68th ANNUAL EIS CONFERENCE
April 29 - May 2, 2019

Epidemic Intelligence Service
www.cdc.gov/eis

CDC
Centers for Disease Control and Prevention

68th Annual Epidemic Intelligence Service (EIS) Conference

April 29–May 2, 2019

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: HIV and STDs ..... 10:50 am–12:15 pm
CONCURRENT SESSION B2: Occupational and Environmental Health ..... 10:50 am–12:15 pm
LUNCH (on your own) ..... 12:20–1:35 pm
SESSION C: J. Virgil Peavy Memorial Award Finalists ..... 1:45–3:10 pm
CONCURRENT SESSION D1: Infections Transmitted in Enclosed Communities ..... 3:25–5:10 pm
CONCURRENT SESSION D2: Global Health ..... 3:25–5:10 pm
EIS Alumni Association Meeting (private event sponsored by EISAA) ..... 5:30–7:30 pm

Tuesday

CONCURRENT SESSION E1: Immunization ..... 8:30–10:15 am
CONCURRENT SESSION E2: Chronic Disease and Health ..... 8:30–10:15 am
SESSION F: Donald C. Mackel Award Finalists ..... 10:35 am–12:00 pm
LUNCH (on your own) ..... 12:05–1:15 pm
SESSION G1: Poster Symposium ..... 1:25–3:00 pm
SESSION G2: Public Health Laboratory Science ..... 1:25–3:00 pm
SPECIAL SESSION 1: Public Health Response in Natural Disasters ..... 3:15–4:20 pm
TED-STYLE TALK 1 ..... 3:15–4:20 pm
SESSION H: FETP International Night — Poster Presentations (sponsored by TEPHINET) ..... 6:00–8:30 pm
PREDICTION RUN (Sponsored by EIS Alumni Association) ..... 6:00 pm

Wednesday

CONCURRENT SESSION I1: Opioid Misuse, Overdose, and Related Harms ..... 8:30–10:15 am
CONCURRENT SESSION I2: Infections Transmitted through Food and Water ..... 8:30–10:15 am
CONCURRENT SESSION J1: Antimicrobial Resistance and Healthcare-Associated Infections ..... 10:30–11:55 am
CONCURRENT SESSION J2: Preventing Violence ..... 10:30–11:55 am
LUNCH (on your own) ..... 12:00 pm–1:10 pm
SESSION K: Alexander D. Langmuir Lecture ..... 1:20–2:50 pm
CONCURRENT SESSION L1: Maternal Child Health ..... 3:10–4:55 pm
CONCURRENT SESSION L2: Public Health Surveillance ..... 3:10–4:55 pm
SESSION M: FETP International Night — Oral Presentations (sponsored by TEPHINET) ..... 6:30–9:00 pm

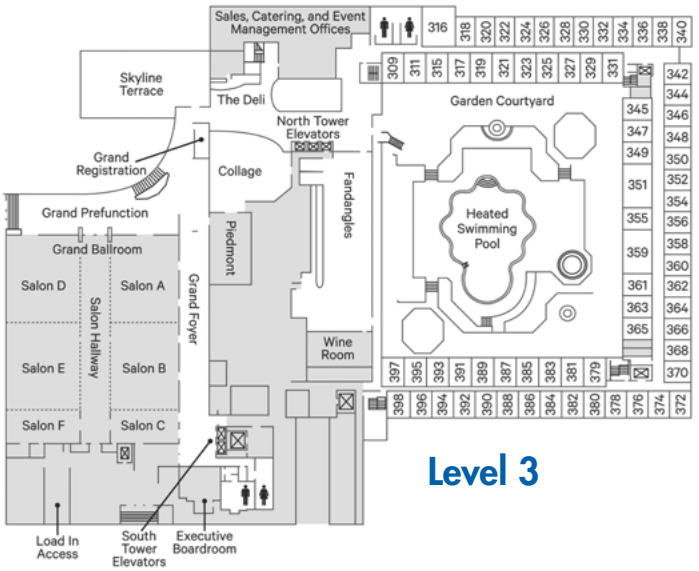
Thursday

CONCURRENT SESSION N1: Viral Hepatitis and Tuberculosis ..... 8:30–10:15 am
CONCURRENT SESSION N2: Respiratory Diseases ..... 8:30–10:15 am
SPECIAL SESSION 2: With the Benefit of Hindsight: Reflections on Key Public Health Events and Decisions ..... 10:30–11:35 am
TED-STYLE TALK 2 ..... 10:30–11:35 am
LUNCH (on your own) ..... 11:40 am–12:55 pm
CONCURRENT SESSION O1: Infections Transmitted in the Community ..... 1:05–2:30 pm
CONCURRENT SESSION O2: Birth Defects and Disability ..... 1:05–2:30 pm
PRESENTATION OF AWARDS ..... 2:45–3:15 pm
SESSION P: Late-breaking Reports ..... 3:15–4:20 pm
CLOSING REMARKS ..... 4:20–4:30 pm
POST-CONFERENCE EIS SATIRICAL REVUE ..... 7:30 pm

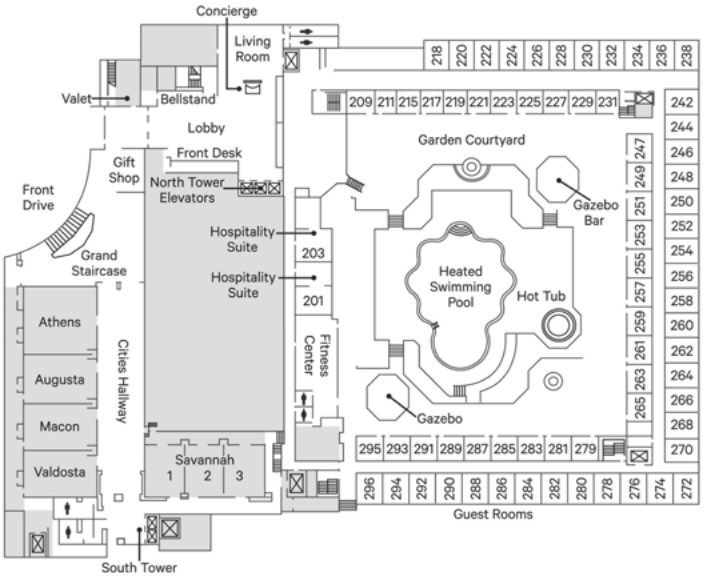
Awards presented during session.

Disclaimer: The findings and conclusions of the reports presented at the 68th Annual EIS Conference are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention (CDC). Use of trade names and commercial sources is for identification only and does not imply endorsement by the Division of Scientific Education and Professional Development; Center for Surveillance, Epidemiology, and Laboratory Services; CDC; the Public Health Service; or the U.S. Department of Health and Human Services. Published April 2019.

Sheraton Atlanta Hotel
Meeting Facilities Floor Plans



Level 3



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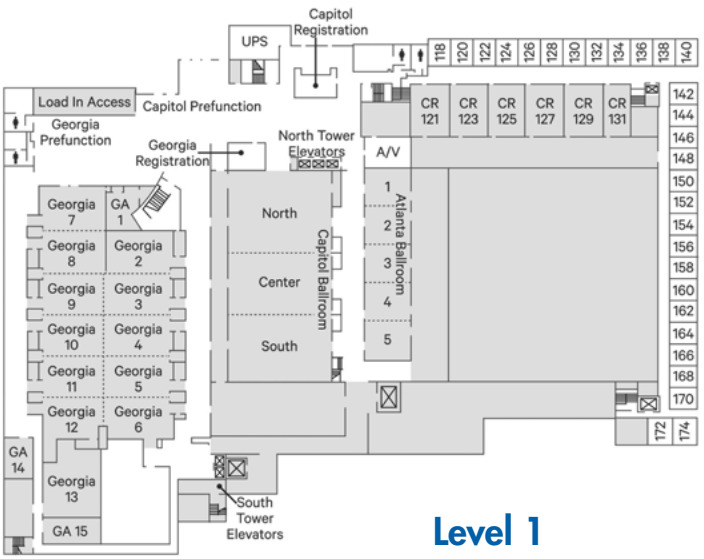

Level 1

Name Tags Color Key

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

SAVE THE DATE

69th ANNUAL EIS CONFERENCE

EPIDEMIC INTELLIGENCE SERVICE

April 27–30, 2020

Centers for Disease Control and Prevention
Atlanta, Georgia

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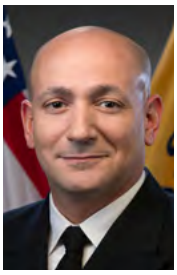
Preface

Dear Conference Participants,



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

Welcome to CDC's 2019 Epidemic Intelligence Service (EIS) conference. Why are you attending the conference? Are you here to learn about the breadth of work conducted by EIS officers with local, state, and international partners? Are you an alumnus of the program here to connect with classmates and other colleagues? Maybe you are attending because you are interested in applying to be a Disease Detective? Regardless of your reason for attending, the purpose of this conference is first and foremost for EIS officers to effectively share their scientific work and service. It is also an opportunity for you as conference participants to raise questions and challenge the officers to clearly explain their rationale and work.

The role and expectations of EIS officers have continuously evolved since the program's inception in 1951. EIS officers are increasingly expected to collaborate with other partners and trainees to complete projects or investigations, both domestically and internationally. As we have done in previous years, the conference includes "international nights" to feature the work of CDC's Field Epidemiology Training Program (FETP) on Tuesday and Wednesday. There is a special Public Health Laboratory Science session featuring fellows from the Laboratory Leadership Service (LLS) on Tuesday. New this year, presentations by LLS fellows, FETP trainees, and fellows from the Council of State and Territorial Epidemiologists (CSSTE) Applied Epidemiology Fellowship are integrated into the general scientific sessions. Including our FETP, LLS, and CSTE colleagues in the general program emphasizes the importance of the collaborations between our programs and trainees.

TED-style talks are back based on conference participants' feedback to last year's inaugural sessions. We have doubled the number of talks and sessions will also include alumni of both EIS and LLS programs. TED-style talks are another opportunity for trainees and now alumni to refine and expand their scientific presentation skills.

This year's Alexander D. Langmuir speaker exemplifies the mission of the EIS program. Dr. Mona Hanna-Attisha of Michigan State University — GO GREEN, GO WHITE! — is the courageous pediatrician and scientist at the center of uncovering the Flint, Michigan water crisis. She has also been a force behind the recovery efforts. Please join us on Wednesday for the honorary Langmuir lecture where Dr. Hanna-Attisha will share how she navigated the complex milieu of science, politics, and service in addressing a public health emergency.

A special thanks to all involved in planning the conference including the staff of the Epidemiology Workforce Branch, the Scientific Program Committee, EIS officers and LLS fellows, supervisors, and the EIS Alumni Association. As with everything we do, we are evaluating the conference with the goal of looking at how we can improve as a program. Please take the time to complete the consolidated conference evaluation that will be emailed to all registered conference participants.

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 3,500 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 EIS Program; and the ***Stephen B. Thacker Excellence in Mentoring Award*** initiated 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 **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 EISAA has also 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 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 29 at 5:30 p.m. in the Capitol Ballroom South 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,

Tina Tan, MD, MPH, EIS '00
President, EIS Alumni Association

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

Scientific Program Committee

Co-Chair: Lindsay Kim, National Center for Immunization and Respiratory Diseases
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 and Sharyn Parks Brown
National Center for Emerging and Zoonotic Infectious Disease .....Agam Rao and Jennifer Cope
National Center for Environmental Health/Agency for Toxic Substances and Disease Registry ..... Maria Mirabelli
National Center for Health Statistics ..... Tala Fakhouri
National Center for HIV/AIDS, Viral Hepatitis, STD and TB Prevention ..... Virginia Bowen
National Center for Immunization and Respiratory Diseases ..... Cristina Cardemil
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):
Jennifer Liang, Stacey Bosch, Matthew Maenner, Jennifer Cope, Agam Rao, Virginia Bowen, Michael Gronostaj, Cristina Cardemil, Erin Parker, Tala Fakhouri, Maria Mirabelli, Candice Johnson, Susan Chu, Sharyn Parks Brown, and Lindsay Kim
Not pictured: Andrea Sharma

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 68th 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.

Post-Conference Survey

Tell us about your experience at the

68th Annual EIS Conference

Take the brief

Post-Conference Survey

(Different from the Continuing Education Survey)

https://tinyurl.com/EISConference2019

Available via desktop or mobile device

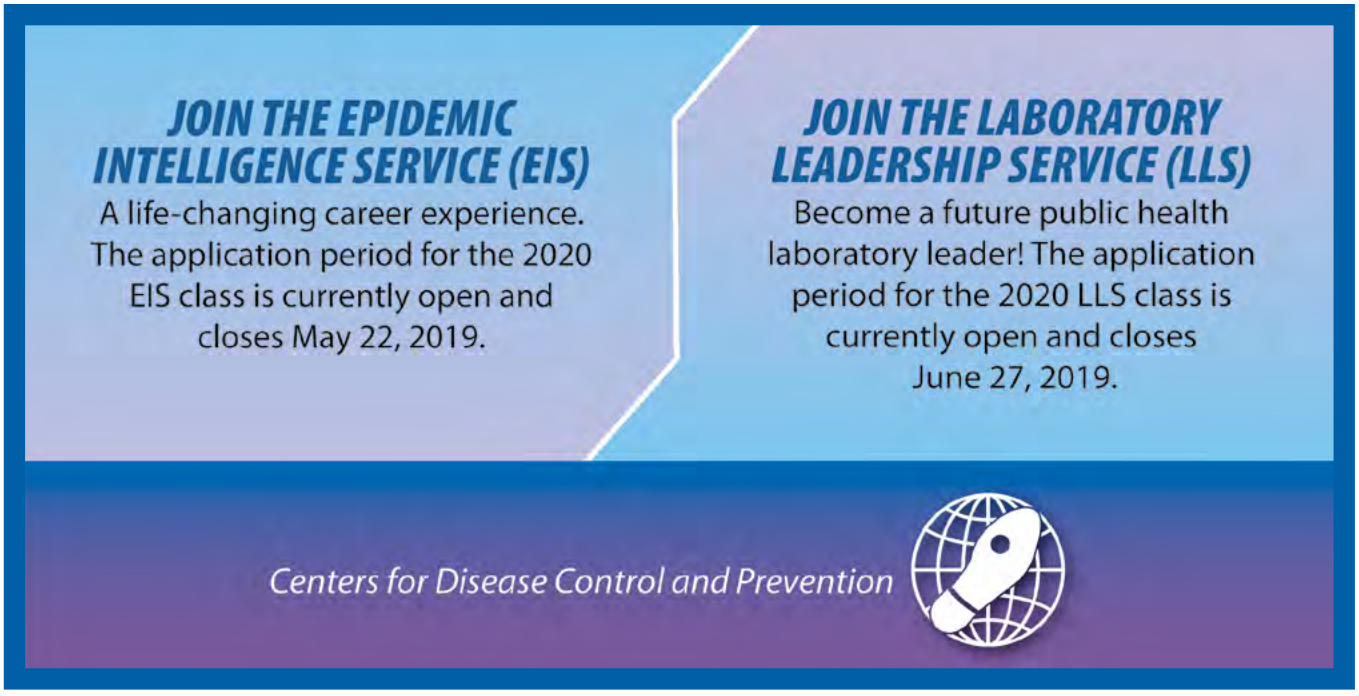
Instructions for Obtaining Continuing Education (CE)

To receive continuing education (CE) for this conference, please visit TCEO (www.cdc.gov/getCE) and follow the "9 Simple Steps to Get CE."

The deadline to complete CE is June 3, 2019.

- Course Title: 68th Epidemic Intelligence Service (EIS) Conference – Atlanta, GA
- Course Access Code: Provided in printed copy of the EIS conference program

FEES: There are no fees for CE.



68th Annual EIS Conference Schedule

Monday, April 29, 2019

7:00 **Registration Desk Opens**

8:15 **Welcome and Call to Order ..... Grand Ballroom**
Robert Redfield, CDC Director
Eric Pevzner, EIS Program Chief
Tina Tan, EIS Alumni Association President
Maria Thacker, daughter of Stephen B. Thacker, EIS '76
Presentation of Stephen B. Thacker Excellence in Mentoring Award

8:45–10:30 **SESSION A: Stephen B. Thacker Opening Session ..... Grand Ballroom**
Moderators: Stephen Redd and Patricia Simone

- **8:50** Imported Measles Outbreak in an Undervaccinated Community — Rockland County, New York, 2018. *Robert A. McDonald*
- **9:10** Risk Factors for Heat-Related Illness Among Workers — California, 2000–2017. *Amy P. Heinzerling*
- **9:30** Hepatitis A Vaccine Immunogenicity 25 Years After Vaccination in Alaska. *Maya Ramaswamy*
- **9:50** Invasive Group A *Streptococcus* Infections Among Residents of Multiple Nursing Homes — Denver, Colorado, 2017–2018. *Osatohamwen I. Idubor*
- **10:10** Adverse Childhood Experiences and Opioid Misuse Among Adolescents: Strong Associations and High Attributable Fraction — Stark County, Ohio, 2018. *Elizabeth A. Swedo*

10:30 **BREAK**

10:50–12:15 **CONCURRENT SESSION B1: HIV and STDs ..... Grand Ballroom**
Moderators: Eugene McCray and Virginia Bowen

- **10:55** New HIV Infections Among People Who Inject Drugs — Northeast Massachusetts, 2015–2018. *Charles Alpren*
- **11:15** Evaluation of HIV Preexposure Prophylaxis Surveillance Algorithms Using a Reference Population from New York City — July 2016–June 2018. *Nathan W. Furukawa*
- **11:35** Self-Reported HIV-Positive Status but Subsequent HIV-Negative Test Results in Population-Based HIV Impact Assessment (PHIA) Survey Participants — 11 Sub-Saharan African Countries, 2015–2017. *Naeemah Logan*
- **11:55** Barriers and Opportunities for Contact Tracing Related to Syphilis Among Men Who Have Sex with Men — Anchorage, Alaska, 2018. *Laura Quilter*

10:50–12:15 **CONCURRENT SESSION B2: Occupational and Environmental Health ..... Capitol Ballroom**
Moderators: Patrick Breysse and Maria Mirabelli

- **10:55** Psittacosis Outbreak at a Chicken Slaughter Plant — Virginia, 2018. *Kelly A. Shaw*
- **11:15** Pediatric Blood Lead Level Screening Rates Among Populations with Risk Factors for Lead Exposure — Indiana, 2017. *Kathryn L. Gaub*
- **11:35** Identifying Occupational Patterns in Opioid-Involved Overdose Mortality to Inform Local Opioid Response — Utah, 2012–2016. *Laurel Harduar Morano*
- **11:55** Colorado Tick Fever Virus Disease Cases — Oregon, 2018. *Emily S. McDonald*

Awards presented during session.

12:20–1:35 **LUNCH (on your own)**

1:45–3:10 **SESSION C: J. Virgil Peavy Memorial Award Finalists ..... Grand Ballroom**
Moderators: Nancy Messonnier and Byron Robinson

1:50 Spatiotemporal Patterns in Pertussis Incidence — United States, 2000–2017. *Heather Reese*

2:10 Using Active and Passive Surveillance to Estimate Respiratory Syncytial Virus Hospitalization Rates — Hamilton County, Ohio, 2009–2015. *Erica Billig Rose*

2:30 Elevated Rates and Temporal Trends of Norovirus Associated Hospitalizations in Adults Aged 65 Years and Older — United States, 2001–2015. *Talia Pindyck*

2:50 Novel Approach to Estimating Trends in Human Papillomavirus Type-Specific Cervical Precancer Rates Among Young Women in the United States, 2008–2014. *Nancy M. McClung*

3:25–5:10 **CONCURRENT SESSION D1: Infections Transmitted in Enclosed Communities ..... Grand Ballroom**
Moderators: Rima Khabbaz and Agam Rao

3:30 Pneumococcal Disease Outbreak at a State Correctional Facility — Alabama, 2018. *Guillermo V. Sanchez*

3:50 Widespread Carriage of Carbapenemase-Producing Carbapenem-Resistant *Acinetobacter baumannii* at a Long-Term Care Facility in Utah, 2018 — A Joint Epidemiology and Laboratory Investigation. *Roberta Z. Horth*

4:10 Transmission of Multidrug-resistance in a Community-Based, Residential Care Setting — Nevada, 2018. *Danica J. Gomes*

4:30 Factors Associated with *Candida auris* Colonization Among Residents of Nursing Homes with Ventilator Units — New York, 2016–2018. *John A. Rossow*

4:50 Multidrug-resistant *Shigella sonnei* in a Retirement Community — Vermont, 2018. *Jennifer P. Collins*

3:25–5:10 **CONCURRENT SESSION D2: Global Health ..... Capitol Ballroom**
Moderators: Rebecca Martin and Susan Chu

3:30 Population Structure of a Large Diphtheria Outbreak Among Forcibly Displaced Myanmar Nationals — Bangladesh, 2017–2018. *Marlon G. Lawrence*

3:50 Opportunities to Increase HIV Testing Among Adolescent Girls and Young Women — Malawi, 2017–2018. *Melissa M. Arons*

4:10 Molecular Surveillance for Antimalarial Drug Resistance Markers in *Plasmodium falciparum* Cases — Roraima, Brazil, 2016–2017. *Christina M. Carlson*

4:30 Risk Factors for Cholera Deaths During an Urban Outbreak — Lusaka, Zambia, 2017–2018. *Alison V. Winstead*

4:50 Risk Factors Associated with Increased Mortality from Intussusception in African Infants. *Talia Pindyck*

5:30–7:30 **EIS ALUMNI ASSOCIATION MEETING ..... Capitol Ballroom South**
(private event sponsored by EISAA - All current EIS officers and alumni are welcome)

Tuesday, April 30, 2019

8:30–10:15 **CONCURRENT SESSION E1: Immunization ..... Capitol Ballroom South**
Moderators: Cindy Weinbaum and Cristina Cardemil

8:35 Human Papillomavirus Prevalence Among Females in the United States, Overall and By Race/Ethnicity, National Health and Nutrition Examination Survey, 2003–2006 and 2013–2016. *Nancy M. McClung*

8:55 Unexpected Change in Pertussis Patterns — Maine, 2018. *Jennifer A. Sinatra*

9:15 Deltoid Bursitis as an Adverse Event Following Injectable Influenza Vaccine in the Vaccine Safety Datalink — United States, 2016–2017. *Elisabeth M. Hesse*

9:35 Interventions to Reduce Measles Exposures in Outpatient Healthcare Facilities — New York City, 2018. *Karen A. Alroy*

9:55 Vaccine Effectiveness Against Influenza A(H3N2)-Related Illness Among Children and Adolescents — United States, 2017–18. *Chandresh N. Ladva*

8:30–10:15 **CONCURRENT SESSION E2: Chronic Disease and Health ..... Capitol Ballroom**
Moderators: Peter Briss and Andrea Sharma

8:35 Insufficient Sleep and Obesity Among Adults — United States, 2013–2016. *Kendra B. McDow*

8:55 Intake and Food Sources of Dietary Sodium Among Adults by Blood Pressure Status — United States, 2015–2016. *Rebecca C. Woodruff*

9:15 Prevalence, Awareness, Control, and Trend of Diabetes, Hypertension, Hypercholesterolemia, and Hypertriglyceridemia Among Adults in Jordan: A Cross-sectional Study, Jordan, 2018. *Sa'ed Assaf*

9:35 The New "Cool" in School: A Media Content Analysis of JUUL Use Among U.S. Schools. *Mays Shamout*

9:55 Use of an Environmental Burden Index for Health Outcome Research — United States, 2018. *Amy M. Lavery*

10:30 **BREAK**

10:35–12:00 **SESSION F: Donald C. Mackel Award Finalists ..... Grand Ballroom**
Moderators: Michael Iademarco and Wences Arvelo

10:40 Coagulopathy Caused by Brodifacoum Rodenticide Poisoning Among Persons Who Smoke Synthetic Cannabinoids — Wisconsin, 2018. *Erica F. Wilson*

11:00 *Corynebacterium pseudodiphtheriticum* Identified as a Potential Cocirculating Pathogen During a Large Diphtheria Outbreak — Bangladesh, 2017. *Lauren M. Weil*

11:20 Bloodstream Infections with a Novel Nontuberculous *Mycobacterium* Among Oncology Clinic Patients — Arkansas, 2018. *Sarah M. Labuda*

11:40 Novel Serotype of Enteroinvasive *Escherichia coli* Associated with a Party — North Carolina, June–July 2018. *Carolyn T. A. Herzig*

12:05–1:15 **LUNCH (on your own)**

1:25–3:00 **SESSION G1: Poster Symposium ..... Grand Ballroom**
Moderators: Wendy Bamberg and Tala Fakhouri

G1.1 Exchange Sex Among High School Students — Washington, DC, 2017. *Sara K. Head*

G1.2 Mercury Toxicity Associated with Ayurvedic Medications — California, 2018. *Amy P. Heinzerling*

G1.3 Post-Licensure Safety Surveillance of Recombinant Zoster Vaccine (Shingrix) Using the Vaccine Adverse Event Reporting System — United States, October 2017–June 2018. *Elisabeth M. Hesse*

G1.4 Syndromic Surveillance to Monitor Emergency Department Visits During a Synthetic Cannabinoid Overdose Outbreak — Connecticut, 2018. *Sydney A. Jones*

G1.5 Group A *Streptococcus*-Associated Hospitalizations and Risk Factors for In-Hospital Mortality in California, 2000–2016. *Ellora Karmarkar*

G1.6 Case Series of Glans Injuries During Voluntary Medical Male Circumcision for HIV Prevention — 14 African Countries, 2015–2018. *Todd J. Lucas*

G1.7 Identifying and Characterizing Census Tracts with Elevated Opioid Overdoses — Idaho, 2010–2017. *Bozena M. Morawski*

G1.8 Severe Bleeding Associated with Exposure to the Superwarfarin Brodifacoum through Use of Synthetic Cannabinoids — Illinois, 2018. *Erin Moritz*

G1.9 A Coccidioidomycosis Mandatory Reporting System: From Facsimile to Electronic Laboratory Reporting — Los Angeles County, California, 2010–2017. *Lisa P. Oakley*

G1.10 Opioid Overdose Death Surveillance Evaluation — Wyoming, 2006–2017. *Heather Rhodes*

G1.11 Legionnaires' Disease Associated with a Resort Cooling Tower — Wisconsin, 2018. *Amy C. Schumacher*

G1.12 Carbapenemase-Producing *Klebsiella pneumoniae* in a Ventilator-Capable Nursing Home — Maricopa County, Arizona, July–November 2018. *Sarah E. Scott*

G1.13 Maternal Occupational Oil Mist Exposure and Birth Defects — United States, 1997–2011. *Miriam Siegel*

G1.14 Extrapulmonary Nontuberculous Mycobacteria Infections — Minnesota, 2013–2017. *Joanne Taylor*

G1.15 Coccidioidomycosis in U.S. Residents Returning from House-Building Trips in Baja California, Mexico, June–July, 2018. *Mitsuru Toda*

1:25–3:00 **SESSION G2: Public Health Laboratory Science ..... Capitol Ballroom**
Moderators: Ren Salerno and Aufra Araujo

1:30 Detection of *Bacillus anthracis* in Autoclaved Specimens — a Safe and Simple Diagnostic Method for Low-Resource Countries. *Atanaska Marinova-Petkova*

1:50 Improving Rabies Animal Models for Medical Countermeasures Through Luminescent Animal Models. *David E. Lowe*

2:10 Dried Blood Spots as an Alternative Laboratory-Based Surveillance Method for Dengue Virus — American Samoa, 2018. *Emily Curren*

2:30 Does One Plus One Equal Two Times the Resistance? Understanding the Epidemiology of Dual-Mechanism carbapenemase-producers in the United States — Antibiotic Resistance Laboratory Network, 2017–2018. *Ashutosh Wadhwa*

3:15–4:20 **SPECIAL SESSION 1: Public Health Response in Natural Disasters ..... Capitol Ballroom**
Moderators: Tegan Boehmer and Satish Pillai

3:15–4:20 **TED-STYLE TALK 1..... Grand Ballroom**

6:00–8:30 **SESSION H: FETP International Night — Poster Presentations ..... Capitol Ballroom**

Wednesday, May 1, 2019

8:30–10:15 **CONCURRENT SESSION I1: Opioid Misuse, Overdose, and Related Harms ..... Grand Ballroom**
Moderators: Debra Houry and Erin Parker

8:35 Surveillance of Emergency Medical Services Response with Naloxone Administrations — North Carolina, April–September 2017. *Lauren J. Tanz*

8:55 Reporting Timeliness and Estimated Incidence of Nonfatal Opioid Overdoses After Implementation of Mandated Reporting — Arizona, June 15, 2017–June 14, 2018. *Sarah E. Scott*

9:15 Initiation of Nonmedical Use of Prescription Opioids Among High School Students — Virginia, 2017. *Nicholas P. Deputy*

9:35 A Hidden Risk of the Opioid Crisis: Bacterial and Fungal Infections in People who Inject Drugs — New York, 2017. *Kathleen P. Hartnett*

9:55 Wound Botulism Outbreak Among People Who Use Black Tar Heroin — San Diego County, California, 2017–2018. *Corey M. Peak*

8:30–10:15 **CONCURRENT SESSION I2: Infections Transmitted through Food and Water ..... Capitol Ballroom**
Moderators: Robert Tauxe and Jennifer Cope

- **8:35** Multiple Pathogen Gastroenteritis Outbreak Associated with an Outdoor Recreational Facility — Tennessee, 2018. *Julia Brennan*
- **8:55** Invasive *Cronobacter* Infections Among Infants — United States, 1979–2018. *Jonathan P. Strysko*
- **9:15** Shigellosis at a Wedding — Oregon, 2018. *Steven I. Rekant*
- **9:35** False-Positive Culture-Independent Diagnostic Test Reports and Effects on *Vibrio* Surveillance — Nebraska, 2017–2018. *Rebecca J. Free*
- **9:55** Multistate Outbreak of *Salmonella* Mbandaka Infections Linked to Sweetened Puffed Wheat Cereal — United States, 2018. *Amelia Keaton*

10:30–11:55 **CONCURRENT SESSION J1: Antimicrobial Resistance and Healthcare-Associated Infections .... Grand Ballroom**
Moderators: Denise Cardo and Dianna Carroll

- **10:35** Group A *Streptococcus* Bacteremia Isolates with a Penicillin-Binding Protein 2x Gene Mutation Conferring Reduced Susceptibility to Ampicillin — Seattle, Washington, 2017–2018. *Kirsten Vannice*
- **10:55** Positive Deviance Study for Timeliness of Mandated Reporting of Carbapenem-Resistant Enterobacteriaceae — Los Angeles County, 2017–2018. *Howard Chiou*
- **11:15** Transmission of OXA-23-Producing Carbapenem-Resistant *Acinetobacter baumannii* Through Lung Transplantation — 2018. *Ana C. Bardossy*
- **11:35** Regional Containment of an Outbreak of Carbapenem-Resistant *Pseudomonas aeruginosa* — Lubbock, Texas, 2017–2018. *Christopher Prestel*

10:30–11:55 **CONCURRENT SESSION J2: Preventing Violence ..... Capitol Ballroom**
Moderators: Linda Dalhberg and Candice Johnson

- **10:35** Spatiotemporal Cluster of Suicidal Ideation and Behavior — New York City, 2018. *Genevieve Bergeron*
- **10:55** Nonfatal Violent Workplace Crime Characteristics and Rates by Occupation — United States, 2007–2015. *Miriam Siegel*
- **11:15** Leading Causes of Death, Suicide, and Opioid-Related Deaths Among American Indian and Alaska Native Residents — Washington, 2012–2016. *Alexander C. Wu*
- **11:35** Intimate Partner Violence Among Adults and High School Students — New York City, 2016–2017. *Karen A. Alroy*

12:00–1:10 **LUNCH (on your own)**

1:20–2:50 **SESSION K: Alexander D. Langmuir Lecture ..... Grand Ballroom**
Moderators: Anne Schuchat and Patricia Simone

3:10–4:55 **CONCURRENT SESSION L1: Maternal Child Health ..... Grand Ballroom**
Moderators: Wanda Barfield and Sharyn Parks Brown

- **3:15** Excess Infant Mortality in Metropolitan and Nonmetropolitan Areas by Race and Ethnicity — United States, 2014–2016. *Lindsay S. Womack*
- **3:35** Evaluating the Quality of Hospital Discharge Data as a Mechanism for Passive Surveillance of Neonatal Abstinence Syndrome in Illinois. *Ashley Horne*
- **3:55** Impact of the Recommendation for Routine Rotavirus Vaccination in Infants and Vaccine Uptake in Germany, 2013–18. *Adine Marquis*

Awards presented during session.

4:15 Outbreak of Staphylococcal Scalded Skin Syndrome in a Neonatal Intensive Care Unit — Illinois, 2018. *Caitlin F. Biedron*

4:35 Characteristics of Home Births — United States, 2012–2014. *Sonal Goyal*

3:10–4:55 **CONCURRENT SESSION L2: Public Health Surveillance ..... Capitol Ballroom**
Moderators: James Watt and Stacey Bosch

3:15 Upsurge of Acute Flaccid Myelitis in the United States — CDC Surveillance Results, 2018. *Susannah L. McKay*

3:35 Enterovirus D68 Circulation: Results from the New Vaccine Surveillance Network — United States, July–October 2017–2018. *Stephanie A. Kujawski*

3:55 Assessing Case Definition During a Hepatitis A Outbreak in San Diego County. *Corey M. Peak*

4:15 Common Errors and Deficiencies in Lyme Disease Testing and Reporting — Georgia, 2018. *Lee Hundley*

4:35 Trends in the Laboratory Detection of Rotavirus Before and After Implementation of Routine Vaccination — United States, 2000–2018. *Benjamin D. Hallowell*

6:00–8:30 **SESSION M: FETP International Night — Poster Presentations ..... Capitol Ballroom**
Sponsor: TEPHINET

Thursday, May 2, 2019

8:30–10:15 **CONCURRENT SESSION N1: Viral Hepatitis and Tuberculosis ..... Grand Ballroom**
Moderators: Carolyn Wester and Danice Eaton

8:35 Tuberculosis Transmission Among U.S.-Born Persons — Arkansas, 2010–2018. *Sarah M. Labuda*

8:55 Association of Area-Based Socioeconomic Measures With Tuberculosis Incidence Rates — California, 2012–2016. *Yasser Bakhsh*

9:15 Uptake of Tuberculosis Preventive Treatment Among People Living with HIV in Zambia and Challenges. *Michael Melgar*

9:35 Hepatitis C Virus Transmission Associated with Drug Diversion in a Local Hospital Emergency Department — Washington State, August 2017–March 2018. *Henry N. Njuguna*

9:55 Identification of Sustained Virologic Response Among Individuals with Hepatitis C Virus Infection — Chicago, Illinois. *Tristan D. McPherson*

8:30–10:15 **CONCURRENT SESSION N2: Respiratory Diseases ..... Capitol Ballroom**
Moderators: Daniel Jernigan and Jennifer Liang

8:35 Invasive *Haemophilus influenzae* Type a Disease Outbreak in an Alaska Village, 2018. *Amanda J. Tiffany*

8:55 Racial Disparities in Invasive *Haemophilus influenzae* Disease Affecting American Indian and Alaska Native Populations — United States, 2008–2017. *Nicole E. Brown*

9:15 Trends in Reported Legionnaires' Disease in North Carolina, 2010–2017: Increasing Disease or Increasing Detection? Carolyn T. *A. Herzig*

9:35 Acute Cardiovascular Events and Outcomes Among Adults Hospitalized with Influenza — United States, 2010–2017. *Eric J. Chow*

9:55 Clinical Characteristics at Hospital Admission Associated with Severe Influenza-Related Outcomes — United States, 2017–2018. *Joshua D. Doyle*

10:30–11:35 **SPECIAL SESSION 2: With the Benefit of Hindsight: Reflections on Key Public Health Events and Decisions ..... Capitol Ballroom**
Moderator: Jonathan (Jono) Mermin

10:30–11:35 **TED-STYLE TALK 2 ..... Grand Ballroom**

11:40–12:55 **LUNCH (on your own)**

1:05–2:30 **CONCURRENT SESSION O1: Infections Transmitted in the Community ..... Grand Ballroom**
Moderators: Chris Braden and Michael Gronostaj

1:10 Measles Contact Tracing in the Ridesharing Economy — Oregon, 2018. *Steven I. Rekant*

1:30 Community-Associated *Clostridium difficile* Infection and Antibiotic Exposure — Minnesota, 2009–2016. *Joanne Taylor*

1:50 *Candida auris* Colonization in the Community Setting — New York City (NYC), 2017–2018. *Genevieve Bergeron*

2:10 Use of Mass Antimicrobial Prophylaxis to Stop a Group A *Streptococcus* Outbreak Among Unaccompanied Children in a Shelter — Maricopa County, Arizona, January–August 2018. *Carla P. Bezold*

1:05–2:30 **CONCURRENT SESSION O2: Birth Defects and Disability ..... Capitol Ballroom**
Moderators: Margaret Honein and Matthew Maenner

1:10 Feasibility of Using Birth Defects Surveillance to Address Antiretroviral Safety Concerns: Evaluation of a Hospital-Based Birth Defects Surveillance System — Malawi, 2016–2018. *Elizabeth M. Rabold*

1:30 Assessing Completeness of Maternal Antiretroviral Use Within Perinatal HIV Surveillance: A Precursor to Monitoring Adverse Infant Effects — United States and Puerto Rico, 2013–2017. *Samira Sami*

1:50 Loss to Follow Up and Loss to Documentation Among Infants Who Do Not Pass Newborn Hearing Screening — Texas, 2018. *Robyn A. Cree*

2:10 Prevalence of Pica in Preschoolers With and Without Autism Spectrum Disorder, Study to Explore Early Development — United States, 2008–2016. *Victoria L. Fields*

2:45–3:15 **Presentation of Awards ..... Grand Ballroom**
Presenters: Dianna Carroll and Awards Chairs

- EISAA Class Membership Award
- Poetry 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

3:15–4:20 **SESSION P: Late-Breaking Reports ..... Grand Ballroom**
Presenters: Anne Schuchat and Eric Pevzner

3:20 Characterization of Dockless Electric Scooter Related Injury Incidents — Austin, Texas, September–November, 2018. *Laurel Harduar Morano*

3:30 A Dark Horse Candidate: Legionellosis Cluster Associated with Working at a Racetrack Facility — West Virginia, 2018. *Jared R. Rispens*

3:40 Botulism Outbreak after Consumption of Traditionally Prepared Alaska Native Foods — Alaska, 2019. *Amanda J. Tiffany*

Awards presented during session.

3:50 Norovirus GII.P16-GII.4 Sydney outbreak among wildfire evacuation shelter populations — Butte County, California, November 2018. *Ellora Karmarkar*

4:00 Late-Season Multistate Outbreak of *Salmonella* Infantis and Agona Infections Linked to Backyard Poultry — United States, 2018. *Mary A. Pomeroy*

4:10 Verona Integron-Encoded Metallo-β-Lactamase-Producing Carbapenem-Resistant *Pseudomonas aeruginosa* Infections Associated with Elective Invasive Medical Procedures in Mexico — Multiple U.S. States, 2018–2019. *Ian Kracalik*

4:20–4:30 **CLOSING REMARKS AND ADJOURNMENT..... Grand Ballroom**
Presenter: Patricia Simone

POST-CONFERENCE ACTIVITY

7:30 **Post-Conference EIS Satirical Revue ..... Grand Ballroom**
Presentation of Phillip S. Brachman Award

Awards presented during session.

