

Executive Summary



Background

Since 2001, the Council of State and Territorial Epidemiologists (CSTE) has periodically assessed the numeric and functional capacity of epidemiology programs in the United States and its territories. Seven Epidemiology Capacity Assessments (ECAs) have been undertaken: in 2001, 2004, 2006, 2009, 2013, 2017, and 2021. This report does not include numbers for Big Cities Health Coalition members, local or tribal health department capacity.

These assessments serve a wide range of stakeholders, including state and national public health leaders and schools and programs of public health. Workforce data, for example, inform government planning for the provision of public health services with respect to staffing, salary levels, and relative state and federal funding levels. For schools and programs of public health, which train much of the epidemiology workforce, the ECA provides information about the skills and program area expertise needed to respond to public health priorities, such as data analytics, genomics, and mental health.

The COVID-19 pandemic required an immediate response from state health departments and challenged the workforce's ability to track the spread of COVID-19 and disease outcomes and respond accordingly. The 2021 ECA included questions to measure the pandemic's effects on epidemiologic capacity and staffing within state, District of Columbia (DC), and territorial health departments. Although the pandemic might have impacted results for the 2021 ECA, the added questions were intended to enable the reader to incorporate the pandemic's effects particularly on trending analyses from previous ECAs.

Public health has entered a period of rapid change as enhanced funding opportunities arise and the landscape of the field transforms. Furthermore, addressing emerging public health topics, such as genomics and informatics, requires specialized knowledge and skills. Increased understanding of the current status of the workforce and the perceived challenges facing health departments is essential to identify efforts to adjust to the changing landscape.

One of the most important recent changes has been a move toward updating the Ten Essential Public Health Services (EPHS) to reflect current practices. The EPHS are the national standard for public health activities (Centers for Disease Control and Prevention [CDC], 2014). CDC released an updated version of the EPHS in September 2020. Three of the EPHS relate directly to epidemiology: EPHS 1 (monitoring health status), EPHS 2 (investigating health problems and hazards), and EPHS 9 (research and evaluation). Previous ECAs used EPHS 1 (monitor), 2 (assess), 9 (research), and 10 (evaluation). The updated EPHS combines research and evaluation into EPHS 9. Therefore, to ensure continuity and the ability to measure trends, the 2021 ECA measures EPHS 1, 2, and 9.

The 2021 ECA was launched in January 2021 and completed in April 2021. Building on recommendations from the 2017 ECA, the 2021 ECA was designed to achieve 5 goals:

1. Enumerate and describe the applied epidemiology workforce;
2. Describe the training needs of the applied epidemiology workforce;
3. Describe the funding supporting the applied epidemiology workforce;
4. Describe the level of epidemiology capacity in state and DC health departments; and
5. Assess the impact of the COVID-19 pandemic on epidemiologic capacity and staffing.

Methods

The assessment was developed in an online format using Qualtrics® software and was piloted in October 2020 in 3 states. After revision, the assessment was distributed to the State Epidemiologist in the remaining states, DC, and the 8 US territories.

Most of the questions were short-answer, multiple choice, scales, or matrix tables. Wherever possible, questions, response categories, and definitions remained identical to previous ECA questions to ensure comparability with previous data. The 2021 ECA added generalist and COVID-19 response as program areas. The 2021 ECA included epidemiologists employed by the state, DC, and territorial health departments; epidemiologists working at the state level who are federal assignees, contract employees, contractors from schools of public health to work at the health department, fellows, or state employees assigned to work at the local or regional level. For the purpose of this assessment, jurisdictions were asked to count only COVID-19 response staff serving as an epidemiologist or performing functions consistent with those of an epidemiologist. Contact tracers or case investigator staff were not included. The 2021 ECA also included 4 open-ended qualitative questions.

Quantitative data were analyzed in Excel 2008 and SAS 9.4 statistical software. For most questions, results were tabulated separately for the 50 states and DC and for the 4 participating territories (American Samoa, Guam, Northern Mariana Islands, and Puerto Rico). The territories were analyzed separately because they differed substantially from the 50 states and DC in their organization of epidemiology services, hiring practices, and salary scales. For some analyses, data were stratified by population size: small (<2 million; 14 states and DC), medium (2–6 million; 17 states), or large (>6 million; 19 states) and by region (Northeast, South, Midwest, and West). Qualitative data from the open-ended questions were coded and grouped thematically by CSTE staff during analysis, and illustrative quotations were selected for inclusion.

