COUNCIL OF STATE AND TERRITORIAL EPIDEMIOLOGISTS

2017 Epidemiology Capacity Assessment Report

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Acknowledgments

The Council of State and Territorial Epidemiologists (CSTE) completed this assessment in cooperation from state and territorial health departments. CSTE acknowledges the contributions of Joseph McLaughlin, Kathy Turner, Patty Quinlisk, Richard Danila, Sara Huston, Sharon Watkins, Mike Landen, Elizabeth Daly, Robert Harrison, and Aaron Fleischauer. Contributing CSTE National Office Staff members are Jessica Arrazola, Amanda Masters, Mia Israel, Jennifer Lemmings, Jeffrey Engel, Dhara Shah, Meredith Lichtenstein Cone, Kevin Gibbs, Becky Lampkins, and Jeremy Arieh. Other partners we would like to acknowledge include Emily Holubowich and Nancy Maddox. The primary author is Nancy Binkin, CSTE Consultant.

For more than seven decades, CSTE and the US Centers for Disease Control and Prevention (CDC) have worked together to improve the public's health by supporting the efforts of epidemiologists working at the state, territorial, and local levels by promoting the effective use of epidemiologic data to guide public health practice and improve health. CSTE and its members represent two basic components of public health – epidemiology and surveillance.

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2017 Epidemiology Capacity Assessment

Key Findings

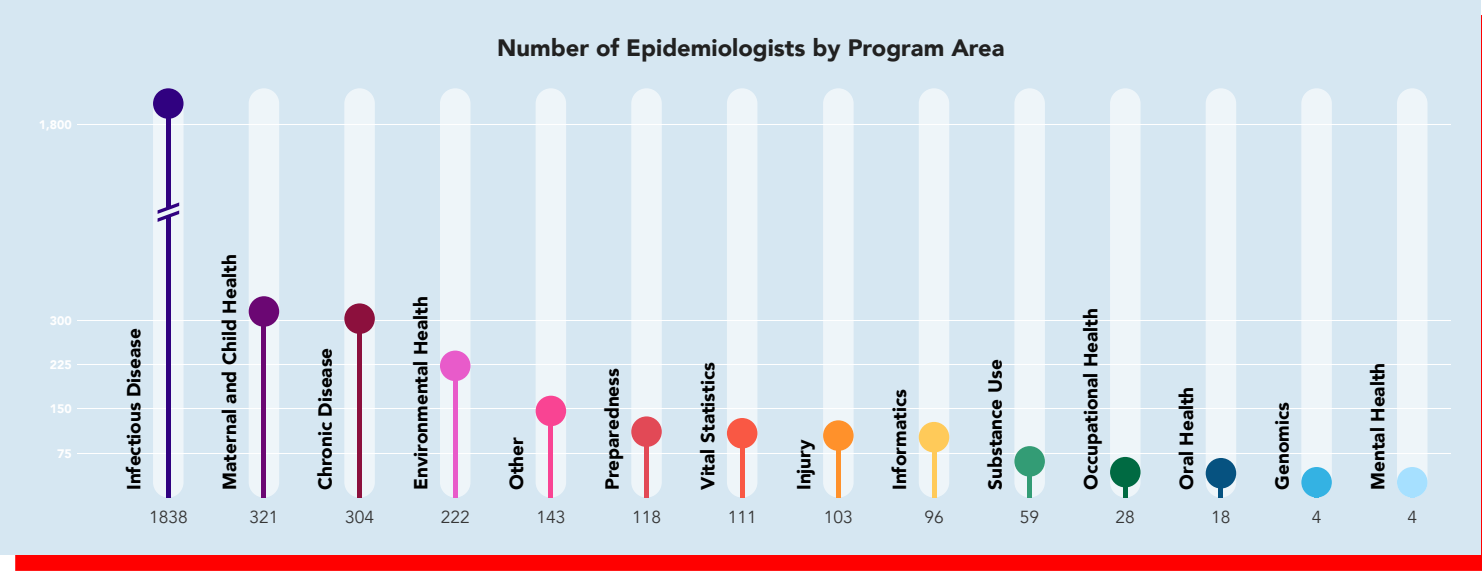
INTRODUCTION

Since 2001, the Council of State and Territorial Epidemiologists (CSTE) has conducted six periodic **Epidemiology Capacity Assessments (ECAs)** to monitor the numerical strength and functional applied epidemiology capacity in state and territorial health departments. The 2017 ECA was completed by the State and Territorial Epidemiologists from all 50 states, the District of Columbia, and three territories, between April and August 2017. The ECA serves many purposes:

- Monitor changes in the quantity and quality of the applied epidemiology workforce
- Identify policy, system and environmental influences affecting epidemiology services and staffing
- Provide data to health departments for evidence-based decision making and assessment of performance compared to other jurisdictions
- Describe the needed skills and expertise among the applied epidemiology workforce

RESULTS

The state and territorial epidemiology workforce continues to grow, but more epidemiologists are needed in both well-established and emerging program needs. From 2013-2017, the number of epidemiologists **increased 22%** to a total of 3370, the highest increase observed since the ECA began in 2001. Three quarters of epidemiologists work in infectious disease, chronic disease, and maternal and child health (MCH), while **less than 5% work in emerging areas**, such as substance abuse, informatics, and mental health.



Less than 5% of epidemiologists work in the emerging areas of substance abuse, informatics, and mental health

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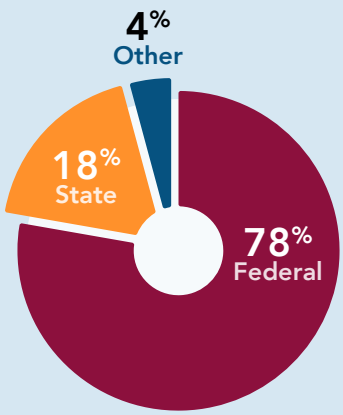
Capacity

Capacity to monitor and investigate health problems remains high, but evaluation and research capacity lag behind. Overall, capacity is low in emerging program areas such as informatics, substance, abuse, and mental health. An additional 1200 epidemiologists are needed to reach full capacity, which would be a 36% increase over current capacity.

1200
additional epidemiologists are needed to reach full capacity

- In 2017, the percentages of the states and DC that reported substantial to full capacity to monitor health status and investigate health problems and hazards were high (84% and 92%, respectively). Yet only 39% reported substantial to full capacity in evaluation and 22% in research.
- The percentage of states reporting substantial to full capacity overall was greatest for the program areas of infectious disease (96%), chronic disease (78%), and MCH (75%), and lowest for informatics (2%), substance abuse (16%), and mental health (25%).

Funding Sources



Training, Hiring, & Retention

Training, hiring, and retaining a qualified workforce represent serious challenges to health departments, as does the continued reliance on federal funding.

- The greatest training priority was in analytics, defined as informatics and the application and translation of public health data.
- Restrictions on offering competitive pay (80%), salary scale (76%), opportunity for promotion (73%), and hiring quickly (62%) were challenges for hiring.
- The most frequently cited issues for retention were opportunity for promotion (88%), salary scale (80%), merit raise restrictions (70%), and loss to the private sector (65%).
- In 2017, more than three quarters of health department epidemiology funds were provided by the federal government, with an average of 20% provided by the states. Heavy reliance on federal funds reduces flexibility, adds to insecurity in the workplace, and may affect the ability to cover core functions.

RECOMMENDATIONS

1. Develop a strategy to increase epidemiology capacity, especially in evaluation, research and underdeveloped program areas, such as substance abuse, mental health, and informatics and data translation. The next generation of epidemiologists needs the appropriate skillsets and subject-matter expertise to complement existing staff.
2. Review and develop new recruitment and retention strategies for state health department epidemiologists.
3. Maintain efforts to establish training standards and provide training to ensure a highly qualified public health epidemiology workforce. In particular, CSTE and others must work closely with public health schools and programs to ensure a supply of graduates trained in emerging areas and in evaluation and applied research techniques.
4. Explore the gap between state public health mandates and state capacity to meet those mandates. Policy makers, especially at the state level, must provide adequate funding to close critical gaps—especially for epidemiology positions and training—if health departments are to meet the needs of their populations.
5. Conduct future assessments to monitor workforce trends and identify changes in the workforce and overall epidemiology capacity.