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.

2019 Committee Members: Christina "Tina" Tan (Chair), Isaac Benowitz, Hannah Gould, Doug Hamilton, Ann Marie Kimball, Art Liang, Christina Mikosz, Emily Mosites

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.

2019 Committee Members: Class of 2017

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.

2019 Committee Members: Christina "Tina" Tan (Chair), Isaac Benowitz, Hannah Gould, Doug Hamilton, Ann Marie Kimball, Art Liang, Christina Mikosz, Emily Mosites, 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.

2019 Committee Members: Samuel Posner (Chair), Melinda Wharton, Stephanie Schrag, 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.

2019 Committee Members: Matthew Maenner (Chair), Anindya De, Tala Fakhouri, Erin Parker, Glen Satten, Andrea Sharma

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.

2019 Committee Members: Agam Rao (Chair), Virginia Bowen, Serena Carroll, Michael Gronostaj, Brandi Limbago

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.

2019 Committee Members: Susan Chu (Chair), Jennifer Cope, Issac S. Evans, Kimberley Folkman, Michael Gronostaj, Candice Johnson

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 a 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 who has made a significant contribution to international public health.

2019 Committee Members: Thomas Handzel (Chair), Roodley Archer, Joe Bressee, Kevin Clarke, Susan Cookson, 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.

2019 Committee Members: Casey Barton Behravesh (Chair), Colin Basler, Kirk Smith, Kendra Stauffer, Ryan M. Wallace

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.

2019 Committee Members: Kanta Sircar (Chair), Diana Bensyl, Tim Dignam, Tim Jones, Michael King, Jacek Mazurek

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.

2019 Committee Members: Hannah Gould (Chair), Janet Arrowsmith, Suzanne Beavers, Maria Thacker Goethe, Greg Heath, Christina Mikosz, Sanjeeb Sapkota

Shalon M. Irving Health Equity Award

The Shalon M. Irving Health Equity Award, established by the EIS Program and sponsored by the EIS Alumni Association, was awarded for the first time in 2018. The Shalon M. Irving Award recognizes a current EIS officer or recent alumni (classes 2015–2018) for having made exemplary contributions in the areas of health equity and racial disparities research.

2019 Committee Members: Jennifer Lind (Co-Chair), Francisca Abanyie-Bimbo (Co-Chair), Michelle Chevalier, Rachel Idowu, Asha Ivey-Stephenson, Rashid Njai, Erika C. Odom, and 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.

2019 Committee Members: Christina Mikosz (Chair), Wences Arvelo, Isaac Benowitz, Larry Cohen, Fatima Coronado, Doug Hamilton, Greg Heath, Pam Mahoney

Awards Presented at the 2018 EIS Conference

Alexander D. Langmuir Prize Manuscript Award
Mary-Margaret Fill

Philip S. Brachman Award
Anne Schuchat

Distinguished Friend of the EIS Award
Robert "Mike" Hoekstra

Iain C. Hardy Award
Heather Scobie

J. Virgil Peavy Memorial Award
Elizabeth Soda

Donald C. Mackel Memorial Award
Eugenie Poirot

Outstanding Poster Presentation Award
Vivian Leung

Paul C. Schnitker International Health Award
Rebecca Casey

James H. Steele Veterinary Public Health Award
Laura Adams
Thomas Doker

Mitch Singal Excellence in Occupational and Environmental Health Award
Reed Grimes

Stephen B. Thacker Excellence in Mentoring Award
James Mercy
William Schaffner

Shalon M. Irving Health Equity Award
Francis Annor

Alexander D. Langmuir Lectures, 1972–2018

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

2018 Better Health through Better Partnerships.
Vice Admiral Jerome M. Adams

Alexander D. Langmuir Prize Manuscripts, 1966–2018

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2012 Multistate Outbreak of *Escherichia coli* O157:H7 Infections Associated with In-Store Sampling of a Raw-Milk Gouda Cheese, 2010. J. Food Prot. 2012 Oct;75(10):1759-65.
J. McCollum, N. Williams, S. W. Beam, et al.

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

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

2015 New Delhi Metallo-Beta-Lactamase-Producing Carbapenem-Resistant E. coli Associated with Exposure to Duodenoscopes. JAMA 2014 Oct 8;312(14):1447-55.
L. Epstein, J.C. Hunter, M.A. Arwady, et al.

2016 Exposure to Advertisements and Electronic Cigarette Use among U.S. Middle and High School Students. Pediatrics. 2016 May;137(5).
T Singh, I.T. Agaku, R.A. Arrazola, et al.

2017 Geospatial Analysis of Household Spread of Ebola Virus in a Quarantined Village — Sierra Leone, 2014. Epidemiol Infect. 2017 Oct;145(14):2921-2929.
B.L. Gleason, S. Foster, G.E. Wilt, et al.

2018 Educational Disabilities Among Children Born with Neonatal Abstinence Syndrome. Pediatrics. 2018 Sep;142(3).
M.A. Fill, A.M. Miller, R.H. Wilkinson, et al.

Philip S. Brachman Awards, 1983–2018

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
2018 Anne Schuchat

Distinguished Friend of EIS Awards, 1984–2018

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
2018 Robert "Mike" Hoekstra

Iain C. Hardy Awards, 1996–2018

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
2018 Robert "Mike" Hoekstra

J. Virgil Peavy Memorial Awards, 2003–2018

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
2018 Elizabeth Soda

Donald C. Mackel Memorial Awards, 1987–2018

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

2018 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

Outstanding Poster Presentation Awards, 1986–2018

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

2018 Multiple Reports of Gastrointestinal Illness at a Hotel and Convention Center — Connecticut, 2017.
Vivian Leung

Paul C. Schnitker International Health Awards, 1995–2018

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 J. Lyle Conrad *(Official Paul C. Schnitker Committee Historian Award)*
2018 Rebecca Casey

James H. Steele Veterinary Public Health Awards, 1999–2018

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
2018 Laura Adams and Thomas Doker

Mitch Singal Excellence in Occupational and Environmental Health Awards, 2010–2018

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

2018 Occupational Exposure to Carbon Disulfide in an Artificial Casing Manufacturing Plant — United States, 2017.
Reed Grimes

Stephen B. Thacker Excellence in Mentoring Award, 2013–2018

2013 Stephen B. Thacker
2014 Lyle Conrad
2015 Douglas H. Hamilton
2016 Polly A. Marchbanks
2017 Jennifer McQuiston
2018 James Mercy and William Schaffner

Shalon M. Irving Health Equity Award

2018 Francis Annor

Monday, April 29, 2019

SESSION A: Stephen B. Thacker Opening Session

8:45–10:30 AM

Grand Ballroom

Moderators: Stephen Redd and Patricia Simone

Presentation of Stephen B. Thacker Excellence in Mentoring Award

8:50 Imported Measles Outbreak in an Undervaccinated Community — Rockland County, New York, 2018

Authors: Robert A. McDonald, M. Souto, D. Johns, K. McKay, C. Compton, C. Manini, T. DeLuna-Evans, M. Kaplan, M. Mosquera, P. Bryant, A. Khandekar, T. Yildirim, S. Ostrowski, E. Rausch-Phung, P. Ruppert, D. Blog

Background: Measles is a highly contagious vaccine-preventable disease declared eliminated from the United States in 2000. During October 1–17, 2018, the Rockland County Department of Health (RCDOH) alerted the New York State (NYS) DOH of 7 unvaccinated travelers with measles. Each had traveled in Israel where an outbreak was occurring, then stayed within Rockland County's Orthodox Jewish community, which had a pediatric vaccination rate ~66%. The departments of health and partners investigated to identify outbreak magnitude, implement control measures, and address vaccine concerns.

Methods: Cases were identified by laboratory and clinical reporting, and defined using Council of State and Territorial Epidemiologists criteria. Contact tracing was implemented, and postexposure prophylaxis (PEP) was offered. Home isolation was recommended for contacts without proof of presumptive immunity. Unvaccinated students were excluded for 21 days at schools with known cases or vaccination rates ≤80%. Vaccination points of dispensing (POD) were held to increase vaccination coverage. The Wadsworth Center Laboratory tested clinical samples. A measles and vaccine education campaign was initiated.

Results: As of November 30, we have identified 88 measles cases; 50 laboratory confirmed and 38 epidemiologically linked. Median age for patients was 7 years (range: 4 months–62 years); 80 (91%) were unvaccinated and 15 (17%) received vaccine as PEP. Wadsworth tested samples from 93 individuals, identifying 45 measles wildtype virus and 10 vaccine strain results. At 33 schools, 1,116 (11%) students were excluded. Eight vaccination POD were held and >10,000 community provider vaccinations administered. NYSDOH, RCDOH and partners held 9 informational events and distributed 45,000 educational door hangers.

Conclusions: This is the largest measles outbreak in NYS since 1992, and among the largest in the United States since measles was declared eliminated. Low vaccination rates allowed for widespread transmission. The outbreak highlights the importance of partnerships and education to increase vaccination rates.

Awards presented during session.

9:10 Risk Factors for Heat-Related Illness Among Workers — California, 2000–2017

Authors: Amy P. Heinzerling, R. Laws, M. Frederick, R. Jackson, G. Windham, B. Materna, R. Harrison

Background: As climate change raises global temperatures, studies have projected that heat-related morbidity and mortality will increase. Workers who perform exertional tasks or work in non-climate-controlled environments are particularly susceptible to heat-related illness (HRI). California is 1 of 3 states with an occupational standard to prevent HRI, requiring employers to provide employees with training and access to water, shade, and rest. We assessed occupational HRI patterns in California during 2000–2017 to identify workers at highest risk and guide prevention strategies.

Methods: We identified HRI claims in California's Workers' Compensation Information System (WCIS) during 2000–2017, using *International Classification of Diseases* Ninth and Tenth Revision codes, WCIS nature and cause of injury codes, and HRI keywords. We assigned census industry and occupation codes using NIOSH's Industry and Occupation Computerized Coding System (NIOCCS). We calculated average annual HRI rates/100,000 workers during 2000–2017, by sex, age group, year, county, and industry and occupation, using employment denominator data from NIOSH's Employed Labor Force and California's Employment Development Department.

Results: We identified 15,996 cases of HRI during 2000–2017 (average 6.0 cases/100,000 workers/year). Among age groups, those aged 16–24 years had the highest HRI rate (7.6); men (8.1) had a higher rate than women (3.5). Geographically, rates were highest in southern California, including Imperial (36.6), San Diego (32.7), and Los Angeles (31.8) Counties. Occupational groups with the highest HRI rates were protective service (56.6), farming, fishing, and forestry (36.6), and material moving occupations (12.3). Among individual occupations, firefighters had the highest rate (389.6).

Conclusions: Young workers, male workers, workers in southern California, and workers in firefighting, agriculture, and material moving occupations are particularly susceptible to occupational HRI in California. Collaboration with these workers and their employers to develop prevention strategies, such as education and training, may help reduce HRI in the workplace.

9:30 Hepatitis A Vaccine Immunogenicity 25 Years After Vaccination in Alaska

Authors: Maya Ramaswamy, D. Bruden, M. Snowball, J. Morris, P. Spradling, N. Nelson, L. Nolen, M. Bruce, B. McMahon

Background: The Hepatitis A vaccine is recommended for children ≥1 year old, however the duration of vaccine protection is unknown. In 1991, a cohort of Alaska Native children 3 to 6 years old was recruited to assess initial response to a 3-dose Hepatitis A vaccine series and the duration of protection. We report on the 25 year follow up of the cohort.

Methods: Participants were randomized to three different schedules: A) 0, 1, and 2 months; B) 0, 1, and 6 months; and C) 0, 1, and 12 months. We assessed IgG antibody concentrations to Hepatitis A virus (anti-HAV) every 2–3 years by calculating the geometric mean concentration (GMC) and proportion of participants with protective levels of anti-HAV (≥20 miU/ml) at each time point. We estimated the amount of time until anti-HAV dropped below protective levels using a Kaplan-Meier survival analysis.

Results: Of the 144 participants, 43 (29.9%) were available at the 25 year follow up period. There was a statistically significant lower GMC among participants who received vaccines on schedule A compared to schedules B and C (A = 42.9 miU/ml vs B = 100.6 vs C = 176.5, $P = 0.004$). Overall, 81.4% (35/43) of participants had protective levels of anti-HAV, a 5.6% decrease from the previous measurement at 22 years after vaccination. In a survival analysis, using data from the entire cohort, 78.7% of participants had protective levels of anti-HAV at 25 years.

Conclusions: At 25 years following the initial vaccination series, four of five of participants exhibit protective levels of anti-HAV. The high level of protective antibodies in this cohort indicate that supplemental doses of hepatitis A vaccine are not needed at or before 25 years after completion of the vaccine series.

9:50 Invasive Group A *Streptococcus* Infections Among Residents of Multiple Nursing Homes — Denver, Colorado, 2017–2018

Authors: Osatohamwen I. Idubor, N. Alden, H. Johnston, A. Burdorf, D. Barter, A. Dale, A. Cilwick, J. Nichols, G. Brousseau, A. Burakoff, W. Bamberg, R. Herlihy, H. Reese, S. Tanwar, W. Odongo, A. Ogundimu, N. Stone, S.A. Nanduri, S. Chochua, C. Van Beneden

Background: Older adults residing in nursing homes (NH) are at increased risk for invasive group A *Streptococcus* (GAS) infections due to advanced age, presence of wounds, and comorbidities; approximately one third of infected patients die. Beginning in 2015, increasing numbers of GAS infections in NH residents and several NH clusters were reported from the Denver metropolitan area. Colorado Department of Public Health & Environment (CDPHE) and CDC investigated to characterize cases and assess if outbreaks resulted from interfacility transmission.

Methods: We reviewed data from Active Bacterial Core surveillance (ABCs) in the 5-county Denver area from January 2017–June 2018. We defined a case as isolation of GAS from a normally sterile site in a NH resident. GAS isolates underwent whole-genome sequencing (WGS) at CDC's *Streptococcus* Laboratory to determine *emm* types for genotyping. Among isolates with the same *emm* type, pairwise single nucleotide polymorphism (SNP) distances were calculated using Nucmer software. In October 2018, a CDPHE-CDC team assessed infection control at NHs with cases of the most common *emm* type.

Results: Over 18 months, among >100 NHs in the Denver area, ≥1 GAS case was identified in 31 NHs, with 6 having ≥4 cases. During this period, 83 cases in NH residents were identified. WGS identified 17 *emm* types among isolates from these cases; most common was *emm11.10* (30%, n = 25), a rare subtype in ABCs. All *emm11.10* isolates had nearly identical genomes (average pairwise SNP distance: 2.8), and were isolated from 8 NHs, with 2 NHs having ≥4 cases. Multiple infection control lapses were noted during site visits to these 8 NHs.

Conclusions: Multiple outbreaks due to GAS were noted in 5-county Denver area NHs in 2017–2018. WGS of surveillance isolates identified a rarely seen *emm* subtype 11.10 from multiple facilities with temporal and genomic clustering suggesting interfacility GAS transmission.

10:10 Adverse Childhood Experiences and Opioid Misuse Among Adolescents: Strong Associations and High Attributable Fraction — Stark County, Ohio, 2018

Authors: Elizabeth A. Swedo, S. Sumner, S. de Fijter, L. Werhan, K. Norris, J. Beauregard, M. Montgomery, E. Rose, S. Hillis, G. Massetti

Background: Adverse childhood experiences (ACEs) increase the risk of many chronic diseases in adults, including opioid misuse. Few reports describe the impact of cumulative exposure to childhood trauma on adolescent opioid misuse. We estimate the proportion of recent opioid misuse attributable to ACEs among northeastern Ohio adolescents.

Methods: A cross-sectional survey examining substance use and related risk factors was administered to 10,608 7th–12th grade students in northeastern Ohio in Spring 2018. Using general estimating equations to account for clustering of students within schools, we evaluated associations between recent opioid misuse and cumulative number of ACEs. Recent opioid misuse was defined as using heroin or a prescription pain medicine without a doctor's prescription in the past 30 days. Eight measures of childhood trauma were summed to estimate cumulative ACE exposure. We calculated population attributable fractions (PAF) to determine the proportion of adolescents' recent opioid misuse attributable to ACEs.

Results: Nearly 1 in 50 adolescents reported opioid misuse within 30 days (1.8%). About 60% of youth experienced ≥1 ACE; 22.5% experienced ≥3 ACES. Cumulative ACE exposure demonstrated a significant graded relationship with opioid misuse. Compared to youth with zero ACEs, youth with 1 ACE (adjusted odds ratio [AOR]: 2.0, 95% confidence interval [CI]: 1.0–4.0), 2 ACEs (AOR: 3.8, CI: 2.2–6.6), 3 ACEs (AOR: 4.0, CI: 2.6–6.3), 4 ACEs (AOR: 6.6, CI: 3.0–14.7), and ≥5 ACEs (AOR: 16.4, CI: 9.4–28.6) had higher odds of recent opioid misuse. The PAF of recent opioid misuse associated with experiencing ≥1 ACE was 68.5%.

Conclusions: There was a significant graded relationship between number of ACEs and recent opioid misuse among adolescents. Nearly 70% of recent adolescent opioid misuse in our study population was attributable to ACEs. Efforts to decrease opioid misuse should include investment in policies to reduce childhood adversity and mitigate the negative effects of ACEs.

CONCURRENT SESSION B1: HIV and STDs

10:50 am–12:15 pm

Grand Ballroom

Moderators: Eugene McCray and Virginia Bowen

10:55 New HIV Infections Among People Who Inject Drugs — Northeast Massachusetts, 2015–2018

Authors: Charles Alpren, K. Cranston, E. Dawson, B. John, N. Panneer, D. Fukuda, K. Roosevelt, M. Klevens, J. Bryant, P. Peters, S. Lyss, W. Switzer, A. Burrage, A. Murray, C. Agnew-Brune, T. Stiles, E. Campbell, P. McClung, C. Breen, L. Randall, S. Dasgupta, S. Onofrey, D. Bixler, K. Hampton, J. Jaeger, A. DeMaria, K. Buchacz

Background: In mid-2016 Massachusetts Department of Public Health (MDPH) identified an increase in HIV diagnoses among people who inject drugs (PWID) in northeastern Massachusetts, an area with high rates of fatal opioid overdoses. MDPH initiated an investigation to characterize the outbreak and recommend control measures.

Methods: Cases were defined as HIV diagnoses during January 2015–May 2018 in PWID who received medical care, resided, or injected drugs in the Cities of Lawrence or Lowell; or who were a named injecting or sex partner, or were molecularly linked by HIV nucleotide sequences at a genetic distance of ≤1.5% to a case meeting temporal and geographic criteria. Case interviews identified needle-sharing and sexual contacts. Stakeholders provided information on local services. A purposeful sample of 34 PWID gave qualitative interviews.

Results: Of 122 people identified as cases, 71 (58%) were male; 89 (73%) were aged 20–39 years at diagnosis; 80 (66%) were white, and 101 (83%) reported injection drug use. Thirty-one cases (25%) had only molecular links to other cases. Three molecular clusters of ≥5 cases were identified. Median CD4 count at diagnosis was 556 cells/μL (range 1–1470 cells/μL). Stakeholders reported fentanyl use and frequent homelessness and incarceration among PWID. Syringe service program (SSP) accessibility was higher in Lawrence than Lowell. All PWID interviewed expressed a desire not to share syringes and acknowledged that sharing injection equipment occurs; 7 reported injecting >10 times/day, and 7/13 females reported exchange sex.

Conclusions: Molecular analysis aided case identification and indicates several introductions of HIV into this population with recent rapid transmission alongside detection of longstanding infections. Fentanyl use alters risk behaviors including increasing injection frequency. In 2016, Lawrence established a state-funded SSP; a privately funded SSP opened in Lowell in 2018. MDPH has expanded local field epidemiology to link individuals to care.

11:15 Evaluation of HIV Preexposure Prophylaxis Surveillance Algorithms Using a Reference Population from New York City — July 2016–June 2018

Authors: Nathan W. Furukawa, D. Smith, D. Hanna, Y. Huang, U. Felsen, J. Arnsten, V. Patel

Background: Use of tenofovir disoproxil fumarate/emtricitabine (TDF/FTC) as preexposure prophylaxis (PrEP) to prevent HIV infection has increased nationwide. Because TDF/FTC is also indicated for postexposure prophylaxis (PEP), HIV treatment, and hepatitis B (HBV) treatment, surveillance must distinguish TDF/FTC prescribed for PrEP use. PrEP surveillance relies on applying algorithms to databases containing prescription records and diagnosis codes to classify indications for TDF/FTC. We evaluated the accuracy of 3 algorithms used by CDC, Gilead Sciences, and New York State (NYS) compared with criterion standard results from a Bronx, NY reference population.

Methods: The reference population comprised patients aged ≥16 years prescribed TDF/FTC during July 2016–June 2018 in the Montefiore Health System. Diagnosis codes and other antiretroviral prescriptions were extracted from an electronic health record database for the date of first TDF/FTC prescription and the preceding 2 years. Chart review was conducted to classify the true indication of first TDF/FTC use as PrEP, PEP, HIV treatment, or HBV treatment. Each algorithm was applied to the reference population and compared with the chart review indication to calculate algorithm sensitivity and specificity for identifying PrEP.

Results: Of 2,862 patients included in the analysis, 694 used PrEP, 748 used PEP, 1,407 received HIV treatment, and 13 received HBV treatment. The CDC algorithm predicted 578 PrEP users (sensitivity 80.3%, specificity 99.0%), the Gilead Sciences algorithm predicted 692 PrEP users (sensitivity 94.7%, specificity 98.4%), and the NYS algorithm predicted 701 PrEP users (sensitivity 96.1%, specificity 98.4%). The CDC algorithm misclassified 109 (15.7%) PrEP prescriptions as PEP because it defined TDF/FTC prescriptions ≤30 days as PEP. Defining PEP as TDF/FTC prescriptions ≤28 days improved algorithm performance (sensitivity 95.8%, specificity 98.6%).

Conclusions: Defining PEP as ≤28 days of TDF/FTC in the CDC algorithm improves the sensitivity in comparison to that of the Gilead Sciences and NYS algorithms.

11:35 Self-Reported HIV-Positive Status but Subsequent HIV-Negative Test Results in Population-Based HIV Impact Assessment (PHIA) Survey Participants — 11 Sub-Saharan African Countries, 2015–2017

Authors: Naeemah Logan, Y. Pottinger, H. Patel, S. Saito, K. Lee, S. Jonnalagadda, P.H. Kilmarx, I. Rolle, A. Voetsch, B. Parekh

Background: HIV testing is a critical entry point to receive HIV care and treatment services. Although rare, false-positive HIV testing results can have considerable individual and public health implications. We present data from cross-sectional, nationally representative Population-Based HIV Impact Assessment (PHIA) surveys conducted in 11 sub-Saharan African countries from 2015 to 2017 to characterize individuals who self-reported being HIV-positive but tested HIV-negative.

Methods: Survey participants aged ≥15 years were interviewed by trained personnel using a standard questionnaire to determine HIV testing history and self-reported HIV status. HIV rapid-diagnostic tests (RDT) were performed according to the respective national HIV testing algorithms on venous blood samples. For participants who self-reported being HIV-positive but tested HIV-negative by RDT in the house-hold, repeat RDT testing, BioRad GeeniusTM HIV-1/HIV-2 Supplemental Assay testing, and, if negative, DNA PCR testing was performed in the laboratory. Analyses for extrapolation estimates were weighted based on survey design and non-response.

Results: Among the 221,941 survey participants, 198 (0.089%; range by country 0.021% to 0.366%) self-reported as HIV-positive but tested HIV-negative in the laboratory. Of the 198 individuals, 134 (67.7%) were female, 89 (44.9%) were aged 15–29 years, 128 (64.6%) lived in rural settings, and 49 (24.7%) reported currently taking antiretroviral therapy (ART). Extrapolating to overall HIV-positive burden across all 11 countries, we estimate approximately 72,800 HIV-negative persons potentially misclassified as HIV-positive and approximately 27,800 individuals may have been inappropriately initiated on ART among people age ≥15 years.

Conclusions: Although a very small proportion of survey participants reported a false-positive HIV status, extrapolation suggests a potentially large number of HIV-uninfected persons misperceiving their HIV status or even unnecessarily being on ART. Our study underscores the importance of quality assurance in testing, unambiguous post-test counseling, and re-testing prior to ART initiation.

11:55 Barriers and Opportunities for Contact Tracing Related to Syphilis Among Men Who Have Sex with Men — Anchorage, Alaska, 2018

Authors: Laura Quilter, J. Brennan, J. Harvill, S. Jones, E. Llata, J. McLaughlin, B. Morawski, A. Ridpath, T. Smith, A. Tiffany, E. Torrone, K. Bernstein

Background: Early syphilis is highly infectious and can lead to life-threatening complications if left untreated. During 2017–2018, early syphilis cases in Alaska tripled from 24 to 76, with most 2018 cases occurring among Anchorage men who have sex with men (MSM). Contact tracing of sex partners can mitigate transmission. We conducted an investigation to identify syphilis contact tracing barriers and opportunities among MSM in Anchorage.

Methods: During October 19–November 13, 2018, we administered an anonymous survey to men and transgender women aged ≥18 years residing in Alaska who reported sex with a man during the previous 6 months. The self-administered survey, available online and as paper, asked about knowledge, risk behaviors, medical care-seeking practices, and attitudes regarding syphilis. A convenience sample was recruited from digital platforms (e.g., Facebook®) and bars, clinics, and community-based organization events.

Results: Of 117 survey respondents, 88 (75%) lived in the Anchorage/Mat-Su region. Of these, 9.1% (95% confidence interval [CI]: 4.7–16.9) reported a syphilis diagnosis during the previous 12 months and having a median of 3 (interquartile range: 1–6) sex partners during the previous 6 months. High-risk behaviors commonly associated with syphilis were reported, including condomless anal sex (36.4%; 95% CI: 27.1–46.8) during the previous month, ≥1 episode of group sex (27.3%; 95% CI: 19.1–37.4) during the previous 6 months, and meeting sex partners online or on a geospatial mobile app (67.1%; 95% CI: 56.7–76.0) during the previous 6 months. Additionally, 45.5% (95% CI: 35.5–55.8) reported a sex partner living outside Anchorage and 28.4% (95% CI: 20.1–38.6) outside Alaska.

Conclusions: Large numbers of sex partners outside Alaska presents barriers to contact tracing among Anchorage MSM with syphilis. Opportunities include using innovative strategies (e.g., app-based contact tracing and out-of-jurisdiction partnerships) to reach populations at risk for syphilis.

CONCURRENT SESSION B2: Occupational and Environmental Health

10:50 am–12:15 pm

Capitol Ballroom

Moderators: Patrick Breysse and Maria Mirabelli

10:55 Psittacosis Outbreak at a Chicken Slaughter Plant — Virginia, 2018

Authors: Kelly A. Shaw, S. Kellner, L. Kornegay, M. Davis, P. Bair, M. de Perio, O. McGovern, M. Kobayashi, J. Winchell, B. Ritchie, J. Murphy, C. Holsinger, L. Forlano

Background: On August 31, 2018, a hospital notified the Virginia Department of Health (VDH) that 2 people who worked at a chicken slaughter plant were hospitalized with fever, cough, and pneumonia. Polymerase chain reaction (PCR) detected *Chlamydia psittaci,* a zoonotic pathogen which can cause psittacosis, a respiratory illness in humans. Sixty psittacosis cases were reported in the United States during 2008–2017. VDH and CDC investigated to determine outbreak source and prevent additional illnesses.

Methods: VDH collected environmental samples, observed work practices, and conducted a cohort study, surveying workers about illness and exposures. Clinical specimens from ill workers were sent to CDC for PCR testing. Among anyone who worked at the plant during August 1–September 7, 2018, a case was defined as illness with any of the following: a clinical specimen PCR-positive for *C. psittaci*; physician-diagnosed pneumonia; or fever or chills with ≥2 symptoms of headache, cough, and muscle aches.

Results: VDH identified 50 cases among 141 workers. Overall, 23/50 (46%) ill workers had pneumonia. Of clinical specimens from 13 workers, 5 were PCR-positive for *C. psittaci*. Workers ever in the evisceration area were more likely to be ill compared with unexposed workers (Relative Risk: 2.1; 95% confidence interval [CI]: 1.1–3.8). *C. psittaci* was not detected in any of 62 environmental samples, including 10 from the evisceration area. Repositioning cooling fans, misting birds on entry, and inspecting evisceration equipment were recommended to reduce aerosol formation and exposure. No cases were identified with onset later than September 8.

Conclusions: This is the largest psittacosis outbreak associated with a chicken slaughter plant in the US. Exposure to the evisceration area increased illness risk among workers. Environmental sampling results did not suggest ongoing contamination with *C. psittaci*. Recommendations to prevent future illnesses focused on reducing worker exposure to contaminated aerosols at the plant.

11:15 Pediatric Blood Lead Level Screening Rates Among Populations with Risk Factors for Lead Exposure — Indiana, 2017

Authors: Kathryn L. Gaub, P. Krievins, A. Hancock, J. Brown

Background: Pediatric lead exposure can have detrimental effects on cognition and other health outcomes. Common risk factors for lead exposure include residence in older housing and lower socioeconomic status (SES). Blood lead level (BLL) screening is recommended for children at risk and required for those enrolled in Medicaid; results of all BLL tests are reportable in Indiana. We examined rates of pediatric BLL screening among populations with risk factors for lead exposure to guide public health outreach.

Methods: The addresses of Indiana residents aged <7 years with ≥1 BLL test in 2017 were geocoded by census tract; BLL screening rates were calculated. Estimated proportions of the population residing in homes built pre-1940, and those aged <18 years enrolled in Medicaid (proxy for low SES) were obtained from the 2016 American Community Survey and mapped by census tract using Esri ArcGIS Desktop 10.5.1. Census tracts with higher proportions (>60%) of risk factors and lower (<50th percentile) pediatric BLL screening rates were identified.

Results: In total, 65,297 children aged <7 years had ≥1 BLL test reported in 2017, with a median screening rate of 73 tests/1,000 population (range: 2–2100). Addresses of 49,434 (76%) children were geocoded. Among 1,511 census tracts, 240 (16%) had >60% of children enrolled in Medicaid and 80 (5%) had >60% of homes built pre-1940. Eight (0.53%) census tracts had higher proportions of both risk factors and lower BLL screening rates (range: 51–73/1,000 population). All were located in urban areas, including Indianapolis (3), Fort Wayne (2), Muncie (2), and Evansville (1).

Conclusions: We identified areas with low pediatric BLL screening rates despite higher proportions of risk factors for lead exposure. Outreach to healthcare providers in these areas might help identify children with previously unrecognized need for medical treatment and environmental remediation to reduce future exposures.

11:35 Identifying Occupational Patterns in Opioid-Involved Overdose Mortality to Inform Local Opioid Response — Utah, 2012–2016

Authors: Laurel Harduar Morano, R. Horth, E. Brutsch, S. Luckhaupt

Background: Utah's opioid-involved overdose death rate (16.4/100,000 persons) is 1.23 times the national rate. The opioid overdose epidemic affects populations differently across occupations, partially because opioid prescriptions for work-related injuries vary. We explored occupational patterns in overdose mortality to inform Utah's opioid response.

Methods: Using Utah's Violent Death Reporting System (UTVDRS), we identified drug overdose deaths of unintentional or undetermined intent occurring from 2012–2016 among decedents aged ≥16 years. UTVDRS includes decedent data from medical examiner, law enforcement, and toxicology reports; it also contains decedents' usual lifetime occupation coded using U.S. Census Occupation codes. *International Classification of Disease*, 10th revision codes or drug name listed in the narrative enabled specification of heroin- and prescription opioid-involved deaths. We calculated heroin- and prescription opioid-involved overdose mortality rates per 100,000 person-years by sex and 26 occupation groups using American Community Survey data as the denominator.

Results: Among the 2,911 drug overdose deaths, 76% involved an opioid. For men (n = 1,335), occupation groups with the highest rates for heroin- and prescription opioid-involved overdoses were: *Construction* (heroin = 31.6; prescription = 55.6), *Material moving* (heroin = 20.4), and *Installation, maintenance,* and *repair* (prescription = 37.4). Among women (n = 879), the occupation groups with the highest rates for heroin-involved overdoses included *Food preparation* and *serving* (10.7) and *Sales* (2.7); for prescription opioid-involved overdoses, the highest rates were among *Healthcare support* (27.9) and *Healthcare practitioners and technical* (19.6). For males, 25% of prescription opioid-involved overdoses involved opioids reportedly prescribed to the decedent compared with 49% for females.

Conclusions: Occupation groups with the highest burden of opioid overdose mortality varied by sex and, for women, by drug type. State-specific occupational analyses can inform local response. In Utah, targeted prescription-overdose workplace interventions may be occupation specific for males and industry specific (i.e., Health Care) for females.

11:55 Colorado Tick Fever Virus Disease Cases — Oregon, 2018

Authors: Emily S. McDonald, D. George, S. Rekant, E. Curren, E. DeBess, K. Hedberg, J. Lutz, J. Faith, H. Kaisner, R. Fawcett, R. Sherer, R. Kanyuch, A. Gudmundsson, N. Gardner, M. Salt, O. Kosoy, J. Velez, E. Staples, M. Fischer, C. Gould

Background: Colorado tick fever (CTF) virus is transmitted by infected Rocky Mountain wood ticks (*Dermacentor andersoni*). Over the past decade, Oregon reported ≤1 CTF case annually. In early summer 2018, four residents of central Oregon presenting to the same healthcare system were confirmed to have CTF virus infection by RT-PCR testing. We conducted an investigation to describe the clinical course, exposures, and geographic distribution of the confirmed cases, and to identify additional cases.

Methods: We used standard tools to collect case information through medical record review and phone interview. We searched electronic medical records using ICD-10 codes to identify suspect cases with fever and leukopenia, and no alternative explanation, presenting to the same healthcare system from April 15–July 31, 2018. Identified patients were interviewed and offered testing for CTF virus infection.

Results: Of the four confirmed cases, three patients were male and the median age was 74.5 years (range: 55–76 years). All patients had fever, leukopenia, and thrombocytopenia and three were hospitalized. All reported a tick bite prior to illness onset and spent extensive time outdoors (≥5 hours/day), including work in wooded or brushy areas. Tick exposures occurred between 3,200–4,500 feet; however, no geographic clustering was identified. All patients wore long sleeves and pants, but none used insect repellent prior to outdoor exposures. Three suspect cases were identified; one patient submitted a serum sample, which was positive for CTF neutralizing antibodies.

Conclusions: More CTF cases were identified in Oregon in 2018 compared to prior years, possibly due to increased tick activity or heightened provider awareness and testing. No common locations of tick exposure were identified, suggesting the pathogen is enzootic in central Oregon. Health departments should reinforce tick prevention measures, including use of EPA-registered insect repellents, and target messaging to individuals at high risk for tick exposure.

SESSION C: J. Virgil Peavy Memorial Award Finalists

1:45–3:10 pm

Grand Ballroom

Moderators: Nancy Messonnier and Byron Robinson

1:50 Spatiotemporal Patterns in Pertussis Incidence — United States, 2000–2017

Authors: Heather Reese, N. Shang, S. Hariri, T. Skoff

Background: Pertussis, or whooping cough, is a highly contagious, vaccine-preventable respiratory disease. Historically, pertussis incidence was cyclic with peaks in disease every 3–5 years. In the United States, reported pertussis has increased over the past few decades despite high vaccination coverage; however, there is no clear national spatiotemporal pattern. We aimed to assess: 1) the spatiotemporal distribution of pertussis in the United States, and 2) whether geographically distinct areas share similar temporal patterns.

Methods: We used pertussis cases reported through the National Notifiable Diseases Surveillance System, and county population estimates from the U.S. Census Bureau, for 2000–2017. County-level case counts were aggregated by month. To assess the distribution of pertussis cases, and identify spatiotemporal clusters during our study period, we used Kulldorf's spatiotemporal scan statistic ($p<0.01$). For each cluster of identified counties, wavelet analysis was used to quantify the timing and periodicity of pertussis incidence.

Results: National pertussis incidence over 2000–2017 averaged 6.4 cases/100,000 annually with peaks in 2004–2005, 2010, 2012, and 2014. We detected spatiotemporal clusters of high pertussis incidence, with the geographically largest clusters in the East North Central (relative risk (RR) of disease within cluster compared to outside: 3.9), New England (RR: 3.1), and northern Mountain regions (RR: 2.4). On average, clusters spanned 24 (1–331) counties and lasted 28 (4–108) months. Although there was substantial variability in the temporal pattern for each cluster, spatially distinct areas can be grouped by similar dominant periods of 12 months or >20 months.

Conclusions: Pertussis has disproportionately affected certain areas across the nation. A better understanding of the current spatiotemporal patterns of pertussis across the United States will allow us to better characterize current epidemiology, potentially helping predict and plan for the occurrence of future outbreaks.

2:10 Using Active and Passive Surveillance to Estimate Respiratory Syncytial Virus Hospitalization Rates — Hamilton County, Ohio, 2009–2015

Authors: Erica Billig Rose, M. Rice, M. McNeal, H. Biggs, G. Langley, M.A. Staat

Background: Respiratory syncytial virus (RSV) hospitalization rates are crucial to estimate disease burden prior to licensure of vaccines currently in development. Common approaches to estimating rates of disease likely underestimate the true burden of RSV. We estimated RSV hospitalization rates using results from two independent surveillance systems, and estimated the sensitivity of each system.

Methods: Prospective, active, and clinician-directed, passive, surveillance systems were used to identify laboratory-confirmed RSV cases among <5 year old residents of Hamilton County, Ohio hospitalized at Cincinnati Children's Hospital Medical Center from 2009–2015. Cases were matched between systems, and using capture-recapture methods, the numbers of missed RSV hospitalizations and hospitalization rates by season (July–June) were estimated using the probability of capture by both or only one surveillance system. These rates were used as the gold standard to measure the sensitivity of active surveillance, adjusted by number of surveillance days and eligible children, and passive surveillance.

Results: Active and passive surveillance identified 469 and 628 RSV hospitalizations, respectively; 111 were matched between systems. An estimated 1,667 RSV hospitalizations were missed across both systems. Estimated capture-recapture RSV hospitalization rates ranged from 69.6 (95% confidence interval [CI]: 59.8–83.6) to 109.2 (95% CI: 80.9–160.6) per 10,000 children during 2009–2015. The sensitivity of the adjusted active surveillance rate was 48%, and the sensitivity of passive surveillance was 24%. The adjusted active surveillance hospitalization rate was lower than the capture-recapture estimate in all seasons but one.

