIKV RNA in more symptomatic patients and for a longer duration than serum testing. We compared rRT-PCR testing performance of whole blood, serum, and urine with serum IgM antibody testing for asymptomatic women in Puerto Rico to optimize diagnosis of ZIKV from October–November, 2016.

Methods: Pregnant women provided serum, urine, and whole blood specimens for ZIKV rRT-PCR and IgM testing. McNemar's $\chi 2$ was used to test for statistical differences in diagnostic utility.

Results: Of 519 asymptomatic pregnant women, 44 (8.5%) had laboratory evidence of possible ZIKV infection: 26 (5.0%) had positive ZIKV rRT-PCR results on one or more specimens (19 serum, 10 urine, and 5 whole blood) and negative IgM results. Seventeen women (3.3%) had positive IgM test results but negative rRT-PCR results. One (0.2%) woman tested positive by rRT-PCR and IgM. Whole blood rRT-PCR testing detected fewer ZIKV infections than other specimens ($p < 0.001$).

Conclusions: Compared to testing guidelines, performance of rRT-PCR and IgM testing at a single time-point detected an additional 26 asymptomatic women with ZIKV infection. rRT-PCR testing of whole blood did not detect additional ZIKV infections compared to other specimens. Findings suggest testing serum and urine from asymptomatic pregnant women by rRT-PCR, followed by serology if negative, would increase identification of ZIKV-infected pregnant women in areas with local ZIKV transmission.

Awards presented during session.

4:05 Identification of Cat-to-Human Transmission During an Outbreak of Influenza A (H7N2) Among Cats in an Animal Shelter — New York City, 2016

Authors: Christopher T. Lee, S.A. Slavinski, C. Schiff, D. Daskalakis, J.L. Rakeman, D. Liu, F. Havers, A. Fry, T. Davis, J.K. Varma, M.C. Layton

Background: On December 14, 2016, the New York City Department of Health (DOH) was notified of an influenza A (H7N2) outbreak (an avian-lineage virus) among cats at a Manhattan animal shelter. We conducted surveillance to assess risk for H7N2 transmission to humans.

Methods: We defined a suspected case as illness in a person who adopted a cat from (adopter) or worked at (worker) the shelter during November 12–December 29, 2016, and developed conjunctivitis or ≥2 symptoms of sore throat, fever, myalgia, or cough ≤10 days postexposure to a shelter cat. We interviewed adopters by telephone and workers in person, and collected nasopharyngeal specimens for H7N2 ribonucleic acid (RNA) detection by real-time polymerase chain reaction (RT-PCR).

Results: We interviewed 185/382 (48.4%) adopters; 10 (5.4%) met the case definition and 4 were tested. We interviewed and tested 165/265 (62.3%) workers; 23 (13.9%) met the case definition. H7N2 RNA was not detected in any specimen. On December 19, a previously untested worker who had collected oropharyngeal specimens from cats without using a respirator or mask reported to DOH sore throat, myalgia, and cough with onset December 18. H7N2 RNA was detected in a nasopharyngeal specimen collected on December 19, and not detected in a specimen collected on December 20. The patient recovered without hospitalization. Tracing of contacts with exposure to the patient during December 17–20, including persons onboard a domestic flight, identified no additional cases.

Conclusions: We identified the first case of cat-to-human transmission of an influenza A virus, but no evidence of additional cat-to-human or human-to-human transmission. Rapid transmission risk assessment was critical to evaluate pandemic potential, craft public messaging, and implement control measures.

4:15 Investigation of *Salmonella* Enteritidis Harboring the *mcr-1* Resistance Gene — Connecticut, 2017

Authors: Vivian H. Leung, N. Montero, M. Maloney, L.F. Watkins, J. Chen, L. Sosa

Background: In December 2016, routine surveillance identified the first *mcr-1* gene in a *Salmonella* Enteritidis (SE) isolate in the United States. The isolate was from a stool specimen collected in May 2016 from a Connecticut patient experiencing diarrhea. *Mcr-1* is located on a plasmid potentially capable of spreading among bacteria and confers resistance to colistin, a last-line antibiotic used to treat multidrug-resistant infections. We assessed possible routes of exposure to *mcr-1*, determined whether *mcr-1* spread to the patient's close contacts, and evaluated prevalence of *mcr-1* among similar SE isolates.

