67th ANNUAL EIS CONFERENCE

April 16-19, 2018

Innovations in Public Health

From Science to Service

CDC

SAFER·HEALTHIER·PEOPLE

67th Annual Epidemic Intelligence Service (EIS) Conference

April 16–19, 2018

Agenda-at-a-Glance

Monday

WELCOME AND CALL TO ORDER ..... 8:15–8:45 am
SESSION A: Stephen B. Thacker Opening Session ..... 8:45–10:30 am
CONCURRENT SESSION B1: Influenza ..... 10:50 am–12:15 pm
CONCURRENT SESSION B2: Chronic Disease Prevention ..... 10:50 am–12:15 pm
LUNCH (on your own) ..... 12:20–1:35 pm
SPECIAL SESSION 1: Rohingya Refugee Crisis ..... 12:25–1:25 pm
SPECIAL SESSION 2: Big Data in a Fast-Changing World ..... 12:25–1:25 pm
EIS Recruitment Information Session ..... 1:45–2:45 pm
SESSION C: J. Virgil Peavy Memorial Award Finalists ..... 1:45–3:30 pm
CONCURRENT SESSION D1: Vaccine Preventable Diseases ..... 3:45–5:10 pm
CONCURRENT SESSION D2: Antimicrobial Resistance and Treatment ..... 3:45–5:10 pm
CONCURRENT SESSION D3: Mortality Surveillance ..... 3:45–5:10 pm
EIS Alumni Association Meeting (private event sponsored by EISAA) ..... 5:30–7:30 pm

Tuesday

CONCURRENT SESSION E1: Healthcare-Associated Infections ..... 8:30–10:15 am
CONCURRENT SESSION E2: Injury: Violence and Opioid Overdose ..... 8:30–10:15 am
SESSION F: Donald C. Mackel Award Finalists ..... 10:35 am–12:00 pm
LUNCH (on your own) ..... 12:05–1:20 pm
SPECIAL SESSION 3: TED-Style Talks: Behind the Scenes with Officers and Fellows ..... 12:10–1:10 pm
POSTER SYMPOSIUM I ..... 1:30–2:55 pm
SESSION G: Laboratory Leadership Service Presentations ..... 1:30–2:55 pm
CONCURRENT SESSION H1: Global Health ..... 3:10–4:55 pm
CONCURRENT SESSION H2: Occupational and Environmental Health ..... 3:10–4:55 pm
LLS Recruitment Information Session ..... 4:00–5:00 pm
PREDICTION RUN ..... 6:00 pm
SESSION I: FETP International Night — Poster Presentations (sponsored by TEPHINET & CDC Foundation) ..... 6:00–8:30 pm

Wednesday

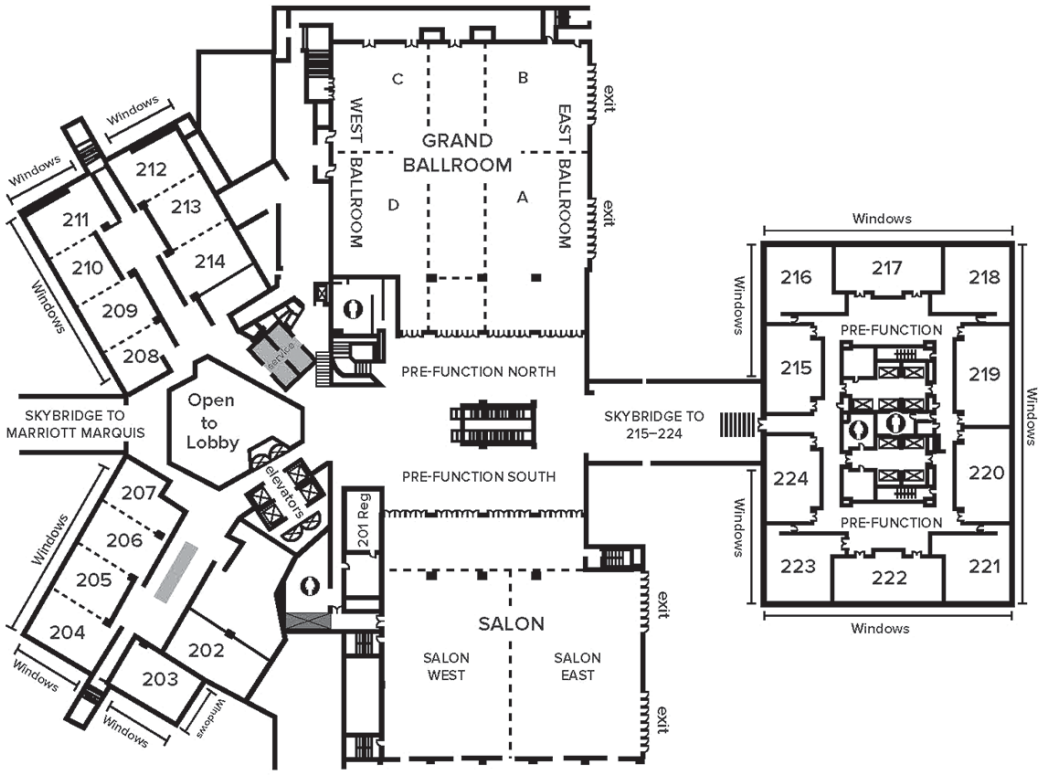
CONCURRENT SESSION J1: Hurricane Response ..... 8:30–10:15 am
CONCURRENT SESSION J2: HIV, Tuberculosis, and Hepatitis ..... 8:30–10:15 am
POSTER SYMPOSIUM II ..... 10:30–11:45 am
Extending Your Public Health Legacy: A Planned Giving Seminar with the CDC Foundation ..... 11:50 am–1:05 pm
LUNCH (on your own) ..... 11:50 am–1:05 pm
SPECIAL SESSION 4: The 1918 Influenza Centenary ..... 11:55 am–12:55 pm
CONCURRENT SESSION K1: One Health ..... 1:15–3:00 pm
CONCURRENT SESSION K2: Measles, Mumps, and Meningitis Outbreaks ..... 1:15–3:00 pm
SESSION L: Alexander D. Langmuir Lecture ..... 3:15–4:45 pm
SESSION M: FETP International Night — Oral Presentations (sponsored by TEPHINET & CDC Foundation) ..... 6:30–9:00 pm

Thursday

CONCURRENT SESSION N1: Fungal Infections ..... 8:30–9:55 am
CONCURRENT SESSION N2: Preconception, Pregnancy, and Maternity Care ..... 8:30–9:55 am
CONCURRENT SESSION O1: Food and Water ..... 10:10–11:55 am
CONCURRENT SESSION O2: Child Health ..... 10:10–11:55 am
LUNCH (on your own) ..... 12:00–1:10 pm
SPECIAL SESSION 5: U.S. Opioid Epidemic: Maternal and Child Health Response Opportunities ..... 12:05–1:05 pm
CONCURRENT SESSION P1: Notes from the Field ..... 1:15–3:00 pm
CONCURRENT SESSION P2: Emerging and High Consequence Pathogens ..... 1:15–3:00 pm
SESSION Q: Awards and Late-Breaking Reports ..... 3:15–5:05 pm
CLOSING REMARKS ..... 5:05–5:15 pm
POSTCONFERENCE EIS SATIRICAL REVIEW ..... 7:30 pm

Awards presented during session.

Hilton Atlanta
Second Floor Meeting Facilities



Name Tags Color Key

- EIS Alumni
- Current EIS Officers
- Incoming EIS Officers
- Current LLS Fellows
- LLS Alumni
- Incoming LLS Fellows
- Conference Participants
- Prospective EIS Officers
- Conference Staff
- Field EIS Alumni
- Recruiters
- Media

SAVE THE DATE

68th ANNUAL EIS CONFERENCE

April 29–May 2, 2019

EPIDEMIC INTELLIGENCE SERVICE

Centers for Disease Control and Prevention
Atlanta, Georgia

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Contents

Awards presented during session.

Awards presented during session.

Preface

Dear Conference Participants,

Eric Pevzner, PhD, MPH
CAPT, U.S. Public Health Service

Welcome to the 2018 annual conference of CDC's Epidemic Intelligence Service (EIS). This is my first time attending the conference as chief of the EIS program and Epidemiology Workforce Branch; I'm honored to be in this role and grateful for your participation.

What is the allure of the EIS program? Is it the mystique surrounding the "disease detective" experience, our training, or maybe the heights to which many of our graduates have ascended? I would argue that the foundation of the program and the element that separates it from other training programs is you—the alumni, the subject matter experts at CDC and state and local health departments, and our international partners. You provide the unique opportunity for EIS officers to gain on-the-job training in applied epidemiology and public health. You are the teachers, mentors, and scientists creating opportunities for EIS officers to practice applied epidemiology. You are the ones planning and pushing EIS officers to use data for public health action. You are the foundation of this great program and the embodiment of the science and service in this year's conference theme.

Our conference theme, *Innovations in Public Health: From Science to Service*, is the very core of what the EIS program strives to accomplish with our training. We seek to attract bright scientific minds with a passion for service. We then provide them with training, mentors, and opportunities to apply innovative thinking to address public health problems through service. This year's Langmuir speaker personifies the conference theme and the mission of EIS. As the Indiana State Health Commissioner from 2014 to 2017, Surgeon General Jerome M. Adams brought innovative approaches to responding to and halting the opioid fueled HIV outbreak in his state. We are fortunate to have the Surgeon General in attendance and hope you will join us for his Langmuir Lecture on Wednesday afternoon.

As part of the conference, we are also highlighting the scientific accomplishments and service of fellows from the Laboratory Leadership Service (LLS) and the Field Epidemiology and Training Program (FETP). The second cohort of LLS fellows is preparing to graduate this spring and is making remarkable contributions at CDC and with state and local public health laboratories. LLS fellows are participating with EIS officers on Epi-Aids, deploying to support CDC's response to public health emergencies, and leading Lab-Aids. The work of several LLS fellows is included in the general scientific program and in the LLS session on Tuesday afternoon. The work of several FETP fellows will be featured during International Nights on Tuesday and Wednesday.

Our training must constantly evolve to keep pace with the ever changing fields of epidemiology, laboratory science, and communication. We are constantly evaluating our training so that we can provide fellows with the training and experiences to prepare them to meet the needs of the public health workforce. From our fellowship survey, we know that the ability to communicate persuasively is a highly desired skill from both the perspective of employers and EIS graduates. We have revised our training to better prepare EIS officers to communicate effectively, both verbally and in writing. We are also asking them to practice communicating through a variety of channels to better reach their intended audiences. We expect that our emphasis on the use of data visualization techniques will improve your understanding and retention of our EIS officers' and LLS fellows' work. I also invite you to join us for the inaugural TED-style Special Session during lunch on Tuesday, featuring the work of EIS officers and LLS fellows.

Preface (continued)

Planning the EIS conference requires the effort and time of many people including our staff, the Scientific Planning Committee, EIS officers and LLS fellows, supervisors, and the EIS Alumni Association. Our approach to the conference is the same as our approach to training our fellows. We are collecting data to evaluate what we do, with the goal of always looking for ways to improve the conference. We ask that you please take the time to complete the consolidated conference evaluation that will be emailed to all registered conference participants.

Innovative thinking and the practice of applied epidemiology resulting in service is the conference theme but also a core value of EIS. We hope that everyone attending the conference can take away a lesson learned, an idea generated, or a connection made that leads to innovation in your work, and ultimately, public health action. Thanks for making the time to attend the EIS conference.

Eric Pevzner, PhD, MPH
CAPT, U.S. Public Health Service
Chief, Epidemiology Workforce Branch, Epidemic Intelligence Service (EIS)
Division of Scientific Education and Professional Development
Center for Surveillance, Epidemiology, and Laboratory Services

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.

The EIS Alumni Association, in partnership with the CDC Foundation, awards the ***Alexander D. Langmuir Prize,*** named in honor of the beloved founder of the EIS; the ***Distinguished Friend of EIS Award,*** honoring an individual who has provided exceptional support to the EIS Program; and the ***Stephen B. Thacker Excellence in Mentoring Award*** begun in 2013 in honor of Dr. Steven Thacker, an inspirational leader who championed the EIS program and its officers throughout his career.

In addition, the EISAA helps support the ***J. Virgil Peavy Memorial Award,*** named in honor of a distinguished CDC statistician and EIS mentor; the ***Philip S. Brachman Award***, named in honor of the distinguished director of the EIS (1970–1981); and ***The Outstanding Poster Presentation Award***.

Each year, EISAA also provides competitive travel scholarships for prospective applicants to attend the EIS Conference through the ***David J. Sencer Scholarship Award.*** EISAA also helps support EIS Conference events such as the ***Prediction Run*** and ***Skit Night***.

In 2017, EISAA proudly launched a **new, user-friendly website** (www.eisalumni.org) and alumni portal that allows 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 provides 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 Association has been able 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 (www.eisalumni.org) or at the EISAA table at this Conference.
- **Stay Connected!** If you do not recall receiving login instructions for the alumni portal, reach out to eisalumni@cdcfoundation.org immediately. This information will guide you on how to log-on to the new password protected alumni portal and update your contact information and alumni profile.
- **Learn More!** Join us at our Annual meeting on Monday, April 16 at 5:30 p.m. Ballroom C 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,

Arthur (Art) Liang, MD, MPH
President, EIS Alumni Association, EIS '80

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

Scientific Program Committee

Co-Chair: Katherine Fowler, National Center for Injury Prevention and Control
Co-Chair: Jennifer Liang, Center for Surveillance, Epidemiology, and Laboratory Services

Center for Global Health ..... Susan Chu
National Center on Birth Defects and Developmental Disabilities ..... Matthew Maenner
National Center for Chronic Disease Prevention and Health Promotion ..... Andrea Sharma
National Center for Emerging and Zoonotic Infectious Disease ..... Agam Rao and Isaac See
National Center for Environmental Health/Agency for Toxic Substances and Disease Registry ..... Ekta Choudhary
National Center for Health Statistics ..... Tala Fakhouri
National Center for HIV/AIDS, Viral Hepatitis, STD and TB Prevention ..... Anne Marie France
National Center for Immunization and Respiratory Diseases ..... Lindsay Kim
National Center for Injury Prevention and Control ..... Erin Parker
National Institute for Occupational Safety and Health ..... Candice Johnson
Center for Surveillance, Epidemiology, and Laboratory Services ..... Michael Gronostaj and Stacey Bosch

Standing (left to right):
Isaac See, Agam Rao, Andrea Sharma, Ekta Choudhary, Stacey Bosch, Candice Johnson, Erin Parker, Michael Gronostaj, Tala Fakhouri, Anne Marie France, Matthew Maenner, Susan Chu, and Lindsay Kim

Seated (left to right):
Katherine Fowler and Jennifer Liang

General Information

Program Production

EIS Program
On Par Productions, 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 67th 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 deliver 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 and Thursday, 7:00 am–1:00 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 throughout 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–5:00 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.

Instructions for Obtaining Continuing Education (CE)

To receive continuing education (CE) for this conference, please visit TCEO (www.cdc.gov/getCE) and follow the link on the homepage to the "9 Simple Steps to Get CE." **The deadline to complete CE is May 21, 2018.**

- Course Number: CM2960
- Course Title: 67th Epidemic Intelligence Service (EIS) Conference – Atlanta, GA
- Course Access Code: Provided in printed copy of the EIS conference program

67th Annual EIS Conference Schedule

Monday, April 16, 2018

7:00 **Registration Desk Opens**

8:15 **Welcome and Call to Order** ..... **Salon**
Moderators: Eric Pevzner
Presentation of Stephen B. Thacker Excellence in Mentoring Award

8:45–10:30 **SESSION A: Stephen B. Thacker Opening Session** ..... **Salon**
Moderators: Anne Schuchat and Michael Iademarco

- **8:50** Accuracy of Medical Examiner's Preliminary Overdose Assessment for Near Real-Time Surveillance of Fatal Drug Overdoses — King County, Washington, March–July 2017. *Kirsten Vannice*
- **9:10** Lead Exposures Among Employees at a Bullet Manufacturing Company — Missouri, 2017. *David Jackson*
- **9:30** Epidemiology and Risk Factors for Recurrent Invasive Methicillin-Resistant *Staphylococcus aureus* Infection — Nine U.S. States, 2006–2013. *Ian Kracalik*
- **9:50** Children with Heart Conditions and Their Special Healthcare Needs — United States, 2016. *Meng-Yu Chen*
- **10:10** Toxoplasmosis Associated with Venison Consumption During a Retreat — Wisconsin, September–October 2017. *Amy Schumacher*

10:30 **BREAK**

10:50–12:15 **CONCURRENT SESSION B1: Influenza** ..... **Salon**
Moderators: Nancy Messonnier and Jennifer Liang

- **10:55** Modeling Projected Impact of Increased Vaccination Effectiveness and Coverage on Influenza Burden — United States, 2016–2017. *Michelle Hughes*
- **11:15** Influenza A (H3N2) Variant Virus Infections at County Fairs — Maryland, 2017. *Monique Duwell*
- **11:35** Incidence and Temporality of Influenza-Related Parotitis — Arkansas, 2016–2017. *Sarah Labuda*
- **11:55** High-Dose and Standard-Dose Influenza Vaccine Effectiveness Against Influenza-Related Hospitalization Among Older Adults — United States, 2015–2016. *Joshua Doyle*

10:50–12:15 **CONCURRENT SESSION B2: Chronic Disease Prevention** ..... **Ballroom East**
Moderators: Betsy Thompson and Dianna Carroll

- **10:55** Advice and Action to Reduce Dietary Sodium Among Adults With and Without Hypertension — Behavioral Risk Factor Surveillance System, 2015. *Puthiery Va*
- **11:15** Increasing Trend in Heart Disease Death Rates — Maine, 2011–2015. *Jennifer Sinatra*
- **11:35** Predictors of High Blood Pressure and Diabetes Among Women of Reproductive Age — Guatemala, 2016. *Cassandra Pickens*
- **11:55** Decreasing Cervical Cancer Trends Among Females Aged Younger than 40 Years — United States, 1999–2014. *Elizabeth Van Dyne*

12:20–1:35 **LUNCH (on your own)**

12:25–1:25 **SPECIAL SESSION 1: Rohingya Refugee Crisis** ..... **Salon**

Awards presented during session.

12:25–1:25 **SPECIAL SESSION 2: Big Data in a Fast-Changing World ..... Ballroom East**

1:45–2:45 **EIS Recruitment Information Session ..... Ballroom C**

1:45–3:30 **SESSION C: J. Virgil Peavy Memorial Award Finalists ..... Salon**
Moderators: William Mac Kenzie and Byron Robinson

1:50 Estimating the Population Size of Female Sex Workers in Kampala, Uganda, Using Three-Source Capture-Recapture Methods, 2017. *Reena Doshi*

2:10 Association Between Community-Level Ethnic and Linguistic Distributions and the Spatiotemporal Spread of Ebola Virus Disease — Liberia, 2014. *Laura Zambrano*

2:30 Estimating 13-Valent Pneumococcal Conjugate Vaccine Impact on Community-Acquired Pneumonia Hospitalizations using Synthetic Controls — United States, 2005–2014. *Elizabeth Soda*

2:50 Evaluating the Validity of 24-Hour Dietary Recalls for Assessing Sodium Intake Among U.S. Adults — National Health and Nutrition Examination Survey, 2014. *Puthiery Va*

3:10 Repeat Users of Emergency Medical Services — Idaho, 2013–2016. *Bozena Morawski*

3:45–5:10 **CONCURRENT SESSION D1: Vaccine Preventable Diseases ..... Salon**
Moderators: Barbara Mahon and Lindsay Kim

3:50 Reduction of Seizure Hospitalization Risk Among Commercially Insured Children Vaccinated Against Rotavirus — United States, 2006–2014. *Rachel Burke*

4:10 Trends in HPV Vaccine Types in Cervical Precancers in Five States — United States, 2008-2014. *Nancy McClung*

4:30 Invasive Pneumococcal Disease in Adults on Chronic Dialysis — United States, 2014–2015. *Katherine Fay*

4:50 Pneumococcal Conjugate Vaccine Breakthrough Cases Among Children <5 Years Old by Schedule — United States, 2011–2015. *Tolulope Adebanjo*

3:45–5:10 **CONCURRENT SESSION D2: Antimicrobial Resistance and Treatment ..... Ballroom East**
Moderators: Christopher Braden and Michael Gronostaj

3:50 Antibiotic Prescribing by Dermatologists — United States, 2011–15. *Kathleen Hartnett*

4:10 Prevalence of Carbapenemase-Producing Carbapenem-Resistant Enterobacteriaceae (CRE) Among CRE in Thailand. *Caitlin Biedron*

4:30 Implementation of a Transfer Protocol for Patients with Rocky Mountain Spotted Fever — Arizona, 2011–2017. *Carla Bezold*

4:50 Etiology and Antimicrobial Resistance Patterns of *Salmonella* Bacteremia in Hospitalized Children with Acute Febrile Illness — Uganda, 2016–2017. *Alison Winstead*

3:45–5:10 **CONCURRENT SESSION D3: Mortality Surveillance ..... Ballroom C**
Moderators: Margaret Warner and Tala Fakhouri

3:50 Could Online Media Reports be Useful for Tracking Mortality During Disaster Response? Hurricane Irma, 2017. *Anindita Issa*

4:10 Influenza-Associated Death Surveillance — North Carolina, 2014–2016. *Carolyn Herzig*

4:30 Two U.S. Surveillance Systems — A Comparison of Tuberculosis-Related Mortality, 2010–2013. *Zimy Wansaula*

4:50 Variation in Sudden Unexpected Infant Death by State and Urbanicity — United States, 2011–2015. *Lindsay Womack*

5:30–7:30 **EIS ALUMNI ASSOCIATION MEETING ..... Ballroom C**

Tuesday, April 17, 2018

8:30–10:15 **CONCURRENT SESSION E1: Healthcare-Associated Infections ..... Salon**
Moderators: Denise Cardo and Isaac See

8:35 Out of Thin Air: Assessing Dispersion of *Mycobacterium chimaera* in the Operating Room. *Matthew Stuckey*

8:55 Whole-Genome Sequencing Used to Link a Platelet Donor Colonized with *Clostridium perfringens* to Two Fatal Cases of Sepsis After Transfusion — Salt Lake City, 2017. *Roberta Horth*

9:15 Hospital-Associated Cluster of Mucormycosis — Chicago, Illinois, 2017. *Janna Kerins*

9:35 Socioeconomic Status Factors Associated with Incidence of Community-Associated *Clostridium difficile* Infection — United States, 2014–2015. *Kimberly Skrobarcek*

9:55 First Recognized Transplant Transmission of Eastern Equine Encephalitis Virus to Three Solid Organ Recipients — United States, 2017. *William Walker*

8:30–10:15 **CONCURRENT SESSION E2: Injury: Violence and Opioid Overdose ..... Ballroom East**
Moderators: Debra Houry and Erin Parker

8:35 Childhood Exposure to Violence and Forced Sexual Initiation — Malawi, 2013. *Elizabeth Swedo*

8:55 Violence in the Age of the Islamic State: Trends in Injury-Related Deaths — Baghdad, Iraq, 2010–2015. *Matthew Goers*

9:15 Suicide Mortality Among Veterinarians — United States, 1979–2015. *Suzanne Tomasi*

9:35 Occupational Patterns in Drug and Opioid-Involved Overdose Deaths — United States, 2007–2012. *Laurel Harduar Morano*

9:55 Prescribing Histories of Unintentional Opioid-Involved Overdose Deaths — Ohio, 2014. *Lawrence Scholl*

10:35–12:00 **SESSION F: Donald C. Mackel Memorial Award Finalists ..... Salon**
Moderators: Steve Monroe and Jennifer Wright

10:40 *Neisseria meningitidis* Serogroup C Outbreak Associated with a Funeral — Liberia, 2017. *Jaymin Patel*

11:00 Invasive Infections from a Rare Subtype of Group A *Streptococcus* — Anchorage, Alaska, 2016–2017. *Emily Mosites*

11:20 Use of a New Serologic Approach to Identify Avian Influenza A(H7N2) Virus Infections Among Animal Shelter Employees and Volunteers — New York City, 2016–2017. *Eugenie Poirot*

11:40 First Case of Human Brucellosis Caused by *Brucella abortus* Strain RB51 Through Consumption of Raw Milk Acquired in the United States — Texas, 2017. *Caitlin Cossaboom*

12:05–1:20 **LUNCH (on your own)**

12:10–1:10 **SPECIAL SESSION 3: TED-Style Talks: Behind the Scenes with Officers and Fellows ..... Salon**
Moderators:

1:30–2:55 **POSTER SYMPOSIUM I ..... Salon**
Moderators: Hannah Gould 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 Salon. 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 *Elizabethkingia anophelis* Outbreak Among Ventilator-Dependent Patients at a Subacute Long-Term Care Facility — Los Angeles, 2017. *Gloria Chi*

P1.2 Detecting Potential Group A *Streptococcus* Clusters using Epidemiologic and Genomic Methods — United States, 2015-2017. *Katherine Fay*

P1.3 Evaluation of Tornado Fatality Identifiers for Mortality Surveillance in Electronic Death Registration System — Oklahoma, May 2013. *Anindita Issa*

P1.4 Canine Leptospirosis Outbreak Without Identifiable Zoonotic Transmission — Maricopa County, Arizona, 2016–2017. *Sally Ann Iverson*

P1.5 Arsenic Toxicity Associated with Dietary Mineral Supplements — California, 2017. *Rebecca Laws*

P1.6 Multiple Reports of Gastrointestinal Illness at a Hotel and Convention Center — Connecticut, 2017. *Vivian Leung*

P1.7 Zika Knowledge, Attitudes, and Practices Among Adult Women of Reproductive Age Seeking Healthcare — Dominican Republic, September, 2017. *Grace Marx*

P1.8 Hepatitis C Cluster in an Alternative Medicine Practice — New York State, 2015–2017. *Robert Mcdonald*

P1.9 Surveillance for Measles-Like Illness in a Commercially Insured U.S. Population: Is the United States On Par with Regional Standards? *Susannah McKay*

P1.10 Are Unique Age Restrictions Affecting Rotavirus Vaccination Coverage in African Infants? *Talia Pindyck*

P1.11 Contact Investigation Involving a Case of Multidrug-Resistant Tuberculosis in a Seafood Processing Plant — Alaska, 2017. *Amanda Tiffany*

P1.12 Factors Associated with *Clostridium difficile* Co-Infection Among Patients with Candidemia — United States, 2014–2016. *Sharon Tsay*

1:30–2:55 **SESSION G: Laboratory Leadership Service Presentations ..... Ballroom East**
Moderators: Kevin Karem and Aufra Araujo

1:35 *Neisseria meningitidis* Isolate of the Emerging U.S. Urethritis Clade Causing Conjunctivitis in a Neonate — New York City, August 2017. *Cecilia Kretz*

1:55 Validation of the Universal Parasite Diagnostic (UPDx) Assay for Blood Parasites. *Kristine Kines*

2:15 Facility Assessments Rapidly Identify Public Health Laboratory Needs Following Hurricane Maria — Puerto Rico, 2017. *Rita Czako Stinnett*

2:35 Laboratory Confirmation of Enterotoxigenic *Escherichia coli* Detected by Culture-Independent Diagnostic Tests — Minnesota, 2015–2017. *Randal Fowler*

3:10–4:55 **CONCURRENT SESSION H1: Global Health ..... Salon**
Moderators: Rebecca Martin and Susan Chu

3:15 Recurrent Outbreaks of Vaccine-Type Pneumococcal Meningitis Five Years After Introduction of 13-Valent Pneumococcal Conjugate Vaccine — Ghana, 2015–2017. *Catherine Bozio-Eldridge*

3:35 Timeliness of Severe Acute Respiratory Infections Surveillance — Burkina Faso, January–September 2017. *Amen Ben Hamida*

3:55 Efficacy of Artemether-Lumefantrine, Artesunate-Amodiaquine, and Dihydroartemisinin-Piperaquine for the Treatment of Uncomplicated *Plasmodium falciparum* Malaria — Angola, 2017. *Elizabeth Davlantes*

4:15 High Tetanus Burden or Surveillance Reporting Error? — Uganda, 2017. *Rebecca Casey*

4:35 Clinical Profiles to Distinguish Rotavirus from Other Etiologies of Diarrhea in Children <5 Years of Age Seeking Medical Care for Moderate-to-Severe Diarrhea Pre- and Post-Rotavirus Vaccine Introduction — Rural Western Kenya, 2008–2017. *Tracy Ayers*

3:10–4:55 **CONCURRENT SESSION H2: Occupational and Environmental Health ..... Ballroom East**
Moderators: Margaret Kitt and Candice Johnson

- **3:15** Occupational Exposure to Carbon Disulfide in an Artificial Casing Manufacturing Plant — United States, 2017. *George Grimes*
- **3:35** Postexposure Prophylaxis Use Among Veterinary Staff Exposed to Tularemia-Infected Animals — Wyoming, 2012–2017. *Andrea Cote*
- **3:55** High-Impact Communication Channels for Air Quality Alerts — United States, 2014. *Audrey Pennington*
- **4:15** Evaluating the Risk of Tick-Borne Relapsing Fever Among Occupational Cavers — Austin, Texas, 2017. *Stefanie Campbell*
- **4:35** Trajectories of Post-Traumatic Stress Symptoms Among International Humanitarian Aid Workers. *Blanche Greene-Cramer*

4:00–5:00 **LLS FELLOWSHIP RECRUITMENT INFORMATION SESSION ..... Ballroom C**

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 ..... Ballroom East**
(Sponsored by TEPHINET & CDC Foundation)

Wednesday, April 18, 2018

8:30–10:15 **CONCURRENT SESSION J1: Hurricane Response ..... Salon**
Moderators: Patrick Breysse and Ekta Choudhary

- **8:35** Initial Public Health Laboratory Response After Hurricane Maria — Puerto Rico, 2017. *Brunilís White*
- **8:55** Pharmacy Needs Following Natural Disasters — United States, September-October 2017. *Amy Lavery*
- **9:15** First Reported Cases of Leptospirosis and Melioidosis Following Hurricanes Irma and Maria — U.S. Virgin Islands, 2017. *Jonathan Strysko*
- **9:35** Case Definition for Surveillance of Invasive Mold Infections: Hurricane Harvey — Houston, October 2017. *Juliana Da Silva*
- **9:55** Hurricane-Associated Mold Exposures Among Patients at Risk of Invasive Mold Infections — Houston, Texas, 2017. *Mitsuru Toda*

8:30–10:15 **CONCURRENT SESSION J2: HIV, Tuberculosis, and Hepatitis ..... Ballroom East**
Moderators: Jonathan Mermin and Anne Marie France

- **8:35** HIV in a Mostly Rural Area Affected by the Opioid Epidemic — West Virginia, 2017. *Mary Evans*
- **8:55** Community Hepatitis A Outbreak in Multiple Counties — Michigan, 2016–2017. *Caroline Castillo*
- **9:15** Multidrug-Resistant Tuberculosis Outbreak — Minnesota, 2016–2017. *Victoria Hall*
- **9:35** Prevalence and Characterization of HIV and Hepatitis C and Hepatitis B Virus Coinfections — Alabama, 2007–2016. *Charlene Siza*
- **9:55** Characteristics of Recently Acquired HIV Infection and Performance of a Point-of-Care HIV Recency Test Among Pregnant Adolescent Girls and Young Women — Malawi, 2017. *Elfriede Agyemang*

10:30–11:45 POSTER SYMPOSIUM II ..... Salon
Moderators: Allison Arwady and Danice Eaton

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 Salon. 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 Impact of a Third Dose Measles-Mumps-Rubella Vaccine Campaign in Response to a Mumps Outbreak in a Highly Vaccinated Population: A Transmission Modeling Approach. *Tracy Ayers*

P2.2 Community-Acquired Legionnaires' Disease Cluster Detection and Response — New York City, 2017. *Genevieve Bergeron*

P2.3 Assessing Rabies Risk After a Mass Bat Exposure in a National Park — Wyoming, 2017. *Andrea Cote*

P2.4 Differences in Mental, Behavioral, and Developmental Disorders, Health Care, and Use of Federal Assistance Programs by Federal Poverty Level Among Children Aged 2–8 years — United States, 2016. *Robyn Cree*

P2.5 Malaria Case Management Commodity Supply and Use by Community Health Workers — Mozambique, 2017. *Elizabeth Davlantes*

P2.6 Exposure to Lead and Cadmium in Electronic Recyclers — Four U.S. States, 2015–2017. *George Grimes*

P2.7 *Mycobacterium chimaera* Infections Among Cardiac Surgery Patients Associated with Heater-Cooler Units — Hospital A, Los Angeles County, 2013–2016. M. *Claire Jarashow*

P2.8 Enhanced *Campylobacter* Laboratory Surveillance to Improve Outbreak Investigations — Ohio, 2017. *Martha Montgomery*

P2.9 Antimicrobial Resistance Among *Helicobacter pylori* Sentinel Surveillance Isolates — Alaska, 2000–2016. *Emily Mosites*

P2.10 Baseline Measurement of Invasive Mold Infections Before Hurricane Harvey — Hospitals A and B, Houston, Texas, 2016–2017. *Kimberly Skrobarcek*

P2.11 *Vibrio vulnificus* Infections Associated with Handling of Tilapia from Live Retail Fish Market Tanks — King County, Washington, 2016–2017. *Kirsten Vannice*

P2.12 Receipt of Medical Advice To Increase Physical Activity Among U.S. Adults, NHANES 2013–2016. *Marissa Zwald*

11:50–1:05 LUNCH (on your own)

11:50–1:05 Extending Your Public Health Legacy: A Planned Giving Seminar with the CDC Foundation..... Ballroom East

11:55–12:55 SPECIAL SESSION 4: The 1918 Influenza Centenary ..... Salon

1:15–3:00 CONCURRENT SESSION K1: One Health ..... Salon
Moderators: Casey Barton Behravesh and Agam Rao

1:20 Multistate Outbreak of Multidrug-Resistant *Campylobacter* Infections Linked to Contact with Pet Store Puppies. *Scott Robertson*

1:40 Bat Rabies Surveillance and Risk Factors for Rabies Transmission — Washington, 2000–2017. *Jesse Bonwitt*

2:00 Outbreak of *E. Coli* O157:H7 Infections in a Utah and Arizona Border Community — June, 2017. *Vikram Krishnasamy*

2:20 Assessment of Rabies Exposure Risk Among Residents of a University Sorority House — Indiana, 2017. *Betsy Schroeder*

2:40 Unexplained Transmission of Guinea Worm Disease Among Dogs and Humans — Chad, 2017. *Eugene Liu*

1:15–3:00 **CONCURRENT SESSION K2: Measles, Mumps, and Meningitis Outbreaks ..... Ballroom East**
Moderators: Mark Pallansch and Wences Arvelo

1:20 Measles Strikes Back: an Outbreak of Measles in an Undervaccinated Community — Minnesota, March–August, 2017. *Victoria Hall*

1:40 Mumps Outbreak in a Recently Vaccinated Population — Kosrae, Federated States of Micronesia, August–December, 2017. *Susannah McKay*

2:00 Viral Meningitis Outbreak — Lassen County, California, 2017. *Yasser Bakhsh*

2:20 Laboratory Investigation of a *Neisseria meningitidis* Serogroup C Outbreak, Liberia, 2017. *Caelin Potts*

2:40 Ongoing Mumps Outbreak Results in Recommendations for a Third Dose of Vaccine — Alaska, 2017. *Amanda Tiffany*

3:15-4:45 **SESSION L: Alexander D. Langmuir Lecture ..... Salon**
Presentation of Alexander D. Langmuir Award and Distinguished Friend of EIS Award
Presenter: Arthur Liang

Alexander D. Langmuir Lecture
Better Health Through Better Partnerships
Speaker: VADM Jerome M. Adams, MD, MPH, 20th U.S. Surgeon General
Moderator: Patricia Simone

6:30–9:00 **SESSION M: FETP International Night — Oral Presentations ..... Ballroom East**
(Sponsored by TEPHINET & CDC Foundation)

Thursday, April 19, 2018

8:30–9:55 **CONCURRENT SESSION N1: Fungal Infections ..... Salon**
Moderators: Robert Tauxe and Andrea Winquist

8:35 Antibiotic and Antifungal Treatment Among Patients with Confirmed Coccidioidomycosis — Southern California, 2011. *Gloria Chi*

8:55 *Candida auris* Point-Prevalence Surveys and Environmental Sampling in Facilities Without Currently Admitted *C. auris* Patients — New York, 2017. *Robert Mcdonald*

9:15 Antifungal Prescribing Patterns in the Outpatient Setting — United States, 2015. *Sharon Tsay*

9:35 Coccidioidomycosis Among Workers Constructing a Solar Power Farm — Monterey County, California, 2016–2017. *Rebecca Laws*

8:30–9:55 **CONCURRENT SESSION N2: Preconception, Pregnancy, and Maternity Care ..... Ballroom East**
Moderators: Ruth Petersen and Andrea Sharma

8:35 Attention-Deficit/Hyperactivity Disorder Medication Prescription Claims Among Reproductive-Aged Women with Private Employer-Sponsored Insurance — United States, 2003–2015. *Kayla Anderson*

8:55 Prenatal Syphilis Screening Using Vital Statistics Birth Certificate Data — Colorado, 2009–2016. *Grace Marx*

9:15 Trends in Mother to Newborn Skin-to-Skin Contact Indicators — United States, 2007–2015. *Ellen Boundy*

9:35 Maternity Care Facility Trends in Providing Post-Discharge Breastfeeding Supports to New Mothers — United States, 2007–2015. *Jennifer Beauregard*

Awards presented during session.

10:10–11:55 **CONCURRENT SESSION O1: Food and Water ..... Salon**
Moderators: Michael Beach and Stacey Bosch

10:15 Water, Sanitation, and Hygiene Infrastructure in Rural Healthcare Facilities — Kamwenge District, Uganda, 2017. *Jarred Mcateer*

10:35 *Campylobacter* Outbreak at a Food Festival Detected Using SaTScan™ — Connecticut, 2017. *Vivian Leung*

10:55 Cyclosporiasis Among Patrons of Restaurant A — Houston Metropolitan Area, Texas, May–August 2017. *Rebecca Chancey*

11:15 Salmonellosis Outbreak at a Chili and Chowder Cook-Off — Virginia, 2017. *Kelly Shaw*

11:35 Gastrointestinal Illness Outbreak at Multiple Outdoor Festivals — Pennsylvania, 2017. *Patrick Mitchell*

10:10–11:55 **CONCURRENT SESSION O2: Child Health ..... Ballroom East**
Moderators: Georgina Peacock and Matthew Maenner

10:15 Neonatal Abstinence Syndrome, Epidemiology, and Estimated Burden — Tennessee, 2013–2016. *Julia Brennan*

10:35 Infant and Young Child Feeding Practices Among Rohingya Refugees in Cox's Bazar, Bangladesh — October–November 2017. *Blanche Greene-Cramer*

10:55 Clinician Characteristics Associated with Referral to Pediatric Weight Management Programs in the United States — DocStyles, 2017. *Omoye Imoisilispeci*

11:15 Surveillance of Attention-Deficit/Hyperactivity Disorder Among Children in the United States Using Parent Report of Provider Diagnosis on the National Survey of Children's Health. *Robyn Cree*

11:35 Incidence Rates and Trends of Pediatric Cancer — United States, 2001–2014. *David Siegel*

12:00–1:10 **LUNCH (on your own)**

12:05–1:05 **SPECIAL SESSION 5: U.S. Opioid Epidemic: Maternal and Child Health Response Opportunities ..... Salon**

1:15–3:00 **CONCURRENT SESSION P1: Notes from the Field ..... Salon**
Moderators: Ken Komatsu and Kris Bisgard

1:20 Group A Streptococcal Infection Among People Who Inject Drugs in Boston — 2014–2017. *Charles Alpren*

1:40 Successive Norovirus Outbreaks at an Event Center — Nebraska, October–November 2017. *Rebecca Free*

2:00 High Volume of Lyme Disease Laboratory Reporting in a Low-Incidence State — Arkansas, 2015–2016. *Elizabeth Dietrich*

2:20 Unnecessary and Incorrect Administration of Postexposure Prophylaxis for Rabies — Illinois, 2016. *Erin Moritz*

2:40 Hepatitis A Outbreak Among Persons Experiencing Homelessness — Maricopa County, Arizona, 2017. *Sally Ann Iverson*

1:15–3:00 **CONCURRENT SESSION P2: Emerging and High Consequence Pathogens ..... Ballroom East**
Moderators: Inger Damon and Larry Cohen

1:20 Anthrax Epizootic in Hippopotami and Cape Buffalo and Associated Human Exposures — Namibia, 2017. *Caitlin Cossaboom*

1:40 Exposures Among Middle East Respiratory Syndrome Coronavirus Patients — Saudi Arabia, July–October 2017. *Erica Rose*

2:00 Viral Hemorrhagic Fever Preparedness, Kween and Kapchorwa Districts — Uganda, 2017. *Aaron Kofman*

2:20 Characteristics of Persons with Invasive Group A Streptococcal Infections Reporting Intravenous Drug Use — United States, 2000–2016. *Sandra Valenciano*

2:40 Risk Factors for Middle East Respiratory Syndrome Coronavirus Seropositivity Among Camel Workers — Abu Dhabi, United Arab Emirates, 2014–2017. *Marie Killerby*

3:15–5:05 **SESSION Q: Awards and Late-Breaking Reports ..... Salon**

3:15 **Presentation of Awards ..... Salon**
Presenter: Eric Pevzner

- EISAA Class Membership Award
- Haiku Contest Award
- 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
- Shalon M. Irving Health Equity Award

3:50 **Late-Breaking Reports ..... Salon**
Moderators: Stephen Redd and Katherine Fowler

3:55 An Emerging Zoonosis: Monkeypox — Nigeria, 2017. *Anna Mandra*

4:05 Occupational Carbon Monoxide Exposure in an Industrial Kitchen Facility — Wisconsin, September 2017. *Erica Wilson*

4:15 Outbreak of *E. coli* O157:H7 and *E. coli* O26 Infections at a Marine Corps Recruit Depot (MCRD) — San Diego, California, October–November, 2017. *Amelia Keaton*

4:25 Outbreak of Acute Poisonings Associated with a Counterfeit Cannabidiol Products — Utah, 2017–2018. *Roberta Horth*

4:35 Hepatitis A Virus Outbreak Among Adults Experiencing Homelessness and Illicit Drug Users — San Diego County, 2016–2017. *Corey Peak*

4:45 Public Health Emergency Risk Communication and Social Media Reactions to an Errant Warning of a Ballistic Missile Threat in Hawaii — United States, January 2018. *Bhavini Murthy*

4:55 Diphtheria Among Forcibly Displaced Myanmar Nationals — Cox's Bazar, Bangladesh, 2017. *Lauren Weil*

5:05–5:15 **CLOSING REMARKS AND ADJOURNMENT ..... Salon**
Patricia Simone

POSTCONFERENCE ACTIVITY

7:30 **EIS Satirical Review ..... Salon**
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 and sponsored by Joanna Buffington (EIS '90), in partnership with the CDC Foundation, encourages EIS officers to publish papers based on epidemiologic work done while in the EIS. This prize recognizes a current EIS officer or recent alumnus (1 year) for excellence in a written report or an epidemiologic investigation or study.

2018 Committee Members: Art Liang (Chair), Hannah Gould, Doug Hamilton, Laurene Mascola, Christina Mikosz, Nick Somerville, Christina "Tina" Tan, Steve Waterman

Philip S. Brachman Award

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

2018 Committee Members: Class of 2016

Distinguished Friend of EIS Award

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

2018 Committee Members: Art Liang (Chair), Hannah Gould, Doug Hamilton, Laurene Mascola, Christina Mikosz, Nick Somerville, Tina Tan, Steve Waterman, Eric Pevzner (*ex officio*)

Iain C. Hardy Award

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

2018 Committee Members: Samuel Posner (Chair), Melinda Wharton, Cynthia Whitney, Eric Mast, William Schaffner, John Modlin

J. Virgil Peavy Memorial Award

The J. Virgil Peavy Memorial Award, established in 2003 and sponsored 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.

2018 Committee Members: Andrea Sharma (Co-chair), Tala Fakhouri (Co-chair), Matthew Maenner, Glen Satten, Anindya De

Donald C. Mackel Memorial Award

The Donald C. Mackel Memorial Award, created by the EIS Alumni Association in partnership with the CDC Foundation, 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.

2018 Committee Members: Anne Marie France (Chair), Serena Carroll, Lindsay Kim, Brandi Limbago, Agam Rao

Outstanding Poster Presentation Award

The Outstanding Poster Presentation Award is sponsored by the EIS Alumni Association and 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.

