MEETING OF THE BOARD OF SCIENTIFIC COUNSELORS
DEPUTY DIRECTOR FOR INFECTIOUS DISEASES

Centers for Disease Control and Prevention
Hybrid Meeting
December 7-8, 2022

A two-day, open public hybrid meeting of the Board of Scientific Counselors (BSC), Deputy Director for Infectious Diseases (DDID), Centers for Disease Control and Prevention (CDC), was held on December 7-8, 2022. In addition to board members and CDC staff, representatives of several public health partner organizations and other members of the public attended the meeting (appendix). No votes were taken.

The agenda included the following updates/presentations:

Opening Remarks

BSC/DDID Chair Dr. James LeDuc, Adjunct Professor in the Department of Microbiology and Immunology, University of Texas Medical Branch (UTMB), called the meeting to order and conducted the roll call.

The following conflicts of interest (COIs) were identified:

- Jesse Goodman serves as Chair of the Science Committee for GSK's board. GSK manufactures vaccines, monoclonals, drugs, et cetera.
- Mike Loeffelholz is employed by Cepheid, which manufactures a variety of diagnostics.
- Jeanne Marrazzo serves on the Scientific Advisory Boards for Merck and OSO pharmaceutical companies.
- Lauren Meyers is employed by the University of Texas (UT), which receives substantial grant support from CDC, and she occasionally provides consultation support to Roche, a biotech company.
- Jennifer Rakeman is employed by Cepheid, which manufactures a variety of diagnostics.

The following changes to the BSC/DDID were identified:

- Laura Hughes-Baker is serving as the new Designated Federal Official (DFO).

DDID Update

Dr. Butler, CDC DDID, welcomed everyone and noted that this was the first somewhat traditional BSC/DDID in almost 3 years. He emphasized that it has been a busy time that felt like a crescendo on top of the ongoing COVID-19 pandemic with the Mpox epidemic, a global event that has impacted the United States (US); identification of cholera throughout the world, and back in the Western Hemisphere again with the current outbreak in Haiti; an outbreak of pediatric hepatitis of unknown etiology potentially related to adenovirus or adenovirus-associated viruses; the continuing issue of avian influenza among birds, with the first instance of a positive test from a human in April 2022; identification of paralytic polio in the US in 2022; a resurgence of measles, particularly with the outbreak in Ohio; the outbreak of Ebola Sudan Virus (SUDV) in which CDC has been vigorously involved and which is occurring in the context of a Crimean-Congo hemorrhagic fever (CCHF) outbreak and at least one case of Rift Valley Fever (RVF); and dengue occurring in Southeast Asia and the Caribbean, with a fairly unprecedented outbreak impacting Cuba. The complexity of infectious diseases continues to challenge the ability to respond and control.

Leadership Updates

- **CDC Office of the Director (OD)**
  - Mr. Kevin Griffis is now the permanent Associate Director for Communication. He served as Assistant Secretary for Public Affairs with the US Department of Health and Human Services (HHS) under HHS Secretary Sylvia Burwell.
  - Dr. Jim Pirkle is now the permanent Associate Director for Laboratory Science and Safety (ADLSS) in the Office of Laboratory Science and Safety (OLSS).
  - Ms. Lauri Ishak is serving in the role of Acting Director for the Office of the Associate Director for Policy and Strategy (OADPS) in Dr. Robin Ikeda's stead.
  - Dr. José Montero has moved from the Center for State, Tribal, Local, and Territorial Support (CSTLTS) to the OD to lead some of the health equity efforts as part of CDC Moving Forward.

- **Deputy Director for Public Health Service and Implementation Science (DDPHSIS)**
  - Dr. Nathaniel Smith, Lead for PHSIS, has left CDC. Best known for his work in global human immunodeficiency virus (HIV) prevention and his interest in the care of physical and spiritual health, he completed a PhD in Ministries and is now an Associate Pastor at an Episcopalian church in Atlanta where he focuses on the physical and spiritual needs of people living with HIV.
  - Dr. Denise Cardo is now serving as Acting Director of the Center for Global Health (CGH) while a new permanent Director is sought for CGH.
  - Dr. Celeste Philip is serving as the Acting Director of the CSTLTS in Dr. José Montero's stead.
- **Deputy Director for Public Health Science and Surveillance (DDPHSS)**
  - Dr. Jennifer Layden recently joined CDC as the Acting Deputy Director for DDPHSS.
  - Dr. Leslie Dauphin is now the permanent Director for the Center for Surveillance, Epidemiology, and Laboratory Services (CSELS).
- **Deputy Director for Non-Infectious Diseases (DDNID)**
  - Dr. Patrick Breysse, Director of NCEH/ATSDR, has announced his retirement.
  - Dr. Robin Ikeda is serving as the Acting Director of NCEH/ATSDR while a new permanent Director is sought.
- **Deputy Director for Infectious Diseases (DDID)**
  - Dr. Laura Hughes-Baker is serving as the Scientific Advisor and Designated Federal Official (DFO) for BSC/DDID.
  - Dr. Wendi Kuhnert has accepted the position of the Associate Deputy Director of Infectious Diseases, although she is currently detailed to the role of Acting Deputy Director of the National Center for Emerging and Zoonotic Infectious Diseases (NCEZID).
  - Dr. José R. Romero has accepted the position as the permanent Director of the National Center for Immunization and Respiratory Diseases (NCIRD). Most recently, Dr. Romero served as the Arkansas Secretary of Health, which he stepped into when Dr. Nathaniel Smith left the role to move to CDC. Dr. Romero also served as the Chair of CDC's Advisory Committee on Immunization Practices (ACIP). Dr. Sam Posner served as Acting Director of NCIRD while the search took place over a long period of time.
  - Dr. Georgina Peacock has been named as the permanent Director of the Immunization Services Division (ISD) of NCIRD.
  - Dr. Barbara Mahon, who previously served as CDC's COVID-19 Incident Manager (IC), is serving as Acting Director of the newly proposed Division of Coronavirus and Other Respiratory Viral Diseases (CORVD).
  - Dr. Rima Khabbaz retired earlier in 2022 as the Director of the NCEZID. Dr. Dan Jernigan stepped into the role of Acting Director of NCEZID after Dr. Christopher Brayden served in this role for over 6 months before moving on to a detail with the National Security Council (NSC) helping to lead the domestic response to the SUDV in Uganda.
  - Dr. Marty Cetron retired in Summer 2022 as Director of the Division of Global Migration and Quarantine (DGMQ). Lisa Rotz is serving as Acting Director of the DGMQ while a permanent Director is being sought.
  - Dr. Inger Damon, Director of the Division of High-Consequence Pathogens and Pathology (DHCPP), and husband Dr. Greg Armstrong, Director of the Advanced Molecular Diagnostics (AMD) group, recently retired.
  - Dr. Jennifer McQuiston, who has served as the IM for the Mpox response has now stepped into the role of Acting Director of the DHCPP.
  - Dr. Mike Bell is serving as the Acting Director of the Division of Healthcare Quality Promotion (DHQP) while Denise Cardo is serving as Acting Director of the CGH.

- Dr. Peggy Honein has been named as the permanent Director of the Division of Preparedness and Emerging Infections (DPEI) in NCEZID to fill the void created by Dr. Henry Walke's departure to become Director of the Center for Preparedness and Response (CPR) within the DDPHSIS.
- Duncan MacCannell is serving as Acting Director of the Office of Advanced Molecular Detection (OAMD) in the wake of Dr. Greg Armstrong's retirement.
- Dr. Jonathan Mermin, Director of the National Center for HIV, Viral Hepatitis, STD, and TB Prevention (NCHHSTP), is detailed as the IM for the Mpox response. Dr. Deron Burton has stepped in as Acting Director of NCHHSTP in his stead.
- Dr. Robin Fanfare is serving as Acting Director of the NCHHSTP Division of HIV Prevention (DVP) while Dr. Demetre Daskalakis is serving as the Deputy Coordinator for the White House's national Mpox response.

- **In Memoria:**
  - Casey Barton Behravesh shared a remembrance of board member Ann Garvey who recently passed away. Dr. Garvey was a State of Iowa Public Health Veterinarian and Deputy State Epidemiologist. She served on the BSC/DDID since September 2019.
  - Rob Tauxe and Katie Fullerton shared a remembrance of board member Lee Riley. Dr. Riley was a pioneer in epidemiology and global health. He served as a BSC/DDID member from June 2014 through September 2019.
  - Dr. Butler recognized the long-lasting impact of Dr. Garvey and Dr. Riley that will continue to live in the passion, energy, and commitment that they instilled in many—particularly those who had the privilege to work with them as mentees early in their careers.

Office of the Director's Welcome

Debra Houry, MD, MPH, Acting Principal Deputy Director of CDC, greeted the BSC/DDID on behalf of Dr. Walensky who was unable to attend. Dr. Houry echoed her sentiments for the members who recently passed and expressed appreciation for the opportunity to pause and celebrate them. She expressed appreciation for all of the BSC/DDID members for their time and sharing their critical expertise and knowledge in infectious diseases to inform the important work the agency does. CDC values the opportunity to speak with those in the field in academia and the private sector to advise the agency on its work.

Dr. Houry emphasized that in the past 3 years, CDC has stood up 2 emergency responses through the Emergency Operations Center (EOC) for COVID-19 and Mpox. In addition, there have been ongoing agency-led responses for global polio, cholera, Ebola, and domestic polio. CDC has been working non-stop at every level across the agency. COVID-19 has been one of the biggest challenges in CDC's 75-year history. While the agency has learned a lot from the COVID-19 response in terms of where improvements can be made, a lot of the challenges have not been just because of COVID-19. CDC has grown over the past 10 to 20 years in terms of engagement with health departments and in how the public receives and relays information.

CDC is evolving to be more nimble, flexible, and forward-thinking. There is much to be proud of that probably has gone unrecognized due to the focus on the COVID-19 pandemic. For instance, CDC has provided antiretroviral treatment for nearly 12 million people living with HIV; resolved an outbreak of an unknown source that ultimately was traced to aromatherapy spray that was contaminated with bacteria; deployed staff to New York to assist with investigation of a case of vaccine-derived polio and to help provide over 42,000 polio vaccines in 3 counties; and deployed a staff member to repel out of a helicopter to deliver Coronavirus test kits to a cruise ship.

CDC's experience with COVID-19 has shined a light on critical long-term investments. As part of CDC Moving Forward, the agency is prioritizing improving public health infrastructure for the long-term, developing a strong and diverse public health workforce, modernizing data systems, and advancing global health security. Input has been sought from CDC staff, partners, and leaders. Approximately 120 interviews have been conducted to identify ways to improve and institutionalize how CDC deploys its science. The agency established 10 Strike Teams to assess structural changes in terms of data, global health, laboratory, preparedness, and more to inform the structural reorganizational process. Additionally, 21 Priority Action Teams were stood up to examine sustainable solutions to drive results. The Strike Teams have presented to senior leaders and developed a memo that has been finalized. The Priority Action Teams were planning to present to leadership on December 8, 2022, after which their recommendations would be finalized. The goal is to submit the reorganization package by the end of 2022.

Office of the Director Welcome - Discussion

- BSC questions/observations/suggestions and Dr. Houry's responses:
  - CDC is commended for its comprehensive look internally and its commitment to reform.
  - In response to an inquiry about the goal and metrics for the $3.2 billion to be allocated for investments in public health infrastructure, Dr. Houry indicated that these funds would be allocated to state and local health departments to build infrastructure with a focus on staffing; diversity, equity, and inclusion (DEI); laboratory support; and data. While this sounds like a lot of money, it is over several years to 100+ groups. During emergencies, there are boosts of funding that are not sustained. This allocation will be a great booster, but she is concerned that it will be insufficient for long-term sustainability.
  - Improvements in public health must be tied to measurable outcomes. Without these, state governments will use the infrastructure dollars to fund their state and local health departments as they always have done rather than to increase their funding. Dr. Houry indicated that there are some evaluation metrics attached to the infrastructure funding, noting that CDC often is criticized for being too prescriptive. The effort was made to build in more flexibility with this grant, but some baseline requirements are included that CDC will be tracking closely.
  - Serious concerns were expressed early in the pandemic by city and state health officials that they could not respond to a single case due to inadequate resources.
  - Workforce development is critical in terms of staffing.
  - Data modernization is crucial in terms of communication between hospital systems and state and local health departments in order to achieve rapid responses.
  - Regarding the criticism of CDC for the length of time it took to release information to the public about COVID-19 when other countries were much faster reporting their real-world evidence, Dr. Houry pointed out that there already have been efforts to reform the speed of reporting. For instance, the agency quickly scaled up laboratories in the private sector and publications in terms of the Mpox response. Part of reporting relates to becoming more comfortable with relaying provisional data, with the understanding that data will need to be revised as information evolves. CDC is working on this agency wide.
  - A major challenge with CDC is the number of silos, the number of surveillance systems, the agency's culture, and other issues. While it is recognized that this is the result of how the agency grew, it would be unfortunate if the reorganization reversed some of the progress that has been made in addressing some of these things. The rewards in CDC should be around public health outcomes rather than publications or positions within the organization. Dr. Houry emphasized

that the agency does not want to create more bureaucracy, barriers, or siloes. The goal of the reorganization is to break those down more.
  - The need for sustained funding to the public health laboratory system should be a priority. It is not ideal for the public health laboratory system to continue to operate with "duct tape and bubble gum" between emergencies.

CDC Moving Forward

Mr. James Macrae, Senior Advisor to CDC from the Health Resources and Services Administration's (HRSA) Bureau of Primary Care (BPHC), provided a background, general overview, status update, and next steps for CDC Moving Forward. Emphasizing that examining what is being done well and taking a hard look at what needs to improve is not easy, he expressed appreciation to Dr. Walensky for undertaking this review and for pushing the agency to make changes that hopefully will improve what CDC is able to accomplish with its partners in domestic and global public health. The overarching focus of CDC Moving Forward is to create a public heath action-oriented CDC that emphasizes accountability, collaboration, communication, and timeliness.

- **The 4 Inter-related pillars of the CDC Moving Forward goal are to:**
  - Improve how CDC operates through agency-wide systems, processes, and governance;
  - Develop and submit a reorganization package;
  - Delineate flexibilities, authorities, and programs to improve public health; and
  - Improve how CDC develops and delivers its science.
- **Core change principles were developed** to increase the likelihood of success and sustainability of CDC Moving forward. These principles were tailored based on a combination of Kotter's 8 Steps[1], Prosci's ADKAR® Model[2], and Deloitte's "Humanizing Change" Guidance[3] and are as follows:
  - *Go deep to diagnose challenges*. Before initiating change, define the problem and focus on fixing the cause. Root cause analyses are being conducted so that solutions address root causes rather than symptoms.
  - *Involve every layer*. Each layer of the organization has a distinct role in bringing change to fruition. Priority Action Teams (PATs) have been established that are comprised of a diverse set of staff, with senior leaders championing and staff defining solutions. They have engaged in 13 agency-wide listening sessions and connected with several external partners.
  - *Communicate frequently and clearly*. Continuously communicate what is known (and what is in process) during change, while always embracing feedback. All available venues (e.g., webinars, email, intranet) are being used to share updates and encourage staff participation and feedback.
  - *Drive continuous improvement.* At each stage of development and implementation, information and insights will be collected to inform next steps. The CDC Moving Forward report was informed by agency-wide interviews. PATs will include metrics to evaluate success in their implementation plans.
- **Regarding development and submission of the reorganization package:**
  - Strike Teams were established based on the functional areas of Public Health Data; Global Health; External Affairs; Laboratory Science, Safety, Quality, and Capacity; Public Health Readiness and Response; Communications; Policy; Science; Public Health Infrastructure, Including Workforce Capacity; and Advancing Equity.

[1] https://www.kotterinc.com/methodology/8-steps/
[2] https://www.prosci.com/methodology
[3] https://www2.deloitte.com/tr/en/pages/human-capital/articles/developing-more-effective-change-management-strategies.html

- With input gathered from across the agency at all levels over the past several months, the Strike Teams have submitted their recommendations to CDC leadership. An update will be shared during the next CDC All Hands meeting.
- Dr. Walensky is making some final decisions about how CDC's structure can be set up to better support the functional areas and make sure that there is nothing in the structure that could limit the impact of what CDC is doing in each of these areas.

- **In terms of how CDC develops and delivers its science (Pillar 4):**
  - The *Scientific and Programmatic Review* conducted by Mr. Macrae[4] identified 5 operational focus areas to address: 1) share scientific findings and data faster; 2) translate science into practical, easy to understand policy; 3) prioritize public health communications; 4) develop a workforce prepared for future emergencies; and 5) promote results-based partnerships.
  - The resulting recommendations and priority actions support progress across all pillars, which was the focus of the report that Mr. Macrae developed based on internal and external input he heard about what people think CDC needs to change to be a better partner and implementer in public.
- **Within each of the operational focus areas, high-level recommendations in the *Scientific and Programmatic Review* follow:**

  Sharing Scientific Findings and Data Faster
  - Recommendation 1: Release scientific findings and data more quickly (prior to formal publications) in response to the need for information and action, and be transparent about the agency's current level of understanding.
  - Recommendation 2: Strengthen and expedite the development and review/approval process for scientific publications and data (including laboratory data) to match the needs of the emergency.

  Translating Science into Practical, Easy to Understand Policy
  - Recommendation 3: Develop and implement a standardized policy development process for implementation guidance documents.
  - Recommendation 4: Develop the implementation guidance and put it into final expedited clearance for publication.

  Prioritizing Public Health Communications
  - Recommendation 5: Focus communication efforts to the general public first with additional communications tailored to key partners.
  - Recommendation 6: Restructure the agency web site and digital communication platforms to eliminate unnecessary content and focus on key target audiences with a primary emphasis on the public.

  Developing a Workforce Prepared for Future Emergencies
  - Recommendation 7: Change the agency's emergency response operating model as well as its rewards and incentive structure to better recognize the importance of the agency's response work.
  - Recommendation 8: Expand and diversify workforce recruitment, retention, training, and development programs.

[4] https://www.cdc.gov/about/organization/cdc-moving-forward-summary-report.html

- Recommendation 9: Increase senior leadership team engagement with staff throughout the agency.

Promoting Results-Based Partnerships

- Recommendation 10: Establish an agency-wide performance-based framework for operations and programs focused on key agency goals and results, timeliness and quality of products/services, customer/grantee satisfaction (as measured through a new annual grantee survey), and staff satisfaction.
- Recommendation 11: Work in partnership with others in and outside of the government to turn science into public health action and results.

- **In terms of a status update,** the 21 PATs were charged with creating actionable implementation plans to address the 21 Tier 1 Priority Actions identified for each high-level recommendation:
  - PATs are led by individuals with critical knowledge, skills, and abilities related to their PAT recommendation and include staff from various organizational units, levels, skills, and experiences.
  - The goal was for each PAT to create sustainable solutions that drive results.
  - PATs were required to conduct listening sessions with all of the staff to acquire input from across the organization, and to engage in partnership conversations with CDC's key partners.
  - PATs have submitted the first drafts of their proposals, which are currently being reviewed.
  - Implementation of the final plans is anticipated to begin in early January 2023.
- **Questions for the BSC/DDID:**
  - What do you see as the most critical areas for improvement in CDC? What related solutions should be considered?
  - What other key actions do you recommend that we pursue in CDC Moving Forward?

CDC Moving Forward - Discussion

- BSC questions/observations/suggestions:
  - More resources and attention seem to be being paid to data modernization, but it is happening in a siloed way and often not by experts or people who have the authority to obtain the data. One of the most critical areas for improvement seems to be related to taking a holistic and coordinated approach to gathering, analyzing, visualization of, and disseminating the data and public communication. In the early days of COVID-19, the Institute for Health Metrics and Evaluation (IHME) developed an intuitive visualization of the data. CDC should have been front and center, which is likely to take a lot of investment and coordination of the work. Perhaps it would be beneficial to appoint a Data Czar.
  - The Infectious Disease Society of America (IDSA) worked with CDC leaders during the pandemic to discuss communication content and how IDSA and experts in communication could help in communicating key messages. This worked okay, but a gigantic issue was what they called the "Friday Surprise." IDSA would talk to people about what was going on and then on Fridays, CDC would release spectacularly challenging communication that often had a profound impact, particularly for hospitals in terms of policies on testing, isolation, and healthcare workers. CDC needs as many allies as possible in communicating messages to the media and brokering the implications with healthcare systems and public healthcare partners. Strong consideration must be given to the approach to communications and engaging people who really are CDC's best friends.
  - In addition to the BSC/DDID and IDSA, the National Association of County and City Health Officials (NACCHO) and Council of State and Territorial Epidemiologists (CSTE) also are committed to working with CDC to making the CDC Moving Forward initiative successful, and to

make the changes that are needed in public health agencies top to bottom and as a country in terms of being better prepared.

- Critical partnerships also will be needed with organizations that represent vulnerable populations that can help CDC in terms of messaging. It is important to think about partnerships in smaller cities in terms of hospitals, clinics, frontline providers, infectious disease specialists, laboratory capacity, and others who can help with communication. A good example of this is the Indianapolis Patient Safety Coalition.
- The communication discussion underscores the importance of quality data. Early guidance with poor data is different from early guidance with high-quality data. In that context, having a framework to describe the quality of the evidence or the strength of a recommendation, such as using GRADE (Grading of Recommendations Assessment, Development and Evaluation) or a similar approach, would be beneficial. There will be a learning curve for people to learn that a strong recommendation can be made in certain circumstances with low-quality evidence. There is risk with early action on limited data, which will be an important part of making people comfortable with that risk.
- The CDC Center for Forecasting and Outbreak Analytics (CFA) seems like a highly important part of this effort, particularly given the importance of modeling. Thought should be given to having a central place such as the CFA to coordinate academic centers during outbreak responses and public health emergencies.
- Much of what public health does during outbreak responses is through partnerships with the healthcare delivery system at one level or another (hospitals, clinics, frontline providers, infectious disease specialists, and others). The US has a very discombobulated healthcare delivery system, which makes this highly challenging. It would be beneficial to incorporate into the CDC Moving Forward paradigm the challenges of working with the healthcare delivery system as it is structured in the US in terms of what public health can do to be more effective in partnering with hospitals and other clinical facilities during outbreak responses. For instance, this could be something as obvious as how to assess an Ebola patient, the expectations, the capacity needed, and so forth.

- Mr. Macrae's responses:
  - Internal change processes within the organization itself are underway. CDC operates in a variety of centers and programs, each of which developed their own systems, reporting, datasets, et cetera over the years. One focus of the data modernization effort is on how to modernize and bring those systems into a more centralized and interoperable system within the organization. The second element of this is to work with partners (e.g., state and local health departments, universities, and others) to determine how data can be collected in a less burdensome way and shared more quickly with the public, researchers, health departments, and so forth. Several investments have been made, such as the establishment of a Data Modernization Team that is focused on ensuring that this system works for everyone so that CDC does become, if not THE, at least one of the sources for data analytics capacity and other components.
  - In terms of communications, one of the recommendations in the report is that there needs to be a more standardized way of putting out guidance or information so that it is clearly built in and is not an afterthought or outside of standard procedures.
  - In terms of the quality of the data and recommendations, CDC is thinking through how to communicate this in ways that people can understand it. This is a mindset shift that has to happen within the CDC itself and in terms of managing public expectations about whether what CDC says is the absolute truth forever. While this is not a specific priority in the recommendations, the idea of tiering and exploring that is incorporated.

- Two of the suggestions Mr. Macrae made to CDC regarded the idea of coordinating among the academic centers in terms of how CDC can play more of a convener role or partner role, and the idea of clinical delivery and public health integration.

Agency Updates

Office of Laboratory Science and Safety (OLSS)

Dr. Jim Pirkle, Associate Director of the Office of Laboratory Science and Safety (OLSS) provided a laboratory update in the context of how the CDC Moving Forward initiative affects the agency's infectious disease laboratories.

- **The public health role of CDC laboratories** is to provide scientifically sound, technically advanced, high-quality, safe, efficient and timely laboratory support for the detection, diagnosis, treatment and prevention of disease and harmful exposures, prioritizing public health emergencies and collaborating with private and public health partners.
- **Some special challenges** in this role include the following:
  - Quality must be ensured for emergency rapid test development for tests that have high consequences for quality failure. CDC did not do a good job of that with the COVID-19 test in February 2020.
  - Clinical, surveillance, and research laboratories are commonly together and share personnel at CDC, so quality standards across laboratory types should be as consistent as possible.
  - There are more than 2,200 CDC laboratory scientists in over 200 laboratories in multiple states and territories.
- **CDC Moving Forward infectious disease laboratory goals** that the agency is pursuing include the following:
  - The Infectious Disease Test Review Board (IDTRB) started on March 1, 2022 as the previous process was informal and insufficient. The purpose of the IDTRB is to conduct extensive additional reviews of tests before they are released from CDC for use by the agency's public health partners and the private sector. The IDTRB was used for the Mpox assay.
  - A Quality Manual for Microbiological Laboratories (QMML) is under development that has separate sections for clinical, surveillance and research laboratories. While there are a number of quality manuals throughout the infectious disease community, CDC feels that there needs to be a consistent, high-quality set of standards used across CDC so that when people move between laboratories, they are working within the same quality system.
  - Method Expert Groups (MEGs) are being established to develop method-specific quality control criteria standards based on the method type/type of data to be released (e.g., immunoassay, RT-PCR, next generation sequencing, CRISPR).
  - Development is underway of a customized electronic Quality Management System (eQMS).
  - Annual internal audits will be required for all laboratories, including surveillance and research laboratories, in addition to the existing annual audits for Clinical Laboratory Improvement Amendments (CLIA)-related and clinical laboratories. These audits will be based on the QMML standards being developed and will be customized for CDC relevance.
  - Biannual external quality reviews will be instituted for all infectious disease laboratories, including surveillance and research, in addition to the existing external biannual quality reviews

of clinical laboratories. CDC is working with the American Association for Laboratory Accreditation (A2LA), which is especially interested in the research laboratories for which there are no established quality management systems in the field.
  - In terms of emergency response, CDC is establishing a test development and deployment procedure, developing a test readiness review, and creating commercial laboratory and reagent manufacturing readiness contracts.
- **Quality indicators will be tracked by the custom eQMS** that is under development for all laboratories, including tracking of the following important activities in CDC laboratories that show they are operating at a quality level:
  - Document management, especially for test procedures and standard operating procedures (SOPs)
  - Non-conforming events (NCEs), root cause analyses (RCAs), risk analyses, and corrective and preventive actions (CAPAs)
  - Proficiency testing records
  - Personnel training, competency assessment, and qualification records
  - Equipment and instrument maintenance records
- **Test Development and Deployment (draft plan)** is under development, which is needed to establish CDC's role, ensure that there are no failures for high-consequence events in the rapid development of high-quality tests, and make sure that the agency optimizes the transition to the private sector. The protocol components for this plan will include the following:
  - CDC will engage a subject matter expert (SME) with the appropriate expertise, who will work on rapid test development and will be provided with much better support for that process than there has been in the past.
  - Simultaneously, CDC will engage with 2 state laboratories that will be working independently to develop the same test. This will be a double-redundant, parallel operation.
  - Regular communication and collaboration with state and commercial laboratories and manufacturers on test development, including sharing of reagents, will be required. CDC has taken to heart that there must be a much stronger communication connection between public health laboratories, private sector laboratories, and manufacturers than there has been in the past.
  - The best method will be chosen and will go through the quality assessment process through the IDTRB and regulatory approval from CDC's CLIA Laboratory Director to ensure that the method validation shows quality fit for purpose.
  - CDC would then engage with the Food and Drug Administration (FDA) for an Emergency Use Authorization (EUA) review if needed. The CDC testing samples do not have to wait for FDA approval because it will be considered a laboratory-developed test and testing could begin inside the agency.
  - Simultaneously, commercial reagent manufacturer(s) will be notified of the primers and probes CDC anticipates needing. CDC keeps some internal reagent manufacturing, which is for multiple CDC purposes. This process will be started because CDC can pivot to make limited amounts of reagents faster than the agency can engage the commercial sector. While CDC is working to minimize the time delay in the commercial sector, there is a pivot time. No matter how much this time is reduced, it always will be faster for the first sets of reagents to be produced at CDC. Once commercial manufacturers pick up reagent manufacturing, the CDC process will stop as there no longer will be a need.
  - CDC will transfer the method to state and select private partners with limited amounts of reagents for method verification and initial testing. While CDC will not have unlimited volume to share it with everybody, an effort will be made to distribute as much as possible so that others

can work on method verification in their laboratories and/or change or adjust a test based on their own instruments.

- **CDC's Test Readiness Review (draft plan)** will evaluate the readiness of diagnostic tests for pathogens that have a reasonable possibility of causing a major emergency to ensure that:
  - A diagnostic test exists and **if not**, that the agency develops one and obtains FDA 510(k) approval.
  - An existing test has FDA 510(k) approval and **if not**, such approval is obtained.
  - An existing test is approved for major platforms available in state laboratories and available for adapting to major proprietary testing platforms (e.g., Roche, Abbott) and **if not**, that the test is adapted to run on major platforms and is resubmitted for 510(k) approval.
  - An existing test is optimized for high-throughput analysis using automated steps whenever possible and **if not**, the test is optimized for rapid sample analysis and resubmitted for 510(k) approval.
  - There is a straightforward process for commercial manufacturing of reagents and **if not**, that this is facilitated appropriately.
- **Commercial laboratory and reagent manufacturing readiness contracts** are under development to ensure that there is a national laboratory response system that uses CDC, public health laboratory, and other laboratory assets and is effectively using the private sector—all of which has to be coordinated in advance in a fluid manner that works well. CDC already has a Memorandum of Understanding (MOU) with all of the key players in all of the field, but this needs to go much further. To that end, CDC proposes to:
  - Collaborate with the American Clinical Laboratory Association (ACLA) to select laboratories and Advanced Medical Technology Association-Diagnostics (AdvaMedDx) to select reagent manufacturers; and
  - Establish indefinite delivery/indefinite quantity contracts (IDIQ) with these laboratories and manufacturers that: 1) specify responsibilities for reagent manufacturing and laboratory testing during an emergency; 2) provide immediate funding for initial manufacturing and testing; and 3) evaluate test transfer processes to ensure quality and timeliness.