The entire report can be found at cste.org. For further information, contact Jessica Arrazola at jarrazola@cste.org.

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CSTE

EXECUTIVE SUMMARY

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. So far, six of these Epidemiology Capacity Assessments (ECAs) have been undertaken: in 2001, 2004, 2006, 2009, 2013 and 2017.

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, informs governmental planning for the provision of public health services, as well as comparisons with other jurisdictions with respect to staffing, performance on key epidemiology competencies, 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 on the skills and program area expertise needed to respond to current public health priorities, such as substance abuse prevention and control.

In recent years, there has been a move toward greater standardization of public health services. The Ten Essential Public Health Services (EPHS)—a list of core public health responsibilities drafted by a Centers for Disease Control and Prevention (CDC) working group, based on the landmark 1988 Institute of Medicine report *The Future of Public Health*—constitute the national benchmarks for public health practice (Centers for Disease Control and Prevention, 2017). Four of the EPHS relate directly to epidemiology: monitoring health status, investigating community health problems and hazards, evaluating the effectiveness of public health interventions, and conducting research. According to the 2013 ECA, overall US capacity for monitoring health status and investigating health problems was good, but public health capacity for research and evaluation was limited. Moreover, the assessment showed that at least 4,100 additional epidemiologists were needed to achieve adequate capacity to successfully perform these four EPHS. The 2017 ECA provides the opportunity to assess whether these additional epidemiologists have been hired and whether the current ability to provide these four critical public health services has changed.

The 2017 ECA was launched in April 2017 and completed in August 2017. Building upon recommendations from the 2013 ECA and the 2014 Public Health Workforce Interest and Needs Survey (Liss-Levinson, Bharthapudi, Leider, & Sellers, 2015), the 2017 ECA was designed to achieve four goals:

1. Enumerate and describe the applied epidemiology workforce.
2. Describe the skills of the applied epidemiology workforce.
3. Describe the funding supporting the applied epidemiology workforce.
4. Describe the level of epidemiology capacity in state health departments.

Methods

The assessment questionnaire was developed into an online format using Qualtrics software and was piloted in February 2017 in three states. After revision, the questionnaire was sent out in electronic format to the State Epidemiologists in 50 states, the District of Columbia, and the US territories.

Most 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. For the first time, an open-ended question was included that asked: *As the State Epidemiologist, what are the most critical issues you face?*

Quantitative data were analyzed in Excel 2007 and Epi Info™ 7. For most questions, results were tabulated separately for the 50 states and Washington, DC, and for the three participating US territories, American Samoa, Northern Mariana Islands, and the US Virgin Islands, all of which had populations of <110,000 and differed substantially from the 50 states and DC in their organization of epidemiology services, hiring practices, and salary scales. For purposes of some analyses, data were stratified by state population size (<2 million; 15 states), 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 question asking about the most critical problems State Epidemiologists face were coded and grouped thematically by CSTE staff and a CSTE consultant, and illustrative quotations were selected for inclusion.

Results and conclusions

The response rates for states and DC was 100%, while three US territories responded. Overall, the 2017 ECA shows that the epidemiology workforce continues to grow and improve in quality. However, there is ongoing unmet need for additional epidemiologists in both well-established areas such as infectious disease, as well as in emerging areas, including substance abuse and informatics, for which many states lack program leads. While capacity continues to improve overall and within program areas, evaluation and research capacity lag behind capacity for monitoring and diagnosis of public health problems. Moreover, there is not a strict relationship between growth in workforce size and EPHS capacity. As detailed below, problems in hiring, retaining, and providing training for a quality workforce remain problematic, as does the continued reliance on federal funding, which reduces flexibility, adds to workplace insecurity and may affect the ability to cover basic functions, such as surveillance.