2018 Committee Members: Isaac See (Chair), Stacey Bosch, Ekta Choudhary, Issac Evans, Kimberley Folkman, Erin Parker

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 in partnership with the CDC Foundation, recognizes a current EIS officer or alumnus (1 year) who has made a significant contribution to international public health.

2018 Committee Members: Ezra Barzilay (Chair), Roodley Archer, Tom Handzel, Nancy Messonnier, Kevin Clarke, Diane Morof

James H. Steele Veterinary Public Health Award

The James H. Steele Veterinary Public Health Award, sponsored by CDC veterinarians in partnership with the CDC Foundation, 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.

2018 Committee Members: Casey Barton Behravesh (Chair), Colin Basler, 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.

2018 Committee Members: Candice Johnson (Co-chair), Kanta Sircar (Co-Chair), Diana Bensyl, Timothy Dignam, Michael King, Barbara Materna, Jacek Mazurek, Suzanne Beavers, Cammie Chaumont Menendez, Ekta Choudhary

Stephen B. Thacker Excellence in Mentoring Award

The Stephen B. Thacker Excellence in Mentoring Award, established in 2013 by the EIS Alumni Association and sponsored by the Thacker family in partnership with the CDC Foundation, recognizes an individual who is an inspiration to the EIS community and exhibits unwavering commitment to the EIS Program, officers, and alumni through demonstrated excellence in applied epidemiology training, mentoring, and building public health capacity.

2018 Committee Members: Hannah Gould (Chair), Hammad Ali, Janet Arrowsmith, Wences Arvelo, Fatima Coronado, Maria Thacker Goethe, Greg Heath

Shalon M. Irving Memorial Award

The Shalon M. Irving Memorial Award, established by the EIS Program and sponsored by the EIS Alumni Association, is being awarded for the first time in 2018. The Shalon Irving Award recognizes a current EIS officer or recent alumni (classes 2014-2017) for having made outstanding contributions in the areas of health inequality and racial disparities research.

2018 Committee Members: Jennifer Lind (Chair), Rashid Francisca Abanyie-Bimbo, Michelle Chevalier, Asha Ivey-Stephenson, Rashid Njai, Chimeremma Nnadi, Erika C. Odom, Lynda Osadebe

David J. Sencer Scholarship Award

The David J. Sencer Scholarship Award fund was established by the EIS Alumni Association to provide travel scholarships to potential Epidemic Intelligence Service (EIS) applicants to attend the EIS Conference each year. For a list of scholarship recipients, contact EISAA.

2018 Committee Members: Christina Mikosz (Chair), Wences Arvelo, Larry Cohen, Fatima Coronado, Doug Hamilton, Greg Heath, Pam Mahoney, Tina Tan

Awards Presented at the 2017 EIS Conference

Alexander D. Langmuir Prize Manuscript Award
Brigette L. Gleason

Philip S. Brachman Award
Joshua Mott
Michael King

Distinguished Friend of the EIS Award
Marcelle "Marci" Layton
Mary Anne Duncan

Iain C. Hardy Award
Paul A. Gastañaduy

J. Virgil Peavy Memorial Award
Julie Lynn Self

Donald C. Mackel Memorial Award
Jesse Bonwitt

Outstanding Poster Presentation Award
Janna Kerins

Paul C. Schnitker International Health Award
Lawrence Purpura

Official Paul C. Schnitker Committee Historian Award
J. Lyle Conrad

James H. Steele Veterinary Public Health Award
Ilana Schafer

Mitch Singal Excellence in Occupational and Environmental Health Award
Jessica L. Rinsky

Stephen B. Thacker Excellence in Mentoring Award
Jennifer McQuiston

Alexander D. Langmuir Lectures, 1972–2017

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

2017 Moving from Epidemiology to Quantitative Population Health Science.
Sandro Galea

Alexander D. Langmuir Prize Manuscripts, 1966–2017

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

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G. Miller, R. Chamberlin, W.M. McCormack

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S.B. Werner, J. Allard, E.A. Ager

1969 Outbreak of Tick-Borne Relapsing Fever in Spokane County, Washington. JAMA 1969;210:1045–50.
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1970 Tularemia Epidemic: Vermont, 1968—Forty-Seven Cases Linked to Contact with Muskrats. N Engl J Med 1969;280:1253–60.
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1971 Tomato Juice-Associated Gastroenteritis, Washington and Oregon, 1969. Am J Epidemiol 1972;96:219–26.
W.H. Barker Jr., V. Runte

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F.S. Rhame, R.K. Root, J.D. MacLowry, T.A. Dadisman, J.V. Bennett

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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.
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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.

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E.M. Kilbourne, K. Choi, T.S. Jones, S.B. Thacker

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2016 Exposure to Advertisements and Electronic Cigarette Use Among U.S. Middle and High School Students.
T. Singh

2017 Geospatial Analysis of Household Spread of Ebola Virus in a Quarantined Village — Sierra Leone, 2014.
B.L. Gleason

Philip S. Brachman Awards, 1983–2017

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

2017 Joshua Mott and Michael King

Distinguished Friend of EIS Awards, 1984–2017

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
2017 Marcelle "Marci" Layton and Mary Anne Duncan

Iain C. Hardy Awards, 1996–2017

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
2017 Paul A. Gastañaduy

J. Virgil Peavy Memorial Awards, 2003–2017

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
2017 Julie Lynn Self

Donald C. Mackel Memorial Awards, 1987–2017

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

2017 2017 Unusual Pathogen Associated with Nonbiting Flies in a Person with Bacteremia — Washington State, 2016.
Jesse Bonwitt

Outstanding Poster Presentation Awards, 1986–2017

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

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

Paul C. Schnitker International Health Awards, 1995–2017

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

2017 Lawrence Purpura
J. Lyle Conrad (Paul C. Schnitker Committee Historian Award)

James H. Steele Veterinary Public Health Awards, 1999–2017

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

2017 Ilana Schafer

Mitch Singal Excellence in Occupational and Environmental Health Awards, 2010–2017

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 Breathlessness: Asthma and Other Health Problems Related to a New Cleaning Product Among Hospital Staff—Pennsylvania, 2015.
Megan Casey

2017 Occupational and Take-Home Lead Exposure Associated with a Lead Oxide Manufacturing Plant — North Carolina, 2016.
Jessica L. Rinsky

Stephen B. Thacker Excellence in Mentoring Award, 2013–2017

2013 Stephen B. Thacker

2014 Lyle Conrad

2015 Douglas H. Hamilton

2016 Polly A. Marchbanks

2017 Jennifer McQuiston

Monday, April 16, 2018

SESSION A: Stephen B. Thacker Opening Session

8:45–10:30 AM

Salon

Moderators: Anne Schuchat and Michael Iademarco

Presentation of Stephen B. Thacker Excellence in Mentoring Award

8:50 Accuracy of Medical Examiner's Preliminary Overdose Assessment for Near Real-Time Surveillance of Fatal Drug Overdoses — King County, Washington, March–July 2017

Authors: Kirsten Vannice, J. Hood, N. Yarid, M. Kay, J. Duchin, R. Harruff

Background: Fatal drug overdose surveillance is traditionally based on the certified cause of death. In King County, Washington, the time from death to certification varies substantially (median: 50 days; range: 3–217 days) and is generally too late for a timely response to an overdose outbreak. In March 2017, the King County Medical Examiner's Office initiated surveillance using the medical examiner (ME) preliminary assessment of overdose likelihood to monitor suspected overdoses daily and guide prompt public health and law enforcement responses. We assessed system accuracy to correctly identify certified fatal drugs overdoses.

Methods: All deaths in King County during March 1, 2017–July 31, 2017, with routine toxicology testing were analyzed (N=610). Deaths from alcohol alone were excluded. A fatal drug overdose was defined as a death attributed to acute drug intoxication. During ME investigation, the likelihood of fatal overdose was assigned for each decedent based on the autopsy and review of the scene and circumstances documented during death investigations. Suspect overdose deaths were categorized by the ME as probable (high likelihood of overdose) or possible (moderate or low likelihood of overdose). Sensitivity and positive predictive value (PPV) of ME designations were calculated based on the cause of death determined after toxicology test results became available.

Results: Toxicology testing determined that 157/610 (26%) deaths were overdoses involving drugs. Sensitivity of ME designation of probable overdose was 79% (124/157); PPV was 93%. Sensitivity of ME designation of probable or possible overdose (any suspected overdose) was 91% (143/157); PPV was 75%.

Conclusions: With 93% of probable overdoses confirmed by toxicology, King County ME determination of probable overdose was an accurate, near real-time indicator of fatal overdoses. This system of fatal overdose monitoring has potential to guide rapid public health interventions, including targeted public messaging or naloxone distribution, and law enforcement investigations.

Awards presented during session.

9:10 Lead Exposures Among Employees at a Bullet Manufacturing Company — Missouri, 2017

Authors: David Jackson, G. Burr, C. Braun, M. de Perio

Background: Lead is toxic to humans, resulting in acute and chronic health effects from inhalation and ingestion. Over 94% of the thousands of U.S. adults with elevated blood lead levels (BLLs) are exposed at work. A Missouri bullet manufacturer, which melts lead ingots into bullets, requested NIOSH assistance to evaluate employee lead exposures. We determined the prevalence of elevated BLLs and characterized the routes and extent of lead exposures.

Methods: In October 2017, we interviewed 11 employees and collected 10 blood specimens for lead. We defined an elevated BLL as ≥5 µg/dL, the current CDC reference level. We observed work practices, collected 22 hand wipe samples pre-lunch and at shift's end, and collected 10 full-shift personal air samples for lead and compared results to occupational exposure limits (OELs).

Results: Nine of 10 tested employees, including those working in the packaging and shipping area, had an elevated BLL (median: 8.5 µg/dL; range: 4–35 µg/dL). The 3 employees with the highest BLLs worked in the casting and coating areas. All air concentrations of lead were below the OEL (50 $\mu g/m^3$), with higher air levels among casting and coating employees. All employees had lead on their hands after their usual personal clean-up practices. Interviews revealed inconsistent handwashing before lunch and at shift's end and reports of dry sweeping the floors. We observed food and drinks in work areas.

Conclusions: Almost all employees at this lead manufacturer had elevated BLLs. Although personal airborne lead exposures were below OELs, inconsistent handwashing, dry sweeping which generates airborne lead dust, and eating and drinking in lead contaminated areas contributed to unnecessary lead exposures through inhalation and ingestion. Improving work practices by consistently handwashing with lead removal soap, using HEPA-filtered vacuums, and eliminating eating and drinking in bullet production areas, is needed to reduce employee lead exposures.

9:30 Epidemiology and Risk Factors for Recurrent Invasive Methicillin-Resistant *Staphylococcus aureus* Infection — Nine U.S. States, 2006–2013

Authors: Ian Kracalik, K.A. Jackson, J. Nadle, W. Bamberg, S. Petit, S. Ray, R. Lynfield, L. Harrison, J. Townes, G. Dumyati, W. Schaffner, J. Lake, I. See

Background: Methicillin-resistant *Staphylococcus aureus* (MRSA) is one of the most common antibiotic-resistant bacteria in the United States, causing >70,000 invasive infections annually. Recurrent infections lead to increased morbidity and healthcare costs, and represent a target for MRSA prevention. We examined risk factors for recurrent MRSA infections to identify priorities for prevention.

Methods: We identified patients with an initial invasive MRSA infection (isolation from a normally sterile body site) from 2006–2013, through active, population-based surveillance in selected counties in nine states. Recurrence was defined as invasive MRSA isolation >30 days after initial isolation. We used logistic regression with backwards selection to evaluate adjusted odds ratios (aOR) associated with recurrence within 180 days, including demographics, underlying comorbidities, prior healthcare exposures, and initial infection type.

Results: Among 29,712 patients with invasive MRSA, 3,804 (13%) experienced a recurrence, of which 70% (2,681) occurred within 180 days. Risk factors were diabetes (aOR; 1.35, 95% confidence interval [CI]: 1.21–1.49), AIDS (aOR; 1.62, 95% CI: 1.23–2.13), intravenous drug use (IVDU) (aOR; 1.31, 95% CI: 1.07–1.61), black race (aOR vs white; 1.38, 95% CI: 1.24–1.54), dialysis (aOR; 2.75, 95% CI: 2.43–3.10), and central venous catheter use (aOR; 1.69, 95% CI: 1.50–1.91). Accounting for patient characteristics, recurrence was more likely for bone/joint infections (aOR; 2.94, 95% CI: 2.58–3.35) and bloodstream infections (aOR; 1.34, 95% CI: 1.16–1.55) and less likely for pneumonia (aOR: 0.72, 95% CI: 0.61–0.85).

Conclusions: Approximately one in eight persons with invasive MRSA infections had recurrence. Priority areas for preventing recurrence include improving the management of patients with bloodstream and bone/joint infections (including both during and after antibiotic treatment) and mitigating risk of infection from IVDU and dialysis. These findings can inform ongoing revision of clinical guidelines for bloodstream and bone/joint infections.

9:50 Children with Heart Conditions and Their Special Healthcare Needs — United States, 2016

Authors: Meng-Yu Chen, T. Colarusso, L. Yeung, C. Smith, S. Farr

Background: Congenital heart disease (CHD) is the most common birth defect in the United States; the vast majority of children with CHD survive beyond infancy. Children also experience acquired heart conditions, such as infective endocarditis. Little is known about the total number of children living with any heart condition and their special healthcare needs. We estimated the prevalence of heart conditions and associated special healthcare needs among a population-based sample of U.S. children.

Methods: Using parent-reported data from the 2016 National Survey of Children's Health, we estimated the prevalence of a clinician-diagnosed heart condition among children aged 0–17 years. By heart condition status, we examined demographic characteristics, using chi-square tests, and the prevalence of five special healthcare needs (prescription medication use, more medical care than other children, activity limitations, needing special therapy, and needing counseling or treatment for developmental/behavior problem), using multivariable logistic regression. All analyses were conducted in SUDAAN to account for complex sampling and weighted to generate population-based estimates.

Results: Of 48,487 children in the analysis, 2.4% (representing 1.7 million U.S. children) had heart conditions and were more commonly male (55%), 6–11 years old (38%), non-Hispanic white (53%), and privately insured (53%). Of demographic characteristics, only insurance type differed significantly among children with and without heart conditions (privately insured: 53% and 62%, respectively). One or more special healthcare needs were reported among 51% of children with heart conditions compared to 19% of those without (adjusted prevalence ratio: 2.6; 95% confidence interval: 2.3–3.0). Commonly reported special healthcare needs of children with heart conditions were prescription medication use (36%), more medical care (33%), and activity limitations (24%).

Conclusions: Of the 1.7 million U.S. children with heart conditions, half have special healthcare needs. These findings can inform public health resource planning to ensure that these children receive necessary services.

10:10 Toxoplasmosis Associated with Venison Consumption During a Retreat — Wisconsin, September–October 2017

Authors: Amy Schumacher, J. Kazmierczak, E. Moldenhauer, T. Handly, J. Montoya, C. Press, D. Letzer, L. Elbadawi, S. Smiley, J. Davis

Background: On October 19, 2017, a physician contacted the Wisconsin Division of Public Health (WDPH) regarding a patient with fever, myalgia, leukopenia, and thrombocytopenia of undetermined etiology. One week before illness onset, the patient and 11 other persons attended a retreat during September 28–October 1 in northwestern Wisconsin. The patient reported consuming venison during the retreat and that other attendees had similar illnesses. After consultation with WDPH, the patient and 2 other attendees were tested for *Toxoplasma*-specific antibodies; results indicated a recent infection. We investigated to determine outbreak magnitude and illness-related factors.

Methods: We interviewed 10 of 12 attendees, and assessed signs, symptoms, and exposures and coordinated *Toxoplasma* testing. A clinical toxoplasmosis case was defined as fever, fatigue, muscle aches, or sweats (≥3 symptoms) in an attendee with onset during October 3–21; a confirmed case included serologic test results consistent with recently acquired *Toxoplasma* infection. Raw, frozen venison from the same deer was tested at the Palo Alto Medical Foundation Toxoplasma Serology Laboratory.

Results: All 10 persons interviewed were male; median age was 55.5 years (range: 34–75 years). One attendee did not consume venison and was not ill. All 9 attendees who consumed venison reported it was definitely or possibly undercooked; 8 (89%) had illnesses meeting the clinical case definition with onsets during October 5–8. All 8 patients sought health care, 8 were laboratory-confirmed; none were hospitalized. The venison served at the retreat was refrigerated since being locally harvested on September 21. *Toxoplasma gondii* DNA was detected in the venison sample by polymerase chain reaction.

Conclusions: Evidence implicated consumption of undercooked venison as the illness source. Based on this outbreak, WDPH seeks to increase awareness that game meat should be frozen to –4°F for 2 days and cooked to 160°F to kill *Toxoplasma*.

CONCURRENT SESSION B1: Influenza

10:50 AM–12:15 PM

Salon

Moderators: Nancy Messonnier and Jennifer Liang

10:55 Modeling Projected Impact of Increased Vaccination Effectiveness and Coverage on Influenza Burden — United States, 2016–2017

Authors: Michelle Hughes, M. Rolfes, S. Garg, B. Flannery, A. Fry, C. Reed

Background: Influenza vaccination provides protection against annual influenza epidemics in the United States; however, vaccination effectiveness (VE) is moderate, and coverage remains below the Healthy People 2020 target of 70%. We estimated the potential impact of increased VE and vaccination coverage on influenza burden during the 2016–2017 season.

Methods: Using existing age group-specific estimates of influenza-associated burden (FluSurv-NET), vaccination coverage (National Health Interview Survey) and VE (United States Flu VE Network), we calculated burden prevented through vaccination. We then modeled the impact of increasing VE (by 5–10 percentage points per age group) or increasing vaccination coverage (by 5–10 percentage points per age group, and by using 70% total coverage per the Healthy People goal). We calculated absolute number of averted community illnesses and hospitalizations associated with influenza compared with observed burden under the 2016–2017 season VE (39%, overall) and vaccination coverage (47%, overall).

Results: In the United States, an estimated 31,000,000 illnesses and 604,000 hospitalizations occurred during the 2016–2017 influenza season. Influenza vaccination prevented an estimated 5,350,000 illnesses and 85,600 hospitalizations. A 5–10 percentage point increase in VE would have prevented an additional 494,000–982,000 illnesses and 11,500–22,800 hospitalizations. Increasing vaccination coverage by 5–10 percentage points would have prevented an additional 490,000–974,000 illnesses and 7,030–14,000 hospitalizations, while increasing coverage to 70% would have prevented an additional 1,920,000 illnesses and 17,600 hospitalizations. The impact of increasing effectiveness or coverage varied by age group.

Conclusions: Equivalent increases in VE or vaccination coverage would have resulted in a similar relative reduction in influenza illness in 2016–2017. However, for hospitalizations, improvements in VE would have had a greater relative impact in reducing burden compared to vaccination coverage, possibly due to age-related differences in VE and severe disease burden.

11:15 Influenza A (H3N2) Variant Virus Infections at County Fairs — Maryland, 2017

Authors: Monique Duwell, D. Blythe, M. Radebaugh, B. Bachaus, E. Kough, D. Crum, K. Perkins, K. Feldman

Background: In September 2017, multiple swine exhibited at Maryland county fairs were diagnosed with swine influenza A(H3N2) virus. Concurrently, state health officials were notified of influenza-like illness (ILI) among persons who attended agricultural fairs where swine were exhibited. We investigated to determine whether persons contracted an influenza virus that normally circulates in swine (variant influenza).

Methods: Through active case finding (i.e., press releases, Epi-X alert, clinician notifications, and community meetings), we identified fair attendees with ILI onset (fever with cough or sore throat) within 7 days of swine exposure, and collected respiratory specimens for influenza testing. We interviewed patients by phone who tested presumptive positive for H3N2 variant (H3N2v) influenza using a novel influenza A virus case report form to collect demographic, health, and exposure information, where swine exposure was characterized as direct (e.g., touching swine) or indirect (e.g., walking through a swine barn).

Results: In total, 80 fair attendees with ILI were identified, of whom 76 underwent influenza testing. H3N2v infection was confirmed among 40 patients who attended 1 of 3 co-occurring county fairs (A [15], B [1], and C [24]). Among these 40 patients, 24 (60%) were aged <5 years, 21 (53%) were male, 6 (15%) had chronic medical conditions, and 26 (65%) had direct and 14 (35%) had indirect swine exposure. Thirty (75%) patients were at high risk for complications from influenza (i.e., aged <5 or ≥65 years or chronic medical conditions). Two children were hospitalized; no deaths were reported.

Conclusions: This investigation highlights that even indirect swine exposure, such as walking through swine barns, can put persons at risk for contracting H3N2v. CDC recommends that persons at high risk for influenza complications avoid swine and swine barns, and publicizing this recommendation to fairgoers might help to prevent future variant influenza outbreaks among these vulnerable groups.

11:35 Incidence and Temporality of Influenza-Related Parotitis — Arkansas, 2016–2017

Authors: Sarah Labuda, C. Yang, C. Daniels, S. Young, D. Haselow

Background: During August 2016–July 2017, Arkansas experienced the second largest mumps outbreak in the last 30 years. Mumps virus is the most common cause of epidemic parotitis. However, other respiratory viruses, including influenza A, have been implicated in sporadic parotitis. Among ~4,000 buccal swabs taken from persons with clinical parotitis in Arkansas during the outbreak period, ~2,400 were negative for mumps by real-time polymerase chain reaction (RT-PCR). We tested mumps-negative buccal swabs available from January–July 2017 for presence of influenza virus.

Methods: Up to 20 mumps-negative buccal swab samples from patients with clinical parotitis, but without epidemiologic links to mumps cases were randomly selected in each calendar month during January–July 2017 for influenza PCR analysis. Demographic information collected during the outbreak investigation was analyzed. The positive influenza results among mumps-negative cases were compared to Arkansas' reported influenza cases by month.

Results: Eighteen of 122 (14.8%) mumps-negative samples tested were positive for influenza virus; all were influenza A. Eleven (61.1%) of those testing positive were male, 17 (94.4%) were white, and median age was 11 years (range: 4–25 years). Among mumps-positive cases, 1,688 (50%) were male, 688 (23%) were white non-Hispanic, and median age was 15 years (range: 4 months-82 years). Monthly positive influenza test results were as follows: January, 3/20 (15%); February, 7/20 (35%); March, 6/20 (30%); April, 1/20 (5%); and July, 1/11 (9%); results that mirrored the local influenza season.

Conclusions: Influenza-associated parotitis was reported among a subgroup of mumps-negative patients during a mumps outbreak in Arkansas. Since buccal swabs are a suboptimal sample for influenza, reasonable inferences can be made that an even higher proportion of parotitis might have been attributable to influenza. Influenza vaccine could be considered to potentially reduce cases of mumps-negative parotitis in future outbreaks.

11:55 High-Dose and Standard-Dose Influenza Vaccine Effectiveness Against Influenza-Related Hospitalization Among Older Adults — United States, 2015–2016.

Authors: Joshua Doyle, L. Beacham, B. Flannery, E. Alyanak, M. Gaglani, E. Martin, D. Middleton, F. Silveira, R. Zimmerman, H. K. Talbot, J. Ferdinands

Background: Seasonal influenza causes substantial morbidity and mortality, with persons aged ≥65 years affected disproportionately. Newer vaccines have been developed for use in older adults, including a trivalent inactivated vaccine with a four-fold higher dose of antigen (IIV-HD). In recent years, the use of IIV-HD has increased sufficiently to evaluate its effectiveness compared to standard-dose inactivated influenza vaccines (IIV-SD).

Methods: Hospitalized patients with acute respiratory illness were enrolled in an observational vaccine effectiveness study at seven participating hospitals as part of the United States Hospitalized Adult Influenza Vaccine Effectiveness Network (HAIVEN). All enrolled patients were tested for influenza virus with polymerase chain reaction. Receipt and type of 2015-2016 influenza vaccine was determined from electronic records. Odds of laboratory-confirmed influenza were compared among vaccinated and unvaccinated patients. Vaccine effectiveness against influenza-associated hospitalization was estimated as (1 – odds ratio × 100%) from logistic regression, controlling for potential confounding factors. Relative odds of influenza were compared for patients who received IIV-HD or IIV-SD.

Results: Among 560 enrolled patients aged ≥65 years, 368 (66%) were vaccinated; among those vaccinated, 165 (45%) received IIV-HD and 203 (55%) received IIV-SD. Overall, 82 (15%) tested positive for any influenza, including 19 (3%) who received IIV-HD, 28 (5%) who received IIV-SD, and 33 (6%) who were unvaccinated. Controlling for age, race, sex, enrollment site, date of illness, and index of comorbidity, effectiveness of IIV-HD was 25% (95% confidence interval [CI]: -43% to 61%) and effectiveness of IIV-SD was 9% (95% CI: -64% to 50%). Relative odds of influenza among patients vaccinated with IIV-HD versus IIV-SD were 0.83 (95% CI: 0.43 to 1.6).

Conclusions: Preliminary estimates of vaccine effectiveness did not identify significant differences between high-dose and standard-dose vaccine in protecting against influenza-associated hospitalization among persons aged ≥65 years during the 2015-2016 season.

CONCURRENT SESSION B2: Chronic Disease Prevention

10:50 AM–12:15 PM

Ballroom East

Moderators: Betsy Thompson and Dianna Carroll

10:55 Advice and Action to Reduce Dietary Sodium Among Adults With and Without Hypertension — Behavioral Risk Factor Surveillance System, 2015

Authors: Puthiery Va, C. Luncheon, A. Thompson-Paul, J. Fang, R. Merritt, M. Cogswell

Background: Hypertension is a major cardiovascular disease (CVD) risk factor. The 2017 Hypertension Guideline emphasizes nonpharmacologic approaches, including sodium reduction, as an important part of hypertension prevention and treatment, with the threshold for high blood pressure lowered to ≥130/80 mmHg (previously prehypertension). Using multi-state data, we describe reported health provider advice and respondent action to reduce sodium intake among adults by hypertension status before the 2017 guideline.

Methods: Data were analyzed from 50,576 respondents to the sodium-reduction module implemented by 9 states and Puerto Rico in the 2015 Behavioral Risk Factor Surveillance System, a state-based cross-sectional telephone survey. We estimated prevalence of sodium reduction advice and action by hypertension status (defined as reported "borderline high or prehypertensive" or "high" blood pressure diagnosis). Estimates accounted for complex survey design and were adjusted for state, sex, age, race, education, smoking, body mass index, and comorbidities (diabetes, kidney disease, or CVD).

Results: Among 23,111 participants reporting hypertension, 39.0% (95% confidence interval [CI]: 37.9%–40.0%) reported receiving sodium reduction advice. Advice was most frequently reported by participants in Puerto Rico (51.4%), with ≥1 comorbidity (48.4%), or who were non-Hispanic black (47.1%). Prevalence of taking action to reduce sodium intake was 80.9% (CI: 79.5%–82.2%) among those receiving advice versus 55.6% (CI: 54.1%–57.1%) among those reporting no advice. Among 27,465 participants without hypertension, 13.4% (CI: 12.7%–14.0%) reported receiving advice. Advice was most frequently reported by participants in Puerto Rico (21.1%) or with ≥1 comorbidity (25.1 %). Prevalence of taking action was 72.4% (CI: 69.8%–75.0%) among those receiving advice versus 46.8% (CI: 45.8%–47.8%) among those reporting no advice.

Conclusions: Less than half of participants with hypertension and even fewer participants without hypertension reported receiving health provider advice on sodium reduction, despite association with action, suggesting an opportunity for hypertension prevention and treatment.

11:15 Increasing Trend in Heart Disease Death Rates — Maine, 2011–2015

Authors: Jennifer Sinatra, S. Huston

Background: Death rates for heart disease decreased 60% in the United States during 1950–1996, a major public health achievement. Recently, declines appear to have slowed nationally and stalled in Maine. We examined whether Maine's change in trend was statistically significant and possible reasons for changes.

Methods: CDC's wide-ranging online data for epidemiologic research was used to retrieve Maine's annual heart disease (*International Classification of Diseases*, Tenth Revision codes I00–I09, I11, I13, I20–I51) death data during 1999–2015. We used joinpoint regression to determine changes in trend and annual percent change (APC) in death rates for heart disease overall, by demographic groups, and specific heart diseases.

Results: Joinpoint's final model of Maine's age-adjusted heart disease death rates included 1 joinpoint, indicating a significant change in trend. After declining during 1999–2011, Maine's rates increased significantly from 149.5 deaths/100,000 persons in 2011 to 157.3 deaths/100,000 persons in 2015 (1999–2011 APC: -4.1%; 2011–2015 APC: +1.7%). Significant trend changes, with declines stalling since 2011, occurred for both sexes and all age groups 45 years and over. Examining specific heart diseases, declines continued for acute myocardial infarction (AMI), cardiac arrest, and heart disease with diabetes contributing; whereas, hypertensive heart disease (HHD) increased significantly after 2011 (1999–2011 APC: -5.3%; 2011–2015 APC: +21.9%), heart disease with heart failure contributing increased significantly since 2009 (1999–2009 APC: -4.1%; 2009–2015 APC: +3.5%), and other ischemic heart diseases declines stalled since 2012 (1999–2012 APC: -5.2%; 2012–2015 APC: +1.4%).

Conclusions: Maine's heart disease death rates significantly increased during 2011–2015, apparently driven by trends in HHD, heart failure, and ischemic heart diseases other than AMI. Increased efforts to address hypertension, heart failure, and ischemic heart disease are necessary to maintain the public health achievement of prevention of heart disease deaths.

11:35 Predictors of High Blood Pressure and Diabetes Among Women of Reproductive Age — Guatemala, 2016

Authors: Cassandra Pickens, R. Flores-Ayala, O. Addo, R. Whitehead, G. Gonzalez, M. Palmieri, M. Ramirez-Zea, H. Kahn, Y. Hong, M. Jefferds

Background: Diabetes and high blood pressure (HBP) are associated with increased morbidity and premature mortality. There are limited data on the prevalence and predictors of these conditions among Guatemalan women of reproductive age (WRA). We identified the prevalence and predictors of diabetes and HBP among nonpregnant Guatemalan women aged 15–49 years.

Methods: *Sistema de Vigilancia Epidemiológica de Salud y Nutrición* is an annual, cross-sectional, nationally representative household survey. We analyzed the prevalence and predictors of HBP (systolic blood pressure ≥130 mmHg, diastolic blood pressure ≥80 mmHg, or currently taking blood pressure medication) and diabetes (hemoglobin A1c ≥6.5%) among 1,358 nonpregnant WRA surveyed in 2016. We used logistic regression models with backward elimination to identify statistically significant predictors of each outcome (P <.05), accounting for complex sampling design. Potential predictors included anthropometric, sociodemographic, and health characteristics.

Results: The prevalences (95% Confidence Intervals [CI]) of HBP and diabetes were 42.9% (39.7%–46.2%) and 10.9% (8.2%–13.6%), respectively. Obesity (body mass index [BMI] ≥30 kg/m^2) was prevalent in 21.9% (18.5%–25.3%) of women. In multivariable analyses, predictors of HBP included obesity (adjusted odds ratio [AOR]: 2.0 [95% CI: 1.5–2.8] for BMI ≥30 versus <25 kg/m^2), rural residence (AOR: 1.4 [1.03–1.9] for rural versus urban), age (AOR: 3.0 [2.1–4.3] for 40–49 versus 20–29 years), and diabetes (AOR: 1.7 [1.01–2.8] for diabetes versus no diabetes). In multivariable models, predictors of diabetes included obesity (AOR: 4.1 [2.2–7.6] for BMI ≥30 versus <25 kg/m^2), age (AOR: 3.1 [1.8–5.1] for 40–49 versus 20–29 years), and HBP (AOR: 1.7 [1.01–2.7]).

Conclusions: The prevalences of HBP and diabetes were high among Guatemalan WRA. Obesity was a strong modifiable risk factor for both conditions. Because 1 in 5 women had obesity, population-based obesity prevention and control strategies are needed.

11:55 Decreasing Cervical Cancer Trends Among Females Aged Younger than 40 Years — United States, 1999–2014

Authors: Elizabeth Van Dyne, B. Hallowell, M. Saraiya, S. Henley, C. Thomas, V. Benard

Background: Human papillomavirus (HPV) vaccination and cervical cancer screening are proven interventions to prevent cervical cancer. Recent cervical cancer trends among females aged <40 years (approximately 25% of all cases) can help characterize the landscape of cervical cancer amid the 2006 introduction of the HPV vaccination, evolving recommendations for less frequent screening, and later-age screening beginning at age 21.

Methods: Using US Cancer Statistics covering 97% of the US population (1999–2014), we calculated invasive cervical cancer incidence rates among females aged 15–39 years. Rates were standardized to the 2000 US standard population. During 2010–2014, rates for ages 15–19 years were not calculated because there were <16 cases each year. Differences in trends were examined using parallelism comparability testing.

Results: During 1999–2014, 3,188 cervical cancer cases occurred annually among US females aged 15–39 years. Incidence rates increased with age (0.2 per 100,000 for 15–19 years to 14.0 per 100,000 for 35–39 years). Rates decreased among ages 20–24 years (-3.6% per year), 25–29 years (-2.7%), 30–34 years (-1.9%), and 35–39 years (-1.2%). Among ages 15–19 years, rates decreased during 1999–2009, but overall trends could not be calculated because of small counts. Trends differed among females aged 15–34 years compared with 35–39 years (P <.05).

Conclusions: Cervical cancer rates decreased during 1999–2014 among females aged 15–39 years, with larger declines among younger age groups. These decreases are reassuring with recent screening recommendations for later and less frequent screening, thereby preventing overdiagnosis harms among females at low risk for cervical cancer. HPV vaccination reduces infection and precancers; longer-term surveillance will be needed to measure resulting reductions in cervical cancer. Timely screening and continued vaccination among recommended age groups may result in further declines in cervical cancer.

SPECIAL SESSION 1: Rohingya Refugee Crisis

12:25–1:25 PM

Salon

Moderators: Nancy Knight and Leisel Talley

Sponsor: Center for Global Health (CGH), National Center for Immunization and Respiratory Diseases (NCIRD)

This session will cover CDC's ongoing response to needs of the Rohinigya refugee influx into Bangladesh. The focus will be on the need areas currently being addressed around nutrition, water, sanitation and hygiene (WASH), vaccine preventable diseases, including the recent diphtheria outbreak, and global health security.

Relevance and Appropriateness for the EIS Conference

Nearly 700,000 Rohingya have been displaced to Bangladesh since August, fleeing violence in Myanmar. The mass displacement has caused overcrowding, overwhelmed health services and sanitation infrastructure, and resulted in communicable disease outbreaks, collectively overwhelming the Government of Bangladesh and humanitarian partners. The principles of the Global Health Strategy of Prevent, Detect, Respond are highlighted in CDC's public health response. With more than 20 TDYS including four EISOs, one LLS fellow, and engagement of the Bangladesh FETP and IMPACT training programs, CDC is collaborating with the Government of Bangladesh and international partners to minimize health threats and address the key needs of the affected and host population.

Speakers

- How is CDC responding to the Rohingya crisis? (5 min)
  Leisel Talley, MPH, Team Lead, Humanitarian Health Team, Center for Global Health
- Morbidity and nutritional status of Rohingya children and implications for humanitarian response (10 min)
  Aimee Summers, PhD, Epidemiologist, Center for Global Health
- WASH conditions and challenges in the Rohingya refugee camps (10 min)
  Anu Rajasingham, MPH, CGH, Public Health Engineer, Center for Global Health
- Diphtheria outbreak among a displaced Rohingya population, Bangladesh, 2017-2018 (10 min)
  Lauren Weil, PhD, MPH, EIS Officer, National Center for Immunization and Respiratory Diseases
- Immunization access and delivery in the Rohingya refugee camps (10 min)
  Leora Feldstein, PhD, MSc, EIS Officer, Global Immunization Division, Center for Global Health
- Bangladesh FETP and Refugee Crisis, 2017 (10 min)
  Nusrat Sharmin Popy, MBBS, MPH, FETP/PHEM Fellow, Institute of Epidemiology, Disease Control and Research, Bangladesh

SPECIAL SESSION 2: Big Data in a Fast-Changing World

12:25–1:25 PM

Ballroom East

Moderators: Peter Briss and Rachel Kaufman

Sponsor: National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP)

This session will describe innovative ways "big data" are being used to inform public health and individual actions to mitigate risk factors and prevent chronic disease. Each of the topics presented in this session will focus on at least one of the five core attributes of "big data": velocity, volume, value, variety, and veracity.

Relevance and Appropriateness for the EIS Conference

Chronic diseases are responsible for 7 of 10 deaths each year in the United States. While multiple data systems are available to track and better understand the burden of chronic disease risk factors, morbidity and mortality, there are often limitations in the timeliness and representativeness of these data. Especially given declining response rates in population surveys, it is critical to consider supplemental sources of real-time data for public health programs, and policy. There is also need for making data understandable and useful to a range of decision makers and the public. The use of "big data" in innovative and informative ways can allow for public health to better understand the chronic disease burden among populations, appreciate the healthiness of the communities in which people live, and interact with people during their everyday activities to encourage healthy behaviors. EIS officers in the Center have been and will be called upon to help evaluate these new data systems to improve their usefulness and support the NCCDPHP's mission to improve the health of the nation.

Speakers

- From concrete to pixels: using Google street view and computer vision to create a national sidewalk inventory (8 min)
  Geoffrey Whitfield, PhD MEd, Epidemiologist, Physical Activity and Health Branch, Division of Nutrition Physical Activity and Obesity
- Where's the hookah? Leveraging Google maps to understand accessibility and social aspects of hookah smoking in communities (8 min)
  Israel Agaku, DMD, MPH, PhD, Senior Scientist, Office on Smoking and Health
- The holy grail—linking billing and clinical data to understand the health status of populations (8 min)
  Matthew Ritchey, PT, DPT, OCS, MPH, Senior Scientist/Lead, Health Services and Systems Research Section, Division for Heart Disease and Stroke Prevention
- Not just a pretty picture—the U.S. cancer statistics data visualization tool (8 min)
  Loria Pollack, MD, MPH, Senior Epidemiologist/National Program of Cancer Registries, Division of Cancer Prevention and Control
- Making big data small—the award-winning "My Fertility" app (8 min)
  Sheree Boulet, DrPH, MPH, Health Scientist, Division of Reproductive Health

SESSION C: J. Virgil Peavy Memorial Award Finalists

1:45–3:30 PM

Salon

Moderators: William Mac Kenzie and Byron Robinson

1:50 Estimating the Population Size of Female Sex Workers in Kampala, Uganda, Using Three-Source Capture-Recapture Methods, 2017

Authors: Reena Doshi, K. Apodaca, M. Ogwal, R. Bain, E. Amene, H.S. Kiyingi, A.F. McIntyre, W. Hladik

Background: Female sex workers (FSW) are at high risk of HIV infection. Measuring the magnitude of the epidemic among FSW requires accurate population estimates that inform the development and implementation of prevention and treatment programs. Traditional estimation methods are challenging; criminalization of sex work, discrimination and stigma keep FSW hidden. Capture-recapture is an estimation method, where a portion of the population is sampled, tagged, and resampled, with a stringent assumption of sample independence. We piloted three-source capture-recapture, which relaxes the sample independence assumption, to estimate the number of FSW in Kampala, Uganda.

Methods: During October 2017, FSW were "tagged" by trained peers through the distribution of bracelets (capture 1) and compact mirrors (capture 2) at locations where FSW work. Three captures were completed one week apart to minimize the influence of FSW migration in and out of Kampala. During captures 2 and 3, FSW were asked if they had received any of the objects. The proportions of FSW receiving a bracelet, a mirror, or both were calculated. The total (uncaptured) FSW population was estimated by fitting a log-linear Poisson model to a 2^k contingency table with interaction terms to control for dependence between captures and differential capture probabilities.

Results: Captures 1, 2, and 3 yielded 962, 965, and 1,417 FSW, respectively. There were 316 recaptures between captures 1 and 2, 214 recaptures between captures 2 and 3, and 235 recaptures between captures 1 and 3. There were 109 FSW captured in all three rounds. The estimated FSW population including those captured and uncaptured was 6,060 (95% confidence interval: 5,645, 6,533).

Conclusions: We employed three-source capture-recapture to estimate the number of FSW in Kampala, providing critical denominator data for targeted service provision. Accurate and up-to-date estimates are needed to monitor the HIV burden over time and document progress toward epidemic control.

2:10 Association Between Community-Level Ethnic and Linguistic Distributions and the Spatiotemporal Spread of Ebola Virus Disease — Liberia, 2014

Authors: Laura Zambrano, P. Thomas, L. Bawo, T. Nagbe, R.D. Merrill

Background: Viral hemorrhagic fever risk can be modeled with multivariable indices that include measures of population connectivity. In rapid response environments, however, population connectivity may be difficult to quantify or characterize. Community-level ethnolinguistic distributions may inform population connectivity patterns; therefore, we evaluated regional ethnolinguistic diversity to determine its association with risk of disease spread.

Methods: Liberia's national Ebola virus disease (EVD) case dataset contains 667 village-level geocoded cases with disease onset from March 9 – August 16, 2014. We calculated a space-time permutation scan statistic, which involved Monte Carlo hypothesis testing to explore spatial and temporal characteristics for each detected case. Ethnolinguistic composition of administrative clans was categorized as having one ethnic or linguistic type (homogeneous) or more than one (heterogeneous) using WorldMap data modified by Liberian Ministry of Health co-investigators. We explored the association between ethnolinguistic heterogeneity and the presence of an EVD case in a significant 74km or 24km spatiotemporal case cluster through Poisson regression, controlling for clan distance to major roads and population size.

Results: Of Liberia's 305 clans, 232 were ethnically and linguistically homogenous, 51 were ethnically and linguistically heterogeneous, and 22 were ethnically homogenous but linguistically heterogeneous. When compared to ethnically homogenous clans (n=240/305), ethnically heterogeneous clans (n=65/305) were more likely to have an EVD case in a 72km cluster (aRR: 2.86; 95% CI: 1.45 – 5.65; *P*=0.002) and a 24km cluster (RR: 3.21; 95% CI: 1.45 – 7.14; *P*=0.004). Similar effect sizes were found with language diversity.

Conclusions: There was major overlap between ethnic and linguistic heterogeneity across clans in Liberia. Clans with more than one ethnic or language group were at significantly increased risk of EVD circulation. Future multivariable indices designed to predict regions at risk for disease importation during an outbreak should account for ethnolinguistic heterogeneity, which may serve as a proxy for population connectivity.

2:30 Estimating 13-Valent Pneumococcal Conjugate Vaccine Impact on Community-Acquired Pneumonia Hospitalizations using Synthetic Controls — United States, 2005–2014

Authors: Elizabeth Soda, M. Spiller, T. Pondo, N. Shang, C. Whitney, J. Warren, D. Weinberger, F. Lessa

Background: Hospital administrative data can be used to evaluate the impact of prevention measures; however, changes in healthcare access or coding practices may lead to biased estimates. In 2010, 13-valent pneumococcal conjugate vaccine (PCV13) replaced 7-valent vaccine in the United States. We evaluated PCV13 impact on community-acquired pneumonia (CAP) hospitalizations among children <5 years using the synthetic controls method (SCM) to adjust for unobserved confounders.

Methods: We used hospital discharge data from 23 US states to calculate rates of all-cause CAP for children ≤1 and 2–4 years. We identified CAP cases from 7 million records using published algorithms of discharge codes. Non-CAP records with conditions unaffected by PCV13 were grouped into clinical diagnosis categories. Non-SCM time-series models and SCM models adjusted for the non-CAP clinical categories were fit to the pre-PCV13 (January 2005–April 2009) period to predict post-PCV13 (August 2010–December 2014) CAP incidence. We calculated CAP hospitalization declines with 95% credible intervals [CI] by comparing observed to predicted incidence in the post-PCV13 period.

Results: The SCM models estimated a decline in CAP incidence across all states of 24% (95% CI: 2%–34%) and 18% (95% CI: 1%–49%) for children ≤1 and 2–4 years, respectively. Significant declines were observed in 20 (87%) and 18 (78%) of 23 states for children ≤1 and 2–4 years. Using non-SCM models, significant declines were observed in only 11 (47%) and 6 (26%) of 23 states for the two age groups. In California, the non-SCM model for 2–4 year olds estimated a 24% (95% CI: 4%–47%) increase in CAP rates after vaccine introduction compared to no significant change with the SCM model.

Conclusions: While the observed trends from several states suggested no vaccine impact after PCV13 introduction, with SCM, PCV 13 showed significant impact in reducing pneumonia hospitalizations.