Laboratory – Discussion

- BSC questions/observations/suggestions:
  - FDA should be included early for science, experience, and partnership reasons—not just regulatory reasons.
  - It is great to see the emphasis on laboratory quality systems and the redundancy that is being built in.
  - There are some unique quality considerations with regard to test manufacturing that are distinct from assay development and validation.
  - There appear to be 4 categories of work occurring in laboratories: 1) diagnostics testing that needs to be CLIA-compliant; 2) surveillance testing; 3) discovery research; and 4) test development research for tests that ultimately will be used for surveillance and/or clinical diagnostic testing. It is important to make this distinction because these are different. It is a challenge to have staff who cross between these 4 categories and spaces that include multiple types of work being done. Therefore, CDC must ensure quality and appropriate credentialling and oversight of CLIA-based testing versus the other categories.
  - CDC should call for Congressional appropriation to ensure that the agency is able to hire laboratory professionals and CLIA-level laboratory directors with the appropriate credentials and is able to appropriately compensate them.

- In terms of development of tests, the selection of only 1 test that moves forward, which potentially could lose some capacity and diversity and platforms by "throwing away" the other test that may be very good.
- In terms of capacity, rather than early testing moving forward only within CDC. However, the other 2 state public health laboratories could be kept in the running to ensure diversity and capacity in the early days of an emergency response.
- Nimbleness and "warm" capacity are very difficult and expensive to maintain between emergencies because as soon as there are funding cuts, that tends to be the "fat that gets carved off."
- FDA is available for and encourages early consultation and is in a unique position because they see all development programs for drugs, vaccines, devices, et cetera. Given this, the FDA can assist CDC and others with regard to implementation of certain requests. For instance, if there is a concern about lack of minority enrollment, FDA can talk to the pharmaceutical industry to indicate that they would like more minorities to be enrolled. If FDA feels like data are lacking when they review protocols, they can ask for labs to be drawn and request longer-term follow-up. In addition, FDA can reach out to other centers within the FDA and can contact other regulatory agencies and other USG agencies.
- Local public health laboratories were not listed among the partners. While key partners at the local level such as health departments work very well with their state public health laboratory colleagues, these laboratories can quickly be overwhelmed as occurred with COVID-19 and Mpox. This becomes a limiting factor in terms of being able to work quickly.
- While Congressional constraints on categorical funding are understood, CDC could remove administrative constraints at the agency level versus being tied into the way things always have been done to get resources where they are most needed at the local level.
- The problem with the current rendition of the Infectious Disease Test Review Board (IDTRB) is that the stages and checkpoints that are associated with it should be implemented during the assay development stage, more like a branch/team level activity. It is usually too late and a lot of wasted time has passed if presenting an assay to the IDTRB after it is thought to be up to par.
- Consider including a private diagnostic manufacturer as a 4th partner laboratory in test development, with the intent of transferring the test to a high-throughput automated platform in parallel with the laboratory-developed test that could be implemented by clinical testing laboratories.
- Recognize that direction should come from and be shaped by experience on all levels and not by what degree or initials are behind one's name. Often at CDC people are put in charge of boards, programs, and activities because of initials and have no idea of the overall way how things can progress, especially in a manner that invites input at all levels in terms of laboratory involvement, coordination, and output.

- Dr. Pirkle's responses:
  - CDC meets with FDA on a regular basis.
  - CDC recognizes that "research" is a broad term and test development and other discovery are a part of that. CDC is working on some wording to break this out in the Quality Manual for Microbiological Laboratories (QMML). The QMML will be what people need to abide by. The clinical section will meet CLIA and will have things that are not in CLIA. The surveillance and research sections will not be as demanding, but they will address what CDC considers to be the important quality features that are needed in laboratories.
  - CDC supports the notion that there should be many tests as fast as possible. The chart can be redone to clarify "the best test for inside CDC." If there are 3 good tests, it is anticipated that the

outcome will be 3 good tests. If a particular state develops a test that works best for them, they should use that. CDC is not saying the agency will choose and the other 2 will be discarded. In addition, the chart also can be adjusted to reflect the value and importance of local laboratories.
  - There are major conversations at the highest levels at CDC to emphasize the importance of sustained funding.
  - There is a good case study from the Pacific Northwest demonstrating the first COVID case, outbreak, and transmission was widespread in the community before the go-ahead was given to test. The University of Washington had developed a test and was working with Greg Armstrong, the CDC team, and FDA colleagues to be able to use the test, but approval was repeatedly denied for weeks. Once approval was received, they recognized that there were unrecognized cases of transmission weeks before the first clinical case was recognized. It would be interesting to apply the new framework to that experience to determine whether it would have allowed for identification of COVID-19 transmission in the US earlier. If not, there is still work to do.

Center for Preparedness and Response (CPR)

Dr. Henry Walke, Director of the Center for Preparedness and Response (CPR) provided an update on preparedness in the context of CDC Moving Forward.

- **Current active outbreak responses** include several agency-wide responses (COVID-19, 2022 multi-national Mpox, and global polio) and center-led responses (2022 Ebola outbreak-Uganda, 2022 New York State polio, and 2022 Haiti cholera outbreak). CDC has a graduated response framework such that the agency responds every day 24/7 at a program level until the resources needed to respond outstrip the program and/or staffing, at which time the response moves to a center-led response in one of CDC's national centers. When the center-led response resources are outstripped, the response moves to an agency-wide response. An agency-led response allows for the deployment of staff from across the agency and frees up some flexibility in terms of funding to support responses. The CPR is supporting these various levels of responses through an Incident Management Structure (IMS) with staffing, logistics, deployments, and in a number of other ways.
- **In terms of CDC Moving Forward**, improvement of processes and systems within CDC improves its ability to response as an agency. Dr. Walke noted that he is moving away from the word "preparedness" and to the word "readiness." There are public health functions in which the agency is involved on a daily basis (data, laboratory, and immunization systems), which CDC can leverage in a response. There is an area between preparedness and the agency's daily work that constitutes the readiness piece, which is more forward-leaning. Optimizing core capabilities will improve CDC's readiness to respond. For instance:
  - Improving laboratory efforts will help the agency respond to a surge with a new emerging pathogen.
  - Accelerating data modernization in terms of improving the pipelines of data that are flowing into CDC from around the nation with respect to integrating, analyzing, and translating those data into information for policymakers and to guide response activities.
  - Increasing CDC's capacity to respond to disease outbreaks can be optimized in terms of partnerships and developing a workforce that is prepared for future emergencies.
  - There is a need for CDC to develop stronger and deeper partnerships with its academic, state and local, and US Government (USG) partners. These partnerships are incredibly important in terms of logistics and moving items around. Unlike the Administration for Strategic Preparedness and Response (ASPR) that is set up in a regional manner with regional offices, CDC is set up to work directly with states. ASPR was able to pull together its regional representatives to work with Governors' staffs. CDC was not as well-connected to ASPR as it could have been at

the outset of COVID-19, but they are now working to strengthen that connection so that they are much better coordinated to address any future events. The same is true for the National Institutes of Health (NIH) in terms of test development and utilization, the Centers for Medicare and Medicaid Services (CMS) in terms of increasing hospital reporting, the Health Resources and Services Administration (HRSA), and the Department of Homeland Security (DHS)/the Federal Emergency Management Agency (FEMA). The USG can be a better partner to State, Tribal, Local and Territorial public health departments (STLTs) by improving the process for incorporating STLT input during a response, supporting response-ready systems, and providing flexible funding.

- Developing a workforce that is prepared for future responses is crucial. CDC and STLTs need: 1) an operating model that assures continuity in policies, procedures, and staffing; 2) a diverse and response-ready workforce, equipped to quickly address real-time public health emergency science, policy, and communication needs; and 3) processes that protect the well-being and mental health of emergency responders to prevent burnout and better recognize the importance of response work. CDC staff and STLT health department staff get burned out during a response, so CDC is assessing different systems within the agency to make sure they are tapping from all employees.
- CDC's CPR is responsible for the Public Health Emergency Preparedness (PHEP) Cooperative Agreement, which is focused on a number of elements related to response and a significant amount of funding for STLTs that is allocated annually. The PHEP is organized around 15 capabilities and a number of domains related to countermeasures, mitigation, surge management, laboratory testing, and biosurveillance. The PHEP Cooperative Agreement is just one of multiple financial mechanisms CDC uses to support STLTs for preparedness, readiness, and response. CPR has been spending time assessing how CDC is changing as an agency and how the public health system is changing related to lessons learned from COVID-19, which is reflected in the upcoming 2024 PHEP Cooperative Agreement's emphasis on data modernization, advancing the capabilities of public health laboratories, and incorporating health equity considerations.

Preparedness – Discussion

- BSC questions/observations/suggestions:
  - Not only does the science have to be ready to act, but also the science has to be ready to prepare. This goes beyond CDC and involves partners like NIH, FDA, and ASPR. As part of readiness and response, CDC must define the questions in advance that will have to be answered on the first day of an outbreak, such as about vaccine effectiveness (VE), the data/data systems that will be needed, and policy.
  - In terms of workforce diversity, the USG tends to get career people who are very distant from healthcare and the healthcare system. More people are needed in the CDC workforce who have recent or ongoing experience in healthcare and state and local responses.
  - Despite all of these amazing efforts and scale-up plans, CDC runs the risk of setting up systems, playbooks, and processes that would have worked very well for COVID-19 but may not work well for issues that have not been experienced in the past.
  - Readiness exercises will be important in preparing for the future, specifically in terms of addressing the identification of the right people and structures for the response, putting the right bridges in place with partner agencies and state and local health, and developing the channels of communication before unexpected threats.
  - There is concern about funding related to rapid response. CDC should not have to "borrow from Peter to pay Paul" for a priority. For instance, it took Congress months to approve funding for

Zika virus. Perhaps CDC could recommend to Congress that a bipartisan Response Ready Committee that can approve funding without the entirety of Congress is needed.
  - While preparedness is essential at CDC and at the federal level, it is not sufficient for national level preparedness. There must be preparedness at every level of US society (e.g., state and local public health and the healthcare system at the community level). PHEP funds have decreased by 50% over the last 20 years, which is grossly inadequate. It is necessary to be realistic and CDC's responsibility is to point out the serious gaps there are for funding public health preparedness at every level of community and governmental responses. Many have lost the staff they were able to hire with COVID-19 funding, many of whom were working in the community on the types of actions that are necessary to begin to address chronic, ongoing health inequities and their determinants. We cannot talk about inequities unless the needed investments are made during and in between pandemics to address structural and agency-level needs. The Hospital Preparedness Program (HPP) has withered to an even greater extent than the PHEP funding.

- Dr. Walke's responses:
  - There is an emergency reserve fund which CDC can tap into, but there are challenges. For instance, there was a desire to use some of the funds from the COVID response for the Mpox and Ebola responses. However, the way CDC is funded for COVID does not allow for this type of flexibility. CDC has been engaged in ongoing conversations with Congress about the need for flexibility in funding, given that the numerous lines of funding coming into the agency are restricted in terms of using funding that is dedicated for one pathogen for another pathogen.

Center for Global Health (CGH)

Dr. Denise Cardo, Acting Director of the Center for Global Health (CGH) provided an update in terms of enhancing the impact of CDC's work in global health in the context of CDC Moving Forward. Given the enhanced approach, consideration is being given to restructuring the center to ensure optimal strategic planning and implementation of CDC's global health work to: 1) protect the US; and 2) achieve global public health impact.

- **The goals of the proposed renamed center are to:**
  - Ensure that CDC's global strategic vision is implemented.
  - Improve strategic planning, resource allocation, oversight, and the impact of CDC's global health work across the agency.
  - Provide consistent and robust operational support and coordination to regions and countries.
  - Establish a new position within the CDC OD, Deputy Director for Global Health (DDGH). This position has been established. The person in this position will report directly to Dr. Walensky and the Center Director will report to the DDGH. The hope is for the DDGH to be primarily in Washington, DC working with partners at the federal level.
  - Merge the Global Health Coordinating Unit (GHCU) and the Center for Global Health (CGH).
  - Provide coordinated planning and enhanced support for regions and countries.
  - Align work with other centers, institutions, and offices (CIOs) for CDC's global impact.

Global – Discussion

- BSC questions/observations/suggestions:
  - If Canada is having an outbreak, local Health Officers should be informed as soon as possible before the outbreak occurs in the US in order to prepare.

- Dr. Cardo's responses:
  - One purpose of working globally and working with the CDC CFA is to try to prevent an outbreak that is occurring in other countries from reaching the US if possible, and to be prepared in advance to respond if it does reach the US.
  - In terms of healthcare, CDC is working closely with CMS, hospital associations, and others to understand what is needed. Globally, this is a major issue.

Health Equity

Dr. José T. Montero, acting Senior Advisor to the Office of the Director, provided a health equity update in the context of CDC Moving Forward. He has been deputized to the OD to lead an effort on equity. Equity is not new at CDC—it is at the center of many of CDC's activities, but simply has not been called "equity" per se. Dr. Montero highlighted several initiatives reflecting CDC's recognition that equity efforts within the agency need to be made more visible.

- **CDC's Moving Forward Equity Strike Team** is led by Dr. Montero.
  - The Director announced this initiative in April 2022 with an objective to strengthen systems and processes to equitably deliver CDC's science and program activities to the American people.
  - Tied to this initiative was the intent to create a new equity office that will promote this focus across all of the work CDC does, as well as how the agency operates—a CDC that reflects the diversity of America will be better positioned to respond to outbreaks, from science to communications.
  - The Equity Strike Team is the designated equity lead, has cross-agency representation across all of the CIOs, and is charged with making organizational recommendations that would serve as the foundation for the 2022 reorganization package.
  - CDC must look internally to ensure that the agency "walks the walk" and "talks the talk" in terms of how diverse, inclusive, and welcoming it is.
- **In terms of Diversity, Equity, Inclusion, and Accessibility (DEIA)**, President Biden signed Executive Order 14035, Diversity, Equity, Inclusion, and Accessibility in the Federal Workplace on June 25, 2021 (DEIA EO). DEIA EO establishes a government-wide initiative to advance diversity, equity, inclusion, and accessibility (DEIA) in all parts of the Federal workforce.
- **The CDC Diversity and Inclusion Executive Steering Committee (DIESC)** was established approximately a year ago to oversee agency-wide commitments to a work environment and organizational culture that fosters diversity, equity, belonging, inclusion, and accessibility (DEBIA). DIESC is accountable for:
  - Ensuring senior leaders make measurable progress toward improving diversity and inclusion at CDC.
  - Increasing agency and CIO-specific communication to enhance transparency and awareness of priority diversity and inclusion activities.
  - Promoting and disseminating CIO best practices that enhance or improve diversity and inclusion.
  - Increasing integration of health equity across CDC programs.
  - Ensures that CDC will advance and embed DEIA principles throughout its workforce and workplace, at every level.

- **CDC is implementing an agency-wide *Diversity, Equity, Inclusion, and Accessibility (DEIA) Strategic Plan 2022-2024*** that builds upon its existing workforce skills and capabilities and expands its efforts for recruitment and retention, while ensuring that its infrastructure supports and enables the best science and public health approaches. The plan is focusing on 6 DEIA principles:
  - Principle 1: Demonstrated focus on increasing diversity within CDC
  - Principle 2: Improved Retention and Opportunity Creation
  - Principle 3: Enhanced Climate for Diversity, Equity, Inclusion, and Accessibility
  - Principle 4: Leadership-Driven DEIA Cultural Reform
  - Principle 5: Strengthened DEIA Insights Through Improved Data
  - Principle 6: Strengthen Institutional Subject Matter Expertise and Equity Infrastructure
- **CDC CORE is the organizing framework** from which the breadth of CDC's efforts to advance health equity are conceptualized, implemented, and monitored. This effort was developed from Dr. Walensky's mandate for CDC to be engaged in this work and make it visible and measurable.
- CORE: **C**ultivate comprehensive health equity science, **O**ptimize interventions, **R**einforce and expand robust partnerships, **E**nhance capacity and workplace diversity, inclusion, and engagement
  - DEIA is foundational to CDC's ability to achieve its health equity science and intervention agenda.
  - CORE will periodically assess progress toward shortfalls related to the 4 pillars, which include: DEIA (e.g., assessment of progress toward milestones reported by divisions/CIOs); Interactive Dialogue Sessions; and Success Stories.
  - Workplace diversity, inclusion, and engagement is the "E" of CORE. The long-term goal is to establish a dynamic CDC culture that infuses DEIA in all CDC does, with an enhanced social/cultural understanding of communities.
  - The CDC DEIA strategic plan is a large part of "E" in CORE for which the DIESC will lead and have primary oversight.
  - Dr. Montero shared graphics of the CORE Framework and Roadmap and the CDC Social Determinants of Health (SDOH) Framework, emphasizing that the agency must have the engagement of its entire workforce. Everyone must be attuned to what CDC is doing, so every center was asked to develop goals at the division level to help advance and integrate health equity into the foundation of the agency's work. Each CIO Director is accountable for the goals of the various CORE components.
  - There are recent publications related to these efforts.[5]
- **CDC's Office of Minority Health and Health Equity (OMHHE) initiated the Health Equity Leadership Network (HELN)** to advance the science and practice of health equity, promote a sustained focus on reducing health disparities, and exchange best practices between CDC programs. HELN is composed of 32 members who share information and promote the importance of health equity across the agency. Representing 16 different CIOs, these individuals were nominated to participate in HELN by their leadership.

Health Equity – Discussion

- BSC questions/observations/suggestions:

[5] Hacker K, Auerbach J, Ikeda R, Philip C, Houry D; SDOH Task Force. Social determinants of health—an approach taken at CDC. J Public Health Manag Pract. 2022;28(6):589-594. doi: 10.1097/PHH.0000000000001626; Hacker K, Houry D. Social needs and social determinants: the role of the Centers for Disease Control and Prevention and public health. Public Health Rep. 2022; Sep 9:00333549221120244; and JPHMP Direct. CDC's Approach to Social Determinants of Health. Accessed October 31, 2022.

- While CDC is engaged in a major transformation, partner federal agencies also must be engaged, and CDC must be involved in advocacy for this.
- Medicaid reimbursement for vaccines through CMS was woefully underfunded for minority providers, who were not able to meet their costs in order to do this. The low reimbursement amounts resulted in a large group of providers being unable to perform testing and administer vaccines.
- HRSA has all of the Federally Qualified Health Centers (FQHCs). Some of the funding was given to Federally Qualified Health Centers (FQHCs) that did not work in the homeless population, while others doing that work did not receive funding.
- Communication and structural racism must be addressed. Many of the hospital testing sites may not be in areas with high numbers of minority populations. Health equity strategies are needed for mobile programs, testing, and vaccines.
- CDC has done a remarkable job with community engagement. CDC's work with vulnerable populations, the National Hispanic Medical Association (NHMA), National Medical Association (NMA), NACCHO, Association of State and Territorial Health Officials (ASTHO), and others should continue as a priority.

- Dr. Montero's responses:
  - CDC's effort on equity does not work in isolation. CDC is part of the bigger HHS family and as such, engages with many of its partners across that family. This does not mean that CDC always gets what it wants or proposes. That is part of the engagement process. In many cases, CDC's role has been to identify areas where improvement can take place and propose solutions. However, CDC cannot make decisions for other agencies.
  - All of government is interested in improvements in this area. From that perspective, the new CDC office, once set up, will work with the other components of CDC that are involved in external engagement to advance this thinking about health equity solutions.
  - CSTLTs allocated $2.2 billion to 108 health departments to work on equity. Even though this work on equity is tied to COVID-19, it is building that foundation that those health departments need to engage at different levels of community. Part of the work that the proposed Health Equity Office will do will be to advocate for long-term changes and the funding that these efforts require.

Outbreak Response Updates

Ebola

Dr. Trevor Shoemaker, Epidemiology Team Lead in CDC's Viral Special Pathogens Branch (VSPB) and Epidemiology Task Force Lead for the 2022 Uganda Sudan Ebolavirus (SUDV) outbreak, provided an update on the SUDV outbreak.

- **The Uganda Ministry of Health (MOH) declared an outbreak of Ebola caused by SUDV on September 20, 2022:**
  - The first confirmed case was reported to the MOH on 19 September, symptom onset was on 11 September, and death occurred on 19 September.
  - This case was in Madudu Sub-County, Mubende District in Central Uganda, which is approximately 107 miles from the capital Kampala.
  - This outbreak is caused by SUDV whereas other recent outbreaks of Ebola virus disease (EVD) have been caused by Zaire ebolavirus (ZEBOV).

- Options for medical countermeasures and testing differ for SUDV and ZEBOV in that there are no FDA-approved treatments, vaccines, or rapid diagnostic tests for SUDV. However, there are a number of candidate treatments being used under compassionate use or experimental protocols. There also are some vaccine candidates, which may be sent to Uganda and trials may be started, although the outbreak is somewhat waning. The diagnostic tests for ZEBOV can pick up SUDV, but at a lower level than ZEBOV. The tests do have utility, especially in cadaveric surveillance where there is usually higher viremia at death.
- This is the fifth outbreak of Ebola caused by SUDV in Uganda since 2000 and the eighth outbreak overall, with the others being in what is now present-day South Sudan. In 2011, there was a single case and death. In 2012, there were 2 outbreaks, one not far from the current outbreak location and the other a smaller outbreak to the East later in that year.
- Dr. Shoemaker shared a graphic of notable Ebola outbreaks from 1976 to the present. Notably during this timeframe, there have been a lot of outbreaks due primarily to ZEBOV. The large outbreak from 2018 to 2020 that caused 3000 cases just across the border in the Democratic Republic of the Congo (DRC) was caused by ZEBOV.

- **The status of the epidemiology and surveillance of the current SUDV outbreak,** the third largest outbreak of SUDV on record, includes the following:
  - Total cases: 164 (142 confirmed, 22 probable)
  - Total deaths: 78 (56 confirmed, 22 probable)
  - Case-Fatality Proportion: ~48%
  - Total recoveries: 87
  - Districts (n=4) affected reporting confirmed cases in previous 21 days: Kassanda, Mubende, Kampala, and Jinja
  - Total infections among healthcare workers (HCWs): 19 (7 deaths)
  - Contact Tracing: 36 active contacts as of 5 December, with 100% follow-up
- **Uganda coordination and response efforts** include the following:
  - Ugandan health authorities are leading the response in coordination with the district-level health authorities in each district and support from partners.
  - District and National Rapid Response Teams (RRTs) have deployed to support outbreak response activities, including contact tracing.
  - The National Emergency Operations Center was activated on 20 September.
- **CDC support** includes the following:
  - The CDC Country Office has deployed 10 full-time staff who are supporting the response in Mubende, Jinja, and Entebbe.
  - As of 12/1, 17 CDC Headquarters (HQ) Responders are in Uganda supporting response activities in the following roles: Epidemiology (5), Laboratory (3), IPC (4), Management and Operations (2), Social and Behavioral Science (1), Communications (1), and Safety/Security (1).
  - As of 12/1, one (1) CDC Responder is in South Sudan in the following role: Epidemiology (1).
  - CDC staff are assisting with border activities at HQ and in-country, including border health activities; Infection, Prevention, and Control (IPC) activities, identifying and advocating for logistical needs, assisting in data analysis, contact tracing, and establishing surveillance sites.
- **In terms of domestic preparedness and response:**
  - The Department of Homeland Security (DHS) is redirecting air travelers who have been in Uganda in the previous 21 days to five (5) US airports for CDC public health entry screening: Atlanta (ATL), Chicago (ORD), Newark (EWR), New York City (JFK), and Washington Dulles (IAD).
  - Travelers undergo public health monitoring by destination health departments for 21 days, with health departments reporting findings to CDC.

- To date (6 October – 4 December), there have been 6,204 entry screenings in the US by CDC, and 95 secondary public health risk assessments at arrival airports. None of them have been referred to hospitals and no high-risk exposures have been identified.
- Since the start of the response, CDC has conducted 32 Ebola-related clinical consultations. As a result, 2 patients were referred for testing. Both patients tested negative at the Laboratory Response Network (LRN) and CDC laboratories. At least 1 individual had an alternative diagnosis of malaria.
- The testing capability for SUDV under CLIA includes 29 LRN laboratories across the US that can run the BioFire® Warrior Panel that can detect a broad array of viral pathogens, including SUDV.There are also 6 Regional Emerging Special Pathogens Treatment Centers (RESPTCs). The CDC laboratory has a CLIA-approved test that is the agency's own polymerase chain reaction (PCR) assay.
- CDC completed outreach and technical assistance (TA) sessions with the 10 jurisdictions receiving the largest numbers of returning Ugandan travelers to improve their SUDV response readiness, including healthcare system and Emergency Medical Services (EMS) readiness, contact tracing, quarantine/isolation, and testing protocols.
- CDC's health department liaisons are conducting follow-up calls with the 10 jurisdictions for continued communication on these topics.
- CDC also has put out 2 Health Alert Network (HAN) updates, updated the agency's websites, and distributed many communication messages throughout this outbreak.

Ebola – Discussion

- BSC questions/observations/suggestions:
  - Regarding an inquiry about whether there have been supply chain issues such as the ones that occurred during the COVID-19 pandemic, especially with personal protective equipment (PPE), Dr. Shoemaker indicated that he has not heard of any shortages and has heard on the Domestic Preparedness calls he has attended that work is underway to identify PPE for CDC responders should the need arise.

Monkeypox (Mpox)

Dr. Jonathan Mermin, Incident Manager for the Mpox Response, provided an update on the Mpox outbreak that has been going on for the past few months globally and in the US and some of the lessons that have been learned from this experience.

- **In terms of background:**
  - Monkeypox virus is one of the *orthopoxviruses* from the same group of viruses as *variola virus* that causes smallpox, *vaccinia virus* that is used in smallpox vaccine, and *cowpox virus* that was the first virus used for smallpox vaccination.
  - It was first discovered in 1958 following 2 outbreaks of a pox-like disease in colonies of research monkeys. Hence its original name of "monkeypox" that was recently changed to Mpox by the World Health Organization (WHO).
  - It has been noted that for a couple of decades, increasing numbers of cases and outbreaks of Mpox have been observed in West and Central Africa where it is endemic. That has been attributed to both reduced smallpox vaccine-derived immunity because people are no longer

being vaccinated for smallpox and the changing geographic distribution of human populations coming into contact with animals.

- **The clinical presentations in the current outbreak include:**
  - Rash that often starts in mucosal areas (e.g., genital, perianal, throat)
  - Absence of "prodromal" symptoms or presence of "prodromal" systems that follow rash onset
  - Typical duration is usually 2-4 weeks
  - This outbreak is of Clade IIb, which is less pathogenic compared to Clade I of Mpox
  - Lesions can be quite painful, spread, and have severe manifestations
- **The Mpox disease course can be severe:**
  - It can present with multiple coalescing or necrotic lesions despite treatment.
  - Lesions may lead to obstruction, stricture, and scar formation; urethral and bowel strictures; phimosis; and facial scarring. There have been major issues requiring surgery. For instance, people have had to had colostomies.
  - There may be secondary bacterial or fungal infections and/or multiple organ system involvement may occur. There have been cases of multi-system organ failure.
  - The majority of severe cases, including deaths, occur in people who are immunocompromised—particularly people with HIV and CD4 counts below 350.
- **Most Mpox infections in this outbreak are associated with sexual contact**:
  - 96% of cases occurred among cisgender men, 3% of cases occurred among cisgender women and 1.6% of cases occurred among transgender men, women, or another gender.
  - The majority of cases for which information was reported were in gay, bisexual, and other men who have sex with men (MSM).
  - In terms of demographics, 32% of cases have occurred among Black/African American populations, 31% have occurred among Hispanic/Latino populations, 30% have occurred among White populations, and 3% have occurred among Asian populations.
  - Of particular note, approximately 40% of the cases have occurred in people with HIV and about 40% of the cases have had an STI diagnosis in the past year.
  - About a third had over 5 sexual partners in the past 3 weeks during the incubation period.
  - Cases have also been associated with non-sexual contact such as through caregiving and nosocomial events.
- **In terms of the community response:**
  - When Mpox was first noted in the US, the gay, bisexual, and other MSM community responded by changing their risk behaviors.
  - Over 48% reduced their number of sexual partners, 50% reduced 1-time sexual encounters, and 50% reported reducing sex with partners met on dating apps or at sex venues.[6]
  - Supplies of ACAM2000 and JYNNEOS vaccine were available from the Strategic National Stockpile (SNS), which enabled vaccination to occur faster than might otherwise would have been possible as compared to SARS-CoV-2 for which a vaccine was not available.
  - While ACAM2000 is thought to be effective, there are more adverse effects (AEs) compared to JYNNEOS.
  - It took a few weeks for the JYNNEOS vaccines, which is now the preferred vaccine for Mpox, to become fully available.
  - Since the onset of the Mpox outbreak, over 1.1 million doses of vaccine have been administered and reported to CDC since May 20, 2022. Close to 700,000 people have received their first dose of this 2-dose vaccine series.

[6] American Men's Interview Survey, 2022 Monkeypox Supplement

- The peak of vaccination occurred in July and August 2022. There has been a dramatic decrease in vaccination over the past couple of months.

- **The epidemic curve, disparities, and the outbreak trajectory:**
  - The decrease in vaccination is concurrent with a decrease in the incidence of infections. Infections peaked in late July and early August. Since then, there has been over a 95% reduction in incidence of Mpox cases. At this time, fewer than 7 cases per day are being identified.
  - Disaggregating the epidemiologic curve by race and ethnicity, there has been a dramatic reduction in Mpox incidence regardless of race/ethnicity. However, the proportion of cases by race/ethnicity has changed over time.
  - As the epidemic progressed, the proportion of cases in African Americans increased from 15% to closer to 40%. Particularly with African Americans, there is a disparity that has grown over time even at the same time the outbreak itself was decreasing.
  - CDC has been monitoring this as a way of emphasizing what is important (e.g., reduce incidence and reduce disparities), while at the same time comparing progress to the goals.
  - Looking at the disaggregated race/ethnicity of cases in the past 2 weeks, the percentage of cases were about 35% African Americans, 25% Hispanic/Latinos, and about 29% Whites. However, the number of people vaccinated is much more like the general population in the US at about 12% African Americans, 20% Hispanic/Latinos, and 50% White.
  - From the beginning, CDC has focused on equity. This included some special vaccine equity projects through which vials of vaccine have been provided specifically for outreach activities in disproportionately affected communities. While this likely would have been worse if this had not been done, the effort was not completely successful.
- **In terms of why this Mpox outbreak occurred at this time**:
  - According to the STD Surveillance Network (SSuN), the rates of gonorrhea changed dramatically from 2015 after which gonorrhea increased by an order of magnitude .
  - There are geographic disparities for sexually transmitted infections (STIs) and HIV. Very few of the 3100 counties in the US comprise the majority of the cases of HIV, chlamydia, gonorrhea, acute hepatitis B virus (HVB), acute hepatitis C virus (HCV), syphilis, and/or TB. Those counties seem to overlap with the counties that had Mpox cases in the last 2 weeks of October 2022.
- **Regarding the state of STIs prior to the introduction of Mpox into the US:**
  - There is an inadequate STI infrastructure.
  - Systemic homophobia, racism, and economic policies are engrained into the US that have been associated with increasing STIs and disparities.
  - MSM and transgender persons have borne the largest burden of HIV, syphilis, and gonorrhea and now Mpox.
  - There is strong scientific evidence that people who are taking antiretroviral therapy for their HIV and are virally suppressed do not transmit HIV to their sexual partners. In addition, there are strong data showing that taking antiretroviral therapy pre-exposure prophylaxis (PrEP) is greater than 99% effective at preventing one from acquiring HIV. These 2 medical breakthroughs and some reductions in HIV incidence have changed the prevention landscape and made it more challenging to address STIs.
  - There has been an increasing incidence of STIs every year in the US for the past 7 years, with 2022 having the greatest number of syphilis cases ever reported.
  - Within this framework, there has now been the rapid spread of a rare viral infection with scientific unknowns—essentially a grey swan. This is a situation of potentially serious outcomes, which had been discussed and anticipated, but thought to be unlikely.
- **To respond to the outbreak:**
  - There has been multi-agency preparedness and engagement.