Conclusions: Accurate estimates of RSV hospitalization rates are needed to evaluate disease burden, but active surveillance may underestimate these rates, and passive surveillance is even less sensitive. Understanding the sensitivity of surveillance methods helps inform decisions about how to estimate burden. When multiple independent systems are available, capture-recapture methods that utilize information from more than one system may provide the best estimates.

2:30 Elevated Rates and Temporal Trends of Norovirus Associated Hospitalizations in Adults Aged 65 Years and Older — United States, 2001–2015

Authors: Talia Pindyck, J. Rudd, R. Burke, C. Mattison, A. Hall

Background: Norovirus is a leading cause of acute gastroenteritis (AGE) across the age spectrum and candidate norovirus vaccines are currently in development. Previous studies have demonstrated an increasing rate of norovirus-associated hospitalizations in the U.S. from 1996–2007, particularly in the adult population. We updated national burden estimates of norovirus hospitalizations and described temporal trends.

Methods: AGE-coded hospital discharges during July 2001–December 2015 were extracted from the National Inpatient Sample of the Healthcare Cost and Utilization Project, a nationally representative database of hospital discharges. To estimate monthly norovirus hospitalizations, we used time-series regression models to fit cause-unspecified AGE discharges to specified causes other than norovirus. Remaining excess seasonal hospitalizations (i.e., model residuals) were attributed to norovirus and summarized by seasonal year (July–June). Norovirus hospitalization costs were estimated using the median age-stratified annual costs of cause-unspecified AGE hospitalizations.

Results: Over the 14-year study period, 74% (901,519/1,224,186) of all AGE hospitalizations were cause-unspecified, with a mean annual rate of 296 per 100,000 person-years (PY). The model estimated an annual mean of 106,592 norovirus hospitalizations (40 per 100,000 PY), accounting for 7% of all-cause AGE hospitalizations. Adults aged ≥65 years had the highest mean annual rate of norovirus hospitalizations (120 per 100,000 PY) and rates increased with age. Overall, norovirus hospitalization rates remained stable over the study period, but spiked during January (61 per 100,000 PY) and with the emergence of pandemic norovirus strains (i.e., during 2002–03 and 2006–07). The median age-adjusted cost of a cause-unspecified AGE hospitalization was $10,272, yielding an estimated cost for norovirus hospitalizations of $1.1 billion per year.

Conclusions: Norovirus gastroenteritis continues to cause a substantial number of hospitalizations in the United States, with older adults disproportionately affected. The disease burden from norovirus hospitalizations in older adults can help target and predict impacts of candidate norovirus vaccines.

2:50 Novel Approach to Estimating Trends in Human Papillomavirus Type-Specific Cervical Precancer Rates Among Young Women in the United States, 2008–2014

Authors: Nancy M. McClung, J. Gargano, R. Lewis, M. Griffin, N. Bennett, E. Whitney, N. Abdullah, M. Brackney, A. Cleveland, T. Querec, E. Unger, L. Markowitz

Background: Since human papillomavirus (HPV) vaccine introduction, cervical precancer incidence rates among women screened for cervical cancer have declined 56% in 18–20 year-olds and 39% in 21–24 year-olds. Along with vaccination, changes to cervical screening and management guidelines could have contributed to declines. To assess potential vaccine impact, we applied inverse probability weighting (IPW) procedures to incomplete HPV typing data to estimate vaccine and non-vaccine type-specific cervical precancer incidence rates among 18–24 year-old women and evaluated trends, 2008–2014.

Methods: We analyzed data on cases of cervical intraepithelial neoplasia grades 2–3 and adenocarcinoma in situ (CIN2+) from a 5-site, population-based surveillance system. A subset of cases with available specimens underwent HPV DNA typing. Types were categorized as vaccine-type during the analytic time-period (16/18) or non-vaccine type (any other HPV). We developed IPW based on variables differing between typed and untyped cases, and generated weighted frequencies to estimate type-specific CIN2+ incidence per 100,000 women screened for cervical cancer and 95% confidence intervals (CI). We evaluated trends using log-linear models and report average annual percent change (AAPC).

Results: Of 2,383 CIN2+ cases, 1,644 (69%) had HPV typing results. From 2008–2014, weighted 16/18-positive CIN2+ rates decreased from 397 to 133 per 100,000 screened 18–20 year-olds (AAPC = -20.7% [95% CI: -29.0,-11.3]), and from 667 to 340 per 100,000 screened 21–24 year-olds (AAPC = -11.6% [95% CI: -14.6,-8.4]). Non-vaccine type CIN2+ rates did not decline.

Conclusions: Declines in vaccine-type, but not other type-associated CIN2+ rates, supports the specific impact of HPV vaccination; changes in screening and management guidelines would have impacted HPV types equitably. IPW allowed us to overcome biases of incomplete typing data and create the first-ever estimates of type-specific CIN2+ rates; ongoing application of these methods can help disentangle competing influences of vaccination and evolving clinical guidelines.

CONCURRENT SESSION D1: Infections Transmitted in Enclosed Communities

3:25–5:10 pm

Grand Ballroom

Moderators: Rima Khabbaz and Agam Rao

3:30 Pneumococcal Disease Outbreak at a State Correctional Facility — Alabama, 2018

Authors: Guillermo V. Sanchez, C. Bourne, N. Brown, S. Davidson, M. Ellis, K. Fay, E. Geeter, L. Feldstein, L. Foster, C. Gilmore, B.M. McIntyre, B. Taylor, A. Matanock

Background: In September 2018, Alabama Department of Public Health was notified of 2 prison inmates with invasive pneumococcal disease. Pneumococcal disease outbreaks are rare, but can occur in institutional settings. We investigated to determine disease severity, risk factors, and intervention strategies.

Methods: We identified cases using clinic records. A suspected case was defined as respiratory or meningitis symptoms in an inmate or close contact with onset between September 1–November 27, 2018. Probable cases were defined as suspected cases plus radiographically confirmed pneumonia or laboratory evidence of bacterial meningitis with negative testing or unknown etiology. Confirmed cases were defined as suspected cases plus a positive *Streptococcus pneumoniae* test. We performed medical chart review and patient interviews to explore risk factors. We conducted prospective pneumococcal disease surveillance among inmates in the prison clinic between October 5–November 27.

Results: We identified 40 cases (3 confirmed, 2 probable, and 35 suspected) among approximately 1,300 inmates and none among employees. Median patient age was 39 years (range: 22–63 years). All patients with confirmed and probable pneumococcal disease were hospitalized and 1 died; diagnoses included meningitis (2), pneumonia (2), and septicemia with pneumonia (1). All patients with confirmed pneumococcal disease had *S. pneumoniae* serotype 12F, lived in dormitory X, and had symptom onset between September 14–25. Among all 40 patients, 85% reported substance use (cigarettes, alcohol, or illicit drugs) and 33% had medical conditions that increase pneumococcal disease risk. Starting September 29, inmates living in dormitory X (264) were offered pneumococcal disease prophylaxis; 93% received azithromycin and 78% received 23-valent pneumococcal polysaccharide vaccine, which protects against serotype 12F. No *S. pneumoniae* transmission was identified during prospective surveillance.

Conclusions: Close living quarters, substance use, and underlying medical conditions likely contributed to increased risk for pneumococcal disease. Timely prophylaxis may have interrupted pneumococcal transmission.

3:50 Widespread Carriage of Carbapenemase-Producing Carbapenem-Resistant *Acinetobacter baumannii* at a Long-Term Care Facility in Utah, 2018 — A Joint Epidemiology and Laboratory Investigation

Authors: Roberta Z. Horth, A. Rossi, A.R. Smith, K. Oakeson, M. Vowles, L. Smith, L. Rider, H. Schuckel, J. Stewart, R. Gruninger, A.K. Nakashima

Background: The emergence and spread of carbapenemase-producing carbapenem-resistant *Acinetobacter baumannii* (CP-CRAB) are a public health threat. These bacteria may not respond to last-line antibiotic treatment and can transmit resistance genes across species. Few states mandate reporting of CP-CRAB, and detection requires complex methods not routinely performed. In August 2018, the Utah Department of Health conducted an urgent investigation at a long-term care facility to contain an outbreak of CP-CRAB carrying the resistance gene OXA-23 affecting 4 patients; 2 had died.

Methods: Investigators conducted chart abstractions, observed infection control practices, and collected environmental swabs from high-risk locations (e.g., shared equipment and high-touch areas). Investigators obtained consent for swab collection from skin, oropharynx, tracheal aspirate, and wounds from patients considered high risk as determined by case patient characteristics (those who in ≤6 months resided in the ventilator unit, received wound or respiratory care, or out-of-state transfers). Utah Public Health Laboratory investigators used selective media to grow *Acinetobacter* and conducted whole-genome sequencing (WGS) of isolates to detect OXA-23 carbapenemase gene and determine genetic relatedness.

Results: Gaps in infection control included ~40% compliance with hand hygiene, inadequate delineation of equipment cleaning responsibilities, and limited antibiotic stewardship. Of 47 patients identified for screening, 10 (21%) had CP-CRAB skin colonization (4 had concurrent positive wounds; 1 had both positive tracheal aspirate and wound). Fourteen (37%) of 38 environmental samples mostly from shared equipment grew CP-CRAB. WGS detected 3 distinct CP-CRAB clusters; all isolates carried OXA-23 gene.

Conclusions: Infection control recommendations, including improved hand hygiene and equipment cleaning, were implemented at the facility. State laboratory capabilities to test specimens and close collaboration with epidemiologists were key to the rapid response. Widespread asymptomatic carriage and contamination of shared equipment demonstrate that long-term care facilities can be reservoirs of highly resistant pathogens highlighting the need for improved CP-CRAB detection.

4:10 Transmission of Multidrug-resistance in a Community-Based, Residential Care Setting — Nevada, 2018

Authors: Danica J. Gomes, A. Bardossy, L. Chen, A. Forero, A. Gorzalski, H. Holmstadt, K. Causey, N. Chidinma, N. Stone, A. Ogundimu, H. Moulton-Meissner, G. McAllister, A. Halpin, P. Gable, N. Vlachos, S. Larson, M. Walters, L. Epstein

Background: *Klebsiella pneumoniae* carbapenemase-producing organisms (KPCOs) are often multidrug-resistant, and the KPC resistance determinant can be transmitted between bacteria. KPCOs are associated with healthcare facility exposures; identification in community-based, residential care settings is uncommon. In September 2018, the Washoe County Health District was notified of a KPC-producing *Escherichia coli* from a group home (GH) resident. We investigated the source of this KPCO and evaluated transmission in the GH.

Methods: A case was defined as detection of KPCO from a GH resident or staff from June to October 2018. Staff included caregivers who provided daily care (including toileting, bathing, feeding) and visiting healthcare workers. Residents and staff were offered KPCO screening. Exposures were assessed by medical record review and interviews. Genetic relatedness of KPCOs was evaluated by whole genome sequencing (WGS). Infection prevention and control (IPC) practices were reviewed.

Results: Overall, six cases were identified, including the index, two of seven staff screened and three of six residents screened. Three residents with KPCOs had recent hospitalizations; one overlapped on the same hospital unit as a patient with KPC-producing *Klebsiella oxytoca*. Staff with KPCOs were caregivers who had extensive contact with residents and their environment and no IPC training. Gaps in hand hygiene and environmental cleaning were observed. Organism was recovered from 4 positive screening tests, all were KPC-producing *E. coli*. WGS showed that the five *E. coli* isolates were closely related, consistent with transmission, and harbored the same KPC variant as the *K. oxytoca*. No new cases occurred after IPC was improved.

Conclusions: A GH resident likely acquired KPCOs during a recent hospitalization, and extensive transmission among GH residents and staff occurred. Factors contributing to transmission included resident dependence on caregivers for daily care and minimal IPC knowledge among caregivers. Facilities with similar populations should increase IPC training to prevent transmission of resistant pathogens.

4:30 Factors Associated with *Candida auris* Colonization Among Residents of Nursing Homes with Ventilator Units — New York, 2016–2018

Authors: John A. Rossow, R. McDonald, T. Lucas, S. Perez, K. Forsberg, K.A. Alroy, K. Woodworth, K Jacobs-Slifka, S. Vallabhaneni, R. Jean Denis, K. Southwick, R. Giardina, J. Greenko, R. Erazo, B. Ostrowsky, E. Adams, D. Blog

Background: *Candida auris* is an emerging, multidrug-resistant yeast that spreads in healthcare settings. People colonized with C. auris can transmit this pathogen and are at risk for invasive infections. New York State (NYS) has the largest U.S. burden (>500 colonized and infected people); most colonized individuals live in nursing homes (NH) that care for mechanically ventilated persons. We evaluated factors associated with *C. auris* colonization among NH residents to inform interventions to reduce transmission.

Methods: During 2016–2018, the NYS Department of Health conducted point prevalence surveys (PPS) for *C. auris* colonization in residents of affected NYS NHs by swabbing residents' axilla, groin and nares. In a matched case-control investigation, we defined a case as *C. auris* colonization in a resident and matched each case with up to four residents with negative swabs during the same PPS. We abstracted data from medical records on facility transfers, antimicrobials, and medical history.

Results: We included 60 cases and 218 controls identified during 12 PPSs at 6 NHs. After controlling for age, underlying conditions, functional status, and infection with other multidrug-resistant organisms in the 90 days before screening, the following characteristics were associated with *C. auris* colonization: having a urinary catheter (adjusted odds ratio [aOR]: 2.5; 95% confidence interval [CI]: 1.1–5.4), having a tracheostomy (aOR: 8.2; 95% CI: 1.1–58.8), being on a ventilator (aOR: 3.4; CI: 1.2–9.2), receiving meropenem in the prior 90 days (aOR: 2.5; CI: 1.2–5.3), and having ≥1 hospitalization in the prior six months (aOR: 4.3; CI: 1.8–10.0).

Conclusions: Targeted screening of patients with the above risk factors for *C. auris* can help identify those who are colonized and facilitate implementation of infection control measures to prevent transmission. Antibiotic stewardship may be an important factor in the prevention of C. auris colonization.

4:50 Multidrug-resistant *Shigella sonnei* in a Retirement Community — Vermont, 2018

Authors: Jennifer P. Collins, J. Strysko, V. Fialkowski, Z. Marsh, A. Wadhwa, R. Gharpure, K. Weening, V. Devlin, M. Celotti, C. Achilles, E. Meservey, J. Chen, J. Folster, E. Vidyaprakash, M. Schroeder, A. Adediran, L. Francois Watkins, P. Kelso, C. Friedman, K. Fullerton

Background: During October–November 2018, an outbreak of multidrug-resistant (MDR) *Shigella sonnei* occurred at a Vermont retirement community. In the United States, MDR shigellosis outbreaks primarily occur among men who have sex with men (MSM) and are rare in group residential settings such as retirement communities. We sought to determine modes of transmission and recommend prevention measures.

Methods: We conducted a case-control study using a standardized questionnaire administered to a convenience sample of residents, staff, and visitors that asked about exposures and behaviors pertinent to *Shigella* transmission. A confirmed case was *Shigella sonnei* isolation from stool; a probable case was any diarrheal illness since October 1. Controls met neither of these criteria. Antibiotic susceptibility was determined using broth microdilution. Isolate relatedness was determined using high quality single nucleotide polymorphism (hqSNP) analysis.

Results: We identified 75 cases (24 confirmed, 51 probable). The attack rate was 15% (47/311) among residents and 11% (23/209) among staff. The median age of patients was 80 years (range 21–99 years); 75% were female. Six patients were hospitalized; 2 died. Early cases occurred in food handlers; one had diarrhea at work. We enrolled 35 cases and 173 controls in the study. Illness was associated with eating facility meals during October 11–14, including brunch on October 14 (aOR 5.5; 95% confidence interval = 2.3–13.3). The outbreak strain was not susceptible to ampicillin, trimethoprim/sulfamethoxazole, azithromycin, or ceftriaxone. HqSNP analysis showed outbreak isolates were closely related to one another and to isolates from a cluster that included MSM (0–11 SNPs).

Conclusions: Our findings support predominantly foodborne transmission of this MDR shigellosis outbreak. The facility should review food safety precautions with staff and support exclusion of ill workers. This outbreak underscores that MDR shigellosis does not exclusively affect MSM, and strategies are needed to prevent transmission among other vulnerable populations.

CONCURRENT SESSION D2: Global Health

3:25–5:10 pm

Capitol Ballroom

Moderators: Rebecca Martin and Susan Chu

3:30 Population Structure of a Large Diphtheria Outbreak Among Forcibly Displaced Myanmar Nationals — Bangladesh, 2017–2018

Authors: Marlon G. Lawrence, M.M. Williams, L. Weil, T. Shirin, P. Cassiday, M. Farrque, T. Hossen, Q. Zaki, M. Weigand, G. Maldonado-Quiles, Y. Peng, Z. Habib, A. Alam, A. Muraduzzaman, A. Akram, L. Feldstein, L. Conklin, M. Samad, P. Ahmed, J. Aneke, N. Cook S. Doan, M. Friedman, A. Acosta, S. Hariri, L. Fox, M. Flora, T. Tiwari, M. Tondella

Background: Toxin-producing *Corynebacterium diphtheriae* is the causative agent of diphtheria, a vaccine preventable disease. During December 2017, in response to a suspected diphtheria outbreak among Forcibly Displaced Myanmar Nationals (FDMNs) in Bangladesh, CDC provided technical assistance to confirm the outbreak and strengthen in-country laboratory testing capacity for diphtheria. We characterized *C. diphtheriae* isolates obtained from diphtheria cases among FDMNs and the host Bangladeshi population residing in surrounding communities.

Methods: Biochemical and Elek testing were performed on isolates cultured from 51 FDMNs and 2 Bangladeshi nationals to determine biovar and toxigenicity, respectively. Antibiotic sensitivity was determined by E-test. Illumina whole genome sequencing was performed to determine genetic relatedness and identify putative mutations conferring antibiotic resistance.

Results: *C. diphtheriae* biovar mitis was isolated from 53 (100%) culture-confirmed patients; all but one were toxigenic. Co-infections of non-toxigenic *C. diphtheriae* biovar gravis were detected in 2 (3.6%) culture-confirmed patients infected with *C. diphtheriae* biovar mitis. Penicillin sensitivity was intermediate in 52 (94.5%) isolates. Macrolide resistance was identified in a single non-toxigenic gravis isolate. Seven Multi-Locus Sequence Types (MLST) were observed and the majority of isolates (63.6%) shared ST-453. The outbreak also included 3 novel allele profiles, two of which were most closely related to ST-301 and represented 15 (27.3%) isolates. Isolates from the local Bangladesh nationals clustered with a single FDMN isolate.

Conclusions: Our findings reveal a complex multi-clonal outbreak with multiple lineage of *C. diphtheriae* simultaneously circulating among the FDMN population. Additionally, we identified circulating intermediate resistance to penicillin, one of the primary antibiotics used for diphtheria treatment and post-exposure prophylaxis. Co-infections of genetically distinct *C. diphtheriae* highlight the benefit in testing multiple isolates from individual patients to improve detection of resistant phenotypes.

3:50 Opportunities to Increase HIV Testing Among Adolescent Girls and Young Women — Malawi, 2017–2018

Authors: Melissa M. Arons, A. Maher, D. Payne, S. Shaw, M. Nyangulu, P. Patel, W. Msungama, S. Welty, A. Auld, E. Kim, G. Rutherford, A. Kim, K. Curran

Background: Adolescent girls and young women (AGYW), aged 15–24, in Malawi, have an eight fold higher rate of HIV infection than male counterparts. Early detection of HIV is critical to improve health outcomes and prevent further transmission. We assessed factors associated with previous HIV testing and potential opportunities to increase testing among AGYW in a cross-sectional survey in four districts in Malawi.

Methods: From November 2017 to May 2018, we consecutively enrolled pregnant AGYW who were newly diagnosed with HIV at their first antenatal care visit for their current pregnancy at 121 (of 155) public clinics. Health workers administered a questionnaire to ascertain HIV testing history, clinical history, and risk behaviors. After pooling data for analysis, we computed descriptive statistics and performed multivariable logistic regression to identify correlates of self-reported previous HIV testing.

Results: Among 604 AGYW, 419 (69.4%) reported previous HIV testing. Of AGYW who had not received previous HIV testing, 28.3% (49/173) reported previous pregnancy, 14.0% (24/172) were aware of their partner's HIV positive status and 10.8% (20/185) had previously been treated for a sexually transmitted infection (STI). In multivariable analysis, previous HIV testing, after adjusting for age, was associated with having at least a primary education (adjusted Odds Ratio [aOR]: 3.71; confidence intervals [CI]: 1.79–6.57) and reporting >1 lifetime sex partner (aOR: 1.81; CI: 1.18–2.75) compared to no previous HIV testing.

Conclusions: Missed opportunities for HIV testing exist within routine antenatal care, STI screening and partner testing. AGYW with at least a primary education may have improved access to health services, while those with more than one lifetime sex partner may have increased HIV risk perception. HIV interventions and testing strategies can be adapted to reach women without education and those with low risk perception while programs continue to support women's access to education.

4:10 Molecular Surveillance for Antimalarial Drug Resistance Markers in *Plasmodium falciparum* Cases — Roraima, Brazil, 2016–2017

Authors: Christina M. Carlson, J. Kelley, R. Abdallah, D. Patel, J. Louzada, B. Ezema, V. Udhayakumar, J. Oliveria-Ferreira, E. Talundzic, N. Lucchi

Background: Artemisinin-based combination therapies (ACTs) are standard treatment for *Plasmodium falciparum* (*Pf*) malaria. Resistance to artemisinin and partner drugs is well documented in Southeast Asia and has generated concern over the potential spread of resistant parasites to other regions, threatening ongoing malaria elimination efforts and case management. Recent (2010) detection of independent emergence of *Pf* parasites with the C580Y allele in the k13 gene (a marker of artemisinin resistance) in Guyana motivated a molecular surveillance study in the neighboring state of Roraima, Brazil to monitor for spread of resistance alleles across the region. Here, we report pooled targeted deep amplicon sequencing data on currently known antimalarial drug resistance genes in *Pf* from the Roraima State.

Methods: Dried blood spots were collected in 2016–2017 from patients diagnosed with uncomplicated *Pf* malaria in three sites in Roraima State: Pacaraima, Boa Vista, and Rorainopolis. The CDC-developed next generation sequencing Malaria Resistance Surveillance (MaRS) method was used to generate molecular data for drug resistance genes. Data analysis was performed using the MaRS Next-generation Sequence-analysis Toolkit (NeST).

Results: Of 204 initial samples, 194 were successfully sequenced and no associated or confirmed k13 artemisinin resistant mutations were found. All samples exhibited known *pfcrt* mutations associated with chloroquine resistance and mutations in *dhfr* and *dhps* genes associated with sulphadoxine-pyrimethamine resistance. Interestingly, the C350R mutation, associated with ACT partner drug piperaquine resistance and a reversal to chloroquine sensitivity, was found at an allele frequency of 18%.

Conclusions: This study found no artemisinin resistant mutations in *Pf* in samples from the State of Roraima. However, molecular markers associated with chloroquine, sulphadoxine-pyrimethamine, and piperaquine resistance were observed. Given the high mobility of people in this region, continued molecular surveillance will be important to monitor the emergence, selection, and spread of drug resistant mutations in the border region.

4:30 Risk Factors for Cholera Deaths During an Urban Outbreak — Lusaka, Zambia, 2017–2018

Authors: Alison V. Winstead, L. Mutale, P. Sakubita, F. Kapaya, N. Langa, F. Nanzaluka, N. Sinyange, C. Nakazwe, S. Nyimbili, R. Narra, S. Kim, E. Yard, E. Mintz, M. Riggs, J. Brunkard

Background: A cholera outbreak was declared in Lusaka (the capital of Zambia) on October 6, 2017. By mid-December, 20 of 661 reported cases had died (case fatality rate [CFR] 3%), prompting the Zambia Ministry of Health, Zambia National Public Health Institute, and CDC to investigate risk factors for cholera mortality.

Methods: We conducted a study of cases (cholera deaths from October 2017–January 2018) matched by age group and onset date to controls (persons admitted to a cholera treatment center [CTC] and discharged alive). A questionnaire was administered to a family member of each located decedent and each cholera survivor (or a relative). We used univariate exact conditional logistic regression to calculate odds ratios (OR) and 95% confidence intervals (CIs) for risk factors associated with cholera mortality.

Results: We conducted interviews for 38 cases and 76 controls. Median ages for cases and controls were 37 (range: 0.5–95) and 26 (range: 1–82), respectively; 55% of cases and 58% of controls were male. Decedents were more likely than survivors to be >55 years old (26% versus 4%; OR = 9.3, 95% CI = 2.0–87.8, P<0.05) and more likely to have completed less than primary education (62% versus 35%; OR = 10.3, 95% CI = 2.3–94.5, P<0.05). Decedents were less likely to receive immediate oral rehydration solution (ORS) upon presentation at the CTC than survivors (29% versus 73%; OR = 0.1, 95% CI = 0.0–0.6, P<0.05).

Conclusions: Older age and lower education were risk factors for cholera death. Early treatment with ORS was protective, underscoring its critical importance. ORS should be available at the household level and promoted as a first step in cholera treatment in areas experiencing cholera. Cholera prevention and outbreak response should include focused efforts on ensuring access to timely and appropriate care for elderly and less educated populations at home and in health facilities.

4:50 Risk Factors Associated with Increased Mortality from Intussusception in African Infants

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

Background: Intussusception, or the invagination of one segment of the intestine within another segment, has been associated with rotavirus vaccination in high- and middle-income countries. Because mortality from intussusception is higher in Africa than in other regions of the world, we examined potential risk factors to help inform the implementation of rotavirus vaccines in the region.

Methods: Infants with intussusception from 7 sub-Saharan African countries (Ethiopia, Ghana, Kenya, Malawi, Tanzania, Zambia, and Zimbabwe) were enrolled through active, hospital-based surveillance from February 2012 to December 2016. We examined demographic, clinical, and socioeconomic factors associated with death or intestinal resection following intussusception, using multivariable logistic regression.

Results: A total of 1020 infants <1 year of age with intussusception were enrolled. Overall, 13% of children (133/1020) died during the hospitalization, and 48% (467/969) required intestinal resection. The median duration of symptoms prior to hospitalization at the sentinel facility was 3 days (interquartile range: 1–4), and the median duration of symptoms prior to hospitalization at any hospital was 2 days (interquartile range: 0–3). In multivariable analyses, female sex (OR 1.8, 95% confidence interval [CI] 1.2–3), longer duration of symptoms prior to presentation (OR 1.1; 95% CI: 1.0–1.2), and undergoing intestinal resection (OR 3.3; 95% CI: 1.9–5.9) predicted death after intussusception. Radiologic diagnosis (OR 0.4; 95% CI: 0.3–0.7), presence of electricity at home (OR 0.5, 95% CI: 0.3–0.7), and employment by a household member (OR 0.6; 95% CI: 0.4–0.9) were associated with a reduced likelihood of undergoing intestinal resection.

Conclusions: Delays in hospital presentation and female sex were significantly associated with death, whereas higher socioeconomic status and availability of radiologic diagnosis reduced requirement for intestinal resection. Efforts are needed to improve the awareness, diagnosis, and management of intussusception in sub-Saharan Africa, especially in resource poor settings.

CONCURRENT SESSION E1: Immunization

8:30–10:15 am

Grand Ballroom

Moderators: Cindy Weinbaum and Cristina Cardemil

8:35 Human Papillomavirus Prevalence Among Females in the United States, Overall and By Race/Ethnicity, National Health and Nutrition Examination Survey, 2003–2006 and 2013–2016

Authors: Nancy M. McClung, R. Lewis, J. Gargano, T. Querec, E. Unger, L. Markowitz

Background: Since introduction of human papillomavirus (HPV) vaccination in 2006, prevalence of HPV vaccine types has been decreasing among young women in the United States. To monitor ongoing vaccine impact, we evaluated quadrivalent vaccine (4vHPV)-type prevalence in the pre-vaccine (2003–2006) and vaccine (2013–2016) eras overall and by race/ethnicity in the National Health and Nutrition Examination Survey (NHANES).

Methods: We analyzed HPV DNA prevalence in self-collected cervicovaginal specimens and demographic characteristics, sexual behavior, and self/parent-reported vaccination status from females 14–34 years-old. We compared pre-vaccine to vaccine era 4vHPV-type prevalence, using unadjusted and adjusted prevalence ratios (PR and aPR) and 95% confidence intervals (CIs). PRs were calculated by race/ethnicity (non-Hispanic White [NHW], non-Hispanic Black [NHB], Mexican American [MA]). Overall aPRs were adjusted for race/ethnicity, lifetime sex partners, and poverty.

Results: Overall, 4,674 females had valid HPV typing results and 3,915 reported NHW, NHB, or MA race/ethnicity. Vaccination coverage of >1 dose was 53.9% among 14–19 year-olds (NHW 52.6%, NHB 58.1%, MA 59.5%) and 51.5% among 20–24 year-olds (NHW 58.8%, NHB 45.0%, MA 33.8%). 4vHPV-type prevalence decreased from the pre-vaccine to vaccine era in 14–19 year-olds overall (11.5% to 1.8%; aPR = .14 [95% CI: .08–.24]) and in NHW (PR = .14 [95% CI: .06–.29]), NHB (PR = .26 [95% CI: .12–.54]), and MA (PR = .13 [95% CI: .03–.53]). In 20–24 year-olds, 4vHPV-type prevalence decreased overall (18.5% to 5.3%; aPR = .29 [95% CI: .15–.56]) and in NHW (PR = .27 [95% CI: .11–.67]) and NHB (PR = .38 [95% CI: .18–.80]).

Conclusions: Within 10 years of vaccine introduction, 4vHPV-type prevalence declined 86% among 14–19 year-olds, with similar declines in NHW, NHB and MA, and 71% among 20–24 year-olds, with variation by race/ethnicity likely explained by vaccination coverage. These extraordinary declines should lead to substantial reductions in HPV-associated cancers.

8:55 Unexpected Change in Pertussis Patterns — Maine, 2018

Authors: Jennifer A. Sinatra, J. Mackenzie

Background: Pertussis is a highly contagious vaccine-preventable respiratory disease caused by *Bordetella pertussis*. Since 2014, Maine has had one of the highest pertussis rates in the United States. For 2013–2017, Maine Center for Disease Control and Prevention (MCDCP) identified a median of 51 cases during September–October (range 13–67). During September–October 2018, case counts more than doubled. To better understand pertussis dynamics in Maine, we compared 2018 case reports with those reported during 2011–2017.

Methods: Pertussis data reported during January 2011–October 2018 were retrieved from Maine's National Electronic Disease Surveillance System Base System. Incidence rates were calculated by age groups (<1 years, 1 to 6 years, 7 to 10 years, 11 to 18 years, and >18 years) using U.S. Census Bureau data. Proportion of patients with vaccination appropriate for age was calculated based on CDC's immunization schedule. Comparisons were made between 2018 and 2011–2017 aggregate estimates.

Results: We identified 332 confirmed or probable pertussis cases during 2018. Highest incidence was among children aged <1 year (265.6/100,000 population) followed by children aged 1 to 6 years (131.7/100,000 population); these rates were higher than the 2011–2017 mean incidence for these age groups (156.1/100,000 population and 85.6/100,000 population, respectively). Pertussis incidence decreased in 2018 for all other age groups. Among patients, significantly more were appropriately vaccinated in 2018 versus the 2011–2017 mean (83.3% vs 61.1%, $P<0.05$). In 2018, 87.8% of children with pertussis aged <7 years were appropriately vaccinated, compared to the 2011–2017 mean of 68.8% ($P<0.05$).

Conclusions: Pertussis incidence among Maine children aged <6 years increased in 2018 despite improved vaccination among patients across age groups. MCDCP is investigating possible reasons for this increase, including non-compliance with vaccine storage recommendations, and potential blunting of the child's immune response associated with maternal immunization.

9:15 Deltoid Bursitis as an Adverse Event Following Injectable Influenza Vaccine in the Vaccine Safety Datalink — United States, 2016–2017

Authors: Elisabeth M. Hesse, E. Weintraub, D. Getahun, L. Jackson, O. Zerbo, C. Zheng, J. Duffy

Background: Deltoid bursitis, characterized by pain and loss of motion in the shoulder, has been reported as an adverse event following intramuscular vaccination in the deltoid muscle. The majority of published case reports involved influenza vaccine, which is recommended annually for people aged ≥6 months. Our objective was to estimate the risk of deltoid bursitis following influenza vaccination during the 2016–2017 season.

Methods: This retrospective study utilized the Vaccine Safety Datalink (VSD) which comprises 10.2 million members of seven U.S. health care organizations. To identify potential incident cases, we searched for people with medical visits with a shoulder bursitis code (*International Classification of Diseases*-10-Clinical Modification) within 180 days after receiving an injectable influenza vaccine in the same arm. People with shoulder conditions in that arm prior to vaccination were excluded. Bursitis onset was assigned as the date of the first medical visit for a shoulder diagnosis in the vaccinated arm. We used Poisson regression to perform a self-controlled risk interval analysis and calculate the incidence rate ratio (IRR) of bursitis in a risk interval of 0–7 days following vaccination compared to the control interval of 60–90 days, which represents the background rate.

Results: 2,943,493 VSD members were vaccinated, among whom 118 were cases in the risk and 192 in the control interval. The median age of risk interval cases was 59 years (range 16–89) and 52.5% were male. The IRR was 2.38 (95% CI: 1.89–2.99), with an overall incidence of 4.01 cases per 100,000 people vaccinated.

Conclusions: We quantified an association between deltoid bursitis and injectable influenza vaccine among those without known pre-existing shoulder conditions. While the risk of bursitis is present, the absolute risk is small. Further work is needed to identify prevention strategies.

9:35 Interventions to Reduce Measles Exposures in Outpatient Healthcare Facilities — New York City, 2018

Authors: Karen A. Alroy, N.M. Vora, J.B. Rosen, R. Arciuolo, B.M. Isaac, A. Jean, M. Asfaw, M. Iwamoto, D.H. Benkel, B.Crouch, A. Geevarughese, K. Graham, D. Daskalakis, J.R. Zucker

Background: Measles virus is highly contagious and remains airborne for 2 hours after an infected person's cough or sneeze. It causes rare but severe complications including pneumonia, miscarriage, and death. Because patients are infectious before rash onset, preventing measles exposures in healthcare facilities (HCF) is challenging. During September 30–December 10, 2018, New York City (NYC) experienced an ongoing measles outbreak; >2000 persons were exposed to measles in HCF settings. The NYC Department of Health and Mental Hygiene (DOHMH) recommended screening for measles symptoms or exposures, patient education, and alternative isolation procedures when negative pressure rooms were unavailable. We describe interventions taken for reducing measles exposures in outpatient HCFs.

Methods: A standard questionnaire was used to survey infection control staff from all 17 outpatient HCFs that had measles exposures. HCF exposures occurred when patients with measles entered a facility through 2 hours after departure or appropriate isolation. The questionnaire was administered by telephone on December 10–12, 2018, and included 14 questions about measles screening practices, facility infrastructure, and procedures for seeing patients with suspected measles.

Results: Fifteen (88%) of 17 HCFs responded to the survey. Among responding HCFs, 87% (13/15) instituted telephone-based screening for measles symptoms while scheduling appointments, 73% (11/15) screened at check-in, and 100% (15/15) posted signs about measles symptoms. No HCFs reported having a negative pressure room, and 60% (9/15) had written protocols to minimize measles exposures. Most HCFs, 87% (13/15), established alternative isolation procedures for potentially infectious patients, compatible with their clinic space and acceptable for staff, including separate entrances, examinations outside, after-hours examinations, and at home visits.

Conclusions: Most HCFs implemented DOHMH-recommended interventions. While negative pressure rooms are uncommon in outpatient settings, HCFs identified creative solutions to prevent healthcare-associated measles exposures. In a postelimination measles era, preventing HCF exposures can contribute to outbreak control.

9:55 Vaccine Effectiveness Against Influenza A(H3N2)-Related Illness Among Children and Adolescents — United States, 2017–18

Authors: Chandresh N. Ladva, J. Chung, A. Monto, E. Martin, M. Gaglani, M. Reis, M. Jackson, L. Jackson, R. Zimmerman, M. Nowalk, E. Belongia, H. McLean, M. Patel, S. Garg, A. Fry, B. Flannery

Background: During the 2017–18 influenza season, when A(H3N2) circulation predominated over A(H1N1) and B viruses, the United States experienced the highest influenza hospitalization rate since the 2009 pandemic. Vaccination provides protection against influenza, but it has been less effective against A(H3N2) viruses than others. Distinct A(H3N2) viruses emerged in 2014. Because initial influenza infections shape later immune responses to vaccine strains, we compared differences in vaccine effectiveness (VE) against A(H3N2)-related illness among children born before and after 2014.

Methods: We examined VE against laboratory-confirmed influenza among children aged ≥6 months to 17 years with acute respiratory illness from 36 clinics in 5 states during the 2017–18 season. Vaccination status derived from medical records and immunization registries was compared using χ^2 tests. We stratified analyses by birth before versus after 2014. VE and 95% confidence intervals (CI) were estimated with logistic regression models as (1–adjusted odds ratio of vaccination) among A(H3N2)-positive cases versus influenza-negative controls. We tested an interaction term for difference by birth year.

Results: Between November 2017–April 2018, we enrolled 2,927 patients; 631 (22%) tested positive for A(H3N2), 444 (15%) for A(H1N1) or B, and 1,852 (63%) tested negative. Among 508 A(H3N2) cases and 1,106 controls born before 2014, 34% versus 40% were vaccinated, respectively ($p<0.52$). Among 123 A(H3N2) cases and 746 controls born since 2014, 37% versus 57% received vaccine ($p<0.01$). After adjusting for state, enrollment month, race/ethnicity, and presence of ≥1 high-risk condition, VE was 24% (95% CI: 4–40%) against A(H3N2) among children born before 2014, and 53% (95% CI: 29–69%) among children born since 2014 (interaction: $p<0.04$).

Conclusions: Children born before 2014 had reduced VE against A(H3N2) during 2017–18, suggesting early exposures, and other potential factors, may have influenced response to vaccination. Improved vaccines are needed to provide protection regardless of viral exposure history.

CONCURRENT SESSION E2: Chronic Disease and Health

8:30–10:15 am

Capitol Ballroom

Moderators: Peter Briss and Andrea Sharma

8:35 Insufficient Sleep and Obesity Among Adults — United States, 2013–2016

Authors: Kendra B. McDow, L. Akinbami, D. Nguyen

Background: Sleep is essential for health. Insufficient sleep (<7 hours of sleep/night) has been associated with obesity, as well as with diabetes, hypertension, stroke and all-cause mortality. In 2015–2016, 40% of U.S. adults had obesity. We aimed to determine the prevalence of insufficient sleep among adults and the adjusted association with obesity using nationally representative data with measured weight and height.

Methods: National Health and Nutrition Examination Survey 2013–2016 data for adults ≥20 years (n = 10,094) were used in this study. Adults with insufficient sleep were compared to those with adequate sleep (7–<10 hours). Differences between age-adjusted group estimates were tested using a chi-square test. Logistic regression assessed associations between insufficient sleep and weight status adjusted for covariates. SAS-callable SUDAAN was used to account for the complex survey design.