2:50 Evaluating the Validity of 24-Hour Dietary Recalls for Assessing Sodium Intake Among U.S. Adults — National Health and Nutrition Examination Survey, 2014

Authors: Puthiery Va, K. Dodd, L. Zhao, A. Thompson-Paul, C. Mercado, A. Terry, S. Jackson, C. Wang, C. Loria, A. Moshfegh, D. Rhodes, M. Cogswell

Background: Accurate assessment of sodium intake is essential for population monitoring and research on the health effects of sodium reduction. We evaluated the validity of sodium intake derived from 24-hour dietary recalls (24HDR), a commonly used self-report measure, compared with a reference measure derived from 24-hour urinary excretions (24HUE).

Methods: We analyzed nationally representative survey data from 779 noninstitutionalized U.S. adults aged 20–69 years who completed up to two 24HUE and 24HDR measures in the 2014 National Health and Nutrition Examination Survey. We estimated group-level reporting bias (RB%) for sodium intake assessed with 24HDR, correlation between person-level 24HUE and 24HDR (both measures adjusted for within-person error), and the attenuation factor (λ). The λ reflects the degree to which true association between long-term intake (estimated by adjusting 24HUE for within-person random error) and a hypothetical health outcome would be approximated using a single 24HDR: λ values near 1 indicate close approximation, and values near 0 indicate bias toward null. RB% was estimated as the mean difference between log 24HDR and 24HUE, re-expressed as relative bias by exponentiation. Correlations and attenuation factors were estimated using mixed linear models.

Results: For men, mean sodium intake measured with 24HDR and 24HUE was 3,622 mg and 3,730 mg, respectively, RB% -3% (95% confidence interval [CI]: -11%, 6%), λ was 0.12 (CI: 0.06, 0.18), and correlation = 0.20 (CI: 0.11, 0.30). For women, mean sodium intake measured with 24HDR and 24HUE was 2,672 mg and 2,768 mg, respectively, RB% -3% (CI: -9%, 2%), λ was 0.13 (CI: 0.06, 0.20), and correlation = 0.27 (CI: 0.13, 0.41).

Conclusions: Group mean 24HDR and 24HUE for sodium are similar. The low attenuation factors and correlations suggest associations of health outcomes with 24HDR sodium may be strongly biased toward the null because of both systematic and random measurement errors.

3:10 Repeat Users of Emergency Medical Services — Idaho, 2013–2016

Authors: Bozena Morawski, A. Kassem, K. Carter, J. Cramer

Background: Localities have saved up to $5,000/patient in annual health care costs by enrolling repeat emergency medical services (EMS) users in community paramedicine programs. We characterized Idaho EMS use as a preliminary step in allocating medicosocial support resources, like community paramedicine programs.

Methods: Among 83 EMS agencies using Idaho's prehospital electronic record collection system, 8 rural agencies were selected by stratified sampling. Link Plus associated response records by name and birthdate. Repeat users were persons with >1 ground ambulance response during January 2013–December 2016. Holm-Bonferroni-adjusted logistic regression compared demographic characteristics and EMS responders' primary clinical impression (primary impression) across repeat versus single users. Among frequent users (≥5 responses), we summarized within-patient primary impression similarity by Simpson's Diversity Index (diversity), a 0 (none) to 1 (infinite) observation heterogeneity and relative abundance metric. Linear regression estimated associations between diversity and demographic characteristics.

Results: Overall, 15% (738/4,906) of users initiated 36.3% (2,378/6,546) of EMS responses. Repeat users had a median of 2 (interquartile range [IQR]: 2–3; maximum 102) responses, 15.8 (IQR: 2.8–44.4) weeks apart. Repeat users were median 68 (IQR: 44–80) years of age and 51.2% female; whereas, single users were median 47 (IQR: 23–67) years of age (P <.001) and 44.0% female (P <.001). Repeat users were more likely than single users to have responses associated with primary impressions of chronic obstructive pulmonary disease, patient assistance (e.g., falls), seizures, or weakness (P <.001 for each association). Among frequent users (n = 91), median primary impression diversity was .68 (IQR: .61–.79). Diversity was positively associated with increasing age ($\beta_{5\text{-year}}$ = .015; 95% confidence interval: .007–.023).

Conclusions: We identified characteristics of Idahoans who might benefit from preventive medicosocial support. EMS agencies statewide could characterize their response data to assess suitability of community paramedicine programs for their communities.

CONCURRENT SESSION D1: Vaccine Preventable Diseases

3:45–5:10 PM

Salon

Moderators: Barbara Mahon and Lindsay Kim

3:50 Reduction of Seizure Hospitalization Risk Among Commercially Insured Children Vaccinated Against Rotavirus — United States, 2006–2014

Authors: Rachel Burke, J. Tate, R.M. Dahl, N. Aliabadi, U. Parashar

Background: Rotavirus is a common cause of severe diarrhea in young children and has been associated with extraintestinal symptoms including seizures. Following rotavirus vaccine introduction in the United States in 2006, the burden of rotavirus-associated diarrhea substantially declined. However, the vaccine's impact on childhood seizures has not been well studied. We assessed whether seizure hospitalization risk differs by rotavirus vaccination status.

Methods: Data were abstracted from the Truven Health MarketScan Commercial Claims and Encounters databases for 2006 – 2014, covering U.S. patients enrolled in employer-sponsored commercial health insurance. Children were included in the analysis if born on or after January 1, 2006 and continuously enrolled since the month of birth. Timing and receipt of rotavirus vaccine doses were identified using CPT codes, while seizure-associated hospitalizations were identified using ICD codes. Survival analysis was conducted using time-to-first-seizure as the outcome and age as the time scale. In the absence of a seizure, children were censored at 60 months of age or when no longer enrolled, whichever came first. Extended Cox regression accounted for the time-varying nature of rotavirus vaccination; year of birth was included to control for secular trends. Several sensitivity analyses were run, such as excluding children born in states with universal rotavirus vaccination programs.

Results: Overall, 1,837,420 children were eligible for analysis; 3,000 seizures were recorded, and the estimated 5-year seizure risk was 0.4%. Seizure hazard was significantly reduced among children fully (Adjusted Hazard Ratio [aHR]: 0.72; 95% confidence interval [CI]: 0.66 – 0.79) and partially (aHR: 0.90; 95% CI: 0.81 – 1.00) vaccinated against rotavirus, versus unvaccinated children. Results were similar in sensitivity analyses.

Conclusions: Rotavirus vaccination may reduce seizure hospitalization risk by up to 28% in children under 5. Reduction in seizure hospitalization risk may be an added benefit of rotavirus vaccination, supporting continued universal rotavirus vaccination in the U.S.

4:10 Trends in HPV Vaccine Types in Cervical Precancers in Five States — United States, 2008–2014

Authors: Nancy McClung, J. Gargano, N. Bennett, L. Niccolai, N. Abdullah, M. Griffin, I. Park, A. Cleveland, E. Unger, L. Markowitz

Background: Human papillomavirus (HPV) causes cervical cancer, diagnosed in 12,000 women annually in the United States. Since 2006, HPV vaccination has been recommended routinely for 11-12 year-old girls and for catch-up vaccination through 26 years. While the effect of vaccination on cancers might take more than a decade to detect, cervical precancers can provide more timely evidence of vaccine impact. Declining precancer incidence in the vaccine era has already been described in young women. To further evaluate vaccine impact, we described trends in HPV vaccine types 16/18 in cervical precancers.

Methods: We analyzed data from a 5-site, population-based surveillance system (2008-2014). Archived lesions from women ages 18-39 years diagnosed with cervical precancers (cervical intraepithelial neoplasia grades 2-3, adenocarcinoma *in situ)* were tested for 37 HPV types. We described the proportion of precancers HPV16/18-positive over time, overall and by age, race/ethnicity, and vaccination history, and conducted Cochrane-Armitage trend tests.

Results: In 8,554 cases (63% non-Hispanic White, median age 28 years) with HPV typing results, the proportion of HPV16/18-positive cases declined (from 51.4% in 2008 to 44.1% in 2014, $P<.001$). Declines were observed in non-Hispanic white (57.6% to 47.5%, $P<.001$) and non-Hispanic black (39.6% to 26.8%, $P<.001$), but not Hispanic (43.8% to 44.9%, $P=.8$) or Asian (40.6% to 49.4%, $P=.1$) women; in women ages 21-24 (50.9% to 40.6%, $P<.001$) and 25-29 (55.1% to 41.9%, $P<.001$), but not in older groups; and in vaccinated (51.4% to 34.0%, $P<.001$), but not unvaccinated (49.8% to 53.0%, $P=.4$) women.

Conclusions: The declining proportion of HPV16/18-positive cervical precancers provides additional evidence of vaccine impact. The greatest reductions in vaccine types were among vaccinated women. Despite baseline differences in proportion of HPV16/18-positive precancers, both black and white women had significant declines. Monitoring trends by race/ethnicity should continue in order to evaluate equity of vaccination program benefits.

4:30 Invasive Pneumococcal Disease in Adults on Chronic Dialysis — United States, 2014–2015

Authors: Katherine Fay, A. Matanock, R. Gierke, A. Reingold, S. Petit, M. Farley, L. Harrison, R. Lynfield, N. Spina, C. Smelser, A. Thomas, W. Schaffner, M. Barnes, L. McGee, B. Beall, T. Pilishvili

Background: In 2012, CDC recommended 13-valent pneumococcal conjugate vaccine (PCV13) in series with 23-valent polysaccharide vaccine (PPSV23) for adults on dialysis, a group at increased risk for invasive pneumococcal disease (IPD). In 2015, 787,000 people were on chronic dialysis in the United States, yet little is known about IPD burden and PCV13 impact in this group. We characterized IPD among adults on dialysis in the years following this recommendation.

Methods: Using data currently available in all sources from 2014–2015, we identified IPD cases among adults aged ≥19 years using Active Bacterial Core surveillance (ABCs). Presence of chronic dialysis was ascertained through chart reviews. We calculated incidence (cases/100,000 population) using U.S. Census and U.S. Renal Data System data as denominators. We stratified results by IPD infection serotype into by vaccine groupings (PCV13-type+6C due to cross protection, PPSV23-unique serotypes, and non-vaccine types [NVT]).

Results: Of 4,638 reported IPD cases, 91 (2%) were in patients on chronic dialysis. African Americans made up a higher proportion of cases in persons on chronic dialysis versus not on dialysis (40% vs 22%, p<0.0001). Comparing persons on dialysis versus not on dialysis, average annual IPD incidence was higher (85 vs 11 cases/100,000 persons, p=0.02), but IPD case-fatality ratios did not differ (15% vs 13%, p=0.2). When stratified by serotype group, there was no significant difference in proportion of IPD caused by PCV13+6C types (13% vs 14%), PPSV23-unique types (4% vs 7%), and NVT (73% vs 70%) between persons on chronic dialysis and those not on dialysis.

Conclusions: Patients on chronic dialysis have a seven-fold higher incidence of IPD than persons not on dialysis, even after vaccine recommendations targeting dialysis patients. Given that the remaining IPD burden is largely due to NVT serotypes, higher-valency pneumococcal vaccines might help to reduce IPD burden among adults on dialysis.

4:50 Pneumococcal Conjugate Vaccine Breakthrough Cases Among Children <5 Years Old by Schedule — United States, 2011–2015

Authors: Tolulope Adebanjo, T. Pondo, D. Yankey, R. Gierke, M. Farley, W. Schaffner, A. Thomas, A. Reingold, L. Harrison, C. Holtzman, J. Rowlands, S. Petit, M. Barnes, C. Smelser, B. Beall, T. Pilishvili

Background: Invasive pneumococcal disease (IPD) incidence among children declined following introduction of 7-valent pneumococcal conjugate vaccine (PCV7) in 2000 and PCV13 in 2010. PCV13 is licensed as a 4-dose schedule (ages 2, 4, and 6 months with a booster at 12-15 months) in the United States, but coverage with 4 doses (84%) is below the Healthy People 2020 target of 90%. We evaluated whether receiving fewer doses is associated with higher incidence of vaccine-type IPD.

Methods: We used CDC's Active Bacterial Core surveillance to identify breakthrough infections (BI), defined as vaccine-type IPD in a child who received ≥1 PCV13 dose, among children aged <5 years born 2011-2015. We compared BI among children who received 2 vs. 3 doses before age 7 months with and without a booster at age 12-16 months (2+1 vs. 3+1; 2+0 vs. 3+0). We used Poisson regression to estimate vaccine schedule-specific incidence rates (IR) per 100,000 (95% confidence interval [CI]), and rate ratios (IRR) comparing schedules, using Census denominators for each birth cohort and PCV13 coverage by schedule from the National Immunization Survey.

Results: We identified 54 BIs; common serotypes were 19A (50%), 3 (29.6%), and 19F (14.8%). BI incidence by age 12 months was greater among children receiving 2+0 (IR: 2.12, 95% CI: 0.72-6.26) than those receiving 3+0 (IR: 0.07, 95% CI: 0.01-0.34; IRR: 33.8, 95% CI: 8.4-135.0). Incidence by age 24 months following a 3+1 schedule was 0.6 (95% CI: 0.3-1.1); we could not compare incidence following a 2+1 schedule because no BI were reported (IR: 0.0, 95% CI: 0-5.1).

Conclusions: PCV13 BIs are rare. Our data suggest that BI incidence in the first year of life is higher in children receiving fewer than the age-recommended number of doses. These results should be interpreted with caution given the wide confidence intervals for estimated rates.

CONCURRENT SESSION D2: Antimicrobial Resistance and Treatment

3:45–5:10 PM

Ballroom East

Moderators: Christopher Braden and Michael Gronostaj

3:50 Antibiotic Prescribing by Dermatologists — United States, 2011–2015

Authors: Kathleen Hartnett, M. Bartoces, L. King, L. Hicks, J. Barbieri, D. Margolis, K. Fleming-Dutra

Background: Antibiotic use is an important driver of antibiotic resistance, a major public health threat. U.S. dermatologists prescribe more antibiotics per provider than any other medical specialty, although recent dermatology guidelines recommend antibiotic-sparing acne treatment when possible. Our aim was to describe antibiotic prescriptions by dermatologists from 2011–15 to identify targets for improving antibiotic use.

Methods: We calculated proportions and population-based rates of dermatologists' oral antibiotic prescriptions by agent, class, and patient characteristics using the 2011–15 IQVIA™ Xponent and U.S. Census data. Using Poisson regression, we assessed the change in prescription rate per year. We used 2015 National Ambulatory Medical Care Survey (NAMCS) data to determine the most common diagnosis for which dermatologists prescribe antibiotics (oral, topical, and parenteral).

Results: Dermatologists' antibiotic prescribing declined from 8.5 million oral courses in 2011 to 7.1 million in 2015 (prevalence rate ratio [PRR] for the decrease in log rate per year: 0.9521; 95% confidence interval [CI]: 0.9519–0.9523). Tetracyclines were the most commonly prescribed class, ranging from 67–70% of oral antibiotics annually. The most frequently used agent was doxycycline, representing 36–42% of oral antibiotics prescribed during 2011–15. Youth ages 10–19 years received the highest rate of oral antibiotic prescriptions, but the rate in this age group dropped from 58 prescriptions per 1,000 people in 2011 to 44 per 1,000 in 2015. In NAMCS, the diagnosis most often leading to antibiotic prescriptions by dermatologists was acne, accounting for 31% (95% CI: 23%–40%) of 2015 antibiotic prescriptions, but only 39% (95% CI: 26%–52%) of dermatology visits for acne resulted in antibiotics.

Conclusions: Antibiotic prescribing by U.S. dermatologists has declined substantially since 2011, although antibiotic prescribing for acne remains common. Continued development and increased use of antibiotic-sparing treatments for dermatologic conditions, including acne, may help combat antibiotic resistance.

4:10 Prevalence of Carbapenemase-Producing Carbapenem-Resistant Enterobacteriaceae (CRE) Among CRE in Thailand

Authors: Caitlin Biedron, N. Chea, M. Lyman, A. Kolwaite, B. Park, P. Kitsutani, C. Bunthi, A. Kerdsin, W. Paveenkittiporn

Background: Carbapenem-resistant Enterobacteriaceae (CRE) are considered urgent antibiotic-resistant threats by CDC and WHO and are associated with high mortality and limited treatment options. Understanding the prevalence and epidemiology of carbapenemase-producing CRE (CP-CRE) is particularly important, as CP-CRE carry mobile genetic elements that can spread between bacteria, thereby indicating the need for aggressive containment actions. We characterized the molecular epidemiology of CRE in Thailand to inform the need for additional public health measures to prevent CRE spread.

Methods: During September 2016–August 2017, 22 geographically representative clinical laboratories prospectively submitted all CRE isolates identified in their laboratories, along with demographic and limited clinical data, to the Thailand National Institute of Health (NIH). Carbapenemase-producing genes were detected using multiplex polymerase chain reaction.

Results: A total of 1,551 CRE isolates from 1,551 patients were tested (range, 9–248 isolates per laboratory). Median age of patients was 66 years and 61.5% were male. The most common specimen types were urine (650, 42.0%), sputum (547, 35.3%), and blood (105, 6.8%). Of 1,551 CRE isolates, 1,483 (95.6%) were CP-CRE (range, 88.9–100.0% per laboratory); 1,080 (72.8%) were *Klebsiella pneumoniae*, and 370 (24.9%) were *Escherichia coli*. Among *K. pneumoniae,* New Delhi Metallo-β-lactamase (NDM) was detected in 472 (43.7%) isolates, and oxacillinase-48-like carbapenemases (OXA-48-like) were present in 340 (31.5%). Among *E. coli* isolates, NDM was present in 322 (87.0%) and OXA-48-like in 20 (5.4%) isolates. We found the coexistence of both NDM and OXA-48-like genes in 195 (18.1%) *K. pneumoniae* and 19 (5.1%) *E. coli* isolates. None of the CP-CRE isolates was positive for *K. pneumoniae* carbapenemase (KPC).

Conclusions: CP-CRE are highly prevalent among CRE in this study, with a high proportion of NDM and OXA-48-like. Containment efforts aimed at preventing CP-CRE transmission should be considered for CRE patients in Thailand.

4:30 Implementation of a Transfer Protocol for Patients with Rocky Mountain Spotted Fever — Arizona, 2011–2017

Authors: Carla Bezold, N. Fowle, H. Yaglom, C. Levy, K. Komatsu, M. Kretschmer, R. Sunenshine, T. Sylvester, H. Venkat

Background: Rocky Mountain spotted fever (RMSF) is a disease caused by *Rickettsia rickettsii* and transmitted by the brown dog tick (*Rhipicephalus sanguineus* sensu lato). Doxycycline administered <5 days of infection reduces the risk of a severe outcome; ≥20% of illnesses among US patients are fatal if treatment is delayed or not provided. In Arizona, cases primarily occur on Native American reservations and residents with RMSF are often transferred to Maricopa County (MC) acute care hospitals; initiation and continuation of doxycycline is crucial to patient survival and a public health priority. In July 2012, a new patient transfer protocol was implemented by state, county, and tribal partners to ensure continuation of doxycycline during transfers from Reservation A to MC. We evaluated patient outcomes before and after transfer protocol implementation.

Methods: Patients with confirmed or probable RMSF (clinically compatible with supportive or confirmatory laboratory criteria) transferred from Reservation A to MC hospitals during January 2011–October 2017 were identified through Arizona's notifiable disease surveillance system. Patients transferred before July 31, 2012, were classified as before protocol implementation; subsequent patient transfers were classified as after. We compared proportion of patients with doxycycline continuation and fatalities before and after protocol implementation using Fisher's exact test.

Results: Among 282 RMSF cases, 19 patients were transferred from Reservation A to MC hospitals; 17 had available data (6 before and 11 after). Twelve (71%) patients were female; 8 (47%) were children. Doxycycline continuation occurred for 1/6 (17%) patients before and 8/11 (73%) after protocol implementation ($P = .05$). Fatalities decreased from 5/6 (83%) during the period before protocol implementation to 2/11 (18%) after ($P = .01$).

Conclusions: Doxycycline continuation among RMSF patients occurred more consistently and fatalities decreased after transfer protocol implementation. This protocol could serve as a model to improve patient care during cross-jurisdictional patient transfers.

4:50 Etiology and Antimicrobial Resistance Patterns of *Salmonella* Bacteremia in Hospitalized Children with Acute Febrile Illness — Uganda, 2016–2017

Authors: Alison Winstead, A. Mpimbaza, A. Sserwanga, J. Kapisi, C. Maiteki, M. Lamorde, F. Kizito, G. Aniku, J. Nanteza, A. Tagoola, H. Kajumbula, A. Kusemererwa, Y. Manabe, R. Ransom, J. Borchert, P. Mead, K. Kugeler, M. Mikoleit, M. Freeman, K. Fagerli, E. Mintz, G. Appiah

Background: Typhoid fever, paratyphoid fever, and invasive non-typhoidal *Salmonella* cause an estimated 30.4 million illnesses and >1 million deaths annually worldwide. In a systematic review, *Salmonella enterica* was found to cause 29% of community-acquired bacterial bloodstream infections in Africa (58.4% of which were non-typhoidal *Salmonella*). However, data from sub-Saharan Africa are scarce because of limited laboratory capacity. To characterize invasive salmonellosis in hospitalized Ugandan children, we evaluated data from six hospitals participating in the Uganda Acute Febrile Illness (AFI) Project.

Methods: The Uganda AFI Project recommends a blood culture for any febrile child aged ≤14 years admitted to a hospital surveillance site with a negative test for malaria. We evaluated demographic information, blood culture results, and antimicrobial susceptibility results from all six participating hospitals from July 1, 2016 to November 16, 2017.

Results: Over a combined total of 2,146 days across all sites, blood cultures were performed and results were available for 4,257 (19%) of 22,533 hospitalized children. Overall, 3,894 (91%) yielded no growth, 220 (5%) yielded a likely contaminant, and 143 (3%) yielded a pathogen. *Salmonella* was the most commonly detected pathogen, found in 57 (38%) positive samples, including 17 identified as non-Typhi *Salmonella*, 3 as *Salmonella* Typhi, and 37 whose serotypes are pending. Among patients with *Salmonella* bacteremia, the median age was 36 months (range: 2 days to 12 years), 70% were male, and 3 (6%) died. *Salmonella* isolates were resistant to ampicillin (58%), cotrimoxazole (62%), ciprofloxacin (12%), and ceftriaxone (4%). Additionally, decreased susceptibility was noted to ciprofloxacin (26%) and ceftriaxone (6%). One isolate was resistant to both ciprofloxacin and ceftriaxone.

Conclusions: *Salmonella* is a key cause of bacterial bloodstream infections in Ugandan children. Data from this ongoing project document the threat of emerging antimicrobial resistance, notably to fluoroquinolones and ceftriaxone, which are often used for *Salmonella* infections.

CONCURRENT SESSION D3: Mortality Surveillance

3:45–5:10 PM

Ballroom C

Moderators: Margaret Warner and Tala Fakhouri

3:50 Could Online Media Reports be Useful for Tracking Mortality During Disaster Response? Hurricane Irma, 2017

Authors: Anindita Issa, R. Law, N. Nakata, A. Wang, T. Bayleyegn, T. Boehmer

Background: Although some U.S. jurisdictions have implemented active disaster mortality surveillance to provide timely and accurate data to response agencies, an approach for capturing multi-jurisdictional mortality data during an emergency response has yet to be established. Alternative data sources, such as online media reports, can address the need for timely and accurate mortality data. We describe how CDC measured the timeliness and accuracy of media mortality tracking during Hurricane Irma.

Methods: The CDC Emergency Operations Center tracked online media reports for Hurricane Irma-related deaths by using keywords, such as "hurricane", "Irma", and "death," in common web search engines. A spreadsheet of media-reported deaths was created with the following variables: name, age, sex, manner of death, circumstance of death, location of death, date of death, and media report publication date. We assessed timeliness by calculating the interval between media-reported date of death and media report publication date. We assessed accuracy by matching media-reported death to state vital statistics death records based on name, sex, location of death, and circumstance of death.

Results: We identified 116 media-reported Hurricane Irma-attributed deaths in the contiguous United States. Among the 50 deaths (43%) that contained a media-reported date of death, the median timeliness of reporting was one day (range: 0–13 days). Preliminary results based on data from two affected states show that 83% of media-reported deaths were identified in state vital records. Timeliness and accuracy will be recalculated after receiving official mortality data from all affected states.

Conclusions: During Hurricane Irma, online media reports of hurricane-related deaths were timely and accurate. These results suggest that mortality surveillance using online media reports in the immediate disaster response phase can be useful for situational awareness and crafting public health messaging to prevent further morbidity and mortality.

4:10 Influenza-Associated Death Surveillance — North Carolina, 2014–2016

Authors: Carolyn Herzig, Z. Moore, J. MacFarquhar, J. Maillard, V. Mobley, A. Fleischauer

Background: Approximately 12,000–56,000 influenza-associated deaths occur annually in the United States. In North Carolina (NC), physicians are required to report all influenza-associated deaths confirmed by laboratory or rapid diagnostic testing. The validity and representativeness of influenza-associated death surveillance in NC is unknown. Therefore, we assessed whether influenza-associated deaths reported to the NC Electronic Disease Surveillance System (NCEDSS) differ from those in other datasets.

Methods: During 2014–2016, NCEDSS influenza-associated deaths, hospital discharge (HD) deaths with any influenza diagnosis, and death certificate (DC) records with influenza as the primary cause of death were probabilistically linked by name, sex, and birth year using LinkPlus. Agreement among datasets was determined and demographic characteristics were compared using chi-square and *t* tests.

Results: During 2014–2016, a total of 1,477 potential influenza-associated deaths were identified; 377 by NCEDSS, 601 by HD, and 499 by DC. After linking, 855 unique deaths were identified; an average of 285 deaths annually. All datasets were concordant for 173 (20%) deaths. Overall, 85% of NCEDSS cases (n = 322) matched HD or DC cases. No statistically significant differences among datasets were observed for sex, ethnicity, or metropolitan versus rural residence. Mean ages were similar in NCEDSS (68 years) and HD (69 years) cases; however, DC cases were older (72 years; $P < .01$). Compared with NCEDSS (75% white) and HD (76% white), cases in DC (83% white) were more likely to be white ($P < .01$).

Conclusions: Because fewer deaths were captured in NCEDSS, compared with HD and DC, NC surveillance may underestimate the true burden of influenza-associated death. However, 85% of cases in NCEDSS were matched to another data source suggesting that predictive value positive is high. Additionally, NCEDSS cases were similar by sex, ethnicity and rurality suggesting they are representative of all influenza-associated deaths in NC.

4:30 Two U.S. Surveillance Systems — A Comparison of Tuberculosis-Related Mortality, 2010–2013

Authors: Zimy Wansaula, J. Wortham, M. Haddad, A. Langer

Background: Tuberculosis (TB), the world's leading infectious disease cause of death, results in >600 U.S. deaths annually. Because a cure exists, understanding TB-related mortality aids targeted prevention efforts. Two separate CDC systems collect U.S. TB-related mortality data, the Vital Statistics (VS) system and the National TB Surveillance System (NTSS). However, reported TB-related mortality differs between the 2 systems. To identify opportunities to improve surveillance quality, we compared the agreement of death records between NTSS and VS and assessed factors associated with discordance.

Methods: We used a probabilistic matching algorithm, including such variables as age and dates of birth and death, to match NTSS and VS death records reported during 2010–2013. TB-related deaths were those for which TB was listed in either system as contributing to the death. Using clinical and demographic information from NTSS, we compared characteristics of deaths between the 2 systems with chi-square tests.

Results: A total of 2,683 death records from NTSS and VS matched; both systems considered 705 (26.3%) TB-related and 1,161 (43.3%) not TB-related. Of the remaining 817 (30.4%), 282 (34.5%) were TB-related only by NTSS and 535 (65.5%) only by VS. Among pulmonary-related TB cases, NTSS classified fewer deaths as TB-related, compared with VS (29.0% versus 71.0%, $P < .001$). In contrast, among HIV coinfection-related cases, NTSS classified more deaths as TB-related, compared with VS (82.9% versus 17.1%, $P < .001$).

Conclusions: NTSS and VS agreed in <50% of TB-related deaths. Agreement was particularly poor among pulmonary and HIV coinfection TB cases. Misclassification of TB-related deaths can hamper the design and implementation of targeted prevention efforts to reduce TB mortality. Therefore, efforts to improve measurement of TB-related mortality should focus on reconciling cause-of-death classifications for patients with pulmonary TB and TB-HIV coinfection.

4:50 Variation in Sudden Unexpected Infant Death by State and Urbanicity — United States, 2011–2015

Authors: Lindsay Womack, L. Rossen, M. Warner

Background: Sudden unexpected infant deaths (SUID) includes three underlying causes of death: sudden infant death syndrome (SIDS), accidental suffocation and strangulation in bed (ASSB), or unknown cause. Among SUID deaths, the percentage reported as SIDS has declined since 2010, while ASSB and unknown cause have increased. The study objective is to examine variation in SUID reporting by state, urbanicity, and other factors.

Methods: We conducted a population-based study of U.S. linked birth and infant death certificates from 2011–2015, identifying underlying cause of death from ICD-10 codes. Mixed-effects multinomial logistic regression was used to examine variation in SUID reporting by state of occurrence, residential urbanicity, and other factors.

Results: Of 17,173 SUID deaths from 2011–2015, 47.4% were reported as SIDS, 22.7% as ASSB, and 29.9% as unknown cause. Decreases in the proportions reported as SIDS occurred each year. The state of occurrence accounted for 21–25% of the variability in the percentage of SUID deaths reported as ASSB or unknown cause compared with SIDS. SUID deaths were less likely to be reported as ASSB (adjusted odds ratio [AOR]: 0.85; 95% confidence interval [CI]: 0.75–0.96) or unknown cause (AOR: 0.77; 95% CI: 0.69–0.87) among infants residing in rural counties compared with large urban counties. Additionally, SUID deaths were less likely to be reported as unknown cause for deaths in small/medium urban counties (AOR: 0.83; 95% CI: 0.76–0.91) compared with large urban counties.

Conclusions: Reporting of SUID deaths varies by year, state, and urbanicity. Variation in underlying cause of death may be partially related to improvements in death investigation practices, diagnostic techniques, reporting practices, or medical advances. Better understanding of variations in reporting of SUID deaths is critical for infant mortality surveillance and prevention.

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CONCURRENT SESSION E1: Healthcare-Associated Infections

8:30–10:15 AM

Salon

Moderators: Denise Cardo and Isaac See

8:35 Out of Thin Air: Assessing Dispersion of *Mycobacterium chimaera* in the Operating Room

Authors: Matthew Stuckey, B.E. Christensen, H. Moulton-Meissner, J. Swift, T. Rhodes, K.A. Thure, M.A. Kainer

Background: On May 19, 2017, a case of *Mycobacterium chimaera* was confirmed in a patient who received a coronary artery bypass graft at a Tennessee hospital during June 2016. Certain heater-cooler devices (HCDs) used during open-chest surgery have been shown to generate aerosols of *M. chimaera*. Since 2015, at least 50 episodes of *M. chimaera* infection have been associated with these HCDs in the United States. CDC joined the Tennessee Department of Health (TDH) and the reporting facility to rapidly assess and mitigate potential dispersion of *M. chimaera* from HCDs in the operating room (OR).

Methods: We characterized OR dimensions, configuration, and airflow. During HCD operation in the OR, we performed bioaerosol sampling and real-time measurement of 0.5–10.0 µm particle concentrations. We repeated OR sampling after implementing interventions to limit aerosol dispersion, including draping and repositioning the HCD exhaust. HCDs were visually inspected and sampled for *M. chimaera*. Samples were cultured and stained for acid-fast bacilli (AFB); AFB-positive samples and clinical isolates were identified using matrix-assisted laser desorption/ionization using a time-of-flight mass spectrometer (MALDI-TOF). Species and strain were confirmed by whole genome sequencing (WGS).

Results: The OR met recommended airflow standards. Particle concentrations in the surgical field ranged from 456 to 11,520 #/m^3 during HCD operation. A 1-log reduction in average particle concentrations occurred at the patient surgical field after interventions were performed on HCDs. Internal compartments of HCDs were visually contaminated with biofilm. *M. chimaera* was detected in HCD water samples and non-interventional bioaerosol samples. WGS confirmed *M. chimaera* strains as closely related to those previously associated with HCDs in the US.

Conclusions: Interventions including HCD draping or relocation may reduce the dispersion of HCD-generated particles to the patient surgical field. Facilities may consider our sampling methods to assess aerosol dispersion by HCDs and evaluate mitigation strategies.

8:55 Whole-Genome Sequencing Used to Link a Platelet Donor Colonized with *Clostridium perfringens* to Two Fatal Cases of Sepsis After Transfusion — Salt Lake City, 2017

Authors: Roberta Horth, B. Lopansri, S. Ilstrup, S. Gelman, W. Kelley, W. Garcia, K. Oakeson, J. Wagner, J. Jones, S. Basavaraju, A. Dunn, A. Nakashima

Background: Bacterial contamination of platelets, primarily from a donor's skin flora, results in substantial morbidity and mortality. In August 2017, the Utah Department of Health was notified of 2 patient deaths from *Clostridium perfringens* sepsis. Patient A expired 5 days and Patient B a few hours after receipt of apheresis platelets from the same donation. We investigated to determine contamination source and prevent additional cases.

Methods: We reviewed blood collection facility and hospital records and infection prevention practices. Healthcare professionals at the hospital and blood collection facility and the donor were interviewed to assess risk factors. Whole-genome sequencing (WGS) was performed on specimens cultured from the donor (axilla, antecubital fossa, self-administered perianal swabs) and specimens associated with each patient.

Results: Each patient received platelet units 4 days after collection and ~14 hours apart. *C. perfringens* was isolated from Patient B's platelet bag samples, and from anaerobic blood culture from Patient A 5 days post-transfusion. No blood collection or transfusion-related infection control breaches were identified. The blood collection facility confirmed the donor's initial platelet screening culture was negative. The donor reported no recent exposures to farm animals, children or travel; however, 2 household canines had had recent diarrheal illness. The donor was noted to have poor general hygiene. WGS identified 3 isolates from the donor's skin and 1 from each patient (Patient A's blood and Patient B's platelet bag residual) that were highly related. The donor was permanently deferred from donating.

Conclusions: This investigation is the first to use WGS to link bacteria on a donor's skin to a contaminated platelet product. It documents transmission by platelet transfusion of a rarely reported organism, *C. perfringens,* and highlights the urgent need for increased uptake of evidence-based bacterial contamination risk mitigation strategies.

9:15 Hospital-Associated Cluster of Mucormycosis — Chicago, Illinois, 2017

Authors: Janna Kerins, J. Williams, K. Hartnett, E. Moritz, W. Clegg, S. Tsay, T. Pindyck, K. Walblay, B. Jackson, M. Bolon, D. Cullen, A. Salim, M.A. Sotelo, K. Beer, K. Perkins, J. DeWitt, B. Christensen, B. Cox, J. Layden, T. Zembower, S. Black

Background: On October 18, 2017, Hospital A notified the Chicago Department of Public Health of 8 patients with mucormycosis in 2017, a two-fold increase from prior years. Mucormycosis, a rare and often fatal invasive mold infection affecting immunocompromised patients, is typically acquired by inhalation of spores ubiquitous in the environment. Outbreaks have been linked to inpatient hospital exposure. We aimed to characterize cases, identify a source, and prevent further infections.

Methods: Cases were Hospital A inpatients or outpatients with clinically compatible mucormycosis confirmed by histology or culture during 2017. We abstracted medical charts, evaluated inpatient and outpatient visit and procedure locations during the 3 months before diagnosis, reviewed hospital repair and construction records, and performed environmental assessments.

Results: Of 8 Hospital A mucormycosis patients, 6 had diagnoses clustered during August 1–October 31, 2017. Of these 6 patients, 3 (50%) had stem cell transplant, 2 (33%) kidney transplant, and 1 (17%) hematological malignancy. Five (83%) patients developed pulmonary and 1 (17%) cutaneous mucormycosis; 4 (67%) died. The 6 patients collectively visited 6 Hospital A buildings 212 times. All patients shared exposure to 1 location, a major inpatient and outpatient diagnostic imaging center. Inpatient day range was 11–59 days (median 28); 2 patients spent >85% of time as outpatients. Among >1,000 repair and construction orders potentially generating soil and dust exposures during 2017, no single exposure affected all patients. Environmental assessments did not reveal widespread mucormycete exposure, but identified visible mold on linen storage area walls and potted plants in Hospital A common areas.

Conclusions: No definitive mucormycosis source has been implicated in this cluster, although active surveillance is ongoing. We recommended consideration of antifungal prophylaxis effective against mucormycetes and high-efficiency respirator use among patients at high-risk, linen storage area mold remediation, and limiting soil and dust exposure.

9:35 Socioeconomic Status Factors Associated with Incidence of Community-Associated *Clostridium difficile* Infection — United States, 2014–2015

Authors: Kimberly Skrobarcek, Y. Mu, J. Ahern, Z. Beldavs, G. Brousseau, G. Dumyati, M. Farley, S. Holzbauer, M. Kainer, J. Meek, R. Perlmutter, E. Phipps, L. Winston, A. Guh

Background: Traditionally a healthcare-associated infection, *Clostridium difficile* infection (CDI) is increasingly emerging in communities. Health disparities in CDI exist, but the social determinants of health that influence community-associated (CA) CDI are unknown. We used factor analysis and disparate data sources to identify area-based socioeconomic status (SES) factors associated with CA-CDI incidence.

Methods: CDC's Emerging Infections Program conducts population-based CDI surveillance in 35 U.S. counties. A CA-CDI case is defined as a positive *C. difficile* specimen collected as an outpatient or within 3 days of hospitalization in a person aged ≥1 year without a positive test in the prior 8 weeks or an overnight stay in a healthcare facility in the prior 12 weeks. 2014–2015 CA-CDI case addresses were geocoded and incidence rates were calculated within each 2010 census tract (CT). CT-level SES variables were obtained from the 2011–2015 American Community Survey. The Health Resources and Services Administration provided medically underserved area (MUA) designations. Exploratory factor analysis transformed 15 highly correlated SES variables into 3 factors using scree plot criteria: "Low Income," "Foreign-born" and "High Income." To account for CT-level clustering, a negative binomial generalized linear mixed model was used to evaluate the associations of these factors and MUA with CA-CDI incidence, adjusting for age, sex, race and diagnostic test.

Results: Of 9,417 CA-CDI geocoded cases, 62% were female, 82% were white, and 35% were aged ≥65 years. Annual CA-CDI incidence was 42.9/100,000 persons. In multivariable analysis, "Low Income" (rate ratio [RR]: 1.21; 95% confidence interval [CI]: 1.17–1.25), "Foreign-born" (RR: 0.95; CI: 0.92–0.98), and "High Income" (RR: 0.91; CI: 0.88–0.94) were significantly associated with CA-CDI incidence.

Conclusions: Factor analysis was instrumental in identifying key drivers of disparities among interrelated SES variables. Understanding how SES factors might impact CA-CDI incidence can inform prevention strategies in low-income areas.

9:55 First Recognized Transplant Transmission of Eastern Equine Encephalitis Virus to Three Solid Organ Recipients — United States, 2017

Authors: William Walker, S. Pouch, W. Shieh, P. Annambhotla, S. Katugaha, S. Basavaraju, J. Jones, T. Huynh, S. Reagan-Steiner, J. Bhatnagar, K. Grimm, S. Stramer, J. Gabel, G. Lyon, A. Mehta, R. Radcliffe, C. Williams, J. Staples, M. Fischer, A. Panella, R. Lanciotti, J. Laven, O. Kosoy, I. Rabe, C. Gould

Background: Eastern equine encephalitis virus (EEEV) is transmitted by mosquitoes and causes a rare, but often fatal, encephalitis. In October 2017, 3 cases of encephalitis were identified in recipients of solid organs from 1 donor. After other etiologies were excluded, immunohistochemical staining and molecular testing of heart biopsy tissue from the heart recipient were positive for EEEV, suggesting possible transplant transmission. The objectives of our investigation were to confirm transplant transmission of EEEV and determine the donor's source of infection.

Methods: We tested specimens from the organ donor and recipients to confirm EEEV infection. To determine the source of EEEV infection, we reviewed local EEEV surveillance data and evaluated blood products received by the organ donor. We performed molecular and serologic testing of remaining blood co-components and segments, or serologic testing of convalescent specimens from blood donors.

Results: The organ donor had molecular evidence of EEEV infection. The 3 organ recipients had molecular and serologic evidence of acute EEEV infection. The organ donor received blood products from 8 people; all were negative for EEEV infection by molecular and serologic testing of the donated blood product (n=4), serologic testing of a convalescent specimen (n=3), or both (n=1). No reports of encephalitis were noted among 3 recipients of blood co-components. No EEEV human disease cases were reported near the organ donor's residence; however, EEEV equine cases and 1 positive mosquito pool were reported in nearby counties.

Conclusions: We report the first known transmission of EEEV through organ transplantation. To date, the 3 organ recipients have survived. While the investigation is ongoing, the available evidence suggests the organ donor was likely infected through mosquito exposure rather than transfusion transmission of EEEV. Clinicians should remain vigilant for clusters of encephalitis associated with organ transplantation and notify public health officials for prompt investigation.

CONCURRENT SESSION E2: Injury: Violence and Opioid Overdose

8:30–10:15 AM

Ballroom East

Moderators: Debra Houry and Erin Parker

8:35 Childhood Exposure to Violence and Forced Sexual Initiation — Malawi, 2013

Authors: Elizabeth Swedo, S.A. Sumner, W. Msungama, G.M. Massetti, M.S.H. Kalanda, A. Auld, S.E. Hillis

Background: Among adolescent girls and young women, studies confirm associations between forced sexual initiation and subsequent health problems, including HIV infection. Despite adverse consequences, little is known about the risk factors for forced sexual initiation. Our study aims to describe associations between childhood violence and forced first sexual intercourse.

Methods: We analyzed data from 595 sexually active 13–24 year old females who participated in the 2013 Malawi Violence Against Children Survey (VACS), a nationally representative household survey. We estimated overall prevalence of forced sexual initiation and identified subgroups with highest prevalences. We used logistic regression to examine childhood violence and other independent predictors of forced sexual initiation.

Results: Overall prevalence of forced sexual initiation was 38.9% among sexually active girls and young women in Malawi; over half of those aged 13–17 years (52.0%), unmarried (64.6%), or experiencing emotional violence (EV) in childhood (56.9%) reported forced sexual initiation. After adjustment, independent predictors of forced sexual initiation included being unmarried (adjusted Odds Ratio (aOR): 3.5; 95% Confidence Interval (CI): 1.2–10.3) and any EV (aOR: 2.5; CI: 1.5–4.2). Most of those reporting EV experienced added forms of childhood violence (85.8%). Those experiencing EV alone, or in combination with physical and/or non-penetrative sexual violence, had elevated independent odds of forced sexual initiation [EV alone (aOR: 3.2; CI: 1.1–9.6), EV plus one added form of violence (aOR: 2.2; CI: 1.1–4.4), and EV plus two added forms of violence (aOR: 2.6; CI: 1.2–5.7)].

Conclusions: Experiences of forced first sex are common among Malawian girls and young women who ever had sex. Emotional violence is a robust risk factor, whether alone or in combination with other forms of childhood violence. The relationship between childhood emotional violence and forced first sex highlights the importance of comprehensive programs and policies preventing childhood violence.

8:55 Violence in the Age of the Islamic State: Trends in Injury-Related Deaths — Baghdad, Iraq, 2010–2015

Authors: Matthew Goers, E. Leidman, O. Bilukha

Background: After the United States-led invasion in 2003, insurgency-related violence in Iraq peaked in 2007 before decreasing through 2012. However, the advent of the Islamic State of Iraq and Levant (ISIL) in 2013 led to a resurgence of violence in Baghdad, Iraq's capital and largest city. We evaluated trends in injury-related deaths in Baghdad before and during ISIL insurgency.

Methods: By law, all injury-related deaths in Iraq require examination by medical coroners to issue death certificates. We used data on these deaths in Baghdad reported to the Iraqi National Injury Mortality Surveillance System by the Baghdad Forensic Institute from January 1, 2010 to December 31, 2015.

Results: There were 17,848 injury-related deaths from 2010–2015 (range: 2,395–3,413 per year); 6,241 from gunfire (35%), 1,381 explosions (8%), 1,348 non gun-related assaults (8%), 3,435 traffic accidents (19%), 5,150 unintentional injuries (29%) and 293 missing data on intent or mechanism (2%). Deaths from gunfire and explosions increased from 2010 to 2014 by 77% (823 to 1,455 deaths) and 33% (276 to 366), respectively, before decreasing in 2015 (to 1,053 and 168, respectively). Non gun-related assaults steadily increased from 2010 to 2015 by 80% (187 to 336). Deaths from traffic accidents decreased from 2010 to 2015 by 46% (751 to 403). Unintentional deaths remained stable with most attributed to burns (46%) and electricity-related injuries (31%).