- Community engagement and equity were incorporated into the CDC IMS structure from the onset and is still ongoing, including fact-based and stigma-reducing messaging; focused digital media, dating apps, and other channels; continued engagement with communities, leaders, and influencers; guidance to integrate equity into distribution and access to vaccination; and vaccine equity programs reaching tens of thousands.
- Place-based interventions were introduced and are ongoing that ensconce routine Mpox vaccination in clinics that provide HIV, STI, and PrEP services, and link with community-based organizations; normalize Mpox prevention and treatment as part of STI services; continue venue and event-based vaccine equity initiatives; and nurture engagement with local community organizations and leaders.
- Policy interventions were introduced, some of which are still ongoing, that allow flexibility with existing funding streams to incorporate Mpox; provide specific Mpox resources to community-based organizations (CBOs) through small grants and to health departments; ensure collaboration between communicable disease and STI/HIV programs and institutions; develop and make available toolkits and guidance (e.g., clinics, corrections, sex venues, schools, testing, vaccination, treatment); and allow for continued research on treatment, vaccine effectiveness (VE) and mode of administration, animal reservoirs and zoonotic risk, viral shedding and transmission dynamics, diagnostics, and surveillance.

- **A number of challenges remain.** For example:
  - Vaccination uptake is decreasing, yet fewer than half of the people in the US who potentially would benefit from Mpox vaccination have received it.
  - There is intersectionality that increases obstacles for African American and Hispanic/Latino gay, bisexual, other MSM, and transgender persons.
  - Public health has been criticized not only for increasing stigma by providing focused messaging for gay and bisexual community, but also for not highlighting the disproportionate burden experienced by MSM and persons with HIV. There is constant tension in terms of how to do both well at the same time.
  - Existing scientific questions remain to be answered and intervention tools are currently limited.
- **While preparation greatly benefitted the response, there is more work to do.** For example:
  - Although there is vaccine for Mpox in the SNS, there are limited data on safety, efficacy, and durability of immunity. The FDA licensed this vaccine based on safety in humans and efficacy in animals. The vaccine is now being evaluated in the human population because the outbreak occurred, which will provide additional information that should make people more comfortable with the use of the vaccine, determines the magnitude of effect, and identifies any safety issues.
  - Potential treatments are available, but there are limited data on the effectiveness of these treatments in humans. For instance, the NIH is conducting a trial on tecovirimat (TPOXX or ST-246) that has been administered to several thousand Mpox patients under compassionate use. However, the trial did not begin until after the epidemic was decreasing and NIH is having difficulty enrolling enough patients.
  - Accurate tests are available, but there are no point-of-care (PoC) diagnostics.
  - Despite years of research on transmission, previous outbreaks have not been associated with sexual contact.
- **Some Mpox lessons learned** were that it is critical to anticipate the future and act fast; focus on equity and work with communities; and bring services to people and make prevention easy; and realize that as societal concern decreases, public health needs often increase.
- **Questions posed for the BSC members** included the following:
  - When is the Mpox outbreak over for the US and for the world in terms of how that should be defined epidemiologically and from a programmatic standpoint?

- What needs to be in place in the US to prevent a resurgence?
- What did we learn from the outbreak that can be applied elsewhere, either in the future or for other infections?
- What has CDC done well with Mpox, what could the agency do better, and what should the agency stop doing?

Monkeypox – Discussion

- BSC questions/observations/suggestions:
  - Perhaps there is an argument and justification to continue the investment in the CDC-maintained field station in the DRC, one of the activities of which was to assess Mpox and treatment.
  - In terms of the question regarding when the outbreak is over for the US, a good example was defining when syphilis would be eliminated in the US since that was so successful and the metric was a good one. Relate the Mpox outbreak to known incubation periods and then develop something similar to what was developed for syphilis.
  - The National Institute of Allergy and Infectious Diseases (NIAID) is sponsoring 2 trials, the Study Of Tecovirimat For Human Monkeypox Virus (STOMP) randomized-controlled trial (RCT) that is recruiting very slowly and a placebo-controlled RCT in the DRC where mostly children and their caretakers get Mpox. Perhaps there will be an answer on the efficacy of tecovirimat there within the next several years if the STOMP RCT is not successful.
  - Regarding what could be learned from the Mpox outbreak, the tolerance for the seeming epidemic of STIs would be much lower if it was occurring in the general population. In a sense, this seems like an STI emergency that needs to be prioritized. There remains concern about what the "next thing" is going to be, such as another retrovirus. In terms of what CDC could do, this could be elevated to a warning signal about the transmission of STIs without stigmatizing it.
  - While there already was an Mpox test that was deployed to LRN laboratories across the country, it was a low throughput test that resulted in a long turnaround time and it was not near patients. Dr. Pirkle is going to address this as part of preparing for the future and converting capabilities to high throughput.
  - A messaging issue is that the recommendation on the CDC website is to perform all Mpox testing in a Biosafety Level-2 (BSL-2) laboratory, which is not compatible with PoC testing. This creates questions and concerns about performing testing and working with patients due to fear and inhibits test development because of that discordance. The CDC Moving Forward guidance that is in the works should be helpful.
  - The ability to diagnose Mpox with a multi-plex genital ulcer test should be a top priority for the CDC. There is not an available direct type of herpes test that can be used in most public health settings. This could be done easily and could be a huge win for the public health and HIV communities, not just the sexual health community.
  - Regarding lessons learned, this seemed like an incredibly successful intervention and response that was well-coordinated in terms of speed of control, equity, strategic use of the SNS, effective behavioral interventions, et cetera.
  - When vaccines first became available in very small quantities from the state, some local public health departments struggled with how to prioritize them. Based on the presentation, the vaccine guidelines appear to be to continue to vaccinate MSM and other high-risk populations indefinitely. This raises concern that there could be emergence in other populations as long as Mpox is still circulating at low levels.

- Dr. Mermin's responses:
  - There is some ongoing research in the DRC. There is a very strong argument to continue the CDC presence of staff and engagement in multiple countries throughout the world. Just having CDC staff on the ground made a major difference in helping the MOHs and communities in those countries respond to their normal public health issues, as well as the Ebola outbreak. The Ebola outbreak in Uganda is just one example. The Poxvirus & Rabies Branch (PRB) within the National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) does a great deal of work in multiple countries that have been affected by Mpox over time and continues to do so.
  - From the beginning, CDC considered what responsibilities and opportunities would be suited to the agency and what scientific questions would be answered by others. There is a European trial of tecovirimat and multiple countries are evaluating the effectiveness of Mpox vaccine, including CDC, through different mechanisms. A meta-analysis may be needed to amass enough data.
  - CDC has been giving a lot of thought to which diagnostics are essential to be brought to licensure and made available, one of which is a POC treponemal/nontreponemal test (NTT) for syphilis. There is an effort to try to perform multi-plex testing, which is a top priority along with a POC test for Mpox. Roche has a product that can assess for syphilis, herpes simplex virus (HSV-1) and HSV2, varicella, zoster, and Mpox. The idea is to have diagnostic capacity in the hands of clinicians when a patient has a lesion. Thinking about it from the patient and physician side rather than a disease-specific side allows the physician to tell someone what they have. About a third of all specimens that CDC has received are positive for Mpox, meaning that the other two-thirds were something else.
  - In terms of limited vaccine early on, CDC assessed the scientific data showing that intradermal vaccination developed a response with one-fifth less a dose than subcutaneous vaccination. While that was a somewhat controversial recommendation, it allowed CDC to immediately increase the limited supply and vaccinate more people. Soon they were working with a more traditional vaccination approach of providing people with vaccine before they were exposed.
  - The notion of how to prioritize when there is a disaster or epidemic is a critical one and many people are spending time thinking about it, including the use of the Social Vulnerability Index (SVI). This is a continuing challenge and self-reflection is an honest way to evaluate how well one did.
  - One way of deciding when Mpox is over is through a case-based approach (e.g., cases are very rare and there is an ability to respond rapidly). Another strategy is to ascertain whether there is enough immunity to prevent resurgence of new clusters and cases if Mpox is reintroduced from one jurisdiction to another or from outside the US back to the US. This is where the idea of having a robust vaccination program for at least a period of time to observe what happens with the global outbreak will be very beneficial.

Cholera

CAPT David Fitter, Co-Incident Manager for the Cholera Response, presented an update on the 2022 Haiti cholera response.

- **In terms of the background of the Haiti cholera outbreak**:
  - The Haiti cholera outbreak occurred in the context of over 30 cholera outbreaks globally in 2022, which impeded supply quantities and vaccine for response. There has been an increase in insecurity in Haiti since 2019 that has impacted the ability of movement in terms of population movement as a whole and movement of many of the partners to support public health and health interventions. Haiti knows how to respond to cholera but is impeded because the current

cholera outbreak is occurring in the context of a major humanitarian crisis and is amplified by that.
  - Haiti's last cholera outbreak occurred between October 20, 2010-February 2019, with over 820,000 cases and almost 10,000 deaths.
  - There were over 12 months of political instability in the country after the presidential assassination in July 2021.
  - While there was fuel insecurity with the preliminary liberation of the main fuel port as of 2:00 pm on November 4, fuel circulation has been increasing. This has positive and negative consequences for an outbreak and spread. One negative consequence of fuel insecurity is that a lot of movement of water is dependent upon fuel, fuel pumps, and chlorination of water systems. However, as fuel circulation increases, population movement also increases.
  - There has been heightened insecurity with increased gang-on-gang violence and armed clashes with Haitian National Police (HNP).
  - In addition, there has been record-high food insecurity, with the most impoverished neighborhoods in metro Port-au-Prince (PAP) requiring assistance.
- **Regarding the timeline of the 2022 cholera outbreak**
  - On September 27, 2022, which was 6 months into the WHO cholera-free declaration process, Médecins Sans Frontier (MSF; Doctors Without Borders) reported acute watery diarrhea (AWD) in Cite Soleil in PAP.
  - A pediatric case tested positive via rapid diagnostic testing (RDT) on October 1, 2022 before dying of dehydration. MSF notified the Haitian Ministry of Health (MSPP) and the Pan American Health Organization (PAHO) country office.
  - The MSPP stood up a Cholera Response Taskforce on October 2, 2022 with participation from US government (USG) agencies (US CDC, USAID, DoD, Embassy), UN agencies (PAHO, UNICEF, and IOM), and MSF. This response includes five main pillars: Epidemiology and Laboratory Surveillance, Case Management, Water Sanitation and Hygiene (WASH), Risk Communication and Community Engagement (RCCE), and Vaccination.
  - The USG reconvened the Interagency Health Working Group (IHWG) at the Embassy on October 3, 2022 to coordinate the cholera response support across agencies.
  - Spread into the Dominican Republic was reported on October 21, 2022. The case reported in the Dominican Republic was identified in a 32-year-old Haitian woman who had traveled from Haiti to the La Altagracia Province in the Dominican Republic (DR) on October 17, 2022.
  - A second imported cholera case was confirmed in the DR on November 21, 2022 by the MSPP. This case was in a 4-year-old boy coming from Port-au-Prince who entered the country from Haiti through the Dajabon border on November 18, 2022.
  - Flowminder[7] helped to map population movement and communes where there might be pressure from population movement, which is important in a country like Haiti where the surveillance system is not as robust as it could be.
- **With regard to the current situation as of December 6, 2022:**
  - A total of 13,454 cases had been reported, of whom 11,557 were hospitalized and 281 died. Institutional/Community was 182/99. The case fatality rate (CFR) Institutional/Total was 1.57%/2.09%. One of the indicators of success for a cholera outbreak is a CFR of 1% or below, especially for institutional cases.
  - The median age of the cases is 21 years and the current distribution by sex is approximately 58% male and 42% female.

[7] https://www.flowminder.org/resources/publications/haiti-cholera-outbreak-2022-report-1

- Preliminary deoxyribonucleic acid (DNA) sequencing results indicated the current circulating cholera strain is the same as that of the 2010 outbreak. This suggests that despite no cases having been reported in country in 3 years, this cholera strain may have remained in an unknown reservoir in Haiti or was reintroduced from elsewhere. Sequencing from a geographically representative set of reference samples from 2016-2019 is in process at CDC.
- Much of the epidemiological data is coming from 2 sources. One of these is the SitReps, which are largely phone-based and require calls to 10 districts. The other source is the District Health Information Software 2 (DHIS2) system where information is being logged in. The phone-based system is quicker and allows for pulling a smaller set of indicators needed on a daily basis. The DHIS2 requires several more indicators for tracking purposes.

- **The WASH strategy pulls from the USG strategy** including the following elements:
  - The WASH strategy supports chlorination and water quality monitoring of piped networks, community water networks, and water trucks.
  - As part of the WASH strategy, there is also an inventory and activation of a network of water and sanitation technicians, known as Technicien en Eau Potable et en Assainissement pour les Communes (TEPACs), who are commune-based. Haiti has 133 communes across the 10 departments. The TEPACs were trained by CDC to monitor water networks and test water reservoirs. The TEPACs report to the Direction Nationale de l'Eau Potable et de l'Assainissement (DINEPA), which is the water and sanitation aspect of the government of Haiti. There were 2 TEPACs per commune who monitored the water pumping stations and reservoirs, as well as testing throughout the past 10 years. As cholera decreased over the years, the TEPAC network has not been as strong and funding for the network has decreased.
  - Another element of the WASH strategy is wide distribution of chlorine throughout the country, ensuring that there is access to HTH and Aquatabs® to treat larger reservoirs of water and water at home.
  - Other aspects of the WASH strategy include a national survey of WASH needs and improvement of mapping efforts using mWater, which allows ministry partners and ministries to track water, sanitation, and hygiene networks throughout the country online.
  - The WASH strategy also supports distribution of point-of-use water treatment products and hygiene kits and strengthening of WASH and infection prevention and control (IPC) in health centers.
- **The objectives of the vaccination strategy and campaign** are to: 1) support the country to access oral cholera vaccine (OCV) through the global stockpile; and 2) support the country with campaign planning, implementation, and evaluation.
  - The Government of Haiti (GOH) submitted an OCV application to the Global Task Force for Cholera Control (GTFCC), which reviewed and approved the application in November 2022.
  - Doses will be provided in 2 allotments given the supply constraints, with the initial 1.2 million doses to be given shortly. Following that, approximately 300,000 to 400,000 doses will be given. The vaccination campaign is set to begin around December 14, 2022.
  - Microplans are being developed for Ouest and Centre departments, which have been hit hard by the cholera outbreak. CDC and USAID have been participating in meetings to assist with the microplanning for this effort going forward.
  - CDC developed and distributed updated training materials, with training of trainers having begun on December 2, 2022. The training of vaccinators should begin shortly.
  - CDC is also developing a communications campaign and supporting demand assessments. The demand assessments are based on knowledge that has come out of the domestic and international COVID-19 vaccination activities and helps to acquire better information at the local level of concerns pertaining to vaccination.

- **Case management objectives are to**: 1) support improved operation of Cholera Treatment Centers (CTCs) and Cholera Treatment Units (CTUs) run by CDC and USAID implementing partners; and 2) support improved access to oral rehydration therapy by supporting implementing partners to establish 6 to 10 oral rehydration points (ORPs) and distribute oral rehydration solution (ORS) packets.
  - Case management training slides have been developed in French and Creole for the population.
  - An issue at the beginning of the response was that people were arriving at CTCs, CTUs, and ORPs late stage, which contributed to the elevated CFR and illustrates the importance of pushing messaging out to the populations as well.
- **The RCCE is engaged in a number of efforts**, including the following:
  - The RCCE is supporting MSPP communication strategy development by providing technical guidance and supporting the production and dissemination of cholera prevention, risk mitigation, and WASH messages via traditional and social media.
  - In addition, the RCCE is conducting community-level outreach to deliver risk communication messages on WASH/IPC, health seeking behavior, preventing transmission, and accessing safe drinking water.
  - RCCE also supports the OCV campaign through the development and distribution of public service announcements (PSAs), communications materials, and key message development.

Cholera – Discussion

- BSC questions/observations/suggestions:
  - It is concerning that the first epi-curve that was shown suggested that cholera was declining, but vaccine did not go out until 2 months into the episode and the rollout is just now starting 3 months into the outbreak as cholera is already on the decline. It is not clear how vaccines figure into these kinds of responses or whether there is an opportunity to use them more effectively.

- CAPT Fitter's responses:
  - From the beginning of the response, there was an ask from the GTFCC about whether Haiti wanted vaccine. The Haitian Ministry of Health, MSPP, debated about this for quite some time. A lot of partners were providing evidence and the initial recommendation for OCV was administration of a 2-dose regimen to maintain about 60% efficacy over about a 3-year period. WHO recently put out a recommendation to shift to a 1-dose policy, especially during outbreaks. There is global evidence for duration of efficacy.
  - Consideration is being given to how to improve the vaccine stockpile. While there is cautious optimism that the cases are declining, it has now spread from the 2 main departments and has been confirmed in 8 of 10 departments, with suspect cases having been reported in 10 of 10 departments. Cases are probably being missed since it is not possible to get as many data points as needed due to insecurity and conflict. Vaccine is just one tool in a larger toolkit, but it is an extraordinarily important tool that needs to be employed to provide assistance.

Acute Pediatric Hepatitis

Dr. Hannah Kirking, CDC Hepatitis of Unknown Etiology Response Team, provided an overview of the US pediatric hepatitis of unknown etiology investigation.

- **With respect to background:**
  - This investigation began over a year ago when a group of clinicians in Alabama identified 5 children who were admitted with acute hepatitis in a period of less than 6 weeks, none of whom had any etiology identified but were noted to have tested positive for adenovirus in their blood.

- Clinicians reached out to CDC and the agency set up a meeting with state and local health departments to discuss this. A 2-pronged strategy was developed for moving forward. First, CDC wanted to investigate the early 5 patients and the virologic characteristics of their infection. Second, local prospective surveillance was put in place.
- The outcome of the 2-pronged strategy was the identification of 4 additional children. Out of these original 9 children, the enteric adenovirus from 5 children was able to be typed and was found to be adenovirus 41 (HAdV-F41).
- While Alabama issued a statewide call on February 1, 2022 to identify additional patients, no additional children were identified.
- At the same time this was occurring in the US, the United Kingdom Health Security Agency (UKHSA) noticed a similar increase in cases of acute pediatric hepatitis. Some of the UK's cases under investigation also were testing positive for adenovirus. The UKHSA reached out to CDC in April 2022.
- In April 2022, this escalated to a nationwide response in the US, as well as in Europe and globally.
- A HAN[8] was issued on April 21, 2022 that defined who patients under investigation (PUIs) might be and asked for nationwide reporting of additional PUIs. PUIs were defined as "Children <10 years of age with elevated aspartate aminotransferase (AST) or alanine aminotransferase (ALT) (>500 U/L) who have an unknown etiology for their hepatitis (with or without any adenovirus testing results, independent of the results) with onset on/after October 1, 2021."
- The HAN also suggested adenovirus testing among children who presented this way, with a preference indicated for whole blood testing based on some early signals from the adenovirus cases.
- Data collection instruments include preliminary notification from jurisdictions when a PUI is identified, the case report form (medical chart abstraction), and exposure questionnaire (parental interview).

- **Specific questions CDC has sought to address in its investigation** include the following:
  - To what extent are we seeing an increase in pediatric hepatitis of unknown etiology? Is it focal or nationwide? Is this truly an outbreak in the US?
  - If this is primarily due to adenovirus, why is it happening now (larger than usual adenovirus type 41 season, unusual strain, etc.)?
  - What is the etiologic role of adenovirus (and specifically adenovirus type 41)?
  - Are there other pathogens/cofactors (e.g., SARS-CoV-2) playing a role?
- ***Trends in Acute Hepatitis of Unspecified Etiology and Adenovirus Stool Testing Results in Children-United States, 2017–2022***[9] analyzed 4 sources of data to assess trends in pediatric hepatitis of unknown etiology using the following resources: 1) emergency department (ED) visits from the National Syndromic Surveillance Program (NSSP); 2) hospitalizations from the Premier Healthcare Database Special Release (PHD-SR); 3) liver transplants from the Organ Procurement and Transplant Network (OPTN); and 4) adenovirus 40/41 testing from LabCorp data. Looking more closely at each source of data utilized, which were compared to the pre-COVID-19 pandemic baseline from October 2021–March 2022:

[8] https://emergency.cdc.gov/han/2022/han00462.asp

[9] Kambhampati AK, Burke RM, Dietz S, et al. Trends in Acute Hepatitis of Unspecified Etiology and Adenovirus Stool Testing Results in Children — United States, 2017–2022. *MMWR Morb Mortal Wkly Rep* 2022;71:797–802. DOI: http://dx.doi.org/10.15585/mmwr.mm7124e1

- ED visits with hepatitis-associated ICD-10 codes by week of visit were assessed among children 0–4 and 5–11 years of age in the NSSP from January 2018 through March 2022. What was seen during the timeframe of interest did not exceed what would be expected.
- Hospitalizations with hepatitis-associated ICD-10 codes were assessed among children 0–4 and 5–11 years of age by month of admission from January 2019 through March 2022. Cumulative hospitalizations occurring during the timeframe of interest did not exceed what would be expected.
- Liver transplants were assessed among persons <18 years of age by month of transplant between January 2017 and March 2022. During the timeframe of interest, the number of transplants was similar to before the COVID-19 pandemic and did not exceed what had been tracked in prior years.
- Trends seen in adenovirus 40/41 testing and positivity from October 2017 through March 2022 among children 0-4 and 5-9 years of age were not significantly above trends seen before the COVID-19 pandemic. Notably, testing numbers and the proportion positive were lower during the pandemic.
- While US data did not suggest an increase in pediatric hepatitis, liver transplants, or adenovirus 40/41 positivity above pre-COVID-19 pandemic baseline levels, CDC continues to monitor these data sources and trends to ensure that nothing changes in the future.
- The statistical tests are included in the *MMWR* article.

- **With regard to the characteristics of the PUIs identified and pathogens detected:**
  - Subsequent to the issuance of the HAN, 383 PUIs have been identified from 45 jurisdictions between October 1, 2021 and November 29, 2022. It is important to note that the epi-curve is known to have significant surveillance bias based on how this has played out in time, so interpretation requires some caution. Reports of PUIs have come from a broad geography across the US and do not necessarily seem to be focal.
  - Demographically, the age of the 383 PUIs identified seems to be younger, with a median age of 2.8 years of age. Approximately 75% of the PUIs are under 5 years of age. Hispanic or Latinos are over-represented in the sample at approximately 40%. Medically, 60% of the children were previously healthy with no underlying conditions that possibly could contribute to hepatitis. About 90% of the PUIs were hospitalized with their acute hepatitis, 6% received a liver transplant, and between 3% to 4% died.
  - Looking at PUIs by adenovirus test result, 81/207 (39%) were positive for adenovirus in blood specimens as follows: Whole blood: 61/133 (46%), Plasma: 21/89 (24%), and Serum: 11/23 (48%). Adenovirus was detected in other specimens as follows: Respiratory: 64/232 (28%), Stool: 33/110 (30%), Liver: 10/61 (16%). A total of 25/40 (63%) PUIs typed were positive for HAdV-F41.
  - In terms of the pathogens detected among PUIs, the highest was adenovirus. While no pathogen was detected in 79 (33.9%), 77 (33%) had 1 pathogen detected, 40 (17.2%) had 2 pathogens detected, and 37 (15.9%) had ≥ 3 pathogens detected. This is important in thinking about what the cofactors might be in terms of who is developing acute hepatitis.
- **CDC continues to conduct ongoing routine surveillance for acute hepatitis in children with unknown etiologies.** It is important to note the following:
  - The current PUI numbers are likely not a real-time representation of cases, given that reporting is not complete. For instance, few jurisdictions have reached out about recent severe cases.
  - CDC's goals in conducting ongoing surveillance are to maintain awareness of trends in hepatitis of unknown etiology and to continue to collect basic information about identified PUIs.
  - To reduce the burden on states, the case report form has been shortened and the exposure questionnaire has been discontinued.

- CDC has ongoing active engagement with jurisdictions and clinicians to encourage continued reporting. One of the challenges throughout this effort has been that this is more of a clinical diagnosis and falls less in the public health realm. Therefore, bridging those 2 groups of target audiences and partners has been challenging but is important.

- **To highlight some findings from a UK case-control evaluation and special studies:**[10]
  - CDC's colleagues in the UK were able to identify pre-existing samples from another study that could be used for a retrospective case-control evaluation. The retrospective case-control study included 74 cases and 225 controls using residual blood/serum.
  - This study found significantly higher odds of detection of adenovirus in cases compared to controls, with an adjusted odds ratio of 35.27 (95% CI: 15.23-81.68).
  - There also were questions about how SARS-CoV-2 might be playing a role. In the UK case-control study, SARS-CoV-2 with concurrent or recent or antibody levels was not found to be associated with cases of pediatric hepatitis of unknown etiology.
  - Importantly, because the pathophysiology is not well-understood, liver pathology evaluations are being pursued among subsets of patients in the UK and US. Thus far, these evaluations have not found viral inclusions, immunohistochemical evidence of adenovirus, or viral particles seen on electron microscopy.
- Some small research studies in the UK and US have used metagenomics to try to assess co-infection as well and/or to identify undiagnosed pathogens on clinical testing alone. Adeno-associated virus type 2 (AAV-2) frequently has been detected among cases (PUIs), but has been infrequently detected among controls. The role of AAV-2 is not yet clear and is definitely an area of ongoing investigation. AAV-2 is a companion virus to adenoviruses or other viruses, but historically has been thought to be non-pathogenic. **Moving forward, CDC is conducting a US case-control prospective evaluation:**
  - The objectives of this evaluation are to determine: 1) whether adenovirus infection is more commonly detected in children with hepatitis of unknown etiology than in healthy children without hepatitis; and 2) whether there are other exposures or pathogens (e.g., SARS-CoV-2) or risk factors (e.g., AAV-2) more commonly detected in children with hepatitis of unknown etiology than in healthy children without hepatitis.
  - PUIs (cases) will be compared with healthy controls who will be matched by age, time, geography, and blood specimen types.
  - Detailed data collection will be done for all of the cases and controls that includes completion of a full case report form and exposure questionnaire; blood, respiratory, stool specimen collection; and liver pathology.
  - Notably, the launch of the case-control evaluation coincided with the scale-back of surveillance and a decline in case reporting. While CDC is trying to keep this investigation going, enrollment has been slow. While respiratory adenoviruses do not necessarily have strong seasonality, enteric adenoviruses do. It could be that the upcoming winter, which is the time that an increase would be seen for adenovirus 40/41, may allow this evaluation to continue to move forward and/or enroll more quickly.
- **To summarize overall:**
  - Identification and reporting of US pediatric patients with acute hepatitis of unknown origin has dropped, is currently low, but is not thought to be over.

[10] Investigation into acute hepatitis of unknown aetiology in children in England: technical briefing 4 (publishing.service.gov.uk); https://media.gosh.nhs.uk/documents/MEDRXIV-2022-277963v1-Breuer.pdf; and https://www.medrxiv.org/content/10.1101/2022.07.19.22277425v1

- There is an association between adenovirus infection and pediatric hepatitis of unknown etiology. Adenovirus type 41 (enteric adenovirus) is more frequently implicated relative to other adenovirus types (respiratory adenovirus). However, the exact pathophysiology remains unknown.
- A large proportion of US PUIs had co-infection of adenovirus with additional pathogen(s). This raises a question regarding whether co-infection increases the risk of hepatitis, which makes good clinical sense and could be part of this.
- More data are needed on which host factors could be co-factors in those with adenovirus infection who develop the clinical outcome of acute hepatitis or severe hepatitis.
- Findings from CDC's ongoing epidemiologic investigation definitely will help direct and focus future research into co-factors, underlying pathophysiology, and potential treatments. From a public health standpoint, the goal is to get to a point where acute hepatitis of unknown etiology moves more into a clinic or research setting to work out the finer details.

Acute Pediatric Hepatitis – Discussion

- BSC questions/observations/suggestions:
  - If not for the seeming case-control association, it would be unclear whether this is even a disease. Not finding virus in the liver is potentially questionable.
  - There is not much sequence variability in adenoviruses DNA.
  - AAV-2 is very interesting in that very high doses of AAV have been associated with some toxicity in gene therapy. This may be the immune response, so it would be interesting to know whether there was any evidence of an abnormal immune response.
  - A potential root cause seems to be SARS-CoV-2, perhaps in terms of potential changes in the immunology of these children.
  - The comprehensiveness and quality of the analysis to evaluate whether this is a significantly different trend in terms of hepatitis and identifiers is impressive.
  - Considering future potentially urgent matters that may arise, it could be beneficial to document the lessons learned from this response that could inform data modernization for the CDC in general in terms of the amount of effort involved in gaining access to the data, setting up a prospective data collection instrument, et cetera.