Results and conclusions

The response rate for the states and DC was 100%; 4 (50%) US territories responded. Overall, the 2021 ECA shows that the epidemiology workforce continues to grow; however, ongoing unmet need exists in both well-established areas, such as infectious diseases, and emerging program areas, such as genomics and mental health. Compared with 2017, capacity decreased for EPHS 1 (monitoring health status), from 84% to 76% reporting substantial to full capacity and for EPHS 2 (investigating health problems and hazards), from 92% to 88%. Capacity in EPHS 9 (research and evaluation) increased from 39% to 43% reporting substantial to full capacity; however, capacity is still substantially lower than capacity for EPHS 1 and EPHS 2. Participants cited job interests/fulfillment, job benefits, and the opportunity for a flexible schedule as current assets for recruiting and retaining a qualified workforce, but there remains a need to reform civil service job categories to include more competitive salaries and advancement opportunities and career ladders to attract a diverse applicant pool. Similar to 2017, most states and DC also noted the need for training in data analytics. As state health departments continue to rely heavily on federal funds, there is less flexibility for prioritizing emerging and local needs and added workplace insecurity.

Key Findings

Numbers of epidemiologists

The number of epidemiologists continues to increase.

- A total of 4,135 epidemiologists work in the 50 states and DC, a 23% increase over the 3,370 enumerated in 2017 and the highest number observed in the ECA.
- The number of epidemiologists per 100,000 population increased 21% since 2017, from 1.04 to 1.26/100,000. This composite value continues to mask low rates (<1/100,000) in 15 states. The program area with the greatest absolute and relative increase from 2017 to 2021 was informatics, for which 102 epidemiologists were added, a 107% increase.

- For infectious disease, the number of epidemiologists decreased by 340 since 2017; however, 36% (1,498) of the workforce remains concentrated in infectious diseases and 24% (978) in COVID-19 response. The decrease in epidemiologists in certain program areas, particularly infectious disease, might reflect the need to reallocate personnel during the COVID-19 response. The number of epidemiologists in chronic disease and maternal and child health also decreased since 2017.

The need for additional staffing remains, even in large program areas that have the majority of epidemiologists.

- State Epidemiologists expressed the need for nearly 2,196 additional epidemiologists to reach full capacity in the 3 EPHS, representing a 53% increase over the 4,135 current number, for a total of 6,331 epidemiologists.
- The greatest number of positions needed were in infectious disease (562), COVID-19 response (454), chronic disease (153), maternal and child health (135), and environmental health (135).
- Although states expressed the need for additional capacity in areas such as genomics and mental health, the total number of positions needed in these areas was relatively small. Genomics needs an additional 46 epidemiologists (a 922% increase), and mental health needs an additional 57 epidemiologists (a 656% increase).

EPHS capacity

States continue to have substantial capacity for monitoring and assessing health problems but lack capacity for research and evaluation.

- In 2021, the percentages of states and DC with substantial to full capacity for EPHS 1 (monitoring health status) was 76%, a decrease from 84% in 2017.
- The percentages of states and DC with substantial to full capacity for EPHS 2 (investigating health problems and hazards) was 88%, a decrease from 92% in 2017.
- The percentages of states and DC with substantial to full capacity for EPHS 9 (research and evaluation) was only 43% in 2021. However, research and evaluation were evaluated separately in 2017 with EPHS 9 and EPHS 10. In 2017, 39% of

states and DC reported substantial to full capacity in EPHS 9 (research and evaluation), whereas only 22% reported substantial to full capacity in EPHS 10 (evaluation).

Training Priorities

Similar to 2017, data analytics remains a top training priority among states.

- Thirty-four states mentioned data analytics as the top training priority; 16 states also mentioned software skills (statistical software, such as Epi Info, SPSS, and R) and 14 mentioned systems thinking (systems development, change management, strategic planning) as training needs.

Access to peer-reviewed literature that is not open-access remains limited in many states.

- Timely access to peer-reviewed literature is essential to respond to emerging threats and to ensure that ongoing activities are evidence-based. A quarter of all states and DC have access to peer-reviewed literature within 24 hours of requesting it. Although overall access has increased significantly since 2017, 14% of states and DC still do not have access to peer-reviewed literature, and >40% of states had to wait >24 hours after a request to gain access.

Funding

Federal funding continues to pay for most epidemiology activities and personnel and limits adequate coverage of underserved program areas.

- Federal funds constituted 85% of funding for all epidemiologic activities in state programs. Unlike previous ECAs, 2021 federal funding percentages also include COVID-19 funds provided by the federal government. States contributed an average of 12%, and other sources accounted for only a small percentage of the total in most states.
- Similar to epidemiology activities, federal funds constituted 83% of funding for personnel, including COVID-19 funds. States contributed an average of 15%, and other sources accounted for a small percentage of the total in most states.
- Federal grants constitute the vast majority of funds for virtually all program areas; only for vital statistics and generalist program areas did state funding contribute >50% of funding.