Conclusions: Deaths from gunfire and explosions in Baghdad peaked in 2014 following the emergence of ISIL. Trends suggest a potential impact of insurgency-related activity on other injuries as evidence by an increase in deaths from non gun-related assaults and a decrease in deaths from traffic accidents. Decreased traffic-related deaths could be from decreased vehicle and pedestrian activity during times of violence. These trends in all-cause injury mortality during conflict can help Iraq monitor potentially preventable causes of mortality.

9:15 Suicide Mortality Among Veterinarians — United States, 1979–2015

Authors: Suzanne Tomasi, E. Fechter-Leggett, N. Edwards, A. Reddish, R. Nett

Background: U.S. male veterinarians had suicide mortality 1.7-times higher than the general population during 1947–1977. Suicide mortality in U.S. female veterinarians has not previously been assessed. The number of U.S. female veterinarians is expected to increase as >80% of U.S. veterinary students are female. In 2016, 63,857 (59%) of 107,995 U.S. veterinarians were female. The purpose of this study was to update estimates of suicide mortality in U.S. male veterinarians, and for the first time, assess suicide mortality in U.S. female veterinarians.

Methods: Decedent information from American Veterinary Medical Association obituary and life insurance databases for veterinarians who died during 1979–2015 was submitted to the National Death Index to obtain underlying causes of death. The Life Table Analysis System was used to calculate proportionate mortality ratios (PMR) for suicide, stratified by sex and occupational characteristics, and indirectly standardized for age and calendar time, with 95% confidence intervals (CI).

Results: Of the 11,620 decedents analyzed, 11,047 (95%) were male and 573 (5%) female. A total of 398 (3%) deaths were attributable to suicide; 326 (82%) suicide deaths occurred among males and 72 (18%) among females. Male (PMR = 2.09 [CI = 1.87–2.33]) and female (PMR = 3.49 [2.73–4.39]) veterinarians had higher suicide mortality compared with the general population. Increased suicide mortality was observed among certain occupational and species specialization subgroups including clinical positions (male: PMR = 2.22 [1.96–2.51] and female: 3.41 [2.52–4.42]), non-clinical positions (male: PMR=1.80 [1.36–2.33] and female: 5.01 [2.50–8.98]), and dog and cat specialization (male: PMR=2.71 [2.32–3.16] and female: 3.37 [2.52–4.42]).

Conclusions: Female sex and certain occupational characteristics were associated with increased suicide mortality in U.S. veterinarians. Partnerships among veterinarian professional associations and veterinary schools could contribute to implementation of an effective and comprehensive suicide prevention strategy.

9:35 Occupational Patterns in Drug and Opioid-Involved Overdose Deaths — United States, 2007–2012

Authors: Laurel Harduar Morano, A. Steege, S. Luckhaupt

Background: The United States (US) drug overdose mortality rate increased by 137% between 2000 and 2014, largely driven by opioid-related overdoses. Opioids are often prescribed for work-related injuries, which vary by occupation. Many workers (e.g., emergency responders) encounter opioids while performing their job duties. We explored occupational patterns in overdose mortality, potentially a critical part of understanding the opioid epidemic.

Methods: National Occupational Mortality Surveillance (NOMS) system data were used (2007–2012). NOMS contains death certificate data including usual lifetime industry and occupation coded to the US Census Industry/Occupation codes, with limited information on employment status or deaths occurring at work. During the study period, 21 states contributed ≥1 year of mortality data to NOMS. Drug overdose mortality of unintentional or unknown intent was compared to total mortality within 26 occupational groups using proportional mortality ratios (PMRs) indirectly standardized for age, race, year, and state. Mortality patterns for opioid-related overdose were also examined.

Results: Among 57,810 drug overdose deaths aged ≥18 years, 6 occupational groups had significantly elevated PMRs: construction, extraction (e.g., mining), food preparation/serving, healthcare practitioners, healthcare support, and personal care. Construction had the highest PMRs for drug overdose deaths (1.25; 95% Confidence Interval [CI]: 1.23–1.28), and for both heroin (1.46; CI: 1.38–1.54) and opioid analgesics (1.21; CI: 1.17–1.26). Regarding opioid analgesic subtypes, construction had the highest PMR for methadone: 1.34 (CI: 1.26–1.42); extraction had the highest PMR for prescription opioids: 1.39 (CI: 1.21–1.59); and healthcare practitioners had the highest PMR for synthetic opioids (including fentanyl): 1.81 (CI: 1.59–2.06).

Conclusions: Identification of occupations with high burden of drug overdose deaths further characterizes the opioid epidemic. As the workplace is an integral part of life for the majority of the adult US population, incorporating workplace research and interventions will benefit the opioid epidemic response.

9:55 Prescribing Histories of Unintentional Opioid-Involved Overdose Deaths — Ohio, 2014

Authors: Lawrence Scholl, A. Peterson, J. DeFiore-Hyrmer, J. Halpin

Background: Ohio's opioid overdose mortality rates are among the highest in the country. Improving our understanding of opioid prescribing practices that place persons at increased risk for overdose is critical, but few studies have analyzed specific prescribing behavior risk indicators among drug overdose decedents. We analyzed high-risk prescribing behaviors before opioid overdose death in order to inform prescriber-focused prevention efforts.

Methods: Ohio death certificates in 2014 were linked to Ohio's prescription drug monitoring program (PDMP) data, revealing 1,184 unintentional opioid-involved overdose decedents who filled at least 1 prescription during the 6 months before they died: 844 deaths involving fentanyl or heroin and 340 deaths involving prescription opioids but not fentanyl or heroin. We analyzed proportions of decedents with average daily dosages of opioids ≥90 morphine milligram equivalents (MME) and doctor-shopping behavior, defined as obtaining prescriptions from ≥4 prescribers within a 6-month period—both considered high-risk prescribing behaviors. Using PDMP data, we compared prescribing behaviors among Ohio opioid decedents and the 2014 Ohio controlled substance prescription population.

Results: Approximately 35.5% of persons with fatal overdoses involving prescription opioids and 18.7% of persons who died from overdoses involving fentanyl or heroin were prescribed opioid dosages ≥90 MME during each month prior to death, while roughly 10.5% of Ohio's 2014 controlled substance prescription population was prescribed dosages ≥90 MME. Doctor shopping was identified in 30.4% of deaths involving prescription opioids and in 22.8% of deaths involving fentanyl or heroin, but just 5.7% of Ohio's controlled substance prescription population.

Conclusions: High opioid dosage and doctor-shopping behavior were elevated in both decedent groups prior to death and were markedly higher than in Ohio's statewide controlled substance prescription population. Prescribers should refer to opioid prescribing guidelines and utilize PDMP data to ensure more cautious prescribing to their patients who exhibit these risk factors for overdose.

SESSION F: Donald C. Mackel Award Finalists

10:35 am–12:00 pm

Salon

Moderators: Steve Monroe and Jennifer Wright

10:40 *Neisseria meningitidis* Serogroup C Outbreak Associated with a Funeral — Liberia, 2017

Authors: Jaymin Patel, C. Potts, J. Vuong, C. Bozio-Eldridge, T. Clark, J. Waller, M. Diaz, M. Whaley, L. Jenkins, S. Fuller, G. Gwesa, D. Williams, J. Redd, R. Arthur, Y. Walker, V. Katawera, P. Clement, H. Kohar, M. Stone, T. Nyenswah, J. Winchell, X. Wang, L. McNamara, E. Dokubo, L. Fox

Background: Meningococcal disease is a serious illness that causes ~1.2 million cases of meningitis or septicemia annually. Worldwide, the greatest burden is in the African meningitis belt, which spans from Senegal to Ethiopia, but does not include Liberia. In April 2017, an outbreak of unexplained, predominantly gastrointestinal illnesses and deaths was reported among funeral attendees in Sinoe County, Liberia. Ebola virus disease or a toxin exposure were initially suspected. We describe the epidemiologic and laboratory investigation to determine outbreak etiology.

Methods: We identified and characterized cases meeting the initial outbreak case definition: two or more symptoms (headache, vomiting, mental confusion, or weakness) with onset on or after April 10, 2017, in any person who visited or lived in Sinoe County. Patient specimens were tested by polymerase chain reaction (PCR) for Ebola and Lassa viruses, Taqman Array Card (TAC) for 48 additional pathogens, and real-time (rt) PCR for *N. meningitidis* detection.

Results: We identified 31 cases and 13 (42%) deaths in residents of three counties. Twenty-nine cases occurred among ~150 funeral attendees (attack rate: 19%). Predominant symptoms were weakness (90%), abdominal pain (81%), and gastrointestinal symptoms (74%); fever (19%) was uncommon. Five patients had purpura (16%). Ebola and Lassa virus PCR was negative for all specimens tested. TAC assay initially identified *N. meningitidis* in six specimens from four patients. rt-PCR confirmed *N. meningitidis* in 14/24 (58%) patients with available specimens, 13 of which were NmC. Specimens were available for 11 fatal cases; all tested positive for NmC by PCR.

Conclusions: Rapid detection of the outbreak and characterization through TAC assay and rt-PCR identified NmC as the cause of this initially unexplained outbreak, prompting antibiotic chemoprophylaxis of exposed people. This investigation highlights the importance of strengthening surveillance and laboratory networks worldwide to promote rapid determination of outbreak etiology and appropriate outbreak response.

11:00 Invasive Infections from a Rare Subtype of Group A *Streptococcus* — Anchorage, Alaska, 2016–2017

Authors: Emily Mosites, A. Frick, P. Gounder, L. Castrodale, Y. Li, K. Rudolph, D. Hurlburt, K.D. Lecy, T. Zulz, T. Adebanjo, J. Onukwube, B. Beall, C.A. Van Beneden, T. Hennessy, J. McLaughlin, M. Bruce

Background: In 2016, we detected an outbreak of invasive infections from a rare subtype of group A *Streptococcus* (GAS) —*emm26.3*—among the estimated 1000 persons experiencing homelessness (PEH) in Anchorage, Alaska. We aimed to characterize the GAS outbreak strain and to stop disease transmission through mass antibiotic administration.

Methods: We identified GAS cases, defined as a sterile-site isolate of GAS (or nonsterile site isolate if diagnosed with necrotizing fasciitis or streptococcal toxic shock syndrome) through Alaska's laboratory-based surveillance system from July 2016 to May 2017. In February 2017, we conducted the intervention at six homeless service facilities using a single dose of 1 gram of azithromycin. We collected oropharyngeal and non-intact skin swabs on consenting participants concurrent with and 4 weeks after the intervention to assess changes in GAS colonization. To characterize the outbreak GAS strain, we conducted molecular typing, antimicrobial susceptibility testing, and whole genome sequencing (WGS) on all invasive and colonization isolates.

Results: We detected 42 invasive *emm26.3* cases in Anchorage, 35 of which were among PEH. The isolates were uniformly susceptible to antimicrobials. We dispensed azithromycin to 391 PEH and collected swabs from 277 participants during the intervention. We collected swabs from 287 participants 4 weeks later. Colonization with *emm26.3* decreased from 4% to 1% of swabbed participants (p=0.05). Invasive GAS incidence decreased from 1.5 cases per 1000 PEH/week in the 6 weeks prior to the intervention to 0.2 cases per 1000 PEH/week in the 6 weeks after (p=0.01). The *emm26.3* isolates differed from each other by 2 single nucleotide polymorphisms on average, and comprised three genetic clusters. No changes were detected in antimicrobial resistance.

Conclusions: This outbreak of invasive GAS infections resulted from clonal spread of a newly introduced GAS subtype. Mass antibiotic administration was temporally associated with reduced invasive disease cases and colonization prevalence.

11:20 Use of a New Serologic Approach to Identify Avian Influenza A(H7N2) Virus Infections Among Animal Shelter Employees and Volunteers — New York City, 2016–2017

Authors: Eugenie Poirot, M. Levine, K. Russell, R.J. Stewart, J. Pompey, S. Chiu, A. Fry, L. Gross, F. Havers, Z. Li, F. Liu, A. Crossa, C.T. Lee, V. Boshuizen, J.L. Rakeman, S. Slavinski, S. Harper, L.H. Gould

Background: In December 2016, the New York City (NYC) Department of Health and Mental Hygiene identified the first case of cat-to-human transmission of influenza A(H7N2) virus infection during an outbreak among cats in NYC animal shelters. During January 25–February 8, 2017, we conducted a serosurvey to determine whether additional A(H7N2) human infections had occurred among shelter staff before outbreak identification and to assess exposure risk.

Methods: We administered an in-person questionnaire to employees and volunteers in two shelters with confirmed A(H7N2) cat infections, and collected and screened single serum samples for A(H7N2) antibodies among participants. Evidence of past infection was defined by microneutralization and hemagglutination inhibition titers ≥40 to A(H7N2) virus. Because serologic assays for novel influenza viruses can yield misleading results due to cross-reactivity of seasonal influenza virus antibodies, we used a newly developed series of microneutralization and immunoabsorbant assays to differentiate antibody responses to A(H7N2) versus seasonal viruses.

Results: Ninety-five of 219 (43.4%) employees and 26/383 (6.8%) volunteers present during the outbreak participated. Of the 121 participants, 99 (81.8%) had direct cat contact. Median duration from last outbreak-associated cat exposure to serum collection was 36 days (range: 27–73). One person was seropositive, indicating A(H7N2) infection (seroprevalence: 0.8% [1/121]). Among five persons tested, we could not exclude A(H7N2) infection versus cross-reactive antibody responses to seasonal influenza viruses. The remaining 115 participants were seronegative. The seropositive person reported multiple, direct exposures to cats and mild illness with subjective fever, runny nose, and sore throat during the exposure period.

Conclusions: We identified an additional human infection with A(H7N2) virus, confirming cat-to-human transmission of A(H7N2) viruses is possible; however, risk is low. Combining advanced laboratory methods with detailed epidemiologic investigation helps describe risk for novel influenza virus transmission.

11:40 First Case of Human Brucellosis Caused by *Brucella abortus* Strain RB51 Through Consumption of Raw Milk Acquired in the United States — Texas, 2017

Authors: Caitlin Cossaboom, G. Kharod, J. Salzer, R. Tiller, L. Campbell, K. Wu, M. Negrón, S. Stonecipher, N. Ayala, J. Shuford, J. Massey, L. Gaul, T. Sidwa, N. Evert, S. Tomasi, S. Robbe-Austerman, C.R. Quance, A. Hoffmaster, W. Bower, H. Walke

Background: RB51 is a live-attenuated vaccine strain of *Brucella abortus* used to prevent brucellosis in cattle and has been documented to be pathogenic in humans. Unlike field strains of *Brucella spp.,* RB51 is not detectable by routine serological assays and is rifampin-resistant, a first-line treatment of human brucellosis. In July 2017, the Texas Department of State Health Services reported a case of brucellosis associated with consumption of raw milk purchased from a dairy farm in Paradise, Texas. Bacterial Special Pathogens Branch confirmed the isolate to be RB51.

Methods: To identify the source of RB51, milk samples collected from the bulk milk tank and individual dairy cows at the implicated dairy were tested by culture and PCR. Potentially exposed individuals were identified from a customer logbook and referrals. An assessment and notification tool was developed to evaluate exposure status and provide recommendations to those with contact information.

Results: Bulk milk tank samples tested positive for RB51 by culture and PCR. Culture of individual milk samples from the 43 cows in the herd revealed two cows to be positive for RB51. Whole genome sequencing indicated genetic relatedness between the cow and human isolates. Over 800 patrons of the dairy, from eight states, were identified as having been potentially exposed between June 1st and August 7th. Of these, 577 households (72%) had complete contact information available. A full notification was administered to 377 of the 577 households (65%). Exposed individuals were identified in 287 (76%) of the contacted households and post-exposure and symptom monitoring recommendations were provided.

Conclusions: To our knowledge, this is the first instance of human brucellosis caused by RB51 through consumption of raw milk acquired in the U.S. This investigation is ongoing, and efforts continue to raise awareness on RB51 treatment and diagnostic recommendations and risks of raw milk consumption.

SPECIAL SESSION 3: TED-Style Talks: Behind the Scenes with Officers and Fellows

12:10–1:10 PM

Salon

Moderator: Eric Pevzner

CIO Sponsor: Center for Surveillance, Epidemiology, and Laboratory Services (CSELS), Office of the Associate Director for Communications (OADC)

This session provides the "behind the scenes" or "the rest of the story" behind the compelling work of EIS officers and LLS fellows.

Relevance and Appropriateness for the EIS Conference

There are an increasing number of formats and forums for scientists to communicate results and public health messages. A format growing in popularity and significance are TED talks. TED talks have already been incorporated into several scientific forums at CDC including the National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) Science Summit and the Division of Global HIV and TB (DGHT) annual meeting. The objectives of the TED session are to: 1) use TED Talks for EIS officers and LLS fellows professional development on clearer messaging and public speaking; 2) provide EIS officers with another format for communicating scientific information; 3) inspire and engage EIS conference attendees.

Speakers

- Crowdsourcing GIS: Halting the Spread of Polio in Somalia
  Amy Lavery, PhD, EIS Officer
- Blood, Sweat, and Sometimes Tissue Samples: Tracking a Killer Germ Back to its Watery Birthplace
  Cecilia Kretz, PhD, LLS Fellow
- The Untold Stories of Men Who Have Sex With Men in Rural America
  Mary (Molly) Evans, MD, EIS Officer
- Food Behind Bars: When Food Safety Isn't Enough
  Sarah Luna, PhD, EIS Officer

POSTER SYMPOSIUM I

1:30–2:55 PM

The Symposium begins in the Salon with each presenter providing a 2-minute overview. Afterward, poster viewing will occur in the pre-function area.

Moderators: Hannah Gould and Michael King

P1.1 *Elizabethkingia anophelis* Outbreak Among Ventilator-Dependent Patients at a Subacute Long-Term Care Facility — Los Angeles, 2017

Authors: Gloria Chi, M. Kim, M. Santos, A. Marutani, N. Green, D. Jensen, J. McQuiston

Background: Health care-associated *Elizabethkingia* outbreaks are uncommon. In July 2017, a subacute long-term care facility (Facility A) notified the Los Angeles County Department of Public Health of 10 *Elizabethkingia* cases (baseline: 5.5 cases/year). We investigated possible infection sources and recommended control measures.

Methods: A case was defined as *Elizabethkingia* isolated from any Facility A patient during January–October 2017 from cultures conducted by the facility. We reviewed medical records, interviewed staff, observed health care practices, sampled sinks, showers, and ventilators, and conducted whole-genome sequencing (WGS) on 8 available patient isolates.

Results: We identified 18 *Elizabethkingia anophelis* cases from respiratory culture reports, including 4 infected and 14 colonized ventilator-dependent patients. Mean age was 70 years (range: 52–89 years). Median time from admission to positive culture was 140 days (range: 13–2,822 days). Other bacterial pathogens were concurrently isolated with *E. anophelis* from respiratory cultures in 14 patients. We observed ventilator parts reused between patients without cleaning and sterilization per manufacturer's instructions, ventilator storage in wet shower rooms, inadequate ventilator cleaning, and insufficient hand hygiene during tracheostomy care. *E. anophelis* was not isolated from sinks, showers, or ventilators. Water samples from 66% of 41 patient room, shower, and nursing station outlets had heterotrophic plate counts >500 CFU/mL, of which 52% were >3,000 CFU/mL. Chlorine residuals were low (range: 0–0.16 ppm). Seven of 8 patient isolates were closely related by WGS.

Conclusions: Multiple infection control lapses likely contributed to this *E. anophelis* outbreak. We recommended correcting respiratory care, ventilator equipment reprocessing, and hand hygiene practices, cohorting patients, and implementing water management actions. WGS strongly suggested a common source. High bacterial burden in water possibly limited *E. anophelis* recovery. Facilities should consider reviewing care practices for ventilator-dependent patients to prevent exposure to and transmission of *E. anophelis* and other respiratory pathogens.

P1.2 Detecting Potential Group A *Streptococcus* Clusters using Epidemiologic and Genomic Methods — United States, 2015–2017

Authors: Katherine Fay, J. Ricaldi, S. Nanduri, J. Watt, N. Alden, S. Petit, M. Farley, L. Harrison, K. Como-Sabetti, C. Smelser, T. Poissant, N. Spina, P. Cieslak, W. Schaffner, C. Van Beneden

Background: Approximately 10–15% of persons with invasive group A *Streptococcus* (iGAS) infection die. Outbreaks are common, especially among long-term care facility (LTCF) residents and persons experiencing homelessness. In the United States, iGAS cases are monitored in 10 states through CDC's Active Bacterial Core surveillance (ABCs). Case data and GAS isolates are sent to CDC; isolates undergo whole genome sequencing (WGS) which has the capability to detect relatedness among isolates not apparent through conventional typing methods. To determine whether WGS data could help detect outbreaks, we reviewed iGAS case data from January 2015 through June 2017 and identified potential clusters in high-risk settings using epidemiologic or WGS criteria.

Methods: We defined a potential epidemiologic cluster as ≥3 iGAS cases of the same *emm* type with onset within 60 days of each other in residents of the same zip code. A potential genomic cluster was defined as ≥3 iGAS isolates of the same *emm* type differing by ≤5 single nucleotide polymorphisms obtained from residents of a single state over the evaluation period. Temporal relatedness differed between methods to maximize sensitivity of identifying cases. We reviewed potential clusters for cases occurring in LTCF residents or persons experiencing homelessness and determined the number of potential clusters identified by each method.

Results: Among 3,641 iGAS cases reported over 2.5 years, we identified 45 potential clusters: 15 (33%) by epidemiologic data only, 21 (47%) by WGS only, and 9 (20%) by both methods. Among 19 potential clusters detected in LTCFs (n=5) and among homeless populations (n=14), 32% (n=6) were detected only by WGS (2 in LTCFs; 4 among homeless).

Conclusions: Use of WGS data in conjunction with epidemiologic data likely improves detection of iGAS clusters, particularly among high-risk groups. Additional field investigations are needed to validate these potential clusters and determine efficacy of each screening approach.

P1.3 Evaluation of Tornado Fatality Identifiers for Mortality Surveillance in Electronic Death Registration System — Oklahoma, May 2013

Authors: Anindita Issa, R.S. Noe, K. Baker, D. Pate, R. Law, T. Bayleyegn

Background: Official counts of deaths attributed to disasters are often underreported, thus adversely affecting public health messaging designed to prevent further mortality. During the Oklahoma May 2013 tornadoes, Oklahoma Vital Records (VR) piloted a flagging procedure to track tornado-attributed deaths within their electronic death registration system (EDRS). To determine if the EDRS was capturing all tornado-attributed deaths, we evaluated three tornado fatality identifiers (TFI), which are used to collate information about deaths for immediate response and retrospective research efforts.

Methods: Oklahoma identified 48 tornado-attributed deaths through a retrospective review of hospital morbidity and mortality records. CDC analyzed the sensitivity, timeliness, and validity for three TFIs which included: 1) a tornado-specific flag on the death record, 2) a tornado-related term in the death certificate, and 3) the X37 ICD-10 code for cataclysmic storm, which includes tornadoes.

Results: The flag was the most sensitive TFI (89.6%, 43/48), followed by the tornado term (75.0%, 36/48) and the X37 code (56.2%, 27/48). The most timely TFI was the flag, which took 2.0 median days to report (range: 0–10), followed by the tornado term (median 3.5, range 1–21) and the X37 code (median >10, range 2–122). Over half (52.1%, 25/48) of the tornado-attributed deaths were missing at least one TFI. Twenty-six percent (11/43) of flagged records had no tornado term, and 44% (19/43) had no X37 code. Eleven percent (4/36) of records with a tornado term did not have a flag.

Conclusions: The tornado flag was the most sensitive and timely TFI. Using the flag to collate death records and identify additional deaths without the tornado term and X37 code may improve immediate response and retrospective investigations. Moreover, each of the TFIs can serve as quality controls for the others to maximize capture of all disaster-attributed deaths from vital statistics records in the EDRS.

P1.4 Canine Leptospirosis Outbreak Without Identifiable Zoonotic Transmission — Maricopa County, Arizona, 2016–2017

Authors: Sally Ann Iverson, S. Guagliardo, H. Yaglom, L. Reynolds, H. Venkat, R. Galloway, A. Reindel, A. Artus, M. LaFerla Jenni, M. Kretschmer, P. Woodward, S. Tarrant, N. Beatty, T. Sylvester, R. Klein, C. Levy, I. Schafer, R. Sunenshine

Background: Leptospirosis is a potentially fatal illness caused by exposure to animal urine containing *Leptospira* bacteria. Infected dogs can transmit leptospires to humans, but transmission frequency is poorly understood. In Arizona, canine leptospirosis is reportable to the state veterinarian (baseline: ≤5 cases annually). During 2016, in Maricopa County, 2 clusters (9 cases from one household and 18 cases from one boarding facility) of canine leptospirosis were reported. We characterized the outbreak, examined risk factors for canine infection, and investigated zoonotic potential.

Methods: We contacted 18 veterinary and 4 boarding facilities associated with reported cases of canine leptospirosis. Canine blood and urine specimens were tested by polymerase chain reaction (PCR); serum was tested for anti-*Leptospira* antibodies by microscopic agglutination test (MAT) using a *Leptospira* serovar-panel, enzyme-linked immunosorbent assay (ELISA), or rapid diagnostic test (RDT). We reviewed canine medical records, interviewed owners, and classified canine cases as confirmed (positive PCR or MAT) or probable (≥2 of the following: compatible clinical signs, epidemiologic link, or positive ELISA or RDT). We conducted a serosurvey and interviewed exposed persons; those with acute onset of symptoms compatible with leptospirosis were tested by PCR and MAT.

Results: During January 2016–June 2017, we identified 71 canine cases (55 confirmed). We interviewed 39 owners of 43 dogs (confirmed or probable cases); 31 dogs (72%) boarded at the 4 facilities. *L. interrogans* serovar Canicola was the highest reacting serovar in 16/19 (84%) dogs with MAT titers available and onset after September 30, 2016. All 118 serosurvey participants (9 owners and 109 staff from 17 veterinary clinics and boarding facilities) were seronegative. Six exposed persons with acute illness were tested; all were negative.

Conclusions: Boarding facilities likely facilitated canine infection. No exposed humans showed evidence of infection, indicating that canine-to-human transmission is infrequent; whether this is serovar-dependent requires further investigation.

P1.5 Arsenic Toxicity Associated with Dietary Mineral Supplements — California, 2017

Authors: Rebecca Laws, T. Barreau, N. Demeter, K. Tait, L. Termini, T. Nguyen, B. Moezzi, K. Choe, G.C. Windham, L. Copan, J. Talarico

Background: Inorganic arsenic is a naturally occurring element, and toxicity can manifest as systemic inflammation, skin hyperpigmentation and keratoses, peripheral neuropathy, or cancer. In August 2017, Lake County Health Services Department notified California Department of Public Health of a person with an elevated urinary arsenic level and symptoms compatible with arsenic toxicity. We conducted an exposure assessment to identify the arsenic source.

Methods: We administered an in-person exposure assessment survey, collected repeat urine samples, and obtained samples of drinking water and 5 dietary supplements consumed by the patient. We measured arsenic in urine, drinking water, and dietary supplements obtained from the patient and purchased commercially by investigators. We calculated excess lifetime cancer risks (ELCRs) for products found to have elevated arsenic concentrations.

Results: The patient reported consuming 14 commercially available dietary supplements. Arsenic was not elevated in drinking water, but concentrations were elevated in trace mineral drops (3000 µg/L) and mineral clay (13,000 µg/kg) supplements being consumed by the patient. Commercially purchased lots were also elevated. The local health department recommended discontinuing these supplements; the patient's total urinary arsenic fell from 94.6 µg/g to 28.7 µg/g (reference: <30 µg/g), and symptoms improved. Daily arsenic intake from mineral clay exceeds the ATSDR Minimal Risk Level for noncancer health effects for chronic exposure. ELCRs of trace mineral drops and mineral clay, when consumed as directed, were 1–2 in 10,000 and 3 in 10,000, respectively (cancer risk level of concern is 1 in 10,000). None of these products listed arsenic on their labeling.

Conclusions: We identified dietary supplements with arsenic concentrations that may increase risk for carcinogenic and noncarcinogenic health effects. Ingredients in dietary supplements are not independently verified; thus, companies might consider testing products derived from natural sources, and consumers and clinicians need to be aware of the potential for arsenic toxicity.

P1.6 Multiple Reports of Gastrointestinal Illness at a Hotel and Convention Center — Connecticut, 2017

Authors: Vivian Leung, J. Krasnitski, N. Montero, Q. Phan, R. Wisniewski, E. Milardo, T. Nguyen, T. Rabatsky-Ehr, M. Cartter

Background: In April 2017, the Connecticut Department of Public Health (DPH) received reports of multiple gastrointestinal illnesses cases among attendees at 3 events at a hotel and adjoining convention center during one week. DPH assisted the local health department to investigate illness extent, cause, and prevention measures.

Methods: Three separate questionnaires, asking about symptoms and event-specific exposures, were administered to attendees by e-mail (Events 1 and 3) or telephone (Event 2). A case was defined as vomiting or diarrhea (≥3 stools within 24 hours) in an attendee with onset on or after the first day of their event. Case-control analysis was conducted separately for each event. We conducted food-worker (FW) interviews and onsite environmental investigations at the hotel and convention center. Case-patient and FW stool specimens were tested for enteric pathogens.

Results: Among ~900 total attendees, 200 cases were identified (in 65/179, 36/86, and 99/212 responding event attendees, respectively). No Event 1 food or beverage items were associated with illness; however, 3 items from Event 2, and 5 items from Event 3 were. All 3 events occupied an inadequately cleaned area where an Event 1 attendee vomited. An Event 1 subgroup that met closest to this area was at increased risk for illness (odds ratio: 3.13; confidence interval: 1.48–6.58). Eight of 9 case-patient stool specimens (≥1 per event) tested norovirus-positive. All FWs initially denied illness. After 7 of 29 hotel FW stool specimens tested norovirus-positive, re-interviews found 6 had recent illness; 2 bartended at Events 2 and 3 while ill. Six specimens (from FWs and case-patients) underwent RNA sequencing; all had genotype GI.P7-GI.7.

Conclusions: A norovirus outbreak occurred among 3 cohorts that shared event space. Environmental contamination and ill FWs contributed to this outbreak, highlighting the importance of appropriate environmental cleaning and ill-FW policies for preventing event-venue outbreaks.

P1.7 Zika Knowledge, Attitudes, and Practices Among Adult Women of Reproductive Age Seeking Healthcare — Dominican Republic, September, 2017

Authors: Grace Marx, R.A. Paulino-Ramirez, L.V. Sanchez-Vincitore, C. Ruiz-Matuk, A. Paziraei, S.J. Robinson

Background: Zika virus infection has been linked to congenital birth defects. During January 2016–October 2017 in the Dominican Republic (DR), 966 confirmed or suspected Zika cases were reported among pregnant women. We sought to describe knowledge, attitudes, and practices (KAP) regarding Zika virus infection and mosquitoborne disease prevention among adult women of reproductive age.

Methods: We surveyed women aged 18–49 years not previously diagnosed with Zika virus infection and seeking outpatient treatment at any of 4 hospitals in southcentral DR during September 18–29, 2017. Trained health professionals administered confidential, in-person interviews. Demographic and KAP data were collected using Epi Info™ and analyzed in aggregate and by pregnancy status.

Results: Of 766 women approached, 668 (87%) completed the survey; median age was 28 years. Approximately 50% reported being currently (n = 221) or recently (≤12 months) pregnant (n = 111). When asked to name diseases transmitted by mosquitoes, 359 (54%) mentioned Zika. The proportion of women ranking Zika as more worrisome than dengue and chikungunya (219/668; 33%) was the same across pregnancy status (33% in pregnant/recently pregnant versus 33% in nonpregnant; $P = 0.98$), as was reporting receipt of Zika-related information during the prior year (48% versus 44% respectively; $P = 0.20$). Of 462 (69%) women reporting that mosquito repellent is easy to use, 125 (27%) reported usually using repellent, which did not differ by pregnancy status ($P = 0.89$). Reported frequency of usually sleeping under mosquito netting (70%) or wearing long sleeves (38%) also did not differ by pregnancy status ($P = 0.27$ and 0.79, respectively).

Conclusions: Zika knowledge and use of mosquito prevention methods among respondents in DR was suboptimal regardless of pregnancy status. Zika virus disease prevention efforts in the DR should consider why mosquito prevention methods are not commonly used, particularly among pregnant women.

P1.8 Hepatitis C Cluster in an Alternative Medicine Practice — New York State, 2015–2017

Authors: Robert Mcdonald, S. Amler, P. Kurpiel, K. Southwick, E. Clement, M. Parker, K. Alvarez, K. Baker, S. Ostrowski, E. Lutterloh, D. Blog

Background: In June–July 2017, Westchester County (New York) Department of Health (WCDOH) reported 2 cases of hepatitis C virus (HCV) genotype 1b infection in residents who had received an intravenous (IV) infusion at alternative medicine practice A. The New York State Department of Health (NYSDOH) and WCDOH investigated to detect the infection source, identify additional cases, and prevent further infections.

Methods: A case was an HCV-positive result in a person who had received an IV infusion, injection, or phlebotomy at alternative medicine practice A during November 2015–August 2017. Public health personnel visited the practice to interview staff, observe infection control practices, and review patient records. We matched patient records with reportable disease registries. NS5b Sanger sequencing and HVR1 next generation sequencing was conducted for phylogenetic analysis of HCV. Public notification was conducted through media, mass mailings, and a telephone hotline.

Results: Reportable disease registries revealed 6 additional persons with HCV meeting the case definition, for a total of eight cases. Specimens from 5 patients underwent phylogenetic analysis; all were genetically linked within a single transmission cluster. Specimens from the remaining 3 patients were not analyzed given HCV clearance. An infusion timeline implicated >1 transmission event. Site visits found an unlicensed person preparing and infusing therapies where manipulations of blood occurred. The medical practice was closed, and the physician's license was suspended. NYSDOH mailed alerts to 584 practice patients; WCDOH tested 109 practice A patients; the NYSDOH hotline received 80 calls. Additional persons were tested by private providers. No additional cases have been identified.

Conclusions: Inadequate infection control and unsafe injection practices likely contributed to HCV transmission at this practice. Surveillance and reporting of HCV is crucial for identifying healthcare associated HCV clusters. This investigation highlighted the value of phylogenetic analysis in epidemiologic investigations.

P1.9 Surveillance for Measles-Like Illness in a Commercially Insured U.S. Population: Is the United States On Par with Regional Standards?

Authors: Susannah McKay, J. Leung, P. Gastanaduy, J. Routh, R. Harpaz

Background: In September 2016, the Americas was the first region to eliminate measles, a highly contagious, vaccine-preventable disease that can lead to complications and death. To maintain elimination, the Pan American Health Organization (PAHO) suggested a minimum rate of suspected measles investigations (≥2 per 100,000 population) be conducted annually. However, measles-like illness (MLI) investigations conducted by U.S. clinicians are not tracked by the measles surveillance program in the U.S. To ensure the U.S. meets PAHO standards, we estimated the rate of MLI investigations using a large insurance claims database.

Methods: We used the 2009–2016 Truven Health MarketScan® Databases to identify MLI and MLI investigations. MLI were defined using International Classification of Diseases (ICD)-9/10 diagnostic codes in two ways: *a priori*, using the Council of State and Territorial Epidemiologists (CSTE) measles case definition or empirically, using ICD codes on insurance claims with a measles diagnostic code. MLI investigations were defined as MLI occurring up to 5 days prior to a measles diagnostic code or billing code for measles serology testing. We computed annual rates of MLI investigations per 100,000 population.

Results: We identified approximately 35.5 million MLI using the *a priori* definition. Of these, 24,010 had a measles serology code within 5 days; median age was 30 and 51% were aged 18–34 years. Using the empirical definition we identified approximately 46 million MLI. Of these, 29,940 were coupled with a measles serology code; median age was 31 and 50% were aged 18–34 years. The median annual rates for MLI investigations were 3.2 (*a priori*) and 4.3 (empirical) per 100,000 population.

Conclusions: Maintaining measles elimination requires continued vigilance by clinicians and high-quality case-based surveillance. The estimated rates of MLI investigations in this U.S. population exceeded the PAHO standard, suggesting that the quality of U.S. measles surveillance is robust.

P1.10 Are Unique Age Restrictions Affecting Rotavirus Vaccination Coverage in African Infants?

Authors: Talia Pindyck, J. Tate, U. Parashar

Background: Rotavirus is the leading cause of severe childhood gastroenteritis and causes >200,000 deaths annually, mostly in low-income countries. In 2009, the World Health Organization (WHO) recommended routine vaccination against rotavirus worldwide, but due to concern for intussusception, a rare adverse event associated with rotavirus vaccine, WHO initially recommended the first and last doses to be given by 15 and 32 weeks of age, respectively. While these unique age restrictions were removed in 2013, they are hypothesized to contribute to comparatively low coverage of rotavirus vaccine in many countries. We compared the coverage and timing of rotavirus vaccine with that of pentavalent vaccine (DTPw-HepB-Hib), which is concurrently administered but has no age restrictions, in Ghana and Rwanda.

Methods: Children <5 years old enrolled in Ghana and Rwanda's active rotavirus surveillance programs from 2012–2015 who tested rotavirus-negative, were included in the analysis. Vaccination data were obtained through vaccine card review. Cumulative percent frequency of pentavalent versus rotavirus vaccine first dose and last dose were compared at weeks 15 and 32, respectively, using Chi-squared analyses.

Results: 536 children from Ghana and 971 children from Rwanda were included in this analysis. In Ghana, rotavirus versus pentavalent vaccine first dose coverage at week 15 was 93% versus 93%, and last dose coverage at week 32 was 93% versus 95%, respectively. In Rwanda, rotavirus versus pentavalent vaccine first dose coverage at week 15 was 98% versus 98%, and last dose coverage at week 32 was 96% versus 98%, respectively. Coverage estimates did not significantly differ between first and last doses of rotavirus and pentavalent vaccines at weeks 15, 32, or overall ($p > 0.05$).

Conclusions: The similar pentavalent and rotavirus vaccine coverage at 15 weeks, 32 weeks, and overall indicates that age restrictions did not impact rotavirus vaccine coverage in Ghana and Rwanda.

P1.11 Contact Investigation Involving a Case of Multidrug-Resistant Tuberculosis in a Seafood Processing Plant — Alaska, 2017

Authors: Amanda Tiffany, D. Fearey, S. Massay, L. Castrodale, E. McClory, J. Bergen, B. Chandler, J. McLaughlin

Background: Multidrug-resistant tuberculosis (MDR-TB) costs 10 times more to treat and has 4 times the case-fatality rate of pan-susceptible TB. On October 11, 2017, the Alaska Section of Epidemiology was notified of a case of MDR-TB in a seafood processing plant employee. We immediately investigated to identify exposed persons and inform treatment decisions.

Methods: We screened plant employees and household contacts for signs and symptoms of TB and administered tuberculin skin tests (TSTs). TST-positive persons were interviewed in-person using a standardized questionnaire. Whole-blood samples were collected for interferon-gamma release assay (IGRA) testing for persons who were TST-positive or who self-reported having TB symptoms. IGRA-positive persons were evaluated for active TB. Follow-up screening for IGRA-negative persons occurred in December.

Results: All 148 available plant employees and 10 household contacts were screened; 126 (79%) received a TST, and 49 (39%) were TST-positive. All 49 TST-positive employees were born outside the United States; 29/49 (59%) were IGRA-positive and were diagnosed with latent TB infection (LTBI). The median age of IGRA-positive employees was 59 years (range: 37–71 years); 18 (62%) were male. One IGRA-positive employee had documentation of prior TB infection. No active TB cases were identified; one of the household contacts converted from IGRA-negative in October to IGRA-positive in December. None of the employees had been previously screened for TB by the employer.

Conclusions: Because plant employees had not been recently screened for TB, it is unclear whether any of the 29 employees with LTBI were infected by the index patient. This uncertainty is concerning because the index patient has MDR-TB and treatment for MDR-LTBI is different than that for pan-susceptible LTBI. One household member appears to have been infected by the index patient. Pre-employment TB screening at seafood processing plants would allow for better characterization of conversion after an exposure event.

P1.12 Factors Associated with *Clostridium difficile* Co-Infection Among Patients with Candidemia — United States, 2014–2016

Authors: Sharon Tsay, K. Benedict, Z. Beldavs, M. Farley, L. Harrison, W. Schaffner, A. Blackstock, S. Vallabhaneni

Background: Candidemia (bloodstream infections caused by *Candida* species) and *Clostridium difficile* infection (CDI) are both healthcare-associated infections with similar risk factors, such as broad-spectrum antibiotic use and prolonged hospitalization. We aimed to identify prevalence of, and factors associated with, CDI co-infection among patients with candidemia to inform prevention efforts.

Methods: Active, population-based surveillance for candidemia was conducted through CDC's Emerging Infections Program during 2014–2016. A case of candidemia was defined as a blood culture positive for *Candida* species collected from a surveillance area resident. Demographic and medical information, including occurrence of CDI, was collected. We defined co-infection as CDI within 90 days of candidemia and selected a multivariable logistic model to calculate adjusted odds ratios (aOR) for factors associated with co-infection.

Results: Among 2,129 cases of candidemia, 193 (9%) had CDI co-infection; 118 (5%) had CDI in the 90 days before candidemia (median: 10 days) and 60 (3%) had CDI following candidemia (median: 7 days). Median age of those with co-infection was 61 years, and 53% were male. Compared with candidemia alone, the odds of CDI-candidemia co-infection was significantly greater for patients with diabetes (aOR 1.4; 95% confidence interval 1.03–1.92), solid organ transplant (aOR 2.9; 1.46–6.00), hemodialysis (aOR 1.8; 1.24–2.67), and prior hospitalization in the past 90 days (aOR 1.74; 1.26–2.43). There were no significant differences in 30-day mortality (25% for both groups) or in type of *Candida* species.

Conclusions: Candidemia-CDI co-infection occurred frequently, with nearly one in ten patients with candidemia also experiencing CDI. Clinicians should be vigilant for co-infection among patients with diabetes, solid organ transplant, hemodialysis, and recent hospitalization and mitigate any modifiable risk factors, such as broad-spectrum antibiotic use, to prevent the added morbidity from the second infection once the first has occurred.

SESSION G: Laboratory Leadership Service Presentations

1:30–2:55 PM

Ballroom East

Moderators: Kevin Karem and Aufra Araujo

1:35 *Neisseria meningitidis* Isolate of the Emerging U.S. Urethritis Clade Causing Conjunctivitis in a Neonate — New York City, August 2017

Authors: Cecilia Kretz, G. Bergeron, M.L. Aldrich, D. Bloch, P.E. Del Rosso, T. A. Halse, B. Ostrowsky, Q. Liu, E. Gonzalez, E. Omoregie, L.Chicaiza, G. Zeiyas, B. Tha, A. Liang, J.C. Wang, M.H. Levi, S. Hughes, K.A. Musser, D. Weiss, J.L. Rakeman

Background: *Neisseria meningitidis* (*Nm*) is a leading cause of bacterial meningitis and has caused outbreaks of urethritis since 2015. On August 31, 2017, a nongroupable *Nm* (*Nm*NG) was isolated from the eye of an infant aged 3 days with conjunctivitis. The infant was born to a healthy mother by Cesarean section done for prolonged rupture of membranes in a New York City (NYC) hospital. *Nm* is a rare cause of conjunctivitis and to determine the genetic similarity to circulating strains and potential modes of transmission, including perinatal, we characterized this *Nm* isolate.

Methods: We used whole-genome sequencing for in-depth molecular characterization to determine sequence type (ST), clonal complex (CC), and genes of interest. Then, we used phylogenetic analyses to compare *Nm* sequences belonging to the same CC and dating back since 2012. This included publicly available *Nm* sequences and available NYC sequences from outbreak investigations. Vaginal and nasopharyngeal swabs were collected from the mother to determine potential carriage and transmission to the infant.

Results: The isolate possessed specific molecular characteristics from an emerging clade of *Nm*NG associated with recent and ongoing outbreaks of urethritis since 2015. This novel clade belongs to ST-11/CC 11, a hyperinvasive lineage that has caused substantial meningococcal outbreaks. Genomic analyses confirmed that the conjunctivitis isolate was phylogenetically part of the *Nm* urethritis clade which was mostly composed of urethral and anal but also one other conjunctivitis isolate and one that had caused invasive disease. No cultures were recovered from the mother.