Results: Overall, 28.8% of adults had insufficient sleep. By weight status, 31.4% of adults with obesity (BMI> = 30) and 28.5% of overweight adults (30>BMI> = 25) had insufficient sleep compared with 25.7% of underweight/normal weight adults (BMI>25). Prevalence of insufficient sleep also varied by demographic subgroups: higher prevalence was observed among men (30.6%), adults 40–59 years old (32.8%), non-Hispanic black (44.9%) and those with less than high school education (32.0%) (Chi-square $P<.05$). Insufficient sleep was associated with overweight and obesity in bivariate regression (OR 1.2, 95% CI: 1.0–1.3 and OR 1.3, 95% CI: 1.2–1.5). In adjusted analysis, only the association with obesity persisted (AOR 1.2; 95% CI: 1.1–1.4).

Conclusions: Over a quarter of U.S. adults have insufficient sleep, with greater odds among adults with obesity after adjustment for demographic characteristics also associated with insufficient sleep. Additional research is needed to determine the relationship between insufficient sleep and obesity in adults to guide interventions to attenuate health risks associated with these conditions.

8:55 Intake and Food Sources of Dietary Sodium Among Adults by Blood Pressure Status — United States, 2015–2016

Authors: Rebecca C. Woodruff, J. Ahuja, C. Gillespie, A. Moshfegh, D. Rhodes, A. Terry, L. Zhao, M. Cogswell

Background: High blood pressure (BP) raises the risk of cardiovascular disease. Decreasing mean sodium intake to 2,300 mg/day, a Healthy People 2020 target, can reduce BP with greater effects among adults with hypertension. This analysis aimed to estimate sodium food sources by BP status to guide sodium reduction efforts overall and among adults with hypertension.

Methods: Respondents to the 2015–2016 National Health and Nutrition Examination Survey who were aged ≥19 years and not pregnant or lactating (n = 4,926) were classified as having normal BP (<120/80 mmHg, n = 1,173); elevated BP (systolic BP 120–129 and diastolic BP <80 mmHg; n = 667); or hypertensive BP (systolic BP ≥130, diastolic BP ≥80 mmHg, or reported taking antihypertensive medication; n = 2,546). Foods consumed and reported on a 24-hour dietary recall were linked with nutrient data to estimate population mean sodium intake ± standard error and identify top sodium food sources by BP status.

Results: Mean sodium intake was 3,573 ± 61 mg/day among adults with normal BP; 3,699 ± 61 mg/day among adults with elevated BP; and 3,472 ± 66 mg/day among hypertensive adults. The top 10 food sources were similar by BP status and accounted for 44% of sodium intake. The top 5 mutually exclusive sources overall—sandwiches, cured meats (e.g., bacon), pizza, burritos and tacos, and breads or rolls—ranked among the top 10 in each BP group.

Conclusions: Though sodium intake was lowest among hypertensive adults, it was above target levels among all BP groups and came from similar sources. These findings provide support for National Academy of Medicine (formerly IOM) recommendations to prevent and control hypertension by working with industry to reduce sodium added to commercially processed and prepared (e.g., restaurant) foods and for encouraging consumers to choose foods lower in sodium (e.g., fruits/vegetables).

9:15 Prevalence, Awareness, Control, and Trend of Diabetes, Hypertension, Hypercholesterolemia, and Hypertriglyceridemia Among Adults in Jordan: A Cross-sectional Study, Jordan, 2018

Authors: Sa'ed Assaf, I. Ablan, A. Abuslaih, Y. Khader

Background: Diabetes mellitus (DM), hypertension, and lipid abnormalities are the major risk factors of cardiovascular disease. This study aimed to determine the prevalence, awareness, and control rates of diabetes, hypertension, hypercholesterolemia, and hypertriglyceridemia among Jordanian adults.

Methods: A multistage sampling technique was used to select a nationally representative sample of adults from the population of Jordan in 2018. Trained interviewers collected data using a questionnaire and collected blood specimens. The studied conditions were diagnosed based on the International Diabetes Federation criteria. The findings from this survey were compared with those from the 1994 survey that used the same methods and diagnostic criteria. The age-standardized prevalence rates (95% confidence intervals) were calculated. Z-test was used to compare proportions of the two surveys at α of 0.05.

Results: This study included 1,193 men and 2,863 women aged from 18 to 90 years with a mean (SD) of 43.8 (14.2) year. The ASR of DM were 32% (29%–35%) among men and 18% (17%–19%) among women. The ASRs of hypertension were 34% (31%–37%) among men and 29% (27%–31%) among women. Overall, the ASR of hypercholesterolemia and hypertriglyceridemia were 44% (42%–46%) and 42% (40%–44%), respectively. Compared to ASRs in 1994, the ASRs in 2018 increased significantly by 10% for DM ($p < 0.001$), 4% for hypertension ($p = 0.033$), and 20% for hypercholesterolemia ($p < 0.001$), and 18% for hypertriglyceridemia ($p < 0.001$). Of all patients with DM in 2018, 84% were aware of diagnosis and 41% of treated patients had good glycemic control. Of those with hypertension, 61% were aware of hypertension and only 34% of those on treatment had controlled blood pressure.

Conclusions: The prevalence rates of DM, hypertension, and lipid abnormalities were considerably high, increasing, and they are poorly controlled. Therefore, health care systems should be strengthened for effective prevention and management of these conditions.

9:35 The New "Cool" in School: A Media Content Analysis of JUUL Use Among U.S. Schools

Authors: Mays Shamout, R. Glover-Kudon, K. Marynak, S. Sturgis, Y. Gomez, B. Theodore, I. Agaku

Background: During 2017–2018, e-cigarette use among U.S. high school students increased by 77.7%, coinciding with the emergence of JUUL, a USB drive-shaped e-cigarette with high nicotine content popularly used among students. Although anecdotal reports indicate frequent JUUL use among students on school premises, we lack information on how schools are responding. To fill knowledge gaps and provide formative research for future surveillance, a media content analysis was conducted to qualitatively assess JUUL use among U.S. students, as well as school administrators' responses.

Methods: We searched U.S. online media published during August 2017 to November 2018 by using Cision, a global media database. Articles were selected if they: (1) involved an interview with a school staff member; and (2) mentioned a JUUL device confiscated from a student. Thematic analyses were performed to qualitatively describe characteristics of confiscated products, burden or patterns of use, and school efforts to curb use.

Results: School administrator responses were assessed from 33 states, and D.C. principals and other school staff described the burden of the problem in varying ways, including: rate of device confiscation (e.g., 2 devices/week), cumulative devices confiscated (e.g., 40 devices), or the record number of confiscations observed in a week (e.g., 8 devices). Frequent places JUUL was reportedly used included bathrooms, classrooms, and hallways. School administrators responded by patrolling hallways and bathrooms, installing video cameras and environmental sensors, and reaching out to parents through meetings and newsletters. Disciplinary measures ranged from counseling referral to law enforcement.

Conclusions: JUUL use by students in schools has received media coverage in the United States and showed varied administrator responses. Continued surveillance of this emerging public health threat can guide efforts to prevent use of e-cigarettes by youth, including in schools.

9:55 Use of an Environmental Burden Index for Health Outcome Research — United States, 2018

Authors: Amy M. Lavery, S. Foster, J. Kolling, B. Lewis, I. Dunn, R. Funk, A. Dent

Background: People encounter a wide range of environmental factors which may contribute to chronic disease and inflammatory responses. To explore health associations with multiple environmental factors, CDC/ATSDR created an Environmental Burden Index (EBI), combining data on air pollution, industrial sites, and aspects of the built environment. This is the first study evaluating the utility of the EBI and its relationship to health indicators.

Methods: U.S. census tracts were assigned percentile rankings for particulate matter ($PM_{2.5}$), ozone, industrial sites, proximity to transportation, and proximity to greenspace, and a total EBI ranking summarizing all components. Health data were gathered from National Health and Nutrition Examination Survey (2007–2010) participants and assigned EBI rankings based on the participant's census tract of residence (N = 8,900). Biomarkers of inflammation and chronic disease and chronic disease status (diabetes, asthma, cardiovascular disease) were compared to EBI. Weighted logistic regression assessed total EBI and individual EBI components as predictors of health indicators.

Results: Total EBI and $PM_{2.5}$ rankings were associated with diabetes (EBI Odds Ratio [OR]: 1.80; 95% Confidence Interval [CI] 1.3–2.47, $PM_{2.5}$ OR: 1.66; 95% CI: 1.26–2.22). Rankings for individual components of the EBI were associated with several health indicators, including $PM_{2.5}$ and elevated hemoglobin (OR: 1.42; 95% CI: 1.02–1.99), and inverse ranking of greenspace and elevated diastolic blood pressure (OR: 0.50; 95% CI: 0.76–0.93), total cholesterol (OR: 0.67; 95% CI: 0.48–0.94) and triglycerides (OR: 0.63; 95% CI: 0.45–0.90).

Conclusions: This analysis revealed associations between health indicators and EBI percentile rankings. Specifically, $PM_{2.5}$ may increase health risks related to diabetes while greenspace may have protective effects on health indicators. Uncovering these associations supports the use of the EBI as an investigative tool for environmental health studies. Improving our understanding of how the EBI and underlying data sources are associated with health indicators will strengthen our understanding of how environmental burden affects public health.

SESSION F: Donald C. Mackel Award Finalists

10:35 am–12:00 pm

Grand Ballroom

Moderators: Michael Iademarco and Wences Arvelo

10:40 Coagulopathy Caused by Brodifacoum Rodenticide Poisoning Among Persons Who Smoke Synthetic Cannabinoids — Wisconsin, 2018

Authors: Erica F. Wilson, N. Stanton, M. Roach, A. Schumacher, G. Christensen, D. Patel, D. Gummin, C. Tomasallo, J. Meiman

Background: On March 30, 2018, the Wisconsin Division of Public Health (WDPH) was notified of coagulopathy caused by brodifacoum poisoning associated with synthetic cannabinoid (SC) use. Brodifacoum is a long-acting anticoagulant rodenticide. Poisoning can result in life-threatening coagulopathy and requires lengthy Vitamin K treatment; if treatment is discontinued early, coagulopathy can reoccur. To improve detection and guide treatment length, the Wisconsin State Laboratory of Hygiene (WSLH) developed a quantitative brodifacoum assay not available at commercial laboratories. We sought to find additional cases and examined the utility of quantitative assay results.

Methods: Probable cases had coagulopathy with either SC use in the prior 3 months or detectable brodifacoum; confirmed cases had both. Wisconsin Poison Center and hospitals were asked to report cases to WDPH and submit specimens to WSLH for testing; WDPH and local health departments interviewed patients.

Results: During March 30–October 31, WDPH identified 17 probable and 69 confirmed cases in 3 distinct clusters. Of these 86 patients, 84 were hospitalized and 1 died. Patients' median age was 35 years (range 16–63 years); 57 (66%) were male. Among 60 interviewed patients, the most common bleeding symptom was hematuria (77%). WSLH tested 73 patients; median brodifacoum level on initial presentation was 70.1 µg/L (range: 1.85–419 µg/L). Eighteen patients had repeat measurements. Fourteen patients had decreased brodifacoum levels (median decrease: 34.3 µg/L, range: 0.15–353.7 µg/L); median time between measurements was 32 days (range: 2–102 days). Five patients had increased brodifacoum levels (including one patient with a subsequent decreased level) (median increase: 82.9 µg/L, range: 11.4–150 µg/L); median time between measurements 72 days (range: 65–73 days).

Conclusions: We confirmed the brodifacoum poisoning outbreak with distinct clusters and reexposures suggesting continued contaminated SC availability. Few patients had repeat quantitative tests limiting its use to monitor treatment duration.

11:00 *Corynebacterium pseudodiphtheriticum* Identified as a Potential Cocirculating Pathogen During a Large Diphtheria Outbreak — Bangladesh, 2017

Authors: Lauren M. Weil, M. Williams, M. Lawrence, T. Shirin, P. Cassiday, M. Tondella, J. Aneke, N. Cook, G. Maldonado-Quiles, M. Farrque, J. Waller, M. Diaz, J. Winchell, T. Hossen, L. Feldstein, Q. Zaki, Z. Habib, A. Alam, A. Muraduzzaman, A. Akram, L. Conklin, S. Doan, M. Friedman, A. Acosta, S. Hariri, L. Fox, M. Flora, T. Tiwari

Background: Respiratory diphtheria, caused by toxin-producing strains of *Corynebacterium diphtheriae,* is characterized by a firmly adherent grey pseudomembrane. Other nontoxigenic corynebacteria, such as *C. pseudodiphtheriticum*, have been reported to cause exudative pharyngitis mimicking a pseudomembrane. In late 2017, a suspected diphtheria outbreak occurred in makeshift camps housing Forcibly Displaced Myanmar Nationals in Bangladesh. A CDC team provided technical laboratory and epidemiologic assistance to confirm *C. diphtheriae* as the causative agent and to characterize the outbreak.

Methods: We developed and implemented a protocol to collect paired throat and nasal swabs from patients at two diphtheria treatment centers during December 19–25, 2017. We used a standardized data collection form to extract clinical information from patient triage notes. We defined severe disease as a membranous pharyngitis lasting ≥3 days, with neck swelling and/or lymphadenopathy. Throat swabs were tested in Bangladesh and nasal swabs were later tested at CDC. Swabs were tested for toxigenic *C. diphtheriae* by real-time (RT) PCR and culture. A large number of *C. pseudodiphtheriticum* isolated from nasal swab cultures prompted an investigation of the presence of this organism in nasal swabs by RT-PCR.

Results: Among 382 patients with suspected diphtheria, nasal or throat swabs from 153 (40%) tested positive for toxigenic *C. diphtheriae* by RT-PCR; 31 (20%) PCR-positive specimens were culture-confirmed. Testing of nasal swabs by RT-PCR revealed that 78% (297/382) were positive for *C. pseudodiphtheriticum*; of which 48 (16%) were also positive for *C. diphtheriae*. Severe disease was less common in patients from whom only *C. pseudodiphtheriticum*, as compared to both species, was detected (43% vs. 58%, $P = .022$).

Conclusions: We identified a unique laboratory-confirmed diphtheria outbreak with a high codetection rate of *C. pseudodiphtheriticum*. The potential of *C. pseudodiphtheriticum* to cause diphtheria-like illness may impact patient treatment and outbreak management and needs further investigation.

11:20 Bloodstream Infections with a Novel Nontuberculous *Mycobacterium* Among Oncology Clinic Patients — Arkansas, 2018

Authors: Sarah M. Labuda, H. Moulton-Meissner, K. Garner, P. Yu, E. Bolton, R. Pierce, O. Atiq, J. Wheeler, M. Cima, J. Thompson, M. Crist, D. Gomes, N. Charles-Toney, P. Gable, A. Halpin, G. McAllister, A. Lawsin, N. Patil, R. Bradsher, K. Vyas, D. Haselow

Background: In July 2018, the Arkansas Department of Health (ADH) was notified by Hospital A of three cases of bloodstream infections with a rapidly growing, nontuberculous *Mycobacterium* (NTM) species; six additional cases were reported on September 5, 2018. All were cancer patients at Clinic A. We report here efforts directed at identifying a novel infectious agent.

Methods: ADH performed an onsite investigation at Clinic A on September 7, 2018. Clinic A provided environmental and product samples, and cultures from asymptomatic patients with mediports accessed at the clinic during March 22–September 12, 2018; Hospital A provided records and culture isolates from symptomatic patients. CDC cultured samples and performed matrix-assisted laser desorption/ionization time-of-flight mass spectrometry and sequencing (16S ribosomal RNA, *rpoB* genes, and whole genome) to identify organisms and determine relatedness.

Results: As of October 31, a total of 52 (33%) cancer patients among 157 with mediports accessed during the investigation period at Clinic A had blood cultures positive for the same NTM. Infected patients received a median of 5 (range: 1–17) saline flushes during the investigation period. The organism grew from four saline flushes provided by Clinic A. Species identified was novel and designated *Mycobacterium FVL 201832.* Whole-genome sequencing showed isolates from cases and saline flushes were highly related (0–10 single-nucleotide polymorphisms), indicating a common source. Onsite investigation identified staff making saline flushes by drawing from intravenous fluid bags; Clinic A changed to prefilled saline flushes on September 12.

Conclusions: Novel *Mycobacterium FVL 201832* caused bloodstream infections in oncology clinic patients. Laboratory data allowed investigators to rapidly link infections to contaminated saline flushes; cooperation among multiple institutions resulted in timely outbreak resolution. Policy changes ADH considered because of this outbreak included adding NTM to ADH's reportable disease list and regulating outpatient cancer clinics.

11:40 Novel Serotype of Enteroinvasive *Escherichia coli* Associated with a Party — North Carolina, June–July 2018

Authors: Carolyn T.A. Herzig, A. Fleischauer, B. Lackey, N. Lee, T. Lawson, Z. Moore, J. Hergert, V. Mobley, J. MacFarquhar, T. Morrison, N. Strockbine, H. Martin

Background: On July 2, 2018, the North Carolina Division of Public Health was notified that ~38 members of an ethnic Nepali immigrant community were transported to area hospitals for severe gastrointestinal illness after consuming food at a potluck on June 30. We investigated to identify the cause of the outbreak.

Methods: We reviewed medical records, conducted a retrospective cohort investigation, and coordinated laboratory testing. A case of gastroenteritis was defined as diarrhea, vomiting, or temperature ≥100°F in a person who consumed food from the party. One hospital used a commercial multiplex polymerase chain reaction (PCR) assay; the State Laboratory of Public Health (SLPH) employed culture for enteric pathogens and PCR for Shiga toxin genes stx_1 and stx_2; and CDC used a molecular guided approach for isolation.

Results: Fifty-two of ~100 attendees met the case definition; 28 (54%) were hospitalized and 8 (15%) admitted to intensive care. Forty-nine attendees (35 ill) were interviewed. Although no specific food was statistically associated with illness, persons who ate chicken curry were more likely to become ill than those who did not (risk ratio: 1.47; 95% CI: 0.76–2.83). Food was not available for testing. Stool PCR assays from 25 persons were positive for *Shigella*/Enteroinvasive *Escherichia coli* (EIEC). However, among 24 specimens tested at SLPH, no enteric pathogens grew on culture media and all were PCR-negative for Shiga toxin genes. Ultimately, CDC identified novel EIEC serotype O8:H19 from 12 patient specimens.

Conclusions: A novel EIEC serotype caused the outbreak, likely through a food vehicle. This represents the first reported U.S. outbreak of EIEC in >40 years. *Shigella* was initially suspected based on preliminary PCR results and because domestic EIEC infections are rare. However, clinical and epidemiologic findings appeared more consistent with EIEC leading to use of advanced molecular methods and detection of a novel organism.

SESSION G1: Poster Symposium

1:25–3:00 pm

The Symposium begins in the Grand Ballroom with each presenter providing a 2-minute overview. Afterward, poster viewing will occur inside the Grand Ballroom.

Moderators: Wendy Bamberg and Tala Fakhouri

G1.1 Exchange Sex Among High School Students — Washington, DC, 2017

Authors: Sara K. Head, D. Eaton, P. Lloyd, A. McLaughlin, J. Davies-Cole

Background: Exchanging sex for drugs or money is associated with sexually transmitted diseases and HIV. Approximately 5% of youth age 11–27 in the United States have exchanged sex; prevalence in the District of Columbia (DC) was unknown. We sought to identify prevalence and correlates of exchange sex among DC high school students.

Methods: We analyzed data from the 2017 DC Youth Risk Behavior Survey, a cross-sectional survey of students in grades 9–12 (n = 8,578). We assessed exchange sex with the question "Have you ever been given money, a place to stay, food, or something else of value in exchange for sex?" We calculated descriptive statistics and used multivariable logistic regression to examine associations between exchange sex and demographic characteristics, home environment, and drug use.

Results: In 2017, a total of 7.4% (95% CI: 6.6–8.2) of students reported having ever exchanged sex. Odds of exchange sex were higher among male students (adjusted odds ratio [AOR]: 2.5; 95% CI: 1.6–4.0) and students who had sexual contact with partners of both sexes, compared with students having sexual contact with partners of opposite sex only (AOR: 2.4; 95% CI: 1.2–4.9). Exchange sex was also associated with having been kicked out of home, run away, or abandoned in the past 30 days (AOR: 10.7; 95% CI: 7.0–16.3]); going hungry in the past 30 days (AOR: 2.2; 95% CI: 1.1–4.5); and ever using synthetic marijuana (AOR: 2.6; 95% CI: 1.3–5.0) or cocaine, heroin, methamphetamines, or ecstasy (AOR: 2.9; 95% CI: 1.6–5.3]), compared with those who had not.

Conclusions: Approximately 1 in 14 DC high school students report having ever exchanged sex. DC programs providing services to youth with unstable housing, food insecurity, or who use drugs should consider incorporating sexual health services to address exchange sex practices.

G1.2 Mercury Toxicity Associated with Ayurvedic Medications — California, 2018

Authors: Amy P. Heinzerling, T. Barreau, L. Copan, J. Talarico

Background: Mercury has been shown to have endocrine-disrupting effects in humans and animals. In February 2018, the California Department of Public Health was notified of a woman with an elevated blood mercury concentration and newly diagnosed adrenal insufficiency. We conducted an investigation to identify the source of mercury exposure.

Methods: We interviewed the patient regarding possible mercury exposures, including Ayurvedic medications she had recently been prescribed by a practitioner in India, and reviewed her medical records. We assessed mercury contamination in her home using a mercury vapor analyzer. Her medications were analyzed by cold-vapor atomic absorption. Total mercury intake was calculated by multiplying medication mercury concentration by daily dose and dividing by body weight.

Results: Mercury vapor concentrations in the patient's home were not elevated, and she did not report any dietary risk factors. She reported taking 9 Ayurvedic medications 2–3 times daily for 5 months preceding symptom onset. Seven medications with sufficient sample for laboratory analysis had mercury concentrations of 9–76,000 mg/kg. The patient's estimated mercury intake from these medications was 2.06 mg/kg/day, >1,000 times ATSDR's Minimal Risk Level of 0.002 mg/kg/day. Her blood mercury concentration was 69 µg/L (normal: <5 µg/L). Her morning cortisol level was 1.8 µg/dL (normal: >5 µg/dL) and adrenocorticotropic hormone level was <5 pg/mL (normal: 6–50 pg/mL), consistent with a diagnosis of secondary adrenal insufficiency.

Conclusions: Our investigation identified mercury toxicity caused by Ayurvedic medication use and associated adrenal insufficiency. While mercury has been shown to have endocrine disrupting effects, no prior human studies have reported adrenal insufficiency associated with mercury exposure. Ayurvedic medications are available online and from local practitioners, and are minimally regulated. Consumers and clinicians should be aware of potential mercury toxicity associated with Ayurvedic medication use and adrenal insufficiency as a possible clinical effect.

G1.3 Post-Licensure Safety Surveillance of Recombinant Zoster Vaccine (Shingrix) Using the Vaccine Adverse Event Reporting System — United States, October 2017–June 2018

Authors: Elisabeth M. Hesse, T. Shimabukuro, J. Su, B. Hibbs, K. Dooling, R. Goud, P. Lewis, C. Ng, M. Cano

Background: Recombinant zoster vaccine (RZV, GSK), an adjuvanted glycoprotein vaccine, was licensed by FDA and recommended by the Advisory Committee on Immunization Practices (ACIP) for adults aged ≥50 years in October 2017. In pre-licensure clinical trials the 2-dose RZV series was highly efficacious up to 4 years post-vaccination; 85% of study participants reported local or systemic reactions, and 17% experienced a grade 3 reaction (erythema or induration >3.5 inches, or systemic symptoms that interfere with normal activity). We analyzed early post-licensure reports of AEs following RZV as the vaccine is used in the larger general population.

Methods: We analyzed RZV reports submitted from October 20, 2017—June 30, 2018 to the Vaccine Adverse Event Reporting System (VAERS), a national spontaneous reporting system. Physicians clinically reviewed selected reports and Empirical Bayesian data mining was conducted to identify disproportional reporting of adverse events.

Results: During the analytic period, when ~3.2 million RZV doses were distributed, VAERS received 4,381 AE reports (136 reports/100,000 doses distributed); 130 (3.0%) reports were classified as serious. Commonly reported symptoms included pyrexia (n = 1034 reports, 23.6%), injection site pain (n = 985, 22.5%), and erythema (n = 880, 20.1%). Seven confirmed deaths (by autopsy report or death certificate) were reported following RZV; causes of death were not vaccine-related. There were 230 reports of vaccination errors, with a majority involving errors in administration technique. In 6 reports of "incomplete course of vaccination," healthcare providers advised patients to skip the second RZV dose after they experienced common and expected AEs following first dose. Empirical Bayesian data mining did not reveal any disproportionate reporting patterns compared to other vaccines.

Conclusions: Early post-licensure safety data for RZV from VAERS are consistent with the safety profile observed in pre-licensure clinical trials. Self-limited local and systemic symptoms were most commonly reported.

G1.4 Syndromic Surveillance to Monitor Emergency Department Visits During a Synthetic Cannabinoid Overdose Outbreak — Connecticut, 2018

Authors: Sydney A. Jones, K. Soto, E. Grogan, A. Senetcky, S. Logan, M. Cartter

Background: Synthetic cannabinoids (SCs) have been associated with mass poisonings in multiple states. On the morning of August 15, 2018, the Connecticut Department of Public Health (CTDPH) learned from media reports of multiple people found unresponsive in a city park after using SCs. We created an ad hoc syndromic surveillance definition to identify outbreak magnitude and provide situational awareness to state and local public health departments.

Methods: CTDPH syndromic surveillance system collects data for all emergency department (ED) visits in near real-time (i.e., <5 minutes). We developed an ad hoc syndromic case definition to identify ED visits for park-associated suspected SC overdoses by analyzing chief complaint data. Keywords, selected in an iterative process based on media reports and ED visit record reviews, included terms for SCs (e.g., "K2," "spice," or "weed") and location (e.g., "green," "bench," or "park"). On August 20, we expanded the syndromic case definition to include keywords in both chief complaint and triage notes to retrospectively identify outbreak-associated ED visits missed by the chief complaint analysis.

Results: By midday on August 15, we had identified 25 outbreak-associated ED visits; by August 16, the number increased to 55 ED visits. Analyses using the expanded syndromic definition identified 72 outbreak-associated ED visits during August 15–16. Those 72 ED visits comprised 53 unique patients, with 12 patients returning to the ED 2–5 times. Of these 53 patients, median age was 43 years (interquartile range: 35–51 years) and 41 (77%) were men; none died.

Conclusions: For the first time in Connecticut, near real-time syndromic surveillance data provided timely, accurate situational awareness to state and local public health departments during an SC overdose outbreak. CTDPH is developing additional substance-specific overdose syndromic case definitions to help detect future drug overdose outbreaks.

G1.5 Group A *Streptococcus*-Associated Hospitalizations and Risk Factors for In-Hospital Mortality in California, 2000–2016

Authors: Ellora Karmarkar, G. Cooksey, J. Myers, A. Kamali, S. Jain

Background: Group A *Streptococcus* (GAS), a common cause of pharyngitis, can also cause severe illness and death. GAS is not reportable in California, thus we sought to better understand disease incidence, patient characteristics, and risk factors for GAS-associated disease and death in California.

Methods: Using California patient discharge data during 2000–2016, we identified GAS-associated hospitalizations as records with ≥1 GAS-associated *International Classification of Diseases, Ninth* (ICD-9) *and Tenth* (ICD-10) *Revisions* discharge diagnosis codes. We included ICD-9 and ICD-10 codes for GAS, GAS pharyngitis, GAS pneumonia, GAS sepsis, and known GAS-associated syndromes (acute rheumatic fever, erysipelas, necrotizing fasciitis, and scarlet fever). Hospitalization records were de-duplicated using unique identifiers. We calculated GAS-associated hospitalization incidence rates/100,000 population and conducted bivariate analysis to identify risks for in-hospital mortality (*P* value <0.05).

Results: During 2000–2016 in California, 83,959 patients were hospitalized for GAS-associated infections; 4,877 (5.8%) died during hospitalization. Median age was 45 years (interquartile range [IQR] 24–60 years). Mean annual incidence of GAS-associated hospitalization was 13.6/100,000 population (95% CI: 13.5–13.7). After adjusting for age, GAS-hospitalized patients who died in-hospital were more likely to use opioids (odds ratio [OR] 4.2; 95% CI: 3.8–4.5), have liver disease (OR 3.1, 95% CI: 2.9–3.3), abuse alcohol (OR 1.8; 95% CI: 1.6–2.0), or be immunosuppressed (including malignancy) (OR 1.3; 95% CI: 1.2–1.4) than patients who survived. Patients hospitalized with GAS and influenza were not more likely to die in-hospital, but were more likely to have GAS pneumonia (OR 9.1; 95% CI: 7.3–11.2) or GAS sepsis (OR 2.6; 95% CI: 1.6–4.0) than patients without influenza.

Conclusions: GAS-associated hospitalization in California is substantial; in-hospital death was associated with opioid use, liver disease, alcohol abuse, and immunosuppression. Our analysis, while limited by the imprecision of diagnostic coding, highlights specific populations with greater risk of in-hospital GAS-associated deaths.

G1.6 Case Series of Glans Injuries During Voluntary Medical Male Circumcision for HIV Prevention — 14 African Countries, 2015–2018

Authors: Todd J. Lucas, C. Toledo, H. Watts, J. Cavanaugh, C. Cooney, V. Kiggundu, A. Thomas, S. Davis, J. Hines

Background: Voluntary medical male circumcision (VMMC) confers partial protection against HIV among men. The President's Emergency Plan for AIDS Relief (PEPFAR) has supported >18 million VMMCs. Glans injuries (GIs), including amputations and lacerations, are rare but devastating adverse events (AEs) that can occur when forceps-guided (FG) method is used on patients with immature genitalia. PEPFAR has supported ministries to prevent GIs through guidance in 2014 prohibiting FG method in at-risk patients, training in the safe alternative dorsal-slit (DS) method, making DS instruments widely available, surveilling and investigating GIs and holding partners accountable, developing guidance for GI management, and conducting widespread educational outreach. We describe GI cases reported to PEPFAR to better understand associated factors and guide additional prevention efforts.

Methods: Since 2015, PEPFAR has conducted passive surveillance of GIs and other severe AEs. Under PEPFAR, GIs are reportable within 24 hours, after which an investigation commences, including reviewing records and interviewing staff. This information is synthesized and submitted on a report form, which we abstracted.

Results: Thirty-six GIs were reported from 2015–2018, all among patients <15 years (roughly 1 per 140,000 VMMCs). Most (64%) were partial or complete amputations. All amputations among adolescents occurred during FG method use. Of 19 attempted amputation repairs, 9 (47%) were within the recommended 6-hour timeframe; reattached tissue was viable in 4 (21%) in the short-term, with no information available on longer-term outcomes. In some cases, a lack of DS method training and being overworked contributed to FG method use.

Conclusions: Despite clear guidance on methods to prevent GIs, these are a rare but persistent problem. Preventing further cases will require additional interventions that prevent FG method use in young patients, such as training only in DS method and phasing-out instruments specific to FG method. Improving management is critical to optimizing outcomes when GIs occur.

G1.7 Identifying and Characterizing Census Tracts with Elevated Opioid Overdoses — Idaho, 2010–2017

Authors: Bozena M. Morawski, C. Johnson, K. Carter, J. Cramer, P. Harder, C. Hahn

Background: Annual opioid-involved overdose mortality increased in Idaho during 2000–2016 from 2.2 deaths/100,000 persons to 7.4 deaths/100,000 persons. We sought to strengthen opioid overdose epidemic response by identifying and characterizing census tracts experiencing elevated opioid overdoses.

Methods: We included opioid-involved overdose deaths, as classified by *International Classification of Diseases, Tenth Revision* underlying (X40–44, X60–64, X85, or Y10–14) and multiple cause-of-death codes (T40.0–40.4, or T40.6), and emergency medical services (EMS) responses involving ≥1 naloxone administration and evidence of drug ingestion or poisoning (EMS-NA). We geocoded 2010–2017 Idaho Department of Health and Welfare death certificate decedent address and EMS incident response location to census tracts. To identify statistically significant (P <0.05) census tract clusters of higher rate opioid overdoses, we used spatiotemporal Poisson models in SaTScan™. To characterize associations between opioid overdoses and 2011–2015 American Community Survey census tract characteristics, we jointly modeled deaths and EMS-NA with Poisson-distributed age- and sex-adjusted generalized linear mixed models (GLMM). GLMM included census tract-level random intercepts and accounted for spatial autocorrelation.

Results: We identified 746 opioid-involved overdose deaths among Idaho residents, and 2,235 EMS-NA. Of 7 census tract clusters, 5 (median population 63,498) exhibited elevated opioid-involved overdoses during 2016 or 2017 (1 opioid-related overdose mortality cluster and 4 EMS-NA clusters). For each 5% increase in renter-occupied housing and uninsured population, opioid-involved overdose mortality increased by a factor of 1.06 (95% CI: 1.03–1.10) and 1.14 (95% CI: 1.06–1.22), respectively. Urban tracts had 1.64 (95% CI: 1.37–1.97) times higher EMS-NA rates than rural tracts. For each $250 increase in median gross rent, EMS-NA increased by a factor of 1.18 (95% CI: 1.05–1.32).

Conclusions: Joint spatiotemporal analyses identified areas with elevated opioid overdoses. Idaho health officials plan to strengthen opioid overdose epidemic prevention and response to these areas.

G1.8 Severe Bleeding Associated with Exposure to the Superwarfarin Brodifacoum through Use of Synthetic Cannabinoids — Illinois, 2018

Authors: Erin Moritz, L. Navon, K. Walblay, A.M. Lavery, A.F. Pennington, C. DesLauriers, M. Wahl, L. Yip, J. Layden

Background: Synthetic cannabinoids (SCs) are heterogeneous psychoactive compounds identified as substances of misuse. Because the SC supply chain is unregulated, contents are unknown to users. In March 2018, the Illinois Department of Public Health (IDPH) was notified of 4 patients treated in emergency departments during the preceding 2 weeks with unexplained bleeding and recent SC use. Clinical specimens from 1 patient tested positive for brodifacoum, a long-acting anticoagulant (i.e., superwarfarin). SCs seized by law enforcement from a convenience store contained brodifacoum. We investigated to identify cases and characterize the outbreak.

Methods: IDPH issued calls for cases through health and emergency response alert systems, electronic distribution lists, and press releases. Patient demographics, clinical presentation, and SC use patterns and purchase locations were collected through poison center consultations, medical chart abstraction, and patient interviews. Case definitions were developed based on SC use, clinical signs, and presence of superwarfarins in clinical specimens. Data were summarized and compared among geographic areas using Pearson's chi-square test.

Results: By July 5, 2018, a total of 174 patients met the probable or confirmed case definition; 129 (74.1%) were male; median age was 33 years (range: 18–66 years). Hematuria was reported by 145 (83.3%) patients and 140 (80.5%) reported bleeding from multiple sites. Nearly all patients (167, 96.0%) were hospitalized; 5 (2.9%) died. Specimens from 94/95 (98.9%) patients tested for superwarfarins were positive for brodifacoum. Patients living in northwestern Illinois were more likely than those in central Illinois to use SCs in order to evade positive drug screening (87.5% versus 41.4%; $P < .01$) and obtain product from stores (61.7% versus 4.8%; $P < .01$).

Conclusions: This outbreak demonstrated serious health effects associated with use of adulterated SCs. Reasons for use and product source differed geographically and might be important factors when tailoring public health interventions during future outbreaks.

G1.9 A Coccidioidomycosis Mandatory Reporting System: From Facsimile to Electronic Laboratory Reporting — Los Angeles County, California, 2010–2017

Authors: Lisa P. Oakley, J.M. Lawrence, D. Terashita, S. Balter, S. Tartof

Background: *Coccidioidomycosis* is a fungal infection endemic to the southwestern United States causing influenza-like illness and infrequently severe disease or death. Since 2015, incidence of reported *coccidioidomycosis* in California has increased 57%. In Los Angeles County (LAC) incidence increased from 235 cases in 2010 to 809 cases in 2016. Effectiveness of mandatory coccidioidomycosis reporting has not been fully assessed. We sought to evaluate data quality of coccidioidomycosis reporting from Kaiser Permanente Southern California (KPSC) to the LAC Department of Public Health (LACDPH).

Methods: We defined KPSC cases as positive coccidioidomycosis tests in KPSC's electronic health records (EHRs) among persons residing in LAC. LACDPH cases were those identified in LACDPH's database containing a KPSC facility identifier. We assessed sensitivity and positive predictive value (PPV) of the reporting system during 2010–2017, treating KPSC cases as the gold standard.

Results: KPSC identified 2,488 cases in the EHR and LACDPH identified 965 cases in their database; a total of 889 cases were identified in both. Reporting methods changed during 2010–2017, from facsimile-only (2010–2013) to 2 separate electronic laboratory reporting (ELR) methods (2014–2016 and 2017). Sensitivity of reported cases increased substantially with changes in reporting methods. During 2010–2013, 2014–2016, and 2017, sensitivity was 6%, 78%, and 82%, respectively; PPV was 68%, 96%, and 96%, respectively.

Conclusions: Sensitivity during facsimile-only years was low but increased substantially after ELR implementation. Investigations into cases found in KPSC's EHR but not in LACDPH's database, and vice versa, are ongoing and will support recommendations for system improvement. Although this study is limited to KPSC data for LAC (19% of LAC population), these findings could have substantial implications for coccidioidomycosis incidence estimates over time. Increasing reported trends could be attributable to improvements in reporting methods rather than true disease burden.

G1.10 Opioid Overdose Death Surveillance Evaluation — Wyoming, 2006–2017

Authors: Heather Rhodes, A. Busacker, C. Van Houten, A. Harrist

Background: Opioid overdose is a national public health emergency. In 2017, Wyoming's age-adjusted opioid overdose death rate (8.7 deaths/100,000 population) was lower than the national rate (14.9 deaths/100,000 population). To ensure effective opioid overdose death monitoring, we evaluated the quality of Wyoming's opioid overdose death surveillance data.

Methods: Data quality was measured in October 2018 by an online survey of coroners and deputy coroners designed to understand current opioid overdose death determination practices. Annual vital statistics death records were evaluated to calculate frequency of unspecified narcotic diagnostic classification in opioid overdose deaths during 2006–2017.

Results: Twenty-nine coroners and deputy coroners from 21 of 24 jurisdictions (88%) responded to the survey. Not all respondents answered every question. Among respondents, 21/22 (95%) reported they "always" or "very often" request autopsy or toxicology studies in suspected opioid overdose deaths, 17/22 (77%) feel "very" or "somewhat" comfortable with the definition of opioid overdose death, 21/22 (95%) avoid nonspecific free-text language about the opioid involved, and 28/28 (100%) have a coroner certification. During 2006–2017, unspecified narcotic was listed in 89/468 (19%, annual range 13–29%) opioid overdose deaths.

Conclusions: Data quality is supported by coroner use of autopsy or toxicology studies, comfort with the opioid overdose death definition, and coroner certification. However, reported current practices do not align with past data about unspecified narcotic opioid overdose deaths. The Wyoming Department of Health (WDH) is reviewing death certificates to understand why the free-text language used during certification resulted in deaths being listed as unspecified narcotic opioid overdose deaths. This review coupled with the survey findings will guide WDH education to coroners and deputy coroners on practices to improve the data quality of opioid overdose death surveillance. Understanding the specific opioids causing overdose deaths will support development of targeted prevention efforts.