Key Findings

Numbers of epidemiologists

The number of epidemiologists continues to increase.

- The number of total epidemiologists working in the 50 states and DC is 3370, a 22% increase over 2013 and the highest number yet observed in the ECA.
- Much of the increase occurred in program areas such as infectious disease that already have many epidemiologists.
- The number of epidemiologists per 100,000 population increased 20% since 2013, to 1.04/100,000.
- This composite value masks very low rates (≤0.5/100,000) in six states, four of which have populations greater than 6 million.
- Values may underestimate the true number per 100,000 in states with large city and county health departments (which employ their own epidemiologists), but further monitoring of capacity is needed, especially in states with low EPHS capacity.

There is a perceived need for additional staffing, even in program areas that already have many epidemiologists.

- Participating State Epidemiologists expressed the need for nearly 1200 additional epidemiologists at a master's level or higher to reach full capacity in the four EPHS, representing a 36% increase over current levels.
- Nearly 600 of the additional epidemiologists needed are in infectious disease, MCH, and chronic diseases—areas that already represent 75% of the epidemiology workforce.
- While states felt that they needed additional capacity in areas such as substance abuse, mental health, and genomics, the total number of positions needed nationally was small (64 for substance abuse, 42 for mental health, and 20 for genomics).

EPHS capacity

Changes in the number of staff have not been accompanied by substantive improvements in overall and program area-specific EPHS capacity.

- A jump in the overall number of state health department epidemiologists between 2009 and 2013 was associated with contemporaneous improvements in capacity

for the four epidemiology-dependent EPHS. This effect, however, was not replicated between 2013 and 2017.

- In 2017, the percentages of the states and DC with substantial to full capacity for EPHS #1 (monitoring health status hazards) and #2 (investigating community health problems and hazards) capacity were high (84% and 92%, respectively), with little change since 2013.
- Only 39% of jurisdictions had substantial to full capacity in EPHS #9 (evaluating the effectiveness of public health interventions), up from 35% in 2013. For EPHS #10 (conducting research) there was a drop from 29% reporting substantial to full capacity in 2013 to 22% in 2017. This low capacity may limit health agencies' ability to respond to funding opportunity announcements.
- There were no statistically significant changes in the percentage of jurisdictions reporting substantial to full capacity in any of the program areas, despite changes in the number of epidemiologists.
- These findings suggest that hiring additional staff is insufficient to achieve hoped-for improvements. Instead, states need to place greater emphasis on hiring epidemiologists with specific skillsets, such as evaluation and research, to attain EPHS capacity goals. The low capacity in evaluation and research may limit the ability of jurisdictions to respond to funding opportunity announcements.
- Stakeholders need to work more closely with schools and programs of public health to inform their epidemiology curricula.

Training and the Applied Epidemiology Competencies

By a considerable margin, the greatest training priority was analytics, defined as informatics and the application and translation of public health data.

- Analytics was mentioned as one of the two top priorities by 38 states, with 12 states mentioning systems thinking (systems development, change management, strategic planning, and/or flexibility), persuasive communication, and leadership development.
- Although training is readily available in epidemiology, the area of data analytics relevant to a state epidemiology department setting is less well developed. Opportunities for partnership can be explored to build data analytics and systems thinking skills, especially with academic institutions and entities with experience in workforce training in systems management.

The Applied Epidemiology Competencies have been available since 2008 but a quarter of the jurisdictions have not used them.

- The AECs, which were developed by CDC and CSTE, consist of a comprehensive, four-tiered list of competencies that defines the discipline of applied epidemiology and describes the skills needed by epidemiologists at each level. They have been used by 76% of the states and DC for one or more purposes.
- Use of the AECs has largely been limited to developing or updating position descriptions and job qualification statements and assessing epidemiology capacity of specific positions; they are far less commonly employed to develop training plans to address knowledge gaps or to develop training or continuing education efforts.