Conclusions: Our investigation demonstrated that an isolate genetically similar to the *Nm* urethritis clade caused neonatal conjunctivitis. Modes of transmission are not fully understood for this clade, a better understanding of *Nm* non-invasive disease, including conjunctivitis in newborns and urethritis, will improve our understanding of clinical presentation, transmission modes and epidemiologic evolution of *Nm* strains.

1:55 Validation of the Universal Parasite Diagnostic (UPDx) Assay for Blood Parasites

Authors: Kristine Kines, M. Lane, E. Talundzic, J. Barratt, B. Flaherty, J. Kelley, F.S. Nascimento, R.S. Bradbury

Background: Current diagnostic approaches for the detection and identification of blood parasites require either prescience of the likely infectious agent (PCR, serology) or lack sensitivity and need specialized skills (microscopy). Previous attempts to develop assays capable of detecting and definitively identifying all parasitic agents in a single sample using universal primers to target conserved eukaryotic genes have been hampered by competitive priming and preferential amplification of host DNA. We have developed a next-generation sequencing-based assay that reduces host DNA background and enhances amplification of parasite DNA for improved diagnosis of parasitic diseases.

Methods: Genomic DNA was extracted from 96 clinical blood specimens suspected to contain parasites, digested with restriction enzymes and amplified using a nested *18S rRNA* PCR. PCR products were sequenced using an Illumina MiSeq sequencer. Reads were quantified and binned according to their respective parasite reference sequences. Results were compared to those obtained using established real-time PCR (qPCR) assays.

Results: The sensitivity of the UPDx nested assay was 94% (48/51) for *Plasmodium* spp. [*P. falciparum* 89% (31/35), *P. vivax* 100% (5/5), *P. ovale* 80% (4/5) and *P. malariae* 80% (4/5)]. UPDx detected *Babesia microti* infections with a sensitivity of 67% (6/9) but was unable to reliably detect *Trypanosoma cruzi* infections from transplant recipients with very low level parasitemias. Several rare blood parasite infections of humans were detected by the UPDx assay (*P. knowlesi*, *B. duncani*), as well as one mixed malaria infection (*P. ovale* and *P. malariae*).

Conclusions: The novel nested UPDx assay should allow the detection of all blood parasites with a single assay. Improvements in sensitivity will be required to allow application as a diagnostic tool. This new tool has the potential for the improved detection of existing and emerging parasitic diseases, and enhances our capacity to identify and respond to outbreaks of public health importance.

2:15 Facility Assessments Rapidly Identify Public Health Laboratory Needs Following Hurricane Maria — Puerto Rico, 2017

Authors: Rita Czako Stinnett, J. Concepción-Acevedo, V. de Jesus, J. Quiñones, M. Ansbro, A. de Leon, G. Rao, B.B. White, M.C. Hardy, J. Castro-Georgi, E. Ribot, A.M. Mercante, D. Lowe, R. González Peña, R.I. Cuevas Ruiz, H. Rivera Arbolay, E. Martinez Rondón, G. Rodríguez Plá, B. del Valle Rosado, N.M. Sanchez, J.F. Crespo Ramos, C. Deseda, M.T. Tirado, C.L. Bean, A. Cannons, C.N. Mangal, M. Mcgarvey, T. Wolford, A. Muehlenbachs, N. Anderson, M. Lozier, B. Sunshine, A. Patel, C. Luna-Pinto, S. Pillai, E. O'Neill

Background: Hurricane Maria interrupted public health laboratory services provided by Puerto Rico Department of Health (PRDOH), including proficiency and diagnostic testing, surveillance, and analysis of water and milk. In response to a request for assistance from PRDOH, CDC collaborated with APHL and USACE, FEMA, and HHS/ASPR to perform systematic assessments. The objectives were to assess short-term and long-term PRDOH laboratory needs.

Methods: Beginning October 13, 2017, laboratory scientists from CDC and response partners visited PRDOH laboratories to assess the hurricane's impact on facilities, environmental health, and operational capacity through facility tours and interviews with laboratory leadership. The PRDOH system includes a central public health laboratory facility and the Biological and Chemical Emergencies Laboratory (BCEL) in San Juan and regional facilities in Arecibo, Mayaguez, and Ponce. Assessment methods varied, including tools adapted from health facility assessments, structural damage assessments, and operational status assessments. A custom framework was developed based on 12 Quality System Essentials to synthesize assessments.

Results: Hurricane Maria impacted all PRDOH facilities, but structural and resource challenges to restoring services varied. Short-term needs included structural repairs (e.g. roof damage ranging from 1%-30% surface area), repair of essential equipment damaged by loss of power, and replacement of essential reagents (69% and 92% of laboratories affected, respectively). Long-term needs included re-connection to the power grid, facility reconstruction, mold remediation, and equipment re-qualification. Analysis in the context of quality systems identified opportunities for coordinating response with strengthening of laboratory systems, e.g. repair/procurement of equipment monitoring systems.

Conclusions: Hurricane Maria's impact on PRDOH operations was compounded by damage to public utilities and infrastructure. Coordination among response and recovery partners is critical in this context; these assessments represent an ongoing collaboration between PRDOH, CDC, and other federal and private partners.

2:35 Laboratory Confirmation of Enterotoxigenic *Escherichia coli* Detected by Culture-Independent Diagnostic Tests — Minnesota, 2015–2017

Authors: Randal Fowler, E. Cebelinski, D. Boxrud, S. Vetter

Background: Enterotoxigenic *Escherichia coli* (ETEC) is the leading cause of travelers' diarrhea and can cause foodborne outbreaks. Increasingly, diagnostic testing is shifting from culture-based methods to culture-independent diagnostic tests (CIDTs), some of which identify ETEC. Molecular and culture confirmation is imperative for surveillance and identification of ETEC outbreaks because culture alone cannot distinguish ETEC from other *E. coli*. This study analyzes the impact delays in sample transport duration have on the molecular confirmation of ETEC in ETEC-positive CIDT fecal samples received by the Minnesota Department of Health (MDH).

Methods: During 2015–2017, MDH received 263 fecal samples positive for ETEC by the FilmArray® GI Panel. Samples were inoculated on Sorbitol MacConkey agar (SMAC), and culture sweeps were tested for ETEC enterotoxin genes by polymerase chain reaction (PCR). The percentage of culture sweeps positive for ETEC was compared to the number of transport days after sample collection.

Results: Culture sweep PCR confirmed the presence of ETEC in 122 (46%) of 263 samples. Of the 263 samples, the daily confirmation rates were between 41-52% for 178 samples submitted 1-6 days after sample collection, whereas the daily confirmation rate ranged between 0-20% for 14 samples submitted 7-9 days after sample collection.

Conclusions: Confirmation of ETEC in ETEC-positive CIDT samples was dependent on the number of transport days after sample collection, with the highest rates observed for samples submitted 1-6 days after collection. Even at the highest confirmation rate, only 46% of ETEC-positive CIDT samples could be confirmed by PCR. Low confirmation rates could be due to transport issues, false positive results by CIDTs, or false negative results from an imperfect gold standard. This study highlights the importance of submitting CIDT-positive samples soon after detection to public health laboratories and the need for further investigation into evaluating the performance characteristics of CIDTs.

CONCURRENT SESSION H1: Global Health

3:10–4:55 PM

Salon

Moderators: Rebecca Martin and Susan Chu

3:15 Recurrent Outbreaks of Vaccine-Type Pneumococcal Meningitis Five Years After Introduction of 13-Valent Pneumococcal Conjugate Vaccine — Ghana, 2015–2017

Authors: Catherine Bozio-Eldridge, A. Abdul-Karim, J. Abenyeri, B. Abubakari, W. Ofosu, J. Zoya, C. Walker, M. Ouattara, S. Velusamy, J. Vuong, D. Opare, F. Asiedu-Bekoe, F. C. Lessa

Background: Case fatality of pneumococcal meningitis in Africa approaches 50%. Ghana observed recent increases in pneumococcal meningitis despite introduction of 13-valent pneumococcal conjugate vaccine (PCV13) into the infant immunization program in 2012, with 88–93% immunization coverage during 2013–2016. We described pneumococcal meningitis epidemiology across two meningitis seasons in Ghana.

Methods: Suspected meningitis cases were identified using World Health Organization standard definitions. A pneumococcal meningitis case was defined as pneumococcus detected by real-time polymerase chain reaction (PCR), culture, or latex agglutination in cerebrospinal fluid from a person with suspected meningitis during December 2015–March 2017. Pneumococcal serotyping was done using PCR. Annual age-specific pneumococcal meningitis incidence (cases per 100,000 population) was calculated. Incidence was adjusted for suspected cases without confirmatory testing performed by applying the proportion of confirmed cases to suspected cases without testing performed. We compared data from December 2015–March 2016 and December 2016–March 2017 meningitis seasons using the chi-squared test.

Results: During 2015–2017, 153 pneumococcal meningitis cases were reported; 28.6% were fatal. Of 137 (89.5%) cases with serotype available, 73.0% (100/137) were PCV13-type, primarily (85/137; 62.0%) serotype 1. Persons aged ≥5 years accounted for 96.7% (148/153) of cases. Adjusted pneumococcal meningitis incidence was 1.8 in children aged <5 years, and ranged from 6.8–10.6 in older children and adults. Comparing 2015–2016 and 2016–2017 seasons, the proportion of serotyped pneumococcal meningitis cases that were PCV13-type decreased from 95.5% [42/44] to 76.9% [50/65] (P=.01), whereas the proportion that were serotype 1 was stable (75.0% [33/44] vs. 69.2% [45/65] (P=.51)).

Conclusions: Low pneumococcal meningitis incidence in young children suggests a direct protective effect of PCV13. However, high incidence of PCV13-type disease in older children and adults suggests infant immunization is not preventing transmission of vaccine-type pneumococci, particularly serotype 1, to unvaccinated persons.

3:35 Timeliness of Severe Acute Respiratory Infections Surveillance — Burkina Faso, January–September 2017

Authors: Amen Ben Hamida, E. Dirlikov, A.S. Sanou, S. Mirza, T. Guigma, A. Ilboudo, A. Adjami, F. Ake, C. Whitney, I. Medah, Z. Tarnagda, R. Greco Kone, B. Bicaba

Background: Severe acute respiratory infections (SARI) are a major global health security threat; information on their incidence can inform national respiratory disease detection, prevention, and response strategies. In December 2016, the Burkina Faso Ministry of Health (MOH) implemented SARI surveillance at four sentinel sites to identify circulating pathogens and guide preventive strategies. In April 2017, MOH contracted the national postal service (SONAPOST) for transportation of naso/oropharyngeal swabs to the national influenza reference laboratory. We evaluated the system's ability to promptly collect and transport specimens.

Methods: A SARI case was defined as an acute respiratory infection with fever, cough, hospitalization, and symptom onset (onset) ≤10 days before healthcare worker (HCW) consultation. We analyzed three time steps for SARI cases with onset during January–September 2017: onset to specimen collection (collection time), HCW consultation to specimen collection, and specimen collection to laboratory-receipt (transport time). Collection and transport times were evaluated against MOH targets (≤10 and ≤2 days, respectively). Median times and interquartile ranges (IQR) were calculated, and the Wilcoxon signed-rank test was used to compare quarter (Q) one and three.

Results: Of 397 SARI cases, collection and transport data were available for 363 (91%) and 328 (83%), respectively. Collection time was ≤10 days for most (353/363, 97%) specimens (median=4 days, IQR=3–6 days). Median consultation to specimen collection time was 1 day (IQR=0–2 days). Transport time was ≤2 days for 68% (223/328) of specimens (median=2 days, IQR=1–3 days); transport time was lower in Q3 than Q1 (IQR=1–2 days vs. IQR=2–3 days, $P<0.001$).

Conclusions: Most specimen collection met target times. Transport time improved, likely due to contracting with SONAPOST, which proved fast and reliable for clinical specimen transport, a critical health security need. Sustaining prompt specimen collection and transport should include regular HCW trainings and continued partnership with SONAPOST.

3:55 Efficacy of Artemether-Lumefantrine, Artesunate-Amodiaquine, and Dihydroartemisinin-Piperaquine for the Treatment of Uncomplicated *Plasmodium falciparum* Malaria — Angola, 2017

Authors: Elizabeth Davlantes, P.R. Dimbu, C.M. Ferreira, M. Florinda, D. Pode, J. Félix, E. Sanhangala, B. Nieto Andrade, S. dos Santos Souza, E. Talundzic, V. Udhayakumar, C. Owens, L. Okoko, E. Mbounga, G. Ponce de Leon, E.S. Halsey, F. Fortes, M.M. Plucinski

Background: The Angolan government recommends three artemisinin-based combination therapies (ACTs) for treatment of uncomplicated *Plasmodium falciparum* malaria: artemether-lumefantrine (AL), artesunate-amodiaquine (ASAQ), or dihydroartemisinin-piperaquine (DP). Due to emerging resistance to artemisinin derivatives and their partner compounds, it is important to periodically monitor ACT efficacy. This study evaluated these medications' therapeutic efficacy in Zaire, Lunda Sul, and Benguela Provinces.

Methods: Enrollment occurred during March-July 2017. Study participants were children with symptomatic *P. falciparum* monoinfection recruited from two health facilities in each provincial capital. Participants received a three-day course of an ACT and were monitored for 28 to 42 days depending upon treatment. Each ACT was assessed in two provinces; medication administration was not randomized or blinded, as the aim of the study was not to compare ACTs. The primary study endpoints were follow-up with no complications and failure to respond to treatment or development of a recurrent *P. falciparum* infection. Parasites from each patient experiencing recurrent infection were genotyped to differentiate new infection from recrudescence of persistent parasitemia.

Results: Of 608 children enrolled in the study, 540 (89%) reached a primary study endpoint. The corrected efficacy of AL, after exclusion of reinfections, was 96% (91–100%, 95% confidence interval) in Zaire and 97% (93–100%) in Lunda Sul. The corrected efficacy of ASAQ was 100% (97–100%) in Benguela and 93% (88–99%) in Zaire. The corrected efficacy of DP was 100% (96–100%) in Benguela and 100% in Lunda Sul. Parasitemia was cleared within three days of medication administration in all participants.

Conclusions: AL, ASAQ, and DP continue to be efficacious against *P. falciparum* malaria in these provinces of Angola. Rapid parasite clearance is consistent with full susceptibility to these artemisinin derivatives. Periodic monitoring of *in vivo* drug efficacy remains a critical, routine activity within national malaria control programs.

4:15 High Tetanus Burden or Surveillance Reporting Error? — Uganda, 2017

Authors: Rebecca Casey, J. Nguna, B. Opar, P. Tanifum, J. Lubwama, B. Zhu, A. Kisakye, E. Kabwongera, R. Tohme, B. Dahl, A. Ridpath, H. Scobie

Background: Worldwide, Uganda has among the highest incidence of reported non-neonatal tetanus (non-NT), which can have a case-fatality ratio (CFR) approaching 100% without medical intervention. In Uganda, three tetanus toxoid-containing vaccine (TTCV) doses are offered to infants and five additional TTCV doses are offered to reproductive age women; however, the three childhood booster doses recommended by the World Health Organization are not provided. Analyses of reported non-NT cases in Uganda identified a lower proportion of cases among males (47%) and a lower CFR (18%) than expected. We conducted a field investigation to evaluate whether reported non-NT data reflects true disease burden for Uganda.

Methods: Across all four regions of Uganda, we selected 26 facilities (14 hospitals, 12 health centers) including 20 with high numbers of reported non-NT cases and six with zero reported cases. We abstracted data retrospectively from available patient registers and medical records for cases during January 1, 2016–June 30, 2017. Finally, we compared cases identified in facility patient registers with reported data.

Results: Among 485 non-NT inpatient cases reported from hospitals visited, 345 (71%) were identified, despite some missing registers. Of cases identified, 292 (85%) were among males. Of 146 cases with available medical records, 137 (94%) were clinically-confirmed tetanus; among these, CFR was 57% and another 15% had unknown outcome. Fourteen cases were identified at two hospitals reporting zero cases. From the more than 4,000 non-NT cases reported at selected health centers, only three cases were identified in registers; the remainder were recording or data entry errors.

Conclusions: The non-NT burden in Uganda is substantial, but likely lower than reported. Further surveillance strengthening and data quality improvement activities are needed. The high non-NT burden in men and high CFR indicate the need to add tetanus booster doses for protection of all individuals across the life-course.

4:35 Clinical Profiles to Distinguish Rotavirus from Other Etiologies of Diarrhea in Children <5 Years of Age Seeking Medical Care for Moderate-to-Severe Diarrhea Pre- and Post-Rotavirus Vaccine Introduction — Rural Western Kenya, 2008–2017

Authors: Tracy Ayers, J. Tate, R. Omore, J. Ochieng, A. Ondeng, T. Farag, D. Nasrin, S. Panchalingam, J. Nataro, K. Kotloff, M. Levine, J. Oundo, M. Parsons, K. Laserson, U. Parashar, E. Mintz, R. Breiman, R. Hoekstra, C. O'Reilly

Background: In resource-limited settings, rapid diagnostics for moderate-to-severe diarrhea (MSD) in children are often unavailable, complicating treatment decisions. Among Kenyan children <5 years old, we sought to identify clinical profiles to distinguish rotavirus, which causes >4,000 childhood deaths annually in Kenya, from other diarrheal etiologies, pre- and post-rotavirus vaccine introduction.

Methods: Demographic and clinical features reported by caretakers and clinical assessments were collected for children with MSD for 4 years pre-vaccine and 2 years post-vaccine introduction. Stool specimens were collected and tested for 23 different diarrheal pathogens. Classification tree methods were used to evaluate predictors of rotavirus versus other etiologies.

Results: Pre- and post-vaccine, diarrheal pathogens were identified in 1,436 (81%) and 756 (73%) children with MSD, respectively; of these, 719 (50%) and 441 (58%) had a single pathogen identified with 90 (13%) and 32 (7%) rotavirus positive only. Pre-vaccine introduction, the rotavirus weighted tree model partitioned rotavirus cases based on four main predictors in the following order: age <18 months; vomiting ≥3 times/24 hours; onset in warm-dry month (January – March, July, August and December); skin tenting. No rotavirus cases were identified in infants <18 months, without both vomiting and skin tenting present. Post-vaccine introduction, rotavirus cases were partitioned using four main predictors in the following order: vomiting for >2 days; drinking less than usual; vomiting ≥3 times/24 hours; and onset in a warm-dry month. The largest group with <1% rotavirus-positive (n=299) had vomiting <3 days and were able to continue drinking as usual.

Conclusions: Classification tree models identified the order of importance of clinical variables in predicting rotavirus infection in Kenyan children pre- and post-rotavirus vaccine introduction. After introduction, age was no longer predictive of rotavirus MSD. Recognizing key features, such as severity of vomiting and seasonality, in countries post-vaccine introduction, will improve empiric management of children with MSD.

CONCURRENT SESSION H2: Occupational and Environmental Health

3:10–4:55 PM

Ballroom East

Moderators: Margaret Kitt and Candice Johnson

3:15 Occupational Exposure to Carbon Disulfide in an Artificial Casing Manufacturing Plant — United States, 2017

Authors: George Grimes, J. Ramsey, C. Mueller, J. Gibbins

Background: Carbon disulfide (CS_2), used as a solvent across a range of industries, causes neurotoxic effects, skin damage, and neurobehavioral changes. In July 2016, union representatives contacted NIOSH concerning high exposures to CS_2 at Company A, which produced artificial meat casings. We performed a health hazard evaluation to quantify exposures and health effects among employees.

Methods: We surveyed 85 (94%) of 90 available employees over two shifts. We identified risk factors of exposure and calculated prevalence ratios (PRs) for reported neurologic, behavioral, and dermal health effects. We measured personal air levels of CS_2 for 47 manufacturing employees. We measured urinary 2-thiothiazolidine-4-carboxylic acid (TTCA), an indicator of body burden for CS_2 in 76 (95%) of 80 full-shift employees. We defined employees with at least one air level at or above 0.5ppm as "overexposed." A urinary TTCA equal to or greater than 0.5mg/g of creatinine was defined as a high body burden.

Results: We found ineffective workplace controls and inadequate use and maintenance of personal protective equipment (PPE). Air results showed 33 (70%) of 47 participants were above 0.5ppm, and 21 (28%) of 76 participants had TTCA levels exceeding 0.5mg/g of creatinine. Participants working in the extrusion area were more commonly overexposed to CS_2 ($p<0.01$) and more likely to have a high body burden ($p<0.01$). Participants routinely assigned to extrusion areas more commonly reported changes in personality and mood swings (PR: 1.69; 95% confidence interval 1.05–2.73) and skin irritation (PR: 2.11; 95% confidence interval 1.13–3.94).

Conclusions: Inadequate exposure controls and poor PPE compliance resulted in CS_2 overexposures. Extrusion area participants were statistically more likely to be overexposed, have a high body burden, and report CS_2-associated personality and skin effects. Improved ventilation, worker rotation, and appropriate PPE use will reduce inhalation and dermal exposures and subsequent health outcomes.

3:35 Postexposure Prophylaxis Use Among Veterinary Staff Exposed to Tularemia-Infected Animals — Wyoming, 2012–2017

Authors: Andrea Cote, C. Van Houten, A. Harrist, A. Busacker, C. Nelson, K. Musgrave

Background: Tularemia, a bacterial zoonosis caused by *Francisella tularensis,* is a reportable disease in Wyoming. Because animal tularemia is an occupational risk to veterinary staff, the Wyoming Department of Health (WDH) recommends antibiotic postexposure prophylaxis (PEP) for high-risk exposures (e.g., bodily fluid contact or aerosol inhalation). However, anecdotal reports indicate PEP might be overused among veterinary staff. Because PEP patterns for occupational tularemia exposure are poorly understood, we evaluated PEP use involving animal contact among veterinary staff in Wyoming.

Methods: We invited staff from the 9 veterinary clinics with animals having laboratory-confirmed tularemia infection reported during 2012–2017 to complete a questionnaire electronically or by phone regarding nature of exposure, use of personal protective measures (PPM), and use of PEP. Risk for infection (high or low) was assigned based on exposure type and PPM use. We analyzed frequencies of animal exposures, correct PPM use, individual risk, and PEP.

Results: Thirteen veterinary staff from 6/9 (67%) clinics completed the survey. The three most commonly reported interactions included petting (6/13; 46%), restraining the animal (5/13; 38%), and performing a physical exam (5/13; 38%). Protective measures reported included handwashing after touching the animal (8/13; 62%) and wearing gloves (6/13; 46%). One veterinarian (8%) was at a high risk for contracting tularemia based on exposure type (performed a necropsy) and incomplete PPM use (gloves, but no face mask or goggles), but did not seek health care for PEP. However, 7/13 (53.8%) respondents reported using PEP despite low-risk exposures.

Conclusions: PEP was used incorrectly among veterinary staff exposed to tularemia-infected animals. Provider education and consultation with WDH can help to identify high-risk exposures and need for PEP while reducing incorrect use. WDH will create a letter for veterinary clinics on potential exposure notifications and an algorithm for health care providers for use of PEP.

3:55 High-Impact Communication Channels for Air Quality Alerts — United States, 2014

Authors: Audrey Pennington, K. Sircar, J. Hsu, M. Mirabelli

Background: Air pollution causes respiratory and cardiovascular disease exacerbations and deaths; in the United States 200,000 premature deaths are attributable to air pollution each year. Air quality alert strategies are interventions that notify the public about high air pollution days to help individuals avoid air pollution exposure. We assessed how U.S. adults receive air quality alerts and whether it varies by demographics or clinical conditions.

Methods: We analyzed data from the summer 2014 wave of ConsumerStyles, a cross-sectional survey of U.S. adults (N=4,269) probability sampled to be nationally representative. We calculated the weighted proportion of individuals who received air quality alerts from seven communication channels, combining all individuals and stratifying by demographics. To assess whether the reach of communication channels varied by respiratory and cardiovascular disease status, we used binomial regression to compute weighted prevalence ratios adjusted for sex, age, race, and education.

Results: Only 48% of U.S. adults had heard about air quality alerts. Within every demographic category in this subpopulation, television was the most common communication channel (76% overall). Other common communication modes were radio (30%), newspaper (24%), and internet (20%). Less common communication modes were friend or family member (6%), mobile phone or device app (5%), and electronic highway sign (5%). Percentages reporting each communication channel did not vary by respiratory or cardiovascular disease status. For example, prevalence of receiving alerts via television did not differ by presence or absence of respiratory disease (adjusted prevalence ratio [95% confidence interval]: 1.02 [0.93, 1.11]).

Conclusions: Most U.S. adults had not heard about air quality alerts. Among those who had, television was the farthest-reaching communication channel. Expanding the use of other communication channels might increase awareness of air quality alerts. When resources are limited, these data can help decision-makers target communication channels that achieve the greatest public health impact.

4:15 Evaluating the Risk of Tick-Borne Relapsing Fever Among Occupational Cavers — Austin, Texas, 2017

Authors: Stefanie Campbell, A. Kliouéva, S. Tomasi, C. Nelson, A. Replogle, M. Schriefer, J. Taylor, N. Kwit, A. Hinckley

Background: Tick-borne Relapsing Fever (TBRF) is a potentially serious spirochetal infection caused by certain species of *Borrelia* and acquired through the bite of *Ornithodoros* ticks. In 2017, Austin Public Health identified several TBRF cases among employees who worked in caves. We investigated the occurrence of TBRF and associated risk factors among occupational cavers, with the aim of developing targeted prevention recommendations.

Methods: We conducted a cross-sectional serosurvey of employees at 8 organizations with cave-related work in three Austin-area counties. Participants were interviewed, using a standardized questionnaire, regarding frequency and location of cave exposures, use of protective measures, and recent illness. Serum was tested for antibodies to *B. turacatae* using a 2-tiered testing algorithm.

Results: Among 44 participants, 33 (75%) had entered 89 different Austin-area caves in the previous 12 months. Antibodies against TBRF-causing *Borrelia* were detected in serum of 5 participants; 4 reported recent illness and sought medical care, 3 were diagnosed with TBRF, and all had entered caves in the past 12 months. Seropositive employees entered significantly more caves (23.6 vs 11.7, P=0.04) and were more likely to guide cave tours (80% vs 31%, P=0.05) than seronegative employees. Based on preliminary analysis, 5 caves were identified as the most frequently entered among the seropositive. When comparing seropositive with seronegative employees, rates of using insect repellent (20% vs 33%, P=0.5) and wearing long sleeves plus pants (80% vs 69%, P=0.5) did not differ significantly.

Conclusions: Employees who frequently enter caves in Austin are at increased risk for TBRF. Five specific caves were identified as potentially high risk, many of which are in public use areas and open for tours. CDC is working with Austin Public Health to educate area providers about TBRF and develop prevention recommendations for occupational cavers and tour groups.

4:35 Trajectories of Post-Traumatic Stress Symptoms Among International Humanitarian Aid Workers

Authors: Blanche Greene-Cramer, S. Russell, E. Hulland, C. Eriksson, B. Lopes Cardozo

Background: International relief projects commonly take place in contexts of political upheaval, putting aid workers at high risk for violence and exposure to human suffering that can precipitate negative mental health outcomes. Studies examining post-traumatic stress (PTS) in this population are mostly cross-sectional or evaluate overall group changes in prevalence over time. We used a PTS symptom dataset, part of a longitudinal study, to explore mental health-related outcomes.

Methods: We surveyed 154 international aid workers from 17 organizations pre-deployment, immediately post-deployment, and three to six months after deployment (follow-up) using the Los Angeles Symptom Checklist to evaluate PTS. We used latent class growth analysis, a statistical method for identifying unobservable subgroups in populations, to classify study participants by their trajectories of PTS symptoms from pre-deployment to follow-up. We constructed a logistic regression model to determine which variables predicted PTS subgroup (class) membership.

Results: Latent class growth analysis revealed six distinct classes of PTS symptom trajectories. We re-characterized those classes into two broader classes: resilient (n=117) and non-resilient (n=27). Resilient describes individuals whose PTS levels at follow-up returned to equal or lower levels than pre-deployment. Non-resilient describes individuals whose PTS was elevated immediately post-deployment and remained high or increased at follow-up. Our logistic regression model included five potential risk factors for non-resilient classification: previous counseling (adjusted odds ratio: 2.14; 95% confidence interval: 0.73–6.3), being female (2.31; 0.82–7.2), older age (1.02; 0.97–1.07), having children (3.10; 1.17–8.95), and fewer organizational support services (1.31; 1.01–1.73).

Conclusions: Latent class growth analysis offers an alternative approach to conceptualizing post-traumatic stress in aid workers where post-traumatic stress disorder (PTSD) is low. Identifying trajectories of PTS and the predictors of class membership will allow organizations to identify individuals needing additional support services as well as organizational actions that can increase resilience.

SESSION I: FETP International Night — Poster Presentations (sponsored by TEPHINET & CDC Foundation)

6:00–8:30 PM

Ballroom East

Agenda provided during session

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CONCURRENT SESSION J1: Hurricane Response

8:30–10:15 AM

Salon

Moderators: Patrick Breysse and Ekta Choudhary

8:35 Initial Public Health Laboratory Response After Hurricane Maria — Puerto Rico, 2017

Authors: Brunilís White, J. Acevedo, R. Peña, R. Ruiz, H. Arbolay, M. Toro, V. de Jesus, M. Hardy, R. Stinnett, J. Georgi, G. Rao, J. Quiñones, A. de Leon, M. Ansbro, A. Mercante, E. Ribot, H. Martin, A. Starks, B. Metchock, S. Johnston, T. Dalton, C. Stafford, M. Youngblood, K. Klein, S. Lindstrom, L. Berman, R. Galloway, I. Schafer, H. Walke, R. Stoddard, R. Connelly, E. McCaffery, M. Rowlinson, S. Soroka, D. Tranquillo, A. Gaynor, C. Mangal, K. Wroblewski, A. Muehlenbachs, R. Salerno, M. Lozier, B. Sunshine, A. Patel, C. Luna-Pinto, S. Pillai, E. O'Neill

Background: Hurricane Maria caused significant damage to Puerto Rico Department of Health (PRDH) laboratory buildings and equipment, rendering them largely inoperable. Consequently, PRDH was unable to detect and diagnose many infectious diseases that may affect Puerto Rico's 3.5 million US citizens. In response to a request for assistance by PRDH, the CDC Infectious Disease and Medical Countermeasures Task Force Laboratory Team (Lab Team) sought to establish an alternative approach to laboratory testing to restore disease surveillance.

Methods: The Lab Team deployed to Puerto Rico to implement a system for shipping specimens to the continental US for surveillance, confirmatory, or diagnostic testing of five high priority infectious diseases (rabies, influenza, leptospirosis, salmonella, and tuberculosis). The Lab Team collaborated with CDC Foundation to coordinate specimen shipments, partnered with CDC, APHL, and state laboratories for testing, and created a secure mechanism to report results to PRDH.

Results: Within 27 days of Hurricane Maria, the Lab Team identified 16 CDC and state health laboratories to perform specimen testing and began shipping specimens. During October 17, 2017 - December 20, 2017, the Lab Team facilitated the transport of 1,306 specimens for testing. This novel, sustainable transport system allowed Puerto Rico to re-initiate disease surveillance and identified 138 cases of high priority infectious diseases. Testing results allowed PRDH to investigate cases, identify additional suspect cases, and target public health messaging for food and water safety, prevention of leptospirosis, and the importance of influenza vaccinations, as well as continued vigilance in diagnosing and treating tuberculosis.

Conclusions: The Lab Team developed and implemented a sustainable specimen transport system that reestablished clinical testing and surveillance of priority infectious diseases in Puerto Rico, and informed public health ¬interventions. This is an unprecedented example of federal, state, and territorial collaboration to re-establish specimen testing and disease surveillance for an entire jurisdiction.

8:55 Pharmacy Needs Following Natural Disasters — United States, September–October 2017

Authors: Amy Lavery, A. Patel, S. Pillai, L. Lee, T. Bhavsar, J. Thomas, L. Hall, S. Beavers, M. Murray, T. Boehmer

Background: After disasters such as hurricanes, access to prescription drugs might be limited. Understanding the prescription drug dispensing practices of a region can inform post-disaster medication needs and planning for future emergencies. On September 20, 2017, Hurricane Maria made landfall in Puerto Rico as a Category 5 hurricane. Five days later, less than 30% of pharmacies reporting into Rx Open, an online tool which provides information on access to pharmacies during an emergency, were open. To help project possible medication needs for health care resupply, CDC summarized data from IQVIA (formerly IMS/Quintiles) to assist with response and recovery efforts following Hurricane Maria.

Methods: The IQVIA database contains information on drugs dispensed by retail facilities, and is normally used by industry to monitor drug use and trends in the market. The top 200 drug prescriptions dispensed by retail pharmacies in Puerto Rico during June–August were abstracted by IQIVA data specialists. Total mean prescriptions for these 200 drugs for the 3-month period were calculated. Drugs were categorized by therapeutic category.

Results: During June–August 2017, the top therapeutic categories of medications dispensed were for cardiovascular (average = 21% of prescriptions dispensed), psychiatric (12%), and analgesic (10%). Among the cardiovascular medications dispensed, the most common were angiotensin II receptor antagonists (29%), beta blockers (20%) and angiotensin-converting-enzyme inhibitors (18%). The top-dispensed individual medications were thyroid replacement hormones (230,324 prescriptions, 5% of total dispensed), gabapentin (144,114 prescriptions, 3% of total), and metformin (141,734 prescriptions, 3% of total).

Conclusions: Knowing the top medications dispensed can help focus immediate supply needs for public health response and recovery efforts when the normal pharmaceutical supply chain is disrupted. As this novel analysis indicates, third-party claims adjudication data can be quickly obtained and analyzed during an emergency response to inform public health activities and establish collaborations with drug suppliers.

9:15 First Reported Cases of Leptospirosis and Melioidosis Following Hurricanes Irma and Maria — U.S. Virgin Islands, 2017

Authors: Jonathan Strysko, A. Marinova-Petkova, I.J. Schafer, R. Galloway, M. Glass Elrod, D. Blaney, A. Hoffmaster, W. Bower, H. Walke, J. Yoder, T. Hunte-Ceasar, A. Kahler, B. Ellis, L. LaPlace Ekpo, I. Guendel, E. Ellis.

Background: Following Hurricanes Irma and Maria, the first cases of leptospirosis (n=1) and melioidosis (n=2) ever identified in U.S. Virgin Islands (USVI) were reported. Leptospirosis and melioidosis are potentially fatal bacterial diseases caused by *Leptospira* species and *Burkholderia pseudomallei*, respectively, and are found in contaminated water/soil. Outbreaks have been documented after tropical storms/flooding. We investigated to identify additional cases, establish local surveillance, and examine environmental sources.

Methods: To identify additional cases, we tested patients enrolled post-hurricane in USVI's arbovirus syndromic surveillance system (>two of: fever, rash, headache, conjunctivitis, arthralgia, myalgia) with anti-*Leptospira* IgM rapid diagnostic testing (RDT) on-island, plus confirmatory serology (Microscopic Agglutination) at CDC. Based on consistent symptoms, a subset were tested with a *B. pseudomallei* antigen RDT. To establish local surveillance for leptospirosis/melioidosis, the RDT and confirmatory testing was continued prospectively, and healthcare provider outreach was conducted to increase awareness and reporting. We also reviewed post-hurricane Emergency Department (ED) records, screening and testing patients with consistent symptoms. Water from potential *Leptospira*-contamination sites associated with case patients was tested by polymerase chain reaction.

Results: As of January 1, 2018, retrospective and prospective syndromic surveillance identified 30 patients for leptospirosis testing (one positive) and two for melioidosis (negative). Reviewing 5,220 ED encounters, we tested five patients for leptospirosis (one positive); one tested for melioidosis was negative. Altogether, three leptospirosis and two melioidosis cases from USVI were confirmed, including one leptospirosis case identified by retrospective case finding, and one identified prospectively by newly-established surveillance. One of three household water samples tested positive for *Leptospira* species.

Conclusions: This investigation documents the first cases of leptospirosis/melioidosis reported from USVI and demonstrates how additional cases were discovered by retrospective case finding and adaptation of local syndromic surveillance. The need for disinfection and remediation of household water sources, especially after tropical storms, was reaffirmed.

9:35 Case Definition for Surveillance of Invasive Mold Infections: Hurricane Harvey — Houston, October 2017

Authors: Juliana Da Silva, K. Skrobarcek, J. Strysko, M. Toda, A. Pennington, N. Chow, B. Murthy, L. Ostrosky-Zeichner, D. Kontoyiannis, S. Solomon, K. Short, L. Gaul, T. Chiller, B. Jackson, K. Beer

Background: After severe flooding during Hurricane Harvey, concerns regarding mold growth and possible increased risk of invasive mold infections (IMI), presented the need for rapid hospital-based IMI surveillance. An IMI case definition by the Mycoses Study Group (EORTC/MSG) has been validated for use in clinical trials, however no IMI surveillance case definition currently exists for use in public health. We conducted surveillance using the EORTC/MSG definition in addition to a set of more comprehensive clinical criteria (CC) that included the EORTC/MSG criteria, but were designed to emulate clinical diagnosis by an infectious diseases physician. We evaluated the attributes of these case definitions as part of a surveillance effort to determine risk of IMI following flooding and target prevention efforts.

Methods: We queried databases from two large Houston-based hospital systems for microbiology cultures yielding mold species from September 1, 2016 to October 1, 2017. Clinicians reviewed associated charts and classified each according to EORTC/MSG criteria (proven/probable/not a case) and CC (yes/no). We then calculated sensitivity and specificity of EORTC/MSG criteria against the CC definition, using the more comprehensive CC as gold standard.

Results: Of 395 mold cultures, we identified 86 (21.7%) IMI cases by either criteria, 51 (12.9%) by both, 57 (14.4%) by EORTC/MSG criteria and 80 (20.3%) by CC. Among EORTC/MSG cases, 40 (70.1%) were classified as proven and 17 (29.9%) as probable. Sensitivity of EORTC/MSG criteria was 63,7% (95% confidence interval: 52.2%–74.2%) and specificity was 98.1% (95% confidence interval: 95.9%–99.3%). The CC definition identified 36.2% more cases than EORTC/MSG alone.

Conclusions: The first evaluation of the EORTC/MSG definition for public health surveillance shows it has poor sensitivity, but high specificity; a third of cases were missed using the EORTC/MSG definition alone. A surveillance-driven IMI case definition with higher sensitivity should be used for future surveillance efforts.

9:55 Hurricane-Associated Mold Exposures Among Patients at Risk of Invasive Mold Infections — Houston, Texas, 2017

Authors: Mitsuru Toda, N. Chow, A. Pennington, J. Strysko, B. Murthy, J. Da Silva, K. Skrobarcek, E. Anassi, R. Atmar, B. Garcia, D. Kontoyiannis, L. Ostrosky-Zeichner, M. Al-Mohajer, J. Schulte, J. Shuford, S. Solomon, T. Chiller, B. Jackson, K. Beer

Background: Hurricane Harvey caused record flooding in late August 2017. Flood damage can cause mold growth, and health agencies advise people to assume mold growth will occur if flood-affected surfaces are not dried promptly. In addition, exposure to mold growth can put immunocompromised persons at risk of fatal invasive mold infections (IMI), and CDC advises these patients to avoid contact with mold-damaged areas. Little is known about the actual flood or mold exposures of patients who may be at high-risk of IMI after the storm. We aimed to characterize behaviors of patients at high-risk in Houston, Texas, following Hurricane Harvey.

Methods: We conducted phone interviews with 110 immunocompromised patients at high-risk of IMI living in metropolitan Houston. Inclusion criteria were: use of immunosuppressive medications from July 15–October 15, 2017 or receipt of solid organ transplant from October 15, 2016–October 15, 2017. Questionnaires were administered in English and Spanish.

Results: Of 110 patients interviewed, 42 (38%) cleaned or remediated their own or other people's homes that were affected by the hurricane. Of these 42 people, only 11 (26%) wore a recommended respirator, 30 (71%) gloves, 9 (21%) boots, 3 (7%) goggles, and only one person (2%) wore all recommended personal protective equipment. Of the 24 patients who participated in heavy cleaning, defined as removing furniture, pulling out drywall, pulling out carpet, or using a pressure washer, only 10 (42%) wore a recommended respirator.

Conclusions: Over a third of immunocompromised patients at risk of IMI reported participating in cleaning activities that can dislodge mold spores, most of whom did not wear recommended personal protective equipment despite health agencies' guidance following Hurricane Harvey. Additional messaging and outreach about strategies to prevent mold exposure are needed for patients at higher risk of developing IMI.

CONCURRENT SESSION J2: HIV, Tuberculosis, and Hepatitis

8:30–10:15 AM

Ballroom East

Moderators: Jonathan Mermin and Anne Marie France

8:35 HIV in a Mostly Rural Area Affected by the Opioid Epidemic — West Virginia, 2017

Authors: Mary Evans, S. Labuda, V. Hogan, C. Agnew-Brune, J. Armstrong, A. Babu, D. Blankinship, K. Buchacz, K. Burton, S. Cibrik, W. Hoffman, N. Kirk, C. Lee, D. McGraw, C. Ocfemia, N. Panneer, P. Reynolds, B. Rose, M. Salmon, M. Scott, A. Thompson, D. Wills, S. Young, R. Gupta, L. Haddy, P. Weidle, M. Mark-Carew

Background: Rural communities affected by the opioid epidemic have the potential for rapid spread of HIV via injection drug use (IDU). In July 2017, the West Virginia Department of Health and Human Resources consulted CDC after detecting an increase in HIV diagnoses in a mostly rural area. We assessed characteristics of persons with diagnosed HIV in the area and evaluated the extent to which persons who inject drugs (PWID) were involved, and assessed the availability of HIV prevention measures, including HIV testing, preexposure prophylaxis (PrEP), and harm reduction programs offering sterile injection equipment.

Methods: We reviewed data from HIV surveillance and partner investigations in 15 counties to identify persons with HIV diagnosed in 2017 and their sex and injection partners with previously diagnosed HIV. We interviewed health care and health department staff to understand local HIV prevention capacity including HIV testing, PrEP, and harm reduction programs.

Results: As of October 26, 2017, investigators assessed 57 persons with diagnosed HIV: 40 (70%) were diagnosed in 2017 and 17 (30%) were diagnosed before 2017. Of the total, 51 (89%) were male, 43 (75%) were white, and 28 (49%) were aged <30 years. Values by transmission category follow: 34 (60%), male-to-male sexual contact; 5 (9%), IDU; 3 (5%), male-to-male sexual contact/IDU; 2 (4%), heterosexual contact; 13 (23%), other/unknown. All county health departments offered HIV testing. HIV and primary care providers offered PrEP in 4/15 (27%) counties. Harm reduction programs were available in 3/15 (20%) counties.

Conclusions: We identified HIV infections among men who have sex with men and PWID in a mostly rural area at risk of rapid spread of HIV via IDU. Because current services do not meet current needs, expansion of PrEP and harm reduction programs in these counties can reduce the potential for rapid HIV spread.

8:55 Community Hepatitis A Outbreak in Multiple Counties — Michigan, 2016–2017

Authors: Caroline Castillo, S. Bohm, S. Bidol, D. Donovan, N. Parker-Strobe, J. Lai, J. Fiedler, S. Lyon-Callo, J. McFadden, T. Henderson, J. Chandler, T. Adams, J. Collins

Background: Hepatitis A virus (HAV) infection, transmitted primarily by fecal-oral routes, is vaccine-preventable; vaccination is recommended for children at 1 year and for adults who use illicit drugs, men who have sex with men (MSM), and persons with chronic liver disease. More than 90% of Michigan adults who have not completed HAV vaccination might be susceptible to infection. In August 2016, Michigan Department of Health and Human Services (MDHHS) detected a sixfold increase in acute HAV infections in southeast Michigan. We investigated the outbreak to implement control measures.

Methods: Case definition was acute viral hepatitis signs or symptoms with either positive anti-HAV immunoglobulin M antibody (primary), or an epidemiologic link with a person with laboratory-confirmed HAV infection (secondary). Asymptomatic persons infected with HAV genotype 1B outbreak strains, identified through routine surveillance, were also included among cases. Patients were interviewed using a standardized and supplemental questionnaires to capture behavioral and food-borne risk factors. Available patient sera were sent to CDC for genotyping and partial sequencing of VP1/P2B region. Descriptive and temporal-spatial analysis guided targeted vaccination and educational programs.

Results: From August 1, 2016 to December 20, 2017, 630 cases in 19 counties met the case definition. Median age was 41 years (range: <1–90), 65% were male, 82% hospitalized, and 21% lost to follow-up. Twenty deaths were reported. Of 573 primary cases, 56% had sequencing results confirming 2 predominant genotype 1B strains. The most frequently reported risk factors were substance abuse (47%), MSM (14%), and homelessness (12%); 38% reported no known risk factor. MDHHS collaborated with local health departments and community stakeholders to implement vaccination and educational campaigns targeting multiple at-risk populations.