G1.11 Legionnaires' Disease Associated with a Resort Cooling Tower — Wisconsin, 2018

Authors: Amy C. Schumacher, A. Kocharian, S. Koske, A. Koch, S. Fiscus, D. Liebenthal, T. Tuchalski, T. Monson, T. Haupt, T. DeSalvo, S. Smiley

Background: During August 2018, the Wisconsin Department of Health Services (DHS) was notified of 3 urinary antigen-confirmed cases of Legionnaires' disease (serogroup 1; all onsets July 28, 2018), including 1 death, in non-Wisconsin residents who visited the same large (capacity >500 people) resort in rural Wisconsin <2 weeks before illness onset. DHS surveillance data review revealed 1 additional urinary antigen-confirmed case in a Wisconsin resident with exposure to the same resort (serogroup 1; onset March 12, 2018). A potential exposure source was the resort's cooling tower, a source not identified in Wisconsin since 1986. An interagency team with epidemiology, environmental health, and plumbing expertise investigated to identify outbreak source and prevent additional illnesses.

Methods: The 4 patients or proxies were interviewed regarding resort exposures. The team conducted an environmental assessment; assessment and patient interview results were used to select 41 sampling locations (72 samples). Environmental samples were tested for *Legionella* at the Wisconsin State Laboratory of Hygiene and CDC.

Results: Among the 4 patients, median age was 71 years (range: 45–76 years); 3 (75%) were male. Two resort sampling locations, the cooling tower and a public restroom faucet, were positive for *Legionella pneumophila* serogroup 1. No patient had known exposure to the faucet. All 4 patients stayed in rooms or spent time in areas near the cooling tower on days the tower would likely have been operating. No additional cases were identified.

Conclusions: Epidemiologic evidence indicates the cooling tower as outbreak source. The outbreak was terminated by the implementation of two DHS recommendations: development of a new, comprehensive water management program and remediation of the cooling tower (manual cleaning and hyperchlorination) and the faucet (replacement and flushing). Investigation findings highlight value of comprehensive routine patient interviews and an environmental assessment completed by an investigation team with diverse expertise.

G1.12 Carbapenemase-Producing *Klebsiella pneumoniae* in a Ventilator-Capable Nursing Home — Maricopa County, Arizona, July–November 2018

Authors: Sarah E. Scott, S. Prasai, N. Fowle, K. Hobbs, K. Maldonado, J. Matthews, R. Bhattarai, R. Sunenshine

Background: Invasive carbapenemase-producing carbapenem-resistant Enterobacteriaceae (CP-CRE) infections are associated with a 40%–60% mortality rate. On August 2, Maricopa County Department of Public Health (MCDPH) identified 2 cases of carbapenemase-producing *Klebsiella pneumoniae*, a type of CP-CRE, with matching pulsed-field gel electrophoresis (PFGE) patterns in residents of a ventilator-capable nursing home (NH). To prevent additional cases, MCDPH and Arizona Department of Health Services (ADHS) investigated the cluster.

Methods: Cases were defined as PFGE-matched CP-CRE isolated during July–November among NH residents. We defined contacts as persons residing for ≥3 days in the same unit as patients with CP-CRE; contacts were screened by rectal culture on August 13. MCDPH and ADHS conducted a site visit on September 6 to observe infection control practices and recommend targeted control measures. Contacts were rescreened on November 5.

Results: The 2 residents with CP-CRE infections resided in proximal rooms in the ventilator-capable unit. Contact tracing identified 42 contacts; 7 (17%) declined screening, 6 (14%) were discharged, 2 (5%) were deceased, 1 (2%) had a recent infection with a carbapenem-resistant organism, and 26 (62%) were screened for colonization. PFGE-matched CP-CRE isolates were detected in 3 (12%) of 26 screened contacts. Recommended control measures after site observations included adherence to preexisting hand hygiene protocols, increased accessibility to alcohol-based hand rub (ABHR), and contact precautions for colonized or infected residents who either require mechanical ventilation or have uncontained bodily fluids. Twenty-eight residents were identified for rescreening; 13 (46%) declined and 15 (54%) consented. All 15 (100%) rescreening cultures were negative for CP-CRE.

Conclusions: This investigation identified PFGE-matched CP-CRE colonization among 12% of screened contacts, supporting healthcare-associated transmission. NH's focus on hand hygiene, increased access to ABHR, and adherence to recommended contact precautions might have prevented additional healthcare-associated CP-CRE transmission.

G1.13 Maternal Occupational Oil Mist Exposure and Birth Defects — United States, 1997–2011

Authors: Miriam Siegel, C. Rocheleau, C. Johnson, M. Waters, C. Lawson, T. Colarusso, J. Reefhuis

Background: Over one million U.S. workers in approximately 40 industries are exposed to metalworking fluids. When metalworking fluids are aerosolized, workers can be exposed to the resultant oil mists through skin contact or inhalation. A previous CDC birth defect cluster investigation at a steel strip manufacturing company found oil mists were one common exposure among fathers of infants born with heart defects. A potential explanation was take-home exposure —workers wore oil mist-contaminated clothes home from work, exposing pregnant partners. Little research exists on reproductive effects of direct maternal occupational oil mist exposure. Our objective was to investigate associations between occupational oil mist exposure during pregnancy and a spectrum of birth defects.

Methods: We analyzed population-based case-control data from the multisite National Birth Defects Prevention Study. We evaluated occupational exposure among 22,011 mothers of infants with birth defects and 8,140 mothers of infants without birth defects. To estimate associations between oil mist exposure during pregnancy and individual birth defects, we used logistic regression to calculate odds ratios (OR) and 95% confidence intervals (CI), controlling for study site and smoking status.

Results: Manufacturing jobs, particularly apparel manufacturing, comprised the largest groups of exposed mothers. Mothers of infants with septal heart defects (OR: 1.8; CI: 1.1–3.3), especially perimembraneous ventricular septal defects (OR: 2.5; CI: 1.2–5.2), were more likely to be exposed to oil mists than control mothers. Associations for both defects were stronger for mothers with higher exposure (OR: 2.3; CI: 1.1–4.9, OR: 2.8; CI: 1.1–7.6, respectively) than lower exposure.

Conclusions: These results support an association between maternal occupational oil mist exposure and septal heart defects. Findings cohere with the hypothesis that heart defects among infants of male employees working with oil mists could occur by take-home exposure. Further research could evaluate reproductive effects of occupational oil mist exposure.

G1.14 Extrapulmonary Nontuberculous Mycobacteria Infections — Minnesota, 2013–2017

Authors: Joanne Taylor, P. Snippes Vagnone, K. Smith, J. Walters, N. Wengenack, S. Deml, G. Hansen, R. Lynfield

Background: Approximately 80 species of nontuberculous mycobacteria (NTM) causing disease are found environmentally and in animal reservoirs. Typically, pulmonary NTM infections are sporadic; extrapulmonary infections are commonly outbreak-associated. Recent sources of extrapulmonary NTM (ENTM) outbreaks in Minnesota include contaminated heater-cooler units used during cardiac surgery and contaminated hormone injections. We examined patient demographics and characteristics of laboratory-confirmed ENTM isolates to assess potential value of systematic laboratory-based ENTM surveillance in Minnesota.

Methods: The Minnesota Department of Health requested laboratory data from *Mycobacterium* testing during 2013–2017 from 3 Minnesota reference laboratories that characterize *Mycobacterium* isolates. Using the CSTE case definition, we excluded *M. tuberculosis* complex, *M. bovis* and *M. leprae* isolates, and isolates from feces, lung, bronchoalveolar lavage, tracheal secretion, and sputum.

Results: Of 4,017 NTM isolates, 415 (10.3%) were ENTM, representing an estimated burden of 15/1,000,000 people/year in Minnesota. Thirty-one species or complexes were identified; most common were *M. avium* or *M. avium* complex (30.6%), *M. chelonae* (21.7%), *M. fortuitum* or *M. fortuitum* complex (9.2%), and *M. abscessus* or *M. abscessus* complex (8.0%). Most common specimen collection sites included skin and soft tissue (41.2%), neck lymph node or tissue (14.5%), blood (13.5%), sinus (8.9%), and joint fluid (2.2%). The patient's median age was 55 years (range: 3–98 years); 19.1% were from patients aged <18 years, 19.3% aged 18–44 years, 26.1% aged 45–64 years and 35.5% aged ≥65 years. Sex was documented for 244 (58.8%) patients; 126 (51.6%) were males. County information was available for 315 isolates (75.9%); approximately half (48.5%) of patients resided in metropolitan Minneapolis-Saint Paul.

Conclusions: Laboratory data can be used for ENTM surveillance in Minnesota. Implementing laboratory-based surveillance could detect ENTM cases, provide a mechanism for obtaining clinical and epidemiological information, and enable earlier identification of potential healthcare transmission or community clusters.

G1.15 Coccidioidomycosis in U.S. Residents Returning from House-Building Trips in Baja California, Mexico, June–July, 2018

Authors: Mitsuru Toda, D. Caceres, M. Pomeroy, G. Bergeron, E. Wilson, P. Franklin, L. Kresl, K. Lunquest, H. Oltean, C. Raybern, M. Lindsley, T. Chiller, B. Jackson, O. McCotter

Background: On August 8, 2018, New York City health authorities notified CDC of two high school students hospitalized following house-building trips to Baja California, Mexico. By October 15, 2018, both students and six additional travelers were diagnosed with coccidioidomycosis, a disease caused by inhalation of a soil-borne fungus found in parts of the U.S. and Mexico. A seroepidemiologic survey was conducted to identify potential sources and inform prevention measures.

Methods: We identified 209 people who traveled to the area during June–July 2018, performed serum *Coccidioides* antibody enzyme immunoassays, and conducted interviews in person or by online questionnaire. Interviews included questions on activities, exposures, symptoms, and prior knowledge of coccidioidomycosis.

Results: We interviewed 109 (52%) travelers, of whom 48 (44%) reported coccidioidomycosis symptoms. Among 75 with antibody testing, 13 (17%) were seropositive, of whom 12 (92%) were symptomatic. Fourteen (29%) with symptoms sought healthcare, and four were hospitalized, including one in intensive care, for a median of seven days (range 3–12). Travelers who worked on a particular house (odds ratio [OR] 5.7, 95% confidence interval [CI] 1.2–54.9), performed backfilling of the foundation (OR 2.8, 95% CI: 1.1–7.4), or took no precautions against dust generation (OR 9.4, 95% CI: 1.3–424.1) had higher odds of developing symptoms compared with those who did not perform such functions. Only six (6%) travelers had ever heard of coccidioidomycosis.

Conclusions: Almost one in five travelers to Baja California, Mexico showed serological evidence of coccidioidomycosi infection, and over one-third exhibited symptoms compatible with coccidioidomycosis, likely from foundation work at a particular house. Further investigation is needed to determine reasons this site posed elevated risk. Despite engaging in dust-generating activities in a coccidioidomycosis-endemic area, nearly all travelers were unaware of the risk. Service organizations performing soil-disturbing activities in endemic areas should educate travelers and implement prevention measures.

SESSION G2: Public Health Laboratory Science

1:25–3:00 pm

Capitol Ballroom

Moderators: Ren Salerno and Aufra Araujo

1:30 Detection of *Bacillus anthracis* in Autoclaved Specimens — a Safe and Simple Diagnostic Method for Low-Resource Countries

Authors: Atanaska Marinova-Petkova, C. Beesley Kolton, M. Schroeder, M. Elrod, A. Hoffmaster

Background: The Bacterial Special Pathogens Branch at CDC works with low-resource countries to help them build laboratory capacity for anthrax diagnosis. Early identification in animals is important to minimize exposure to humans and take appropriate control measures. Frequently, laboratories in these countries do not want to perform anthrax testing on specimens containing potentially viable spores due to biosafety concerns. The objective of this work was to develop an inactivation/sample preparation method for molecular detection of *Bacillus anthracis* (*B.a.*) while minimizing work with live agent.

Methods: We evaluated PCR detection of *B.a.* directly on autoclaved samples. We developed the method using *Bacillus cereus* (*B.c.*) G9241 spores and validated it by testing *B.a.* Sterne and Ames spores (concentrations 10–10^6 CFU/mL), and *B.a.*-positive bovine ear and bison spleen tissues (4 mm blocks) from anthrax cases. Multiple conditions (length of autoclaving, incubation times in heart infusion broth (HIB) prior to autoclaving, static vs shaking incubation, and bead beating) were evaluated to optimize the procedure, using the Laboratory Response Network's (LRN) real-time PCR protocol for *B.a.* Quality controls validated inactivation procedures, autoclave functions, and PCR assays.

Results: Static incubation of samples collected in tubes with HIB at 37°C/2h, followed by liquid cycle autoclaving at 121°C/20 min, and bead beating for 5 min of the inactivated material, without DNA extraction, was selected as the optimal inactivation method in terms of safety, cost, time and sensitivity. The limit of detection of the method was in the range 16–50 CFU/mL for *B.c.* and *B.a.* spores. Ct values of the autoclaved, anthrax-positive animal tissues were in the range 22.1–26.3, using the LRN PCR.

Conclusions: This inactivation/sample preparation method eliminates manipulation of live samples once they reach the laboratory. The procedure allows for sensitive and specific diagnosis of anthrax in animal specimens in countries with limited reagents, biosafety and biosecurity.

1:50 Improving Rabies Animal Models for Medical Countermeasures Through Luminescent Viruses

Authors: David E. Lowe, N. Gallardo-Romero, J. Ellison, F. Jackson, C. Kling, L. Seigler, C. Hutson

Background: CDC laboratories develop and test novel medical countermeasures (MCMs) for infectious diseases. Developing a rabies treatment is complicated because infection with *Rabies lyssavirus* (RABV) has a long prodromal stage and animal models often exhibit non-specific signs of illness. This requires lengthy studies with large numbers of animals. Our objective was to develop an animal model whereby RABV dissemination can be detected in living animals prior to clinical signs by using a light-emitting virus.

Methods: In this study, we evaluated two luminescent mouse models of experimental rabies. One model used a RABV with the nanoluciferase gene inserted in the viral genome (RABV-NL). The other model used a RABV with the Cre gene inserted in the viral genome (RABV-Cre) and a complimentary transgenic mouse. For both, light is produced only during viral replication. Mice were infected with RABV-NL (n = 10), RABV-Cre (n = 10), or unaltered RABV (n = 10) and observed for 21 days. Following infection, luminescence was analyzed up to once a day and survival curves were compared.

Results: Luminescence was detected in the central nervous system for both models ~24 hours before specific rabies signs appeared. However, light was not detected in peripheral nerves upon post-mortem examination. All mice with CNS luminescence were confirmed rabid by molecular diagnosis. Rarely, luminescence was detected in other tissues. In the RABV-NL mice, light was detected in the eye, while two RABV-Cre mice had luminescence at the injection site. High mortality was observed in mice infected with RABV-NL and the unmodified RABV. However, mortality in the RABV-Cre-infected animals was reduced by half.

Conclusions: Luminescent rabies models can detect CNS infection before the display of clinical features. These models allow us to reduce and refine the use of laboratory animals in the development and testing of new MCMs for rabies encephalitis.

2:10 Dried Blood Spots as an Alternative Laboratory-Based Surveillance Method for Dengue Virus — American Samoa, 2018

Authors: Emily Curren, A. John Tufa, T. Hancock, R. Lanciotti, B. Biggerstaff, J. Vaifanua-Leo, C. Montalbo, T. Sharp, S. Hills, C. Gould

Background: American Samoa has experienced multiple arboviral disease outbreaks, requiring a robust, sustainable surveillance system. Given costs and logistical challenges of sending serum samples overseas for testing, we investigated performance and feasibility of dried blood spots (DBS) as a stabilization and transportation method during a dengue virus type 2 (DENV-2) outbreak.

Methods: To determine the approximate detection threshold of DENV RNA in DBS and serum, human serum was spiked with DENV-2 and serially diluted 10-fold to create five control standards (concentration, 100–1,000,000 genome copies/ml). A 10µl portion of each standard was spotted onto a 5mm diameter Whatman FTA™ Micro Card disk. RNA was extracted from each disk and from 75µl of each standard and tested in parallel by reverse transcription-polymerase chain reaction (RT-PCR). In American Samoa, DBS were created by pipetting 100µl of serum from patients with suspected DENV infection onto the cards. DBS were shipped at ambient temperature via U.S. Postal Service priority mail, and corresponding serum samples were shipped cold per established protocols. DBS and serum samples were tested at CDC using DENV RT-PCR.

Results: In the laboratory assessment, the limit of RNA detection was the same (10,000 genome copies/ml) in DBS or serum. In American Samoa, paired DBS and serum samples were collected from 100 patients. The DBS envelope arrived in four days and cost $8.20 to ship; serum samples arrived in three days and cost $629.28. DENV RNA was detected in 14 DBS and 18 serum samples; therefore, DBS sensitivity was 78% (95% CI: 55–91%), and specificity was 100% (95% CI: 96–100%) compared with serum.

Conclusions: For DENV surveillance, using DBS was cheaper than serum samples but less sensitive. Further validation will determine whether DBS are an acceptable approach for arboviral disease surveillance in American Samoa and other resource-limited settings.

2:30 Does One Plus One Equal Two Times the Resistance? Understanding the Epidemiology of Dual-Mechanism carbapenemase-producers in the United States — Antibiotic Resistance Laboratory Network, 2017–2018

Authors: Ashutosh Wadhwa, J. Huang, R. Stanton, S. Malik, G. McAllister, A.L. Halpin, A.C. Brown

Background: Antimicrobial resistance (AR) caused by plasmid-mediated carbapenemase genes among healthcare-associated pathogens is a major public health concern because of the potential for rapid dissemination. CDC established the Antibiotic Resistance Laboratory Network (AR Lab Network) to provide nationwide capacity for rapid detection, containment, and prevention of AR threats. To date, this network includes public health labs in 50 states, five large cities and Puerto Rico. Using AR Lab Network data, we describe the molecular epidemiology of carbapenem-resistant Enterobacteriaceae (CRE) harboring dual carbapenemase genes.

Methods: In January 2017, AR Lab Network began testing CRE for organism identification, antimicrobial susceptibility (AST), carbapenemase production, and mechanism identification. We analyzed all isolates found to be positive for two carbapenemase genes (dual-mechanism) to describe the distribution of carbapenemases, organisms, AST, as well as whole genome sequencing (WGS) data.

Results: Through August 2018, CDC received 72 reports of dual-mechanism isolates; 75% were *Klebsiella spp*., 11% were *Escherichia coli* and 7% were *Enterobacter spp*. New Delhi Metallo-beta-lactamase (NDM) with oxacillinase (OXA) was the most common combination (n = 47; 65.2%), followed by NDM and *Klebsiella pneumoniae* carbapenemase (KPC) (n = 18; 25%). Thirty (63.8%) NDM-OXA isolates were detected in the Mid-Atlantic region; 7 (38.8%) KPC-NDM isolates were from the Midwest. Twenty-one of 37 isolates tested during 2018, showed resistance to ertapenem, imipenem, meropenem, ceftazidime, cefepime and aztreonam. WGS of ten other dual-mechanism isolates found the carbapenemase genes were on separate plasmids.

Conclusions: Dual-mechanism CRE are being detected in the AR Lab Network. It is critical that all primary carbapenemase gene targets be included in routine public health laboratory workflows to identify isolates harboring dual mechanism. Studies are underway to improve our understanding of multi-mechanism transmission and evolution, and inform strategies for detection and containment of emerging AR threats.

SPECIAL SESSION 1: Public Health Response in Natural Disasters

3:15–4:20 pm

Capitol Ballroom

Moderators: Tegan Boehmer and Satish Pillai

Sponsor: National Center for Environmental Health (NCEH)/Agency for Toxic Substances and Disease Registry (ATSDR); National Center for Emerging and Zoonotic Infectious Disease (NCEZID)

This session will cover CDC's emergency response and recovery activities and strategies to mitigate adverse outcomes following natural disasters.

Relevance and Appropriateness for the EIS Conference

Recent years have seen a large number of devastating natural disasters, intensifying the public health impact in the affected regions. In 2017, the Atlantic Hurricane season was one of the most active hurricane seasons in the United States and included one of the most deadly disasters in U.S. history. CDC deployed numerous staff, including EIS officers, to support local public health needs and provide on-the-ground response. This session will discuss unique recovery activities within some of the affected localities and discuss ways to help mitigate the effects of future disasters.

Speakers

- Community Assessments for Public Health Emergency Response in Puerto Rico, Addressing Public Health Needs 4–months Following Hurricane Maria
  Melissa Bello Pagan, MS, Puerto Rico Department of Health
- Flood Modeling to Assist with Preparedness and Recovery — Hurricane Harvey
  Andrew Berens, MS, NCEH/ATSDR Geospatial Research, Analysis, and Services Program
- Vaccine Management Preparedness
  Anita Patel, PharmD, MS, NCIRD
- Re-Establishing Public Health Laboratory Testing
  Eduardo O'Neill, PhD, MS, MPH, DDID
- CDC's International Hurricane Response — Hurricane Irma and Maria
  Leisel Talley, CGH/DGHP/ERRB

TED-STYLE TALK 1

3:15–4:20 pm

Grand Ballroom

Erin Blau
Unprotected Vaccine, Unprotected Public: Striking a Balance Between Access and Safety

Howard Chiou
Patrol Cars as Vehicles for Public Health: Partnering with Police in a Wound Botulism Outbreak Response

Ann Marie Kimball
How Does Gender Have to Do with It? Cholera in Bahrain — 1978

Kara Levinson
Finding Legionella in a Tourist Town: What Jaws, Drones, and Hot Tubs Taught Me About Public Health Partnerships

SESSION H: FETP International Night — Poster Presentations
6:00–8:30 pm
Capitol Ballroom

Poster Abstract Listing

Full abstracts are found within the International Night Conference Booklet.

Agudey, Daniel – Ghana
Foodborne Disease of Undetermined Etiology among Patrons of a Local Eatery, Bibiani Township, Western Region, Ghana-2018

Akyereko, Ernest – Ghana
Influenza A(H1N1)pdm09 outbreak in a correctional facility, Ghana, July-August, 2018

Alfredo, Roygue – Angola
Risk factors for active Tuberculosis in HIV patients on ART: Hospital Esperança, Luanda, Angola 2018

Al Omran, Ahmed – Saudi Arabia
Investigation of a Cluster of Hepatitis C Cases Associated with a Hemodialysis Center, Alahssa Region, Saudi Arabia — 2017–2018

Gomez, Lara Victoria – Argentina
Situation of Multidrug-resistant Tuberculosis Notification-Argentina, 2016–2017

Gunta, Mesay – Ethiopia
Re-emergence of Yellow Fever — Southern Ethiopia, 2018

Jan, Salman – Saudi Arabia
A Massive Scabies Outbreak in Makkah Region, Western kingdom of Saudi Arabia 2018: Matched Case-Control Study

Kisaakye, Esther – Uganda
Outbreak of Human Anthrax Associated with Handling and Eating Meat from a Cow that Died from Unknown Cause: Kween District, Uganda, April 2018

Lawal, Bola Biliaminu – Nigeria
Risk Factors for Drug-Resistant Tuberculosis: An Unmatched Case-Control Study, Nigeria — 2018

Maramraj, Kiran Kumar – India
Outbreak of Severe Skin and Soft Tissue Infection Including Necrotizing Fasciitis, in a Village of Telangana state, India, August 2018

Mefoug, Severin – Cameroon
Suspicion of Yaws-Buruli ulcer Co-morbidity in Pygmy Children at Lolodorf Health District, South Region Cameroon, December 2017

Mitkie, Ayanaw – Ethiopia
Incidence and Predictors of Adverse Drug Reaction among HIV Positive Adult Patients on Anti-Retroviral Therapy: Government Hospitals of Kaffa Zone, Southern Ethiopia, November 2018

Mutabazi, Zabulon – Rwanda
Factors associated with home delivery among mothers reported in rapid SMS system, Nyanza District, Southern Province, Rwanda, 2017

Nanzaluka, Francis – Zambia
Epidemic Cholera in Urban Lusaka: Groundwater and Contact with Patients as Risks

Nassar, Abdulkareem – Yemen
Cutaneous Leishmania Outbreak at Bani Oshb Sub-district, Hajjah Governorate, Yemen, July 2018

Nsereko, Godfrey – Uganda
Malaria Outbreak Facilitated by Appearance of Vector-Breeding Sites after Heavy Rainfall and Inadequate Preventive Measures: Nwoya District, Uganda, March–May 2018

Orozco, Marcela – Guatemala
Evaluation of the Surveillance System for Acute Neurologic Syndrome Associated with Zika — Northwest and Southwest Regions, Guatemala; 2016–2017

Plotogea, Amalia – Canada
Evaluation of the Enhanced Syphilis Surveillance System — British Columbia, Canada, 2018

Roy, Kaushik – India (Chennai)
Cholera outbreak following a training camp: Shimoga district, Karnataka, India, 2018

Uwamahoro, Bibiane – Rwanda
Factors associated with unsuppressed viral load among HIV-positive patients on anti-retroviral therapy, Gihundwe Hospital, Rusizi District, Rwanda, 2016–2017

Vighio, Anum – Pakistan
Risk factors of Extensive Drug Resistant Typhoid Fever among Children in Karachi: A Case Control Study, 2018

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CONCURRENT SESSION 11: Opioid Misuse, Overdose, and Related Harms

8:30–10:15 am

Grand Ballroom

Moderators: Debra Houry and Erin Parker

8:35 Surveillance of Emergency Medical Services Response with Naloxone Administrations — North Carolina, April–September 2017

Authors: Lauren J. Tanz, S. Proescholdbell, S. Kansagra

Background: In the absence of well-established emergency medical services (EMS) opioid overdose case definitions, naloxone administrations can serve as an important indicator of opioid overdoses. In North Carolina, EMS responders complete patient care reports for suspected opioid overdoses. Reports are delivered electronically from each EMS agency to the EMS Performance Improvement Center, and then to the NC Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT), a syndromic surveillance system. To determine if monitoring EMS naloxone administrations in NC DETECT could be used for opioid overdose surveillance, we evaluated NC DETECT's accuracy and utility.

Methods: To calculate sensitivity and positive predictive value (PPV), we compared EMS naloxone administrations in NC DETECT during April 1–September 30, 2017, with patient care reports provided from 3 EMS agencies. Interviews with local, state, and national stakeholders were used to assess utility of monitoring EMS naloxone administrations.

Results: NC DETECT captured 97.1% of patient care reports with naloxone administration, indicating high sensitivity. All (100%) naloxone administrations in NC DETECT were in patient care reports, demonstrating excellent PPV. Stakeholders reported that EMS data on naloxone administrations provide near real-time and precise geographic information and capture reports of people not transported to the emergency department (27.2% in this study). However, naloxone can be appropriately administered by EMS to any unconscious patient, even those not experiencing an overdose, limiting its utility as a proxy for true overdoses. Additionally, overdose documentation in chief complaints, triage notes, and primary impressions from paramedics and emergency medical technicians is inconsistent.

Conclusions: NC DETECT provides an accurate estimate of EMS naloxone administrations and could guide prevention and intervention strategies. However, EMS naloxone administrations might not be an accurate proxy for EMS responses to true opioid overdoses. Standardizing data entry by responders (e.g., specific keywords) might improve opioid overdose surveillance using EMS data.

8:55 Reporting Timeliness and Estimated Incidence of Nonfatal Opioid Overdoses After Implementation of Mandated Reporting — Arizona, June 15, 2017–June 14, 2018

Authors: Sarah E. Scott, E. Weis, C. Bezold, H. Venkat, K. Komatsu

Background: Opioid-involved fatality rates in Arizona are rising; however, the nonfatal overdose incidence has not been previously estimated. After the Governor's emergency declaration in June 2017, Arizona Department of Health Services mandated nonfatal opioid overdose reporting. We compared cases reported to Arizona's Medical Electronic Disease Surveillance Intelligence System (MEDSIS) with statewide hospital discharge data (HDD) to assess reporting timeliness and estimate nonfatal overdose incidence. HDD have not previously been used for this purpose.

Methods: We analyzed confirmed and probable nonfatal opioid overdoses in MEDSIS during June 15, 2017–June 14, 2018. Probable cases had a clinical presentation compatible with opioid poisoning; confirmed cases required opioid identification with toxicology testing. HDD cases were identified by *International Classification of Disease, Tenth Revision, Clinical Modification* codes T40.0-4, T40.60, and T40.69. Timeliness (days) was from overdose to MEDSIS case receipt or from admission to HDD availability to health department staff. To estimate overdose incidence, we used capture-recapture methods and matched MEDSIS and HDD cases using name, birthdate, sex, race, and date of admission or overdose.

Results: We identified 3,763 nonfatal opioid overdoses in MEDSIS and 3,386 in HDD. Among MEDSIS cases, 2,542 (67.6%) were confirmed or probable; of those, 1,414 (55.6%) were among males and 1,529 (60.1%) were among persons aged <45 years, with similar proportions for HDD cases. In total, 1,115 cases were matched between HDD and MEDSIS datasets. Median timeliness of MEDSIS reporting was 3 days (interquartile range [IQR] = 3 days), compared with 211 days (IQR = 92 days) for HDD. We estimated an incidence of 7,719 nonfatal overdoses.

Conclusions: MEDSIS and HDD can be used to estimate the nonfatal opioid overdose incidence in Arizona. Mandatory reporting, compared with HDD, facilitates more timely data analyses and interpretation, and could improve emergency preparedness by reducing time to intervention and expediting outcome monitoring.

9:15 Initiation of Nonmedical Use of Prescription Opioids Among High School Students — Virginia, 2017

Authors: Nicholas P. Deputy, R. Lowry, H. Clayton, Z. Demissie, M. Bohm, S. Conklin

Background: Approximately 14% of U.S. high school students reported nonmedical use of prescription opioids (NUPO) in 2017. NUPO is an important contributor to opioid overdose deaths among adolescents. Understanding age at NUPO initiation and timing relative to other substances may inform school-based prevention programs. We examined the association between age at NUPO initiation and current NUPO and described patterns of NUPO initiation relative to initiation of cigarettes, alcohol, and marijuana.

Methods: We analyzed data from 3,446 high school students aged ≥14 who completed the 2017 Virginia Youth Risk Behavior Survey. Students reported age at initiation for cigarettes, alcohol, marijuana, and NUPO; ever NUPO; and current (past 30 days) NUPO. Among students reporting ever NUPO (n = 364), we described the association between age at NUPO initiation and current NUPO using adjusted prevalence ratios (aPRs) and 95% confidence intervals from logistic regression models that controlled for race/ethnicity, sex, and grade, and accounted for the complex sample design.

Results: Overall, 11.1% of students reported ever NUPO, and 4.9% reported current NUPO. Current NUPO was reported by 37.7% of students who initiated NUPO after age 14 (referent), 43.7% (aPR = 1.2; CI: 0.9–1.8) of students who initiated NUPO at age 13 or 14, and 55.1% (aPR = 1.6; CI: 1.1–2.1) of students who initiated NUPO before age 13. Among students reporting current NUPO, 18.8% reported NUPO as their first illicit substance use; 24.1% initiated NUPO concurrently with cigarettes, alcohol, or marijuana; and 57.1% initiated alcohol, cigarettes, or marijuana use before NUPO.

Conclusions: Initiating NUPO before age 13 was associated with greater current NUPO. Among students reporting current NUPO, 43% initiated NUPO before or concurrently with cigarettes, alcohol, or marijuana. To prevent NUPO among adolescents, school-based substance-use prevention programs may need to target late-childhood or early-adolescence and address multiple substance use behaviors.

9:35 A Hidden Risk of the Opioid Crisis: Bacterial and Fungal Infections in People who Inject Drugs — New York, 2017

Authors: Kathleen P. Hartnett, K.A. Jackson, C. Felsen, R. McDonald, A.C. Bardossy, R. Gokhale, I. Kracalik, T. Lucas, O. McGovern, C. Van Beneden, S. Vallabhaneni, S. Williams, M. Mendoza, M. Bohm, J.T. Brooks, A. Asher, S. Magill, A. Fiore, D. Blog, E. Dufort, I. See, G. Dumyati

Background: Surveillance data for *Staphylococcus aureus*, *Candida* spp. and group A *Streptococcus* (GAS) in western New York indicate that the number of infections in people who inject drugs (PWID) has risen in association with the opioid crisis. To inform prevention efforts, we characterized the types, severity, and treatment of bacterial and fungal infections in PWID.

Methods: We reviewed hospitalization and emergency department records at five hospitals in western New York from April 1–June 30 to identify patients with 1) positive clinical cultures for *S. aureus*, *Candida* spp. in blood, or invasive GAS or 2) diagnosis codes for both a relevant infection and substance use disorder. Current injection drug use was documented for 112 of the 1,003 patients identified. Infection types, pathogens, and outcomes were abstracted for all 112, and substance use history and treatment for those identified by culture (n = 59).

Results: The median age of the 112 PWID was 32 years (range 18–68); 61% were female. The most common clinical manifestations were skin and soft tissue infections (82/112 [73%]) and endocarditis (16/112 [14%]). Of patients with skin and soft tissue infections, 50 (61%) were at a known injection site. Four people (4%) died during hospitalization, 20 (18%) were hospitalized for 30 days or more, and 33 (29%) left against medical advice. Of pathogens identified, 56 (79%) were *S. aureus*, 12 (17%) Streptococci, including 9 viridans group and 2 GAS, and 4 (6%) *Candida* spp. Most injected opioids (57/59 [97%]); of these, 23 (40%) were offered medication-assisted treatment for opioid use disorder during the visit.

Conclusions: Bacterial infections in PWID have significant morbidity and are predominantly caused by skin and mouth flora. Education should focus on the risks of unclean skin and contaminated equipment. Hospitalizations for infection may be missed opportunities to provide medication-assisted treatment for opioid use disorder.

9:55 Wound Botulism Outbreak Among People Who Use Black Tar Heroin — San Diego County, California, 2017–2018

Authors: Corey M. Peak, H. Rosen, A. Kamali, A. Poe, M. Shahkarami, A. Kimura, S. Jain, E. McDonald

Background: Wound botulism, a rare, serious infection presenting with descending paralysis, is associated with black tar heroin (BTH) use. San Diego County (SDC) reported ~1 case/year during 2001–2016; however, 3 cases were reported during September–November 2017. We investigated to determine illness magnitude, risk factors, and estimated medical costs.

Methods: SDC sent health alerts to local health care professionals to enhance case-finding for wound botulism. Suspected patients were interviewed for clinical history and risk factors; serum specimens for all patients were tested for botulinum neurotoxin by mouse bioassay or matrix-assisted laser desorption ionization–time of flight. We defined a confirmed case as clinically compatible illness with laboratory confirmation; a probable case was clinically compatible illness in a patient with recent injection drug use (IDU) without laboratory confirmation. We estimated inpatient hospital charges based on previous wound botulism hospitalizations in SDC during 2005–2016 using the California Office of Statewide Health Planning and Development database.

Results: During September 29, 2017–April 18, 2018, a total of 8 confirmed and 1 probable cases were identified; 2 patients were initially discharged with IDU diagnosis or withdrawal without botulism recognition. All 9 patients required intensive care unit admission; 6 were mechanically ventilated; 1 of whom died. All received botulinum antitoxin (BAT); median time from symptom onset to BAT administration was 7 days (range: 3–11). All reported injecting heroin; 7 used BTH, 6 by subcutaneous injection. All had government-supported health insurance; total estimated direct hospital costs were $2.3 million.

Conclusions: This wound botulism outbreak, likely secondary to use of contaminated BTH, led to hospitalizations with substantial healthcare costs and severe illnesses including death. Delayed botulism diagnosis and treatment during this outbreak highlights the need to recognize botulism as a complication of the opioid crisis; prompt medical care and BAT treatment can be lifesaving.

CONCURRENT SESSION I2: Infections Transmitted through Food and Water

8:30–10:15 am

Capitol Ballroom

Moderators: Robert Tauxe and Jennifer Cope

8:35 Multiple Pathogen Gastroenteritis Outbreak Associated with an Outdoor Recreational Facility — Tennessee, 2018

Authors: Julia Brennan, B. Isabell, T. Chavez-Lindell, T. Runions, J. Yackley, S.J. Cavallo, M. Fill, D.J. Irving, R. Steece, J.R. Dunn, W. Schaffner, T.F. Jones

Background: During June–July 2018, the Tennessee Department of Health received reports of acute gastroenteritis among visitors to a recreational facility featuring zip lines and mountain bike trails. We investigated to identify source and stop transmission.

Methods: On July 6, 2018 an internet-based survey was sent to 2,904 visitors who purchased tickets on-line, to identify ill persons and conduct a case-control study. A case was defined as diarrhea (≥3 loose stools <24 hours) or vomiting after user visited the facility during June 15–July 6, 2018. Controls were non-ill survey respondents. We interviewed staff and conducted an environmental assessment. Case-patient stool specimens and environmental samples were tested for enteric pathogens by polymerase chain reaction.

Results: We identified 693 (67%) case-patients and 338 (33%) controls among 1,031 survey respondents. Mountain biking (odds ratio [OR]: 2.5; 95% CI: 1.4–4.5) and drinking well water (OR: 4.4; 95% CI: 3.1–6.3) were associated with illness. The facility had no ill-worker exclusion policy and staff reported working while ill. The well supplying water was untreated and unregulated; in Nine (60%) of fifteen stool samples collected norovirus was detected; two (22%) were coinfected with Enteropathogenic *Escherichia coli* (EPEC). *E. coli*, total coliforms, and EPEC were detected in well water. Pooled swabs from the lobby, breakroom, restroom, and mountain bike course were positive for EPEC, *Giardia*, and *Cryptosporidium*. Norovirus was detected on gloves in the gear room, lobby, staff area, and was identified among case-patients; 2 were coinfected with EPEC. Recommendations included using bottled drinking water and disinfection with diluted-bleach solution. No further cases were identified.

Conclusions: This large, multipathogen gastroenteritis outbreak involved multiple transmission modes and widespread facility contamination. Outdoor recreation facilities should be in compliance with public water system regulations, consider implementing ill-worker exclusion policies, and disinfect publicly used equipment.

8:55 Invasive *Cronobacter* Infections Among Infants — United States, 1979–2018

Authors: Jonathan P. Strysko, A. Bowen, H. Martin, C. Tarr, K. Hise, S. Collier, J. Cope

Background: Invasive *Cronobacter* infections among infants are associated with severe neurologic disabilities and 40% mortality. Early *Cronobacter* reports often featured hospitalized, immunocompromised, or premature infants, and identified contaminated powdered infant formula (PIF) as a transmission vehicle. To understand recent epidemiologic trends, we reviewed U.S. cases reported to CDC and in the literature since the first reported U.S. case (1979–2018), and summarized findings from associated case investigations.