Methods: We interviewed the patient and 4 close contacts about symptoms, travel, and exposure to foods, animals, and health care settings. Rectal swabs collected in January 2017 from the patient and contacts were cultured for *Salmonella* and tested for *mcr-1* by polymerase chain reaction. Genomes of 170 U.S. SE isolates collected during October 2015–December 2016 with the same pulse-field gel electrophoresis (PFGE) pattern were screened for *mcr-1*.

Results: The patient had travelled abroad during the salmonellosis incubation period, and had no substantial exposure to health care settings before her illness. Rectal swabs from the patient, 2 travel companions who had diarrhea during travel, and 2 asymptomatic household contacts tested negative for *Salmonella* and *mcr-1*. *Mcr-1* was not identified in the sequences of any of the 170 PFGE-matching SE isolates.

Conclusions: The patient might have acquired *mcr-1* abroad, adding to evidence that acquisition of this gene is associated with international travel. Continued screening of bacterial genomes for *mcr-1* and investigations using these methods might delay the emergence of untreatable infections by identifying individuals at risk of spreading the gene and allowing for implementation of containment measures.

4:25 Investigation of a Nationally Distributed Contaminated Organ Transplant Preservation Solution — United States, 2016–2017

Authors: Matthew J. Stuckey, S. Novosad, N. Wilde, P. Annambhotla, S.V. Basavaraju, H. Moulton-Meissner, K. Seiber, J. Perz, P. Quinlisk, A. Garvey, S. Conrad, S. Fewell, S. Hill, M.B. Edmond, B. Ford, A. Reed, I. Benowitz, M. Walters

Background: In December 2016, bacterial contamination of an organ preservation solution (OPS) was reported by Transplant Center A in Iowa. Annually, >20,000 abdominal organs are transplanted in the U.S.; OPS is used for organ storage. We investigated the scope of OPS contamination and its association with adverse events in patients.

Methods: We assessed infection control practices related to OPS at Center A, Transplant Center B in Iowa, and the local organ procurement organization. We issued national notifications about OPS contamination and requested transplant centers to report potential patient harm or product-related concerns. Among transplant recipients at Center A, we compared adverse events (fever, bacteremia, surgical site infection, peritonitis, or pyelonephritis within 14 days of transplantation) from October–December 2016, when contaminated OPS was distributed, and October–December 2015. Isolates from OPS were characterized.

Results: No infection control deficiencies were identified. In January 2017, contaminated OPS from the same manufacturer was reported by Transplant Center C in Texas. Nationally, there were no reports of patient harm definitively linked to OPS. Post-transplant adverse events at Center A did not increase between fourth quarter 2015 (5/14 [35%]) and 2016 (2/13 [15%]). Organisms recovered from OPS included *Pantoea agglomerans* and *Enterococcus gallinarum* (Center A) and *Pseudomonas koreensis* (Center C). Five *Pantoea* isolates from ≥3 OPS bags were indistinguishable by pulsed-field gel electrophoresis. The manufacturer issued recalls and suspended production pending further investigation.

Conclusions: Bacterial contamination of a nationally-distributed product was identified by astute clinicians and confirmed by this investigation; no illnesses were directly linked to the product. Prompt reporting of concerns about potentially contaminated healthcare products, which might put patients at risk, is critical for swift public health action.

4:35 Mumps Outbreak — Colorado, 2017

Authors: Grace E. Marx, A. Burakoff, D. Hite, T. Ayers, J. Chase, K. Miller, M. Barnes, C. McDonald, L. Miller, B. Albanese

Background: During 2016, an unusually high number (>5,000) of mumps cases were reported in the United States. On January 20, 2017, we identified a mumps outbreak in the Denver metropolitan area among the Marshallese community. We performed active surveillance to assess outbreak magnitude and guide implementation of control measures.

Methods: On January 22, local and state health departments initiated active case surveillance by using church-based community rosters. Each household was contacted by telephone ≥3 times to identify mumps cases, according to the 2012 CDC/Council of State and Territorial Epidemiologists case definition, and risk factors (e.g., household size). Measles, mumps, and rubella (MMR) vaccination status was reviewed in the Colorado Immunization Information System (CIIS). Church-based vaccination clinics (January 29 and February 12) were offered to bring participants up-to-date for MMR vaccination. Targeted messaging about mumps, MMR vaccine, and vaccination clinics was distributed through social media, churches, and Marshallese-language radio.

Results: Of the 17 households contacted, 13 (76%) provided data for 70 persons (median household size: 6 persons; range: 4–12). Through household interviews and laboratory reporting, we identified 33 mumps cases (16 confirmed; 17 probable); median patient age was 21 years (range: 4–44 years), 17 (52%) were male, and 22 (67%) lacked prior MMR vaccine documentation in CIIS. During vaccination clinics, 118 (80%) of 148 persons received MMR vaccine; of those vaccinated, median age was 21 years (range: 1–55 years) and 104 (88%) had no prior MMR vaccine documentation.