Recruitment and Retention

The key assets for recruiting and retaining the epidemiology workforce include job interest and fulfillment, job benefits, and job security.

- The median low and high salaries for the State Epidemiologist position were \$119,000 (range \$47,000–\$239,000) and \$175,000 (range \$81,000–\$327,000), respectively. Most salary increases in career-level categories did not surpass the 7.9% inflation rate from 2017 to 2021, and many states struggled to stay competitive because their salaries ranged well below the national average.
- Epidemiologists are starting at inadequate base salaries and often not receiving regular increases to cope with inflation and the increased cost of living. In an era of increasing education costs and student debt, the salaries offered by health departments are likely to be even less competitive than in the past.
- The most cited assets for recruiting and retaining epidemiologists were job interest and fulfillment, benefits, security, and a flexible schedule. States also cited the opportunity for skills training as an important strategy for retaining epidemiologists.
- In qualitative responses, states also noted the need for standard position descriptions and career ladders that define clear opportunities for advancement.
- Minimum and maximum salaries in the 50 states and DC increased with educational attainment, and physician pay was considerably higher than pay for PhDs and DVMs. Salaries also increased by career level, although the more managerial positions of Deputy and State Epidemiologist had substantially higher median salary ranges than those at senior level and below. No consistent pattern emerged in minimum and maximum salary levels for the 5 career levels by state size or by region.
- Participating states cited allowing a flexible schedule, encouraging taking paid leave, and promoting awareness of mental health as major strategies for minimizing burnout. Epidemiologists struggle with burnout because of the lack of capacity in state health departments and an inability to take adequate paid time off.

Epidemiology Leadership

A high proportion of epidemiologists are new to their positions, and others are likely to retire in the upcoming years.

- Persons in the State Epidemiologist position have been on the job for a median of 4 years, down from 5.8 years in 2017. This is the second lowest median recorded for the State Epidemiologist position since it was added to the ECA and indicates a high amount of turnover for this role.
- One in 6 epidemiologists have been in their position for <1 year, and 41% have served in their current position for at least 5 years.
- New epidemiologists are faced with learning technical aspects of the job, navigating hiring and administrative practices, and obtaining funding to support epidemiologic activities. Additionally, epidemiologists need to be able to navigate political challenges and manage large incoming funding, such as Epidemiology and Laboratory Capacity and other grants. These challenges are further exacerbated by epidemiologists transitioning into the role during the COVID-19 pandemic.
- Leadership training and mentoring might be important in states with new State Epidemiologists, and succession planning might be important for states in which State Epidemiologists will be retiring soon.

The number of states with program area leads has increased for almost all areas, but most states still lack leads in areas such as oral health, mental health, and genomics.

- The greatest increase in program area leads occurred in informatics, where the percentage of jurisdictions with a lead epidemiologist nearly doubled, a significant increase from 37% to 71%.
- Despite overall gains in the number of states with program area leads, more than half of states and DC lacked program leads in oral health, mental health, and genomics.
- Lack of a lead affects a state's capacity to monitor and investigate health problems in the program area and to compete for funding in these areas.

Case-based Surveillance and Outbreak Management Systems

Nearly all states implemented an additional contact-tracing system for the COVID-19 response; however, most states were unsure whether they would continue using the system after the pandemic.

- Seventy-eight percent of states and DC reported also using an Outbreak Management System, defined as a system that “supports the initial characterization, investigation, response, and containment of outbreaks through the collection and analysis of data.” This is a notable increase from the 69% of states reporting use in 2017.
- When asked about contact tracing systems, 94% of states implemented an additional contact tracing system for the COVID-19 response. States that were not going to continue use of the system cited issues of long-term sustainability and problems integrating the system into their surveillance plan.
- When asked to rate their case-based surveillance system’s ability to adapt for COVID-19 based on a scale of poor, fair or good, nearly half of the states and DC rated their system’s adaptability as fair.

Recommendations

Infrastructure

Systems need to be in place to ensure connectivity and critical coordination between clinicians, laboratorians, and public health professionals for timely standardized data collection and analysis to accurately describe the health of communities and to prevent disease. Faxing case reports and duplicate data entry is antiquated and negatively impacts the validity of public health data. Shifting to electronic data collection and management is vital to support the infrastructure transformation resulting in timely and accurate data. Frequently epidemiologists use outdated computers with limited software licenses, which significantly slows the processing and analysis of data. The technology available to support epidemiology activities needs to be upgraded to ensure electronic data collection and timely data analysis and reporting.

Recommendations

- Create and maintain coordinated, interoperable data systems that provide timely, complete, useful, and accurate data from collection through dissemination.
- Adopt national standards for electronic data collection and reporting to ensure comparisons between providers and jurisdictions.
- Ensure public health providers have adequate equipment and software for field work and data analysis.