- Dr. Kirking's responses:
  - The typing assay CDC has used for adenovirus is partial genomic sequencing. Even from those results alone, it was possible to tell that this was different strains of adenovirus 41. It is non-clonal, which led the team to think early on that this was not an outbreak.
  - Regarding whether adenovirus is merely a marker of something else or is actually causative, the pathology results thus far have given the team pause in trying to understand whether it is or is not causative. The answer to that question is still outstanding.
  - The 2 of 9 patients in Alabama who went on to receive transplants had the highest viral loads for adenovirus as well. Even though the numbers are small and do not always hold up in an epidemiologic statistical way, it is hard to ignore this.
  - AAV-2 toxicity being in question, especially in that there could be toxicity at higher viral loads, some of the data are showing higher viral loads of AAV-2 in these individuals to an extent or in a scope that is higher than the adenovirus viral load itself. This has raised more questions to answer.
  - The question pertaining to SARS-CoV-2 is still outstanding and is one that epidemiologically investigators have struggled to know how to answer. In terms of SARS-CoV-2, a history of SARS-CoV-2, or a lack of SARS-CoV-2 being a cofactor is a tough question to answer at this point

because over 80% of children now have antibodies to SARS-CoV-2 in the US. The Omicron wave last winter shot that number up in children. It is difficult to find children now who have not had that exposure, making it difficult to interpret. The bigger question of how the pandemic may play into this is that children have not been exposed to many viruses in the last several years and what that may mean for what is being observed now.

- There is a belief that perhaps acute hepatitis of unknown etiology has always existed, but there was no signal to identify or describe it. Approximately 30% of pediatric hepatitis do not have an identified etiology, so perhaps the findings are describing the 30% that was always there.
- With respect to lessons learned, syndromic surveillance has repeatedly proven its worth because it often allows for filling in the gaps where there is not dedicated surveillance. Reaching out to colleagues within CDC who use syndromic surveillance and to state and local jurisdictions to learn what was occurring locally has been invaluable. Systems that track respiratory viruses that do not have obligatory reporting, oftentimes syndromic systems round out what is not funded or tracked in the US. For data modernization, accessible and usable EMR data was leveraged to look at hospital admissions for this new pattern of hepatitis. Hopefully having better, faster, bigger, and more timely access to those data is something CDC will continue to improve upon.

Polio

Dr. José R. Romero, NCIRD Director, presented an update on the polio outbreak.

- **In terms of poliovirus serotypes, transmission, and clinical syndromes:**
  - Poliovirus, the causative agent of polio, is a group C enterovirus in the family picornaviridae. As a prototypic enterovirus, it is a non-enveloped virus with a single-stranded RNA genome. There are 3 serotypes: types 1-3. Immunity to one serotype does not produce significant immunity to other serotypes.[11]
  - Person-to-person transmission of poliovirus occurs[12] primarily via the fecal-oral or oral-oral routes. The fecal-oral route is the most important transmission pathway in settings with suboptimal hygiene and sanitation. Patients are most infectious during the days immediately before and after onset of symptoms, but the virus may remain present in stool for up to 6 weeks and sometimes longer. Virus can be shed in individuals with minor symptoms or no illness.
  - Regarding clinical syndromes,[13] the vast majority of cases (~75%) are asymptomatic and that may be reported as high as 90% depending upon the literature. Clinical illness with no paralysis is approximately 25%. Far less than 1% of all cases of polio infection result in paralysis.
  - A rapid decrease in paralytic polio occurred in the US following polio vaccine introduction in 1955 with the inactivated Salk polio vaccine. In 1961, the oral Sabin polio vaccine was introduced. This was a live-attenuated vaccine that protected the host from getting the virus, but not from shedding the virus. The last indigenous wild-type case of polio occurred in the US in 1979. The Americas were certified polio-free in 1994. Since 2000, only inactivated polio vaccine has been used in the US.
- **Regarding the characteristics of the New York polio investigation case-patient presentation and diagnosis:**

[11] Source: CDC Pinkbook, PHIL
[12] Source: CDC Pinkbook, PHIL
[13] Sources: CDC, Sutter, Kew, Cochi, and Aylward. Poliovirus vaccine-live. Vaccines, 6th Edition, 2013. NB: Other sources cite different percentages.

- The case-patient was an unimmunized, immunocompetent young adult with no history of travel during the exposure period who attended a large gathering 8 days before symptom onset.
- This individual developed fever, neck stiffness, back pain, abdominal pain, and constipation. This was followed by the development of lower extremity weakness 3 days later.
- The case-patient presented to an emergency department 2 days after weakness began and was admitted to the hospital with flaccid weakness that initially was thought to be Guillain-Barré Syndrome (GBS). As part of the differential diagnosis, this individual was worked up for Acute Flaccid Myelitis (AFM).
- The case-patient's specimens were submitted for pathogen-specific testing. Specimens included stool, nasopharyngeal (NP) swab, oropharyngeal (OP) swab, and cerebrospinal fluid (CSF).
- The stool specimens were positive by enterovirus PCR, while the other specimens were negative. Subsequent sequencing identified vaccine-derived poliovirus, type 2 (VDPV2), which was confirmed by the CDC polio laboratory. There were 10 nucleotide changes in the region encoding viral capsid protein (VP1) compared to the Sabin 2 strain, which indicates approximately 1 year of replication in one or more persons since the initiating oral polio vaccine 2-dose series (OPV2).
- The immediate outbreak response measures focused heavily on vaccination and surveillance that involved strengthening polio vaccine coverage, implementing polio containment measures, strategic wastewater testing, and enhanced clinical surveillance.

- **Vaccination efforts in Rockland County began without delay** following confirmation of the poliomyelitis case:
  - As reported to the New York State Immunization Information System (NYSIIS), vaccination coverage in terms of receipt of 3 doses by 2 years of age ranged from 37.3% - 91.3% as of August 1, 2022.
  - Based on live-attenuated polio vaccine, adequate immunization is considered to be about 80% or so, with a range of 75% to 85%.
  - Point of distribution (POD) sites started on July 22, 2022, after the case-patient viral sequences were confirmed.
  - Provider outreach and assistance were instituted to locate under-vaccinated children and catch them up with inactivated polio vaccine (IPV) or combination vaccines.
  - CDC deployed a field team to assist with pediatrician outreach and education efforts in Rockland and surrounding counties. The agency contacted a number of community organizations to assist in this effort.
- **Polio case surveillance efforts continue through the following existing resources:**
  - Through the NSSP, queries were developed for NYS and NYC. No additional cases of polio paralysis have been detected through this system to date.
  - There has been systematic surveillance for AFM in all jurisdictions since 2015 when the first cases of AFM were identified in association with increased numbers of cases of enterovirus D68 (EV-D68).
  - The NYS case-patient was picked up as part of AFM surveillance and was reported to the NYS Department of Health (NYSDOH). Active education is ongoing during EV season during the Summer and Fall, which is the primary season for these viruses.
  - Active health alerts have been distributed to providers in different jurisdictions during this period of time, including New York and surrounding states.
- **With regard to the role of wastewater testing** in NYS, including communities adjacent to Rockland County (e.g., Orange, Nassau, King, and Queens):

- There has been transmission among populations in multiple locations in the NY metropolitan region, persisting over months of circulating vaccine-derived poliovirus (cVDPV2), which was elevated to notification to the WHO.
- Strains related to the attenuated live poliovirus Sabin strains contained in OPV. If allowed to circulate in under- or unimmunized populations long enough, or replicate in an immunodeficient individual, the attenuated virus can revert to a form that causes illness and paralysis.
- Vaccine-derived polioviruses (VDPVs) emerge when an insufficient number of individuals are vaccinated against polio, and the attenuated OPV strain of the poliovirus spreads among under-immunized populations.[14]

- **In terms of maintaining polio elimination and polio environmental surveillance:**
  - For the US and countries that have eliminated polio, and that have good sanitation systems and high overall polio vaccination coverage, the Global Polio Eradication Initiative (GPEI). recommends sustaining good immunization coverage and ensuring robust surveillance for acute flaccid paralysis.
  - Routine wastewater testing has generally not been recommended in countries that have eliminated polio.
  - Testing for poliovirus in the environment (wastewater, sewage, surface water contaminated with human fecal material) is an important adjunct to acute flaccid paralysis surveillance in high-risk geographies with chronically low polio vaccination coverage, poor sanitation, and history of wild-type poliovirus or cVDPV circulation/outbreaks.
  - Environmental testing is not generally recommended as a routine activity for poliovirus surveillance in polio-free countries with high vaccination coverage and improved sanitation (i.e., the US).
  - During an outbreak, wastewater testing can help to define the geographic size and scope of poliovirus circulation and help direct response efforts.
- **Concerning wastewater testing logistics and workflow for New York and the role of wastewater testing for poliovirus in the US:**
  - Wastewater volume collected in the US is usually small (~40 ml) compared to global practice (~500-1000 ml). This has significant implications in trying to find the virus.
  - Concentration is generally by ultracentrifugation, polyethylene glycol (PEG) precipitation, and filtration of NanoTrap.
  - NYC samples are processed by the Department of Environmental Protection and the NYC Public Health Laboratory. Samples from other New York counties are processed by a contract laboratory. The nucleic acid extracts are shipped weekly to CDC from NYS and NYC public health laboratories.
  - At the CDC, extracts are tested by pan-polio rRT-PCR assay. Samples that are positive for polio by PCR proceed to sequencing. The goal is to attempt complete genome sequencing using Nanopore and Illumina methods, but a minimum of the complete VP1 coding region is necessary to classify as a VDPV and assess the linkage to a case. It takes several months of training and some skill to do this, given that it is not automated.
  - In terms of testing for the US overall, wastewater testing should be used during an outbreak to understand the extent and spread of poliovirus circulation around a polio case and help direct response efforts as is being done currently. This type of testing may help jurisdictions at increased risk for polio to determine whether polio has been imported and is circulating.
- **Expansion of wastewater testing for poliovirus is being considered:**

[14] Polio Vaccine: Vaccine-Derived Poliovirus | CDC; Vaccine-Derived Polioviruses – GPEI (polioeradication.org)

- CDC continues to work with NYS and NYC on wastewater testing and to engage in outreach to health departments whose jurisdictions may include communities of concern (e.g., those with low vaccination coverage, potential for importation, available NWSS sites).
- The initial focus has been on states, counties, and communities that have low coverage and significant interactions with the affected community in New York.
- CDC is engaged in ongoing dialog to gauge interest and answer questions. The agency is having discussions with State Health Officers regarding the implications of finding a virus using wastewater testing in terms of the cost, duration, response, et cetera.
- CDC is preparing to deploy the panPV assay to interested partners and is drafting guidance for jurisdictions titled, "Focused wastewater testing to determine the presence of poliovirus in selected areas of the United States," as well as guidance on containment implications in the event poliovirus is detected.

- **Regarding site selection to identify communities of concern:**
  - Communities with low poliovirus vaccination are identified by zip-code level IPV coverage data for the past 5–10 years (high risk below 80%, the herd immunity threshold for polio). A history of measles outbreaks also may be used as a proxy for vaccine coverage.
  - Another consideration for site selection is the potential for importation. This includes communities with large refugee populations and areas with diaspora communities travel to areas where there is circulating poliovirus (e.g., Africa, Eastern Europe, Middle East, and Israel).
  - Sites participating in NWSS where RNA extracts can be obtained for testing and sequencing are also of interest in terms of site selection. Current NWSS sites may not overlap with high-risk communities within jurisdictions.
  - Other considerations include the size of sewershed, type of system (septic vs. sewer system), and relative contribution of waste inputs (commercial vs. industrial vs. residential). The GPEI has about 300,000 wastewater sewersheds. Comparatively, NYC is 1.2 million. That has significant implication in the dilution of samples and must be taken into account when deciding where to sample.

Polio – Discussion

- Question posed to the BSC/DDID:
  - What are the appropriate uses of wastewater testing in the US where polio has been eliminated and the overall vaccination coverage is high?

- BSC questions/observations/suggestions:
  - Consideration should be given to the impact of wastewater testing versus the impact of prevention via increasing vaccination rates in communities where vaccine uptake is very low.
  - Clearly, there are communities that have been difficult to engage with in terms of vaccination.
  - There has been a lot of modeling and history with regard to the herd immunity threshold for polio. Looking at
  -
  - zip code level coverage and communities with a threshold level of ≥80%, there probably are smaller clusters. For site selection, perhaps consideration should be given to using a 90% threshold that separates out the 10% of zip codes at the lowest end of vaccine coverage spectrum.
  - The best surveillance strategy and allocation of resources for wastewater surveillance seems like an empirical question and that the answer should be data-driven. The current polio situation in NYS could be a good test for collecting data to help answer that question.

- In terms of dedicating time, effort, and resource to prevention rather than response, close to the capacity needed was achieved to engage communities around vaccination due to the supplement funding that were dedicated during COVID-19. However, capacity is now regressing to the pre-COVID state. Now many immunization programs are bare bones. This is clearly a problem, given that there are many pockets of under-vaccinated people throughout the country. Public health priorities and funding do not reflect that need. This is not easy work. It requires building trust, ongoing sustained engagement, and expertise. None of that is possible without ongoing enhanced resources at CDC and the state and local levels.
- For the reasons state, a targeted approach may be preferable.

- Dr. Romero's responses:
  - Emphatically and clearly, the US as a nation is better served by dedicated efforts (e.g., time, money, human resources) into changing the hearts and minds about vaccination among populations and sites where there are low vaccination rates. While the implications of finding poliovirus are significant, spending money and time on education and vaccination is prudent.
  - Use of a herd immunity of 80% is an extrapolation that is based on live-attenuated OPV, which is a more effective vaccine. In the time when poliovirus was circulating, herd immunity that would protect the community was approximately 75% to 85%, which is why 80% was selected.
  - What really helps the US is a well-defined public works infrastructure in that there is potable water and a separate covered wastewater system.
  - Within 2 days of CDC learning of the polio case in NYS, the polio group already had come up with back of the envelope calculations of the number of cases of polio that could be expected in that community based on immunization. That number was 8 to 12 cases, but no cases have been identified. Dr. Romero posits that this is due to the well-defined US public works system in that the waste that is coming out of one house does not contaminate the potable water that goes back into another house.
  - A book titled "Dirt and Disease" was published about 3 decades ago that talked about the decrease in paralytic poliovirus that occurred prior to the advent of the vaccine that had to do with infrastructure.
  - Another reason Dr. Romero believes the US needs to spend more time on vaccination is that not finding the virus in a community with low vaccination is a negative reinforcement because it makes people say, "See, it's not here. I don't have to worry about it."
  - If you look, you will find it. Educating the public about whether a virus that is found is a vaccine strain (not such a big problem), vaccine-derived poliovirus (more of a problem) or circulating (the biggest problem) is going to be difficult.

COVID-19

Dr. Barbara Mahon, Acting Director of Coronavirus and Other Respiratory Diseases (Proposed), presented a COVID-19 pandemic summary, described the NCIRD reorganization and related COVID-19 IMS transition planning, recent publications and policy updates, and cross-CDC activities.

- **In terms of the status of the COVID-19 pandemic:**
  - There currently are about 640 million global cases and 6.6 million global deaths, while the US is approaching about 100 million reported cases and well over 1 million deaths.

- COVID-19 Community Levels (CCLs)[15] tend to be a simple way for communities to know whether the impact of COVID-19 in their community is high, medium, or low. As of December 2, 2022, about 5% of the population was living in counties with high CCLs and about 61% of the population was living with low CCLs.
- However, COVID began notching up over the last few weeks. As the original Omicron wave was waning into February and March 2022, the proportion of communities with low levels increased rapidly, decreased again moving into a BA.4 and BA.5 period during the summer, followed by fairly stable CCLs for most of the country, and then what looks like may turn into an increase.[16]
- On November 16, 2022, CDC released a very important report, *Updated COVID-19-Related Mortality Report COVID-19 Data Review: Update on COVID-19–Related Mortality, CDC.*[17] One of the most important summary points of this report is that signs of improvement have been observed:
  - → There has been a substantial decrease in deaths since March 2022, which has been sustained since then.
  - → The proportion of deaths as compared to hospitalizations has been shown to be lower and lower, which is likely due to 3 major factors: increase in population level immunity from vaccination and recovery from infection, the availability of treatment such as Paxlovid and other therapies, and the inherently somewhat milder nature of the Omicron variant when compared with previous variants.
  - → Where and how deaths are occurring appears to be changing. Over the past year, a higher proportion of deaths were in settings other than hospitals.
  - → In 2022, COVID-19 was still listed as the underlying cause for most COVID-19 deaths, but the proportion where it is listed as a contributing factor rather than an underlying cause is higher than it ever has been.
  - → Importantly, the updated COVID-19 mortality report shows that vaccines continue to be effective. Almost 80% of the in-hospital deaths among persons 18-49 years of age were among people who were unvaccinated. The vaccination coverage in this age group is much higher than 80%.
  - → In older adults, more people were vaccinated. However, this is meaningful only in comparison to the proportions of those vaccination categories in the population as a whole. Adults ≥65 years of age comprise 5% of the total unvaccinated population but make up 22% of hospitalizations and 22% of deaths. Conversely, this age group makes up 34% of the population with ≥2 boosters accounted for only 14% of hospitalizations and 6% of deaths.
- Over the last few months, shifts have been seen in terms of COVID-19 variant proportions.[18] Essentially, only Omicron variants were circulating at this point. A decrease has been observed in the proportion of BA.5, an increase in BQ.1 and BQ.1.1 (both of which are BA.5 descendants), and an increase in BN.1 and XBB.
- Uptake of the COVID-19 bivalent booster has been woefully slow domestically. Uptake has been highest in the age groups that are at highest risk, including adults ≥55 years of age for whom uptake is just over 30%. This is still much lower than where it needs to be.[19]

- **With respect to NCIRD reorganization:**

[15] CDC COVID Data Tracker: County View
[16] Data are provisional until officially released by the CDC. For Internal Use Only (FIUO), Sensitive But Unclassified (SBU)
[17] COVID-19 Data Review: Update on COVID-19–Related Mortality | CDC
[18] CDC COVID Data Tracker: Variant Proportions; CDC Nowcast
[19] CDC COVID Data Tracker: Vaccination Demographics Trends

- A proposal has been made to stand up a new division within NCIRD, the Coronavirus and Other Respiratory Viruses Division (CORVD). This division would take on the respiratory viral responsibilities that previously rested with the Division of Viral Diseases (DVD). Moving this body of work into a new division acknowledges that with COVID, the volume, complexity, and impact of CDC's respiratory viral work needs a division-sized home.
- CORVD is structured similarly to other pathogen-defined divisions across the agency, with Dr. Mahon serving as the Acting Director of the proposed CORVD; an Acting Deputy Director for Strategy, Program, Management, and Operations; an Acting Deputy Director for Science; and 4 proposed branches: Laboratory Branch, Surveillance and Prevention Branch, Epidemiology Branch, and a Global Branch.
- Basically, everyone assigned to the proposed CORVD are on detail pending the approval of the division and the ability to hire permanent leadership staff.

- **Regarding COVID-19 Incident Management Structure (IMS) transition planning:**
  - CDC continues to have an active IMS structure for COVID-19, but it has been greatly streamlined.
  - The majority of response-related activities were transitioned from the emergency response to long-term programmatic CIO homes beginning in July 2022. Many of these activities have moved to NCIRD, but many have gone to other CIOs as well.
  - NCIRD has been working with the COVID-19 Response on continued transition planning. With a current focus on the Data Analytics and Visualization Task Force (DAV TF) and planning for transition of those activities to long-term programmatic homes.
  - NCIRD's COVID-19 Coordination Unit (CCU) is still operational and includes the Laboratory, Epidemiology, and Vaccine Coordinating Units. There are weekly coordination meetings between Response Leads, CCU leads and units, and NCIRD CORVD (proposed) leadership.
- **There have been a number of recent publications and policy updates, some of which are highlighted here:**
  - Uptake and monitoring of bivalent COVID-19 vaccine boosters continues to be an important priority. There are plans to highlight post-authorization safety and effectiveness data for bivalent boosters publicly to encourage uptake.
  - Upcoming policy discussions include boosters in children <5 years of age and transition of the primary series from monovalent to bivalent COVID-19 vaccines.
  - CDC's Increasing Community Access to Testing (ICATT) program released, *Relative VE against symptomatic infection among adults for bivalent booster after 2, 3, or 4 monovalent doses by time since most recent dose, test September 14- November 11, 2022*[20] on November 22, 2022. This is pharmacy-based testing for outpatients who are symptomatic. The takeaways from this analysis are that relative vaccine effectiveness (RVE) increases when the reference group has increased time since last monovalent dose; generally, VE is similar regardless of number of monovalent doses received; and overall, time since dose in the comparison group matters more than number of doses.
  - CDC released surveillance data from 21 jurisdictions on bivalent booster impact, *VIBS: Rates of COVID-19 Cases and Deaths by Vaccination Status and Receipt of Bivalent Booster: COVID Data Tracker* on November 22, 2022. These data are not adjusted for confounders like the VE data, but they are generally consistent. The takeaway from this analysis is that those who received a bivalent booster had about a 15-fold lower risk of death and about a 3-fold lower risk of laboratory-confirmed positive test compared to the unvaccinated.

[20] Gelles, Ciesla, Fleming-Dutra, et al. *MMWR* scheduled for release on November 22, 2022

- Also on November 22, 2022, CDC released an *MMWR*, *Paxlovid Associated with Decreased Hospitalization Rate Among Adults with COVID-19 — United States, April–September 2022*[21] Paxlovid has been recommended for persons ≥12 years of age with mild-to moderate COVID-19 at increased risk of progression to severe illness. The takeaway messages from this publication are that based on medical records of nearly 700,000 adults ≥18 years of age were eligible for Paxlovid during April-August 2022, of whom 28.4% received Paxlovid within 5 days of diagnosis (the timeframe within which the medication must be started). Eligible adults who were prescribed Paxlovid were half as likely to be hospitalized in the 30 days following their infection compared to eligible adults who did not receive Paxlovid. This effect was consistent for both vaccinated and unvaccinated individuals.

- **In terms of cross-CDC activities:**
  - A Cross-CIO Post-Covid Conditions (PCC) Working Group to coordinate programmatic activities, partnership engagement, and communications has been created. There has been significant interest across government regarding PCC. CDC participated in a Senate Health, Education, Labor and Pensions (HELP) Committee majority staff briefing led by HHS and provides regular updates to multiple partners, including the HHS Office of the Assistant Secretary for Health (OASH).
  - There continues to be a national increase in pediatric respiratory illness. Respiratory Syncytial Virus (RSV) has been at or exceeding typical winter peaks, along with early increases in seasonal influenza reported in most regions of the US. However, decreases in RSV are starting to be seen across the country. The public health response includes a prevention focus on influenza and COVID-19 vaccines and diagnostics, which are important to determine etiology and guide therapy. NCIRD has responded with ASPR Town Halls for individual HHS Regions and the release of a HAN on November 4, 2022 *Increased Respiratory Virus Activity, Especially Among Children, Early in the 2022-2023 Fall and Winter.*[22]

COVID-19 – Discussion

- Question posed to the BSC/DDID:
  - What issues and discussions should NCIRD be thinking about in terms of standing up the new CORVD?

- BSC questions/observations/suggestions:
  - It will be important to maintain the connection with the other respiratory divisions, particularly the influenza division because of the co-circulation of COVID-19 and influenza.
  - Consideration should be given to the impact in recent weeks of increased RSV and influenza activity on reported testing versus at-home testing of COVID-19 data.
  - Wastewater surveillance for SARS-CoV-2 in some areas has been a good early predictor of clinical transmission and ultimately hospitalizations, and perhaps could be a good metric for measuring transmission.
  - Perhaps it would make sense to have a data guru elevated to a high-level Data Lead position alongside the Acting Chief Medical Officer and Health Equity Lead who is focused on the confluence of the need for data modernization, better sharing of data, communicating data, using data in policymaking, and so forth.

[21] Shah MM, Joyce B, Plumb ID, et al. Paxlovid Associated with Decreased Hospitalization Rate Among Adults with COVID-19 — United States, April–September 2022. MMWR Morb Mortal Wkly Rep 2022;71:1531–1537. DOI: http://dx.doi.org/10.15585/mmwr.mm7148e2

[22] https://emergency.cdc.gov/han/2022/han00479.asp

- CCLs are supposed to reflect the impact of COVID on US communities, only about 5% of cases are being reported currently, and much of the morbidity of COVID-19 is now occurring in non-hospitalized patients. Therefore, consideration should be given to how long-COVID and PCCs can be better captured to measure the true health impacts and use the results to guide mitigation recommendations more accurately.

- Dr. Mahon's responses:
  - The establishment of the CORVD is an opportunity to enhance the interdigitation and coordination of not only the influenza division, but also across the agency in the wake of COVID-19. The respiratory surge has been helpful in terms of keeping all of the connections between groups across CDC that were forged during the COVID emergency response.
  - In terms of in-home testing, the hospitalization data are probably providing the best indication of what is actually occurring. Hospitalizations have notched up just a little and will be followed closely.
  - Wastewater surveillance was stood up extremely quickly and has provided very useful information at times in terms of detecting new variants before they were detected in any clinical cases. The agency is still figuring out how best to use wastewater surveillance. As COVID surveillance moves to a post-emergency routine public health practice, the role of wastewater surveillance may shift. This is an ongoing and promising topic for attention and work, although its public health benefit has not yet been totally worked out, wastewater surveillance has many other potential applications that also are important. In terms of never letting a good crisis go to waste, this has allowed CDC to stand up the capacity and generate interest in wastewater surveillance that can be applied to other topics.
  - There is an Acting Associate Director for Informatics who is helping with the DAV TF transition planning, which is envisioned as a high-level Data Lead Position. The longer-term vision is to have that office working across the branches to ensure that COVRD is at least participating in and hopefully leading most of the data modernization activities. The COVID response has shown clearly where improvements are needed.
  - With regard to measuring long-COVID and PCC conditions to understand the true impact and guide recommendations, multiple studies have shown that PCCs are strongly correlated with severity of illness. While hospitalization tells something about the risk of PCCs, people certainly can have long-COVID or PCCs without having had severe illness or being hospitalized. The intended use of the CCL is helpful for other purposes, but not for tracking long-COVD. CDC and NIH have a lot of ongoing data collection that is trying to elucidate important questions about mechanisms, prevention, and treatment. Emerging evidence suggests that vaccination not only reduces the risk of COVID, but also reduces the risk of long-COVID if COVID occurs. PAXLOVID™ also reduces the risk of long-COVID. This type of science that informs action to prevent and treat long-COVID is probably most needed.

Special Populations Update

Dr. Emily Mosites, Senior Advisor for Health and Homelessness, provided an update on people experiencing homelessness and Ms. Liesl Hagan, Senior Scientist for Correctional Health, provided an update on people experiencing incarceration. A major takeaway from this presentation was that there is so much work to do in the area of special populations, ways must be found to integrate it more efficiently into public health frameworks.

- **With respect to the Special Populations Team:**

- The mission of the Special Populations Team is to: 1) protect the health of people experiencing homelessness while supporting the goal to end homelessness; and 2) protect the health of people who are incarcerated and improve the conditions of confinement.
- This team has stepped into the nexus of gaps and disparities in health, housing, and incarceration.
- The Special Populations Team currently sits in the Office of the DDID. While the team is small, they work very closely with several other groups across the agency. For instance, they are closely connected with the CDC-wide Homelessness and Public Health Working Group. Ms. Hagan is working to stand up a CDC-wide Justice System Working Group. The team works closely with divisions that are working on homelessness or incarceration, and has deployed often to the COVID-19 and the Mpox responses.
- Special populations are not limited to people experiencing homelessness or incarceration. There are many special populations needs within responses, which may differ by response. For example, in COVID-19 the burden of disease appeared to be much higher in correctional settings, whereas for Mpox, the burden of disease appears to be higher among people experiencing homelessness. Other groups include people with disabilities, people who use drugs, people who engage in sex work, and many others depending upon the nature of the response. There also are a number of special populations who reside in or are receiving care at healthcare facilities and congregate settings and move between settings like assisted living facilities and group homes.

- **In terms of the Special Populations Team's homelessness resources and projects:**
  - CDC now has a landing page on homelessness that has several resources.[23]
  - Several bundles of homelessness projects are evolving along the themes of data, workforce, and vaccination.
  - One problem is that data on homelessness and health are often not available, which leads to a lack of awareness of health disparities that people experiencing homelessness can face. The Special Population Team is working in collaboration with the Center for Surveillance, Epidemiology, and Laboratory Services CSELS and the Homelessness and Public Health Working Group on several data projects to begin addressing this problem:
    - → The Team in DDID supported a supplement in the *Journal of Infectious Diseases* (*JID*) titled, *Homelessness and Infectious Diseases: Understanding the Gaps and Defining a Public Health Approach: Introduction*. [24] This publication includes 11 articles that go through the epidemiology of infectious diseases among people experiencing homelessness, in addition to several promising practices for resolving disparities. An article is also included that describes a framework for public health and homeless response.
    - → Information has been posted on defining homelessness for public health data collection on the CDC homelessness landing page.
    - → Work is underway on a project in collaboration with CSELS to validate interview questions to understand whether someone is experiencing homelessness for case reporting.

[23] https://www.cdc.gov/ddid/homelessness/index.html

[24] Emily Mosites, Laura Hughes, Jay C Butler, Homelessness and Infectious Diseases: Understanding the Gaps and Defining a Public Health Approach: Introduction, The Journal of Infectious Diseases, Volume 226, Issue Supplement_3, 15 October 2022, Pages S301–S303, https://doi.org/10.1093/infdis/jiac352

- → The team is working to support another project that is focused on integrating homelessness information management systems and vaccine registries to better understand vaccine coverage for people experiencing homelessness.
- → There is a lot more to do to support data representation for people experiencing homelessness. One of the next steps is to think about how to get better representation within electronic medical records (EMRs).

- The next bundle of homeless project trajectories is focused on the workforce. The problem here is that public health needs to have dedicated and trained staff who are able to interface with homeless services and people experiencing homelessness. In this area, there are several projects:
  - → One of the major projects in this area is the team's project with the CDC Foundation on homelessness and public health Centers of Excellence (CoEs) based in Seattle, San Francisco, and Minnesota. These CoEs have done some excellent work over the past year with support from the CDC Foundation. The CDC Foundation Project Manager is developing a toolkit from this work that will be broadly available.
  - → The team also developed an online training[25] in coordination with the Division of Foodborne, Waterborne, and Environmental Diseases (DFWED) that was posted in late July. This training is just over 1 hour long, is specifically for public health practitioners, and already has received over 650 registrations and very positive reviews.
  - → Another project the team was able to implement related to workforce involved the dedication of some COVID-19 funding that specifically supports staff members to work on homelessness in state health departments.
  - → The team also has a peer-to-peer network of staff members who are working on homelessness in health departments. One area of activity is focused on respite care and how public health can interface with providers who are giving respite care to people who do not necessarily need to be hospitalized, but do not have anywhere to stay and may need medical care.
  - → An issue with the projects described is that they are all based on short-term funding. The team has heard from several health departments about the need for further support for staff members working in this area.
- A particular area that needs some support is vaccine coverage among people experiencing homelessness. So much of the work that the Special Populations Team has done in this area has been through the COVID-19 response:
  - → First, the team was able to estimate that COVID-19 vaccine coverage is markedly lower for people experiencing homelessness than the general population.
  - → The team was able to conduct 2 surveys with people experiencing sheltered and unsheltered homelessness to understand the acceptability of vaccination, which is fairly similar to the general population, so there are other barriers that are preventing people from accessing vaccination.
  - → A qualitative vaccine motivation project was conducted by the team in collaboration with the University of Washington to try to understand what might cause people to change their minds about getting vaccinated.
  - → Using all of this information, the team is now in the midst of developing a project to evaluate a COVID-19 vaccine intervention to improve coverage specifically among people experiencing homelessness.