Conclusions: Active surveillance, facilitated through culturally appropriate communication with church leaders, helped identify cases, disseminate materials, and promote MMR vaccination. Household interviews provided timely data to define outbreak magnitude and need for urgent MMR vaccination.

4:45 Shiga Toxin-Producing *Escherichia coli* O157:H7 Infections After Attendance at a Cider Festival — Kansas, 2016

Authors: Jessica Nadeau Tomov, D. Neises, L. Webb, A. Barham, A. Inman

Background: On October 21, 2016, the Kansas Department of Health and Environment (KDHE) was notified of 6 Shiga toxin-producing *Escherichia coli* (STEC) O157:H7 isolates with indistinguishable pulsed-field gel electrophoresis patterns from attendees of a cider festival during September 24—25 and October 1—2. KDHE and partner agencies investigated to identify the outbreak source and prevent illness.

Methods: A press release requested festival attendees self-report illness to KDHE. A case was defined as diarrhea (>2 watery stools per day) lasting >24 hours starting >1 day after festival attendance. We conducted a matched case-control study; case-patients were matched to one or more well persons who attended the festival with them. Case-patients and control subjects were interviewed about festival exposures. We calculated odds ratios (ORs) and 95% confidence intervals (CIs) for associations between illness and festival exposures. We observed the mill's food-handling processes and collected environmental samples.

Results: Fifty-six persons reported illness meeting the case definition; 9 (16%) were hospitalized, 2 (4%) developed hemolytic uremic syndrome, and 7 (13%) had laboratory-confirmed STEC O157:H7 infection. Thirty-eight case-patients and 46 control subjects were included in the analysis. Eating cider doughnuts (OR: 10.3; CI: 1.1–94.8) and drinking cold cider (exact OR: 6.6; CI: 1.2–infinity) were associated with illness. Written policy was to serve pasteurized cider but onsite inspection identified food-handlers unknowingly obtained cider from an unpasteurized cider storage tank to serve customers and possibly prepare doughnuts. Testing revealed no STEC O157 among environmental samples.

Conclusions: The process evaluation, particularly on-site evaluation of the mill's processes, identified use of unpasteurized cider as the likely infection source. KDHE recommended labeling unpasteurized cider tanks and educating employees to prevent further illness.

4:55 Immune Response Following Reactive Vaccination Campaign Using Fractional Dose Yellow Fever Vaccine — Kinshasa, Democratic Republic of Congo, 2016

Authors: Rebecca M. Casey, J. Harris, S. Ahuka, M. Dixon, K. Mbunsu, P. Mutantu, J. Laven, G. Paluku, A. Gueye, T. Hyde, E. Staples, J. Muyembe

Background: In 2016, several large outbreaks of yellow fever (YF) led to a global YF vaccine shortage. To vaccinate 7.6 million people in Kinshasa in response to an outbreak, fractional (1/5; 0.1 ml) dose of 17DD YF vaccine was provided to children age ≥2 years and non-pregnant adults via subcutaneous injection. We assessed the effectiveness of this novel control strategy.

Methods: Participants were recruited in four age strata at six vaccination sites. We assessed the presence of YF virus specific neutralizing antibodies from blood samples collected pre vaccination and 28 days post vaccination using the plaque reduction neutralization test (PRNT50). The World Health Organization defines seroprotection as a PRNT50 titer ≥10. The study criteria for immune response were seroconversion (seronegative on pre-vaccination blood to titer ≥10 at follow-up), or ≥4 fold increase in titer.

Results: Of 764 participants recruited, 492 have preliminary results available; 483 (98%; 95% confidence interval: 97%–99%) participants were seroprotected against YF at follow-up. Of these, 439 (91%) met criteria for immune response and 44 (9%) had preexisting immunity and did not meet the criteria. Stratified by age group, the proportion seroprotected at follow-up was 97% in 2–5 year olds; 100% in 6–12 year olds; 97% in 13–49 year olds; and 98% in those 50 and older. For the same age groups, the proportions meeting immune response criteria were 79%, 94%, 93% and 88% respectively.

Conclusions: In our cohort, fractional dose YF vaccine was highly effective at providing protective immunity. These findings support the use of fractional dose vaccination for outbreak control, which is important to address the ongoing global YF vaccine shortage. Additional studies are needed to assess longer-term immunologic response.