Methods: We defined an invasive case as *Cronobacter* cultured from blood, cerebrospinal, or brain abscess fluid in infants (age <12 months). Cases were community onset if symptoms began at home; full-term birth was ≥37 weeks estimated gestational age. We used Poisson regression to characterize annual reporting trends and Chi-square to compare proportions pre- and post-2009, the beginning of the 40-year reporting period's final quarter.

Results: We identified 77 cases (59 reported to CDC, 18 in literature only), 43% (33/77) of which occurred in the final 10 years, when reporting was significantly higher ($p<0.01$). During 2009–2018, 52% (14/27) of cases occurred in full-term infants, and the proportion of community onset cases rose from 57% (21/37) before 2009 to 82% (27/33) thereafter ($p = 0.02$). Overall, one patient had an immunocompromising condition other than prematurity; 83% (52/63) consumed PIF ≤7 days before onset. Among 53 case investigations, *Cronobacter* contamination was identified in 22% (10/45) of opened PIF containers, 35% (6/17) of environmental surfaces, 40% (2/5) of expressed breast milk/pump kits, and 13% (2/15) of opened water bottles used to prepare PIF.

Conclusions: *Cronobacter* reporting and the proportion of community onset cases both rose significantly during 2009–2018, when most cases occurred among full-term infants without immunocompromising conditions. Contaminated PIF from opened containers remains the most commonly identified transmission vehicle, reaffirming the need for behavioral and engineering solutions to minimize contamination risk.

9:15 Shigellosis at a Wedding — Oregon, 2018

Authors: Steven I. Rekant, T. Poissant, D. Tran, Z. Marsh, K. Morey, Z. Bestul, N. Acuff, P. Cieslak

Background: On August 13, 2018, Oregon Health Authority received reports of gastroenteritis among persons attending a wedding, including a woman aged 92 years who was hospitalized. The Oregon State Public Health Laboratory (OSPHL) identified *Shigella flexneri* type 3a in stool samples. In the United States, <3% of *S. flexneri* are type 3a; foodborne shigellosis outbreaks are uncommon. We investigated to determine the cause of the outbreak and prevent further transmission.

Methods: We performed a cohort study by emailing surveys to wedding attendees, asking about exposures and illness; the bride provided addresses. A presumptive case was diarrhea ≤5 days in an attendee; confirmed cases had *S. flexneri* isolation from stool. Multnomah County Health Department and Oregon Department of Agriculture (ODA) officials inspected the caterer and venue, respectively. Specimens were tested at OSPHL and ODA.

Results: Of 263 wedding attendees, 198 (75%) responded; 107 (54%) cases were identified, including 23 (21%) confirmed. Patient age range was 2–93 years; 60 (56%) were female. Eighty-four (90%) of 93 patients with onset information reported illness 12–72 hours after the wedding. Among 107 patients, 91 (85%) reported fever, 51 (48%) vomiting, and 49 (46%) bloody diarrhea. Of 106 patients, healthcare was sought by 57 patients, and 10 were hospitalized; none died. No additional cases were reported. Only asparagus consumption was associated with illness; 64% of those consuming asparagus versus 12.5% of those who denied it became ill (relative risk: 5.1; 95% CI: 2.0–12.9). The caterer served the same foods at other events that day without illnesses reported. No food handling violations were observed during the caterer's inspection. A contamination source was not identified. No related outbreaks were reported.

Conclusions: The epidemic curve indicated a point source, and asparagus was implicated. Poor food-handler hygiene may be the most likely cause of contamination.

9:35 False-Positive Culture-Independent Diagnostic Test Reports and Effects on *Vibrio* Surveillance — Nebraska, 2017–2018

Authors: Rebecca J. Free, B. Loeck, S. Koirala, B. Buss

Background: In August 2018, Nebraska public health officials identified a gastrointestinal illness cluster where stool from 4 patients who resided in close proximity tested positive for *Vibrio cholerae* and vibriosis on culture-independent diagnostic testing (CIDT), but reflex cultures were negative. Patients lacked known exposures for vibriosis or cholera (e.g., travel, saltwater exposure, or seafood consumption), indicating false-positive CIDT results. To determine effects of false-positive results on surveillance, we analyzed *Vibrio* detections in Nebraska.

Methods: We analyzed *Vibrio cholerae* and vibriosis surveillance data to compare 2017 with 2018 counts of probable (detected only by CIDT) and culture-confirmed *Vibrio* cases consistent with national case definitions. After determining initial test type, we calculated proportion of those initially positive by CIDT where attempted culture was negative. We also assessed reported exposures for patients diagnosed by CIDT only.

Results: During January 1–December 31, 2017, a total of 9 *Vibrio* or *Vibrio cholerae* cases were reported, including 4 culture-confirmed (1 initially CIDT-positive) and 5 probable. Of 6 initially CIDT-positive specimens, reflex culture was attempted on 4 and negative on 3 (75%). Overall, 3/5 (60%) probable case reports documented vibriosis or cholera exposures. During January 1–October 31, 2018, a total of 23 *Vibrio* or *Vibrio cholerae* cases were reported, including 1 culture-confirmed and 22 probable. Of 22 initially CIDT-positive specimens, reflex culture was attempted on 21 and negative on 21 (100%). Overall, 5/22 (23%) probable case reports documented exposures. The change from 3 CIDT-positive, culture-negative detections in 2017 to 21 by October 31, 2018, represents a 600% increase.

Conclusions: *Vibrio* detections through CIDT have increased substantially; some are likely false-positives, highlighting the importance of reflex culture. *Vibrio* CIDT results should be interpreted along with clinical, epidemiologic, and culture findings. For culture-negative patients lacking known exposures, utility of probable case classifications in *Vibrio* surveillance is unclear.

9:55 Multistate Outbreak of *Salmonella* Mbandaka Infections Linked to Sweetened Puffed Wheat Cereal — United States, 2018

Authors: Amelia Keaton, C. Schwensohn, J. Brandenburg, S. Tecle, B. Adcock, R. Hinnenkamp, K. Bailey, D. Gibson, M. Griffin, J. Havens, K. Manion, C. Biskupiak, J. Ritter, B. Applegate, K. Akileye, M. Majoney, A. Fung, M. Golwalkar, M. Doyle, E. Pereira, C. Hardy, E. Elliot, M. Gosciminski, S. Peters, B. Viveiros, G. Caron, L. McCullough, L. Smith, L. Gieraltowski

Background: Foodborne salmonellosis causes over one million illnesses annually in the United States. Historically, *Salmonella* infections have been commonly associated with foods such as chicken, eggs, and fresh produce products. In May of 2018, CDC's PulseNet USA detected a multistate cluster of illnesses due to an uncommon strain of *Salmonella* Mbandaka infection. We investigated to determine the source of the outbreak and prevent additional illnesses.

Methods: We defined a case as illness in a person infected with the outbreak strain with onset between 3/3/2018 and 9/1/2018. We interviewed patients to identify common food exposures and conducted environmental sampling at manufacturing facilities. Opened and unopened food products were cultured for *Salmonella*. Whole genome sequencing (WGS) was conducted to further characterize relatedness of isolates.

Results: A total of 136 cases from 36 states were identified; 35 hospitalizations and no deaths were reported. Ill people ranged in age from <1 year to 95 years (median: 57 years). Sixty-three (75%) of 84 reported consuming a specific sweetened puffed wheat cereal in the week before illness onset. Environmental samples collected at a cereal manufacturing facility during the outbreak yielded the outbreak strain. The outbreak strain was also isolated from open cereal samples collected from ill people and from a sealed retail sample. The product manufacturer issued a voluntary recall of the cereal due to these findings.

Conclusions: Epidemiologic and laboratory evidence indicated that processed cereal was the likely source of this outbreak. This outbreak highlights the ability of *Salmonella* to survive in low-moisture environments, such as ready-to-eat cereals. Public health investigators should examine all potential food products during outbreak investigations, as even non-traditional vehicles such as cereal may cause large outbreaks. Identification of such vehicles is also critical due to the wide distribution area, long shelf life, and high production volume of such products.

CONCURRENT SESSION J1: Antimicrobial Resistance and Healthcare-Associated Infections

10:30–11:55 am

Grand Ballroom

Moderators: Denise Cardo and Dianna Carroll

10:35 Group A *Streptococcus* Bacteremia Isolates with a Penicillin-Binding Protein 2x Gene Mutation Conferring Reduced Susceptibility to Ampicillin — Seattle, Washington, 2017–2018

Authors: Kirsten Vannice, J. Ricaldi, S. Nanduri, F. Fang, J. Lynch, J. Duchin, M. Kay, S. Chochua, C. Van Beneden, B. Beall

Background: *Streptococcus pyogenes* (group A *Streptococcus* [GAS]), a common cause of skin infections and pharyngitis, can cause severe invasive disease. GAS remains universally susceptible to β-lactam antibiotics. Certain mutations within penicillin-binding protein (PBP) genes reduce the affinity of PBPs for β-lactams, resulting in non-susceptibility to these antibiotics. To identify potential emergence of β-lactam resistance in GAS, we screened clinical GAS isolates for *pbp2x* mutations during a GAS investigation at Hospital A in Seattle, Washington.

Methods: We conducted whole-genome sequencing-based characterization and antimicrobial susceptibility testing on a convenience sample of GAS isolates recovered from sterile sites or wounds of patients at Hospital A during June 2017–March 2018. Susceptible, nearly isogenic strains were used as controls for minimum inhibitory concentration (MIC) testing. Medical charts were reviewed to determine patient treatment and social history.

Results: Fifty-two of 267 GAS isolates were sequenced and subtyped. Two nearly identical isolates (different by 2 single-nucleotide polymorphisms) were identified as *emm*43.4 and multilocus sequence type 3 (*emm43.4*/ST3). Both isolates showed a *pbp2x* point mutation predictive of the T553K substitution. MICs were 8-fold higher and at the susceptibility breakpoint for ampicillin (0.25 μg/mL) and 2 times higher for cefotaxime (0.06 μg/mL), compared with the near-isogenic *emm43.4*/ST3 control strains. Both patients received multiple courses of β-lactams during the 3 years before their GAS infections and associated with people experiencing homelessness in Seattle, although no direct link between the two patients was established.

Conclusions: We describe the first identified GAS isolates with elevated ampicillin MICs conferred by a *pbp2x* missense mutation that were cultured from patients with history of repeated β-lactam use. This unusual finding suggests a potential mechanism for the emergence of β-lactam resistant GAS, emphasizing the importance of continued monitoring for β-lactam resistance within this species.

10:55 Positive Deviance Study for Timeliness of Mandated Reporting of Carbapenem-Resistant Enterobacteriaceae — Los Angeles County, 2017–2018

Authors: Howard Chiou, M. Jarashow, W. Manuel, K. Oyong, S. Balter, D. Terashita

Background: In January 2017, Los Angeles County (LAC) hospitals were mandated to report carbapenem-resistant Enterobacteriaceae (CRE) infections. A November 2018 evaluation of CRE reporting revealed lengthy reporting delays (mean: 40 days) with substantial differences among facilities (mean: 8.8–143 days/facility). The Los Angeles County Department of Public Health (LACDPH) adapted the positive deviance methodology by qualitatively studying performance outliers to identify strategies that improve timeliness.

Methods: The National Healthcare Safety Network (NHSN) was queried for CRE cases reported in LAC during January 2017–September 2018. Reporting delays were calculated as difference between culture collection and report dates. Mean reporting delay and 95% confidence limits (CLs) were generated for each hospital. Positive outliers (POs) and negative outliers (NOs) were defined as hospitals with CLs higher or lower than the grand mean, respectively. A sample was created using maximum variation sampling ensuring heterogeneity for mean reporting delay, case volume, and number of infection preventionists (IPs). Semi-structured interviews were conducted with selected IPs to characterize reporting practices.

Results: We detected 2,907 CRE cases from 76 hospitals, and identified 45 POs and 15 NOs with CLs excluding the grand mean (43.5 days). Our sample included 13 POs and 6 NOs. IPs responded from 11 (24%) POs and 5 (33%) NOs. Interviews revealed no novel practices. Common workflow elements were similar between groups, including electronic laboratory notification (PO 82% and NO 80%) and automated NHSN entry (PO 18% and NO 20%). However, internal reporting targets differed between groups. Seven POs targeted reporting ≤5 days; all NOs intentionally batched reporting at least monthly.

Conclusions: Our findings indicate hospitals can improve CRE reporting timeliness with workflow or practice changes alone. LACDPH is designing a campaign with hospital IPs to increase awareness of CRE reporting requirements. This study demonstrates how positive deviance methods can guide intervention design.

11:15 Transmission of OXA-23-Producing Carbapenem-Resistant *Acinetobacter baumannii* Through Lung Transplantation — 2018

Authors: Ana C. Bardossy, P. Annambhotla, S. Basavaraju, D. Pepe, M. Maloney, E. Snavely, W. Haas, E. Nazarian, K. Musser, M. Walters, L. Epstein

Background: On August 20, 2018, the Connecticut Department of Health notified CDC of an OXA-23 carbapenemase-producing, carbapenem-resistant *Acinetobacter baumannii* (CRAB) identified from the sputum of a patient who subsequently died and became a solid organ donor. The patient was admitted to a hospital with an ongoing CRAB outbreak for nine days prior to collection of the positive culture. Multidrug-resistant organisms (MDROs) with the potential for epidemic spread, such as OXA-23-producing CRAB, are targeted for public health interventions to prevent their dissemination. We investigated potential OXA-23 CRAB transmission to transplant recipients.

Methods: Medical records of the donor and recipients were reviewed. Available CRAB isolates from the donor and recipients were tested for resistance mechanism. Whole genome sequencing (WGS) was performed to assess isolate relatedness.

Results: The lungs, liver and kidneys were transplanted into four recipients in 3 transplant facilities in Connecticut and Massachusetts; transplant centers were notified of the donor MDRO status 53 days post-transplantation. Post-transplant blood, urine, and respiratory cultures were obtained from the recipients as part of routine clinical evaluation. OXA-23 CRAB was identified from bronchoalveolar lavage from the lung transplant recipient; OXA-23 CRAB was not identified from other recipients. WGS showed that isolates from the donor and recipient had identical resistance gene profiles, the same sequence type, and differed by only 2 single-nucleotide polymorphisms. The lung recipient received antibiotic prophylaxis for asymptomatic CRAB colonization and did not develop clinical infection.

Conclusions: While the spread of MDROs via person-to-person transmission is well-described, this investigation highlights how transmission from organ donors can introduce rare MDROs into new states and facilities. Once available, donor MDRO culture results should be promptly shared with transplant centers in order to inform treatment of clinical infections among recipients and enable prompt implementation of infection control measures to prevent further spread.

11:35 Regional Containment of an Outbreak of Carbapenem-Resistant *Pseudomonas aeruginosa* — Lubbock, Texas, 2017–2018

Authors: Christopher Prestel, K. Woodworth, K. Hartnett, C. Rault, G. Blackwell, M. McConnell, K. Wells, H. Wolford, A. Laufer Halpin, G. McAllister, R. Stanton, C. Wang, A. Hoffman, J.Y. Huang, L. Epstein, K. Jacobs-Slifka, J. Glowicz, M. Walters

Background: Highly antibiotic resistant carbapenemase-producing organisms (CPOs) like carbapenem-resistant Verona integron-mediated metallo-beta-lactamase (VIM-CRPA) spread rapidly in healthcare facilities. Nearly one-third of VIM-CRPA isolates reported through Antibiotic Resistance Lab Network from June 2017 to July 2018 were identified from two acute care hospital (ACH) laboratories in Lubbock, Texas. We assessed the regional epidemiology and infection control (IC) practices to inform prevention measures.

Methods: Cases were defined as isolation of VIM-CRPA from a culture collected June 2017 to October 2018 from individuals residing in Lubbock in the prior year. Medical records were reviewed for healthcare risk factors in the year prior to first positive culture; patients receiving only outpatient healthcare were contacted for interview about exposures. Facilities housing VIM-CRPA individuals were offered IC consultations and screenings of patients for CPO colonization. Isolate relatedness was analyzed using whole genome sequencing (WGS).

Results: We identified 31 cases from 27 patients during June 29, 2017 to October 9, 2018. Patients had a median age of 63 years; 16 (59%) were male. VIM-CRPA was identified primarily from urine (11, 41%) and wounds (10, 37%). Four patients had no overnight stays in healthcare facilities; among the others, stays in six different facilities were reported. WGS showed Lubbock cases form a cluster distinct from epidemiologically and geographically unrelated isolates. IC consultations were performed at nine facilities; gaps in hand hygiene, environmental cleaning, and interfacility communication of CPO status were common. Screening of 265 individuals across seven facilities identified two CPOs, neither were VIM.

Conclusions: This is a regional outbreak characterized by genetically related cases occurring across multiple healthcare facilities in Lubbock; no environmental reservoir was identified. A novel regional initiative including ongoing infection control support to healthcare facilities and standardized communication of patient's CPO status at transfer is being implemented to prevent further regional transmission.

CONCURRENT SESSION J2: Preventing Violence

10:30–11:55 am

Capitol Ballroom

Moderators: Linda Dalhberg and Candice Johnson

10:35 Spatiotemporal Cluster of Suicidal Ideation and Behavior — New York City, 2018

Authors: Genevieve Bergeron, J. Hoenig, E. Tang, R. Tuskeviciute, A. Protacio, K. Alroy, E. Ruderman, A. Baxter, E. Swedo, A. Anand, U. Kanagasabai, F. Tran, M. Harrison, G. Belkin, C. David-Ferdon, A. Crosby, C. Norman

Background: The New York City Department of Health and Mental Hygiene (DOHMH) detects spatiotemporal clusters from syndromic data on emergency department (ED) visit chief complaints and diagnoses for suicidal ideation and behavior (SIB) among adults aged ≥18 years. It applies the prospective space-time permutation scan statistic in the SaTScan™ software daily to these syndromic data. DOHMH detected a statistically significant cluster of 193 observed versus 139 expected SIB visits at 3 geographically clustered EDs during June 6–14, 2018. An Epi-Aid was initiated to describe the cluster and identify risk factors.

Methods: Visit chief complaint and diagnoses were manually reviewed to confirm SIB. Electronic medical records of 186 confirmed cluster visits and a random sample of confirmed historical SIB visits from the same EDs over the preceding 12 months (n = 253) were abstracted using a standardized form containing sociodemographic and contributing factors. Cluster and historical data were compared using chi-square.

Results: Cluster and historical visits (n = 439) were principally for suicidal ideation (93%), and from patients predominantly male (70%), aged 35–54 years-old (50%), black or Hispanic (77%), unemployed (75%), and unstably housed (47%). No significant differences were found between cluster and historical visits for previous mental illness/behavioral problems (cluster = 71%, historical = 72%, p = 0.75) and financial stress (cluster = 37%, historical = 38%, p = 0.79) but substance use was slightly less frequent among cluster visits (cluster = 63%, historical = 72%, p = 0.04)

Conclusions: DOHMH investigated a syndromic ED cluster of SIB. Analyses indicate that cluster and historical visits had generally similar key demographics and contributing factors, indicating a socioeconomically disadvantaged population with high prevalence of mental illness and substance use. Suicide is preventable with comprehensive strategies that promote economic security, housing stability and access to care. Those measures should be targeted toward the most vulnerable.

10:55 Nonfatal Violent Workplace Crime Characteristics and Rates by Occupation — United States, 2007–2015

Authors: Miriam Siegel, C. Johnson, C. Lawson, M. Ridenour, D. Hartley

Background: Recently, stories of sexual assault and workplace violence have dominated the news. Unfortunately, little data exist on the frequency of workplace violence. Many previous studies included only crimes reported to employers or police, known underestimates. Our objective was to examine characteristics of nonfatal violent workplace crimes, reported to authorities or not, and estimate rates by occupation.

Methods: We analyzed 2007–2015 data from the National Crime Victimization Survey, a nationally representative survey of nonfatal crimes. We included violent crimes (physical assault, verbal threats, sexual violence, robbery) occurring while victims aged ≥16 years were working. We calculated weighted frequencies and 95% confidence intervals (CI) stratified by crime type, victim demographics, and other crime characteristics. We used denominator estimates from the Current Population Survey to calculate crime rates in 22 occupations (crimes per 1,000 workers).

Results: In total, an estimated 10.3 million violent crimes occurred in the workplace, comprising 22% (CI: 20–25%) of all violent crimes. Protective service occupations (e.g., police) experienced the highest rate of violent workplace crimes (100 per 1,000; CI: 77–130); architects and engineers experienced the lowest (0.7 per 1,000; CI: 0.3–2). Only 39% of crimes were reported to law enforcement (CI: 35–43%). Most violent workplace crimes involved physical assault (50%; CI: 46–54%), then verbal threats (44%; CI: 40–48%), sexual violence (3%; CI: 2–6%) and robbery (3%; CI: 2–4%). More crimes against women than men were committed by offenders known from the workplace (34% versus 19%) and resulted in lost pay from lost work time (5% versus 1%).

Conclusions: More than 1 in 5 violent crimes occur in the workplace. Workplace violence is underreported. Including crimes that were unreported to authorities revealed patterns in crime, victim, and offender characteristics that can be used to develop violence-reduction interventions in the workplace.

11:15 Leading Causes of Death, Suicide, and Opioid-Related Deaths Among American Indian and Alaska Native Residents — Washington, 2012–2016

Authors: Alexander C. Wu, S. Joshi, T. Weiser

Background: Ranking death causes is needed for resource allocation but has not been recently assessed for American Indians and Alaska Natives (AI/AN) in Washington. We identified 5 leading causes of death and described suicide and opioid-related deaths.

Methods: Death certificate data from 2012–2016 from the Washington Department of Health were corrected for AI/AN misclassification through probabilistic linkage with the Northwest Tribal Registry. Causes of deaths were classified based on the *International Classification of Diseases, Tenth Revision* (ICD-10) codes in underlying cause of death, according to NCHS's 113 selected causes of death and ranked by frequency and proportion of classified causes. Opioid-related deaths were defined as death from drug overdose and ≥1 ICD-10 codes T40.0–T40.4 or T40.6 in the multiple cause of death fields. Deaths from suicide were defined in the underlying cause of death field. We compared death frequency among AI/AN with non-Hispanic whites (NHWs).

Results: Percent of AI/AN deaths in Washington increased from 2.2% (985) in 2012 to 2.7% (1,279) in 2016, while NHWs decreased from 97.8% (44,452) in 2012 to 97.3% (46,985) in 2016. AI/AN were younger at death (average age 62.1 years; standard deviation [SD] 20.3 years) than NHW (average age 75.4 years; SD 17.0 years), and had higher percentage of death for males (AI/AN 54% versus NHW 51%). Overall, the 5 leading causes of death among AI/AN were cardiovascular disease (n = 1,342, 23.7%), malignant neoplasms (n = 1,036, 18.3%), unintentional injury (n = 660, 11.6%), chronic lower respiratory disease (n = 328, 5.8%), and chronic liver disease and cirrhosis (n = 326, 5.7%). The percentages of death from suicide and opioids were higher among AI/AN (3.5% and 3.8%) than NHW (2.0% and 1.3%), respectively.

Conclusions: Actions are needed to decrease these disparities between AI/AN and NHW: age at death, suicides, and opioid-related deaths.

11:35 Intimate Partner Violence Among Adults and High School Students — New York City, 2016–2017

Authors: Karen A. Alroy, M. Sanderson, A. Wang, C. Stayton, L.H. Gould

Background: Intimate partner violence (IPV) impacts 1 in 4 women and 1 in 10 men. It encompasses psychological aggression, stalking, physical and sexual violence. Beyond acute injuries, IPV can cause lasting effects to health. It occurs across life stages, beginning when a person starts dating. We described prevalence and correlates of IPV among New York City (NYC) adults and adolescents.

Methods: We used data from 2 representative surveys. The 2016 NYC Community Health Survey, an annual telephone survey of NYC adults (aged ≥18 years, n = 10,000), asked about ever being hit, slapped, kicked, or other physical violence by an intimate partner. The 2017 NYC Youth Risk Behavior Survey, a biennial, self-administered survey of public school students (grades 9–12, n = 10,191), asked about being hit, slammed into something, or injured with an object or weapon within the prior 12 months. We calculated weighted prevalence, prevalence ratios (PRs), and 95% CIs to examine demographic characteristics, health outcomes and behaviors associated with IPV. Significant findings are reported below.

Results: Among adults, 9.0% of women and 5.8% of men reported IPV. It was higher among Latinos (9.5%), whites (8.2%), and blacks (7.4%), compared with Asians (2.0%). IPV prevalence was higher among adults with depression (PR 3.2; CI: 2.5–4.0), current smokers (PR 2.3; CI: 1.7–2.6), and current binge drinkers (PR 1.7; CI: 1.4–2.0). Among students, 9.3% of girls and 9.7% of boys reported IPV, and higher among Latinos (10.5%), blacks (10.0%) and Asians (6.5%) compared with whites (4.9%). Attempted suicide was a strong correlate of IPV among students (PR 4.9; CI: 3.5–6.6).

Conclusions: IPV is associated with alcohol, tobacco use and depression among adults, and with attempted suicide among adolescents. Population-based surveillance is a valuable tool to describe affected populations at different life stages and can improve age specific public health programs.

SESSION K: Alexander D. Langmuir Lecture

1:20–2:50 pm

Grand Ballroom

Moderators: Anne Schuchat and Patricia Simone

Mona Hanna-Attisha
MD, MPH, FAAP

Presentation of the Alexander D. Langmuir Award and Distinguished Friend of EIS Award

Presenter: Tina Tan

Alexander D. Langmuir Lecture

Mona Hanna-Attisha, MD, MPH, FAAP

Biography

Mona Hanna-Attisha, MD, MPH, FAAP is founder and director of the Michigan State University and Hurley Children's Hospital Pediatric Public Health Initiative, an innovative and model public health program in Flint, Michigan. A pediatrician, scientist, and activist, Dr. Hanna-Attisha has testified twice before the United States Congress, awarded the Freedom of Expression Courage Award by PEN America, and named one of Time magazine's 100 Most Influential People in the World for her role in uncovering the Flint Water Crisis and leading recovery efforts. She has appeared on CNN, MSNBC, BBC and countless other media outlets championing the cause of children in Flint and beyond. She is founding donor of the Flint Child Health and Development Fund (flintkids.org).

Dr. Hanna-Attisha received her bachelor's and Master of Public Health degrees from the University of Michigan and her medical degree from Michigan State University College of Human Medicine (MSU CHM). She completed her residency at Children's Hospital of Michigan in Detroit, where she was chief resident. She is currently an associate professor of pediatrics and human development at MSU CHM.

Her new bestselling book *What the Eyes Don't See: A Story of Crisis, Resistance, and Hope in an American City* is a riveting, beautifully rendered account of a shameful disaster that became a tale of activism and hope, the story of a city on the ropes that came together to fight for justice, self-determination, and the right to build a better world for their—and all of our—children.

Awards presented during session.

CONCURRENT SESSION L1: Maternal Child Health

3:10–4:55 pm

Grand Ballroom

Moderators: Wanda Barfield and Sharyn Parks Brown

3:15 Excess Infant Mortality in Metropolitan and Nonmetropolitan Areas by Race and Ethnicity — United States, 2014–2016

Authors: Lindsay S. Womack, L. Rossen, A. Hirai

Background: Infant mortality rates are disproportionally high in non-metropolitan areas compared with metropolitan areas; however, variation by race/ethnicity has not been assessed. The study objective is to quantify excess infant mortality in the United States by county urbanization and race/ethnicity.

Methods: Data from the National Vital Statistics System linked birth-infant death data (2014–2016) were merged by county of residence to an urban-rural classification scheme. Potentially excess deaths were defined as deaths in excess of the number that would be expected if the mortality rate of counties with the lowest infant mortality rate (i.e., large fringe metropolitan) occurred across counties of other urbanization levels. The percentage of potentially excess infant deaths was calculated by dividing the number of potentially excess deaths by the total observed number of deaths. Potentially excess deaths were calculated by urbanization level and race/ethnicity.

Results: The percentages of potentially excess infant deaths were highest in non-metropolitan areas for all racial/ethnic groups: 14.5% for non-Hispanic white infants, 4.3% in Hispanic infants, and 58.8% for non-Hispanic black infants. While there were no potentially excess deaths among non-Hispanic white and Hispanic infants in large central and large fringe metropolitan areas, the percentage of excess deaths for non-Hispanic black infants approached or exceeded 50% in all areas: 52.3% in large central metropolitan areas, 48.7% in large fringe metropolitan areas, 58.0% in medium/small metropolitan areas, and 58.8% in non-metropolitan areas.

Conclusions: Non-metropolitan areas have greater percentages of potentially excess infant deaths for all racial/ethnic groups, compared with more urban areas. Non-Hispanic black infants experience substantially greater percentages of potentially excess deaths in all areas, nearing or exceeding 50%, reflecting a persistent disparity regardless of urbanization. A better understanding of differences in mortality rates by urbanization and race/ethnicity can inform public health officials in focusing interventions to reduce preventable infant deaths.

3:35 Evaluating the Quality of Hospital Discharge Data as a Mechanism for Passive Surveillance of Neonatal Abstinence Syndrome in Illinois

Author: Ashley Horne

Background: As the rate of overall opioid use increases in the United States, so does the rate among women of child-bearing age and pregnant women. Consequently, more newborns are experiencing Neonatal Abstinence Syndrome (NAS), a constellation of withdrawal symptoms caused by prenatal exposure to certain drugs. NAS is a notifiable condition in Illinois, but validity and completeness of reporting are unknown. This analysis aimed to more accurately estimate the true NAS incidence in Illinois, and determine the positive predictive value (PPV), sensitivity and specificity of various diagnosis codes in hospital discharge data.

Methods: Illinois received a one-year grant by March of Dimes and CDC to enhance passive NAS surveillance during 2015 and 2016. Illinois identified potential cases from *International Classification of Diseases*, versions 9 and 10 (ICD-9 and ICD-10) maternal and infant diagnosis codes in hospital discharge data, the Illinois birth defects registry, and hospital reports. A standard chart abstraction form and case definition were used to determine if each possible case was a true NAS case. The case definition included: having a Finnegan score >8, history of maternal use of drugs associated with NAS, or laboratory confirmation of drug use in mother or baby, and severity of illness that resulted in an infant hospitalization of more than two days.

Results: 4,642 potential cases were identified during 2015–2016 in Illinois. Of these, 944 (20.3%) were determined to be true cases according to the case definition. The overall Illinois NAS incidence rate was 3.0 per 1,000 births during 2015, and 3.1 per 1,000 births during 2016. The PPV for ICD-9 and ICD-10 diagnosis codes varied from 5.2% to 80.2%. Among ICD-9 codes, the most reliable code was 779.5 "Drug withdrawal syndrome in newborn" (80.2%). Among ICD-10 codes, the most reliable code was P96.1 "Neonatal withdrawal symptoms from maternal use of drugs of addiction" (80.2%). Specificity of all discharge codes was above 99%, and sensitivity varied from 16.4% to 68.6%.

Conclusions: Accurate surveillance of NAS is important for connecting moms and babies to supportive services after birth. This analysis demonstrated that the ICD codes commonly used in passive NAS surveillance have moderate PPV, thus underestimating the NAS incidence rate. The high specificity and wide range of sensitivity indicates that passive NAS surveillance using hospital discharge data is good for identifying infants who do not have NAS, but may require additional case finding methods to determine true cases needing clinical intervention and follow-up.

3:55 Impact of the Recommendation for Routine Rotavirus Vaccination in Infants and Vaccine Uptake in Germany, 2013–18

Authors: Adine Marquis, J. Koch

Background: Routine rotavirus (RV)-vaccination for infants has been recommended in Germany since 08/2013 to reduce severe and nosocomial RV-gastroenteritis (RVGE) in under 5-year-olds. We aimed to assess vaccination coverage and determine the impact of the recommendation.

Methods: We estimated vaccination coverage from 2014–2017 using statutory health-insurance prescription data (covering approximately 85% of the German population). We used RVGE-surveillance data of the German mandatory notification system stratified by epidemiological years (calendar-week 40 until the following year's calendar-week 39) for impact assessment. We defined RVGE-associated hospitalizations of community-acquired RVGE as severe and RVGE-notifications with disease-onset of ≥2 days after hospitalization as nosocomial. We compared the time-period before RV-vaccine was utilized (2005/06–2007/08) with the period after the recommendation (2013/14–2017/18) and calculated incidence rate ratios (IRR) using Poisson regression. We analyzed hospital-discharge data (2006–2016) to determine the effect on intussusception using Wilcoxon rank-sum test.

Results: Vaccination coverage/birth-cohort increased from 59% (2014) to 81% (2017). Incidences of RVGE-outpatient cases, severe RVGE, and nosocomial RVGE among under 5-year-olds decreased by 74% (IRR = 0.26; 95% CI (confidence interval): 0.26–0.27), 70% (IRR = 0.30; 95% CI: 0.30–0.31), and 70% (IRR = 0.30; 95% CI: 0.30–0.31), respectively. Incidence of RVGE-outpatient cases in age groups ineligible for RV-vaccination decreased by 38% (IRR = 0.62; 95% CI: 0.61–0.63). The average number of intussusceptions in the 1st year of life decreased from 443 (range: 434–456) to 377 (range 369–384) (p = 0.03), while at age of the 1st vaccine-dose (7^{th}–12^{th} week of age) the average number was 18 (range: 14–21) compared to 27 (range: 16–30) (p = 0.16).

Conclusions: Routine RV-vaccination in Germany is well accepted and coverage continues to increase. With reduction of RVGE in under 5-year-olds and developing herd immunity in non-vaccinated age groups, the recommendations' objectives were reached. The decrease of intussusceptions in the first year of life suggests potential protection by RV-vaccination but further research is needed. Therefore routine RV-vaccination should be continued and vaccine uptake further increased to extend the positive effects.

4:15 Outbreak of Staphylococcal Scalded Skin Syndrome in a Neonatal Intensive Care Unit — Illinois, 2018

Authors: Caitlin F. Biedron, R. Link-Gelles, M. Weng, E. Moritz, J. Glowicz, R. Philip, A. Lucey, L. Jones, M. Frias, D. Christiansen, J. Layden, I. Benowitz, D. Ham, H. Moulton-Meissner, D. Kuhar, K. Powell, K. Perkins

Background: Staphylococcal scalded skin syndrome (SSSS) is a blistering skin condition caused by toxin-producing strains of *Staphylococcus aureus*, a bacterium commonly transmitted through contact with colonized or infected persons. We conducted an investigation in a neonatal intensive care unit (NICU) with 6 SSSS episodes in August–September 2017 and 3 additional episodes in February–March 2018 to identify opportunities to halt the outbreak.

Methods: On 2/19/18, the NICU initiated admission and weekly patient screenings to detect methicillin-sensitive *S. aureus* (MSSA) colonization. CDC performed pulsed-field gel electrophoresis (PFGE) on MSSA isolates to identify those indistinguishable from, or closely related to, the 2017 outbreak strain. An SSSS case was defined as a clinical diagnosis of SSSS in a patient on or after 2/18/18 with a culture growing the outbreak strain. An MSSA-colonized case was defined as isolation of the outbreak strain from a specimen collected on or after 2/18/18 from a patient without SSSS. Healthcare personnel (HCP) who had contact with ≥1 case-patient were screened for colonization. We reviewed medical records, identified contacts, and observed infection control practices.

Results: We identified 3 SSSS cases and 6 MSSA-colonized cases from 2/18/18 to 7/1/18. Of 112 HCP screened, 27 (24%) were colonized with MSSA; 1 isolate was indistinguishable from the outbreak strain, and 3 isolates were closely related. Control measures at the time of investigation included contact precautions, decolonization of patients and HCP, patient screening, and cohorting. Observations revealed lapses in personal protective equipment (PPE) use and environmental cleaning. Patient screening for 8 weeks following the last MSSA-colonized case did not identify additional cases.

Conclusions: No single source of the outbreak strain was identified. The outbreak was controlled with implementation of competency-based hand hygiene and PPE training, HCP decolonization, and cohorting. Halting these complicated NICU outbreaks requires strict adherence to infection control practices.

4:35 Characteristics of Home Births — United States, 2012–2014

Authors: Sonal Goyal, K. Kortsmit, S. Cox, D.V. D'Angelo, L. Romero, W.D. Barfield

Background: Home births, or births that occur at a residence, are rising, yet information on their characteristics is limited. Home births have more favorable outcomes when reserved for women with low-risk pregnancies, or healthy pregnancies with uncomplicated medical or obstetric history. We describe geographic and maternal characteristics of home births compared with facility births and determine what percentage of home births were low-risk.

Methods: The Pregnancy Risk Assessment Monitoring System (PRAMS) 2012–2014 data were used to calculate prevalence of home births overall and by state, and the percentage of home births considered low-risk. On the basis of available variables, we defined low-risk pregnancy as a term (37–42 weeks), singleton gestation with an infant birthweight within the 10–90 percentile mean for gestational age (as a proxy for estimated fetal size appropriate for gestational age), without pregnancy risk factors (e.g., hypertension), and no prior Caesarean section. We compared the prevalence of home and facility births across several maternal characteristics. We used Chi-square tests and 95% confidence intervals to determine differences.

Results: The overall prevalence of home births was 1.1%, ranging from 0.2% (New Jersey) to 2.6% (Oregon); 70.0% were low-risk. Of non-low-risk pregnancies, 72.8% were not singleton gestation of appropriate weight, 15.1% had pregnancy risk factors, 12% were not term, and 11.1% had a prior Caesarean section. Home birth rates were higher among women that were non-Hispanic white (1.5%), aged 25–35 years (1.2%) and ≥35 years (1.2%), in rural areas (1.9%), with <12 years of education (2.0%), no insurance (11.1%), no prenatal visits (4.6%), and who were married (1.6%) compared to their counterparts.

Conclusions: Prevalence of home births varied by state and demographic characteristics. Nearly a third were not low-risk. Understanding the risk profile of women who have home births can guide safe birthing practices.

CONCURRENT SESSION L2: Public Health Surveillance

3:10–4:55 pm

Capitol Ballroom

Moderators: James Watt and Stacey Bosch

3:15 Upsurge of Acute Flaccid Myelitis in the United States — CDC Surveillance Results, 2018

Authors: Susannah L. McKay, A. Lee, A. Lopez, L. Panagiotakopoulos, A. Keaton, B. Emery, H. Jost, W.C. Weldon, W.A. Nix, M.S. Oberste, M. Patel, J. Routh

Background: Acute flaccid myelitis (AFM) is a paralytic condition for which no proven treatment or prevention exists. Symptoms include limb and bulbar (neck and throat muscles) weakness, similar to poliomyelitis. After increased reports of AFM in 2018 compared with 2017, the National Center for Immunization and Respiratory Diseases activated an incident command structure to investigate patient characteristics and etiologies.

Methods: Health departments submitted reports of patients with weakness onset January 1 through December 22, 2018. We defined a confirmed case as acute flaccid limb weakness and spinal cord lesions largely restricted to gray matter on magnetic resonance imaging. Medical experts classified cases and reviewed hospital charts. We tested specimens for enteroviruses (EV), rhinoviruses (RV), and parechoviruses using real-time reverse transcription polymerase chain reaction (RT-PCR) assays.