[25] https://www.train.org/cdctrain/course/1104013/

- → The next step is to think about support for vaccination against other pathogens.
- → The project involving a deep dive on understanding communication pathways to best reach people experiencing homelessness with health information has been completed. A full communication plan is available on the homelessness landing page. The team is using this plan to inform the vaccine intervention project mentioned earlier. This intervention will leverage shelter social networks.

- **Regarding the Special Populations Team's correction activities homelessness resources and projects:**
  - The Special Populations Team was just beginning to get its corrections activities off the ground at the time of the last BSC meeting. During COVID-19, many connections were made internally within CDC and externally with partners in the field. Creating and maintaining these connections continues to be a major component of what the team does, which has involved the following:
    - → The CDC-wide Justice System & Health Working Group has been stood up. As now planned, there will be 4, and potentially 5, co-sponsors in addition to DDID OD: NCHHSTP, NCEZID, NCIPC, and potentially NIOSH. The team has engaged in a couple of meetings with representatives from each co-sponsor to ensure that all of the subpopulations and groups within the justice system who have health concerns are represented. The Working Group is anticipated to launch in the first quarter of 2023 with the goals to: 1) expand the collaborations that existing within CDC in terms of correctional health; and 2) provide professional development opportunities to those who are interested in this area but have not had an opportunity to work in this field before.
    - → Another opportunity that the team has engaged in to increase its visibility across the agency is providing technical assistance consults to other CDC programs whenever cases and outbreaks of various infectious diseases occur in correctional facilities.
    - → Beyond CDC, the team is working to continue its partnership work by creating cross-jurisdiction public health partnerships, such as engaging with CSTE and other groups to understand creative ways to connect state and local colleagues who work in correctional health.
    - → In addition to its partnership work, the team has been involved in some analytic projects and a field deployment.
  - A lessons learned project in July and August 2022 involved conducting a series of in-depth qualitative interviews with corrections partners across the entire field of corrections (e.g., 5 local jails, 5 federal partners, 5 state health departments, 4 state prisons, 3 youth detention facilities, 2 professional organizations, 2 private healthcare contractors working in corrections facilities, and 1 private prison):
    - → In this project, respondents were asked about their most salient successes and challenges in responding to COVID-19 in their facilities and in corrections in general, and how CDC and public health more broadly could support corrections. The most common response was that corrections realized either for the first time or the first time in a long time that public health can help them.
    - → Respondents also identified several specific ways that facilities said public health could support them. One of the major themes was that corrections needs to be prioritized more actively rather than being included as an afterthought. For emergency response, this involves allocating testing, personal protective equipment (PPE), technical assistance, and even site visits. For more everyday operations, respondents indicated that they would like to see a more sustained investment in training public health staff to understand the correctional setting, the creation of tailored educational materials and

guidance, and improved public health surveillance from corrections. Respondents also indicated that they would like public health to include staff in health education efforts and to create spaces for partners to convene and share experiences.

- Another Special Populations Team project involved conducting a few listening sessions at 3 corrections-focused conferences, including the National Commission on Correctional Healthcare (NCCHC) in April 2022, the American Jail Association (AJA) in May 2022, and the Council of Juvenile Justice Administrators (CJJA) in August 2022. Attendees were asked to indicate the most pressing health concerns in their population:
  - → Mental health (residents and staff) and infectious diseases (non-COVID) rose to the top of the concerns identified.
  - → There was a lot of diversity in the other responses, which ran the gamut and included: reentry and continuity of care after release, substance use disorder (SUD) treatment, chronic diseases, aging and Americans with Disabilities Act (ADA) requirements, data/EMRs, access to care in the facility, suicide/self-harm, violence/assault, staffing shortages, poor baseline health, and transgender health.
  - → This highlights that in any public health department, no matter what an individual's subject matter expertise is or what the strengths are of the health department, there are ways to engage with corrections and to see correctional health as part of community health.
  - → This really is an opportunity for public health to reach out proactively and find ways to build on the momentum and partnerships created during COVID and before.
- Another way the Special Populations Team has begun to use some of the lessons learned during COVID in their own work is that at the beginning of the Mpox outbreak, they understood from COVID that it was very important to convene partners early within correctional health and understand the data gaps:
  - → To understand these gaps, the team held some listening sessions and Dr. Mosites developed a data collection protocol for shelters in order to be ready for a case that might occur in a shelter environment.
  - → In July 2022, the first case was reported from a correctional facility in a county jail in Chicago. The team was able to pivot on the data collection protocol that was created for shelters to adapt it for corrections.
  - → A team was in the field about a week later after an invitation by the state health department to collect data in the Cook County Jail. In addition, the team was able to do some environmental swabbing, test individuals who had been exposed to the person with Mpox, conduct a case interview, and interview some of the people who were detained who had been exposed to understand how much they knew about Mpox and what the contact patterns looked like within the shared dormitories.
  - → Using those data, the Special Populations Team was able to develop tailored public health recommendations for corrections through an *MMWR,* titled *Monkeypox Case Investigation — Cook County Jail, Chicago, Illinois, July–August 2022*.[26]
  - → The team will soon release a corrections toolkit for Mpox, as well as an informational poster that they developed tailored for people who are living in correctional and detention facilities based on the interviews with the people in Cook County Jail.

[26] Hagan LM, Beeson A, Hughes S, et al. Monkeypox Case Investigation — Cook County Jail, Chicago, Illinois, July–August 2022. MMWR Morb Mortal Wkly Rep 2022;71:1271–1277. DOI: http://dx.doi.org/10.15585/mmwr.mm7140e2

→ The most important takeaway is that without the partnerships developed during COVID that the team has continued to sustain, they would not have been invited to the jail or have been able to get these data. This illustrates the importance of investing in those partnerships long-term because they have the power to fill data gaps and drive public health action in corrections.

- In terms of the Special Population Team's anticipated activities in the months to come there are a couple of projects on the horizon:
  - → There are plans to work with Emerging Infectious Diseases (EID) for a supplement on correctional health similar to the *JID* Supplement for persons experiencing homelessness and health. A call for abstracts for this supplement will be issued sometime in 2023.
  - → It also has become apparent that there is a need for infection control training in correction and detention facilities. The National Institute of Corrections (NIC), which is an arm of the Bureau of Prisons (BOP), developed something like this several years ago that is need of refreshing. The team is going to be working with the NIC to determine how that can be updated and disseminated to partners to fill that gap.

Special Populations Update – Discussion

- Question posed to the BSC/DDID:
  - What role can CDC play in convening special populations partners?
  - What are ways to build special populations into the fabric of public health?

- BSC questions/observations/suggestions:
  - The focus on these populations who are incredibly vulnerable and very important to work with is commendable.
  - It is important to think about ways to engage these populations and meet them where they are to get them tested through decentralized and near-patient testing for infectious diseases that are very important in these populations (e.g., COVID, Mpox, TB, hepatitis, HIV), as well as connecting them to care.

- Responses from Dr. Mosites and Ms. Hagan:
  - Engaging populations where they are speaks to the Special Population Team's internal collaborations with NCHHSTP, which now has a Correctional Health Coordinator who helps to oversee some of that work.
  - A major takeaway is the need to think about tailored approaches for making sure that people can access testing and vaccination.

Advanced Molecular Detection (AMD)

Duncan MacCannell noted that he normally serves as the Chief Science Officer in the Office of Advanced Molecular Detection (AMD). Given that the Director, Dr. Gregory Armstrong, retired at the end of August 2022, Dr. MacCannell is serving as Acting Director of the AMD Program during the search for a new Director. There has been a lot of activity since an AMD update has been provided to the BSC, so he was somewhat selective in his presentation in terms of global efforts and their domestic portfolio. Instead, he offered a sense of the momentum and enthusiasm the AMD efforts have capitalized on over the past few years.

- **Regarding the SARS-CoV-2 response in terms of sequencing, bioinformatics analyses, and lessons learned:**
  - Reflecting back to the beginning of the COVID-19 pandemic, an important point is that capacity is not necessarily the same thing as capability. It is important to understand why capacity was/is brittle.
  - At the beginning of 2020, all 50 state public health laboratories and many of the county and local public health laboratories had genomic sequencing capacity for at least 1 pathogen. This often was bolstered by PulseNet, GenomeTrakr, Foodborne Disease Outbreak Surveillance System (FDOSS), and applications for health care associated infections (HAIs), viral hepatitis, influenza, and a host of other infections.
  - By the end of 2020, it was discovered that less than half of the state public health laboratories submitted even a single sequence to one of the public repositories. This was 9 months, almost a year, into the pandemic. Many state public health laboratories did find local partners with whom to work and a lot of the sequences were submitted indirectly.
  - Even if capacity was in place in public health laboratories, the majority of states were in a position such that they either could not or were not able to prioritize sequencing as part of their pandemic response strategy—at least not in-house. Trying to understand that is important.
  - In terms of why capacity was brittle:
    - → First and foremost was an issue of bandwidth and the ability to prioritize funding or limited staff time. There were demands on diagnostics and a host of other priorities.
    - → Sequencing was one of many concerns that most laboratory leadership was trying to juggle.
    - → Access to samples posed another important challenge. In many cases, testing was a distributed model that varied by jurisdiction. Oftentimes, the public health laboratories did not have direct access to samples or contextual clinical data about the samples that they would need to use the samples effectively in surveillance.
    - → In many states, there was not necessarily a flexible bioinformatics and genomic epidemiology skillset in place outside of existing applications and workflows. It requires some level of technical expertise and resources to spin up a completely new analytic workflow for a novel or emerging pathogen.
    - → A lot of the existing capacity was narrow in scope in that it was either focused on PulseNet, FDOSS, or a handful of places where genomics was used effectively. However, there was not necessarily a "warm" knowledge base and capability to pivot a lot of these resources as flexibly as needed.
  - By the end of December 2020, US submitters had submitted just under 60,000 sequences to the Global Initiative on Sharing Avian Influenza Data (GISAID) that was one of the large international repositories for consensus sequencing. The majority of sequencing that was occurring was in academic and clinical laboratories across the US. In many cases, there was not a good connection with public health at any level. This was an important disconnect.
- **In terms of epidemiology and strengthening the capabilities of these technologies across the US and, increasingly, the global public health realm:**
  - One of the first things that was done to address sequencing capacity was to use CDC's power to convene. At the end of March 2020, CDC stood up an initiative called SARS-CoV-2 Sequencing for Public Health Emergency Response, Epidemiology and Surveillance (SPHERES) with a goal to bring together over 2 dozen groups that already were sequencing (e.g., private sector, academic, clinical, and public health at multiple levels, non-governmental groups).
  - SPHERES is a technical Community of Practice (CoP) that enables networking and collaboration at many levels, with a goal to have a technical discussion pertaining to sequencing, how it was

being used, where the sequencing data were being generated, how approaches could be standardized more effectively, how data flows could be optimized, how to connect and make the relationships needed to ensure that the sequence data being generated was feeding into/informing the public health response. The discussion and collaboration generated was a 2-way street.
  - As of the current census, approximately 1700 US scientists from across the country representing well over 250 organizations have joined the SPHERES effort. This is a powerful example of how just leveraging CDC's power to convene in the midst of a pandemic could greatly improve a lot of the data flow.
  - There are now millions of genome sequences from SARS-CoV-2 that are all named in a relatively standard way from across the US, which was one of the early successes of SPHERES. GISAID now has 4,331,974 sequences from US laboratories from the largest states to the smallest territories. State and local sequence submission have been growing steadily over the past few months, which continues to be an important priority area.
- **With respect to the AMD program and lessons learned from COVID:**
  - The AMD program is bringing together bioinformatics, advanced laboratory technologies like sequencing, and epidemiology to inform public health responses.
  - There was a second common good that resulted from the generation of these data and the innovation around surveillance activity that CDC could take advantage of. This has been difficult and challenging sometimes for public health in general to leverage. This is the use of the private sector and academic environments to drive research and innovations to ensure that the data generated through the course of the pandemic and other outbreaks and surveillance can help drive surveillance tools in the future, improve the ability to build more tailored diagnostics, and improve analytic capabilities.
  - While there are a lot of factors that differ, this generalized model captures a lot of genomic surveillance for virtually all pathogens.
  - As time has gone on, new sequencing and surveillance modalities have started to fill in. Consideration must be given to how to tie this not only to clinical care and human public health, but also to One Health and environmental surveillance technology. An area of strong interest is how to ensure that there is an appropriate analytic framework that can tie these various data sources together.
  - Early in 2021, there was a significant Epidemiology and Laboratory Capacity (ELC) supplemental funded by the American Rescue Plan (ARP) to extend and expand support for pathogen genomics. That included capacity-building, hiring new specialized staff, reagents and consumables, instrumentation, and laboratory renovations and improvements which in some cases was to accommodate new IT requirements.[27]
  - CDC also drove innovation to try to put better and more flexible tools into the hands of public health laboratories. These tools were used extensively by public health laboratories across the US as a way of generating, interpreting, and sharing sequence data over the course of the pandemic. A lot of the CDC tools that have been developed are going to be destined for broader public use and public release.

  With respect to the AMD platform vision of the future:
  - CDC's Broad Agency Announcement (BAA) drove the development of a lot of projects.
  - Realizing early on that scientific computing and bioinformatics was still an important gap, CDC contracted with Terra.Bio (a joint effort from the Broad Institute, Microsoft, and Google) to

[27] https://www.cdc.gov/amd/investments/maps.html

build cloud-based solutions. This allowed for the provision of centralized, cloud-based workflows that allowed public health laboratories across the country to analyze their sequences in a consistent way regardless of whether they had access to bioinformatic expertise or infrastructure.

- Prior to 2020, a lot of AMD work was seen as a laboratory-centered activity. In order to maximally impact public health, it is important to ensure that state and federal epidemiology groups are engaged and that these data are put into the hands of policy and decision makers.
- CDC has a new partnership with the American Society of Microbiology (ASM) to expand training for sequencing and bioinformatics for clinical microbiologists across the country, including a workshop and a number of virtual trainings.
- There is an effort to use BAA's much more effectively. One challenge was that a lot of innovative work was occurring in the private sector and academic spaces, but public health as a whole does not have a lot of easy mechanisms to support that work or engage with these groups. Federal entities have used BAAs effectively in the past. CDC currently carries about 29 to 30 projects under the BAA that cover a range of activities.
- The Pathogenomic Centers of Excellence (PGCOE) funding was recently announced. This is a 5-year foundational program for which CDC has announced 5 PGCOE sites. Each PGCOE is a partnership between one or more state or local public health departments and one or more academic institutions.
- The plan for the future with the AMD platform is to create a standardized cloud environment that enables state and local public health departments to be able to use these types of analytic tools in a standardized way and to have applications from various CDC programs that can be run on this platform in a standardized, reproducible, and portable fashion.
    - → This is a platform that CDC, state and local health departments, and even global partners can have access to.
    - → At this time, an architecture is in place and 5 CoPs have been assembled to ensure that the user base is actively engaged on the CDC program side and on the state and local public health side to ensure that systems and services are being built that will meet their needs now and in the future.
    - → The 5 CoEs are: Applied Genomic Epidemiology; AMD Data Modernization; Agile Architectures, Pipeline Development, and Automation; Quality and Standards; and Information Technology Security and Privacy. These are co-led by state partners.
    - → This effort will incorporate a lot of the lessons learned over sustainable, flexible, and universal architectures and will dovetail incredibly nicely with CDC's and public health's broader data modernization efforts.
- The takeaway message is that there are a lot of challenges to genomic surveillance that CDC is active in trying to address, but many of these challenges are incredibly universal. These are challenges that every laboratory on earth faces. Within those challenges, there is an incredible opportunity for collaboration, standardization, and to build a lot of systems that can greatly improve the ability to conduct domestic and global public health surveillance.

Advanced Molecular Detection (AMD) – Discussion

- BSC questions/observations/suggestions:
    - It seems that perhaps a national molecular surveillance plan is needed if there is not one already.

- This is a great success story. One of the challenges that existed pre-pandemic and through the pandemic was how best to communicate the data across laboratories and to the public. That is something that the AMD group seems set to address.

- Dr. MacCannell responses:
  - In terms of broad surveillance applications, a lot of activities have been historically siloed for decades. Genomic and bioinformatics offer an opportunity to think more broadly about what things should look like at a systems level. There always will be friction when thinking about what the 10,000-foot view needs to look like and how to adapt future surveillance models to meet these needs. The first piece of that is to ensure ongoing conversations, collaborative environments, that all necessary stakeholders are at the table, and that there is a broad and creative look at how some of these tools might be applied.
  - A lot of academic groups have worked on the edges of public health or public health-aligned areas in very narrow relationships with either global or domestic public health activities. There is an opportunity to broaden those discussions. It has been challenging to align some of the funding that is available with academic interests.
  - The volume of data sharing and the speed with which data has been shared through the pandemic at a global level has been a remarkable story. At the time of this meeting, 14 million sequences were being shared across that platform with a lot of broad sequence data, such as from wastewater. That volume of open data is critical and public health has embraced the idea of sharing sequence data and the value of sequence data. One place where a number of public health entities worldwide have struggled is in how to contextualize those data on the fly, especially in situations that are evolving and situations where there is a lot of uncertainty around the data being generated and what it means long-term. One challenge in communicating about and contextualizing the data being generated is that in many cases, public health authorities across the world have been frustrated by the fact that sequence data is shared and often because it is so open and available, a narrative takes root in the press or popular culture and public health has to respond to that rather than trying to contextualize it up front. Public health generally needs to work on this.

The first day of the BSC/DDID meeting was adjourned at 5:24 PM and stood in recess until 8:30 AM the following morning.

Center Level Updates and Initiatives Related to Climate Change

NCHHSTP

CAPT Deron Burton, NCHHSTP Acting Director, provided a high-level NCHHSTP update. He noted that he is the NCHHSTP Deputy Director but is filling in as Acting Director while Dr. Mermin is deployed to the Mpox response. NCHHSTP is one of the larger centers at CDC, with a diverse portfolio. Its work touches literally every state, community, age, and gender and includes the most stigmatized reportable diseases in the US.

- **NCHHSTP recently released an update to its Strategic Plan[28] for 2022-2026:**

[28] www.cdc.gov/nchhstp/strategicpriorities

- The Strategic Plan notes NCHHSTP's mission to prevent infections, morbidity, mortality, health inequities, and stigma associated with HIV, viral hepatitis, STIs, and tuberculosis in the US.
- NCHHSTP believes that they need to embody its core values of excellence; equity; diversity, inclusion, accessibility, and belonging; integrity; and transparency both internally within its workforce and as an organization, as well as in all interactions with grantees, partners, and the communities the center serves in order to be successful with its mission.
- The overarching goals identified in the Strategic Plan are to: 1) reduce the incidence of HIV, viral hepatitis, STIs, and TB; 2) reduce the morbidity and mortality of HIV, viral hepatitis, STD, and TB infections; 3) achieve organizational excellence; and 4) reduce disparities and promote health equity.
- NCHHSTP also has identified some cross-cutting themes to the way that the center approaches its work, which include: high-impact prevention, cross-sector collaboration, and incorporating equity principles into everything that the center does.

- **With respect to NCHHSTP's domestic HIV program (DHP), 4 cross-cutting focus areas have been identified to reach the center's HIV prevention and treatment goals:**
  - The health equity focus area seeks to address the impact of racism, homophobia, transphobia, and stigma that drives disparities.
  - The community engagement focus area recognizes the importance of working closely with partners to accomplish shared goals and seeks to increase the number and diversity of partnerships.
  - The focus area of a status neutral approach seeks to have comprehensive delivery for HIV prevention and care that addresses the whole person and the needs of the whole person.
  - The syndemic approach is described below and its focus seeks to identify opportunities to address structural and social factors that are driving a disproportionate burden of disease for multiple infections within some of the same populations and geographic areas.
  - The cross-cutting approach to support these 4 DHPs includes investments in strengthening the DHP's workforce and organizational capacity; enhancing implementation guidance and technical assistance; integrating data and data systems; expanding access to and use of DHP funding; advancing partnerships and increasing collaboration; and supporting partner and recipient communication efforts.

- **New data are out now in CDC's School Health Profiles 2020[29] publication coming out of Division of the Adolescent and School Health (DASH):**
  - This work demonstrates what schools have been doing during the pandemic to promote school connectedness and the wellbeing of student youth during the pandemic.
  - Something that has been highlighted through this work is the importance of LGBTQ supportive school policies and practices (e.g., genders and sexual alliances, identifying safe spaces, prohibiting harassment, and professional development for educators) that result in improved mental health outcomes for all youth in terms of decreased depressive symptoms, decreased suicidal thoughts and behaviors, and decreased suicide attempts.[30]
  - A lot of progress has been made within this work, but there is much more to do. Notably, 97% of middle and high schools prohibit harassment of LGBTQ students and 80% have identified safe spaces for these youth. However, only 44% of middle and high schools have a gay/straight alliance and only 30% report training staff on how to support LGBTQ students.
- **CDC's STD Prevention Program Strategic Plan 2022-2026[31] was recently updated, which aligns with the national STI Strategic Plan:**
  - The key goals are to: 1) prevent new STIs; 2) improve the health of people by reducing adverse outcomes of STIs; 3) accelerate progress in STI research, prevention, and technology; 4) reduce STI-related health disparities and health inequities; 5) achieve integrated and coordinated efforts to address the STI epidemic; and 6) enhance and support an effective internal workforce.
  - To move the needle on identifying STI research priority areas, the program convened a consultation in May 2022 with experts in the field to help identify what the research priorities should be for the next 5 years. The 4 identified areas that rose to the top included: 1) understanding PoC testing in terms of dissemination, impact, and outcomes and integration into existing care, surveillance impact, and cost implications; 2) better understanding the etiology of STI syndromes and screening and treatment options and outcomes; 3) improving the understanding of the outcomes and impact at the individual and population levels for STI screening; and 4) continuing to support the development of STI vaccines.
- **CDC also has developed a Strategic Plan to Reduce Infectious Diseases among People Who Use Drugs:**
  - This plan complements the agency's response to the opioid overdose epidemic and complements the specific disease strategic plans, such as those for HIV and viral hepatitis.
  - The vision of this plan is to eliminate injection drug use-associated infections.
  - The plan's mission is to decrease morbidity, mortality, and incidence of infectious diseases associated with injection drug use, as well as stigma experienced by people who use drugs
  - The Strategic Priorities within the plan are to: 1) strengthen the syringe services program (SSP) infrastructure nationwide and further integrate SSPs into the US public health system; and 2) establish coordinated surveillance, monitoring, and program implementation.

[29] https://www.cdc.gov/healthyyouth/data/profiles/index.htm

[30] Kaczkowski, W., Li, J., Cooper, A. C., & Robin, L. (2022). Examining the Relationship Between LGBTQ-Supportive School Health Policies and Practices and Psychosocial Health Outcomes of Lesbian, Gay, Bisexual, and Heterosexual Students. LGBT health, 9(1), 43–53. https://doi.org/10.1089/lgbt.2021.0133

[31] https://www.cdc.gov/std/dstdp/dstdp-strategic-plan-2022-2026.htm

- **CDC recently launched its first funded program dedicated to supporting SSPs:**
  - This is part of a 5-year funding announcement for which the first year of funding was awarded in September 2022.
  - The aims of this funded activity are to: 1) increase access to harm reduction services for people who use drugs; and 2) prevent hepatitis C, hepatitis B, HIV, and other infectious diseases and complications associated with injection drug use.
  - For the first year of funding, 2 components have been awarded. For Component 1, RTI International was awarded funding to support a national network of SSPs and oversee implementation and use of an annual national survey of SSPs. For Component 2, National Alliance of State and Territorial AIDS Directors (NASTAD) to strengthen implementation of SSPs in the US, territories and affiliated states, and tribal nations.
- **The Viral Hepatitis Program (VHP) has been working to strengthen opportunities to use viral hepatitis data to drive local action:**
  - The HepSEE Dashboard is being built on CDC's Data Collection and Integration for Public Health Event Response (DCIPHER) platform for health departments to visualize, monitor, and analyze viral hepatitis data in real-time with their jurisdictions.
- **This domestic TB program launched the "Think. Test. Treat TB" communications campaign:**
  - This is CDC's first national communications campaign to increase testing for latent TB infection (LTBI), which is encouraging Asian Americans and their healthcare providers to think about the risks for TB infection, test for TB infection where indicated, and to treat LTBI.
  - This program was developed in collaboration with a large number of partners, including many agencies and organizations that are serving Asian American communities.
  - This was a multi-modal campaign that used digital media, social media, community placements and education materials in multiple languages.
  - There have been over 55,000 visits to the "Think. Test. Treat TB" website and over 35,000 materials have been shipped to 44 states, DC, and 4 territories.
  - This campaign was implemented primarily in the Seattle, Washington and Los Angeles, California markets.
  - An evaluation of the campaign is currently underway. Some of the early indications seem to be that this has been successful in increasing awareness of LTBI in populations, particularly among those who were born in the Philippines and Vietnam, as well as their healthcare providers.
- **As seen throughout some of these programs, health equity is a cross-cutting priority for NCHHSTP:**
  - All of NCHHSTP's programs are invested in working toward achieving equity.
  - As a center, NCHHSTP recognizes that cross-cutting approaches will be needed as this work does touch on all of the center's work.
  - Last year, NCHHSTP launched a Center-Wide Equity Initiative with specific goals and accountability metrics. This initiative is focused on both the internal workforce and the outward-facing public health work of the center, with a goal of embedding the equity lens and equity principles into all of the work NCHHSTP does and being forthright about addressing the discrimination, racism, and stigma that drive disparities for this center's infections.
  - The center also would like to use state and federal policies to reduce disparities in collaboration with diverse partners in collaboration with diverse partners, recognizing that policies may be some of the best tools to address some of the upstream social determinants of health (SDOH) factors that drive disparities.
  - NCHHSTP also wants to be able to track disparities over time using disparity measures and established targets. Rather than just looking at tracking the burden of disease in disproportionately affected populations, they want to be more intentional about specifically

looking at disparity measures using absolute and relative comparisons and making sure that the work the center is doing is driving down the disparities.
  - The center also recognizes that it will be important to provide more resources to geographic areas and populations that experience disproportionate burdens of infection.
- **With regard to the syndemic approach:**
  - "Syndemic" is a term that is being used increasingly in public health and speaks to the population-level clustering of social and health problems and describes circumstances where: 1) 2 or more diseases or health conditions cluster within a population; 2) contextual and social factors create the conditions for clustering; and 3) results in adverse disease interaction, either biological, social or behavioral, increasing the health burden of the affected population.
  - There are opportunities for NCHHSTP to be intentional about employing the syndemic approach to increase its efficiencies and impact. In terms of what a syndemic approach could do for HIV, viral hepatitis, STD, and TB epidemics, this offers opportunities for NCHHSTP to be holistic in the work it does:
    - → First and foremost, they need to address the people they serve as a focus of the center's work (e.g., the whole person). There are particular populations who are experiencing dramatic disparities for the burden of these infections, including men who have sex with men (MSM), justice-involved populations, people who inject drugs (PWID), some racial and ethnic groups, LGBTQ youth, and others. Some of the same social and structural factors that are commonly driving increased rates of disease within those same populations.
    - → Place also matters in that there are strong geographic disparities for these infections as well. It is important to target the center's efforts where they are seeing a confluence of burden in the syndemic approach for multiple infections, and also making use of the venues where there are opportunities to reach multiple of those populations that are infected (e.g., STI clinics, correctional settings, SSP settings, et cetera).
    - → Policy offers an opportunity to address some of the social determinants and structural factors that are driving disparities across multiple infections and multiple populations.
    - → Finally, science matters in terms of where innovation can be stressed through a syndemic lens. Being able to test for multiple pathogens at appropriate encounters leverages an opportunity to test, link, and treat the whole person in terms of the conditions that they may be facing.
    - → Underlying all of that is having a strong workforce that has the right tools and skills, as well as strong partnerships.
- **Questions posed to the BSC/DDID:**
  - Are there any lessons learned from COVID-19 or Mpox that NCHHSTP should be incorporating into our Center or Division priorities?
  - The NCHHSTP equity initiative includes specific goals and metrics of accountability. What actions can drive progress and result in sustainable improvement in disparities?
  - As NCHHSTP continues to embrace a syndemic approach, how can we work with partners to amplify syndemic practices? How can we best leverage this approach to accelerate progress?

NCIRD

Dr. José R. Romero, NCIRD Director, provided the NCIRD update in terms of the Center's priorities, vision for adult immunizations, and updates on some outbreaks.