5:05 Determining the End Date of Routine Screening of Asymptomatic Pregnant Women for Zika Virus Infection — American Samoa, 2016–2017

Authors: Ruth Link-Gelles, M.S. Anesi, M. Matai'a, A. Uso, B. Sili, J. Solaita, A.J. Tufa, M. Evans, C. Gould, T. Hancock, S. Hills, N. Krishna, M. Reynolds, K.A. Toews, W. Walker, P. Weidle, J. Wilken, W.R. Daley, W.K. Gallo, E. Irvin-Barnwell, A. Koneru, R.L. Laws, D. Meaney-Delman, H. Soeters, P.M. Talboy, E. Piercefield

Background: Zika virus (ZIKV) infection can cause birth defects in infants born to women infected during pregnancy. The first individuals with ZIKV disease in American Samoa had symptom onset in January 2016 prompting initiation of routine screening for ZIKV infection among asymptomatic pregnant women. Case counts increased rapidly before gradually declining by March 2016. To guide resource allocation and inform decisions about whether asymptomatic pregnant women should continue to be screened, we sought to determine if and when active mosquito-borne transmission ended.

Methods: Transmission end date criteria were finalized in January 2017 and included: (1) implementing enhanced ZIKV disease surveillance, (2) identifying symptom onset date for last polymerase chain reaction (PCR)-positive, locally-acquired case, (3) defining the period after which active mosquito-borne transmission could be considered over (3 extrinsic incubation periods [45 days] after initiating enhanced surveillance), and (4) ongoing monitoring of enhanced surveillance data.

Results: Enhanced surveillance was fully implemented by August 31, 2016. No additional PCR-positive cases were identified and the last symptomatic, PCR-positive patient had symptom onset on June 19, 2016. The end date of transmission was therefore determined as October 15, 2016. Enhanced surveillance from August 31, 2016 through February 1, 2017 included testing of 118 symptomatic individuals and 627 asymptomatic pregnant women; none was ZIKV PCR-positive. Based on guidance to delay attempting conception until ≥8 weeks after possible ZIKV exposure, screening was recommended for asymptomatic pregnant women with estimated conception before December 11, 2016.

Conclusions: We used evidence-based criteria to determine when to discontinue routine screening of asymptomatic pregnant women for ZIKV infection, which could allow for optimal use of public health resources and guide others dealing with similar epidemiologic situations.

Closing Remarks and Adjournment

5:15–5:25

Frieden Plenary

Patricia Simone

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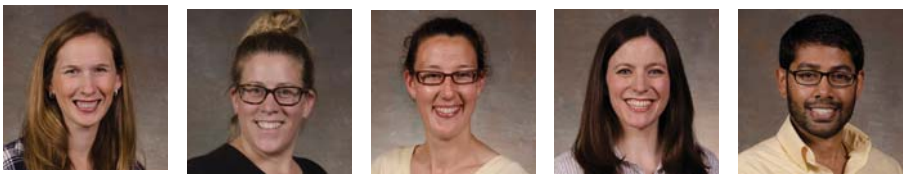

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Nabity, Scott MPH, MD
N'cho, Hammad MS, MA, PhD
Njuguna, Henry MBChB, MPH
Peak, Corey SM, ScD
Pickens, Cassandra MPH, PhD
Pindyck, Talia MD
Quilter, Laura MS, MPH, MD
Richards, Jennifer MPH, PhD
Robertson, Scott MPH, DVM, MS
Schumacher, Amy MS, PhD
Shaw, Kelly PhD
Siegel, Miriam MPH, DrPH
Sinatra, Jennifer DVM, MPH
Strysko, Jonathan MD
Swedo, Elizabeth MD, MPH
Tiffany, Amanda MPH, PhD
Toda, Mitsuru MS, PhD
Udhayashankar, Kanagasabai MPH, MD
Valenciano, Sandra MPH, MD
Vannice, Kirsten MHS, PhD
Weil, Lauren PhD, MPH
Wilson, Erica MD, MPH
Winstead, Alison MD
Womack, Lindsay MPH, PhD

Incoming LLS Fellows, Class of 2017

Fowler, Randal Christopher PhD
Hardy, Margaret C. MSc, PhD
Kretz, Cecilia Batmalle PhD
Lawrence, Marlon G. PhD
Lowe, David Edward PhD
Marinova-Petkova, Atanaska DVM, MS, PhD
Stinnett, Rita Czako MHS, PhD

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