Results: Among 249 patients reported, 175 (70%) were confirmed as AFM with peak month of onset in September. Median age was 4.9 years (range, 5 months–56 years); 106 (61%) were male. An antecedent respiratory or febrile illness was reported in 167 (95%). Most patients (n = 169, 98%) were hospitalized and 95 (58%) admitted to intensive care. Of 72 patients with medical charts abstracted, symptoms of bulbar weakness including dysphagia (n = 9, 13%) and dysarthria (n = 6, 8%) were documented; ventilation was required in 16 (22%). Brain MRIs were abnormal in 36 (52%) with lesions in the pons (19, 53%) and medulla (14, 39%) consistent with bulbar symptoms. Of 121 cases, RT-PCR was positive for EV in 41 (34%), RV in 7 (6%), untyped EV/RV in 6 (5%) and parechoviruses in 7 (6%), primarily from nonsterile sites.

Conclusions: AFM remains a rare disease, primarily affecting children. Surveillance data are consistent with a viral association. Documentation of bulbar involvement suggests the current case definition could be expanded to include isolated bulbar weakness to capture a broader spectrum of AFM.

3:35 Enterovirus D68 Circulation: Results from the New Vaccine Surveillance Network — United States, July–October 2017–2018

Authors: Stephanie A. Kujawski, C. Midgley, B. Rha, J. Lively, W. Nix, D. Payne, J. Englund, J. Boom, J. Williams, G. Weinberg, M. Staat, R. Selvarangan, N. Halasa, E. Klein, L. Sahni, M. Michaels, L. Shelley, M. McNeal, C. Harrison, L. Stewart, M. Oberste, J. Watson, S. Gerber

Background: Enterovirus D68 (EV-D68) infection is associated with acute respiratory illness (ARI) and caused a severe nationwide outbreak in 2014 with a substantial increase in pediatric hospitalizations. In the United States, detections typically peak during late summer–early fall. However, EV-D68 epidemiology, including annual trends, is not fully understood because testing availability is limited and reporting is voluntary. CDC recently established active, prospective surveillance of ARI–associated EV-D68 in the New Vaccine Surveillance Network (NVSN), a collaboration of seven U.S. hospitals; surveillance occurs annually during July–October. We aimed to describe EV-D68 detections within NVSN in 2017 and 2018.

Methods: We enrolled children (aged 0–18 years) with ARI, using a broad case definition, who presented to the emergency department (ED) or were hospitalized at NVSN sites: Tennessee; Pennsylvania; Missouri; Ohio; Texas; New York; or Washington. We collected demographics and admission status from medical charts and upper respiratory tract specimens for EV-D68 molecular testing. Using descriptive statistics, we summarized EV-D68 detections by year, month, site, admission status, sex, and age.

Results: We tested specimens from 2,433 and 2,579 children in 2017 and 2018, respectively. In 2017, two children with EV-D68 were identified: one each in Texas and New York. In 2018, we identified 358 (13.9%) children with EV-D68, with detections at all sites; 242 (67.6%) children were hospitalized. Almost half the EV-D68 detections occurred in September (n = 169, 47.2%), though the peak month varied by site. The median age of EV-D68-positive children in 2018 was three years (range: 1 month–17 years), and 211 (58.9%) were male.

Conclusions: Pediatric ARI surveillance detected substantially higher levels of EV-D68 activity during 2018 than 2017, including a large percentage of hospitalizations. Continued active surveillance over multiple years is critical to better understand trends in EV-D68 circulation and to improve public health and clinical preparedness.

3:55 Assessing Case Definition During a Hepatitis A Outbreak in San Diego County

Authors: Corey M. Peak, S. Stous, M. Hofmeister, A. Kao, E. McDonald

Background: The 2012 Council of State and Territorial Epidemiologists (CSTE) hepatitis A surveillance case definition lacks quantitative cutoffs for serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) and laboratory confirmation with reverse-transcriptase polymerase chain reaction (RT-PCR) -based methods. To consider improvement of the CSTE definition, we assessed alternative case definitions during the largest hepatitis A virus (HAV) outbreak in San Diego County (SDC) in >20 years.

Methods: SDC epidemiologists requested medical records and attempted to interview by phone all patients with hepatitis A reported to SDC during March 1, 2017–March 8, 2018. We assessed case status using CSTE's case definition that included acute onset of hepatitis symptoms, elevated ALT or AST or jaundice, and anti-HAV immunoglobulin M positive or an epidemiologic link. We requested serum specimens for RT-PCR testing from patients whose disease met CSTE's case definition or ≥2 case definition criteria without a more likely clinical diagnosis. Using RT-PCR results to define true case status, we measured sensitivity and specificity of case definitions derived from modifications of CSTE's case definition quantitative cutoffs and random forest machine learning methods with different prior class probabilities.

Results: Of 960 hepatitis A reports, 610 (64%) serum specimens were tested using RT-PCR; 521 (85%) were confirmed by RT-PCR for HAV, and 89 (15%) were negative. A modification of CSTE's case definition that defines a cutoff of ALT ≥280 IU/L and replaces AST criteria with total bilirubin ≥3 mg/dL yielded 95% sensitivity and 82% specificity, which approaches optimal limits of data fitting derived from random forest machine learning methods.

Conclusions: A modified CSTE 2012 hepatitis A case definition achieved high sensitivity and moderate specificity compared with gold-standard RT-PCR results. These results can guide updates to CSTE's hepatitis A case definition to enhance performance and standardize use.

4:15 Common Errors and Deficiencies in Lyme Disease Testing and Reporting — Georgia, 2018

Author: Lee Hundley

Background: Lyme disease (LD) is caused by the transmission of *Borrelia burgdorferi* to humans through the bite of infected ticks. Over 26,000 confirmed cases of LD were reported nationally in 2016, though Georgia, a low-incidence state, reported 8 or fewer confirmed cases each year since 2013. CSTE recommends a two-tier testing process (enzyme immunoassay antibody (EIA) and immunoglobulin Western Blot (WB)) for LD laboratory diagnosis, which should only be conducted if the clinical and exposure criteria are met. Despite these guidelines, Georgia Department of Public Health (DPH) receives numerous incomplete or clinically incompatible LD test results. Improper LD testing and reporting may lead to misdiagnosis, improper treatment, inaccurate disease surveillance, and wasted laboratory and public health resources. To determine common errors in testing and develop recommendations for physicians and laboratories, DPH instituted a new classification system for LD electronic laboratory reports (ELR) beginning January 1, 2018.

Methods: Each ELR was linked to a patient, then classified as positive, negative, or incomplete (with detail on which components are missing); prior to this, incomplete reports were discarded. Only patients with complete positive laboratory reports were further investigated by DPH epidemiologists to determine if they met the clinical and exposure history case criteria. Data from 2018 were analyzed to determine the completeness and accuracy of reporting for LD.

Results: DPH received 530 unique LD ELR in 2018. Of these, 141 (26.6%) were considered positive, 135 (25.5%) were negative, and 254 (47.9%) were missing essential laboratory diagnostic components and could not be properly interpreted. Of those missing components, 82.3% (209/254) were missing EIA results. Case follow-up revealed that 3.2% (17/530) of all reports and 12.1% (17/141) of positive reports met the clinical and exposure requirements (per the CSTE case definition) for a confirmed (n = 4) or probable (n = 13) LD case.

Conclusions: Study results demonstrated that physicians should better ensure that clinical criteria meet the LD case definition before ordering laboratory diagnostics for LD, and that all components of the two-tier tests are ordered when testing is warranted. As such, DPH will conduct outreach to labs to limit the number of negative tests reported to public health, and to physicians to improve the accuracy of LD testing and diagnosis in Georgia. In addition to improving clinical outcomes, this will yield a more accurate picture of LD epidemiology in Georgia and reduce the burden on laboratories and Public Health created by unnecessary LD testing.

4:35 Trends in the Laboratory Detection of Rotavirus Before and After Implementation of Routine Vaccination — United States, 2000–2018

Authors: Benjamin D. Hallowell, J. Tate, A. Curns, A. Haynes, N. DeGroote, U. Parashar

Background: Prior to rotavirus vaccine introduction in 2006, rotavirus infection was the leading cause of severe gastroenteritis among U.S. children. We evaluated the long-term impact of rotavirus vaccination in the United States by analyzing national laboratory testing data for rotavirus.

Methods: Antigen-based rotavirus tests conducted between July 2000 and June 2018 were obtained from laboratories participating in CDC's National Respiratory and Enteric Viruses Surveillance System. To examine trends in rotavirus testing during the pre- (2000–2006) and post-vaccine (2007–2018) periods, analyses were restricted to laboratories that continuously reported rotavirus testing results for at least 26 weeks during each annual rotavirus season from 2000 to 2018. To compare rotavirus season duration (i.e., weeks with >10% positivity) and peak activity (greatest weekly detection rate), data from all reporting laboratories were analyzed.

Results: Nationally, comparing the pre- and post-vaccine periods, the median annual proportion of positive rotavirus tests declined 57.4–90.1% from 26.1% (annual range 25.2–29.4%) to 6.1% (annual range 2.6–11.1%), peak rotavirus activity declined 36.7–88.9% from 43.1% (annual range 43.8–56.3%) to 17.3% (annual range 4.8–27.3%), and the median season duration was reduced by 8–26 weeks from 26 weeks (annual range 23–27 weeks) to 15 weeks (annual range 0–18 weeks), respectively. In the post-vaccine period, a biennial pattern emerged with alternating years of low and high rotavirus activity. In post-vaccine years with high rotavirus activity the median season duration was 17 weeks whereas the season threshold was never reached in low activity years. Median peak activity in high post-vaccine rotavirus years was 25.1% (annual range 21.7–27.3%) compared with 10.9% (annual range 4.8–12.2%) in low activity years.

Conclusions: The implementation of rotavirus vaccine has dramatically reduced the disease burden and altered seasonal patterns of rotavirus in the United States.

SESSION M: FETP International Night — Poster Presentations
6:00–8:30 pm
Capitol Ballroom

Oral Abstract Listing

Full abstracts are found within the International Night Conference Booklet.

Asaad, Asaad – Iraq
Cutaneous leishmaniasis outbreak in Diyala Governorate, Iraq, 2018

Chueh, Yu-Neng – Taiwan
Salmonellosis outbreak in a restaurant associated with French toast sandwich — Chiayi County, Taiwan, 2018

Golicha, Qabale – Kenya
Factors Associated with Tuberculosis Treatment Interruption in Igembe South, Meru County, Kenya

Katelaris, Anthea – Australia
Investigation and response to Australia's largest outbreak of leptospirosis — New South Wales, Australia, 2018

Kokuhabwa Mukurasi, Irene – Tanzania
Linkage into Care among Newly Diagnosed HIV Infected Individuals in Njombe Region, Tanzania 2017–2018: A Prospective Cohort

Singh, Akhileshwar – India
Risk Factors for Melioidosis in Udupi District, Karnataka, India, January 2017–July 2018

CONCURRENT SESSION N1: Viral Hepatitis and Tuberculosis

8:30–10:15 am

Grand Ballroom

Moderators: Carolyn Wester and Danice Eaton

8:35 Tuberculosis Transmission Among U.S.-Born Persons — Arkansas, 2010–2018

Authors: Sarah M. Labuda, A. Talwar, C. McDaniel, A. Braumuller, S. Parker, S. McGaha, C. Blissett, D. Haselow, C. Radcliff, J. Wheeler, J. Wortham, N. Patil, R. Stewart, L. Mukasa

Background: During 2010–2018, the Arkansas Department of Health (ADH) investigated 18 genotype-matched cases of tuberculosis (TB) among residents and nearby residents of Desha County, Arkansas, a low TB-incidence rural area that reported 1 case during 2005–2009. ADH and CDC investigated to determine extent of transmission and provide control recommendations as transmission continued during 2018.

Methods: We reviewed medical records, dates in congregate settings, and interviewed patients to determine patient characteristics and infectious periods. We conducted social media searches to identify epidemiologic linkages and locate potential transmission sites. CDC performed whole-genome sequencing (WGS) on all culture-positive specimens and identified single-nucleotide polymorphisms (SNPs).

Results: We identified 21 cases; 11 during 2010–2013, none during 2014–2015, and 10 during 2016–2018. All were in U.S.-born African American persons. Eighteen had matching genotypes, and 3 clinical cases had epidemiologic links to culture-confirmed cases. Nineteen (91%) cases were in Jefferson, Lincoln, and Desha counties; of those, 10 (53%) were clustered in 2 neighborhoods. Social media searches revealed social links among 12 patients not previously disclosed during interviews. Twelve patients (57%) had ≥1 healthcare visit during infectious periods, indicating missed opportunities for diagnosis; 6 patients had infectious periods of >12 months; and 11 of 14 adult patients with pulmonary TB (79%), considered the most infectious, were hospitalized ≥1 time during their infectious period. Two adult patients died from TB. WGS analysis indicated 17 available TB isolates were ≤2 SNPs of another isolate, consistent with transmission among cases.

Conclusions: Delayed TB diagnoses and prolonged infectiousness led to TB transmission in this rural community. Response efforts are ongoing; we recommended prioritizing education of community members to present to healthcare with symptoms, disclosure of contacts among patients, and encouraging healthcare providers to conduct appropriate TB diagnostic evaluations to reduce outbreak-associated morbidity and mortality in this region of continued transmission.

8:55 Association of Area-Based Socioeconomic Measures With Tuberculosis Incidence Rates — California, 2012–2016

Authors: Yasser Bakhsh, A. Readhead, J. Flood, P. Barry, J. Watt

Background: Country of birth (COB) is a known risk factor for tuberculosis (TB), but establishing control efforts solely by COB is resource intensive. Socioeconomic status (SES) has been associated with TB risk, but SES data are not collected by routine surveillance. We assessed SES association with TB incidence to guide public health efforts.

Methods: Data for 9,901 patients with active TB disease reported to the California TB registry with valid residential address during 2012–2016 were combined with census tract-level population denominator and SES data from the American Community Survey 5-year estimate (2012–2016). SES measures included percent of population below the federal poverty line (poverty), percent of housing units with >1 person per room (crowding), and percent of persons aged ≥25 years with <12th grade education (educational attainment). We calculated adjusted incidence rate ratios using negative binomial regression controlling for patient-level COB and interactions between COB and SES measures. COB included: China, India, Mexico, Philippines, United States, and Vietnam.

Results: Each 10% increase in poverty was associated with 15% (95% CI: 9–20) and 13% (95% CI: 7–19) higher TB incidence for U.S.-born and Mexico-born persons, respectively. Each 10% increase in crowding was associated with 42% (95% CI: 16–74) and 15% (95% CI: 4–27) higher TB incidence for India-born and Philippines-born persons, respectively. Each 10% decrease in educational attainment was associated with higher TB incidence by 29% (95% CI: 22–36) for U.S.-born, 31% (95% CI: 17–46) for China-born, 20% (95% CI: 8–34) for Vietnam-born, 9% (95% CI: 1–18) for Philippines-born, and 6% (95% CI: 1–12) for Mexico-born persons.

Conclusions: Association of SES measures with TB incidence differs by COB. Using area-based SES measures and COB might help focus TB control and prevention efforts on areas with residents at highest risk.

9:15 Uptake of Tuberculosis Preventive Treatment Among People Living with HIV in Zambia and Challenges

Authors: Michael Melgar, R. Shiraishi, N. Mwananyambe, D. Mwakazanga, K. Kapungu, M. Tembo, L. Podewils

Background: The Zambia Ministry of Health recommends tuberculosis preventive treatment (TPT) with 6 months daily isoniazid for all people living with HIV (PLHIV) after ruling out active tuberculosis disease. We sought to estimate the percentage of eligible PLHIV who receive TPT and to identify challenges with TPT implementation in two provinces, Lusaka and Copperbelt, with the highest tuberculosis burden in Zambia.

Methods: In this cross-sectional survey, we used a two-stage cluster sampling method. First, we sampled 12 healthcare facilities with probability-proportional-to-size. Patient volume determined facility cluster size. From each facility, we systematically sampled medical records of approximately 30 adult PLHIV (age ≥15 years) and up to 30 children living with HIV (CLHIV, age <15 years) to estimate TPT initiation and completion rates among eligible individuals. Estimates were weighted and controlled for complex survey design. Additionally, we interviewed one healthcare worker at each facility regarding TPT knowledge and challenges.

Results: We sampled 482 PLHIV (including 128 CLHIV). Four-hundred-twenty-two were TPT-eligible, of whom 25% (95% confidence interval [CI]: 9–51%) initiated TPT. TPT initiation was significantly lower for CLHIV compared with adults (8% vs 25%, Rao-Scott-adjusted chi-square p = 0.03). PLHIV with a positive initial tuberculosis symptom screen but who ultimately were not diagnosed with active tuberculosis disease after additional work up had a significantly lower TPT initiation rate than those with a negative initial symptom screen (12% vs 29%, Rao-Scott-adjusted chi-square p = 0.05). Among PLHIV who initiated TPT, 69% (95% CI: 15–97%) completed 6 months of treatment. Among interviewed healthcare workers, only 41% (unweighted) correctly relayed recommended target populations for TPT. Seventy-five percent (unweighted) reported insufficient stockpile of isoniazid for completion at the time of TPT initiation.

Conclusions: TPT initiation for eligible PLHIV is low overall, with initiation among CLHIV even lower. The Ministry of Health should prioritize provider education and isoniazid procurement.

9:35 Hepatitis C Virus Transmission Associated with Drug Diversion in a Local Hospital Emergency Department — Washington State, August 2017–March 2018

Authors: Henry N. Njuguna, D. Stinson, P. Montgomery, N. Turner, M. D'Angeli, J. Carr, S. Podczervinski, C. Wasserman, S. Ramachandran, H. Thai, T. Lucas, D. Bixler, K. Perkins, I. Benowitz, A. Moorman

Background: Illegal diversion of prescription drugs, particularly injectable narcotics, poses a risk for disease transmission to patients and healthcare personnel (HCP). Washington State received 2 reports of acute hepatitis C virus (HCV) infection among patients without known risk factors. Initial investigation identified an HCP who had treated both patients and tested positive for HCV antibodies. This HCP had accessed the automated drug dispensing system more frequently than other staff and admitted diverting injectable narcotics and antihistamines for personal use. We investigated to confirm infection source, identify patients potentially exposed to the infected HCP, and treat any new infections.

Methods: We reviewed hospital records to identify living patients who had received injectable narcotics, sedatives, or antihistamines in the emergency department from August 4, 2017–March 23, 2018 when the infected HCP was working at the hospital. We contacted patients by mail, alerted them of potential exposure, and offered free testing for HCV, hepatitis B virus (HBV), and HIV. HCV RNA positive specimens were tested for genetic relatedness.

Results: We identified 2,762 living patients, including 208 patients treated by the infected HCP. We tested 1,863 (67%) patients, including 175 (84%) treated by the infected HCP. Among those treated by the HCP, 13 (7%) tested positive for HCV RNA; all were genetically related. Among 1,688 patients not treated by the infected HCP, 15 tested positive for HCV RNA; none were genetically related. All HCV RNA-positive patients were referred to care. No patients tested positive for HIV or new HBV infection.

Conclusions: An HCP who diverted injectable narcotics for personal use was likely the source for spreading HCV infection through contaminated injections to the patients, highlighting the need for closely monitoring drug dispensing systems in healthcare settings. Public health response to drug diversion should include testing of exposed patients and treating when necessary.

9:55 Identification of Sustained Virologic Response Among Individuals with Hepatitis C Virus Infection — Chicago, Illinois

Authors: Tristan D. McPherson, D. Fleary, A. Gagner, S. Kemble, S. Ayala, N. Kosacz, D. Johnson, K. Lee, S. Tilmon, M. Patel

Background: Hepatitis C treatment is not routinely collected in surveillance, creating difficulty in calculating proportion of persons with hepatitis C achieving sustained virologic response (SVR), (i.e., cure). However, a laboratory algorithm for this purpose has been proposed using negative hepatitis C virus (HCV) RNA tests to identify those in treatment (1 negative RNA test) and those with SVR (2 negative RNA tests). We used a novel hepatitis C registry containing both laboratory and pharmacy data to compare SVR percentages derived from the laboratory algorithm with those from a treatment algorithm.

Methods: The registry comprises data from electronic surveillance, pharmacy chains (n = 2), and clinics (n = 11) in Chicago. We calculated SVR status for 2,754 persons tested at these clinics with positive HCV antibody testing or any HCV RNA testing during September 30, 2013–September 30, 2018. SVR was calculated using 2 algorithms, including ≥1 positive RNA followed by ≥2 negative RNA tests without further positive values (laboratory algorithm); secondly, evidence of treatment and a negative posttreatment RNA (treatment algorithm).

Results: Both algorithms yielded similar SVR percentages (laboratory: 6.7% [184/2,754]; treatment: 7.5% [206/2,754]). Among 324 unique persons identified as having SVR, 66 (20.4%) were identified by both methods, 118 (36.4%) by laboratory algorithm only, and 140 (43.2%) by treatment algorithm only.

Conclusions: Inclusion of pharmacy data identified SVR among people who would not be identified using routinely collected surveillance data. SVR identified by the laboratory algorithm alone might result from missing treatment data or spontaneous resolution of infection. Enrollment of additional pharmacy chains to the registry are planned; future studies should determine if treatment data from additional pharmacies validate more instances of SVR identified by the laboratory algorithm. To better estimate SVR, public health jurisdictions could consider incorporating pharmacy data into standard hepatitis C surveillance.

CONCURRENT SESSION N2: Respiratory Diseases

8:30–10:15 am

Capitol Ballroom

Moderators: Daniel Jernigan and Jennifer Liang

8:35 Invasive *Haemophilus influenzae* Type a Disease Outbreak in an Alaska Village, 2018

Authors: Amanda J. Tiffany, L. Nolen, R. Porter, J. Cabusao, K. Krings, E. Mosites, A. Reasonover, G. Thompson, C. DeByle, M. Bruce, J. McLaughlin, L. Castrodale

Background: During April–June 2018, a total of 4 cases of pediatric invasive *Haemophilus influenzae* type a (Hia) disease were reported in an Alaska village (Village A; population <650 people); all patients were hospitalized. Invasive Hia disease is uncommon and life-threatening; on average, 5 cases of Hia are reported annually in Alaska. We investigated to identify contacts, provide chemoprophylaxis, and ascertain community colonization.

Methods: We made 3 visits to Village A; 2 in July and 1 in September. Contacts were people of any age who spent ≥4 hours with the patient for ≥5 of the 7 days preceding that patient's hospitalization. Contacts (visit 1) and children <10 years (visit 2) were offered rifampin chemoprophylaxis and encouraged to submit nasopharyngeal swabs before and ≥4 days after initiating chemoprophylaxis. Community members of any age were encouraged to submit swabs during visits 2 and 3. Swabs were tested, and Hia colonization was culture confirmed. Paired *t*-tests and Fisher's exact tests were used to compare proportions of colonized contacts and community members at different visits.

Results: Patients' age range was 6 months–1.7 years; 3 (75%) were male, 1 died. Fifty-two contacts were identified; 42 (81%) received chemoprophylaxis; 15/42 (36%) provided swabs before and after initiating chemoprophylaxis. Among these 15 contacts, Hia colonization decreased by 67% from visit 1 to visit 2 (20% versus 6.7%, respectively; $P = 0.16$). Chemoprophylaxis was provided to 121/195 (62%) children aged <10 years. During visits 2 and 3, a total of 364 and 114 community members provided swabs, respectively. Community Hia colonization decreased, but not significantly between visit 2 and visit 3 (1.3% versus 0.88%, respectively; $P = 0.67$).

Conclusions: Hia colonization decreased among contacts and community members after chemoprophylaxis was provided. No additional cases of invasive *H. influenzae* disease occurred in Village A after the intervention.

8:55 Racial Disparities in Invasive *Haemophilus influenzae* Disease Affecting American Indian and Alaska Native Populations — United States, 2008–2017

Authors: Nicole E. Brown, A. Blain, K. Burzlaff, M. Farley, L. Harrison, R. Herlihy, C. Smelser, A. Thomas, L. Triden, M. Whaley, F. Hu, X. Wang, S. Oliver, H. Soeters

Background: Invasive *Haemophilus influenzae* (Hi) disease is caused by typeable (serotypes a, b, c, d, e, and f) and nontypeable strains. Hi serotype b (Hib) conjugate vaccines introduced during the 1980s decreased Hib incidence; however, Hib and non-Hib disease remain disproportionally high in American Indian and Alaska Native (AI/AN) populations compared to other racial groups. We describe current Hi disease racial disparities.

Methods: We analyzed 2008–2017 Hi disease data from Active Bacterial Core surveillance, an active, population- and laboratory-based surveillance system conducted in 10 U.S. sites. Sterile-site isolates were serotyped via slide agglutination and real-time polymerase chain reaction. Case-fatality ratios (CFRs) were calculated using cases with known outcomes. Projected nationwide annual incidences per 100,000 population were standardized for race and age; unknown race was multiply imputed. Cases in AI/AN patients were compared to those in all other races (non-AI/AN) and incidence rate ratios (IRR) were calculated.

Results: From 2008–2017, 7,389 cases of invasive Hi disease were reported; 2.4% were in AI/AN. Of 6,546 (88.6%) serotyped cases: 1.8% were Hib; 26.6% were non-b serotypes; and 71.6% were nontypeable. Median age was 24 and 65 years for AI/AN and non-AI/AN patients, respectively ($p < 0.0001$). CFRs were similar (AI/AN: 14.2% vs non-AI/AN: 13.9%, $p = 0.9$). Incidence was higher among AI/AN (3.1/100,000) than non-AI/AN (1.8/100,000; IRR: 1.8, 95% CI: 1.5–2.1). Disease burden and disparity were greatest among children aged <5 years (13.8/100,000 in AI/AN vs 2.8/100,000 in non-AI/AN; IRR: 4.9, 95% CI: 3.9–6.3), particularly for Hi serotype a (Hia, IRR: 16.7) and Hib (IRR: 29.0). Of 15 Hib cases in AI/AN children aged <5 years, Hib vaccine series was complete in 6 (40%).

Conclusions: Invasive Hi disease disproportionately affects AI/AN, particularly Hia and Hib in children aged <5 years. Additional Hia and Hib prevention strategies are needed to address these disparities.

9:15 Trends in Reported Legionnaires' Disease in North Carolina, 2010–2017: Increasing Disease or Increasing Detection?

Authors: Carolyn T.A. Herzig, A. Fleischauer, J-M. Maillard, J. MacFarquhar, Z. Moore

Background: During 2000–2016 in North Carolina (NC), reported incidence of Legionnaires' disease (LD) increased ~4-fold, similar to national trends. To determine if increasing disease burden in NC is attributable to increased testing, we evaluated the number of LD diagnostic tests performed and positivity rate over time.

Methods: We requested reports for the number of LD diagnostic tests performed and number positive during 2010–2017, by year and test type (urinary antigen test [UAT], serology, culture, or other) from MicroNet members, representing all ~120 NC hospitals. We calculated percent of positive tests by year and test type and used Poisson regression to estimate changes in positivity rate over time.

Results: Twenty hospitals provided data; 544 tests were positive, representing 47% of reported LD cases during the same period. Analyses included data from eight hospitals with complete data for all years and test types, including five of NC's largest hospital systems. The total number of tests performed increased from 5,138 in 2010 to 9,729 in 2017. UATs were the most frequently reported test across all years (4,524 [88%] in 2010 to 7,487 [77%] in 2017); percent of positive UATs increased from 0.46% to 1.32%. Compared with 2010, rate of positive UATs was significantly higher in each year during 2014–2017; the highest rate occurred in 2017 (rate ratio [RR]: 2.85; 95% CI: 1.78–4.56). Results did not differ substantially when all test types or all hospitals were analyzed.

Conclusions: Diagnostic testing for LD and number of positive tests increased during 2010–2017; therefore, increased testing contributed to increases in reported LD. However, the positivity rate increased approximately 3-fold, suggesting that increased detection as well as increases in true incidence contributed to increasing disease burden. Identification of factors that contribute to increasing LD is necessary toward implementing effective prevention and control strategies.

9:35 Acute Cardiovascular Events and Outcomes Among Adults Hospitalized with Influenza — United States, 2010–2017

Authors: Eric J. Chow, A. O'Halloran, E. Anderson, N. Bennett, L. Billing, S. Chai, E. Dufort, S. Eckel, R. Herlihy, L. Irizarry, A. George, M. McMahon, P. Ryan, K. Talbot, A. Thomas, K. Yousey-Hindes, M. Rolfes, C. Reed, S. Garg

Background: Influenza virus causes an acute respiratory tract infection and may lead to non-respiratory complications. We describe the acute cardiovascular events associated with influenza infection and their in-hospital outcomes using data from the Influenza Hospitalization Surveillance Network (FluSurv-NET).

Methods: We analyzed FluSurv-NET data from adults (≥18 years) hospitalized with laboratory-confirmed influenza and identified through clinical influenza testing from 2010–2011 through 2016–2017. We defined cardiovascular event as having ≥1 *International Classification of Diseases* (ICD) code for hypertensive crisis, acute ischemic heart disease, acute pericarditis, acute myocarditis, cardiac tamponade, acute congestive heart failure (CHF) exacerbation and cardiogenic shock. We reviewed medical records for data on demographics, underlying medical conditions and outcomes (intensive care unit [ICU] admission, mechanical ventilation, or death). We used multivariable logistic regression to compare outcomes of patients with and without acute cardiovascular events.

Results: Of 61,865 adults hospitalized with laboratory-confirmed influenza, 46% reported cardiovascular disease history (e.g., atrial fibrillation, cardiomyopathy, CHF, coronary artery disease) and 11% (n = 6,695) had in-hospital cardiovascular events, most commonly acute CHF exacerbation (53%) and acute ischemic heart disease (47%). Among the patients with cardiovascular events, 33% required ICU admission, 15% received mechanical ventilation and 8% died in the hospital. After adjusting for age, gender, race/ethnicity, tobacco use history, chronic lung disease, cardiovascular disease history and diabetes, those with cardiovascular events were more likely to require ICU admission (adjusted odds ratio [aOR]3.1; 95% confidence interval [CI]: 2.9–3.3), receive mechanical ventilation (aOR = 3.3; 95% CI: 3.0–3.6), or die in the hospital (aOR = 2.8; 95% CI: 2.5–3.1).

Conclusions: Among hospitalized adults with influenza virus infections, the presence of acute cardiovascular events was associated with severe outcomes. Given that FluSurv-NET only captures clinician-tested influenza infections, the burden of influenza-associated cardiac events is likely underrepresented. Clinicians should remain attentive for hospitalized patients with cardiovascular complications and their attendant morbidity and mortality during the influenza season.

9:55 Clinical Characteristics at Hospital Admission Associated with Severe Influenza-Related Outcomes — United States, 2017–2018

Authors: Joshua D. Doyle, S. Garg, L. Beacham, C. Cummings, A. O'Halloran, R. Herlihy, K. Yousey-Hindes, E. Anderson, M. Monroe, S. Eckel, R. Lynfield, L. Irizarry, N. Spina, N. Bennett, M. Hill, W. Schaffner, H.K. Talbot, W. Self, D. Williams

Background: Influenza causes substantial annual morbidity and mortality. We evaluated the performance of validated pneumonia severity indices in predicting severe outcomes, including intensive care unit (ICU) admission, use of non-invasive mechanical ventilation (NIMV), mechanical ventilation (MV) or vasopressors, and death among adults hospitalized with influenza.

Methods: We included adults (≥18 years) hospitalized with laboratory-confirmed influenza during the 2017–18 influenza season, identified through the Influenza Hospitalization Surveillance Network. Medical chart abstractions were performed on a stratified random sample of cases at a subset of hospitals within the catchment areas of ten network sites to obtain data on vital signs and laboratory values at admission. Cases were assigned to low- and high-risk groups based on the CURB-65 ('Confusion, Urea, Respiratory rate, Blood pressure, Age ≥65') index (high-risk cutoff = score ≥3), and the Pneumonia Severity Index (PSI) (high-risk cutoff = category V). We calculated sensitivity, specificity, and area under receiver operating characteristic curves (AUROC) to estimate the performance of each index in predicting severe outcomes.

Results: Among 27,538 adults hospitalized with influenza, 8,973 (33%) were included; median age was 69 years and 92% had ≥1 chronic condition. A total of 1,444 (16%) were classified as high-risk by CURB-65 and 1,342 (15%) by PSI. The AUROC for ICU admission, NIMV use, MV or vasopressor use, and death was low for both CURB-65 (0.55–0.65) and PSI (0.58–0.72). CURB-65 was less sensitive than PSI in predicting MV or vasopressor usage (31%; 95% confidence interval [CI]: 27–35% versus 42%; CI: 38–46%) and death (45%; CI: 38–51% versus 58%; CI: 52–65%). The specificity of CURB-65 and PSI was similar against all outcomes (85–86% versus 86–88%).

Conclusions: The CURB-65 and PSI indices performed poorly in predicting severe outcomes among adults hospitalized with influenza. Alternative approaches for predicting severe outcomes are needed to optimize clinical care.

SPECIAL SESSION 2: With the Benefit of Hindsight: Reflections on Key Public Health Events and Decisions

10:30–11:35 am

Capitol Ballroom

Moderator: Jonathan (Jono) Mermin

Sponsoring CIO: National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention (NCHHSTP)

This session will ask senior leaders—all EIS alumni—to reflect on CDC's response to a variety of public health issues through the valuable lens of hindsight. Leaders will provide context regarding what was known at the time of critical public health events, what decisions were made as a result, what's known now, and how lessons learned might be applied to current, relevant work.

Relevance and Appropriateness for the EIS Conference

The Epidemic Intelligence Service trains epidemiologists to practice a fast-paced, real-world brand of epidemiology, referred to as 'applied epidemiology.' Applied epidemiology differs from academic epidemiology in several ways, most notably in that it requires the epidemiologist—a public health actor—to make decisions and take action while equipped with incomplete or imperfect information. When making real-world decisions based on applied epidemiology, public health actors sometimes get it right the first time. More often than not, though, public health actors make decisions using the best available information and must quickly adjust based on new information as it is obtained. As epidemiologists, we often miss the critical opportunity that presents itself after a public health crisis has abated—the opportunity to reflect on our response through the valuable lens of hindsight. This session will offer junior and senior epidemiologists alike a chance to witness senior leaders reflect on key decisions that were made—in light of available information—in response to public health situations. The moderator will encourage leaders to discuss what, if anything, they may have done differently given all information available to them now. Senior leaders will identify lessons learned from prior experiences that may inform the way we approach similar problems today.

Speakers

- Recommending HIV Treatment Only for the Sickest Among Us: The Original Decision to Exclude the 'Fairly Healthy'
  John T. Brooks, MD; EIS 1998; Chief Medical Officer, CDC Division of HIV/AIDS Prevention
- The Response to Ebola Virus Disease in West Africa: Expect the Unexpected
  Barbara J. Marston, MD; EIS 1990; Deputy Director for Science and Programs, CDC Division of Parasitic Diseases and Malaria
- Electronic Cigarettes: A Safer Alternative to Traditional Cigarettes?
  Brian King, PhD; EIS 2010; Deputy Director for Research Translation, CDC Office on Smoking and Health
- When is a Foodborne Outbreak Really an Outbreak? And When Do We Sound the Alarm?
  Robert Tauxe, MD; EIS 1983; Director, CDC Division of Foodborne, Waterborne, and Environmental Diseases

TED-STYLE TALK 2

10:30–11:35 am

Grand Ballroom

Aufra Araujo
"God is Guinean" — Miracles in the Laboratory

David Lowe
How Bass Fishing and Tailgates Can Improve Specimen Transportation

Erin D. Moritz
Sexy Monkey, White Tiger, and Blue Giant, Oh My! Navigating an Outbreak Linked to Illicit Substances

Guillermo Sanchez
Breaking into an Alabama Prison to Stop a Meningitis Outbreak: One EIS Officer's Experience

CONCURRENT SESSION O1: Infections Transmitted in the Community

1:05–2:30 pm

Grand Ballroom

Moderators: Chris Braden and Michael Gronostaj

1:10 Measles Contact Tracing in the Ridesharing Economy — Oregon, 2018

Authors: Steven I. Rekant, T. Poissant, J. Liko, M. Powell, D. Tran, J. Hawkins, K. Hillebrand, S. Liong, R. Pierce, P. Cieslak

Background: On August 10, 2018, the Oregon Health Authority (OHA) was informed that a person with measles visited Oregon during her infectious period. On August 20, a secondary case of measles was reported. While in Oregon, both patients visited public places and used transportation ridesharing companies. To find exposed persons and prevent additional cases, state and local public health officials initiated an investigation, including identification of persons exposed through ridesharing.

Methods: OHA defines measles-exposed persons as those spending time indoors within 10 meters of a measles patient and for ≤20 minutes of a measles patient having been at that location. Patients are infectious for 4 days before and after rash onset. We included ridesharing drivers and passengers who rode in the car ≤20 minutes after a patient. We obtained pick-up and drop-off times and locations from patient rideshare accounts, provided this information to rideshare companies, and negotiated release of drivers' and passengers' contact information for follow-up. We ascertained vaccination status of contacts and advised them how to seek care if they experienced measles symptoms.

Results: Patients used two ridesharing companies. Contact by phone was unsuccessful. Information was obtained by visiting Company A's office. In addition to a visit, Company B required a letter citing OHA's legal authority. We obtained contact information for all 14 contacts (9 drivers and 5 passengers) 4 days after confirming patients' trips. Of 14 contacts, 1 driver was incompletely vaccinated; he was instructed to self-monitor and remained symptom-free. Other concerned drivers contacted OHA; their ride details indicated that they had not been exposed to either patient. Company B misinterpreted OHA information request and suspended 1 driver's account, considering him a public health threat.

Conclusions: No measles transmission through ridesharing was identified. Information available from ridesharing companies complemented traditional methods and proved essential to complete contact tracing.

1:30 Community-Associated *Clostridium difficile* Infection and Antibiotic Exposure — Minnesota, 2009–2016

Authors: Joanne Taylor, M. Bye, K. Sweet, K. Smith, S. Holzbauer

Background: Community-associated (CA) *Clostridium difficile* infections (CDIs) account for an increasing proportion of CDIs nationally. Prior antibiotic use is a known risk factor for CA-CDI. We sought to identify other risk factors by comparing CA-CDI patients with antibiotic use in the prior 12 weeks to those without antibiotic use.

Methods: We analyzed Minnesota Department of Health active population- and laboratory-based CDI surveillance data from 2009–2016. A CA-CDI case was defined as a *C. difficile*-positive specimen collected as an outpatient or ≤3 days of hospitalization from a person aged ≥1 year who resided in 1 of 5 sentinel counties and did not have CDI in the prior 8 weeks or an overnight stay in a healthcare facility in the prior 12 weeks. We limited our analysis to cases with negative laboratory results for other enteric pathogens and with symptoms consistent with CDI. CA-CDI contributing factors were ascertained by reviewing medical records and patient interviews.

Results: Of the 2,679 CA-CDI cases, 1,514 (56.5%) were included in the analysis. Antibiotics were not used prior to infection in 749 (49.5%) CA-CDI patients. Compared with patients with prior antibiotic use, patients without antibiotic use were younger (median age: 48.5years versus 56 years, P <.001), more likely male (40.9% versus 35.0%, P <.05), have preexisting inflammatory bowel disease (IBD) (11.1% versus 5.9%, P <.001), take antidiarrheal medications (11.3% versus 7.1%, P <.05), and had animal exposures (11.5% versus 9.6%, P <.05). In a multivariate model including these significant variables, being younger (P <.05) and having preexisting IBD (P <.005) were more likely in CA-CDI patients without prior antibiotic use before CDI.