- **NCIRD's goals through 2024 are to:** 1) strengthen the domestic immunization program; 2) accelerate the development and introduction of new vaccines; 3) innovate through improved use of technology and systems; and 4) protect Americans from influenza threats and improve prevention detection and response for additional respiratory viruses.
- **Regarding NCIRD's draft and pre-decisional reorganization plan:**
  - In response to the rapidly changing public health landscape that has been driven largely by the COVID-19 pandemic, NCIRD leadership led the development of a new 5th division within NCIRD that tentatively will be named the Coronavirus and Other Respiratory Viruses Division (CORVD), pending approval.
  - The overall purpose of the proposed reorganization is to enhance NCIRD's ability to be effective, efficient, nimble, and responsive to the rapidly evolving public health demands and align with the CDC's strategic priorities, including securing global health and American preparedness.
  - The proposed reorganization would: 1) absorb COVID-19 activities from CDC's Emergency Operations Center (EOC) and COVID-19 pandemic response task forces into NCIRD's divisions and programs; 2) increase capacity to continue to achieve public health impact for COVID-19 activities and other vaccine preventable and respiratory disease activities; and 3) expand preparedness and response work domestically and globally.
- **NCIRD is explicit in living its healthy equity and diversity, equity, inclusion, and accessibility (DEIA) values** and actively supports, invests in, and advocates for health equity- and DEIA-related initiatives in the community, government, and society at large.
  - CORE is a framework for embedding health equity into CDC's science and interventions and DEIA into workforce, culture, and infrastructure. As CDC implements Moving Forward, health equity remains one of its CORE capabilities.
  - NCIRD's vision for health equity is to eliminate sociodemographic disparities and inequities in prevention, control, illness, and death from vaccine-preventable and respiratory diseases, while its health equity mission is to prevent disease, disability and death through immunization and by control of respiratory and related diseases.
  - The Center's approach to and priorities for addressing health inequities are centered around tackling the root causes of disparities and SDOH that interact to produce adverse health outcomes in disproportionately affected communities.
  - NCIRD's vision is to be recognized as a leading Center for DEIA—an organization where a diverse group of dedicated and driven employees feels a sense of belonging and has equitable opportunities to thrive and excel.
  - NCIRD recently finalized a comprehensive 3.5-year action plan to elevate all aspects of DEIA throughout the Center. Through this plan, the Center will focus its DEIA efforts on 4 priorities that are consistent with those of the agency, which are to: 1) develop a climate of equity, inclusion and accessibility; 2) implement leadership driven DEIA culture reform; 3) have a demonstrated focus on increasing diversity; and 4) demonstrate improved retention and opportunity creation. Each priority area includes corresponding goals, activities, and objectives to achieve them.
  - NCIRD already has begun to take actions to support DEIA recruitment efforts, which includes identifying conferences and career fairs that support the recruitment components of DEIA. The Center is actively seeking to diversify its workforce by strengthening its collaborations and the opportunities for recruiting qualified, talented, and diverse staff.

- Equally important are the efforts being taken to support the professional development and career pathways of NCIRD's current staff, including full-time employees, contractors, and fellows.
- NCIRD's commitment to health equity and DEIA is intended to reach and reflect the populations that the Center serves. NCIRD seeks to continue to build on the momentum that was established with these strategies and frameworks.

- **Regarding the priority area of improving vaccine confidence through multi-tiered support**:
  - CDC has launched a number of partnerships with a diverse set of organizations from large national partners to small community-based organizations (CBOs) with a goal of beginning to improve equity and uptake across all adult vaccines.
  - Collectively, the efforts and investments made through the COVID-19 pandemic provided an unprecedented momentum for a comprehensive adult immunization program, including the focus and investment needed to build vaccine confidence in communities of color.
  - These include funded partnerships; technical assistance; hands-on support through peer and group learning sessions, expert and one-on-one coaching, materials sharing, data analytic support; and provision of guidance, communication, and resources to share vaccine information, best practices, and strategies.
  - Engagement is required at every level in order to positively influence the perception, understanding, and access to vaccines.
  - A critical part of the approach is to engage and support a network of partners across multiple levels on vaccine confidence and access activities to reach people wherever they are.
- **In terms of some specifics of NCIRD's partnership efforts:**
  - The COVID-19 pandemic highlighted the need for community-level action to address stark disparities in vaccination rates, and also created an opportunity for unprecedented levels of investment in community-level partnerships by the CDC.
  - In 2021, CDC launched the Partnering for Vaccine Equity (P4VE) Program to build a network of partners to drive community-level action to reduce disparities:
    - → The P4VE Program has provided over $6 billion to NCIRD's jurisdictional awardees to focus on equity and local communities. Awardees made strides in advancing equitable adult immunization and implementing adult-focused activities to increase equitable vaccine access, administration, and confidence by broadening reach to priority populations, expanding the partner ecosystem, and increasing organizational capacity.
    - → The P4VE Program also provided over $156 million to over 500 partners at the national, state, and local levels.
    - → For partners, P4VE co-organized tailored funding opportunities directly for potential organizations to meet their needs and reflect the unique capacities of their organizations. CDC offered application support to all organizations to aid those unfamiliar with federal grant application systems and processes. Because of this approach, CDC was able to fund more Black- and Brown-led organizations and give millions of dollars in microgrants to communities.
    - → Since its inception, P4VE's collective partner network has educated, empowered, and trained over 185,000 community-level spokespersons; reached nearly 2 million people who attended promotional events; and administered 1.74 vaccines for COVID-19 or influenza. Additionally, the network launched 14 national educational campaigns, reaching 46 states in 43 languages and dialects.

→ Partners benefit from group learning, expert coaching, online learning events, and publicly available resource hubs. They also receive data-informed technical assistance to inform and scale their efforts.
→ In addition to on-the-ground engagement, partners received over $12 million to mitigate the effects of vaccine misinformation and disinformation transmitted through social media.
→ These efforts highlight the continued investment needed to sustain and scale this work long-term and to extend it to other routinely recommended vaccines for children and adults.

- **NCIRD's goal is to create a comprehensive adult immunization program**:
  - The plan is to leverage the substantial investment and progress that has been made during the COVID-19 pandemic and its response to build the foundation of this program.
  - The program will include all of the elements identified as crucial to the success of the COVID-19 vaccination program, in addition to building on the information learned through the Vaccines for Children (VFC) Program. These include vaccine purchase and administration, vaccine equity support, partnerships, public communications, support for jurisdictions, scientifically sound vaccine policy, and monitoring and evaluation.
  - The proposed Vaccines for Adults (VFA) Program has several components that would work together to reduce the spread of vaccine-preventable diseases (VPD) and ultimately lead to greater health equity.
  - CDC's FY23 request of $2.1 billion in mandatory funding for vaccines for adults will expand access to all routine and outbreak vaccines to uninsured adults by covering vaccine purchase, program operations, provider administration, provider fee reimbursement, and vaccine confidence and equity activities.
  - NCIRD views immunization not only as a pillar of preventative healthcare, but also as a critical tool for outbreak and pandemic preparedness. Immunization is an essential tool at all times, not just during a pandemic.
  - A fully funded, robust immunization program that addresses the needs from childhood through all recommended adult vaccines is a cornerstone in maintaining optimal health and responding to emergencies.
- **With regard to current influenza activity and resources:**
  - CDC maintains a comprehensive, layered influenza surveillance system to track when and where influenza is spreading, what types of viruses are circulating, and the severity of illnesses that are occurring. These systems consist of complementary components to capture virologic, outpatient, hospitalization, and mortality data.
  - After 2 prior seasons of relatively low influenza activity, early and significant increases in influenza activity are being seen this year. The percentage of outpatient visits due to respiratory illness at the time of this meeting was high across the country at 7.5%. All 10 HHS Regions were above their baselines, while 47 jurisdictions were at high or very high levels of activity.
  - When looking at the surveillance systems, it is important to keep in mind that there are many other pathogens besides influenza that meet the definition of an influenza-like illness (ILI). For instance, severe acute respiratory syndrome (SARS) and respiratory syncytial virus (RSV) also are circulating at this time. However, it is known from other systems that influenza is contributing substantially to the respiratory illness occurring across the US.
  - CDC data systems include data showing a dramatic increase in the number of influenza-positive specimens received by public health and clinical laboratories. These data, which CDC tracks

across the country, provide a good idea of where influenza activity is occurring, and which influenza viruses are currently circulating.
  - As of the most recent reporting week, clinical laboratories reported a percent positivity of 25.1%. This is an increase of nearly 7% from the prior week. The majority of influenza viruses detected this season have been influenza A(H3N2), which represent 75% of the isolates that have been subtyped, with the remaining 21% of isolates being A(H1N1).
  - The cumulative hospitalization rate in the FluSurv-NET system is showing that influenza-related hospitalizations across the country are continuing to increase. The overall cumulative FluSurv-NET hospitalization rate is 16.6/100,000 population. This is higher than the rate observed in Week 47 during every previous season since 2010-2011, during which hospitalization rates ranged from 0.1 to 2.0 per 100,000 population. The highest population rates per 100,000 were among adults ≥65 years of age at 39.9, followed by children 0–4 years of age at 28.4.
  - The number of influenza hospital admissions reported in the HHS Protect system almost doubled in the past week to 19,593 patients with laboratory-confirmed influenza who were admitted to the hospital. As a pediatrician, it pained Dr. Romero to hear that 14 pediatric deaths had been reported so far at this time from a vaccine-preventable disease.
  - National Influenza Vaccination Week (NIVW) is December 5-9. NIVW is observed at the beginning of December each year to raise awareness of the importance of influenza vaccination ahead of the holiday season. This is especially important this year as there have been some concerning lags in vaccination coverage, coupled with the early and elevated influenza activity across the country. As part of NIVW, CDC is leading a number of activities designed to reach the general public and specific high groups such as Latinos and African Americans. For instance, Dr. Romero participated in the activities of 2 Spanish-speaking outlets in Spanish in order to increase vaccination uptake. In addition, CDC's NIVW Digital Media Toolkit[32] page has been updated with resources for partners and more information on how to participate.
- **Concerning RSV, which had garnered a lot of attention in the press recently:**
  - National trends for RSV activity suggest that the peak of seasonal activity has passed in nearly all regions, which is good news.
  - Based on data from CDC's National Syndromic Surveillance System (NSSP), RSV-associated emergency department (ED) among people of all ages appear to have plateaued and are decreasing. However, RSV-associated ED visits remain at or above the level typically seen during the peak of RSV activity during the winter. The NSSP captures data from approximately 75% of EDs nationally, so it is a very robust system.
  - The National Respiratory and Enteric Virus Surveillance System (NREVSS) data show that RSV activity remains elevated but is beginning to decrease in all HHS Regions except Region 8—the Mountain Region. Test positivity is decreasing in the South and Southeast, HHS Regions 4 and 6, and has plateaued in New England, Midwest, Mid-Atlantic, Northeast, and Pacific West (HHS Regions 1, 2, 3, 5, 7, 9, and 10.
  - There also are some increased co-circulations and co-detections of viral infections this year compared to previous seasons. Most of these are due to rhinoviruses (RV) and enteroviruses (EV).
  - No increases have been observed in severity of diseases, even when accounting for co-infections compared to previous years.
  - Based on preliminary analyses, the length of hospital stay and the proportion requiring intensive care unit (ICU) admission or mechanical ventilation are similar to previous RSV seasons.

[32] https://www.cdc.gov/flu/resource-center/nivw/activities.htm

- **In terms of adenovirus:**
  - Human adenoviruses are a cause of respiratory illness outbreaks in congregate settings.
  - Outbreak case counts grossly underestimate the true size of outbreaks, given that individuals with mild disease do not seek care. Even if individuals with moderate to severe illness seek care, targeted adenovirus testing often is not done to establish a virologic diagnosis.
  - CDC has been engaged in 2 large university outbreaks in 2022:
    - → The first was an outbreak on a Southern US university campus, with a total of 195 laboratory-confirmed cases. This outbreak spanned an entire semester from January–May of 2022. All specimens received were typed at the CDC and found to be Adenovirus Type 4. This illustrated how challenging it is to mitigate 2 concurrent outbreaks of adenovirus and COVID-19 in congregate settings, as well as the importance and value of multi-plex respiratory viral testing.
    - → The second outbreak is occurring on a Midwestern US university campus, with 82 total laboratory-confirmed cases as of December 2, 2022, and is anticipated to span the entire semester from September–December 2022. All specimens received and typed at the CDC were found to be Adenovirus Type 4. Several previously healthy students were hospitalized with severe illness that included viral meningitis and viral sepsis.
    - → There also is an outbreak among children in Alabama with liver involvement.
- **Most recently, CDC has been involved with a measles outbreak in Central Ohio:**
  - There were 4 imported measles cases from Kenya between June and October 2022. There were 2 community cases identified without known links to the 4 cases or international travel and were confirmed on November 5, 2022.
  - There have been 58 reported outbreak cases, nearly all of which are from the City of Columbus, without reported travel with rash onsets ranging from November 1–December 4, 2022. All of these cases are younger, with a median age of 2 years and range from 6 months to 15 years of age.
  - As of December 6th, a total of 55 cases (95%) were among unvaccinated individuals and the remaining 3 cases (5%) had received only 1 dose of MMR vaccine. For those with known exposure settings, the majority (23 patients) were infected in a healthcare setting, 6 had household infections, and 5 were from daycare settings.
  - A total of 22 individuals (38%) have been hospitalized, which is higher than the 20% that is typically seen. These hospital stays have been largely short in duration and are for dehydration and diarrhea. There were 2 cases with pneumonia. The first case admitted to the ICU followed a reaction to intravenous gamma globulin (IgG) used for the treatment of presumed Kawasaki Disease before measles was confirmed.
  - Kawasaki Disease is the most common misdiagnosis. CDC reached out to the American Academy of Pediatrics (AAP) and the American Academy of Family Practitioners (AAFP) to issue a reminder to think about measles in a rash and febrile illness.
  - An Epi-Aid was requested by Columbus Public Health (CPH) and Ohio Department of Health (ODH). CDC deployed 3 staff and 2 Epidemic Intelligence Service (EIS) Officers from CDC-Atlanta to support the EIS Officer at CPH from November 27–December 11, 2022.
  - CDC also has facilitated procurement of 1,200 adult and pediatric M-M-R®II (Measles, Mumps, and Rubella Virus Vaccine - Live) with funding and completed phylogenetic analysis of the measles cases. All of the measles cases were found to be Genotype B3 and also are closely related to an outbreak that occurred in Minnesota.
  - CDC is supporting CPH and ODH with the following response priorities, which are: 1) improving MMR vaccine coverage among families with low vaccine confidence; 2) leveraging associations

working with affected communities and provider outreach with patient recall for those unvaccinated or behind in their immunization schedule; 3) limiting measles transmission in healthcare settings with early detection, isolation, and cohorting; 4) providing rapid contact tracing; 5) providing post-exposure prophylaxis (PEP); 6) excluding daycare/school attendance for 21 days; and 7) triangulating immunization information systems, school entry, and nationwide children's hospital MMR vaccine data to improve the accuracy of zip code-level coverage estimates.

- **Questions posed to the BSC/DDID:**
  - How can NCIRD improve recruitment efforts for diversity?
  - How can NCIRD promote the importance of the proposed Vaccines for Adults program?
  - How can we increase vaccination in disproportionately impacted populations?
  - How can we improve communication to the field and public regarding new and ongoing outbreaks?

NCEZID

Dr. Dan Jernigan, NCEZID Acting Director, provided an update on the risk for infectious diseases in the context of climate change.

- **In terms of the CDC Moving Forward initiative:**
  - NCEZID is developing its own plan that is in alignment with Dr. Walensky's focus on collaboration, communication, better accountability, and timeliness.
  - The Center will be focusing on response readiness, which will have 3 components: Laboratory Readiness, Data Readiness, and People Readiness.
  - As a part of this, consideration will be given to pathogen prioritization activities to ascertain what pathogens are most likely to be pandemic-prone in order to develop assays in advance to ensure readiness if/when they occur.
  - Some of the factors for emerging infections are that the world is more crowded, connected, and converged in terms of humans and animals (the 3 Cs). In addition, there is the fourth C of climate.
- **More specifically with regard to climate change, annual average temperatures in the US are expected to be about 2.5 degrees hotter by 2050** than they were on average from 1976–2005:
  - As a result, it is anticipated that there will be longer and warmer summers, shorter and milder winters, fewer frost days, more intense heat waves, less intense cold waves, and more extreme and unpredictable weather events (e.g., severe storms like hurricanes, heavy precipitation, severe droughts, flooding).[33]
  - Looking at climate change and emerging infectious diseases through a *One Health* lens, these changes are affecting the relationships and interactions between animals, humans, and the environment (e.g., convergence).
  - Changes in climate lead to changes in the environment, which may change the incidence and distribution of some of these diseases. For example, climate changes force some animals into new habitats as their natural habitats disappear. This movement of animals, including disease vectors, into new areas increases opportunities for contact between humans, animals, and vectors. This enhances the potential spread of zoonotic diseases.

[33] Vose, RS, DR Easterling, KE Kunkel, AN LeGrande, MF Wehner, 2017: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I. pp. 185-206, DOI: 10.7930/J0N29V45

- Common ways climate-sensitive disease spread include mosquito and tick bites, contact with animals, inhaling and having other contact with mold and other fungi, consumption of contaminated food or drinking water, and contact with contaminated water. Not everyone is at equal risk. Important considerations include age, economic resources, and location.
- Several, if not all, of the NCEZID programs and pathogens are impacted by climate change. NCEZID's issues range from the emergence of new fungal pathogens to global migration. NCEZID had previously led and coordinated climate issues with colleagues within and beyond CDC and is prepared and equipped to provide CDC's public health response to the adverse effects of climate change on infectious and environmentally transmitted diseases.

- **In terms of vector-borne diseases:**
  - Climatic factors, including seasonal, temperature, and precipitation patterns, affect the spread of vector-borne diseases (e.g., Lyme, dengue, West Nile Virus, Plague) in the US.
  - These factors impact the population size, survival rates, prevalence of disease, and the ability of disease carrying vectors to spread infection and as a result, influence the risk of diseases spreading to humans.
  - As temperatures continue to rise across the US, ticks that spread Lyme disease and other illnesses likely will show earlier seasonal activity and a more Northward expansion.
  - Rising temperatures, changing rainfall patterns, and increases in some extreme weather events also likely will affect the distribution, abundance, and infections rates of mosquitoes that spread West Nile Virus (WNV) and other pathogens.
  - Vector-borne pathogens likely will emerge or re-emerge due to the interactions of climate factors with many other drivers such as changing land-use patterns, societal disruption, and others.
  - The impact on human diseases likely will depend on the effectiveness of interventions such as vector control practices, vaccines, and personal protective measures.
  - Looking at the distribution of the leading tickborne diseases (e.g., Lyme Babesiosis, Ehrlichiosis, Anaplasmosis, Rickettsioses) from 2001–2019,[34] 2017 marked the worst year ever with almost 60,000 reported cases. This was roughly 3 times the number reported in 2001. The lower number of cases in the last 2 years reflect under-reporting in several key states in the Northeast. Lyme disease accounts for most cases, but all of these diseases are increasing steadily. During the period from 2001–2019, there was significant geographic expansion in all directions of Lyme disease. The Northward increase very likely reflects the influence of warming temperatures on tick survival.
  - The WNV outbreak in Arizona in 2021 was the largest local outbreak ever recorded in the US in Maricopa County, Arizona. Almost 2700 cases and 191 deaths were reported. Analyses are underway to assess how regional weather patterns have interacted with other factors in causing this outbreak and to determine what mosquito-borne pathogens might be appearing in regions where they have not been seen previously.
- **With regard to climate change impacts on foodborne and waterborne diseases:**
  - Climate change fuels conditions favorable to foodborne and waterborne pathogens and harmful algal blooms (HABs).
  - More exposure to foodborne and waterborne pathogens and contaminants are expected due to warming temperatures, more frequent and severe extreme weather events like heavy precipitation and flooding, disruptions to infrastructure (e.g., power outages, temperatures that

[34] cdc.gov/lyme/stats/index.html

allow bacterial growth in food, disruption of water treatment services), and changes in the behaviors and range of non-human hosts.
  - For example, *Vibrio* bacteria are responsible for most bacterial illnesses associated with seafood. They thrive in water that is warmer and can cause illness in people who eat raw or undercooked shellfish contaminated with them, and life-threatening wound infections like *Vibrio vulnificus*.
  - The incidence of *Vibrio* infections increased between 1996-2019.[35] The incidence of human *Vibriosis* is increasing at a faster rate than other enteric illnesses, with cases more than doubling in the last decade. As temperatures rise and salinity changes due to climate change, *Vibrio* has expanded into regions where it was not considered endemic. Climate change also has prolonged the *Vibrio* season and allowed for expansion into previously uncontaminated waterways in regions where *Vibrio* was historically endemic.
  - *Naegleria fowleri* is an amoeba that lives in soil and warm fresh water (e.g., lakes, rivers, hot springs). *Naegleria* infections are severe and usually fatal. Cases historically have occurred in Southern states and are primarily associated with exposure to lakes and rivers during summer months. In recent years, these cases have occurred after exposure to water further North. These cases often follow heat waves. Additionally, infections have occurred after exposure to engineered water systems, including artificial surf in whitewater venues and drinking water systems.[36]
- **Concerning how climate change affects fungal diseases:**
  - Climate change is fueling conditions favorable to mycotic diseases as well. Rising temperatures are expected to produce new and emerging fungal diseases caused by fungi that can survive at human body temperatures. For example, the global emergence of Candida auris (C. auris), a deadly multi-drug resistant pathogen that spreads in healthcare facilities, may be caused or increased by climate change.
  - Changes in rainfall and temperature are contributing to an expansion of fungal diseases into new geographic areas. One in particular is Valley Fever, which is caused by fungi that live in hot and dry areas like the US Southwest. People are exposed when they inhale contaminated dust. In endemic states like Arizona, Valley Fever has been found to be a leading cause of pneumonia accounting for 15% to 30% of community-acquired pneumonia cases. Valley Fever has gained a foothold in the Pacific Northwest far North of where it previously occurred. Habitat modeling predicts that by 2095, Valley Fever will be endemic in much of the Western US as far North as North Dakota and Montana in the coming decades.[37]
- **Not only is climate change affecting the lower part of the US, but also it is affecting the Arctic:**
  - Arctic temperatures are rising more than twice as rapidly as the rest of the world, causing global impact and numerous effects on Artic ecosystems and communities.
  - Ecosystem changes affect health. For example, they might increase infectious diseases with the loss of water and sanitation infrastructure or with new disease reservoir species moving North.
  - These changes will disproportionately impact Alaska Native communities and people at increased risk of exposure to these hazards. For example, warming waters have led to an outbreak of *Vibrio* in people who ate raw oysters that were harvested there. That occurred over 1000 kilometers North of the Northern most previously documented oyster-associated *Vibriosis* outbreak.

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[35] FoodNet Fast Pathogen Surveillance Tool
[36] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7774533/pdf/20-2119.pdf
[37] Gorris, M. et al. GeoHealth, Volume: 3, Issue: 10, Pages: 308-327, First published: 30 August 2019, DOI: (10.1029/2019GH000209)

- Climate extremes are increasing waterborne diseases and threatening water systems and infrastructure. Approximately 15% to 20% of Alaska homes are without piped water or sewer. When existing sanitation systems fail, this impacts human health and infectious disease among community residents.
- CDC's Arctic Investigations Program (AIP) works closely with partners such as the Alaska Native Tribal Health Consortium (ANTHC) to conduct climate-related health surveillance and research to better understand and respond to climate change issues at the human/animal health interface.

- **With respect to NCEZID's priorities:**
  - The impacts of climate change intersect across NCEZID programs, but the programs share the following common priorities: 1) expanding human and ecological surveillance and research, including modeling and forecasting; 2) identifying and validating effective prevention and control strategies that address environmental justice and health equity, tailored for disproportionately affected communities; 3) developing and maintaining local, state, and federal capacity to detect and respond to emerging disease threats; and 4) conducting outreach to the public, partners, and clinical providers to increase awareness of changing disease patterns and/or exotic pathogens.
  - In 2021, CDC stood up the Agency-wide Climate and Health Task Force in response to the Administration's Executive Order 14008, which was tackling the climate crisis at home and abroad. This Task Force was initiated by the National Center for Environment Health (NCEH) and is co-led by them with NCEZID.
  - With 157 representatives from 24 CIOs, the Task Force is comprised of experts in areas such as health communication, epidemiology, evaluation, implementation science, health equity, policy, emergency preparedness and response, and more. This coordination will help to undertake new and innovative projects, engage new stakeholders, and advance CDC's mission by fully integrating climate considerations into activities across the agency.
  - Among its priorities, the Task Force has developed a multi-year Strategic Framework[38] that outlines CDC's vision to 1) enhance preparedness and response capabilities for climate-related emergencies; 2) improve CDC's tracking of climate-sensitive diseases; 3) expand the evidence base of climate research; 4) share information intended to protect the public from climate-sensitive diseases; and 5) address inherent health equity and environmental justice issues. The soft launch of the framework just began.
- **In conclusion, climate change will have wide-ranging health impacts:**
  - These impacts are a priority to NCEZID and CDC offers a wide range of expertise on this topic.
  - Better data and surveillance are needed to understand the full spectrum of climate impacts and to identify appropriate interventions for the most impacted populations.
  - With expansion and continued investment in NCEZID's programs, CDC will be equipped to help guide public health response to the adverse effects of global climate change on infectious diseases.
- **Questions for the BSC/DDID:**
  - How can we partner together?
  - What can CDC do to highlight the public health impacts of climate change, from a communications standpoint?

[38] https://www.cdc.gov/climateandhealth/climate-health-framework.htm

- How can we improve our understanding of climate impacts on infectious diseases and prepare for future issues?
- What is your organization doing in the area of climate and infectious diseases? What are your concerns and priorities?

CGH

Dr. Hank Tomlinson, CGH Acting Principal Deputy Director, presented an update from the CGH in the context of climate change.

- **With respect to how CGH is organized and what largely it focuses on:**
  - The CGH is comprised of the Office of the Director and 4 divisions: 1) Division of Global HIV and Tuberculosis (DGHT), which implements the agency's work under the President's Emergency Plan for AIDS Relief (PEPFAR); 2) Division of Global Health Protection (DGHP), which promotes broad activities in a horizontal way to build some of the capacities for surveillance, laboratory, public health emergency management, workforce development, et cetera; 3) Global Immunization Division (GID), which works on polio, measles, and VDPs; and 4) Division of Parasitic Diseases and Malaria (DPDM), which works on parasitic diseases and malaria and also has a small domestic component.
  - The 4 divisions have as their goals to: 1) promote health security in terms of protecting Americans and those abroad by building capabilities and capacities for prevention, detection, and response of infectious diseases and other threats; 2) save lives by reducing disease morbidity and mortality by implementing programs and interventions for high-burden diseases and consequential geographies; and 3) promote leadership and global public health science, including work in global settings, with a large focus on operations research and implementation science.
  - The CGH is not the only part of the agency that does global health work, so they work collaboratively and collectively with the other national centers within the agency where there is deep subject matter expertise (SME) and a long, important, and current deep engagement with many actors in international settings. This often is complemented with large workforces, or boots-on-the-ground, in 60 countries and have deep engagements with multi-lateral organizations, Ministries of Health (MoH), and other actors on the global health stage.
- **Some of the intersections between global health and climate changes are that:**
  - Climate change contributes to severe weather events, including flooding and drought.
  - It can threaten a country's capacity to prevent, detect, and respond to public health threats through changing priorities; addressing exigent needs because of climatic events; reducing or affecting infrastructure systems; and reducing and changing physical access to what is needed to prevent, detect, and respond to a health emergency of any kind.
  - Climate changes create impacts that are broad-ranging and disproportionately affecting poor and vulnerable populations globally.
  - It presents a direct impact on high-burden vector borne diseases (e.g., malaria, dengue, et cetera).
  - Climate change strains health systems and increases the risk of other infectious and non-communicable disease.

- **Climate change impacts continuity of care:**
  - One example, published in PLOS,[39] was a drought in Lesotho that was associated with higher HIV prevalence in adolescent girls 15–19 years of age in rural areas and with lower educational attainment and riskier sexual behavior in rural females 15-24 years old.
  - The authors articulate in this paper that there are understandable associations between drought, income-generating activities, periodic income shock, early sexual debut, reduced adoption of protection behaviors during sexual activity, increased transactional sex and decreased education generally. That is, all of the things that can be drought- and climate-related can have consequences on HIV programs.
  - Because CGH is not funded to address climate through any of the specific lines that provide resources to the center, CGH has to operate in this context and do the best they can to provide supportive, adaptive, and resilient services that are informed by and understand the complications and future trajectories associated with climate change and the associated severe weather events.
  - This example highlights the opportunity to understand human movement, migration, income-generating activities, risk exposure, and educational opportunities, as well as the extent to which well-resourced programs for global HIV and other activities can be used to meet needs and weave in components that can be supportive in terms of mitigating some of the untoward effects associated with drought and climate change.
- **Climate change can impact interventions for VPDs:**
  - Extreme climatic events, such as prolonged droughts and major cyclones, have been associated with interrupted routine immunization, which leaves birth cohorts vulnerable to diseases easily prevented by missed vaccinations.
  - Catch-up vaccination campaigns in areas affected by climatic events are often delayed or cancelled, further increasing the number of vulnerable children who can become vulnerable adults without directed action to vaccinate them.
  - Climate change, particularly warmer global climates with increasingly variable precipitation patterns and accelerated sea level rise, is likely to have wide-ranging effects on the outbreaks and transmission of water associated VPDs like polio, cholera, and typhoid.
  - It is important to note that direct links between climatic events and VPD outbreaks have not yet been substantiated or established in scientific literature.
- **A particular example of how working in this context is complicated is polio and the impact of climate change in Pakistan:**
  - While ultimately teams were able to accomplish short-term goals in this instance, there were significant challenges in doing so.
  - Powerful monsoon rains in Summer 2022 in Pakistan caused devastating floods that killed more than 1,500 people and destroyed more than 2 million homes.
  - During the 5 days when rain was most extreme during the monsoon, climate change increased rainfall intensity by up to 50% in the hardest-hit provinces.
  - The risks to people are exacerbated by poverty and poor infrastructure. As the flooding in Pakistan shows, the consequences of extreme rain can be dire.