Conclusions: This Michigan hepatitis A outbreak remains an ongoing public health threat with continued targeted interventions. The magnitude and duration underscore importance of adherence to recommendations for HAV vaccination.

9:15 Multidrug-Resistant Tuberculosis Outbreak — Minnesota, 2016–2017

Authors: Victoria Hall, M. DeSilva, N. Moore, D. Thai, M.B. Grimm, N. Sabuwala, M. Brueshaber, S. Gordon, L. Andersen, S. Buuck, C. Hickman, Z. Wansaula, A. Harrist, K. Marks, J. Wortham, J. Posey, L. Cowan, S. Talarico, B. Silk, E. Kingdon, G. Pistulka, K. Guerard, P. Vagnone, D. Tsukayama, R. Mody, K. Ehresmann

Background: Multidrug-resistant tuberculosis (MDR TB) causes higher rates of treatment failure and death than drug-susceptible TB. During 2016 in Minnesota, 9 MDR TB cases were identified through reportable disease surveillance, including 6 in a foreign-born community with increased risk for TB. We investigated to identify risk factors and prevent further transmission.

Methods: We interviewed patients and reviewed medical records to determine when patients were infectious, conducted contact investigations, and performed whole-genome sequencing (WGS) of *Mycobacterium tuberculosis* isolates. We defined outbreak cases as MDR TB disease in Minnesota residents identified during January 2016–November 2017, with WGS-related *M. tuberculosis* isolates. We performed enhanced contact screening, including obtaining chest radiographs for all contacts regardless of TB screening result, at the principal setting of suspected transmission.

Results: Seventeen MDR TB cases were reported in Minnesota, including 10 outbreak cases. All outbreak-associated patients were of Hmong ethnicity, median age was 76 years (range: 35–96 years), and 8 attended the same adult day center (ADC). During his 5-year infectious period before diagnosis, the index patient sought Western health care 4 times and visited traditional Hmong healers. Seven outbreak-associated patients had pulmonary disease and 4 died. We identified >300 ADC contacts; enhanced screening assisted in identifying 4 of 8 outbreak-associated cases in patients who attended the ADC. Before and after enhanced screening implementation, median infectious periods for cases were 829 and 216 days, respectively.

Conclusions: The index patient's delayed diagnosis contributed to this outbreak. Public health agencies should ensure strong partnerships with and awareness of TB among providers and at-risk communities that embrace diverse health concepts. ADCs attended by persons at high risk for TB can pose risks for TB transmission and could consider implementing TB risk-assessment policies. Enhanced screening might aid in outbreak control by limiting cases' infectious periods.

9:35 Prevalence and Characterization of HIV and Hepatitis C and Hepatitis B Virus Coinfections — Alabama, 2007–2016

Authors: Charlene Siza, S. Davidson

Background: HIV, hepatitis C virus (HCV), and hepatitis B virus (HBV) share transmission risk factors; persons infected with HIV are also at risk for hepatitis C or B, which both independently increase a person's risk for serious liver-related complications. Among HIV-infected persons in the United States, an estimated 25% are coinfected with HCV, and 10% are coinfected with HBV. HIV coinfection with HCV or HBV has not been previously described in Alabama; therefore, we characterized prevalence and risk factors to guide future interventions.

Methods: We conducted a case-control study using Alabama HIV, HCV, and HBV surveillance data during 2007–2016. Persons with HIV and known HCV or HBV coinfection were classified as case-patients; persons with HIV only were classified as control subjects. Keeping HIV/HCV and HIV/HBV case-patients separate, we compared case-patient and control subject demographics using univariate analysis. Multivariable regression compared case-patient and control subject risk factors while controlling for age, sex, race, and ethnicity.

Results: Of 6,380 persons infected with HIV, reported coinfection prevalence was 5.4% for HIV/HCV and 2.9% for HIV/HBV. Persons coinfected with HIV/HCV had an increased odds of reporting injection drug use (IDU) (adjusted odds ratio [aOR] 10.4; 95% confidence interval [CI]: 7.0–15.4) and combined IDU and male-to-male sexual contact (aOR; 7.4; CI: 4.3–12.6). Persons coinfected with HIV/HBV had an increased odds of reporting male-to-male sexual contact (aOR: 1.6; CI: 1.1–2.3).

Conclusions: Compared with national estimates, Alabama has a lower prevalence of HIV and hepatitis coinfections reported through the state surveillance system, which likely underrepresents actual HCV and HBV cases. Significant differences in risk factors were reported between case-patients and control subjects, particularly a history of IDU among HIV/HCV coinfected persons and male-to-male sexual contact among HIV/HBV coinfected persons. These results are important for planning targeted interventions and prevention efforts among at-risk groups.

9:55 Characteristics of Recently Acquired HIV Infection and Performance of a Point-of-Care HIV Recency Test Among Pregnant Adolescent Girls and Young Women — Malawi, 2017

Authors: Elfriede Agyemang, E. Kim, D. Payne, I. Zungu, A. Auld, B. Ng'Eno, A. Adhikari, K. Curran, B. Parekh, A. Kim

Background: Approximately 1000 HIV infections occur daily among adolescent girls and young women (AGYW) in sub-Saharan Africa (SSA). Tests for recent infection (TRI) distinguish recent HIV infection (i.e., infected, on average, within the past 6-months) from non-recent infection using immunological biomarkers of early disease progression. CDC's gold standard TRI is the laboratory-based LAg-Avidity enzyme immunoassay (LAg). Point-of-care recency tests (POC-RT) provide results within minutes but require validation. To inform HIV prevention strategies for AGYW in SSA, we implemented a surveillance system in Malawi to detect and characterize recent HIV infection and evaluated POC-RT performance.

Methods: We consecutively enrolled pregnant AGYW aged <25 years testing HIV-positive at their first antenatal clinic (ANC) visit from Lilongwe and Blantyre ANCs. Participants consented to a questionnaire and provided blood for HIV recency testing. Recent infection was defined as testing LAg-recent (normalized optical density value≤2.0), else they were non-recent. We calculated the proportion testing recent, identified factors associated with recency using multivariate logistic regression, and calculated percent agreement between POC-RT and LAg.

Results: Between 11/6/2017–12/31/2017, 18 (20.2%, CI 11.9%–28.6%) of 89 HIV-positive respondents tested recent; the majority were aged 20–24 years (66.7%), had one current partner (94.4%), unaware of their partner's HIV status (58.8%) and used condoms inconsistently with their partners (94.1%). After controlling for age and marital status, recent infection was associated with being college-educated (adjusted odds ratio [AOR] 18.1; CI 1.1–295.4) and fearing one's partner (AOR 1.3; CI 1.0–1.6) compared to non-recent infection. Among 69 specimens available for POC-RT validation, percent agreement with LAg was 91.3%. Among 14 LAg-recent, 10 (71.4%) were POC-RT-recent; among 55 LAg-non-recent, 53 (96.4%) were POCT-RT-non-recent.

Conclusions: One in five HIV-positive pregnant AGYW tested recent, with most transmission occurring within current partnerships. While POC-RT performance is promising, more data are needed for validating the test in this population.

POSTER SYMPOSIUM II

10:30–11:45 AM

The Symposium begins in the Salon with each presenter providing a 2-minute overview. Afterward, poster viewing will occur in the pre-function area.

Moderators: Allison Arwady and Danice Eaton

P2.1 Impact of a Third Dose Measles-Mumps-Rubella Vaccine Campaign in Response to a Mumps Outbreak in a Highly Vaccinated Population: A Transmission Modeling Approach

Authors: Tracy Ayers, A. Hill, M. Marin, M. Patel, P. Paul, P. Gastanaduy

Background: In response to numerous mumps outbreaks reported in the United States in highly vaccinated populations, the Advisory Committee on Immunization Practices recently recommended use of a third dose of Measles-Mumps-Rubella vaccine (MMR3) to protect persons against mumps during outbreaks. However, the effectiveness of MMR3 to decrease the size and duration of mumps outbreaks is unknown. We aimed to use modeling to quantify the impact of an MMR3 campaign on mumps transmission during a university outbreak.

Methods: We used case incidence data, distribution of the interval between clinical onsets in consecutive cases, and two-dose MMR vaccine effectiveness (VE) to estimate the basic reproduction number (R_0). We used a compartmental transmission model, parametrized by baseline two-dose MMR coverage, VE, and R_0, to estimate the size and duration of the outbreak with and without an MMR3 campaign. Given uncertainty around the degree of waning immunity in the affected population, we modeled two scenarios, high and low two-dose VE, 84% and 41%, respectively.

Results: Among 20,500 students with 98% two-dose MMR, 306 mumps cases were reported over 338 days; MMR3 was administered to 4,790 students. In the high two-dose VE scenario, the model estimated 2,704 cases over 471 days without an MMR3 campaign and 1,982 cases over 521 days with an MMR3 campaign. The low two-dose VE model estimated 9,194 cases over 551 days without an MMR3 campaign and 6,769 cases over 633 days with an MMR3 campaign. In both high and low two-dose VE scenarios, the estimated proportion of cases prevented was approximately 26%. Vaccination could not account entirely for transmission reductions.

Conclusions: These findings indicate that implementing an MMR3 campaign during an outbreak can avert a substantial number of mumps cases. A better understanding of waning immunity, contact patterns, and asymptomatic transmission is necessary to improve the utility of these models.

P2.2 Community-Acquired Legionnaires' Disease Cluster Detection and Response — New York City, 2017

Authors: Genevieve Bergeron, C. Bush, M. Eddy, R. Fitzhenry, B. Gutelius, N. Mensah, C. Thompson, C. Crawford, K. Fernandez, D. Fung, J. Novak, S. Hughes, J. Rakeman, E. Peterson, S. Greene, M. Layton, D. Daskalakis

Background: After a Legionnaires' disease (LD) outbreak in 2015, New York City (NYC) began registering and regulating all cooling towers (CTs) and ordering remediation of CTs near LD clusters. During January–November 2017, we identified 2 community-acquired LD clusters, prompting investigations to identify and remediate potential sources.

Methods: The NYC Department of Health and Mental Hygiene (DOHMH) analyzes surveillance data to detect community-acquired LD clusters, applying the space-time permutation scan statistic in SaTScan™ daily, the refined historical limits method (rHLM) weekly, and a proximity analysis to detect cases occurring within <0.32 kilometers and <30 days daily. We define a cluster as ≥3 LD cases with home, work, or other addresses within a <1-kilometer radius, forming a statistically significant SaTScan or rHLM signal. For each cluster, we define an investigation zone, identify CTs and other possible community-based water exposures, and collect samples for polymerase chain reaction (PCR) testing and culture. *Legionella pneumophila* (*Lp*)-positive PCR results prompt orders to adjust biocide as a rapid mitigation measure. CTs with *Lp*-positive cultures are ordered to be remediated. Human and CT isolates are compared using whole genome sequencing (WGS).

Results: Cluster A was detected on the same day by SaTScan and rHLM, involved 9 patients, and 116 CTs were tested. Forty-one CTs were *Lp* PCR-positive; 23 were *Lp* culture-positive and ordered to be remediated. One CT isolate matched a Cluster A patient isolate by WGS. Cluster B was first detected by proximity analysis and 2 days later by SaTScan, involved 15 patients, and 55 CTs and 6 fountains were tested. Eleven CTs were *Lp* PCR-positive; 4 were *Lp* culture-positive and ordered to be remediated. No patients had positive isolates.

Conclusions: DOHMH proactively detects community-acquired LD clusters and orders remediation of contaminated CTs. However, definitively identifying a source is not possible when human isolates are unavailable.

P2.3 Assessing Rabies Risk After a Mass Bat Exposure in a National Park — Wyoming, 2017

Authors: Andrea Cote, S. Guagliardo, M. Said, C. Tran, D. Jackson, K. Musgrave, R. Wallace

Background: In August 2017, the Wyoming Department of Health (WDH) was notified that multiple persons had slept overnight in 2 bat-colonized buildings at a national park research facility. Bats are the most common rabies source in the United States; ~1–3 persons die from bat-associated rabies virus yearly. WDH, CDC, and the National Park Service performed rabies exposure risk assessments to guide postexposure prophylaxis (PEP) recommendations.

Methods: We interviewed persons who slept at the facility since it opened on May 19, 2017 using a standardized risk assessment tool. Their risk level was categorized as follows: no risk (no direct bat contact, no bats observed in the room, and kept room door closed while sleeping); low risk (no direct bat contact or bats observed in the room, but slept with the door open); or high risk (direct bat contact or slept in a room with bats while unaware of direct contact because of medications, deep sleep, or alcohol consumption). Risk categories were used to counsel and encourage consultation with a health care provider; persons at high risk were encouraged to seek PEP. Follow-up assessments were conducted to determine PEP receipt.

Results: Of 171 persons who slept at the facility, 163 (95.3%) were interviewed and categorized as follows: no risk (122, 74.8%), low risk (20, 12.3%), and high risk (21, 12.9%). Eighty persons completed follow-up interviews; 29 persons received PEP, including 6 categorized as no risk, 9 low risk, and 14 high risk.

Conclusions: Our investigation resulted in identifying persons at risk for rabies exposure. Follow-up interviews identified 14 persons at high risk who were successfully administered PEP following risk assessment recommendations. Standardization of risk categories allowed for consistency in determining exposure risk and facilitated targeted PEP counseling, which can be useful in other mass bat exposure investigations.

P2.4 Differences in Mental, Behavioral, and Developmental Disorders, Health Care, and Use of Federal Assistance Programs by Federal Poverty Level Among Children Aged 2–8 years — United States, 2016

Authors: Robyn Cree, R. Bitsko, J. Holbrook, M. Danielson, L. Robinson

Background: As estimated by parent report through the 2011–2012 National Survey of Children's Health (NSCH), 15.4% of children in the United States aged 2–8 years had at least one diagnosed mental, behavioral, or developmental disorder (MBDD). Children living in poverty are more likely to have MBDDs, which are associated with adverse developmental outcomes that can persist into adulthood. The purpose of this analysis was to examine prevalence of MBDDs, healthcare factors, and use of federal assistance programs by federal poverty level (FPL) to identify possible touchpoints to reach children at risk for MBDDs.

Methods: Using 2016 NSCH parent reported data, we compared prevalence of MBDDs, lack of a medical home, visit to a healthcare provider in the past year, and use of Supplemental Nutrition Assistance Program (SNAP) among 16,833 children aged 2–8 years by FPL (<100%, 100–199%, 200–399%, and ≥ 400% of FPL). We calculated weighted prevalence estimates, prevalence ratios (PR), and 95% confidence intervals (CI).

Results: Overall, 16.6% of children had at least one MBDD. Compared to the referent group (≥ 400% of FPL), children living in poverty (<100% of FPL) more often had an MBDD (21.6% vs. 13.4%, PR: 1.6; CI: 1.3–2.0) and lacked a medical home (61.6% vs. 36.6%, PR: 1.7; CI: 1.5–1.8). Among children living in poverty, 58.6% (CI: 53.8–63.2) used SNAP benefits and 80.8% (76.4–84.5) saw a healthcare provider in the last 12 months.

Conclusions: MBDDs in children are more prevalent among those living in poverty. In addition to identification of MBDDs in healthcare settings, federal assistance programs might also provide an opportunity to recognize MBDDs among children living in poverty.

P2.5 Malaria Case Management Commodity Supply and Use by Community Health Workers — Mozambique, 2017

Authors: Elizabeth Davlantes, C. Salomão, F. Wate, D. Sarmento, H. Rodrigues, E. Halsey, B. Candrinho, R. Zulliger

Background: Community health workers in Mozambique, called *agentes polivalentes elementares* (APEs), perform malaria case management with kits containing malaria rapid diagnostic tests (RDTs) and artemether-lumefantrine (AL) treatments that they receive monthly from health facilities. We evaluated the distribution and use of these malaria kits to determine if the current system is appropriate for APEs' practice environments.

Methods: Health facilities in Maputo (low malaria burden), Inhambane (moderate), and Nampula (high) Provinces were selected using probability proportionate to the number of APEs at each facility. We interviewed all APEs and their supervisors at selected facilities to document experiences with APE kit commodities and abstracted case register data. Data were analyzed to assess APE commodity stock levels by province and season.

Results: In total, 216 APEs and 56 supervisors were interviewed at 56 health facilities. APEs reported receiving a median of 7 kits in the last year. Commodity use was highest in the rainy season. One-tenth of APEs reported receiving kits with missing or insufficient RDTs, and 28% reported lacking some AL treatments. Stockouts were reported in all provinces, more commonly in the rainy season. Facility-level stockouts of RDTs or some AL formulation in the past year were reported by 66% of supervisors. Use of APE kit materials by health facilities was reported by 43% of supervisors; this was most common at facilities experiencing stockouts.

Conclusions: We documented variations in geographic and seasonal malaria commodity needs that should be considered in APE kit distribution planning; adjustments could be made to provide APEs with additional antimalarial commodities during the rainy season and in higher malaria burden areas. Improvements in provision of complete, monthly APE kits are needed in parallel with improvements in the broader commodity system strengthening.

P2.6 Exposure to Lead and Cadmium in Electronic Recyclers — Four U.S. States, 2015–2017

Authors: George Grimes, J. Ramsey, C. Beaucham, J. Gibbins

Background: The U.S. electronics recycling industry employs approximately 45,000 workers. Recycling electronics can expose workers to heavy metals that result in adverse health effects. Between January 2015 and October 2016, the National Institute for Occupational Safety and Health (NIOSH) received four health hazard evaluation requests from electronic recycling companies concerning lead and cadmium exposures. NIOSH investigators responded to quantify exposure, characterize risk, and evaluate for potential take-home contamination.

Methods: We visited each facility and performed personal air monitoring, quantitative dermal wipe sampling, and biomonitoring for lead and cadmium to quantify exposure and characterize risk. Lead and cadmium exposed cases were defined as employees with blood levels greater than 5µg/dL and 5µg/L, respectively. We collected surface wipe samples in processing and non-processing areas to evaluate the potential for take-home contamination.

Results: We identified variable workplace controls between facilities. Sixty-seven of 87 (77%) employees participated in air monitoring, dermal sampling, and biomonitoring. One air result exceeded occupational exposure limits (OELs) for cadmium. Sixty-two (93%) employees had lead (range: 0.23–42 µg/sample) and 52 (78%) had cadmium (range: 0.02–37 µg/sample) on their hands after washing them at the end of shift. Biomonitoring revealed six employees met the case definition of a lead-exposed worker and none met the case definition for a cadmium-exposed worker. Of 76 surface samples, 63 (83%) were positive for lead and 48 (76%) for cadmium; 19 (95%) of 20 processing area samples, and 41 (73%) of 56 non-processing area samples, contained lead or cadmium.

Conclusions: Employees are at risk of lead and cadmium exposure during electronics recycling, even when OELs are not exceeded. Employers in this emerging industry should maintain effective workplace controls, including a metal exposure prevention program for employees working in processing areas. We identified surface contamination outside of processing areas, indicating the potential for take-home contamination.

P2.7 *Mycobacterium chimaera* Infections Among Cardiac Surgery Patients Associated with Heater-Cooler Units — Hospital A, Los Angeles County, 2013–2016

Authors: M. Claire Jarashow, M. Kim, H. Rivas, N. Green, B. Schwartz, D. Terashita

Background: *Mycobacterium chimaera* (Mc) is a slow-growing nontuberculous mycobacterium in the *Mycobacterium avium* complex (MAC). Mc infections have been linked with a specific brand of contaminated heater-cooler units (HCUs) used during cardiac surgery. In December 2016, Hospital A in Los Angeles County reported two MAC case-patients. We investigated to detect additional cases, assess surgical practices, and determine risk factors.

Methods: We defined cases as laboratory-confirmed Mc after cardiac surgery at Hospital A during May 2013–December 2016. We abstracted patients' medical records and tested specimens from one HCU. We conducted a case-control study with 4 control subjects/case-patient matched by age <2 years and year of surgery. We assessed differences between case-patients and control subjects by Fisher exact, *t*-test, and Wilcoxon tests; *a priori* risk factors and those associated with Mc infection ($P<.05$) in bivariate analyses were included in a multivariable conditional logistic regression model.

Results: We identified 17 cases; 10 (59%) had disseminated infection and 6 (35%) died. Three HCUs manufactured in 2012 were used during case surgeries; 5 of 6 samples (83%) from 1 of these HCUs had MAC isolated (speciation pending). Mean interval from surgery to infection was 25.7 months. Preoperative procedures for the day's first surgeries occurred in the operating room (OR). In the multivariable model, valve insertion (adjusted odds ratio [aOR]: 6.1; 95% confidence interval [CI]: 1.4–26.2) and day's first surgery (aOR: 3.3; 95% CI: 0.9–12.8) were associated with infection.

Conclusions: Mc in aerosols from contaminated HCUs likely contributed to infection. Conducting preoperative procedures in OR for the day's first surgery might lead to longer exposure. We recommended removing implicated HCUs, conducting preoperative procedures outside OR, positioning HCUs to mitigate possible surgical field contamination, and strictly adhering to additional CDC and Food and Drug Administration guidance and updated manufacturer HCU cleaning guidelines.

P2.8 Enhanced *Campylobacter* Laboratory Surveillance to Improve Outbreak Investigations — Ohio, 2017

Authors: Martha Montgomery, E. Salehi, A. Singh, S. Robertson, M. Weisner, E. Brandt, R. Bokanyi, J. Cui, Y. Zhang, M. Prarat, L. Joseph, R. Aubert, M. Laughlin, R. Silver, L Francois Watkins, C. Basler, S. Dixon, L. Stevenson, L. Koski, P. Sundararaman, M. Nichols, C. Friedman, A. Geissler, C. Bennett, S. de Fijter

Background: During 2016 in Ohio, ~2,000 *Campylobacter* infections were reported. In Ohio, clinical laboratories test for *Campylobacter* by culture or culture-independent tests, but isolates are not routinely submitted to the Ohio Department of Health (ODH). Isolates are needed to conduct whole-genome sequencing (WGS) and differentiate outbreak from sporadic strains. During a multistate *Campylobacter* outbreak associated with pet store chain puppies, ODH implemented enhanced *Campylobacter* laboratory surveillance using WGS to characterize the outbreak.

Methods: Beginning September 7, 2017, ODH requested clinical laboratories to submit all *Campylobacter* isolates. Patients with *Campylobacter* by culture or culture-independent tests who reported puppy exposure during routine interview by local health departments were asked to submit human and puppy stool specimens for culture. Isolates underwent WGS and were compared with outbreak strains using whole genome multilocus sequence typing (wgMLST).

Results: By November 30, a total of 38 patients with *Campylobacter* infection and puppy exposure were identified. Among these, 12 (32%) isolates were obtained. No specimen or isolate was received for 16 (42%) patients. The remaining 10 (26%) patients had a specimen submitted that did not grow *Campylobacter*; 6 of these were collected after illness recovery. Among the 12 isolates, 3 (25%) were from patients exposed to puppies from 2 stores not previously associated with the outbreak and were related to outbreak strains by wgMLST; 9 (75%) were from patients exposed to nonpet store puppies and were unrelated to the outbreak. We obtained 15 puppy specimens; 5 (33%) grew *Campylobacter*. One pet store puppy isolate was outbreak-related, and 4 nonpet store puppy isolates were unrelated.

Conclusions: Enhanced *Campylobacter* laboratory surveillance during the outbreak indicated pet store puppies as a possible source and identified new outbreak-associated pet stores; however, WGS was limited by the low number of isolates. Routine isolate and specimen submission to ODH might strengthen outbreak investigations.

P2.9 Antimicrobial Resistance Among *Helicobacter pylori* Sentinel Surveillance Isolates — Alaska, 2000–2016

Authors: Emily Mosites, D. Bruden, J. Morris, A. Reasonover, K. Rudolph, D. Hurlburt, T. Hennessy, B. McMahon, M. Bruce

Background: Alaska Native people experience a high burden of *Helicobacter pylori* infection and concomitant high rates of gastric cancer. Additionally, the prevalence of antimicrobial resistant strains of *H. pylori* is high in Alaska. We aimed to a) evaluate *H. pylori* antimicrobial resistance over time in Alaska and b) assess risk factors for carrying resistant strains of *H. pylori*.

Methods: Through Alaska's *H. pylori* sentinel surveillance system, we collected and cultured antral and fundal biopsies from Alaska Native patients undergoing esophagogastroduodenoscopy (EGD) for clinical indications between 2000 and 2016. For positive cultures, we performed minimum inhibitory concentration (MIC) testing according to standard methods for metronidazole, amoxicillin, clarithromycin, and tetracycline, and by Etest for levofloxacin.

Results: We tested 800 *H. pylori* isolates among 763 patients. Patients were an average of 51 years old and 370 (49%) were female. Among *H. pylori* isolates, metronidazole resistance was most common (342/800; 43%), followed by clarithromycin resistance (238/800; 30%), resistance to both clarithromycin and metronidazole (128/800; 16%), and levofloxacin resistance (113/800; 15%). Low proportions of isolates were resistant to amoxicillin and tetracycline (16/800; 2% and 1/800; 0%, respectively). Levofloxacin resistance increased from 11/149 (11%) in 2000 to 7/39 (15%) in 2016 ($p<0.001$), but resistance to other antimicrobials did not show changes over time. Metronidazole and clarithromycin resistance were more common among women ($p<0.001$ for both), while levofloxacin resistance was more common among those with an urban residence ($p=0.003$). Levofloxacin resistance was also more common among patients than 60 years ($p=0.012$).

Conclusions: Between 2000 and 2016, a large percentage of the *H. pylori* isolates received by the Alaska Sentinel Surveillance System demonstrated resistance to common antimicrobial agents. Surveillance for antimicrobial resistance provides information that can allow clinicians to ensure the effectiveness of *H. pylori* treatment.

P2.10 Baseline Measurement of Invasive Mold Infections Before Hurricane Harvey — Hospitals A and B, Houston, Texas, 2016–2017

Authors: Kimberly Skrobarcek, M. Toda, R. Chemaly, N. Chow, J. Da Silva, B. Garcia, L. Gaul, B. Murthy, L. Ostrosky-Zeichner, A. Pennington, K. Short, J. Shuford, S. Solomon, J. Strysko, B. Jackson, T. Chiller, K. Beer

Background: In August 2017, Hurricane Harvey caused extensive flooding in Southeast Texas exposing residents to high levels of mold from water-damaged buildings. Immunocompromised patients are at risk for invasive mold infections (IMI), which are often fatal. However, public health surveillance for IMI has been limited, and the few post-hurricane IMI studies have been too small to evaluate risk. In September 2017, the Texas Department of State Health Services requested emergency assistance establishing a surveillance system for IMI to identify risk factors and guide prevention measures.

Methods: We conducted case finding at Hospitals A and B from August 2016–August 2017 by identifying microbiology cultures or indirect blood tests positive for mold species. Cases were evaluated during medical chart review. Proven and probable cases were defined using currently published case definitions. Clinical cases did not meet these definitions but were those diagnosed and treated for IMI.

Results: We reviewed 297 charts at Hospital A, a tertiary hospital system, and 72 charts at Hospital B, a cancer center, identifying 37 proven, 15 probable, and 26 clinical cases. Median age was 64 years (range: 5–89) and 60% were male. Underlying comorbidities included recent immunosuppressive medications (65.4%), cancer (64.3% [45/70]), and transplant (21.0% [13/62]). The most common clinical presentations were lower respiratory tract infections (60.3%), sinusitis (12.8%), or disseminated infection (10.3%). Most (92.3%) received anti-fungal treatment. Median case count was 6 (range: 3–9) in the 13 months prior to Hurricane Harvey.

Conclusions: This hospital-based, rapid response IMI surveillance system is the largest of its kind to date. Baseline data collected, including predominant etiologies and underlying comorbidities, were consistent with other studies of IMI in specific patient populations. This surveillance system will continue to be used to identify new IMI cases and allow ongoing assessment of IMI incidence following the hurricane.

P2.11 *Vibrio vulnificus* Infections Associated with Handling of Tilapia from Live Retail Fish Market Tanks — King County, Washington, 2016–2017

Authors: Kirsten Vannice, V. Kawakami, J. Lloyd, L. Stewart, C. Brostrom-Smith, N. Hatley, M. Kang, M. Kay, E. Mazengia, A. Singh, P. Wyman, J. Duchin

Background: CDC estimates that 77 persons die annually from *Vibrio vulnificus* infections, making it the leading cause of seafood-related deaths in the United States. Two *V. vulnificus* wound infections were reported to Public Health — Seattle & King County (PHSKC) in 2016–2017; both sustained wounds while handling tilapia, a freshwater fish, purchased live from 2 retail fish markets before illness onset. Because *V. vulnificus* infections are typically associated with wound exposure to brackish water and associations with handling tilapia are rare, we investigated to identify contamination source and implement prevention measures.

Methods: PHSKC inspected both retail fish markets where patients purchased live tilapia (Market A and Market B) and transport tanks from a common distributor (Distributor A). Fish specimens and swabs from fish tanks, utensils, and environmental surfaces were collected. Samples underwent polymerase chain reaction and culture; *V. vulnificus* isolates were compared with patient isolates using pulsed field-gel electrophoresis (PFGE).

Results: *V. vulnificus* was identified from 2/2 fish and 7/7 environmental swabs collected from Market A where Patient A shopped, 2/2 fish and 6/8 environmental swabs from Market B where Patient B shopped, and 1/2 fish samples and 3/5 transport tanks from Distributor A. PFGE patterns differed between patients, but matched investigation isolates; 3 environmental isolates from Market A matched Patient A's isolate and all isolates from Market B and Distributor A matched Patient B's isolate.

Conclusions: We describe the first *V. vulnificus* wound infections associated with handling tilapia from retail market fish tanks in the United States. Live fish tanks should be properly cleaned and maintained, and retail fish market employees and consumers with underlying chronic diseases should be educated about *V. vulnificus* infection. Wearing thick rubber or cut resistant gloves when handling tilapia and other seafood products may help minimize risk for infection.

P2.12 Receipt of Medical Advice To Increase Physical Activity Among U.S. Adults, NHANES 2013–2016

Authors: Marissa Zwald, B. Kit, T. Fakhouri, J. Hughes L. Akinbami

Background: Regular physical activity (PA) can reduce the burden of chronic diseases and prevent early death. Healthcare systems represent an important venue for PA promotion, as national recommendations encourage healthcare providers to routinely deliver PA advice, particularly to those with chronic conditions. Despite these national recommendations, there is limited recent information on the characteristics of adults who are receiving PA advice in healthcare settings. We examined characteristics of U.S. healthcare-utilizing adults who reported receiving PA advice in the previous year by selected health conditions and behaviors.

Methods: Analyses included 8,410 healthcare-utilizing adults aged ≥20 years from the 2013–2016 National Health and Nutrition Examination Surveys. Participants were asked about receiving PA advice in the past year. We assessed associations between patient characteristics (measured health conditions and behaviors) and receiving PA advice with multivariate logistic regression controlling for demographic characteristics. SUDAAN was used to account for complex survey design.

Results: Approximately 43% (95% CI 40.8, 44.9) of U.S. healthcare-utilizing adults reported receiving PA advice. Receiving advice was highest among adults with diabetes (69.8%, 95% CI 66.5, 72.8), obesity (63.0%, 95% CI 60.3, 65.7), hypertension (56.5%, 95% CI 53.8, 59.2), hypercholesterolemia (55.6%, 95% CI 52.3, 59.0), and low HDL cholesterol (53.8%, 95% CI 50.1, 57.4), a pattern that remained significant after adjusted analyses. Current smokers (AOR 1.2, 95% CI 1.0, 1.4) and those not meeting PA guidelines (AOR 1.3, 95% CI 1.1, 1.5) were also more likely to receive advice than non-smokers or those meeting guidelines.

Conclusions: Despite national recommendations encouraging PA promotion within healthcare settings, most healthcare-utilizing adults do not receive PA advice. Healthcare providers target PA advice to patients with chronic health conditions, those less physically active, and currently smoking.

SPECIAL SESSION 4: The 1918 Influenza Centenary

11:55 AM–12:55 PM

Salon

Moderators: Dan Jernigan and Nancy Messonnier

Sponsor: National Center for Immunization and Respiratory Diseases (NCIRD)

This session will cover the 1918 influenza pandemic, what we have learned from pandemics and pandemic viruses in the century since 1918, how we are more prepared to address current threats, and address current threats.

Relevance and Appropriateness for the EIS Conference

In 1918, the world experienced the most severe influenza pandemic in recent history. About 500 million people or one-third of the world's population were infected with the 1918 H1N1 virus. Over the last century, there have been three additional pandemics, the latest of which began in 2009. CDC has played a central role in our understanding of the epidemiology and virology of influenza viruses, from reconstructing the 1918 virus so we could understand the properties that contributed to its exceptional virulence, to conducting outbreak investigations of novel influenza viruses that may herald the next pandemic. EIS officers play a central role in our daily work on seasonal and novel influenza, as well as our response efforts during epidemics and pandemics.

Speakers

- A century of pandemics staring with 1918: are we prepared? (15 mins)
  Tim Uyeki, MD, MPH, CDC Influenza Division
- Reconstructing the 1918 influenza virus (10 min)
  Terrence Tumpey, PhD, CDC Influenza Division
- Pandemic preparedness in Utah (10 mins)
  Allyn Nakashima, MD, Former State Epidemiologist, UT Department of Health
- Avian influenza A(H7N9) virus and other current threats (15 mins)
  Alex Millman, MD, CDC Influenza Division

CONCURRENT SESSION K1: One Health

1:15–3:00 PM

Salon

Moderators: Casey Barton Behravesh and Agam Rao

1:20 Multistate Outbreak of Multidrug-Resistant *Campylobacter* Infections Linked to Contact with Pet Store Puppies

Authors: Scott Robertson, M. Montgomery, M. Laughlin, R. Silver, L. Joseph, A. Singh, E. Salehi, L. Francois Watkins, C. Basler, R. Aubert, L. Stevenson, L. Koski, N. Dowell, L. Whitlock, P. Sundararaman, C. Friedman, A. Geissler, J. Chen, J. Folster, S. Crowe, C. Bennett, S. deFijter, D. Stanek, M. Schimenti, A. Ginn, N. Pickens, J. Nasir, J. Blanton, I. Williams, M. Jhung, M. Nichols

Background: *Campylobacter* causes approximately 1.3 million human illnesses in the United States and is becoming increasingly resistant to antibiotics. In July 2017, the Florida Department of Health notified CDC of human *Campylobacter jejuni* infections linked to puppies from Store P, a national pet store chain. The Ohio Department of Health concurrently identified patients with *C. jejuni* infections linked to Store P, suggesting a multistate outbreak. CDC and state partners investigated to determine the outbreak source and to prevent illnesses.

Methods: We defined a confirmed case as laboratory-confirmed *C. jejuni* infection in a patient with Store P puppy exposure within seven days of illness onset. A probable case was diarrheal illness in a patient with Store P puppy exposure within seven days of illness onset but without laboratory testing. We interviewed patients about Store P exposure with a standard questionnaire. State and CDC laboratories performed whole genome multi-locus sequence typing (wgMLST) to characterize relatedness and antibiotic resistance of *C. jejuni* isolates from patients and Store P puppies. We conducted traceback of infected puppies from Store P to breeder and recorded antimicrobial use.

Results: We identified 55 confirmed and 12 probable cases from 15 states, including 17 (25%) hospitalizations and no deaths. Sixty-two patients (93%) reported Store P puppy exposure; 18 (29%) were Store P employees. Analysis of wgMLST data demonstrated close phylogenic relationships between patient and puppy isolates. *C. jejuni* isolates from 13 patients and eight puppies had resistance to seven antibiotic classes. Record review revealed persistent widespread antibiotic use in puppies.

Conclusions: Outbreak-associated *C. jejuni* isolates in people and puppies were resistant to first-line antibiotics used to treat campylobacteriosis. Antibiotic resistance may be associated with increased risk of hospitalization and treatment failure. This outbreak demonstrates the need for a One Health approach to antibiotic stewardship in the commercial dog industry.

1:40 Bat Rabies Surveillance and Risk Factors for Rabies Transmission — Washington, 2000–2017

Authors: Jesse Bonwitt, M. Lang, H. Oltean, M. Goldoft

Background: Approximately 7% of bats tested at public health agencies are positive for rabies virus in the United States. We sought to describe bat rabies epidemiology in Washington where bats are the only rabies virus reservoir.

Methods: Passive surveillance data from bats submitted for rabies testing in Washington were analyzed. For bats tested during 2006–2017 with taxonomic data, we examined temporal trends stratified by species with ≥100 submissions. For bats tested during 2000–2016, rabies virus positivity was analyzed by bat behavior, bat vital status, and circumstances of encounters with humans and pets.

Results: During 2006–2017, complete species data were available for 84.0% (2,907/3,460) of bats. Ten of 16 species had ≥1 rabid bat, 6 species had ≥100 submissions with rabies positivity (range: 2.1%–11.8%; median = 4.9%). Increasing trends in annual positivity was significant only for big brown bats (*Eptesicus fuscus*) ($P = 0.02$). During 2000–2016, reasons for testing were available for 81.0% (2,809/3,466) of tested bats. Abnormal behavior (defined as bat initiating human contact) was significantly associated with rabies positivity (odds ratio [OR]: 3.9; 95% confidence interval [CI]: 2.5–6.2). Bats found alive were more likely to test positive for rabies, compared with bats found dead (OR: 3.3; 95% CI: 1.5–7.6). Among reported encounters, bats found outdoors were 4.0-fold (95% CI: 2.5–6.4) more likely to test positive than those found inside a house. Dogs were more likely to catch rabid bats than cats (OR: 3.8; 95% CI: 1.4–10.5).

Conclusions: Differences in rabies virus positivity across bat species indicate a need to analyze bat rabies data by species. Bat behavior, vital status, and circumstances of encounters with humans and pets cannot be used to conclusively exclude rabies virus transmission, and confirmed or suspected exposures to bats should warrant a public health response.

2:00 Outbreak of *E. coli* O157:H7 Infections in a Utah and Arizona Border Community — June, 2017

Authors: Vikram Krishnasamy, S. Luna, L. Saw, L. Smith, J. Wagner, J. Weigand, M. Tewell, M. Kellis, R. Penev, L. McCullough, J. Eason, K. McCaffrey, D. Barlow, A. Scherzer, M. Sarino, M. Schroeder, L. Gladney, R. Hassan, C. Basler, M. Wise, L. Gieraltowski

Background: On July 7, 2017, officials from the Utah Department of Health notified CDC of a cluster of *E. coli* O157:H7 (O157) infections in a community near the Utah and Arizona border. Infection with O157 can cause severe diarrhea leading to hemolytic uremic syndrome (HUS) and death. We investigated to identify the source and prevent additional illnesses.

Methods: Cases were defined as follows: onset of diarrhea in a resident of the border community after June 1, with either (i) infection with an O157 isolate indistinguishable from the outbreak strain, or (ii) post-diarrheal HUS. We conducted a focus group to generate hypotheses, an age-matched case-control study of cases to identify illness-associated exposures, and environmental sampling. We also performed contact tracing for all case-patients to identify secondary cases resulting from person-to-person transmission.

Results: Twelve case-patients met the case definition; eight were primary. Nine patients were hospitalized, four diagnosed with HUS, and two died. Ten (83%) of 12 patients were under five years old. We enrolled six primary case-patients and 16 controls in the case-control study. Sixty-seven percent of cases versus 19% of controls reported playing in an area that had manure (matched odds ratio, 7.7; 95% confidence interval, 0.8-71.3). Horse and cow manure samples collected from a case-patient's household yielded the outbreak strain. We did not identify a common food or water source for the outbreak. Contact tracing identified epidemiologic links between primary and secondary cases that supported person-to-person transmission.

Conclusions: The source of the outbreak was not confirmed, but evidence supported O157 infection spread via animal contact and person-to-person transmission. Consequently, investigators disseminated guidelines on animal and manure contact to promote infection prevention. This investigation highlights difficulties in solving outbreaks of enteric pathogens when both foodborne and zoonotic transmission modes are possible.

2:20 Assessment of Rabies Exposure Risk Among Residents of a University Sorority House — Indiana, 2017

Authors: Betsy Schroeder, A. Boland, E. Pieracci, J. Blanton, B. Petersen, J. Brown

Background: Bats are the most common source of human rabies infections in the United States; therefore, bat colonization of human dwellings is a public health concern. In February 2017, the Indiana State Department of Health (ISDH) was notified of bat sightings in communal areas of a university sorority house. The initial complainant cited food safety concerns. We investigated to assess rabies exposure risk and identify potential access bat routes.

Methods: We administered a web-based survey to assess bat exposure risk of 148 persons who resided or worked in the sorority house since February 2016. Respondent risk was categorized as low (no bat exposure), moderate (waking and finding a bat in the same room), or high (bite or other direct contact). Interviews with respondents classified as moderate or high risk were conducted in person or by telephone. An environmental health specialist (EHS) inspected the house for evidence of bat colonization.

Results: Of 100/148 (68%) survey respondents, 94 (94%) reported seeing a bat in the house; 34/94 (36%) reported seeing a bat ≥1/month. Initially, 13 (14%) were classified as having a moderate or high risk for rabies exposures. However, 9 (64%) were reclassified as having a low risk after follow-up interviews. The remaining 4 persons (3 moderate risk and 1 high risk) were recommended for postexposure prophylaxis (PEP). The EHS identified multiple openings that can serve as access points for bats.

Conclusions: The initial concern was not for rabies, which might indicate limited disease and risk knowledge among this population. ISDH communicated the risk for rabies at meetings with students and university personnel. Building remediation by the EHS removed the bats' access points. Bat exposures should be reported immediately to public health officials, who can conduct rabies risk assessments and make PEP recommendations.

2:40 Unexplained Transmission of Guinea Worm Disease Among Dogs and Humans — Chad, 2017

Authors: Eugene Liu, A. Sircar, K. Matchanga, A. Mahamat, N. Ngarhor, T. Ouakou, D. Sankara, H. Zirimwabagabo, E. Ruiz-Tiben, S. Roy

Background: Guinea worm disease (GWD), slated for global eradication, is typically spread by drinking stagnant water containing microscopic crustaceans (copepods) infected with larvae of the roundworm *Dracunculus medinensis*, resulting in well-defined clusters of case-persons with worms emerging from the skin. Starting in 2010, after 10 years of no reported cases, 9–16 annual sporadic human cases with few epidemiologic links to each other have been reported in Chad. This unusual situation has been complicated by the appearance of dog infections since 2012. We conducted an epidemiologic investigation to identify risk factors and develop interventions to prevent future cases.

Methods: We conducted a case-control study using standardized questionnaires to assess water and aquatic animal consumption and explore possible epidemiologic links to other human and dog cases. Case-persons were persons with extracted and laboratory confirmed worms during 2013–2017 in Chad. Each case-person was matched to 1–3 controls without any history of disease by age, sex, and residency in the village where the case-person was likely infected. Conditional logistic regression by single factors was performed to calculate odds ratios.

Results: We enrolled 25 case-persons with 63 matched controls. Consumption of untreated water from noncovered wells was associated with GWD, with an odds ratio of 11.04 [95% confidence interval: 1.32–92.05]. We did not find associations between GWD and consumption of aquatic animals or presence of infected dogs in the villages.

Conclusions: Consumption of unprotected water remains associated with GWD. Efforts to instruct populations about consuming water from protected sources and using copepod filters to strain unsafe surface water should continue and expand, as should efforts to install and repair safe drinking water sources. However, the peculiar epidemiology in Chad remains to be fully explained, particularly among dogs. Future studies of dogs and their owners might assist in identifying potential risk factors.

CONCURRENT SESSION K2: Measles, Mumps, and Meningitis Outbreaks

1:15–3:00 PM

Ballroom East

Moderators: Mark Pallansch and Wences Arvelo

1:20 Measles Strikes Back: an Outbreak of Measles in an Undervaccinated Community — Minnesota, March–August, 2017

Authors: Victoria Hall, E. Banerjee, C. Kenyon, A. Ashkir, L. Bahta, K. Como-Sabetti, M. Dittrich, D. Dunn, J. Griffith, J. Heath, D. Johnson, K. Martin, M. McMahon, H. Omar, M. Roddy, F. Sharif-Mohamed, A. Strain, K. Ehresmann

Background: Measles was eliminated from the United States in 2000, although travelers from countries with low vaccination rates reintroduce measles periodically. In April 2017, the Minnesota Department of Health was notified of suspected measles cases in the Somali-Minnesotan community where measles-mumps-rubella (MMR) vaccinations among children aged 2 years had declined from 92% to 42% during 2004–2014, primarily because of autism fears. We identified cases and transmission patterns, and helped implement control measures.