Workforce

Additional epidemiologists in state health departments are clearly needed, as evidenced by the substantial gap between current and ideal numbers to maintain current operations. The workforce requires personnel with the appropriate skills to bolster capacity across program areas and enable departments to continue sustained projects and address emerging issues.

Recommendations

- Create and fill designated positions in health departments to support robust epidemiology activities, including Deputy State Epidemiologist, Data Coordinators to oversee data modernization efforts spanning program areas, and leads for every program area.
- Create standardized career ladders for use across departments that demonstrate clear paths for advancement. Use these career ladders to support the classification of epidemiologists within human resource systems and set competitive salary ranges.
- Provide flexible spending allocations that enable health departments to prioritize their jurisdictional needs for personnel and technology.
- Enhance hiring to increase the number of epidemiologists across program areas, particularly areas with high need, such as genomics and mental health.
- Promote strategic recruitment and hiring of epidemiologists with specialized skills, such as genomics, data analytics, and research and evaluation.
- Incorporate epidemiology into middle and high school curricula, and expand postgraduate training experiences, including the Applied Epidemiology Fellowship, to attract professionals to work in public health and serve their communities instead of

choosing careers in academia, clinical care, or corporate settings.

- Prioritize having a minimum of 1.26 epidemiologists per 100,000 population with an ideal goal of 5 epidemiologists per 100,000 for public health transformation.

Recruitment and Hiring

Faced with less competitive salaries and funding restrictions, many health departments struggle to recruit and hire a workforce with the appropriate skills. To attract and fill positions with qualified candidates, states need standard position descriptions and updated Applied Epidemiology Competencies (AECs) that reflect the changing public health landscape. Additionally, hiring teams need to incorporate strategies that focus on recruiting a workforce with diverse backgrounds and diverse skills.

Recommendations

- Update the AECs to incorporate emerging areas of practice and specialized skills.
- Create and update position descriptions using the AECs that describe the skills and responsibilities of epidemiology personnel by position type (entry, mid, senior manager, and senior scientist).
- Update pay scales to be competitive with other public health sectors.
- Foster collaboration between states and Human Resources departments to facilitate recruitment planning and hiring that focuses on obtaining a workforce with diverse backgrounds, subject area expertise, and skills.

Retention

State health departments continue to struggle to retain epidemiologists, particularly mid-level and senior level epidemiologists. The inability to retain epidemiologists results in frequent turnover, loss of institutional knowledge, and lack of consistent program management. Training to improve job engagement and agency investment through upskilling of the current workforce is needed.

Recommendations

- Create opportunities for advancement within the state health department that enable epidemiologists to obtain career growth.

- Enable states to self-assess current salary ranges and increase salaries to be competitive with surrounding states and geographic areas and to other industries, including academia, clinical care, and the private sector.
- Provide on-the-job training that will upskill the existing workforce to meet emerging needs, including data analytics, software skills, and leadership development.
- Support cross-training between epidemiologists, preparedness personnel, and laboratory staff to update response plans and enhance future response efforts.
- Bolster succession planning to preserve institutional knowledge, including the creation and maintenance of mentorship programs.
- Provide resources to personnel that focus on managing and minimizing burnout, especially during public health emergencies.

Collaboration

Collaboration is fundamental for achieving change and including all relevant stakeholders in decision making. Epidemiologists in state health departments are fundamental to public health and need to have a voice with federal partners. Additionally, state health departments should form academic partnerships to increase access to literature, enhance learning opportunities for students, and ensure relevant training for emerging epidemiologists.

Recommendations

- Foster collaboration between CDC and state health departments that enables inclusion of State Epidemiologists in predecision meetings and provides important feedback and context to decision makers.
- Initiate collaboration with local providers for the smooth onboarding of Electronic Laboratory Reporting, Electronic Case Reporting and syndromic surveillance systems.
- Partner with academic institutions for increased access to peer-reviewed literature, applied learning opportunities for students, surge capacity support by academic epidemiologists, and assurance that current public health curricula meet the emerging needs of the field.

Future Assessments

Future assessments are critical for measuring the progress of the applied epidemiology workforce over time. Additional ECAs should be considered to evaluate the progress in data modernization efforts, assess changes in infrastructure, and monitor progress toward creating a more representative and diverse public health workforce and the field's response to structural racism. Future assessments should also incorporate metrics to evaluate surveillance systems and data completeness, accuracy, and timeliness.

Recommendations

- Conduct additional ECAs that assess ongoing data modernization efforts in state health departments and focus on changes in infrastructure.
- Field assessments that measure surveillance systems' ability to produce complete, accurate, and timely data.
- Assess and monitor public health's progress toward creating a more representative and diverse public health workforce and the field's ongoing response to structural racism as a public health issue.