[39] Low AJ, Frederix K, McCracken S, et al. (2019) Association between severe drought and HIV prevention and care behaviors in Lesotho: A population-based survey 2016-2017. PLoS Med 16(1): e1002727. https://doi.org/10.1371/journal.pmed.1002727

  - Population displacement due to the floods raised concerns about the spread of wild poliovirus gaining a foothold as millions of people were displaced by the floods, left their homes, and looked for refuge elsewhere.
  - Provinces and districts in the Southern part of Punjab and 23 districts were unable to hold a vaccination drive as floods swept away homes and villages throughout the country.
  - Despite the extreme climatic conditions, polio teams reached children in all accessible areas. These types of problems are common not only in Pakistan, but also in neighboring Afghanistan that complicate work in polio.
- **Climate change creates opportunity for increased disease transmission:**
  - Many malaria control interventions are seasonally timed to interrupt transmission, and climate change impacts seasonality and the ability for seasonal interventions to be effective.
  - The ability of an invasive malaria mosquito species, *An. stephensi*, to adapt to more extreme climatic conditions indicates that a larger proportion of Africa is suitable for malaria transmission by *An. stephensi* compared to the current malaria vector.
  - It is not always about the movement of a threat, vector, or animal geographically. It also can be about change among vectors and adaptation within them, which increases risk and might substantially change plans.
  - A recent pre-print showed that *An. Stephensi* persist through dry periods, which is what the initial surveillance data showed as well, unlike current malaria vectors. Therefore, seasonally targeted vector control interventions are unlikely to be as effective.[40]
  - In rural areas, transmission could occur 12 months of the year as this species becomes more established.
- **In terms of CGH field work involving climate change:**
  - Field Epidemiology Training Programs (FETPs) try to help work with MoHs and other institutions in host countries to develop Disease Detectives and the capabilities that are part of that (e.g., surveillance, laboratory, workforce development, and emergency response).
  - FETP investigations are increasingly investigating climactic factors.
  - The ongoing global surge in cholera, with at least 29 countries experiencing outbreaks, is partly attributable to climatic factors resulting in increased rainfall and flooding in the Middle East. This had led to shortages of oral cholera vaccines and standard medical supplies.
  - CDC has been supporting outbreak responses in Haiti, Pakistan, Malawi, and Cameroon and likely will expand this work to include Zimbabwe, Lebanon, and Syria.
  - FETPs engage with the TEPHINET Climate Change and Health Workgroup to integrate climate and health competencies into FETP training and to sensitize and educate the field epidemiology community.
  - The engagement and role of CDC on the workgroup is to provide subject matter expertise, participate in a monthly webinar, and participate in review of materials for FETP audiences relevant to climate change and health.
  - CGH serves as liaison to CDC staff SME's and to country FETPs that have or are involved in investigations related to climate and health.

[40] Villena OC, Ryan SJ, et al. (2022) Temperature impacts the environmental suitability for malaria transmission by Anopheles gambiae and Anopheles stephensi. Ecology 103(8). https://doi.org/10.1002/ecy.3685

- **To recap some general areas of opportunity:**
  - Global health security, humanitarian emergencies, and refugee populations will have increasing needs over time.
  - Non-communicable diseases (e.g., chronic diseases, injuries, environmental degradation, air and water quality) are areas where CDC SMEs at headquarters and also abroad can support MoHs and other actors in those settings.
  - Changing transmission intensity and geographic range of vector-borne diseases is important.
  - CGH's state-of-the-art insectary facilities can be used to study the impact of temperature and humidity changes on the life cycles and vectorial capacity of important malaria vector species.
  - There are opportunities for disruption to routine immunizations and eradication campaigns.
  - Poorer outcomes for PLHIV due to disruptions in ART adherence, challenges accessing care, and food insecurity offer several opportunities for intervention.
  - Climate-induced migration and food insecurity lead to increases in risky sexual behaviors, which may result in higher risk of HIV acquisition.
- **Recalling that CGH does not have dedicated resources in line-item funding, potential CDC global contributions and assets in these areas may include the following:**
  - In terms of facilitating higher level bilateral and multilateral global engagement, CGH has experience engaging on the global stage, including working with the HHS Office of Global Affairs (OGA) and the World Health Organization (WHO) on multilateral initiatives at all levels of operation. The center has been involved in creating or supporting other multilateral engagements, including the Global Polio Eradication Initiative (GPEI) and the Global Health Security Agenda (GHSA).
  - CGH also develops technical capacities around surveillance, laboratory, workforce, and preparedness and response.
  - CDC and its global health partners develop in-country capacity through decades of investment and technical support to programs like PEPFAR, the President's Malaria Initiative, the GHSA, and others that address emerging infections and VPD. These programs contributed to the development of public health laboratory and surveillance capabilities that could be leveraged to establish global climate and health projects.
  - CGH also works directly with host country governments and United Nation (UN) agencies to investigate and control outbreaks related to humanitarian disasters, as well as the effects of displacement on food security, malnutrition, and maternal and newborn health.
  - In addition, the CGH coordinates with experts internal and external to CDC on global Water, Sanitation, & Hygiene (WASH) projects. Activities include developing technical guidance, training, and implementation of effective public health interventions. The CGH works with the Center for Preparedness and Response (CPR) to support countries in strengthening and developing their own EOCs and response capacity.
  - The CGH is currently working with more than 60 countries to provide boots-on-the ground, providing infrastructure and coordination support with US missions and in-country partners for work across the agency, including emerging health threats, One Health, respiratory diseases, and non-communicable diseases.
  - CGH has expertise in modelling and data analytics. Through its global health partners, the center and its partners continue to collect multiple datasets on infectious diseases and indicators that impact the spread of those diseases.
  - All of the CGH's work seeks to promote knowledge, innovate, and facilitate operational research and implementation science.

Center Level Updates and Initiatives Related to Climate Change – Discussion

- BSC questions/observations/suggestions:
  - Given that climate change is an important area and that it is so cross-cutting, it is very important that CDC continues to engage in as broad a space as possible as this touches on all aspects of the agency's mission.
  - It is important to ensure that that migrants entering the US are fully vaccinated.
  - One of the themes that came across was prevention, which includes vaccination. The plan to establish a VFA program is commendable. Including the same reporting requirements as the VFC program would be beneficial.
  - A theme that often arises is the need to build laboratories and train epidemiologists, but this is missing the piece about training laboratory scientists to run the laboratories. It is promising to see that the LLS program has expanded to 25 fellows versus 5 last year. Hopefully, CDC will continue to expand that program.
  - It is outstanding to see the health impacts of climate change being raised to an agency-level priority. Many of these initiatives come down to the state and local level as piecemeal Requests for Applications (RFA), grant opportunities, one-off projects, or a categorial funding opportunity. This is not the way communities work. Communities want a more holistic approach to their various health concerns and priorities. Consideration should be given to how CDC can better integrate the essential activities that need to be conducted with communities around equity, climate, sustaining engagement, et cetera.
  - In terms of the questions pertaining to what can be done around climate, there needs to be an all-out effort to educate healthcare system partners about the health impacts of climate change and bring them on as allies. The American College of Physicians (ACP) has an excellent position paper on this, but there has been very little action on this front.
  - There is a Lyme disease vaccine in the late stages of development in the US. This is historically the type of vaccine that has failed spectacularly in terms of public confidence. Hopefully, efforts are being considered to pave the way to minimize vaccine hesitancy or optimize the use of this public health tool should it become available.
  - It was reassuring and inspiring to hear the impact and thoughtfulness of the many activities in which CDC is engaged.
  - CDC is encouraged to leverage science to an even greater degree in 3 areas: 1) ensuring that behavioral and social science priorities align with need; 2) bringing science to bear more in the design, integration, and improvement of surveillance systems; 3) utilizing serious gaming and exercises to train CDC professionals to be able to respond to rapidly changing and uncertain threats; and 4) utilizing modeling and forecasting to understand the data, make projections, and evaluating how this work translates to policy, guidelines, and investing in more efforts.
  - While fighting a million battles, the agency is clearly thinking strategically. CDC and its staff deserve a lot of credit for that.
  - This is a dangerous period in terms of STIs, but there is an incredible opportunity and need to examine the behavioral health issues to better understand the attitudes around mitigation, how to intervene in these situations, and how to help people reduce risk. The environment is very different with the availability of PrEP and effective HIV treatment, so the messages may need to change.
  - There is a lot of focus on the origins of COVID. It is troubling that despite talking about the wildlife-human interface since SARS, it seems there has been no global effective action or policy

around that. Interfaces in markets still seem to be occurring. It would be remiss to ignore this issue.
  - The cross-cutting approach to thinking about equity and climate is greatly appreciated. It would be helpful to better understand how the agency is thinking about building in and making explicit that communities and state and local health must work together to address cross-cutting issues.

- Responses from session presenters:
  - Dr. Romero indicated that individuals entering the US from areas of conflict are being vaccinated for measles and polio upon admission. Clearly, migration has an impact on the introduction of disease into US society.
  - Dr. Butler pointed out that the rapid intervention under Operations Allies Welcome (OAW) helped prevent the possibility of importation of measles in particular related to the evacuation of people from Afghanistan in 2021.
  - Dr. Jernigan added that there also is the ongoing care and vaccination of unaccompanied children in that setting as well.
  - While specific efforts have not been initiated for the Lyme disease vaccine that is in the pipeline, Dr. Romero indicated that within NCIRD there are efforts directed toward global hesitancy, misinformation, and disinformation that seem to be driving much of this forward. He is proud and happy to say that CDC is pushing back. They are funding partners and are getting down to the grassroots level to address the issues surrounding lack of confidence and are specifically addressing this on a cultural/linguistic level that is appropriate to the communities being served.
  - Ben Beard indicated that the DVBD is actively working to prepare the way for the Lyme vaccine that is currently in clinical trials. They have conducted focus groups and are planning a conference for 2023 in Atlanta where they will be hosting representatives from advocacy organizations and other thought leaders and stakeholders.
  - In terms of the human-wildlife interface, Dr. Jernigan noted that there has been a lot of research and mitigation in wet markets. This is a very complicated and diverse space in which to intervene.
  - Regarding efforts to implement the syndemic approach in terms of funding opportunities, one aspect is to ensure that the agency is leveraging the full flexibility that available in funding announcements to allow braiding of funding across program areas. It also is important for CDC to do a better job on the front end at planning ahead for multi-disease prevention activities and building encouragement in funding announcements for recipients to work with a variety of partners within their jurisdictions.
  - Dr. Romero added that the P4VE program specifically addressed issues of small community organizations that did not have the experience or human resources to apply to these large federal grants.

Updates from Working Groups

Acute Flaccid Myelitis (AFM) Task Force

Dr. Janell Routh, AFM and Domestic Polio Team Lead, provided an update from the AFM Task Force.

- **Since the AFM Task Force's last presentation during the ACD meeting in 2020:**
  - Despite preparation for an increase of AFM in 2020 following the every-other-year pattern that had been documented since the first increase in cases in 2014, AFM cases did not increase.
  - This likely was due to COVID mitigation measures put in place to stop SARS-CoV-2 transmission. Masks, social distancing, and school closures all likely had a role in decreasing other respiratory virus transmission, including enterovirus D68 (EV-D68)—the virus likely responsible for the increases in AFM in 2014, 2016, and 2018.
  - In 2014, a nationwide outbreak of severe respiratory illness in children due to EV-D68 occurred. Cases started in August, reached a peak at the end of September, and then slowly resolved through the late Fall and Winter months. The EV-D68 respiratory case peak occurred just before the corresponding peak in AFM.[41] This was the initial piece of evidence about this temporal association.
  - Since 2014, more evidence has been accumulated to support the causality between enteroviruses, including EV-D68 and AFM. An analysis of the 2018 AFM cases[42] showed that most patients had evidence of a viral infection shortly before weakness onset. Of the 228 AFM cases confirmed with onset in 2018, 97% of AFM cases had some combination of symptoms consistent with a viral illness, 80% had upper respiratory symptoms, 77% had fever, 46% had neck and back pain, and 22% had gastrointestinal (GI) illness.
  - It is interesting to note the timing of symptoms. Patients generally start with an upper respiratory illness (URI) and then develop fever and back pain shortly before weakness onset.
  - One of the working hypotheses about how AFM progresses is that viral replication occurs in the nasal pharynx causing the initial symptoms, and then the virus gets transported back to the spine where it directly invades the cervical cord and mounts an inflammatory response causing fever and back pain. Weakness then develops, and for AFM, that weakness is most common in the upper extremities.
- **Further evidence for the connection between EVs and AFM was demonstrated by 2 separate studies using different techniques, but both of which arrived at the same conclusions:**[43, 44]
  - Academic laboratories from the University of California San Francisco (UCSF) and Columbia University (CU) tested cerebral spinal fluid (CSF) from AFM patients for enterovirus-binding antibodies.
  - In both studies, enterovirus-specific antibodies in CSF from AFM patients were identified in significantly greater proportions than those from non-AFM controls.

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[41] Sejvar J, et al. Acute Flaccid Myelitis in the US, 2014, *CID*, 2016.

[42] Kidd, et al. *MMWR* 69(31;1031-1038.

[43] A) Mishra N, et al Ng TFF, Marine RL, Jain K, Ng J, Thakkar R, Caciula A, Price A, Garcia JA, Burns JC, Thakur KT, Hetzler KL, Routh JA, Konopka-Anstadt JL, Nix WA, Tokarz R, Briese T, Oberste MS, Lipkin WI. Antibodies to Enteroviruses in Cerebrospinal Fluid of Patients with Acute Flaccid Myelitis. mBio. 2019 Aug 13;10(4):e01903-19. doi: 10.1128/mBio.01903-19. PMID: 31409689; PMCID: PMC6692520.

[44] Schubert RD, Hawes IA, Ramachandran PS, Ramesh A, Crawford ED, Pak JE, Wu W, Cheung CK, O'Donovan BD, Tato CM, Lyden A, Tan M, Sit R, Sowa GM, Sample HA, Zorn KC, Banerji D, Khan LM, Bove R, Hauser SL, Gelfand AA, Johnson-Kerner BL, Nash K, Krishnamoorthy KS, Chitnis T, Ding JZ, McMillan HJ, Chiu CY, Briggs B, Glaser CA, Yen C, Chu V, Wadford DA, Dominguez SR, Ng TFF, Marine RL, Lopez AS, Nix WA, Soldatos A, Gorman MP, Benson L, Messacar K, Konopka-Anstadt JL, Oberste MS, DeRisi JL, Wilson MR. Pan-viral serology implicates enteroviruses in acute flaccid myelitis. Nat Med. 2019 Nov;25(11):1748-1752. doi: 10.1038/s41591-019-0613-1. Epub 2019 Oct 21. Erratum in: Nat Med. 2021 Oct;27(10):1849. PMID: 31636453; PMCID: PMC6858576.

- These CSF antibodies, which should not be present in normal CSF gave additional support to the leading hypothesis that enterovirus infection plays a key role in development of AFM.

- **EV-D68 infects spinal motor neurons in human AFM:**[45]
  - A recent study conducted and published in 2022 by a team from the University of North Carolina (UNC) led by Dr. Matthew Vogt took autopsy specimens from a child who died in 2008 from flaccid paralysis and respiratory failure, which was likely AFM before this illness actually had a name.
  - Autopsy findings showed inflammation in the anterior spinal cord and neuronophagia, or the destruction of neurons. The child's CSF did test positive for EV-D68 by polymerase chain reaction (PCR).
  - The subsequent analysis done by Dr. Vogt and his team showed EV-D68 RNA and protein in the anterior horn motor neurons of the spinal cord, demonstrating a direct link as to how EV-D68 can cause destruction in the motor neurons and provided a human example to support the mouse model work that has been done by Dr. Ken Tyler in Colorado.
- **Jumping forward to rhinovirus/enterovirus (RV/EV) and EV-D68 in August 2022:**
  - CDC began hearing about an increase for pediatric hospitalizations for RV/EV+ severe respiratory illness, and many colleagues told CDC anecdotally that this felt very similar to 2014.
  - An increase was observed in RV/EV+ respiratory specimens from the National Respiratory and Enteric Virus Surveillance System (NREVSS) coinciding with these hospitalizations, as well as an increase in EV-D68 detections among children with acute respiratory illness (ARI) in the New Vaccine Surveillance Network (NVSN).
  - The NVSN is a sentinel surveillance system comprised of a network of 7 children's hospitals throughout the country that surveys for other pathogens as well. This system detected EV-D68 in all 7 sites between April–August 2022, with a number of detections July–August 2022 greater than in same period of previous 3 years (2019, 2020, 2021).
  - It is important to note that prior to 2022, respiratory specimens were tested for EV-D68 only during the enterovirus season, which is approximately from July–November. However, year-round surveillance for EV-D68 began in the Summer of 2021.
  - A recent publication by CDC and its NVSN colleagues looked specifically at EV-D68 detections in 2022 compared to those of previous years.[46] Although a big year was anticipated in 2020, there was only some limited circulation of EV-D68. There was not an increase in 2021 during the typical time expected. However, detections of EV-D68 were observed in the Winter months in the US and in Europe. These detections continued to occur into January and February 2022.
  - CDC was on high alert for AFM cases at this time. Given the disruption in known circulation patterns of respiratory viruses, the agency was not sure what to expect. However, there were no AFM cases associated with the increase in EV-D68 in the Winter of 2021.
- **In response to the increase in EV/RV detections:**
  - A health advisory was distributed via the Health Alert Network (HAN) that included information about being aware of and alert for AFM.
  - Given the sharp increase in EV-D68 that was seen in 2022, it was assumed that an increase in AFM would follow and CDC rolled the AFM outbreak response into the ongoing IMS for the case of paralytic polio in NYS.
  - CDC tracks AFM activity by the number of reports of suspected cases received from health departments. AFM cases reports were tracking along the regular baseline of reports until about

[45] Vogt M et al. Enterovirus D68 in the Anterior Horn Cells of a Child with Acute Flaccid Myelitis NEJM 2022
[46] Ma et al, MMWR, 2022 Oct 7;71(40):1265-1270

Week 35, which corresponds to the last week in August. At that time, there was an increase in reports. The usual baseline is from 0–3 cases, but 7 reports were received over the span of a week. While it was anticipated there would be an exponential rise in reports in the following weeks, this did not occur.

- From August 2014 when surveillance was initiated through November 2022, other than the 3 increases (2014, 2016, 2018), there have been no further increases in cases. There have been 30 confirmed cases to date in 2022, which is consistent with what has occurred in other non-peak years.

- **The question on everyone's mind regards why there was no increase in AFM cases despite the increase in EV-D68 circulation:**
  - This is the first year this discordance has been observed. There are many hypotheses being floated, but additional research and surveillance will be needed to help answer this question.
  - The first hypothesis regards whether there has been a change in the virus that caused it to be less neuroinvasive or neurovirulent:
    - → It is known from sequencing efforts in academic centers and CDC, the clade circulating in 2022 is B3, which is the same clade that circulated in 2016 and 2018.
    - → Also known is that minor changes in the antigenic loops of enteroviruses, including polio, are frequent. These enteroviruses are expected to mutate at a rate of about 1% per year. Based on polio, vaccines remain effective. This suggests no major changes in the virus structure or its infective properties.
    - → One important task moving forward will be to see if the 2022 strains cause paralysis in mice like the other outbreaks have done.
  - The second hypothesis is that there could be changes in the host:
    - → Similar to the pediatric hepatitis investigation presented the previous day, it is necessary to better understand how host co-factors in patients with EV-D68 infection bring that patient to develop paralysis.
    - → What is it about the host that causes paralysis in just a few cases where most infections with EV-D68 resolve with no further sequelae.
    - → Attempts to understand host co-factors have been done through hypothesis-generating questionnaires and interviews, but none of these have returned any signal thus far.
    - → Given the immunity gap that exists over the past 3 years, there may be changes in host immunity that have impacted the virus's ability for neuro invasion and pathogenesis.
  - A third hypotheses that has been discussed is the concept of viral interference:
    - → With many respiratory viruses circulating, a non-specific immune response to one respiratory virus might block the pathway for EV-D68 to infect the nervous system.
  - A fourth hypothesis is that perhaps there are other co-factors that increase or decrease the risk of AFM:
    - → One advantage now compared to previous years is that the AFM community has been conducting several activities that have led to 2 biorepositories with specimens from AFM patients and patients who had acute flaccid weakness but were determined not to be AFM.
    - → NIH and CDC have been enrolling patients in these activities and banking critical specimens such as CSF, serum, and stool that can be used to further examine AFM pathogenesis moving forward.
- **During 2021-2022, the AFM Task Force continued to meet every 3–6 months:**

- Discussion topics have included the latest AFM surveillance data, latest EV/RV and EV-D68 surveillance data, the impact of the SARS-CoV-2 pandemic and other pediatric respiratory illnesses on clinical care and AFM research, updates on EV-D68 monoclonal antibodies and AFM research, and NIH AFM Natural History Study updates and plans for future research coming from that study.
- The next meeting will be January 19, 2023, during which the AFM-TF will be discussing hypotheses for why there was no increase in AFM in 2022 despite an apparent increase in EV-D68 circulation.

- **To summarize:**
  - COVID mitigation measures like masks, social distancing, and school closures likely prevented EV-D68 transmission and subsequently AFM in 2020 and 2021.
  - Despite an increase in EV-D68 detections in 2022, AFM cases remained low.
  - The underlying mechanism of disease remains the critical unknown in terms of what changed in the virus or host to prevent AFM cases in 2022.
  - The AFM Team, working together with academic and a number of other colleagues throughout the country, will be focusing on this in the months and years to come. This discordant year offers an opportunity to collect additional data to inform hypotheses about pathogenesis and the role that enteroviruses, including EV-D68 play in AFM.

AFM Task Force – Discussion

- BSC questions/observations/suggestions:
  - Perhaps in terms of the percent positive, it could be that there is just more testing because of COVID and the extension of viral testing and PCR more widely in the community.
  - Regarding sequencing data, while mention was made that the viruses were the same clade in 2022 as earlier, perhaps other potential clues could be drawn from whole genome sequencing (WGS).
  - The NIH's Natural History Study was primed with multiple sites ready to enroll patients, but then the epidemic went away. While this is a good thing, it was not what was anticipated. A monoclonal antibody has been developed that in animal models seems to mitigate neurologic damage, even when given hours after the flaccid limb is observed. This is promising for humans in that it might be possible to test this in a clinical trial in the future.
  - Since most diagnostic testing does not specifically identify EV-D68, EV-D68 is likely under-reported because it requires a secondary test. Perhaps it would be helpful if diagnostics were available to identify EV-D68 specifically in the initial test.
  - EV-D68 also causes respiratory illness that is pretty significant, particularly in children who otherwise have lung disease. The outbreaks are significant in some communities, and it is episodic as well. A diagnostic tool might be relevant in that situation, particularly if there were therapeutic tools such as monoclonal antibodies to treat those children.
  - A number of centers and groups across CDC have mentioned the need for testing. It would be helpful if CDC could assemble a list of priority pathogens across CDC that is forward-thinking in terms of the climate change discussions, syndromic testing, HIV, and STIs. Distributing this publicly to laboratories and developers to consider in terms of planning for future test development would be beneficial.

- Responses from Dr. Routh:
  - In terms of the percent positive, absolute numbers were assessed as well. Percent positive was presented to even out the discrepancies in testing over the years.

- In terms of WGS, the CDC laboratory found a couple of amino acid substitutions in the loops. Whether those lead to a phenotypic change in the virus has yet to be determined. Fortunately, there is a mouse model in Dr. Tyler's laboratory and the hope is to understand how these strains affect mice in that model moving forward.
- A case classification for AFM does not require laboratory confirmation. EV-D68 positivity is not part of the case definition. It is mostly based on acute flaccid weakness documentation by a neurologist and magnetic resonance imaging (MRI) images showing predominant gray matter lesions. None of the AFM-confirmed cases this year have tested EV-D68 positive in the specimens CDC has received. Only 1 enterovirus has been detected, which was EV-A71 from a stool of one of the confirmed patients.
- CDC is very intrigued by EV-D68 circulation, which is why surveillance was expanded to year-round to try to better understand circulation patterns. All of the sentinel surveillance sites test for EV-D68. The hope is to expand across additional laboratories, such as the Association of Public Health Laboratories (APHL) VPD Reference Laboratories, so that specimens coming in can be further typed for EV-D68. Any additional information that can be gathered about EV-D68 circulation would be useful.
- Prior to polio detection in NY, CDC explored the idea of doing EV-D68 detections in wastewater as an early warning system to alert the agency that AFM might be on the horizon. This idea has not been completely dropped, but the agency has just been moving forward with poliovirus testing in wastewater. That could be another way to determine where EV-D68 virus is circulating even before clinical manifestations are seen.
- In August 2022, certain academic centers were able to test their EV/RV specimens for EV-D68, but others had to send their samples to CDC for confirmation. Having diagnostics for EV-D68 more widely distributed would be useful. A paper was recently published on the new 2018 primers and the PCR assay for EV-D68, which is out and available.

Food Safety Modernization Act Surveillance Work Group (FSMA SWG)

Dr. Virginia Caine, FSMA SWG Chair, presented an update on behalf of the FSMA SWG.

- **In terms of the FSMA SWG goals and major topic areas:**
  - The goals of the FSMA SWG are to provide advice and recommendations regarding the improvement of foodborne illness surveillance to the HHS Secretary through the CDC BSC/DDID in the areas of better governmental coordination and integration, evaluating and improving surveillance systems, and external stakeholder collaboration and communication.
  - Major meeting topics discussed by the FSMA SWG have included foodborne disease surveillance and data access enhancements in the context of CDC modernization, advances in surveillance technology, outbreak investigation challenges, and revisiting FSMA Sec 205 to identify potential future topics.
- **Regarding foodborne disease surveillance modernization and data access enhancements:**
  - PulseNet is a national laboratory network that connects foodborne, waterborne, and One Health-related illness cases to detect outbreaks.
  - The PulseNet network uses DNA fingerprinting for bacteria in order to help detect the thousands of outbreaks that are occurring.
  - The key point to recognize is that BioNumerics, the current PulseNet bioinformatics proprietary system will stop operating December 31, 2024. Therefore, it is critical to have a new fully tested system in place by that time that is cloud-based, open-source, and modular.

- PulseNet will be an important part of overall integration efforts. In terms of key milestones, the initial pilot platform has begun. However, there is a lot to accomplish in a fairly short period of time. PulseNet 2.0 software must be fully operational by November 2024.
- The FSMA SWG conducted an analysis of all of the software available and did not identify a single, off-the-shelf solution. As a result, CDC is having PulseNet develop an open-source platform using several products combined.
- Laboratories have identified some potential obstacles that may occur with regard to IT, system longevity, cost, and an appropriately skilled workforce. A roadmap has been developed and it is known that a tremendous amount of resources will be required and training will be critical for the new version at the CDC and state and local partners, as well as for any other partners who are utilizing this new solution.
- PulseNet feeds data into the Bacteria, Enterics, Amoeba, and Mycotics (BEAM) Dashboard that has been developed. The result of this effort will make data more visible to the public. It provides more real-time *Salmonella* serotype-specific information from PulseNet to the public and targets data requests from industry and partners in academia.
- An initial step to this effort was the development of a static quarterly report that was published based on this PulseNet data.
- While *Salmonella* was the first pathogen that has been addressed with this dashboard, the plan is to add Shiga toxin-producing *Escherichia coli* (STEC) as the second pathogen.
- There are plans to link additional sources of data with the PulseNet isolates on the BEAM Dashboard. This will allow users to examine these data from different perspectives and different units of analysis.

- **In terms of the NWSS:**
  - Wastewater surveillance provides an early warning of changing infection trends in a community.
  - CDC has built a wastewater surveillance platform that represents over 134 million Americans. The NWSS program is now in 46 states, 5 major cities, and 2 territories using CDC funds for wastewater surveillance and there are now 2 Centers of Excellence.
  - CDC provides this support through ELC funding to the state, tribal, local, and territorial (STLT) groups in separate contracts.
  - The beauty of this system is the ability to sample over 113,000 unique wastewater samples. This represents at least 1400 sites in 50 states, 2 territories, and 7 Tribal communities.
  - Wastewater data can inform resource allocation, mitigation efforts, public health messaging, and personal exposure decisions.
  - There are 3 strategies in terms of processing wastewater surveillance: 1) a core strategy that involves regular surveillance for endemic or common diseases, such as influenza or antibiotic resistance; 2) an emergency strategy that involves rapid response for outbreaks, emergencies, and natural disasters; and 3) pandemic preparedness that involves horizon scanning for potential epidemic or pandemic threats.
  - Challenges for NWSS development and sustainability including extending coverage, given that 20% of the US is unsewered; improved metrics are needed to evaluate progress and improvements; an optimal geographic and temporal sampling frame is needed for multiple targets; improved methods and streamlined workflow are needed; the impact of vaccination and variants must be taken into consideration; improved data submission, dissemination, and messaging are needed; and ethics must be incorporated into growing wastewater surveillance systems.
  - In 2023, NWSS will expand surveillance to include antimicrobial resistance genes, other respiratory viruses, enteric infections and emerging pathogens.

- **The next area on which the FSMA SWG was improving *Cryptosporidium* surveillance in the US:**
  - It is known that with the existing infrastructure, only 1%–2% of cases of *Cryptosporidium* are reported to the CDC. Only 5% of these cases have been molecularly characterized as *Cryptosporidium*.
  - This means that there is limited capacity to detect national *Cryptosporidium* transmission. When the US surveillance system is used, localized raw milk and unpasteurized apple cider have been identified historically as being involved. *Cryptosporidium* also has been detected in agriculture water.
  - In comparison, European national surveillance programs estimate that 5.6%–12% of C*ryptosporidia* are attributed to food and those programs regularly detect foodborne outbreaks.
  - Since 2015, CryptoNet enhanced surveillance has been the formal CDC-state collaboration that collects laboratory and epidemiologic data. This sentinel, passive surveillance system grew from 7 states participating in 2015 to 13 states now participating in this system at varying levels of capacity. While some of these states are performing in-house typing using the standard typing method that uses a single gene target (gp60), several are developing the capacity to perform WGS.
  - The modernization of CryptoNet, which involves the integration of existing infrastructure and workflows, will result in the ability to expand the capacity to identify traditional and novel links, may be able to detect non-localized distributed national cryptosporidium transmission, and will shorten the time for detections of clusters, outbreaks, and any surveillance anomalies.
  - In addition, CryptoNet epidemiology data are being migrated into the System for Enteric Disease Response, Investigation, and Coordination (SEDRIC). This will enable real-time linking of the epidemiological and molecular data to detect clusters and assess potential exposure.
- **There are a number of challenges involved in solving multistate foodborne outbreaks with strong ingredient collinearity:**
  - Ingredient collinearity can delay or prevent identification of a foodborne outbreak vehicle.
  - Many different types of collinearity scenarios are encountered in multistate foodborne outbreaks.
  - Several methods are currently applied in multistate outbreaks when ingredient collinearity is encountered, but they are not always successful.
  - New epidemiologic approaches are needed, but identifying ways to further leverage traceback, market share, and product testing data are critical for this operation.
- **Concerning an example of an outbreak of STEC O157 infections linked to an unknown ingredient that occurred in 2022:**
  - There were 109 cases reported from 6 states. There were 52 hospitalizations, 13 of which had haemolytic uraemic syndrome (HUS). These isolates were distinct from, but near those from a 2021 outbreak that was linked to organic spinach.
  - Of the cases, 83% reported eating at a Wendy's restaurant in the week before their illness started. Among the 68 Wendy's eaters, 79% ate burgers, 12% ate only a chicken sandwich, 68% ate burgers or sandwiches with romaine lettuce, and 56% ate burgers or sandwiches with onion and tomato. This investigation was unable to identify any meal items or ingredients that stood out compared to the overall order data.
  - The outbreak occurred in a single distribution chain, so traceback led to the same suppliers for several ingredients. However, this investigation was not solved because all of the product testing was negative.
- **Investigations into frozen raw breaded chicken products is of tremendous interest:**

- Chicken is the #1 animal protein consumed in the US, with most broiler meat now sold as further processed.[47] Chicken is estimated to be responsible for more *salmonellosis* than any other food category.
- The stuffed chicken products have caused the most outbreaks with the source confirmed, with data suggesting that contamination is high.
- There is a notable lack of data for further down the line chicken products (e.g., pre-cooked, frozen).
- The amount of *Salmonella* contamination from a whole chicken is estimated to be about 9.8%, cut-up parts are about 15%, and further processed are at 25%.
- Outbreaks associated with frozen raw, breaded, stuffed chicken products have occurred across the US but may be underestimated.
- The US could look to Canada as a model, given that they can narrow down the type of chicken involved. In 2019, the Canadian Food Inspection Agency required the producers of frozen raw breaded chicken products to implement new control measures for *Salmonella.* Following the implementation of these control measures, surveillance data showed that the incidence of *Enteritidis* infections were 33% lower compared to 2017.
- None of the consumer-based interventions being promoted in the US have been sufficient to prevent illness. Survey data with consumers suggest that these meals are commonly consumed, may be commonly undercooked, so they may be responsible for many illnesses.
- Food Safety and Inspection Service (FSIS) planned actions might result in a substantial decrease in illnesses from chicken.