Methods: We defined cases as laboratory-confirmed measles, or as meeting CDC's and the Council of State and Territorial Epidemiologists' confirmed case definition. Measles exposures were assessed in health care, child care, and school settings. Vaccination status of exposed persons was verified, and post exposure prophylaxis (PEP) was recommended for applicable, susceptible persons. Susceptible exposed persons who were ineligible for or did not receive PEP were excluded from child care centers or schools for 21 days. Public health, health care agencies, and Somali-Minnesotan community partners disseminated targeted, culturally appropriate communications concerning measles, MMR vaccine, and autism.

Results: Seventy-five measles cases were identified during March 30–August 25, 2017; 43% were female, 81% Somali-Minnesotan, 91% unvaccinated, and 28% hospitalized. Median age was 2 years (range: 3 months–57 years). No deaths were reported. We identified 8,490 persons exposed to measles virus; at least 154 PEP doses were administered, and over 500 persons were excluded from child care and school.

Conclusions: This was the largest measles outbreak in Minnesota since 1990. Concerns about autism, the perceived increased rates of autism in the Somali-American community, and the misunderstanding that autism was related to MMR vaccine resulted in a vaccine rate low enough to allow widespread measles transmission among Somali-Minnesotans. The outbreak demonstrates the importance of continuing local partnerships and using culturally appropriate interventions to increase MMR vaccination rates.

1:40 Mumps Outbreak in a Recently Vaccinated Population — Kosrae, Federated States of Micronesia, August–December, 2017

Authors: Susannah McKay, A. Kambui, J. L. Taulung, A. Tippins, M. Eckert, A. Wharton, R.J. McNall, C. Hickman, W.T. Hancock, C. Apaisam, M. Patel, J. Routh

Background: On September 15th, 2017, the Kosrae Department of Health Services (KDHS) notified CDC of 11 cases of mumps in Kosrae, Federated States of Micronesia. Other Pacific Islands were concurrently experiencing mumps outbreaks with over 500 cases, raising concern for similar escalation in Kosrae. KDHS planned a mass measles-mumps-rubella (MMR) vaccination campaign for outbreak control. We performed active surveillance to assess outbreak magnitude and provide recommendations for the campaign.

Methods: We conducted interviews with mumps case-patients, collected specimens for laboratory testing, and performed active case-finding. To determine vaccination histories, we reviewed records from routine immunizations and a mass MMR vaccination campaign conducted in response to a nationwide measles outbreak in 2014. Coverage among persons 6 months–57 years of age was estimated to be 90%. The proportion of mumps case-patients who received a 2014 MMR dose was compared to the campaign coverage estimates.

Results: By December 15th, KDHS reported 23 mumps cases (9 confirmed, 6 probable, 8 suspect) with onset dates from 8/5–11/1; 52% were male and the median age was 14 years (range: 1–26 years). Seven (30%) case-patients reported contact with the index case. Twenty-one (91%) of cases had two or more documented MMR doses; however, among 2-dose recipients, 75% (CI: 53–89%; p<.0001) did not receive a MMR dose during the 2014 campaign. For these case-patients, the median time since the last MMR dose was 12 years.

Conclusions: Unlike other Pacific Island communities, the mumps outbreak in Kosrae remained small. Our observations suggest that time since last MMR dose was a risk factor for contracting mumps and that the 2014 campaign dose of MMR may have prevented additional cases. We recommended that KDHS modify the mass MMR vaccination campaign to an activity targeting undervaccinated persons aged 1–24, saving an estimated 1,000 MMR doses.

2:00 Viral Meningitis Outbreak — Lassen County, California, 2017

Authors: Yasser Bakhsh, J. Jones, T. Norwood, D. Walker, S. Taylor, R. Glenn-Finer, K. Harriman, D. Wadford, H. Holmstadt, L. Chen, J. Watt

Background: On September 27, 2017, California Department of Public Health (CDPH) received a report of suspected viral meningitis cases in Lassen County. We investigated to characterize the outbreak and provide control measures.

Methods: We reviewed medical records of patients reported by the local hospital. A case was a California resident with cerebrospinal fluid (CSF) pleocytosis (WBC>5) and negative bacterial culture, or an emergency department visit with headache, fever, and stiff neck on or after September 1, 2017. CDPH laboratory performed real-time polymerase chain reaction testing of CSF or respiratory specimens for enterovirus (EV) detection and sequencing of EV for molecular typing.

Results: Fifty medical charts were referred by local hospital; 35 patients met the case definition. Samples from 17 patients were tested for EV: 14 were positive for echovirus 30, 2 for coxsackievirus B5, and one was negative. Median age of patients was 16 years (range: 13–43); 60% were male. Common symptoms included headache (100%), nausea (71%), and photophobia (69%). Nineteen (54%) patients were hospitalized; no deaths were reported. Eighteen patients were students at one high school; 7 were on the football team. All affected team members tested positive for echovirus 30. Investigation of team practices revealed players were required to share water bottles. Genetic sequence analysis showed Lassen County echovirus 30 samples were nearly indistinguishable from samples from neighboring Washoe County, Nevada, which also experienced a viral meningitis outbreak (55 patients) during July 15–December 3, 2017.

Conclusions: This outbreak is probably attributable to echovirus 30, which commonly causes meningitis. Transmission among high school football players might have been enhanced by water bottle sharing. Lassen County established a 24-hour call center to address community concerns and press releases were issued to communicate health messages, including instructions on personal hygiene and recommendation for affected individuals to self-isolate at home.

2:20 Laboratory Investigation of a *Neisseria meningitidis* Serogroup C Outbreak, Liberia, 2017

Authors: Caelin Potts, J. Vuong, A. Retchless, S. Schmink, M. Whaley, L.T. Jenkins, C. Bozio-Eldridge, J. Patel, L. McNamara, G. Gwesa, V. Katawera, T.A. Clark, D.E. Williams, H. Kohar, E.K. Dokubo, X. Wang, L. Fox

Background: A cluster of 31 cases of unexplained illness, including 13 deaths, associated with a funeral in Liberia was reported in April 2017. Laboratory testing for Ebola virus, Lassa virus, and toxins were negative. The TaqMan Array Card (TAC) assay and real-time (rt-PCR) confirmed *Neisseria meningitidis* serogroup C (NmC) in specimens from four outbreak cases, which has recently emerged in African meningitis belt countries and caused large outbreaks in Niger and Nigeria. This finding prompted further laboratory investigation.

Methods: Direct rt-PCR was used to detect NmC from clinical specimens. Genetic diversity of the outbreak NmC strain was assessed by Sanger sequencing-based multi-locus sequence typing and whole genome metagenomic analysis. To establish in-country capacity for bacterial meningitis detection and characterization, CDC staff led laboratory trainings on direct rt-PCR and specimen management and processing at the National Reference Laboratory after the outbreak investigation.

Results: Sixty-three clinical specimens from 24 of the 31 cases were available for testing by rt-PCR. Forty specimens (63.5%) from 14 cases were positive for *N. meningitidis*, with 39 (97.5%) identified as NmC. Molecular characterization by MLST identified the outbreak strain as most similar to sequence type-9367 (ST-9367) and by metagenomics as most similar to ST-10217. Notably, both ST-9367 and ST-10217 are members of clonal complex 10217 (CC10217). Training for bacterial meningitis testing successfully built local capacity: the National Reference Laboratory in Liberia confirmed the presence of NmC in one of two suspect cases in September 2017.

Conclusions: Laboratory testing confirmed NmC as the outbreak cause. The genetic similarity of the Liberian outbreak strain to CC10217, which has previously been associated with outbreaks in multiple meningitis belt countries, indicates that non-belt countries may be at risk for invasive meningococcal disease. These findings highlight the importance of strengthening regional surveillance and building sustained laboratory diagnostic capacity for meningococcal disease confirmation.

2:40 Ongoing Mumps Outbreak Results in Recommendations for a Third Dose of Vaccine — Alaska, 2017

Authors: Amanda Tiffany, D. Shannon, L. Castrodale, W. Mamtchueng, B. Chandler, J. McLaughlin

Background: Mumps is a vaccine-preventable, viral illness characterized by a febrile prodrome and parotitis. The most effective prevention is vaccination with measles-mumps-rubella (MMR) vaccine. In May 2017, the Alaska Section of Epidemiology (SOE) was informed of a mumps case in an Alaska resident. Subsequent cases were identified during July and August. We investigated to determine outbreak scope and prevent further illnesses.

Methods: Medical records were reviewed; patients with suspected mumps illness were interviewed in-person or by telephone using a standardized questionnaire. We used the Council of State and Territorial Epidemiologists' mumps case definition for classification. Immunization status was verified using Alaska's immunization information system. Buccal swabs were obtained and submitted for confirmatory testing.

Results: By December 22, 2017, a total of 104 confirmed and 18 probable mumps cases were reported to SOE. Among patients with confirmed status, median age was 25 years (range: 3–68 years); 28 (27%) were aged ≤18 years; 49 (47%) were female, and 74 (71%) self-identified as Native Hawaiian/Pacific Islander (NH/PI). Immunization status was verified for 54/104 patients with confirmed status; 1 had received 4 MMR doses, 1 had 3 doses, 37 had 2 doses, and 13 had 1 dose. Immunization status was unverifiable for 50 patients. Among patients with ≥2 doses of MMR, median time from most recent dose to illness was 11 years (range: 2–20 years).

Conclusions: This represents the largest mumps outbreak in Alaska since the 1970s, and is disproportionately affecting NH/PI population. In November 2017, the Alaska Division of Public Health recommended a third dose of MMR for NH/PI persons if their second dose was administered ≥5 years ago. Children and most adults who meet recommendations for a third dose are eligible to receive state-supplied vaccine through Alaska's Vaccine Assessment Program. The effect of this recommendation will be monitored.

SESSION L: Alexander D. Langmuir Lecture

3:15–4:45 PM

Salon

Jerome M. Adams
MD, MPH, 20th U.S. Surgeons General

Presentation of the Alexander D. Langmuir Award and Distinguished Friend of EIS Award

Presenter: Arthur Liang

Alexander D. Langmuir Lecture

Better Health Through Better Partnerships

VADM Jerome M. Adams, MD, MPH, 20th U.S. Surgeon General

Moderator: Patricia Simone

Biography

As Surgeon General, Dr. Adams is committed to maintaining strong relationships with the public health community and forging new partnerships with non-traditional partners, including business and law enforcement. His motto as Surgeon General is "better health through better partnerships." He oversees the operations of the U.S. Public Health Service Commissioned Corps, which has approximately 6,500 uniformed health officers who serve in nearly 600 locations around the world to promote, protect and advance the health and safety of our nation and our world.

Dr. Adams has pledged to lead with science, facilitate locally-led solutions to the nation's most difficult health problems, and deliver higher quality healthcare at lower cost through patient and community engagement and better prevention.

Dr. Adams is a board-certified anesthesiologist and served as the Indiana State Health Commissioner from 2014 to 2017, where he presided over Indiana's efforts to deal with the state's unprecedented HIV outbreak. In this capacity, he worked directly with the Centers for Disease Control and Prevention, as well as with state and local health officials and community leaders, and brought the widest range of resources, policies and care available to stem the epidemic affecting that community. He also helped with the successful launch of Indiana's state-based, consumer-driven alternative to Medicaid expansion and worked with the state legislature to secure more than $10 million to combat infant mortality in high-risk areas of the state.

Dr. Adams was an associate professor of clinical anesthesia at Indiana University School of Medicine and a staff anesthesiologist at Eskenazi Health, where he was Chair of the Pharmacy and Therapeutics Committee. He has served in leadership positions at a number of professional organizations, including the American Medical Association, the Indiana State Medical Association and the Indiana Society of Anesthesiologists. He is the immediate past Chair of the Professional Diversity Committee for the American Society of Anesthesiologists.

Dr. Adams, a Maryland native, has bachelor's degrees in both biochemistry and psychology from the University of Maryland, Baltimore County, a master of public health degree from the University of California at Berkeley, and a medical degree from Indiana University School of Medicine.

Awards presented during session.

SESSION M: FETP International Night — Oral Presentations (sponsored by TEPHINET & CDC Foundation)

6:30–9:00 PM

Ballroom C

Agenda provided during session

CONCURRENT SESSION N1: Fungal Infections

8:30–9:55 AM

Salon

Moderators: Robert Tauxe and Andrea Winquist

8:35 Antibiotic and Antifungal Treatment Among Patients with Confirmed Coccidioidomycosis — Southern California, 2011

Authors: Gloria Chi, K. Benedict, K.D. Beer, B.R. Jackson, O. McCotter, F. Xie, J.M. Lawrence, S.Y. Tartof

Background: Coccidioidomycosis, caused by inhaling *Coccidioides* spp. fungi, can cause respiratory symptoms commonly mistaken for bacterial pneumonia and progress to severe disseminated disease. Antibiotics are ineffective in treating coccidioidomycosis, whereas antifungals are essential for treating severe disease. We investigated coccidioidomycosis testing and treatment patterns in an integrated health care delivery system to identify gaps in the diagnosis and treatment of this neglected disease.

Methods: We identified persons with coccidioidomycosis diagnoses during 2011 using Kaiser Permanente Southern California electronic health records. Cases were confirmed by positive complement fixation or immunodiffusion antibody test, culture, or histological report identifying *Coccidioides*. To analyze complex longitudinal events (antibiotic and antifungal treatments), we used EventFlow to identify sequences and time between events before and after first positive coccidioidomycosis test. We included antifungals given ≤1 year and antibiotics given ≤3 months of testing.

Results: Among 530 patients with confirmed coccidioidomycosis, 77% received antibiotics ≤3 months before or after first positive test; 80% received antifungals during the year before or after first positive test. Among those treated with antibiotics, the majority (70%) received antibiotics before their first positive test; among those with antifungals, 79% received them ≤1 year after first positive test. For patients receiving antibiotics before positive tests, median time between the 2 events was 12 days (interquartile range = 2–33 days), and 74% received >1 antibiotics course before positive tests. The most common event sequence (35%) was antibiotic treatment followed by positive test and then antifungal treatment.

Conclusions: Most patients received antibiotics before their coccidioidomycosis test, with many receiving multiple antibiotics courses and experiencing diagnosis delays. Positive coccidioidomycosis tests led to markedly lower rates of antibiotic treatment and to the initiation of antifungal treatment. Clinicians in coccidioidomycosis endemic regions including California should consider expanding coccidioidomycosis testing to reduce unnecessary antibiotic use and guide correct treatment.

8:55 *Candida auris* Point-Prevalence Surveys and Environmental Sampling in Facilities Without Currently Admitted *C. auris* Patients — New York, 2017

Authors: Robert Mcdonald, E. Gustafson, M. Quinn, E. Adams, S. Chaturvedi, R. Erazo, K. Langguth, V. Haley, D. Blog, E. Lutterloh, N. Ahmad

Background: *Candida auris* is a multidrug-resistant yeast that can spread in healthcare settings by colonizing patients and persisting in the environment for at least 28 days. New York State has identified the majority of *C. auris* patients since it was first reported nationally in 2016. Most patients are linked to a regional network of healthcare facilities, identified through point-prevalence surveys conducted at facilities with multiple *C. auris* patients. To understand if *C. auris* is widespread in facilities with fewer *C. auris* links, we screened patients and obtained environmental samples at such facilities.

Methods: Facility inclusion criteria included caring for ≤2 known *C. auris* patients, all discharged ≥2 months previously. Nares and composite axilla and groin swabs were obtained from facility residents who were on a unit where a *C. auris* patient was previously admitted. Environmental samples were collected from high-touch facility surfaces and rooms previously occupied by *C. auris* patients. The Wadsworth Center Mycology Laboratory cultured and performed polymerase chain reaction (PCR) on samples.

Results: We screened 203 patients at 6 facilities; 1 (0.5%) patient was found to be colonized with *C. auris*. This patient was admitted to facilities with known *C. auris* patients before the current facility admission. Four facilities had environmental detection, with 23 (9.5%) of 241 samples positive for *C. auris* by PCR, including a sample from the unit of the newly found patient; 2 (0.8%) samples from bedside furniture at 2 facilities were culture-positive.

Conclusions: The low colonization percentage suggests *C. auris* is not widespread in facilities linked to few *C. auris* patients. *C. auris* in facility environments was unexpected. Findings might indicate the existence of previously unidentified colonized persons, longer environmental persistence of *C. auris*, or lapses in facility cleaning, and highlight the importance of infection control and environmental disinfection to control *C. auris* spread.

9:15 Antifungal Prescribing Patterns in the Outpatient Setting — United States, 2015

Authors: Sharon Tsay, M. Bartoces, S. Vallabhaneni, B. Jackson, L. Hicks

Background: Analyses of outpatient antibiotic prescribing show widespread inappropriate use, a major driver of resistance. Less is known about antifungal prescribing despite emerging resistance in fungi, particularly to azole antifungals. We characterized U.S. outpatient antifungal prescribing practices and assessed geographic variation in prescribing.

Methods: All antifungal prescriptions dispensed during 2015 were extracted from the IMS Health Xponent database, which represents a 100% projection from a sample of more than 80% of all U.S. outpatient prescriptions. Antifungals were categorized as systemic or non-systemic, and prescriptions were summarized by drug, age, and sex. Total prescriptions and rates were calculated by provider specialty. Number of prescriptions and census denominators were used to calculate prescribing rates by region.

Results: Providers prescribed 23.5 million courses of antifungals (73 prescriptions per 1,000 persons) in 2015. Fluconazole was prescribed most often (73%), followed by terbinafine (12%), and nystatin (11%). Females received most prescriptions (116 prescriptions per 1,000 persons), especially those ≥20 years vs. <20 (141 vs. 38 per 1,000 persons). Family practitioners prescribed the most antifungals (24% of all prescriptions), while the highest prescribing rates were among obstetrician-gynecologists (96 per provider). Prescribing rates were highest in the South (87 per 1000 persons) and lowest in the West (52 per 1,000 persons).

Conclusions: Prescribing of antifungals in the outpatient setting is common, with enough courses dispensed to provide one for every 14 U.S. residents each year. Use of fluconazole, an azole, in adult women accounted for most prescriptions, prescribed most commonly by family practitioners and obstetrician-gynecologists, suggesting vaginal yeast infections as a common indication. Prescribing differences by region could suggest inappropriate use or variations in disease burden. Further study of antifungal use is needed to help target efforts in antifungal stewardship.

9:35 Coccidioidomycosis Among Workers Constructing a Solar Power Farm — Monterey County, California, 2016–2017

Authors: Rebecca Laws, G. Sondermeyer Cooksey, S. Jain, J. Wilken, J. McNary, E. Moreno, K. Michie, C. Mulkerin, A. McDowell, D. Vugia, B. Materna

Background: Coccidioidomycosis is an infection resulting from inhalation of spores of the soil-dwelling fungus *Coccidioides*. Workers performing or near soil-disturbing activities in endemic areas are at risk. In January 2017, two county health departments notified the California Department of Public Health of coccidioidomycosis cases among workers constructing a solar farm in Monterey County and requested assistance.

Methods: We matched solar farm employee rosters during February 2016–April 2017 with the California Reportable Disease Information Exchange database for case-finding, and conducted worker interviews. Cases had clinical and laboratory-confirmed coccidioidomycosis, with illness onset ≥1 week after beginning work and <1 month after final solar farm workday. We calculated incidence rates among workers by dividing number of cases by total person-years spent at the worksite, and compared these rates with incidence rates for Monterey and surrounding counties.

Results: Among 2,410 employees, we identified 9 cases. Median age was 42 years (range: 20–63 years); 7 were male; all were previously healthy. Five visited emergency departments; 1 was hospitalized and none died. Construction began June 2016; illness onset dates were August–December 2016. Of the 8 patients interviewed, 7 worked only at the solar farm within 4 weeks before illness onset; 1 also worked elsewhere. Seven patients missed work because of illness (median: 14 days; range: 1–320). Patients reported dusty work conditions, an inadequate respiratory protection program, and minimal coccidioidomycosis training. Annual coccidioidomycosis incidence among workers was 1170.5/100,000 persons; the 2016 incidence for Monterey and surrounding counties ranged from 2.9–157.3/100,000 persons.

Conclusions: The disproportionately high infection rate among workers indicates coccidioidomycosis was likely acquired at work. To prevent additional cases during future construction, we recommended improved dust control, respiratory protection, worker training, and illness tracking and reporting. These recommendations have implications for employers and health care providers when construction projects occur in *Coccidioides*-endemic areas.

CONCURRENT SESSION N2: Preconception, Pregnancy, and Maternity Care

8:30–9:55 AM

Ballroom East

Moderators: Ruth Petersen and Andrea Sharma

8:35 Attention-Deficit/Hyperactivity Disorder Medication Prescription Claims Among Reproductive-Aged Women with Private Employer-Sponsored Insurance — United States, 2003–2015

Authors: Kayla Anderson, E. Ailes, M. Danielson, J. Lind, S. Farr, C. Broussard, S. Tinker

Background: Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder that affects individuals across the lifespan. There is a lack of consensus about ADHD medication safety during pregnancy. Given that half of U.S. pregnancies are unplanned and early pregnancy is a critical period for fetal development, it is important to understand ADHD medication use among reproductive-aged women. Our objectives were to examine the annual proportion of reproductive-aged women dispensed ADHD medications from 2003–2015, including estimating temporal trends in ADHD medication dispensations, and the specific ADHD medications dispensed.

Methods: We used data from the Truven Health MarketScan® Commercial Database (2003–2015), a large U.S. convenience sample of individuals with private employer-sponsored insurance and their dependents. We restricted the analysis to women aged 15–44 years with ≥11 months of enrollment in the calendar year of interest in a private health insurance plan that included prescription drug coverage (2.3–6.8 million women per year). We calculated the annual proportion of reproductive-aged women who filled at least one ADHD prescription and the percent change in the proportions from 2003–2015. Among women reporting any ADHD prescriptions in a given year, we examined the specific ADHD medications filled.

Results: There was a 344% increase in the proportion of reproductive-aged women who filled a prescription for at least one ADHD medication from 2003 (0.9% of women) to 2015 (4.0% of women). Among reproductive-aged women who filled any ADHD prescriptions in 2015 (n = 183,053), 60.8% filled a prescription for mixed amphetamine salts, 26.7% for lisdexamfetamine, and 18.1% for methylphenidate; other specific ADHD medication prescription types were filled less commonly.

Conclusions: Prescribing ADHD medications to reproductive-aged women is increasingly common. Additional research on ADHD medication safety is warranted to inform women and their healthcare providers about any potential risks of ADHD medication use before and during pregnancy.

8:55 Prenatal Syphilis Screening Using Vital Statistics Birth Certificate Data — Colorado, 2009–2016

Authors: Grace Marx, K. Bol, C. White, B.A. Albanese

Background: Congenital syphilis can cause severe congenital abnormalities or fetal demise if not treated during pregnancy. Syphilis screening is recommended at the first prenatal visit. During 2009–2016 in the United States, congenital syphilis increased from 10 cases/100,000 live births to 16 cases/100,000 live births. We sought to identify sociodemographic characteristics of women not receiving prenatal syphilis screening in Colorado.

Methods: Data from Colorado vital statistics for live births during 2009–2016 were analyzed. Prenatal syphilis screening was considered received when a maternal syphilis screening date was listed on the infant's birth certificate. Sociodemographic characteristics of pregnant women were described when data were available, stratified by receipt of prenatal syphilis screening.

Results: Of 529,185 Colorado birth certificates during 2009–2016, prenatal syphilis screening was received for 496,224 (94%) women, and was more common among women with prenatal care (491,512/512,349 [96%]), compared with women without prenatal care (4,712/16,096 [29%], P <.0001). Screening was received more often among women with private insurance (262,497/276,080 [95%], compared with women with Medicaid insurance (181,882/196,504 [93%], P <.0001) or without insurance (14,038/16,455 [85%], P <.0001). Screening occurred more often among women aged ≥20 years than women aged <20 years (464,593/494,807 [94%] versus 31,581/34,244 [92%], P <.0001); among non-Hispanic women than Hispanic women (353,605/374,437 [94%] versus 138,687/149,882 [93%], P <.0001); and among women whose reported annual household income was ≥$50,000, compared with women from lower household incomes (198,512/208,068 [95%] versus 249,261/267,332 [93%], P <.0001). Women giving birth in the hospital received screening more often than women intentionally giving birth at home (486,963/517,920 [94%] versus 5,931/6,591 [90%], P <.0001).

Conclusions: Prenatal syphilis screening in Colorado was suboptimal during 2009–2016. Targeted efforts are needed to improve prenatal care access and prenatal syphilis screening, particularly for women who are uninsured, young, Hispanic, less wealthy, or planning a home birth.

9:15 Trends in Mother to Newborn Skin-to-Skin Contact Indicators — United States, 2007–2015

Authors: Ellen Boundy, C. Perrine, C. Barrera, R. Li, H. Hamner

Background: Mother to infant skin-to-skin contact (SSC) immediately after birth helps infants transition to the post-uterine environment and increases breastfeeding initiation and duration. SSC is recommended by the World Health Organization and UNICEF's Ten Steps to Successful Breastfeeding, but its practice in the U.S. is not well-described. We examined SSC practices over time and by facility demographics.

Methods: Data were from Maternity Practices in Infant Nutrition and Care (mPINC) surveys (2007–2015), a biennial census of U.S. maternity facilities. Facilities reported the proportion of infants experiencing SSC for ≥30 minutes within 1 hour of uncomplicated vaginal birth and 2 hours of uncomplicated cesarean birth, and how often routine infant procedures (e.g., assessments, Apgar scores) are performed while in SSC. We calculated the percentage of facilities reporting that most (≥90%) infants experience these practices for each survey year, and examined estimates by facility characteristics (size, type, state) for 2015.

Results: The percentage of facilities reporting that most infants experienced SSC more than doubled during 2007–2015 following both vaginal (40% to 83%) and cesarean (29% to 70%) births. The percentage of facilities reporting that infant procedures were almost always performed while in SSC increased from 17% to 50% for vaginal and from 2% to 11% for cesarean births. A SSC rate of ≥90% was most frequently reported in birth centers (98%) and military hospitals (90%) for vaginal births, and in non-profit (74%) and government hospitals (66%) for cesarean births. A SSC rate of ≥90% for vaginal births ranged from 62% of facilities in Arkansas to 100% of facilities in New Hampshire, Rhode Island, and Vermont.

Conclusions: U.S. maternity facilities made significant progress in implementing recommended SSC practices for both vaginal and cesarean births. However, variations in SSC practice by facility demographics exist. Continued efforts to support evidence-based maternity practices are needed.

9:35 Maternity Care Facility Trends in Providing Post-Discharge Breastfeeding Supports to New Mothers — United States, 2007–2015

Authors: Jennifer Beauregard, J. Nelson, H. Hamner

Background: The first weeks after birth are important for establishing successful breastfeeding, yet postpartum breastfeeding care is often fragmented. Maternity care facilities can play a pivotal role in providing or directing mothers to post-discharge breastfeeding support, which improves breastfeeding duration. This study described 2007–2015 national trends in post-discharge breastfeeding supports among U.S. maternity care facilities.

Methods: Data were from the Maternity Practices in Infant Nutrition and Care (mPINC) survey, a biennial census of birth facilities in the United States and territories. Facilities reported whether they provided each of three support modes: physical contact (e.g., return visits), active reaching out (e.g., telephone calls), and referrals (e.g., lactation consultants). We calculated prevalence of each support mode for each survey year and percentage point change over 2007–2015, and we examined whether these differed by facility characteristics. Confidence intervals were not calculated because mPINC is a census rather than a sample.

Results: Among participating facilities (n~2,600; response rates 82%-83%), >98% offered referrals across all survey years. Over 2007–2015, proportions of facilities offering physical contact increased by 6% (43% [2007], 43% [2009], 43% [2011], 46% [2013], 49% [2015]), and proportions offering active reaching out increased by 8% (57% [2007], 58% [2009], 62% [2011], 65% [2013], 65% [2015]). Government, nonprofit, and military hospitals, as well as small facilities (annual births<250), offered physical contact and active reaching out more frequently than private hospitals and larger facilities. These support modes increased the most among government and military hospitals and facilities with the fewest (<250) and the most (≥5,000) annual births.

Conclusions: Although nearly all maternity care facilities provided referrals, there is room for improvement in offering physical contact and active reaching out supports. To help mothers reach their breastfeeding duration goals, facilities could identify and address barriers to ensuring breastfeeding mothers receive adequate post-discharge support.

CONCURRENT SESSION O1: Food and Water

10:10–11:55 AM

Salon

Moderators: Michael Beach and Stacey Bosch

10:15 Water, Sanitation, and Hygiene Infrastructure in Rural Healthcare Facilities — Kamwenge District, Uganda, 2017

Authors: Jarred Mcateer, S. Chae, M. Person, E. Atuheire, D. Kadobera, A Ario, R. Quick

Background: The Ebola epidemic highlighted the crisis of inadequate water, sanitation, and hygiene (WASH) infrastructure in healthcare facilities (HCFs) in developing countries. To protect the health of patients and health workers, universal WASH coverage of HCFs is included among the United Nations' Sustainable Development Goals (SDGs). To prepare for a WASH intervention project, we assessed WASH infrastructure in HCFs in Kamwenge District, Uganda.

Methods: We surveyed 27 HCFs on water sources, availability of hand washing and drinking water stations, and waste management practices, and tested water sources for *Escherichia coli (E. coli)*. In each HCF, we measured the percentage of patient care areas with functional handwashing stations, defined as having a cover, spigot, and water and soap present. We determined the percentage of HCFs with access to drinking water stations, and observed waste management practices.

Results: All 27 HCFs provided outpatient services and 12 (44%) provided inpatient services. Of 27 HCFs, 24 (89%) had an improved water source (i.e, protected from outside contamination) and 18 (67%) had a water source on HCF premises. Water was unavailable from the main source for ≥1 month per year in 13 (48%) HCFs. Eighteen (67%) HCFs had handwashing stations; of all HCFs the median percentage of patient care areas with functional handwashing stations was 20% (range: 0–100%). Of 27 HCFs, 2 (7%) had drinking water stations with a cover and spigot. *E. coli* contamination was found in water samples from 9 (47%) of 19 accessible water sources. Of 27 HCFs, 21 (78%) separated sharps, infectious, and noninfectious waste. All HCFs burned infectious waste, with 19% using recommended disposal systems (lined pits or incinerators).

Conclusions: HCFs in this evaluation had deficient access to safe water, poor coverage of handwashing and drinking water stations, and unsafe disposal of medical waste. Improved WASH coverage is urgently needed.

10:35 *Campylobacter* Outbreak at a Food Festival Detected Using SaTScan™ — Connecticut, 2017

Authors: Vivian Leung, J. Krasnitski, Q Phan, C. Applewhite, R. Wisniewski, L. Mank, A. Krauss, M. Cartter

Background: *Campylobacter* outbreak detection is challenging because pulsed-field gel electrophoresis (PFGE) is not routinely performed for *Campylobacter* at state public health laboratories (SPHLs). In 2016, the Connecticut Department of Public Health began using SaTScan™ software to identify space-time clusters among surveillance data. In June 2017, a cluster of 10 campylobacteriosis cases in eastern Connecticut was detected using SaTScan™; 3 case-patients in the cluster attended the same central Connecticut food festival. This was Connecticut's first SaTScan™-detected outbreak. We investigated to assess illness extent, identify exposure source, and prevent additional illnesses.

Methods: An online questionnaire was distributed to 368 available e-mail addresses among ~1,000 attendees. A case was defined as laboratory-confirmed campylobacteriosis in a festival attendee. A probable case was self-reported diarrhea (≥3 stools within 24 hours) in an attendee with onset ≤7 days post-festival. Case-control analysis compared consumption of 65 festival food items among case-patients and non-ill survey respondents. An onsite environmental investigation was conducted. Connecticut SPHL performed PFGE on *Campylobacter* isolates and cultured suspected food vehicle samples.

Results: Eighty-eight attendees completed the survey [11 case-patients (8 laboratory-confirmed), 73 non-ill persons, and 4 persons reporting illness not meeting the case definition (not analyzed)]. Only one food item – a marinated rib-eye beef stir-fry – was significantly associated with illness (odds ratio: 4.91; confidence interval: 1.14–21.12). No festival food samples were available; beef samples from the vendor who served the stir-fry were culture-negative for *Campylobacter*. Inspection found inadequate food cold-holding temperatures. *Campylobacter* isolates from 4 case-patient stools yielded indistinguishable PFGE *SmaI* patterns.

Conclusions: SaTScan™ detected a *Campylobacter* outbreak. The investigation implicated beef, an unusual vehicle for *Campylobacter*, and indicated improvement in cold-holding temperatures as a preventive measure. For pathogens without routine PFGE testing, using SaTScan™ to detect space-time clusters can lead to investigations that contribute to understanding of exposure sources and preventive measures.

10:55 Cyclosporiasis Among Patrons of Restaurant A — Houston Metropolitan Area, Texas, May–August 2017

Authors: Rebecca Chancey, N. Hall, A. Keaton, V. Heines, V. Cantu, V. Vakil, S. Long, K. Short, E. Franciscus, N. Wahab, A. Haynie, L. Gieraltowski, A. Straily

Background: Cyclosporiasis is an intestinal illness caused by the parasite *Cyclospora cayetanensis*. During July 21–August 8, 2017, CDC was notified of 20 confirmed or probable cases of *Cyclospora* infection in persons who had eaten at one of four Restaurant A locations in the Houston metropolitan area. The Texas Department of State Health Services and Houston-area health departments requested assistance in an epidemiologic investigation to identify the vehicle(s) of infection among restaurant patrons.

Methods: A case-control study was conducted using a Restaurant A-specific questionnaire. A confirmed case was defined as laboratory-confirmed infection in a person with clinically compatible illness who became ill within two weeks of eating at one of the four restaurant locations on or after May 28 and who had not traveled internationally during the two weeks before symptom onset. A probable case was defined similarly, except without laboratory confirmation of infection. Case-patients and controls were matched on dining date and location. Using bivariate logistic regression, associations between food exposures and cyclosporiasis were examined and matched odds ratios (mORs) and 95% confidence intervals (CIs) were calculated.

Results: Overall, 24 case-patients (16 confirmed; 8 probable) and 70 controls completed the questionnaire; 22 case-patients were matched with 66 controls. In menu-item analyses, consumption of tabouli was associated with cyclosporiasis (mOR = 8.0; 95% CI 2.1–44.5). In ingredient-level analyses of menu items containing fresh produce, green onions—eaten by 18 case-patients (81.8%), including 15 who reported eating tabouli (which contained green onions)—were associated with cyclosporiasis (mOR = 11.3; 95% CI 2.6–104.7). Traceback investigations conducted by state and federal officials to determine the source(s) of the green onions were inconclusive.

Conclusions: We present an outbreak of cyclosporiasis epidemiologically linked to green onions, and broaden the range of fresh produce items that have been implicated as vehicles for this infection.

11:15 Salmonellosis Outbreak at a Chili and Chowder Cook-Off — Virginia, 2017

Authors: Kelly Shaw, K. Wright, K. Privett, W. Pfeiffer, K. Greene, K. Holloman, S. Levine, K. McCombs, L. Turner, D. Woolard, D. Matson

Background: After a chili and chowder cook-off featuring 11 local vendors and attended by ~2,500 persons, the Accomack County Health Department received reports of gastrointestinal illness among event attendees. Clinical stool specimens tested positive for *Salmonella* serotype Javiana. We investigated to determine the outbreak exposure source, identify practices that might have contributed, and provide recommendations to prevent future outbreaks at similar events.

Methods: We performed a cohort study, recruiting event attendees through press releases and social media posts containing the link to an online survey about cook-off foods consumed and gastrointestinal illness. A case was defined as ≥3 episodes of diarrhea in <24 hours, or unquantified diarrhea and another symptom (either abdominal pain, chills, dehydration, fever, nausea, or vomiting) in an attendee or someone who consumed festival food. In addition to unadjusted relative risks (RRs), Mantel-Haenszel adjusted RRs were calculated to address potential confounding by multiple exposures. Environmental health specialists interviewed food handlers and conducted inspections of restaurants where professional competitors had prepared food. Available food samples and stool samples from asymptomatic food handlers were tested for *Salmonella*.

Results: Of 439 survey responses, 172 met the case definition. Of all exposures, Chowder A had the strongest association with illness (RR: 8.9; 95% CI: 5.7–13.7). When stratified by exposure to Chowder A, all other chili or chowder RRs were <1.4. Environmental health inspections and interviews did not identify a specific source of contamination. An uneaten sample of Chowder A tested positive for *Salmonella* serotype Javiana. Frozen clams and food handler samples tested negative.

Conclusions: Epidemiologic and laboratory analyses provide evidence Chowder A was the most likely outbreak source; however, the original source of *Salmonella* is unknown. Recommendations to prevent future outbreaks included requiring all food to be prepared on-site and ensuring safe temperatures are maintained during food preparation and service.

11:35 Gastrointestinal Illness Outbreak at Multiple Outdoor Festivals — Pennsylvania, 2017

Authors: Patrick Mitchell, K. Kline, D. Riner, R. McClung, R. Burke, M. Barajas, K. Benedict, J. Murphy, V. Hill, M. Mattioli, A. Kahler, S. Grytdal, J. Yoder, A. Hall, L. Barclay, K. Fullerton, Z. Marsh, B. Behm, J. Vinje, N. Dowell, A. Weltman, A. Longenberger

Background: On June 13, 2017, the Pennsylvania Department of Health was notified of acute gastrointestinal illness (AGI) among attendees of a festival held at Venue A. Further cases were identified from two additional Venue A festivals held May 31–June 18. Another festival was scheduled to occur July 26–30. We investigated to assess transmission risk factors and prevent additional illnesses.

Methods: We defined a case as vomiting or diarrhea in a person linked to a Venue A event after May 31, 2017. Social media pages for Venue A and affected events were used to solicit illness reports. Stool and vomitus specimens were collected and tested for enteric pathogens. We conducted an environmental assessment during July 18–19 at Venue A and tested well, creek, and ground water for fecal microbes. We provided recommendations before the July festival and conducted onsite active surveillance.

Results: We received 179 self-reports of AGI associated with 3 festivals during June. Norovirus was detected in 7/8 clinical specimens from event attendees. Creek and well water samples also contained norovirus and other fecal microbes. A septic leach field was identified as the likely source of well contamination. Venue A installed a new well located farther from the leach field, increased portable toilet and handwashing station availability, and promoted proper hand hygiene during the July festival. Active surveillance during this festival identified 5 ill persons; one submitted a stool specimen, which tested negative for norovirus and other enteric pathogens.

Conclusions: An AGI outbreak affected 3 festivals at a venue where norovirus was detected in the primary drinking water source. Interventions to ensure access to clean water, proper hand hygiene, and adequate sanitation were implemented for the next large event. No outbreak occurred during this event, highlighting the potential of these interventions to prevent AGI.

CONCURRENT SESSION O2: Child Health

10:10–11:55 AM

Ballroom East

Moderators: Georgina Peacock and Matthew Maenner

10:15 Neonatal Abstinence Syndrome, Epidemiology, and Estimated Burden — Tennessee, 2013–2016

Authors: Julia Brennan, C. Wiedeman, J.R. Dunn, W. Schaffner, T.F. Jones

Background: Neonatal abstinence syndrome (NAS), a postnatal drug withdrawal syndrome, is an increasing public health problem in Tennessee, mirroring the opioid epidemic. During 2003–2013, hospital discharges with NAS increased 9-fold from 1.6/1,000 live births to 16.6/1,000 live births annually. In response, Tennessee made NAS reportable in 2013. We described the epidemiology and estimated the burden of NAS since becoming reportable.

Methods: We analyzed NAS cases reported to the Tennessee Department of Health (TDH) during 2013–2016, and estimated burden by comparing TDH data with statewide hospital discharge data (HDD) using capture-recapture methods. HDD cases were identified by International Classification of Disease codes. Cases were linked between datasets using date of birth, sex, medical record number, and hospital.

Results: In total 4,070 NAS cases were reported to TDH, 5,919 cases were identified in HDD and 2,858 were linked between datasets. Reported NAS rates increased from 11.7/1,000 live births (933 cases) in 2013 to 13.2/1,000 live births (1,063 cases) in 2016. Cases were markedly clustered in east Tennessee. The majority (3,402 [84%]) of NAS cases were diagnosed during birth hospitalization. Of reported NAS cases, 728 (18%) had severe symptoms that required pharmacotherapy. Substances used by the mother included opioids prescribed for medication-assisted treatment (MAT) for opioid use disorder, 2,389 (59%), opioids prescribed for pain, 521 (13%) and illicit drugs, 881 (22%). Capture-recapture methods estimated a tentative burden of 8,429 NAS cases (26/1,000 live births) during the study period.

Conclusions: NAS cases continue to increase in Tennessee and the estimated burden is substantially larger than described previously. Illicit drugs and opioids prescribed for pain or MAT play roles in NAS in Tennessee. These data indicate a continued need to address the use of illicit and prescribed opioids during pregnancy and to ensure appropriate services are available for mothers and infants at delivery.

10:35 Infant and Young Child Feeding Practices Among Rohingya Refugees in Cox's Bazar, Bangladesh — October–November 2017

Authors: Blanche Greene-Cramer, E. Leidman, A. Summers, O. Bilukha

Background: In August 2017, violence in the Rhakine State of Myanmar drove more than 650,000 Rohingya across the border into neighboring Bangladesh. Effects of violent displacement, including physical and psychological trauma, loss of income, and lack of privacy, can disrupt breastfeeding practices.

Methods: From October 22–November 27 2017, we conducted population-representative cross-sectional household surveys in both official refugee camps, Kutupalong and Nayapara, and in makeshift refugee settlements using standardized World Health Organization infant and young child feeding questionnaire to inform humanitarian programming. Simple random sampling was used for household selection in Kutupalong and Nayapara, while two-stage cluster sampling was used in makeshift settlements.

Results: Survey samples included 141, 175, and 497 children aged 0–23 months in Kutlupalong, Nayapara, and makeshift areas, respectively. Prevalence of exclusive breastfeeding in infants 0–5 months was generally high in Kutupalong (82.1%; confidence interval: 66.0–91.5) and Nayapara (72.2%; 58.4–82.8), but lower in makeshift settlements (56.1%; 45.1–66.4). Continued breastfeeding at one and two years was high in all sites: 96.4–100% at 1 year and 66.7–75.0% at 2 years. Among non exclusively breastfed infants 0–5 months, 42.9% (9.1–85.0) in Kutupalong, 66.7% (37.2–87.1) in Nayapara, and 89.5% (75.6–95.9) in makeshift were given water. Sweet drink given within 24 hours of birth was a common practice among children 0–23 months: 23.4% (17.1–31.2), 58.9% (51.4–66.0) and 67.6% (61.7–73.0) in Kutupalong, Nayapara, and makeshift, respectively.

Conclusions: In contrast to high prevalence of continued breastfeeding at two years, exclusive breastfeeding is lower, particularly in makeshift areas. Results demonstrate a need for health promotion activities to encourage exclusive breastfeeding and educate mothers on the risks of introducing water and sweet drinks to children under six months, a particular concern given inadequate access to safe water in the camps.

10:55 Clinician Characteristics Associated with Referral to Pediatric Weight Management Programs in the United States — DocStyles, 2017

Authors: Omoye Imoisili, C. Dooyema, A. Goodman, S. Park

Background: The United States Preventive Services Task Force (USPSTF) recommends that clinicians offer or refer children aged ≥6 years with obesity to intensive weight management programs (WMP), which should consist of ≥26 hours of intervention contact; include physical activity, nutrition, and behavioral counseling; and be family-oriented. To determine whether these clinical guidelines are being implemented and in which settings, this study examines associations between the demographic and practice characteristics of clinicians and referrals to WMP.

Methods: This cross-sectional study used data from the *DocStyles* 2017 panel-based survey of 891 clinicians who see pediatric patients. We used multivariable logistic regression to estimate associations between the demographic and practice characteristics of clinicians and the outcome of WMP referrals. In addition, we examined clinician awareness of and referral to WMP in their communities that met USPSTF criteria.

Results: Overall, 53.5% of clinicians provided referrals to WMP. Referral was higher among female clinicians (adjusted odds ratio [aOR]: 1.63; 95% confidence interval [95% CI]: 1.20–2.21) and clinicians who served predominantly middle-income patients (aOR: 1.63; 95% CI: 1.16–2.29) compared with lower-income (aOR: 1.24; 95% CI: 0.88–1.75) and upper-income (reference). Providers without teaching hospital privileges had lower odds of referral (aOR: 0.51; 95% CI: 0.38–0.68). Only 25.4% of clinicians were aware of a WMP in their community that met USPSTF criteria, and of those, 91.2% referred their patients to this WMP.