Conclusions: After exploring potential exposures, we identified CA-CDI patients without prior antibiotic use were more likely to have preexisting IBD diagnosis. This novel finding warrants further investigation as does consideration of other unexplored risk factors.

1:50 *Candida auris* Colonization in the Community Setting — New York City (NYC), 2017–2018

Authors: Genevieve Bergeron, D. Bloch, K. Murray, M. Kratz, H. Parton, A. Fine, J. Ackelsberg, M. Dorsinville, M. Antwi, S. Clark, G. Hrusa, M. Lash, H. Kubinson, E. Harrison, S. Rand, J. Sell, G.M. Foote, E. Lee, D. Weiss

Background: *C. auris* is a multidrug resistant yeast that can spread in healthcare settings and cause invasive infections. It emerged in NYC in 2016. In healthcare settings, most patients remain colonized for months, but it is unclear if patients remain colonized after discharge. NYC Department of Health and Mental Hygiene (DOHMH) piloted a case management program for people colonized with *C. auris* in the community setting to alert healthcare facilities where patients may seek care and monitor colonization status longitudinally.

Methods: Starting October 4, 2017, New York State Department of Health referred people colonized with *C. auris* to DOHMH when they were informed of community discharges from healthcare facilities. DOHMH case managers collected clinical information through patient interview and medical record review and informed the patient's providers and healthcare facilities about the patient's *C. auris* status and infection control needs. Case managers coordinated colonization testing with the patient's providers every 3 months. Colonization testing included swabs of axillae, groins and nares and when applicable a culture of previously *C. auris* positive body site. If *C. auris* was not detected, testing was repeated at least one week later to confirm results.

Results: By October 16, 2018, DOHMH received 59 referrals, performed 33 patient interviews, and sent 89 reports to health care facilities regarding a patient's *C. auris* status. Twenty-nine (49%) patients had at least 2 colonization tests after initial *C. auris* diagnosis, of whom 9 (31%) no longer had *C. auris* detectable on 2 consecutive assessments.

Conclusions: An ongoing pilot case management program supports infection control for people colonized with *C. auris* by informing a person's healthcare facilities of needed infection control. Some people no longer had *C. auris* detectable on repeat colonization testing. Continued data collection is needed to identify factors associated with persistent *C. auris* colonization.

2:10 Use of Mass Antimicrobial Prophylaxis to Stop a Group A *Streptococcus* Outbreak Among Unaccompanied Children in a Shelter — Maricopa County, Arizona, January–August 2018

Authors: Carla P. Bezold, L. Misegades, M. Winbush, J. Matthews, M. Bartholomew, F. Figueroa, R. Khurana, D. Naranjo, J. Peters, N. Somerville, K. Tarter, C. Van Beneden, C. Velasquez, R. Sunenshine

Background: In January 2018, Maricopa County Department of Public Health (MCDPH) and the Office of Refugee Resettlement (ORR) were notified of a group A *Streptococcus (*GAS) pharyngitis outbreak at a shelter for unaccompanied children (UC). Transmission continued through July despite screenings, targeted treatments, and infection control interventions. We sought to characterize transmission sources, including whether cases were shelter-acquired and whether staff were affected, and stop transmission in this congregate setting.

Methods: We reviewed the ORR surveillance system for confirmed cases (pharyngitis or lymphadenopathy with GAS isolation or a positive rapid test in a shelter-residing child); shelter-acquired infections had illness onset >5 days after arrival. To determine potential cases among ~500 shelter staff, we administered an anonymous survey regarding GAS symptoms during the previous 6 months. Staff reporting pharyngitis or lymphadenopathy had suspected cases. We requested all UC and staff to initiate antimicrobial therapy with cephalexin or azithromycin. Staff declining antibiotics were required to wear a surgical mask until the outbreak ended, defined as 2 incubation periods (10 days) after treatment completion and no new shelter-acquired cases reported among UC.

Results: We identified 195 confirmed cases among UC occurring during January–July; 182 (93%) cases were shelter-acquired. Of 195 children, 142 (73%) were from Guatemala; median age was 16 years; 142 (73%) were male. Among 403 staff completing the survey, 144 (36%) had suspected GAS pharyngitis, of whom 100 (69%) also reported working while ill. On July 19 MCDPH dispensed 961 antibiotic courses (423 among UC and 538 among staff). The outbreak ended on August 7.

Conclusions: GAS transmission within a shelter persisting >6 months was successfully halted following mass antimicrobial prophylaxis of residents and staff. Staff who worked while ill likely contributed to sustained transmission. ORR continues to screen, and treat as needed, incoming minors for GAS.

CONCURRENT SESSION O2: Birth Defects and Disability

1:05–2:30 pm

Capitol Ballroom

Moderators: Margaret Honein and Matthew Maenner

1:10 Feasibility of Using Birth Defects Surveillance to Address Antiretroviral Safety Concerns: Evaluation of a Hospital-Based Birth Defects Surveillance System — Malawi, 2016–2018

Authors: Elizabeth M. Rabold, K. Phiri, N. Gowero, V. Samuel, N. Wadonda-Kabondo

Background: Antiretrovirals (ARVs) reduce the risk of mother-to-child transmission of human immunodeficiency virus (HIV), but ARV safety during pregnancy remains a concern. In 2016, Malawi Ministry of Health implemented a surveillance system in 4 high-volume maternity hospitals to estimate the prevalence of major external birth defects and identify potential risk factors, including maternal ARV use. We evaluated system performance to date, focusing on timeliness, data quality, and ability to capture relevant HIV information.

Methods: We used 2001 CDC Guidelines for Evaluating Public Health Surveillance Systems to assess system attributes and data management processes. During site visits in October 2018, we interviewed key informants. We reviewed a convenience sample of maternity delivery records, oversampling for mothers with HIV and those who delivered infants with birth defects, and compared them to the surveillance database. We also confirmed that birth defects were reviewed for final verification by the International Clearinghouse for Birth Defects Surveillance and Research (ICBDSR).

Results: We reviewed delivery records of 116 mothers across all participating sites; 47 (41%) were living with HIV, and 48 (41%) delivered an infant with a birth defect. The delivery record and database differed in 13% (15/120) of deliveries for sex, head circumference, length, and/or weight. All mothers living with HIV were on ARVs, but only 45% (21/47) had ARV start date documented. Time from birth to database submission was <2 days for 97% of deliveries. While the system reported submitting 222 of 365 birth defects recorded at facilities, only 90 (25%) were received by ICBDSR for final verification.

Conclusions: Improving data quality of key infant-specific and HIV-related variables and reducing delays in reporting birth defects to ICBDSR may enhance this system's ability to accurately estimate birth defects prevalence, evaluate the safety of ARVs in pregnancy, and ultimately contribute to improved maternal and infant health outcomes.

1:30 Assessing Completeness of Maternal Antiretroviral Use Within Perinatal HIV Surveillance: A Precursor to Monitoring Adverse Infant Effects — United States and Puerto Rico, 2013–2017

Authors: Samira Sami, K. Gray, X. Dong, A.M. France, A. Balaji, M. Lampe, S. Nesheim, L. Fitzharris, A. Hernandez

Background: Antiretroviral (ARV) treatment during pregnancy reduces perinatal HIV transmission by >95%; however, a 2018 study found potential adverse outcomes among African infants exposed to ARVs in utero. This has increased the importance of rapid evaluation of infant outcomes in the United States. U.S. jurisdictions voluntarily report cases of infants perinatally exposed to HIV to the National HIV Surveillance System (NHSS). We assessed completeness of maternal ARV data and other clinical variables collected through NHSS to understand the system's potential for assessing adverse infant effects of ARVs.

Methods: We identified cases reported to NHSS through September 2018 among infants who had been born during 2013–2017 to women with diagnosed HIV infection in the United States and Puerto Rico. Completeness of 6 variables describing maternal ARV use before pregnancy, during pregnancy, and during labor and delivery, including start and stop dates, was assessed by calculating the percentage with missing responses for each variable using SAS 9.4 statistical software. Data on birth weight, gestational age, and birth defects were also assessed for completeness.

Results: During 2013–2017, 11,986 cases of HIV-exposed infants were reported to NHSS. Among those infants, 36.6%, 83.0%, and 85.0% had any data available regarding maternal ARV use before pregnancy, during pregnancy, or during labor and delivery, respectively. Start and stop dates of ARV use was the variable that was most incomplete, with <13.8% having dates across the 3 pregnancy periods. However, 90.5% of cases had data regarding birth weight; 86.0%, gestational age; and 74.2%, presence or absence of birth defects.

Conclusions: Data included in NHSS regarding maternal ARV use is inadequate for assessing potential adverse infant effects. Higher completeness of other variables indicates that efforts to improve completeness of ARV variables might be successful.

1:50 Loss to Follow Up and Loss to Documentation Among Infants Who Do Not Pass Newborn Hearing Screening — Texas, 2018

Authors: Robyn A. Cree, E. Cahill, N. Logan, S. McKay, D. Dittfurth, R. Bitsko, C. Grimm, A. Nash, E. Dunham

Background: Without detection and early intervention, hearing loss can cause delays in a child's speech, language, and emotional development. Based on data most recently reported to CDC, in 2016, Texas had a higher than average rate of loss to follow-up (LFU) or loss to documentation (LTD; i.e., missing documentation of services received) among infants who did not pass their newborn hearing screening, compared to the U.S. overall (52.3% vs. 25.4%). This investigation aimed to identify factors contributing to LFU/LTD among infants who do not pass their newborn hearing screening.

Methods: The field team conducted 56 interviews with providers along the hearing care continuum, including hospital newborn screening program staff, audiologists, primary care physicians, and early intervention program staff located in various public health regions, including rural and urban communities. Following recording and transcription of the interviews, we used qualitative data analysis software to analyze themes using a conventional content analysis approach.

Results: Providers identified nine provider- and four family-related barriers contributing to LFU/LTD. Commonly mentioned barriers were problems with family access to care (n = 32), difficulty contacting patients (n = 30), problems with coordination and referrals (n = 29), lack of knowledge among providers (n = 26) and parents (n = 20), and problems using the online reporting system (n = 16). Providers in rural areas more often mentioned problems with family access to care (66.7–71.4%) and contacting patients (57.1–62.5%) compared to urban areas (33.3% and 22.2%, respectively).

Conclusions: Recommendations based on findings include making improvements to the online reporting system, providing educational opportunities for providers along the continuum, and creating regional TEHDI advisory boards to address LFU/LTD in Texas. Findings will aid in developing strategies to increase the number of children identified early who may benefit from early intervention services.

2:10 Prevalence of Pica in Preschoolers With and Without Autism Spectrum Disorder, Study to Explore Early Development — United States, 2008–2016

Authors: Victoria L. Fields, G. Soke, A. Reynolds, L. Tian, L. Wiggins, M. Maenner, C. DiGuiseppi, T. Kral, L. Schieve

Background: Pica, the repeated ingestion of nonfood items lacking nutritional value, has been reported in clinical samples of people with developmental disabilities (DDs). It is considered a type of self-injurious behavior (SIB), can result in life-threatening medical consequences, and studies suggest higher mortality rates for pica than for other types of SIB. Little is known about the prevalence of pica in children with or without DDs. Children with autism spectrum disorder (ASD), because of their high risk for SIB, may have a particularly high risk for pica. We assessed pica in children with and without ASD and other DDs.

Methods: We used data from the Study to Explore Early Development, a multi-site case-control study that includes 3–5 year-old children. Children with ASD (n = 1426) and other (non-ASD) DDs (n = 1794) were recruited from multiple clinics and schools at each site; children with other DDs were further sub-divided into those with (n = 571) and without (n = 1223) some ASD symptoms. Population-based controls (POP) (n = 1663) were recruited from randomly-sampled birth records. Final ASD case status was based on research-reliable developmental assessments. Pica was ascertained through parental report using a developmental assessment form. We examined pica prevalence in each group. We compared ASD and DD groups to the POP group via odds ratios (aOR) adjusted for maternal and child sociodemographic factors.

Results: Pica was reported in 23.2%, 16.3%, 4.5%, and 3.6% of children with ASD, DD+ASD symptoms, DD without ASD symptoms, and POP groups, respectively. After adjustment, pica was strongly associated with ASD (aOR 8.0 [95% confidence interval: 5.9–10.9] and DD+ASD symptoms (3.6 [2.4–5.4]) but not DD without ASD symptoms (1.2 [0.8–1.7]).

Conclusions: Pica is common in young children with ASD and with other DDs who exhibit ASD symptoms. These findings inform the specialized healthcare needs of children with ASD or ASD symptomatology.

PRESENTATION OF AWARDS

2:45–3:15 pm

Grand Ballroom

Presenter: Dianna Carroll and Awards Chairs

- EISAA Class Membership Award
- Poetry 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

Awards presented during session.

SESSION P: Late-Breaking Reports

3:15–4:20 pm

Grand Ballroom

Presenters: Anne Schuchat and Eric Pevzner

3:20 Characterization of Dockless Electric Scooter Related Injury Incidents — Austin, Texas, September–November, 2018

Authors: Laurel Harduar Morano, T. Pindyck, S.B. Ballard, A. Anand, D. Zane, A. Tisdale, A. Peterson, E. Sauber-Schatz, J. Taylor

Background: Rentable dockless electric scooters (e-scooters) are shared electric-assisted scooters that are an emerging transportation modality being introduced in cities nationwide. Limited e-scooter injury data exist. To inform data-driven injury prevention strategies, we characterized e-scooter related injury incidents and calculated an injury incidence rate.

Methods: Potential e-scooter related injury incidents occurring in Austin, Texas between September 5, 2018 and November 30, 2018 were identified by searching for the word "scooter" in 1) Emergency Medical Service narratives, and 2) Emergency Department chief complaints from Austin Public Health's syndromic surveillance system. Injured individuals were contacted by phone, text, and letter and administered a standardized questionnaire about e-scooter injury risk factors and outcomes. Incidence rates were calculated by using the number of interview confirmed e-scooter injury incidents as the numerator and the number of e-scooter trips occurring during the study period, provided by the Austin Transportation Department, as the denominator.

Results: During the 87-day study period, 271 individuals were identified with potential e-scooter related injury incidents. Of these, 158 (58%) participated in interviews and 130 confirmed having an e-scooter riding-related injury incident. Preliminary results indicate injured riders were 49% male, had a median age of 29 years (interquartile range: 21–39 years), and 20% were hospitalized. Of the injuries reported, 45% were head injuries, 27% an upper extremity fracture, and 12% a lower extremity fracture. The majority (52%) of e-scooter injury incidents occurred in the street, 29% involved first-time riders, 18% involved motor vehicles, and <1% of riders reported helmet use. Based on 130 confirmed injury incidents, the e-scooter related injury incidence rate was 14.3 per 100,000 trips.

Conclusions: A high proportion of e-scooter related injuries involved potentially preventable risk factors, such as lack of helmet use, or motor vehicle interaction. Interventions aimed at these risks and education to first-time riders could potentially reduce injury incidence and severity.

3:30 A Dark Horse Candidate: Legionellosis Cluster Associated with Working at a Racetrack Facility — West Virginia, 2018

Authors: Jared R. Rispens, M. Hast, M. Siegel, C. Edens, A. Barskey, J. Mercante, T. Ritter, S. Martin, E. Thomasson, J. Huff, C. Baker, C. Everly

Background: In October 2018, the West Virginia Bureau for Public Health (BPH) notified CDC of one laboratory-confirmed case of Legionnaires' disease (LD) in an employee of a racetrack facility. Following investigation by BPH and the Hancock County Health Department, five additional confirmed LD cases were identified among employees of the same facility within a one month period. Our objective was to determine the extent of the LD outbreak and identify potential sources of transmission.

Methods: We interviewed all patients with confirmed LD and conducted extensive case-finding among racetrack employees. Suspected cases of LD and Pontiac fever (PF) were identified among employees with compatible symptomology and exposure to the racetrack facility within 14 days of symptom onset. No clinical samples were available for further testing. We conducted an environmental assessment of the facility's plumbing and ventilation systems and nearby cooling towers for *Legionella* transmission potential.

Results: We identified 17 cases, including six confirmed and four suspected LD cases and seven suspected PF cases. Our environmental assessment revealed a poorly maintained hot tub in the first floor jockey area. One employee with confirmed and nine with suspected LD had exposure to the facility's hot tub or adjacent hallway. The remaining employees were exposed to a second floor office suite. Further investigation identified maintenance deficiencies in the facility's ventilation systems and a crack in the floor between the hot tub and office areas. These factors could have created an environment where aerosol containing *Legionella* from the hot tub was introduced to higher floors via the thermal stack effect and/or passive ventilation and recirculated to occupied areas.

Conclusions: While hot tubs are often reservoirs for *Legionella*, our investigation provides evidence that ventilation systems and airflow dynamics should be considered in LD outbreak investigations and public health prevention strategies.

3:40 Botulism Outbreak after Consumption of Traditionally Prepared Alaska Native Foods — Alaska, 2019

Authors: Amanda J. Tiffany, C. Hesson, D. Stang, J. Newsome, K. Helfrich, K. Spink, L. Castrodale, J. McLaughlin

Background: Suspected botulism cases are immediately reportable in Alaska and constitute a public health emergency. On January 2, 2019, the Alaska Section of Epidemiology was notified of 3 adults presenting to the Community A emergency department in northwestern Alaska with nausea, vomiting, dizziness, and diplopia. All patients had eaten traditionally prepared Alaska Native foods at a January 1 potluck. We investigated to determine exposure source and identify and prevent additional cases.

Methods: On January 2 and 3, we interviewed potluck attendees to ascertain potluck items and attendee food consumption. We reviewed hospitalized patients' clinical records. Because of botulism suspicion, all attendees were monitored for botulism symptoms for 10 days after the potluck. Serum and stool were collected from hospitalized patients; all leftover foods were collected and sent for botulism testing. Risk ratios (RRs) and 95% CIs were calculated for food items.

Results: Fourteen persons consumed food at the potluck; 9 (64%) experienced symptoms compatible with botulism during January 1–11. Of these, 5/9 (56%) were hospitalized and 4/5 (80%) received heptavalent botulinum antitoxin. One patient was intubated, sustained multiple cardiac arrests after antitoxin initiation, and died 13 days after symptom onset. Four (44%) persons were mildly symptomatic and managed as outpatients. Seventeen potluck foods were identified; 6 (67%) symptomatic persons reported eating aged whale flipper (RR: 3.3; 95% CI: 1.29–8.59) and 4 (44%) reported eating Eskimo ice cream (RR: 2.4; 95% CI: 1.22–4.68). Botulinum toxin type E was identified in the aged whale flipper and two serum samples.

Conclusions: This botulism outbreak ended after potluck items associated with illness were promptly identified and disposed. Laboratory testing confirmed the aged whale flipper was positive for botulinum toxin type E. The timely public health response likely averted additional cases and serious outcomes in some patients.

3:50 Norovirus GII.P16-GII.4 Sydney outbreak among wildfire evacuation shelter populations — Butte County, California, November 2018

Authors: Ellora Karmarkar, S. Jain, J. Higa, J. Fontenot, R. Bertolucci, T. Huynh, G. Hammer, A. Brodkin, M. Thao, B. Brousseau, D. Hopkins, E. Kelly, M. Sheffield, S. Henley, H. Whittaker, C. Pan, A. Chen, J. Kim, L. Schaumleffel, E. Epson, S.J. Chai, D. Wadford, D. Vugia, L. Lewis

Background: On November 8, 2018, Camp Fire, California's largest wildfire to date, displaced ~52,000 persons, with >1,100 evacuated to 9 shelters in Butte and surrounding counties. Before the fire, norovirus GII.P16 GII.4 Sydney was reported in the community. On November 10, 2 evacuees from 2 shelters experienced acute gastrointestinal illness (AGI). To identify AGI cases and prevent transmission, Butte County Public Health Department (BCPHD) initiated shelter surveillance and assessed on-site infection prevention and control (IPC), assisted by the California Department of Public Health.

Methods: On November 10, BCPHD distributed paper logs to shelter staff to enter information on persons with AGI (vomiting or diarrhea). When feasible, symptomatic persons submitted stool specimens. We defined confirmed cases as AGI among shelter staff/evacuees with a norovirus-positive stool specimen detected by real-time reverse–transcription polymerase chain reaction; norovirus-positive specimens were genotyped. Probable cases were AGI among staff/evacuees without associated specimens. We analyzed demographics, AGI trends, and assessed IPC.

Results: During November 10–December 1, 292 cases (16 confirmed, 276 probable) were identified among a fluctuating population of ~1100 people across 8 shelters (attack rate ~27%). Twenty-one of 292 cases (7%) sought hospital evaluation and 12 (4%) were staff. Of 255 patients with data, median age was 63 years (interquartile range 52–71). Sixteen (94%) of 17 available specimens were positive for norovirus GII.P16-GII.4 Sydney. The outbreak peaked on November 14 with 54 new cases. On-site assessment revealed deficiencies in surveillance, isolation, cleaning services, and handwashing. In response, we established illness screening at registration, isolation protocols, 24-hour on-site cleaning, and handwashing champions. By December 1, there were no incident cases.

Conclusions: Mass sheltering, limited surveillance, and suboptimal IPC likely facilitated norovirus transmission after Camp Fire. Disaster relief balances numerous competing urgencies; however, prioritizing effective shelter surveillance and IPC is necessary to proactively identify and contain outbreaks.

4:00 Late-Season Multistate Outbreak of *Salmonella* Infantis and Agona Infections Linked to Backyard Poultry — United States, 2018

Authors: Mary A. Pomeroy, L. Koski, C. Basler, L. Stevenson, A. Adediran, I. Hewitson, K. Purcell, K. Machesky

Background: *Salmonella* illness outbreaks linked to backyard poultry (BP) are typically associated with the spring season, when annual chick sales begin. In September 2018, PulseNet, the national laboratory surveillance subtyping network, identified two clusters of *Salmonella* Infantis and Agona infections. Initial case-patient interviews suggested a link to purchased baby poultry. We investigated to characterize the ongoing outbreak and inform control measures.

Methods: We defined a case as illness in a person infected with *Salmonella* Infantis or Agona with pulsed-field gel electrophoresis (PFGE) patterns JFXX01.0731 or JABX01.0555, and with isolation dates from June–December 2018. A BP questionnaire was administered to case-patients, records were collected from purchase locations to determine originating hatchery, and BP flocks were tested for *Salmonella*. Whole genome sequencing (WGS) was performed.

Results: We identified 108 case-patients (64 Infantis and 44 Agona) from 28 states. Of those with information, 29% (24/84) were hospitalized; no deaths were reported. Sixty percent (48/79) of case-patients reported BP contact. Illness onset dates ranged from June–December 2018. The majority of poultry purchase dates ranged from July–October 2018. Of poultry with hatchery records, 69% (11/16) originated from Hatchery A, 13% (2/16) from Hatchery B, and 19% (3/16) from both hatcheries. *Salmonella* Infantis was isolated from BP flocks owned by two case-patients; birds in one flock originated from Hatchery A, while birds in the second flock were from Hatchery B. Hatchery A was identified as the source of BP. *Salmonella* Infantis WGS analysis indicated 47 clinical and 1 animal isolate were closely related (0–8 allele differences). *Salmonella* Agona WGS analysis indicated 34 clinical isolates were closely related (0–8 allele differences).

Conclusions: This outbreak of salmonellosis linked to BP occurred later than previously reported BP outbreaks. *Salmonella* prevention messaging is needed beyond spring sales of BP to prevent future outbreaks.

4:10 Verona Integron-Encoded Metallo-β-Lactamase-Producing Carbapenem-Resistant *Pseudomonas aeruginosa* Infections Associated with Elective Invasive Medical Procedures in Mexico — Multiple U.S. States, 2018–2019

Authors: Ian Kracalik, C. Ham, A. Smith, M. Vowles, K. Kauber, M. Zambrano, G. Rodriguez, K. Garner, K. Chorbi, P. Cassidy, S. Horowich-Scholefield, S. Mcbee, O. Zazueta, N. Hernández Milán, R. Stoney, K. Moser, M. Villarino, A. Brown, R. Stanton, G. McAllister, E. Sula, A. Laufer Halpin, M. Spalding Walters

Background: During September 18–November 19, 2018, CDC received 31 reports of Verona integron-encoded metallo-β-lactamase–producing carbapenem-resistant *Pseudomonas aeruginosa* (VIM-CRPA) isolates through the Antibiotic Resistance Laboratory Network; six were in U.S. patients who recently underwent elective invasive procedures in Mexico. We investigated to identify cases and prevent additional infections.

Methods: A case was defined as isolation of VIM-CRPA from a patient who had an elective invasive procedure in Mexico since January 1, 2018 and in the 30 days prior to specimen collection. We conducted patient interviews, evaluated infection control practices, and characterized isolates by whole genome sequencing (WGS).

Results: As of February 8, 2019, 14 cases in seven states were identified. Median age of patients was 39 years (range: 31–55). All patients reported having bariatric surgery in Tijuana, Baja California, Mexico during August 2018–January 2019. Twelve patients reported surgery at Facility 1. Nine patients were hospitalized after returning to the United States. Mexican authorities visited Facility 1 and identified multiple infection control breaches, including failure to adhere to standard practices of reprocessing surgical equipment. WGS analysis indicated isolates clustered into two distinct groups of closely related isolates: one from patients who had surgery at Facility 1 and one from patients who had surgery at other Tijuana facilities.

Conclusions: This investigation highlights the potential for persons to acquire highly antibiotic resistant organisms not commonly found in the United States when receiving healthcare abroad. Patients with subsequent U.S. hospitalizations presented opportunities for VIM-CRPA transmission. Providers evaluating patients with healthcare exposure abroad should be vigilant for infections and colonization with antibiotic-resistant bacteria. Patients considering elective medical care abroad should discuss with a travel medicine provider at least one month prior to departure, and be aware of potential risks from antibiotic-resistant bacteria.

CLOSING REMARKS AND ADJOURNMENT

4:20–4:30 pm

Grand Ballroom

Presenter: Patricia Simone

EIS Officers, Class of 2017

Alpren, Charles,* MBChB, MPH, MBA – Boston Public Health Commission
Anand, Anjoli, MD, MPH – CGH
Bakhsh, Yasser,* MBBS, MPH – CA Health and Human Services
Ballard, Sarah-Blythe, MD, PhD, MPH – CGH
Beauregard, Jennifer, PhD, MPH – NCCDPHP

Ben Hamida, Amen Allah, MD, MPH – CGH
Bergeron, Genevieve,* MD, MPH – NY City Department of Health and Mental Hygiene
Bezold, Carla,* ScD, MPH – AZ Department of Health Services
Biedron, Caitlin,* MD, MSc – NCEZID
Brennan, Julia,* BSN, MS, MPH – TN Department of Health

Campbell, Stefanie, DVM, MS – NCEZID
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Cossaboom, Caitlin, PhD, DVM, MPH – NCEZID
Cree, Robyn,* PhD – NCBDDD

Curren, Emily,* DVM, MPH – NCEZID
Doyle, Joshua,* MD, PhD – NCIRD
Duwell, Monique, MD, MPH – MD Department of Health and Mental Hygiene
Eboh, Victor, MBBS, MSc – CGH
Fay, Katherine, MD – NCIRD

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Free, Rebecca,* MD – NE Department of Health and Human Services
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Harduar Morano, Laurel,* PhD, MPH – NIOSH
Hartnett, Kathleen,* PhD, MPH – NCEZID

Head, Sara, PhD, MPH – DC Department of Health
Herzig, Carolyn,* PhD, MS – NC Department of Health and Human Services
Hesse, Elisabeth,* MD, MTM&H – NCEZID
Horth, Roberta,* PhD, MPH – UT Department of Health
Hughes, Michelle, PhD, MHS – NCIRD

Imoisili, Omoye, MD, MPH – NCCDPHP
Jackson, David, MD – NIOSH
Kanagasabai, Udhayashankar, MD, MPH – CGH
Keaton, Amelia,* MD, MSc – NCEZID
Kofman, Aaron, MD – NCEZID

** Presenting EIS officer*

EIS Officers, Class of 2017 *(continued)*

Kracalik, Ian, PhD, MPH, MA – NCEZID
Labuda, Sarah,* MD, MPH – AR Department of Health
Lavery, Amy,* PhD, MSPH – NCEH
Logan, Naeemah,* MD – CGH
Lucas, Todd, MD, MPH – NCEZID

Mandra, Anna, DVM, MPH – NCEZID
McClung, Nancy,* PhD, BSN – NCIRD
McDonald, Robert,* MD, MPH – NY Department of Health
McKay, Susannah,* PhD, MPH – NCIRD
Morawski, Bozena, PhD, MPH – ID Department of Health and Welfare

Moritz, Erin, PhD, MS – IL Department of Public Health
N'cho, Hammad, PhD, MS, MA – CGH
Nabity, Scott, MD, MPH – CGH
Njuguna, Henry,* MPH, MBChB – WA State Department of Health
Peak, Corey,* ScD, MS – County of San Diego Health and Human Services Agency

Pennington, Audrey, PhD, MPH – NCEH/ATSDR
Pickens, Cassandra, PhD, MPH – NCCDPHP
Pindyck, Talia,* MD, MPH – NCIRD
Quilter, Laura,* MD, MPH – NCHHSTP
Robertson, Scott, DVM, MPH, MS – NCEZID

Rose, Erica,* PhD, MS – NCIRD
Schumacher, Amy, PhD, MS – Wisconsin Department of Health Services
Shaw, Kelly,* PhD – Virginia Department of Health
Siegel, Miriam,* DrPH, MPH – NIOSH
Sinatra, Jennifer,* DVM, MPH – ME Centers for Disease Control and Prevention

Strysko, Jonathan,* MD – NCEZID
Swedo, Elizabeth,* MD, MPH – NCIPC
Tiffany, Amanda,* PhD, MPH – AK Department of Health and Social Services
Toda, Mitsuru, PhD, MS – NCEZID
Valenciano, Sandra, MD, MPH – NCIRD

Vannice, Kirsten,* PhD, MHS – Public Health – Seattle and King County
Weil, Lauren,* PhD, MPH – NCIRD
Wilson, Erica,* MD, MPH – WI Department of Health Services
Winstead, Alison,* MD – NCEZID
Womack, Lindsay,* PhD, MPH – NCHS

** Presenting EIS officer*

EIS Officers, Class of 2018

Alroy, Karen A.,* DVM, MPH – NY City Department of Health and Mental Hygiene
Arons, Melissa M.,* BNurs, MSc – CGH
Bardossy, Ana C.,* MD – NCEZID
Blau, Erin F., MPH, DNP, BSN – KY Department of Public Health
Brown, Nicole E.,* PhD – NCIRD

Browne, Andrew (Springer), PhD, MPH, MVB – USVI Department of Health
Bustamante, Nirma D., MD, MPH – CGH
Chiou, Howard,* MD, PhD, MS – LA County Public Health Department
Chow, Eric James,* MD, MPH, MS – NCIRD
Conners, Erin, PhD, MPH – NCEZID

Deputy, Nicholas P.,* PhD, MPH – NCHHSTP
Fields, Victoria L.,* DVM, MPH – NCBDDD
Fisher, Kiva A., PhD, MPH – CGH
Furukawa, Nathan W.,* MD, MPH – NCHHSTP
Gaub, Kathryn L.,* DVM, MPH – IN Department of Health

Gharpure, Radhika V., MPH, DVM – NCEZID
Gomes, Danica J.,* MD, MSc – NCEZID
Goyal, Sonal,* PharmD, MPH – NCCDPHP
Greene, Sharon A., PhD, MPH – CGH
Gruber, Joann, PhD, MSPH – PA Department of Health

Hallowell, Benjamin D.,* PhD, MPH – NCIRD
Hast, Marisa Anne, PhD, MPH – CGH
Heinzerling, Amy P.,* MD, MSc – CA Health and Human Services
Holshue, Michelle L., MPH, BSN – WA State Department of Health
Idubor, Osato I.,* MD, MHS – NCIRD

Jones, Sydney A., PhD, MScPH – CT Infectious Diseases
Karmarkar, Ellora, MD, MSc – CA Health and Human Services
Krause, Kathleen, PhD, MSc – NCBDDD
Kujawski, Stephanie,* PhD, MPH – NCIRD
Ladva, Chandresh N.,* PhD, MPH – NCIRD

Lopez, Velma, PhD, MPH – CGH
McDonald, Emily S.,* MD, MPH – NCEZID
McDow, Kendra B.,* MD, MPH – NCHS
McGovern, Olivia L., PhD, MS – NCIRD
McPherson, Tristan D.,* MD – Chicago Department of Public Health

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EIS Officers, Class of 2018 *(continued)*

Medley, Alexandra M., DVM, MPH – NCEZID
Melgar, Michael F.,* MD – CGH
Oakley, Lisa P., PhD, MPH – Kaiser Permanente Southern California
Olaisen, Rho (Henry), PhD, MPH – NCHS
Peck, Megan, PhD, MPH – CGH

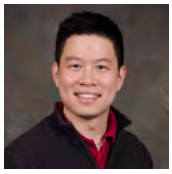
Perez, Stephen M., PhD, RN, MS – NJ Department of Health and Senior Services
Pomeroy, Mary, MSN – NCEZID
Prestel, Christopher S.,* MD – NCEZID
Rabold, Elizabeth M.,* MD, MPH – CGH
Ramaswamy, Maya,* PhD, MS – NCEZID

Reese, Heather E.,* PhD, MPH – NCIRD
Rekant, Steven I.,* DVM, MPH – OR Public Health Authority
Relan, Pryanka, MD, MPH – NCEZID
Rhodes, Heather S., MPH, BSN – WY Department of Health
Rispens, Jared, MD – NCEH

Rossow, John A.,* DVM, MPH – NCEZID
Sami, Samira,* DrPH, MPH – NCHHSTP
Sanchez, Guillermo V.,* MSHS, MPH – AL Department of Public Health
Sayre, Dean M., MD, MS – CGH
Scott, Sarah E.,* MD – AZ Department of Health Services

Shamout, Mays Z.,* MD, MPH – NCCDPHP
Smith, Nailah, DVM, MPH – CGH
Szablewski, Christine M., DVM, MPH – GA Department of Public Health
Talwar, Amish, MD, MPH – NCHHSTP
Tanwar, Sukarma S., MBBS, MScPH, MMED – NCEZID

Tanz, Lauren J.,* ScD, MSPH – NC Department of Health and Human Services
Taylor, Joanne K.,* PhD, BVS – MN Department of Health
Torres-Mendoza, Yaritbel, DVM, MPH – FL Department of Health
Whitehouse, Erin R., PhD, MPH, BSN – NCEZID
Woodruff, Rebecca C.,* PhD, MPH – NCCDPHP



Wu, Alexander C.,* ScD, MPH – Northwest Tribal Epidemiology Center

** Presenting EIS officer*

LLS Fellows, Class of 2017

Fowler, Randal, PhD – MN Department of Health
Hardy, Margaret, PhD, MSc – NCEZID
Kretz, Cecilia, PhD – NY City Department of Health and Mental Hygiene
Lawrence, Marlon,* PhD – NCIRD
Lowe, David E.,* PhD – NCEZID

Marinova-Petkova, Atanaska,* PhD – NCEZID
Stinnett, Rita, PhD, MHS – NCIRD

LLS Fellows, Class of 2018

Buono, Sean, PhD – NCIRD
Carlson, Christina,* PhD, MPH, MSc – CGH
Freeman, Brandi, PhD, MS, MPH – NCIRD
Levinson, Kara, PhD, MPH – NH Department of Health and Mental Hygiene
Scherer, Erin, PhD – NCIRD

Wadhwa, Ashutosh,* PhD, DVM, MS – NCEZID

** Presenting LLS fellow*

Incoming EIS Officers, Class of 2019

Bajema, Kristin, MD, MSc
Barry, Vaughn, PhD, MPH
Beshearse, Elizabeth, PhD, MPH
Board, Amy, DrPH, MPH, MSW
Bryant-Genevier, Jonathan, PhD
Bui, David, PhD, MPH
Bush, Kristen, PhD, MPH
Bushman, Dena, RN, MPH, MSN
Cates, Jordan, PhD, MSPH
Chang, Karen, PhD, MHS
Chard, Anna, PhD, MPH
Chevinsky, Jennifer, MD, MPH
Chu, Victoria, MD, MPH
Chuey, Meagan, BSN, MS
Currie, Dustin, PhD, MPH
Dawson, Patrick, PhD, MPH
DeSisto, Carla, PhD, MPH
Dewart, Courtney, PhD, MPH
Donahue, Matthew, MD
Donovan, Catherine, PhD, SM
Duca, Lindsey, PhD, MS
Dunne, Eileen, PhD
Dyal, Jonathan, MD, MPH
Feder, Kenneth, PhD
Ghinai, Isaac, MBBS, MSc
Gold, Jeremy, MD, MS
Hicks, Joseph, DVM, PhD
James, Allison, DVM, PhD, MPH
Kanu, Florence, PhD, MPH
Kardooni, Shahrzad, MD, MPH
Kimball, Anne, MD, MPH
Kukielka, Esther, DVM, PhD, MSc
Lash, Robert, PhD, MA
Lee, James, MD, MSc
Lewis, Nathaniel, PhD, MA
Marcenac, Perrine, PhD
McMichael, Temet, PhD
Miller, Maureen, MD, MPH
Mooring, Eric, ScD, MPhil, SM
O'Laughlin, Kevin, MD
Ortiz, Nancy, PhD, MPH
Owusu, Daniel DrPH, MPhil
Pettrone, Kristen, MD, MPH
Pray, Ian, PhD, MPH
Pringle, Julia, PhD, MSPH
Rogers, Tia, PhD, MPH
Rubenstein, Beth, MPH, PhD, MBA, MPhil
Rushmore, Julie, PhD, DVM
Salvatore, Phillip, PhD, SM
Samson, Marsha, PhD, MSc, MSHSA
Schrodt, Caroline, MD, MScPH
Schwartz, Noah, MD
Shetty, Varun, MD, MBA, MS
Steinberg, Jonathan, BSN, MPH
Stierman, Bryan, MD, MPH
Tenforde, Mark, MD, PhD, MPH
Tobolowsky, Farrell, DO, MS
Tompkins, Lindsay, PhD, MS
Vahey, Grace, DVM, MPH
Varela, Kate, DVM, MPH
Wallace, Megan, DrPH, MPH
Waltenburg, Michelle, DVM, MPH
Wozniczka, Daniel, MPH, MD, MBA
Xu, Kerui, PhD, MPH
Yousaf, Anna, MD
Zacks, Rachael, MD

Incoming LLS Fellows, Class of 2019

Chastain, Shelby, PhD
Hott, Amanda, PhD
Jacobs, Jesica, PhD, MSc
Mayer, Oren, MS, PhD
Stokes, Kindra, PhD
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* FETP: Field Epidemiology Training Program
** CSTE: Council of State and Territorial Epidemiologists

Notes

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