- **CDC updates:**
  - CDC Moving Forward and related efforts are going to be important.
  - The FSMA SWG is very interested in following up on Cronobacter surveillance and CDC activities in terms of surveillance, investigations, laboratory, and partnerships.
- **Potential future topics for the FSMA SWG include:**
  - Cooperation with international partners and harmonization of methodologies with WGS/PulseNet international
  - Continued dialogue on data modernization efforts (e.g., BEAM Dashboard, PulseNet)
  - Culture-independent diagnostic tests (CIDTs) and the impact on surveillance and progress with metagenomics development
  - Climate change in terms of shellfish and *Vibrio*, produce, and changes in wildlife patterns
  - Issues surrounding surveillance and response of shellfish-related outbreaks
  - The major challenge of investigating frozen breaded chicken outbreaks
- **In terms of next steps:**
  - The FSMA SWG tentatively plans to meet in May 2023.
  - An annual report will be prepared for FY23 meetings to present to the BSC/DDID in December 2023.

[47] National Chicken Council

Updates from the DFWED on Culture-Independent Diagnostic Testing

David Boxrud, Enteric Diseases Laboratory Branch (EDLB) Associate Service Fellow, presented an update on CIDT for foodborne pathogens and CDC plans to address some of the challenges of new methods.

- **In terms of background:**
  - Traditionally, the methods to diagnose enteric bacteria include culture, enzyme immunoassays (EIA), enzyme-linked immunosorbent assays (ELISA), serology, and direct fluorescent antibody (DFA or dFA).
  - Culture typically has been the predominant method used. It has been around for a long time and is compatible with some public health needs.
  - Over the last 10 years, CIDTs have been developed that do not rely on culture. The FDA approved the first diagnostic multiplex, multianalyte molecular panel in 2013 to detect many pathogens in one test. Since that time, quite a few additional panels have been approved.
  - CIDTs are changing the way in which clinical laboratories diagnose infectious diseases, are generally used as a syndromic panel, and are now widely available in clinical laboratories.
- **CIDTs have a number of benefits:**
  - Faster results are achieved with CIDTs, which is great for patient diagnosis.
  - A single test can detect or rule out many pathogens (e.g., viruses, parasites, and bacteria) at one time. There is one panel that can detect up to 22 pathogens in about an hour.
  - It has a unified workflow, so it is quite easy to incorporate into a clinical laboratory.
  - In many cases, it is likely to be more sensitive than culture.
  - There is high potential in resource-poor settings.
  - One of the greatest features of this is that clinical laboratories are incorporating these methods into their laboratories, which may allow them to eliminate or reduce the amount of different types of testing like culture, which relies on quite a number of different types of media and quite a lot of expertise.
- **CIDTs also can have a lot of challenges, including in the public health space:**
  - There is some concern about interpretation. There may be uncertain meaning of some of the targets in terms of whether they are true pathogens or what their role is in disease.
  - Sometimes with these panels, there may be multiple positive analytes in a single specimen. This makes it somewhat challenging to understand which particular pathogen is responsible for a disease.
  - These molecular panels detect nucleic acid as opposed to a specific bacteria or virus. There is a potential that there is not viable virus or bacteria, but the body is still shedding residual nucleic acid, so the test is being called “positive” even though there is no live pathogen in the specimen.
  - A major concern is that a specimen may be rendered incompatible with culture-based tests. Most of the CIDT panels use a stool in a transport media at which point they are compatible with culture. However, some tests are being developed that are not compatible with culture in that the cultures are inactivated right at the start. Therefore, there would not be an opportunity for downstream culture to occur. It is a challenge that this does not result in a culture or isolated bacteria that could be used for downstream analysis.
- **In the pre-CIDT and CIDT eras:**
  - GI diagnosis was compatible with public health. A person would become ill, present to a health care setting, and have a stool collected and cultured that would be used for clinical diagnosis.

However, the isolated bacteria also could be used for public health testing for molecular surveillance and outbreak detection and antimicrobial resistance monitoring.
  - However, GI diagnosis in the CIDT era no longer relies on an isolate, the workflow is somewhat different, and the burden of culture shifts to public health.
  - The workflow differs in that when someone develops an illness, a stool is collected and a CIDT is used to diagnose the illness. In most cases, there is no need for the clinical laboratory to perform culture. In fact, they do not want to perform culture in many cases because it poses an extra burden that uses precious resources.
  - While some clinical laboratories may continue to do some culture , the burden of culture is shifted in large part to public health laboratories.
  - A number of public health activities depend on isolates for culture-based data, including identifying outbreaks; estimating disease burden, trends, and attribution analysis; monitoring and identifying antibiotic resistance (AR); and screening in sensitive settings.
- **Isolates are used for detecting outbreaks with molecular data:**
  - Public health laboratories test clinical isolates using WGS to subtype and characterize them.
  - Data from pathogens identified by state, county, and city public health laboratories are transmitted to a centralized database at CDC where the data can be monitored for illnesses with the same molecular "fingerprint."
  - PulseNet tells epidemiologists about commonalities and clusters to investigate to try to find the source of the illness. Bacteria with the same "fingerprint" are more likely to come from a common source.
- **PulseNet has been extremely successful over the past 25 years in identifying outbreaks:**
  - PulseNet is comprised of 87 laboratories, including all state health departments, some city health departments, and FDA and USDA laboratories.
  - Standard laboratory methods are used for PulseNet and results are held in the national database, which all participants can search.
  - There are conferences, meetings, and communications across the network such that the data produced in one state or jurisdiction can be compared anywhere else throughout the states.
  - There is a strong international link between PulseNet, PulseNet Canada, and PulseNet international.
  - Given that many of the same methodologies are being used worldwide, this is a powerful system to identify clusters in the US and worldwide.
  - A study published in 2016 discusses the benefits of PulseNet.[48] This study estimates that PulseNet has "connected the dots" to detect foodborne outbreaks and prevent over 270,000 illnesses from *Salmonella, E. coli*, and listeria every year.
  - Each year, PulseNet saves at least half a billion dollars in medical costs and lost productivity. Every year, $70 dollars are saved in lost productivity for every $1 spent on PulseNet. This illustrates that this extremely important system is vital to public health.
- **Another key program that is dependent upon getting bacteria isolates is the ability to estimate disease burden, trends, and attribution analysis:**
  - Disease burden data are used to understand the progress being made in reducing foodborne illness, but changes in the methods can have an impact on the trend data.

[48] Scharff 2016. Am J Prev Med 50:S66-S73.

- With foodborne disease surveillance an effort is made to put mitigation strategies in place. In order to understand the effectiveness of that mitigation strategy, good consistent data are needed from year-to-year. CIDTs make that somewhat more challenging.
- CIDTs differ from culture in a number of ways, one of which is use characteristics. This pertains to how and why tests are ordered by healthcare providers. With culture-based methods, the healthcare provider might request a *Salmonella* culture. With CIDT, a physician can order a test for 22 pathogens at once.
- Another way in which CIDTs differ is in terms of performance characteristics in that CIDTs have different sensitivity and accuracy than traditional testing.
- CIDTs also differ in how individual illnesses and outbreaks are or are not reported to public health once they are identified and in terms of how they are counted.

- **Monitoring AR resistance is another important area that is dependent on isolates:**
  - As everyone knows, AR is a huge concern in the US and internationally.
  - In 2019, the CDC published the report[49] titled, "Antibiotic Resistance Threats in the United States, 2019." One of the key features of this report is that tracking of data and using data to get tracked resistance through networks are vital. Therefore, it is vital to maintain these networks that help with the ability to understand AR over time. Some of the pathogens identified in this report as serious or urgent are the enteric pathogens. Thus, it is imperative to maintain the surveillance system moving forward.
- **Based on the situation of GI CIDTs becoming more common and there being some challenges:**
  - A forum was organized by APHL, Pew, CSTE, and The Ohio State University titled, "2018 Forum on Culture-Independent Diagnostics: Charting A Path for Public Health."
  - This incredible forum brought together participants from a variety of perspectives, including leaders and SMEs in public health, clinical microbiology, medicine, epidemiology, molecular biology, health law, policy, economics, and medical/laboratory regulation who represented government, academia, and the medical device industry.
  - Discussion focused on GI CIDT issues, knowledge gaps, solutions, and future studies.
- **The DFWED CIDT Action Plan:**
  - Based on forum discussions, the CDC developed a "Draft DFWED CIDT Action Plan" to try to address the challenges that CIDTs have on CDC's Foodborne Disease Outbreak Surveillance System (FDOSS), and develop strategies to address these challenges before a situation occurs in which surveillance systems are extremely adversely affected.
  - This action plan addresses and has been divided into 4 areas, which are to: 1) Preserve PulseNet, which is vital going forward; 2) address AR monitoring and ensure that there is an ability to identify novel AR mechanisms and monitor the trends with AR; 3) address case-based and outbreak surveillance; and 4) establish recommendations for the use of CITDs in sensitive settings.
- **There are a number of strategies with respect to the first component of the CIDT Action Plan to preserve PulseNet:**
  - Currently, when CIDTs are being performed, someone is engaged in reflex culture. Sometimes it is at the clinical laboratory where they are getting an isolate and sending it to the public health laboratory. More often at this point, the specimen is sent to the public health laboratory and the public health laboratory is performing the culture.

[49] https://stacks.cdc.gov/view/cdc/82532

- In the short-term, isolates absolutely must be preserved. To achieve that goal, isolate recovery must be expedited and reflect culture testing and reimbursement strategies for the future must be identified.
- For the long-term, there likely will be a time when it will not be possible to get isolates very often. Therefore, strategies are needed to develop direct-from-specimen pathogen characterization methods for public health needs directly from a stool and not require isolation; and to improve IT infrastructure for transmission of laboratory data.
- With regard to maintaining isolated availability (short-term), it is necessary to: 1) develop expedited isolate recovery protocols, creating streamlined methods for reflex cultures with public health laboratories and APHL; 2) develop reflect culture testing and reimbursement strategies, given that there is no standard approach to who should perform and pay for a reflex culture; and 3) create model reporting rules for states, given reporting rule language varies considerably from state-to-state and that the way in which reporting rule language is written impacts whether laboratory regulatory agencies can enforce compliance.
- In terms of preserving PulseNet (medium term), an exciting way to think about characterization of GI pathogens without isolates directly from stool is through the development of Highly Multiplexed Amplicon Sequencing (HMAS). HMAS uses a number of technologies and essentially looks for the most important parts of the cell instead of trying to isolate the whole bacteria. CDC is developing panels that can amplify thousands of different targets of interest on different pathogens. The results can be used to subtype the organism without having to isolate the bacteria. HMAS pilots are underway in Minnesota and Colorado to test workflow, protocols, and compatibility with public health laboratory needs. The first assay they are looking at is *Salmonella* subtyping. This assay could be used with other PulseNet pathogens, undiagnosed diarrheal illness, or waterborne pathogen subtyping. One of the challenges of this methodology is that it is trying to amplify a lot of different genes in one specimen.
- Regarding the long-term approach to preserving PulseNet, the future is a metagenomics approach. A metagenomics or shotgun metagenomics approach is exciting. Essentially, sequencing is done for everything in a stool or other type of specimen and then is sorted out after all sequencing is completed. While this is a powerful method that could provide a lot of new information that would not be specific to a single pathogen, there are some significant challenges. For instance, the volume of bacteria, viruses, and parasites in stool make it difficult to tease out the pathogen of interest. Another drawback of a metagenomics program is cost. Sequencing is expensive under the best of circumstances, and metagenomics requires a lot more sequencing on each specimen to be able to identify the pathogen of interest. However, sequencing is becoming less expensive over time and that trend is anticipated to continue. An additional drawback is that shotgun genomics is like "looking for a needle in a haystack."
- The "needled in the haystack" problem can be addressed with binning metagenomics in which almost everything is sequenced for subtyping. Some of the related strategies include Bait Capture, Hi-C, and Binning Informatics.
- The national IT infrastructure must be improved at the federal level to support genomics and metagenomics, and internet bandwidth must be improved at public health laboratories in order for them to have adequate bandwidth and speed for WGS and metagenomic analysis.

- **Regarding the second component of the CIDT Action Plan to address AR:**
  - It is critical to maintain some isolates to identify novel antibiotic resistant mechanisms. If isolate-yielding specimens become inadequate, CDC will need to establish other mechanisms to ensure some isolates are available for phenotypic testing.

- AR targets should be integrated into specimen-based surveillance, model practices should be developed to interpret AT gene detection in specimens and AR targets should be integrated into HMAS panels.
- Additional methods are being developed to link AR targets to pathogens for stool. Fortunately, some of the methods for addressing AR are the same as those to preserve PulseNet. For instance, Hi-C can be used to improve pathogen genome recovery and AR attribution directly from stool.

- **In terms of the third component of the CIDT Action Plan to address case-based and outbreak surveillance:**
  - CIDT usage trends should be monitored among reporting clinical laboratories on an ongoing basis.
  - CIDT test denominator data (e.g., the volume of CIDT tests) shows how CIDT use patterns are changing. A laboratory volume project, last conducted in 2018–2019, obtains denominator data from FoodNet sites. The current plan is to conduct this survey every 5 years, depending upon funding.
  - It is important to continue to collect ELR records, including test volume data, from 2 major commercial laboratories. That is a somewhat easier way of getting this information for analysis, there are challenges with that as well.
  - Data collection by HL7 messaging should be collected through the NNDSS that includes test type and diagnosis data for a number of enteric pathogens, with a long-term goal to expand the data collection to all states and all reportable enteric pathogens.
  - Surveillance data should be adjusted to account for increased use of CIDTs for better understanding of trends.
  - In terms of case and outbreak definitions, CDC worked with CSTE to modify case definitions to include CIDTs and will work with CSTE to consider adding additional diseases and case definitions to the list of nationally reportable conditions (e.g., ETEC). In addition, CDC will work with states and academic partners to better understand co-detections (e.g., EPEC, EAEC) resources permitting. CDC also will convene a working group to develop new confirmed outbreak definitions that include CIDTs.
- **Regarding the fourth element of the CIDT Action Plan to establish recommendations for the use of CITDs in in sensitive settings:**
  - STEC and *Salmonella* outbreaks in daycare and food service settings require serial consecutive negative culture results if someone has tested positive in order to prevent the spread of pathogens. However, the utility of CIDTs in such instances is unknown.
  - It is known that bacterial culture is becoming less common in clinical laboratories, while CIDTs are rapidly becoming the norm.
  - In 2022, CSTE created a workgroup to address the issue using available data. They anticipate completing draft recommendations by the end of 2022. After reviewing the existing data for using CIDTs in these settings, their preliminary conclusion was that it is appropriate to use CIDTs in these settings. While it presents both challenges and opportunities, it is acceptable to use CIDTs as long as the challenges are known. They also recommended that the Food Code should be updated to be consistent with this recommendation.
  - Based on a shedding study, someone who is culture positive may be a likely transmission risk for agents that are spread person-to-person such as *E. coli* 0157:H7. It is unknown whether someone who is positive for a foodborne pathogen by CIDT method is still a likely transmission risk. This is a knowledge gap that could be addressed with a study, funding permitting.

- **One area that is not addressed on the CIDT Action Plan that has become more of an issue over time is CIDT assay performance:**
  - Some pathogens and platforms yield suboptimal test performance (e.g., *Vibrio*). Thus, there is a need for a methodical and ongoing way to assess how CIDT tests are performing, identify issues, and identify public health reflex culture issues (e.g., old specimens, suboptimal culture methods) within public health laboratories to ensure that and make sure that there are no inconsistencies with the specimens that public health laboratories are getting for reflex culture.
  - Consideration must be given to how public health should respond if there is poor CIDT performance and who is responsible for identifying these issues. While traditionally this has not been the role of public health, should it be? What is industry's role? What role do clinical laboratories play? This is a highly challenging issue.
  - Minnesota Department of Health published a study[50] in which they identified quite a number of what they believe are false positives for *Vibrio*. There is very good evidence that these are false positives. Even though they were not able to be confirmed, these false positives looked different epidemiologically.
  - Based on FoodNet data on *Vibrio* infections by year from 1996–2021,[51] a lot of CIDT-only *Vibrio* positives have been observed over this timeframe. Thus, there is a good chance that many of these are false positives and are impacting the surveillance system.
- **In conclusion:**
  - While CIDTs have many advantages, they also pose a significant risk to the foodborne disease surveillance system.
  - The US must respond to the probability of the need for a post-isolate public health foodborne disease system.

FSMA SWG and DFWED - Discussion

- BSC questions/observations/suggestions:
  - Concern was expressed about the impact of CIDT on AR and how it could be measured if all of the clinical laboratories will be making diagnoses but will not have the ability to test the susceptibility of antibiotics. Though most enteric diseases do not require treatment, susceptibility is important for those who have a severe illness that is life-threatening and may require hospitalization. It is not clear that a state laboratory can handle numerous stool cultures from different persons in different counties. If the susceptibilities are unknown, practitioners may be treating blinding and that could generate more AR.

- Responses from Dr. Caine and Dr. Boxrud:
  - Dr. Boxrud recognized the potential impact of CIDT on AR and that it illustrates the challenges and the burden that this has placed on public health laboratories. Many laboratories have put in a lot of resources to be able to perform culture to get isolates. CDC's National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS) is monitoring resistance across the entire nation and looking at 1 out of every 20 *Salmonellas*, so there is a system. Given that the amount of isolates will be reduced over time, CDC's ability to perform monitoring is going to be reduced over time.

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[50] Marijke Decuir, Randal C Fowler, Elizabeth Cebelinski, Kirk Smith, David Boxrud, Carlota Medus, Evidence of False Positivity for Vibrio Species Tested by Gastrointestinal Multiplex PCR Panels, Minnesota, 2016–2018, Open Forum Infectious Diseases, Volume 8, Issue 6, June 2021, ofab247, https://doi.org/10.1093/ofid/ofab247

[51] https://www.cdc.gov/foodnetfast/

- Dr. Caine emphasized that it is very difficult to conduct investigations of outbreaks if the types are unknown, in addition to the increased burden to providers if states have to collect their own stools, send them to their clinical laboratories, and send a specimen to the state laboratory as well. This needs careful consideration.

Public Comments

The floor was opened for public comments on December 7, 2022, at 5:17 PM and December 8, 2022, at 12:45 PM. No comments were made during either public comment session.

Closing Comments

Dr. LeDuc offered sincere gratitude to all of the speakers and participants for an incredibly fruitful discussion and valuable input.

With no further business posed or questions/comments raised, the December 7-8, 2022, meeting was officially adjourned at 1:00 PM.

APPENDIX A: Meeting Participants*

BSC Members

In Person
Virginia Caine
Emily Erbelding
Jesse Goodman
Jim LeDuc
Jennifer Rakeman

Virtual
Alexander Billioux
Debra Birnkrant
Jeff Duchin
Grace Lee (representing Advisory Committee on Immunization Practices)
Michael Loeffelholz
Jeanne Marrazzo
Ilhem Messaoudi
Lauren Meyers
Susan Philip
Emily Spivak

Partners and Other Public Visitors

Jessica Baggett *(Association of State and Territorial Health Officials)*
Eli Briggs *(Infectious Diseases Society of America)*
Amanda Cosser *(Association of Public Health Laboratories)*
Beth Daly *(Council of State and Territorial Epidemiologists)*
Kathy Dolan *(Association of State and Territorial Health Officials)*
Janet Hamilton *(Council of State and Territorial Epidemiologists)*
Peter Kyriacopoulos *(Association of Public Health Laboratories)*
Kirsten Larson *(Association of Public Health Laboratories)*
Marcelle Layton *(Council of State and Territorial Epidemiologists)*
Felicia Lewis *(City of Philadelphia)*
Ericka McGowan *(Association of State and Territorial Health Officials)*
Amelia Poulin *(Association of State and Territorial Health Officials)*
Sharon Shea *(Association of Public Health Laboratories)*
Chris Taylor *(Association of State and Territorial Health Officials)*
Kelly Wroblewski *(Association of Public Health Laboratories)*
Courtney Youngbar *(Association of State and Territorial Health Officials)*

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Kuhnert, Wendi
Lubar, Debra
Macrae, Jim
Mahon, Barbara
McGarry, Sherri
McLean, Clarissa
Mermin, Jonathan
Pirkle, Jim
Rodriguez, Sergio
Romero, Jose
Routh, Janelle
Schildknecht, Kimberly
Sharp, Donald
Sheomaker, Trevor
Slocumb, Sharon
Tate, Jacqueline
Tauxe, Robert
Tomlinson, Hank
Walke, Henry
Wiley, Sarah

Other USG Staff

US Department of Agriculture:
Andrea Cote
Bonnie Kissler

*Additional participants may have included other CDC staff, individuals from Deputy Director for Infectious Diseases partner organizations, and members of the public, including individuals who may have joined remotely but were not recorded.

APPENDIX B: Meeting Notes from the Chair

The Board met on the CDC main campus with four members and one Ex Officio member present in person and 7-8 members joining virtually.

We appreciated the comprehensive **Overview** provided by Dr Jay Butler sharing the exciting activities underway in the infectious disease programs.

- We were struck by the many leadership positions current filled by staff in acting roles and look forward to the appointment of highly qualified individuals to promote stability and consistent program guidance.
- We were saddened to learn of the passing of two Board members and appreciated the tributes made by CDC staff honoring their contributions.
- We noted a significant number of retirements by key CDC leaders and are concerned about staff morale.

Dr Debra Houry provided a nice **Welcome** and commented briefly on the CDC Moving Forward initiative.

- The $3.2 B investment being made to state and local public health departments was welcome news. Comments were made recognizing the significance of this new investment but realizing that there is a major need for long-term funding to improve our national public health infrastructure. Board members volunteered to assist in advocacy for continued investments and to provide metrics to document impact and success.

Dr Jim Macrae gave an excellent overview of the **Moving Forward initiative**, stressing the need for timely provision of accurate information that is presented in an easily understood format that will allow efficient utilization by the public health community and the public in general.

- Board comments were supportive of the initiative and felt that implementation would help address many of the challenges seen during the COVID-19 response.
- Presentations to the Board by CDC programs later in the meeting consistently incorporated the goals and objectives highlighted in the plan and suggests that there is strong buy-in across the agency.

Updates from across the agency were especially valuable.

- Jim Pirkle gave an excellent presentation on the new initiatives in laboratory sciences designed to improve quality of processes, procedures and results that will hopefully address some of the significant shortcomings experienced during the COVID-19 and previous responses. The proposed collaborations with industry and establishment of IDIQ agreements could greatly benefit future emergency responses. His talk was very well received and led to valuable discussions.
- Henry Walke briefed the Board on the Center for Preparedness and Response activities. The need for greater engagement with DHHS ASPR was discussed and follow up introductions were made to some state and regional officials that could enhance CDC's engagement in this area. There is no Ex Officio member on the BSC from DHHS ASPR and perhaps adding one would facilitate communications and coordination between CDC and ASPR.
- Denise Cardo gave a nice summary on the Center for Global Health activities and the global engagement activities of CDC were mentioned often in subsequent presentations from various programs. CDC's engagement globally is critically important.

- The presentation by Jose Montero on Health Equity was very well received and the challenges of health equity were frequently noted in other presentations, for example in monkeypox vaccine uptake.

Updates on recent and ongoing **Outbreaks** provided important information on emergent issues and demonstrated the value of CDC technical programs in ID and global engagement.

- Excellent briefings were given on the ongoing Ebola outbreak in Uganda, monkeypox (Mpox) in the USA and internationally, cholera in Haiti, acute pediatric hepatitis, polio in the USA and COVID-19. Each of these clearly demonstrated CDC's essential leadership in responding to these outbreaks, as well as the value of CDC laboratory capabilities to provide critical information needed to facilitate the responses.
- Discussion of the monkeypox response included recognition of the challenges faced by public health professionals as the incidence of sexually transmitted diseases rises while resources needed to address them dwindle.
- A robust discussion about the benefit and shortcomings of wastewater surveillance was timely and valuable. This emerging surveillance tool is clearly powerful but further consideration is needed to maximize the benefits while avoiding possibly significant pitfalls.
- This session, as well as virtually all others, pointed to the complexity of infectious diseases and the essential interconnectivity of resources found across the agency that are needed to address outbreaks and sustain preparedness. The value of the DDID in coordinating activities and maintaining technical excellence was abundantly clear.

The Board enjoyed learning more about CDC's efforts to address public health needs for **Special Populations,** specifically those homeless or incarcerated. This is an especially timely initiative and clear progress has been made and important partnerships have been developed. The Board was pleased to see CDC's leadership in addressing this difficult problem. These talks also built upon some of the comments made by Jose Romero earlier when he spoke on Health Equity.

Duncan MacCannell provided an exciting overview of progress being made in **Advanced Molecular Detection.**

- The Board recognizes the important value to public health that molecular characterizations of pathogens is bringing. It also realizes that there are many technical challenges to be overcome to optimize the benefits of the program, including developing infrastructure, essential training and adequate funding to implement and sustain the program.
- There will be a continuing need across the agency to ensure that epidemiologists understand and utilize the data generated from molecular testing and that laboratorians recognize the need to interpret and present results in a manner useful for public health applications. The EIS and Laboratory Leaders programs offer excellent opportunities for such cross training, but more will be needed at all levels of public health.

Center Updates

- The presentation from the **Food Safety Modernization Act surveillance work group** and updates from the Division of Foodborne, Waterborne and Environmental Diseases on **Culture Independent Diagnostic Testing** provided valuable information on the evolution of the PulseNet surveillance system and culture independent diagnostics. These advances will contribute to the success of the advanced molecular detection initiative.

- An update from the work group on **Acute Flaccid Myelitis** offered yet another example of how modern molecular techniques are helping CDC address new and emerging challenges and further stressed the importance of linking epidemiology and laboratory resources for a comprehensive, coordinated response.

The Board enjoyed the excellent presentations by Center leaders on updates and initiatives related to **Climate Change.** These presentations were very well received and especially timely.

- Dan Jernigan gave a wonderfully comprehensive summary of the many and varied impacts of climate change on infectious diseases and recognized the linkage with the wider One Health Initiative. His talk provided an excellent foundation for more specific comments provided by Deron Burton on HIV, TB, viral hepatitis and sexually transmitted diseases, Jose Romero on immunizations and respiratory diseases, and Hank Tomlinson on global health.
- The Board had a valuable discussion regarding the **proposed new division on COVID and other respiratory diseases.** Such a program could contribute important expertise and guidance for a wide variety of respiratory pathogens that have not been addressed in depth in the past.
- The importance of aggressive communications to address disinformation regarding vaccines was fully supported by the Board.
- Board members commented on the need for greater engagement with social scientists to enhance effective communications as well as explore opportunities for more relevant preparedness exercises.

Meeting support

- We appreciate the excellent meeting support provided the DDID staff and by Dr Laura Hughes-Baker, designated federal official, and Ms Hilary Eiring, executive secretary.
- Audio-visual support was very good and participants attending virtually were able to contribute effectively; however, we missed the broader discussion and ability to hold informal conversations on relevant issues. Hopefully future meetings will have greater in person attendance.
- Most CDC presenters attended in person and having them with us was very much appreciated.
- Very few CDC staff who were not presenting attended in person. This was unfortunate, since there is always benefit in the broad information exchanged across the various ID programs and the informal discussions that are held.
- Similarly, while there were over 100 participants on the line at some points during the meeting, there was limited opportunity for them to contribute to the discussion. Past meetings had several representatives from important partnerships attend in person and hopefully that will resume in the future.

Conclusions

- The breadth and scope of CDC's programs in infectious diseases is extraordinary and benefits greatly from the centralized organization and control offered by the Deputy Director for Infectious Diseases.

- Infectious diseases are relevant to virtually all programs across CDC and the Board recognizes the valuable steps being taken to integrate capabilities from across the agency.
- The emphasis on Climate Change and public health is timely and will serve as an important foundational theme for programs across the agency for years to come.
- The CDC Moving Forward initiative appears to offer a good framework to help address the shortcomings experienced in the COVID-19 response.
- The application of modern molecular techniques to public health is well-justified and will benefit the agency and the nation greatly. Important challenges remain, including sustained funding and provision of adequate training, among others.
- Steps being taken to address challenges in CDC laboratories are well-founded and should contribute the future successes. Further engagement with the commercial sector could lead to improved preparedness and more efficient capacity building across the entire public health enterprise.
- The focus on emergency preparedness is clearly justified and could benefit from greater engagement through the DHHS regions and enhanced coordination with ASPR.
- The national investment to build public health infrastructure is welcomed but sustained, reliable future funding will be needed. The erosion of our national public health infrastructure is being recognized by Congress. Board members stand ready to help define needs, offer metrics to measure success and to justify future investments.
- Hints of low morale among CDC staff and lack of permanent leadership in critical positions are concerning.
- The Board was disappointed to not have had the opportunity to meet with Dr Walensky either in person or virtually.

I hereby certify that to the best of my knowledge, the foregoing minutes of the proceedings of the meeting of the Board of Scientific Counselors, Deputy Director for Infectious Diseases on December 7-8, 2022, are accurate and complete.

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James W. LeDuc, PhD, MSPH Date
Chair, BSC, DDID