Conclusions: Clinical guideline adherence is essential to curbing the childhood obesity epidemic. In this study, half of clinicians referred pediatric patients with obesity to WMPs. Only 1 in 4 clinicians were aware of a WMP in their community that met USPSTF criteria. Further research is needed to explore WMP referral of lower- and upper-income patients. Results suggest that efforts are needed to increase access and referral to WMPs that meet USPSTF criteria.

11:15 Surveillance of Attention-Deficit/Hyperactivity Disorder Among Children in the United States Using Parent Report of Provider Diagnosis on the National Survey of Children's Health

Authors: Robyn Cree, R. Bitsko, M. Danielson, J. Holbrook, K. Flory

Background: Attention-deficit/hyperactivity disorder (ADHD) affects roughly 10.5% of children aged 4–17 years in the United States and is associated with adverse health outcomes (e.g., increased injury risk, decreased academic and social functioning). Currently the United States relies on national survey data, including the National Survey of Children's Health (NSCH), to monitor prevalence of childhood mental disorders, including ADHD. We examined characteristics of parent reported, provider diagnosed ADHD.

Methods: We analyzed data from two sources to examine reliability, sensitivity, and positive predictive value (PPV) of parent reported ADHD. We assessed reliability over time using NSCH and a follow-up survey of a subset of NSCH respondents two years later, the National Survey of the Diagnosis and Treatment of ADHD and Tourette Syndrome (NS-DATA). We assessed reliability by ADHD severity (mild versus moderate and severe) using a design-based F test statistic. We calculated sensitivity and PPV using data from a community-based study, the Project to Learn about Youth — Mental Health (PLAY-MH), comparing parent reported diagnosis with diagnostic criteria for ADHD using the validated Diagnostic Interview Schedule for Children, Fourth Edition (DISC-IV), by parent report.

Results: Responses were consistent across time; 3,428 of 3,583 parents (95.7%) who reported ADHD on the NSCH also reported it on NS-DATA. Disagreement between responses on the two surveys was more likely for mild cases of ADHD compared with moderate and severe cases, F (df = 1, 2819) = 5.77, P = .016. Sensitivity and PPV of parent-reported ADHD diagnosis compared with the DISC-IV from PLAY-MH were 65.7% and 55.4%, respectively.

Conclusions: Reliability over time was an identified strength of parent-reported diagnosed ADHD; however, data users should consider low sensitivity and PPV compared to diagnostic criteria when interpreting data. These findings can inform future analytic strategies and surveillance activities for children's mental disorders.

11:35 Incidence Rates and Trends of Pediatric Cancer — United States, 2001–2014

Authors: David Siegel, J. Li, S.J. Henley, R. Wilson, N. Buchanan Lunsford, E. Tai, E.A. Van Dyne

Background: Cancer is one of the leading disease-related causes of death among individuals aged <20 years in the United States. Recent evaluations of national trends of pediatric cancer used data from before 2010, or covered ≤28% of the US population. This study describes incidence rates and trends using the most recent and comprehensive cancer registry data available in the US.

Methods: 2001–2014 data from US Cancer Statistics were used to evaluate cancer incidence rates and trends among individuals aged <20 years. Data were from 48 states and covered 98% of the US population. We assessed trends by calculating average annual percent change (AAPC) using joinpoint regression (maximum of two joinpoints). Rates and trends were stratified by sex, age, race/ethnicity, census region, county-based economic status, rural/urban status, and cancer type.

Results: We identified 196,200 cases of pediatric cancer during 2001–2014. The overall cancer incidence rate was 173.0 per 1 million; incidence rates were highest for leukemia (45.6), brain tumors (30.8), and lymphoma (26.0). Rates were highest among males, aged 0–4 years, non-Hispanic whites, the Northeast US Census region, the top 25% of counties by economic status, and metropolitan counties. The overall pediatric cancer incidence rate increased (AAPC=0.7, 95% CI, 0.5–0.8) during 2001–2014 and contained no joinpoints. Rates increased across sex, age, race/ethnicity, region, economic status, and rural/urban status. Rates of brain, renal, hepatic, and thyroid cancers increased, and rates of melanoma decreased.

Conclusions: This study documents increased rates of pediatric cancer during 2001–2014. Increased overall rates of brain and hepatic cancer and decreased rates of melanoma are novel findings using data since 2010. Next steps in addressing changing rates could include investigation of diagnostic and reporting standards, host biologic factors, or environmental exposures. Increasing rates may necessitate changes related to treatment and survivorship care capacity.

SPECIAL SESSION 5: U.S. Opioid Epidemic: Maternal and Child Health Response Opportunities

12:05–1:05 PM

Salon

Moderator: Margaret (Peggy) Honein

Sponsor: National Center on Birth Defects and Developmental Disabilities (NCBDDD), National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP)

This session will cover CDC's response to the opioid epidemic in the United States, with a focus on the risks to pregnant women and babies.

Relevance and Appropriateness for the EIS Conference

The opioid epidemic has escalated to a national public health emergency in the United States. This session will highlight the unique effects of opioid use in women of reproductive age, fetal and infant effects of prenatal opioid use, and CDC's public health response focused on these groups. With the increasing use, misuse, and abuse of prescription and illicit opioids among women and during pregnancy, there has been a corresponding rise in infants born with neonatal abstinence syndrome (NAS), a serious drug withdrawal condition. CDC has worked closely with state maternal and child health partners to implement surveillance of NAS building on the infrastructure of existing birth defects surveillance programs, and implementing data linkages to better understand longer-term outcomes. CDC has also worked closely with clinical and state partners to implement strategies to improve health outcomes such as improving provider screening for substance misuse and the quality of care of NAS-impacted infants. EIS officers have and will continue to play a central role in responding to this public health emergency. Lessons learned from these state projects could help inform surveillance and prevention efforts in other states across the nation.

Speakers

- Epidemiology of the US opioid epidemic among reproductive-aged and pregnant women (15 min)
  Cheryl Broussard, PhD, Associate Director for Science, Division of Congenital and Developmental Disorders, NCBDDD
- Impact of prenatal opioid medication use on infants and children, including follow-up of infants with NAS (15 min)
  Jennifer Lind, PharmD, MPH, Birth Defects Branch, NCBDDD, Jean Ko, PhD, Division of Reproductive Health, NCCDPHP
- Public health strategies to improve outcomes for women and infants (15 min)
  Shanna Cox, MSPH, Associate Director for Science, Division of Reproductive Health, NCCDPHP
- Perspective on opioid/NAS response from TN (10 min)
  Mary-Margaret Fill, MD, Medical Epidemiologist, Communicable and Environmental Diseases and Emergency Preparedness, Tennessee Department of Health

CONCURRENT SESSION P1: Notes from the Field

1:15–3:00 PM

Salon

Moderators: Ken Komatsu and Kris Bisgard

1:20 Group A Streptococcal Infection Among Persons Who Inject Drugs in Boston — 2014–2017

Authors: Charles Alpren, P. Coppinger, J. Gunn, M. Valdes Lupi, J. Jaeger

Background: Invasive group A streptococcal (GAS) infection is a serious bacterial infection with a case fatality rate up to 11.4%, and is notifiable in Massachusetts. After an increase in GAS cases during October 2017, the Boston Public Health Commission (BPHC) investigated cases among persons who inject drugs (PWID) to understand factors contributing to the increase and advise appropriate control measures.

Methods: During 2014–2017, BPHC received 94 reports of invasive GAS infections among persons aged 16–65 years. Medical records were reviewed for demographics and injection drug use (IDU). PWID with GAS diagnosis during October 2017 were surveyed about injection practices and other exposures to GAS, either in person or by telephone. During October 2017, healthcare providers from 5 Boston hospitals were surveyed by telephone and in clinical meetings to understand infective complications of IDU in Boston.

Results: Among 94 GAS infections, 44 were IDU-related. During January–October 2017, 21 (70%) of 30 reported GAS infections were among PWID, 8 (38%) of which occurred in October; 19 (90%) were hospitalized; 10 (48%) were males, and 15 (71%) were aged 25–34 years. Six of 8 eligible patients completed the survey. High-risk behaviors reported included licking the needle before injection (n = 3), sharing drug-use paraphernalia (n = 5), and dissolving drugs in acidic solutions (n = 2). One death was reported. All healthcare providers surveyed reported invasive infections from other organisms. On October 30, BPHC issued a health alert encouraging providers to emphasize the importance of safe injection habits to PWID.

Conclusions: Invasive GAS infections among PWID in Boston might be associated with high-risk injection practices. A multidisciplinary meeting is being convened involving public health, infectious disease, and addiction medicine practitioners to discuss IDU complications, treatment and public health approaches, and strengthen coordination of care for infections relating to IDU.

1:40 Successive Norovirus Outbreaks at an Event Center — Nebraska, October–November 2017

Authors: Rebecca Free, B. Buss, S. Koirala, A. Carlson, B. Loeck, J. Hamik, T. Safranek

Background: Norovirus, an extremely contagious enteric virus, is transmitted through contaminated food or surfaces or person-to-person contact and can be challenging to eradicate from environments. While investigating a norovirus outbreak among wedding attendees, we received reports of similar illnesses after later events at the same event center (Facility A). We expanded our investigation to identify cases, investigate transmission, and provide control recommendations.

Methods: We worked with Facility A management and event sponsors to disseminate Internet-based questionnaires to employees and event attendees to identify ill persons, capture symptom history, and assess potential exposures. Probable cases were defined as diarrhea (≥3 loose stools <24 hours) or vomiting with nausea or abdominal cramps, in Facility A employees, or in attendees with onset 6–72 hours following Facility A-hosted events, during October 27–November 18, 2017; confirmed cases had norovirus RNA detected in stool by real-time reverse transcription-polymerase chain reaction. Using sponsor-estimated number of attendees, we calculated estimated attack rates (AR) per event. We also provided decontamination strategies and recommended excluding ill food handlers.

Results: Overall, 18/25 (72%) employees and 324/1,383 (23.4%) attendees from 9/10 events completed questionnaires. We identified 159 cases; 3 were confirmed norovirus genogroup II. Estimated ARs for the first 6 events ranged from 7% to 35% per event (median: 18.5%). After these events, Facility A attempted decontamination as public health recommended but failed to exclude ill food handlers. Illness transmission continued, with subsequent ARs of 4% (6/150 attendees) and 15% (53/360 attendees). After Facility A contracted professional cleaning services and agreed to exclude ill food handlers, the last event's estimated AR was 0.9% (3/350 attendees).

Conclusions: Partial adherence to public health recommendations likely contributed to continued norovirus transmission at Facility A. Mitigation efforts should focus on comprehensive prevention strategies including extensive environmental decontamination and strict exclusion of ill food handlers.

2:00 High Volume of Lyme Disease Laboratory Reporting in a Low-Incidence State — Arkansas, 2015–2016

Authors: Elizabeth Dietrich, N. Kwit, C. Nelson, R. Taffner, J. Petersen, M. Schriefer, P. Mead, S. Weinstein, D. Haselow

Background: Lyme disease is the most common vector-borne disease in the United States, causing an estimated 300,000 cases annually, but is geographically concentrated in the Northeast, mid-Atlantic, and upper Midwest. Arkansas is considered a low-incidence state, having reported no confirmed Lyme disease cases during 2008–2014. However, during 2015–2016, the Arkansas Department of Health (ADH) received several hundred reports of potentially positive laboratory test results. ADH requested CDC assistance to evaluate these reports and to provide guidance on improving Lyme disease surveillance in Arkansas.

Methods: An initial 911 reports were reviewed, consolidated, and prioritized for follow-up based on available test results and clinical information. Medical records were requested for patients considered likely to meet the surveillance case definition for suspected, probable, or confirmed Lyme disease. Patients meeting the confirmed case definition were interviewed to determine their travel history.

Results: A total of 582 combined reports for unique patients were identified. Of these, 287 lacked required test results or onset date, resulting in insufficient information to make a case determination. Among the remaining 295 reports, 282 (95.6%) did not meet the surveillance case definition. Eleven (3.7%) met the case definition for suspected or probable Lyme disease. Two (0.7%) met the case definition for confirmed Lyme disease; both patients were likely infected in high-incidence states.

Conclusions: Surveillance for Lyme disease represents a considerable burden on the public health system, even in low-incidence states. Incomplete testing and reporting contribute to the burden of Lyme disease surveillance. Surveillance can be streamlined by use of an algorithm to assist in prioritization of reports. Although our analysis provides no evidence of autochthonous transmission of Lyme disease in Arkansas, travel-related cases do occur. Clinicians should be alert to the possibility of Lyme disease in patients with compatible symptoms and should obtain travel histories.

2:20 Unnecessary and Incorrect Administration of Postexposure Prophylaxis for Rabies — Illinois, 2016

Authors: Erin Moritz, C. Austin

Background: Rabies is a fatal neurological illness transmitted by the bite of infected mammals. Human rabies cases are rare in the United States, partly attributable to the availability of postexposure prophylaxis (PEP). The Advisory Committee on Immunization Practices (ACIP) provides recommendations for initiating and administering PEP, which consists of 1 dose of rabies immunoglobulin (RIG) and multiple doses of vaccine at specific times and body locations. PEP administration is costly and following the vaccine schedule is complex. We examined unnecessary and incorrect PEP administration in Illinois.

Methods: Using data reported to the Illinois National Electronic Disease Surveillance System from 2016, we calculated prevalence of unnecessary (i.e., initiated when it should not have been) and incorrect (i.e., improper timing or injection location on ≥1 occasion) PEP administration and potential risk factors. We calculated risk ratios (RRs) and 95% confidence intervals (CIs) to identify factors associated with unnecessary PEP administration and reasons for incorrect administration.

Results: Among 670 persons for whom PEP was initiated, records for 638 contained sufficient information to determine if PEP was necessary; PEP was determined unnecessary for 257 (40.3%) persons. Risk for unnecessary PEP was higher when the health care provider did not consult with the health department (RR = 3.0; 95% CI = 2.3–4.0; P <.0001). PEP was administered incorrectly for 236 (51.6%) of 457 persons whose records contained sufficient information to determine if PEP was administered correctly. The most common reasons for incorrect administration were incorrect vaccination timing (55.5%) and incorrect injection location of vaccine (21.6%) or RIG (18.2%).

Conclusions: Rabies PEP is often administered unnecessarily and incorrectly in Illinois. Health care providers might benefit from targeted education concerning ACIP recommendations and proper PEP administration. Improving communication between health care providers and health departments might reduce the burden of unnecessary and incorrect PEP administration.

2:40 Hepatitis A Outbreak Among Persons Experiencing Homelessness — Maricopa County, Arizona, 2017

Authors: Sally Ann Iverson, J. Narang, M.J. Garcia, J. Matthews, N. Fowle, J. Collins, S. Ramachandran, G. Xia, Y. Lin, M. Leach, R. Sunenshine

Background: Hepatitis A virus (HAV) outbreaks can occur in settings with poor sanitation and crowding. On March 29, the Maricopa County Department of Public Health identified 3 confirmed HAV cases among homeless persons using services at 1 campus. We sought to determine outbreak source and scope and prevent further spread.

Methods: Cases were defined as having symptoms of acute hepatitis and a positive IgM anti-HAV test in persons experiencing homelessness or with epidemiologic link to the campus and onset in 2017. Case-finding included enhanced surveillance with outreach to campus staff and healthcare providers. Interviews were conducted with campus HAV vaccination clinic attendees on April 4 and 11. To assess factors associated with HAV infection, a case-control study was conducted; campus clients or staff without HAV diagnosis were control subjects. An environmental inspection was conducted. CDC performed HAV molecular sequencing.

Results: Fifteen cases were identified. Illness onsets were February 15–May 23; mean age, 41 years; 53% were female. The patient with the earliest onset arrived ~February 5 from San Diego, California, an area with an ongoing HAV outbreak. No campus food safety concerns were identified. HAV vaccine was administered to 221 (22%) of ~1,000 clients and 105 (42%) of 250 staff. Fourteen case-patients and 242 control subjects were enrolled in the case-control study; most questions were answered. Neither eating meals on campus (P = .47) nor sleeping on campus (P = .39) were associated with HAV. Fewer case-patients (43%) than control subjects (78%) reported always washing their hands before eating (P = .05). HAV isolated from 6 cases was molecularly identical to San Diego isolates.

Conclusions: Molecular and epidemiologic data support that this HAV outbreak among homeless persons was associated with the San Diego outbreak. Crowding and suboptimal hygiene practices might have facilitated campus transmission; vaccination might have slowed spread.

CONCURRENT SESSION P2: Emerging and High Consequence Pathogens

1:15–3:00 PM

Ballroom East

Moderators: Inger Damon and Larry Cohen

1:20 Anthrax Epizootic in Hippopotami and Cape Buffalo and Associated Human Exposures — Namibia, 2017

Authors: Caitlin Cossaboom, S. Khaiseb, K. Mbai, J. Hausiku, T. Shuro, A. Kannyinga, P. Katjiuanjo, B. Haufiku, L.A. Miller, S. Agolory, A.R. Vieira, J. Salzer, W. Bower, C. Kolton, A. Hoffmaster, H. Walke

Background: Anthrax, caused by *Bacillus anthracis*, is a naturally occurring zoonotic disease of significant veterinary and public health importance. In late September 2017, a large die-off of hippopotami and Cape buffalo began in Bwabwata National Park. The presumptive cause of death was anthrax, however, confirmation was not initially possible due to sample collection and laboratory challenges. Several ministries within Namibia, CDC's Namibia Country office, and Bacterial Special Pathogens Branch (BSPB) investigated this epizootic.

Methods: BSPB performed and trained on sample collection and use of the InBios Active Anthrax Detect (AAD) Rapid Test, a lateral flow assay that detects capsular polypeptide of *B. anthracis.* BSPB also provided recommendations related to the public health investigation including identification of human exposures, post-exposure prophylaxis (PEP), community education, livestock vaccination, and animal carcass disposal.

Results: By early December, the Ministry of Environment and Tourism had disposed of 155 hippopotami, 86 buffalo, and two impala carcasses. Eight carcasses tested positive by AAD and results were 100% reproducible when multiple samples were tested from the same carcass. The Ministry of Agriculture, Water, and Forestry secured approximately 120,000 doses of livestock anthrax vaccine to prevent spillover into domestic animals and subsequently humans. The Ministry of Health and Social Services assessed over 800 people living in the affected area as having been exposed to the infected carcasses and provided PEP. To date, no human or livestock cases of anthrax have been identified.

Conclusions: This was the first successful use of AAD for anthrax diagnosis in wildlife under field conditions. This tool can greatly improve the ability of low resource, anthrax endemic countries to quickly diagnose and effectively manage epizootics; reducing transmission risk to humans. Swift response in carcass removal, livestock vaccination, community education, and PEP-dissemination likely contributed to the lack of human cases and successful public health outcome.

1:40 Exposures Among Middle East Respiratory Syndrome Coronavirus Patients — Saudi Arabia, July–October 2017

Authors: Erica Rose, A. Hakawi, H. Biggs, M. Mohammed, O. Abdalla, G. Abedi, A. Asiri, J. Watson

Background: Middle East respiratory syndrome coronavirus (MERS-CoV) is an emerging infectious disease known to cause severe respiratory illness in humans. Since its identification in 2012, more than 2,100 confirmed cases have been reported, with death occurring in 35–40%. Identified risk factors for infection include camel contact and healthcare exposure. We investigated MERS-CoV cases reported to the Saudi Arabia Ministry of Health (MoH) during July 1–October 31, 2017 to assess patient exposures.

Methods: Confirmed cases without a link to a known hospital or household outbreak were classified as sporadic, and their exposures were further investigated. Sporadic cases were interviewed by telephone using a standardized questionnaire about demographics and activities during the 14 days before symptom onset (exposure period). For deceased or unavailable cases, relatives were interviewed. When otherwise unavailable, patient information was obtained from local public health officials.

Results: Among 61 MERS-CoV cases reported to the MoH during the study period, 42 (69%) were classified as sporadic. Of these, 35 (83%) were interviewed, and 7 (17%) were followed-up through local public health officials. The mean age of sporadic patients was 57 years (range: 25–90) and 35 (83%) were male. Thirty-two (76%) had co-morbidities and 23 (55%) died. During the exposure period, 21 (50%) patients reported camel contact, of whom 13 (62%) had frequent camel contacts, such as owning, shepherding, or butchering camels. Of those without reported camel contact, 8 (19%) visited a healthcare facility, and 5 (12%) denied high-risk (i.e., camel or healthcare-related) exposures. Exposure data were insufficient to characterize 7 (17%) cases.

Conclusions: Frequent camel contact was common among sporadic cases of MERS-CoV in Saudi Arabia, indicating continued zoonotic transmission to humans. In addition to possible unrecognized healthcare-associated transmission, MERS-CoV infection occurs in a small proportion of persons without known high-risk exposures.

2:00 Viral Hemorrhagic Fever Preparedness, Kween and Kapchorwa Districts — Uganda, 2017

Authors: Aaron Kofman, L. Nyakarahuka, T. Shoemaker, M. Choi, E. Ervin, J. Homsy, S. Nichol, P. Rollin.

Background: On October 17, 2017, a case of Marburg Virus Disease (MVD) was confirmed in a recently deceased patient from Kween District, eastern Uganda. Initial suspicion of a viral hemorrhagic fever (VHF) by local health workers and confirmatory testing led to the declaration of the first MVD outbreak in eastern Uganda. A mixed methods assessment of existing VHF readiness capacity was conducted to improve VHF surveillance and outbreak response in this region.

Methods: An 11-part, point-based questionnaire focusing on epidemiology and laboratory aspects of VHF preparedness and allowing a maximum score of 76 was developed. The questionnaire was administered to physicians, laboratorians and hospital administrators at two health facilities in Kween and neighboring Kapchorwa Districts, and at five other health facilities with existing VHF surveillance programs across Uganda. A six-question qualitative assessment of the MVD outbreak response was also administered to Kween and Kapchorwa District health facility staff.

Results: Kween and Kapchorwa District health facilities scored 39/76 and 21/76 points, respectively. Established VHF surveillance sites scored an average of 49/76 points (range: 42–63). Identified gaps in VHF readiness included lack of comprehensive training in VHF surveillance, missing clinical specimens from deceased patients due to rapid collection of bodies by families, staff uncertainty and lack of awareness that an outbreak alert could be issued before testing clinical specimens. Responses to the qualitative assessment indicated that factors leading to the successful identification of this MVD outbreak were recognition of an epidemiological link between two patients with hemorrhagic symptoms and rapid blood sample submission for laboratory testing.

Conclusions: Despite limited VHF readiness in Kween and Kapchorwa Districts, health officials successfully identified the first cases of a VHF MVD outbreak. Earlier recognition of future VHF cases may be enabled by expanding the VHF surveillance program in Uganda.

2:20 Characteristics of Persons with Invasive Group A Streptococcal Infections Reporting Intravenous Drug Use — United States, 2000–2016

Authors: Sandra Valenciano, J. Onukwube, M.W. Spiller, P. Cieslak, K. Como-Sabetti, W. Schaffner, M. Farley, S. Petit, J. Watt, N. Spina, L. Harrison, N. Alden, C. Smelser, J. Ricaldi, C. Van Beneden

Background: Approximately 15,000 people develop invasive group A *Streptococcus* (iGAS) infection in the United States annually; 10–15% die. Intravenous drug use (IVDU) is a known risk factor for iGAS. To explore a possible link between the U.S. opioid epidemic and recently increasing national iGAS rates, we characterized persons using intravenous drugs among those with iGAS infection detected through Active Bacterial Core surveillance (ABCs).

Methods: We reviewed surveillance data in 10 ABCs sites from 2000–2016. We compared characteristics of iGAS patients with and without IVDU reported in the medical record at the time of GAS culture. We used chi-square or Fisher's exact test to assess association between categorical variables, and logistic regression to model trends in IVDU among iGAS patients over time.

Results: IVDU was documented for 7.0% (1428/20,376) of all iGAS patients, with highest prevalence among those aged 18–34 years (21.7%) and 35–49 years (12.9%). Of those with IVDU, 35.7% were homeless and 20.5% were incarcerated. Compared to iGAS patients without IVDU, those with IVDU more often presented with endocarditis (6.6%; odds ratio [OR]: 9.9), abscesses (12.0%; OR: 2.3), cellulitis (51.7%; OR: 1.9), and septic arthritis (12.6%; OR: 1.3) (each $P<.01$) and more frequently reported smoking (OR: 11.5), HIV infection (OR: 7.6), alcohol abuse (OR: 3.1), and chronic liver disease (OR: 2.6) (each: $P<.001$). Among iGAS patients aged 18–34 years, the odds of IVDU increased on average 2.6% per year ($P<.01$), with a peak prevalence of 39.8% in 2016.

Conclusions: Invasive GAS patients reporting IVDU were commonly homeless or incarcerated and presented with endocarditis, abscesses, and cellulitis. Increases in IVDU among iGAS patients suggest that IVDU might be contributing to increases in iGAS incidence. Public health iGAS prevention messages targeting homeless shelters, drug treatment centers, and prisons might help reduce iGAS infections among those who engage in IVDU.

2:40 Risk Factors for Middle East Respiratory Syndrome Coronavirus Seropositivity Among Camel Workers — Abu Dhabi, United Arab Emirates, 2014–2017

Authors: Marie Killerby, A. Khudhair, M. Al Mulla, K.A. Elkheir, W. Ternanni, Z. Bandar, S. Weber, M. Khoury, G. Donnelly, S. Al Muhairi, A.I. Khalafalla, Y. Eltahir, N. Thornburg, S. Trivedi, A. Tamin, J.T. Watson, S.I. Gerber, A. Hall, F. Al Hosani

Background: Seroprevalence of Middle East Respiratory Syndrome-Coronavirus (MERS-CoV) antibodies is higher in workers with occupational camel contact (2–4%) than the general population (0.2%). Camel contact is a recognized risk factor for infection, but specific camel exposures associated with MERS-CoV seropositivity are not fully understood. We assessed worker-animal interactions and MERS-CoV seroprevalence among camel workers to better understand specific exposures associated with MERS-CoV seropositivity.

Methods: Seroprevalence surveys of workers from two slaughterhouses and one live animal market in Abu Dhabi were performed in 2014, 2015, 2016, and 2017, and an epidemiologic survey was administered in 2016 and 2017. Human sera were tested for anti-MERS-CoV antibodies using indirect ELISAs for nucleocapsid and spike proteins followed by a confirmatory microneutralization test. Seropositivity was defined as having two of three positive assays, or positive by microneutralization alone. Univariable and multivariable logistic regression models were used to identify factors associated with seropositivity. Variable selection was performed using least absolute shrinkage and selection operator.

Results: During 2014–2017, worker seroprevalence ranged from 7–17%, and was highest in camel salesmen (18/37, 48.6%) and animal/waste transporters (6/27, 22.2%). For workers tested at two timepoints, one of 65 demonstrated seroconversion, and five of nine seropositive workers subsequently tested negative. Working as a camel salesman (odds ratio [OR]: 4.3, 95% Confidence Interval [CI]: 1.8–10.6), handling live camels (OR: 10.2, 95% CI: 2.8–50.8), and administering medications or vaccines to camels (OR: 2.9, 95% CI: 1.1–8.6) were each independently associated with seropositivity.

Conclusions: MERS-CoV seroprevalence was higher among camel workers than previously documented, and camel salesmen who handled live camels had the highest odds of seropositivity. These results likely represent unrecognized zoonotic MERS-CoV transmission and are important for understanding infection risk. Identification of high-risk groups is critical for implementation of preventive measures, potentially including future vaccine use.

SESSION Q: Awards and Late-Breaking Reports

3:15–5:05 PM

Salon

Presentation of Awards

Presenter: Eric Pevzner

- EISAA Class Membership Award
- Haiku Contest Award
- 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
- Shalon M. Irving Health Equity Award

Late-Breaking Reports

Moderators: Stephen Redd and Katherine Fowler

3:55 An Emerging Zoonosis: Monkeypox — Nigeria, 2017

Authors: Anna Mandra, T. Numbere, A. Ndoreraho, E. Nkunzimana, Y. Disu, L. Manneh, A. McCollum, J. Doty, M. Reynolds, W. Davidson, K. Wilkins, Y. Li, M. Mauldin, J. Burgado, M. Townsend, P.S. Satheshkumar, M. Saleh, A. Yinka-Ogunleye, O. Aruna, O. Ojo, C. Ihekeazu

Background: On September 22, 2017, a suspected case of monkeypox from Bayelsa State, was reported to the Nigeria Centre for Disease Control (NCDC). This raised national and international concern because monkeypox had not been reported from Nigeria since 1978. *Monkeypox Virus* (MPXV) is a zoonotic Orthopoxvirus. Patients present with a fever followed by a vesiculopustular rash. The case fatality is 11% in unvaccinated individuals. An investigation was initiated to determine the extent of the outbreak, source of infection and risk factors for disease acquisition.

Methods: The NCDC activated a multi-agency and multi-partner emergency operations center (EOC). A monkeypox-specific case investigation form was completed through interviews with patients by public health officials or health care professionals. A standard case definition inclusive of laboratory data was applied to cases. Laboratory testing included real-time PCR and genome sequencing on lesion specimens or sera and Orthopoxvirus IgM and IgG serology.

Results: As of November 17, 2017 146 suspected and 42 confirmed cases were recorded from 22 out of 36 states, plus Federal Capital Territory. One death was reported in a patient with background immunosuppressive illness. Genome sequencing revealed the virus circulating belongs to the West African clade of MPXV and is most closely related to the Nigeria 1971 strain. Epidemiologic and molecular analyses suggests there were at least 7 independent introductions into the population.

Conclusions: This is the largest outbreak of the West African clade of monkeypox ever recorded. Epidemiologic and/or zoonotic linkages have not yet been established between cases. The results of genomic sequencing suggest that this virus has been circulating within Nigeria. Serologic studies are warranted to further explore retrospective prevalence. Deaths and immunosuppressive illness have not been previously described in patients with the West African clade of monkeypox. Further exploration of this is warranted to understand monkeypox risks in this population.

Awards presented during session.

4:05 Occupational Carbon Monoxide Exposure in an Industrial Kitchen Facility — Wisconsin, September 2017

Authors: Erica Wilson, C. Tomasallo, J. Meiman

Background: Carbon monoxide (CO) is an odorless, colorless gas. Unintentional CO poisoning kills ~400 people annually in the United States. On September 6, emergency department (ED) providers contacted the Wisconsin Poison Center (WPC) for assistance in management of multiple patients with occupational CO exposure from an industrial kitchen facility. WPC notified the Wisconsin Division of Public Health (WDPH) who investigated to characterize magnitude and severity of exposure.

Methods: The incident report was obtained from first responders. We contacted all 5 EDs where patients were transported and reviewed medical records; demographic, clinical, and diagnostic data were abstracted from charts using a standardized form. We classified cases using the Council of State and Territorial Epidemiologists/CDC CO case definition (confirmed case, blood carboxyhemoglobin level >5% among nonsmokers, and >10% among smokers or unknown smoking status).

Results: First responders to the facility measured CO air levels; peak CO was 313 ppm (NIOSH ceiling 200 ppm) in a processing area with multiple gas-burning fryers. Forty-five workers were triaged by first responders; 37 were transported directly to area hospitals; 4 presented to hospitals from home. WDPH obtained medical records for 40/41 persons treated at EDs. Among the 40 patients, median age was 27 years (range: 20–63 years), 16 (40%) were female, 15 (38%) smoked or had undocumented smoking status. The most common symptoms included headache (91%), nausea (41%), and dizziness (41%). Mean blood CO level was 11.6% (range: 3.6%–21.4%); 31/40 (78%) met the case definition. Four patients were admitted for monitoring; no patients required hyperbaric oxygen.

Conclusions: Industrial kitchen facility workers experienced acute CO poisoning, likely from gas-burning appliances. Occupational Safety and Health Administration does not require CO detectors use in industrial kitchen facilities. Kitchen facilities using combustion processes should consider installing CO detectors, which was recommended to the implicated facility.

4:15 Outbreak of *E. coli* O157:H7 and *E. coli* O26 Infections at a Marine Corps Recruit Depot (MCRD) — San Diego and Camp Pendleton, California, October–November, 2017

Authors: Amelia Keaton, R. Hassan, S. Luna, I. Lee, R. Magalhaes, M. Bidlack, L. Smith, R. Maves, D. Freer, K. Flinn, G. Monk, P. Graf, K. Trinh, J. Crandall, D. Noveroske, G. Fortenberry, L. Ramos, R. Recio, C. Peak, E. McDonald, T. Waltz, K. Patel, D. Wagner, J. Espiritu, L. Christensen, L. Gieraltowski

Background: Shiga toxin-producing *Escherichia coli* (STEC) infections are a substantial cause of foodborne illness and a cause of hemolytic-uremic syndrome (HUS). In November 2017, CDC assisted the US Navy in a response to an outbreak of STEC illnesses in recruits at a Marine Corps Recruit Depot in San Diego (MCRD). We investigated to determine the source of this outbreak and identify prevention and mitigation measures.

Methods: In October 2017, medical providers identified a high number of gastrointestinal (GI) illnesses at MCRD. Recruits with diarrhea submitted stool specimens for culture and/or culture-independent diagnostic testing (CIDT) for GI pathogens. We performed pulsed-field gel electrophoresis (PFGE) on culture isolates. Case-patients were then defined as follows: confirmed (PFGE-confirmed STEC infection matching outbreak strains), probable (diagnosis of HUS and/or CIDT evidence of STEC), and suspected (bloody diarrhea). We conducted environmental evaluations of dining facilities, training areas, and barracks. A case-control study was performed using PFGE-confirmed case-patients and platoon-matched controls. We performed product traceback for foods identified as exposure risks by interview or case-control study.

Results: We identified 62 confirmed, 62 probable, and 120 suspected case-patients. Thirty case-patients required hospitalization and 15 had HUS. Case-patient ages ranged from 17–28 years (median: 18 years). Poor hygiene practices among recruits and inconsistent cooking temperatures within dining facilities were noted. Forty-three case-patients and 135 controls were interviewed about food, hygiene, and environmental exposures. Consumption of undercooked beef was found to be significantly associated with illness, (mOR 2.40, CI 1.04–5.72, p=0.04). We identified a single ground beef supplier for MCRD, but MCRD records did not document which specific lots of ground beef were used.

Conclusions: Case-control analysis and environmental observations suggested undercooked ground beef as a potential source for this outbreak. We recommended the Navy and Marine Corps retain lot information, address food handling concerns, and improve hygiene among recruits.

4:25 Outbreak of Acute Poisonings Associated with a Counterfeit Cannabidiol Products — Utah, 2017–2018

Authors: Roberta Horth, B. Crouch, M. Slawson, J. McNair, A. Prebish, D. Peterson, A. Dunn

Background: Cannabidiol (CBD) is a compound derived from *Cannabis sativa*. Although CBD is being studied as a treatment for several health conditions, the U.S. Food and Drug Administration has not found any product containing CBD to be safe or effective and has not approved CBD products for the treatment or prevention of any condition. On December 8, 2017, the Utah Department of Health was notified by Utah Poison Control Center (UPCC) of an aberration in emergency department visits associated with use of products labeled as CBD. Adverse reactions were inconsistent with known CBD effects and included altered mental status, seizures, loss of consciousness, and hallucinations. State and federal health and law enforcement officials established a task force to determine source and prevent additional cases.

Methods: Hospitals and law enforcement agencies were asked to report any cases to UPCC. Concomitantly, investigators searched UPCC's database and Utah's syndromic surveillance system for past-year CBD-related events. Patients were interviewed over phone by health officials. Available blood and product samples underwent chemical analysis.

Results: By end of January 2018, 51 individuals had adverse reactions using a product labelled as CBD; 31 (60.8%) were male and 15 (29.4%) were aged <18 years. Individuals reported having used CBD medicinally (29.4%) or recreationally (66.7%) either sublingually (17.6%) or by vaping (72.5%). Over half (66.7%) reported purchasing CBD products at local tobacco stores. Five product samples obtained from patients and 1 purchased sample were found to contain a synthetic cannabinoid compound (4-cyano CUMYL-BUTINACA) and no CBD. Thirty-three individuals reported use of the same brand. The number of cases peaked in mid-December and dropped after press releases and outreach informed of a counterfeit product.

Conclusions: This investigation highlights hazards of consuming unregulated cannabinoid derivatives and synthetic cannabinoids. Rapid identification and a coordinated response among agencies contributed to outbreak control.

4:35 Hepatitis A Virus Outbreak Among Adults Experiencing Homelessness and Illicit Drug Users — San Diego County, 2016–2017

Authors: Corey Peak, S. Stous, J. Healy, M. Hofmeister, Y. Lin, S. Ramachandran, M. Foster, A. Kao, E. McDonald

Background: Transmission of hepatitis A virus (HAV) most commonly occurs through the fecal-oral route and can result in outbreaks in settings with limited sanitation services. Previously, no large U.S. outbreaks have been reported among persons experiencing homelessness. Above an annual baseline of approximately 25 local cases, San Diego County public health officials reported during November 2016–January 2018 a total of 577 outbreak-associated cases of hepatitis A, predominantly among persons experiencing homelessness and illicit drug users. We investigated and characterized the ongoing outbreak to inform control measures.

Methods: We attempted to interview all patients with HAV infection reported through routine surveillance during March 2017–January 2018. We developed a questionnaire on housing, drug use, and other factors. We called patients while hospitalized or by contact number. A probable case was defined as acute onset of hepatitis symptoms, either jaundice or elevated serum aminotransferase levels, and a positive anti-HAV immunoglobulin M result. A confirmed case was defined as viral detection of HAV matching the outbreak genotype IB isolated in April 2017. Descriptive statistics were used to compare affected groups.

Results: Among 577 cases, 490 (85%) were confirmed, 87 (15%) were probable, 395 (68%) patients were hospitalized, and 20 (3.5%) died. Of 519 patients interviewed, 192 (37%) reported homelessness and illicit drug use, 89 (17%) reported only homelessness, 73 (14%) reported only illicit drug use, and 165 (32%) reported neither. The Mantel-Haenszel adjusted risk ratio for hospitalization was 1.4 (95% confidence interval: 1.2–1.6) when comparing homeless with nonhomeless patients. No patients reported a history of receiving the recommended 2 doses of hepatitis A vaccine, including 310 (54%) patients with known indications for vaccination.

Conclusions: In response to the high prevalence of homelessness and illicit drug use among patients with HAV infection during the outbreak, targeted vaccination and sanitation interventions were implemented.

4:45 Public Health Emergency Risk Communication and Social Media Reactions to an Errant Warning of a Ballistic Missile Threat in Hawaii — United States, January 2018

Authors: Bhavini Murthy, N. Krishna, A. Wolkin, R. Avchen, S. Vagi

Background: On January 13, 2018 at 8:07 AM HST, an errant alert advising people to seek shelter from an incoming ballistic missile was sent throughout Hawaii. After 38 minutes, a follow-up false alarm notification was issued recanting the threat. Information management is a key domain for public health preparedness. This event created a unique opportunity to evaluate social media responses to an Emergency Public Information and Warning (EPIW) message.

Methods: Using Sysomos, a social media analytics tool, data was extracted from Twitter using a Boolean search for tweets [e.g., missile AND (Hawaii OR ballistic OR shelter)] posted on January 13th regarding the missile threat warning. Retweets and quote tweets were excluded from this initial analysis. Data was stratified by two time periods: a) early period (8:07 AM to 8:45 AM) and b) late period (8:46 AM to 9:45 AM), designed to reflect an hour post alert correction. Tweets were coded using grounded theory to identify major concepts, categories, and themes. Atlas.ti software was used for this exploratory qualitative analysis.

Results: A total of 5,880 tweets during the early period and 12,236 tweets during the late period met the search criteria. Preliminary results indicated four themes emerged during the early period: information processing, information sharing, authentication, and emotional reactions. During the late period, while emotional reactions and authentication persisted as themes, denunciation also emerged as a new theme.

Conclusions: Information management during a crisis response is complicated by how people perceive and interpret emergency messages. Social media reactions to the perceived ballistic missile threat highlight the complexity of sharing critical information given human behavior. These findings emphasize the need to account for how people interpret, share, and react to public health messages. Information management must address the public's needs during each phase of an unfolding crisis to protect and save lives.

4:55 Diphtheria Among Forcibly Displaced Myanmar Nationals — Cox's Bazar, Bangladesh, 2017

Authors: Lauren Weil, M. Farrque, T. Hossen, L. Feldstein, T. Tiwari, Q. Zaki, M. Williams, M. Lawrence, T. Shirin, Z. Habib, A. Alam, A. Muraduzzaman, A. Akram, L. Conklin, S. Hariri, M. Tondella, S. Doan, M. Friedman, A. Acosta, L. Fox, M. Flora

Background: During August 2017–December 2017, more than 655,500 Forcibly Displaced Myanmar Nationals (FDMNs) have entered Bangladesh seeking refuge. On November 8, 2017, the first suspected case of diphtheria, a rare vaccine preventable disease, was reported among a population of FDMNs in Bangladesh. By December 8, over 100 suspected cases and six deaths were reported. Bangladesh Ministry of Health requested CDC assistance to guide future targeted testing for laboratory confirmation in an environment with limited laboratory capacity and high numbers of reported cases.

Methods: We collected throat swabs from suspected diphtheria patients at two Non-Governmental Organizations managed health care clinics during December 19–25, 2017 and obtained demographic and clinical information from patient triage notes. Based on clinical symptoms, we grouped suspected cases into three categories of disease severity: mild, moderate, and severe. Specimens were tested by real-time PCR, and descriptive statistics were used to summarize and compare demographic and symptom frequencies by PCR result status. Chi square and two-sample t-tests with unequal variance were used to test for statistical significance at the $P<.05$ level.

Results: Among a total of 384 people with suspected diphtheria, 34% (131/384) tested positive by PCR for diphtheria. PCR-positive patients were more likely to be male (55%; $P=.013$), ≤15 years old (88%; $P=.002$), and classified as having severe disease (57%; $P=.002$) compared to those who tested negative (41%, 75%, and 42%, respectively). Presence of pseudomembrane, a classic diphtheria sign, was reported in 79% of all suspected patients. Among PCR-positive patients, 90% had pseudomembrane, compared to 74% of PCR-negative patients ($P<.001$).

Conclusions: To monitor the outbreak in this setting of limited laboratory capacity, we recommended targeted testing of those patients who present with pseudomembrane. Further investigation is needed to assess the PCR-negative specimens to understand other respiratory etiologies causing disease.

Closing Remarks and Adjournment

5:05–5:15 PM

Salon

Patricia Simone

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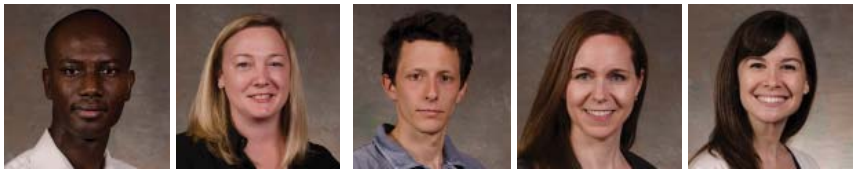

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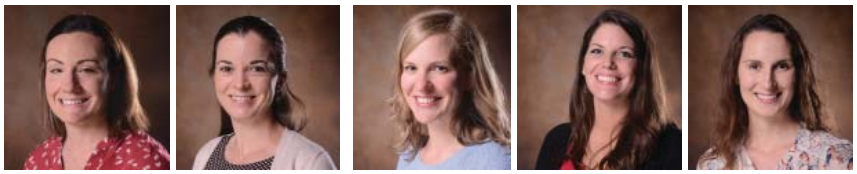

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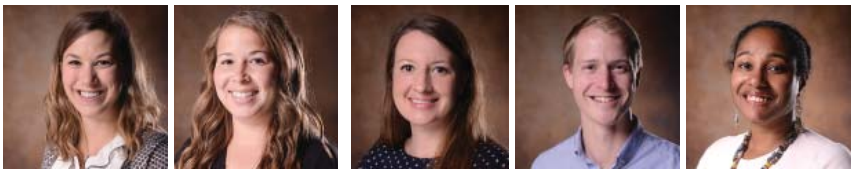

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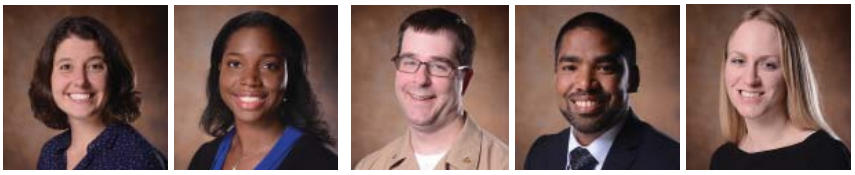

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Index of EIS Officer Presenters

Notes

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Centers for Disease Control and Prevention