Access to peer-reviewed literature that is not open-access is poor in many states

- Timely access to peer-reviewed literature is essential to deal with emerging issues and to ensure that ongoing activities are evidence-based. Yet more than a quarter of states report that they lack access to the literature, and an additional quarter report that access is delayed by more than 24 hours.
- Understanding how states with rapid access have arranged to obtain literature may assist states with slow or no access by illuminating potential solutions, such as university partnerships or participation in the National Network of Libraries of Medicine.

Funding

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

- More than three quarters (77%) of the funding for epidemiologic activities and personnel comes from the federal government, primarily from CDC, with 19% coming from the states themselves and the remaining 4% from other sources.

- Federal funds constitute the vast majority of funds for virtually all program areas; only in the case of vital statistics did state funding contribute more than 33%.
- External funding is perceived to drive programmatic priorities and create silos, leaving some of the broader essential functions, such as maintaining surveillance systems and conducting routine health department investigations, underfunded. It is also perceived to limit flexibility to adjust resources to deal with emerging problems.
- Ebola and Zika supplemental funding ends in 2018, and cutbacks are expected in the Affordable Care Act's Prevention and Public Health Fund, which supports the Epidemiology and Laboratory Capacity for Infectious Diseases and the Public Health Emergency Preparedness cooperative agreements, potentially threatening previous gains in both staffing and capacity.

Recruitment and retention

The biggest recruitment and retention challenges are similar: salaries, opportunities for promotion, and restrictions on offering competitive pay and providing merit raises.

- The most common major or moderate problems in recruiting were restrictions on offering competitive pay (80%), salary scale (76%), opportunity for promotion (73%), and hiring quickly enough (62%).
- The most frequent major and moderate problems for retention were opportunity for promotion (88%), salary scale (80%), restriction on merit raises (70%), and loss to the private or other government entities (65%).
- Salaries increased with educational attainment, although physician pay was considerably higher than that for PhDs and DVMs. Salaries also increased by career level. No consistent pattern in salary level emerged by state population size or region.
- The median minimum salary for a State Epidemiologist was $118, 000 (range $42,000 to $219,000), while the median maximum value was $172,000 (range $84,000 to $291,000). Salaries in most career-level categories increased by more than the rate of inflation between 2013 and 2017.
- 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.
- While non-financial rewards—a stimulating work environment, the opportunity to contribute to the health of the community, and recognition of efforts—may improve retention, efforts need to be made to increase recognition of the unique aspects of epidemiology activities and to advocate for competitive compensation.

Epidemiology Leadership

A high proportion of State Epidemiologists are new to their jobs, and many others are likely to reach retirement age in the next few years.

- State Epidemiologists have been on the job for a median of 5.8 years, up from 5.0 years in 2013.
- One-quarter have been in their positions for a year or less, and 11% for at least 20 years.
- New epidemiologists are faced with learning technical aspects of their job, navigating hiring and administrative practices, and obtaining funding to support epidemiologic activities.
- Leadership training and mentoring may be important in states with new State Epidemiologists, while succession planning may be important for states in which State Epidemiologists will be retiring soon.

The number of states with program area leads has increased in some areas, but the majority of states do not have leads in areas such as substance abuse and occupational health.

- Notable increases occurred between 2013 and 2017 in maternal and child health (MCH), where the percentage of states with a program lead rose from 78% to 92%, and in substance abuse, where it increased from 16% to 49%.
- Despite overall gains in the number of states with program area leads, more than half of states lacked a program lead in substance abuse, occupational 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.
- The lack of substance abuse program leads is particularly concerning given the current opioid drug use emergency (Centers for Disease Control and Prevention, 2017).

The territorial situation

Territories face special challenges related to location, high staff turnover, slow hiring processes, and, in some cases, low salaries and poor access to the literature.

- Only three US territories responded to the ECA, but based on their experience, maintaining continuity and capacity in these settings represents a particular challenge.
- Frequently cited recruitment and retention problems included isolated locations, slow hiring processes, and non-competitive salary scales. These problems, in turn, led to high turnover of senior and staff Territorial Epidemiologists. None of the three responding epidemiologists had been in their positions for more than three years. Two of the three territories had no access to the literature, and the third had access only after 72 hours.
- Further efforts are needed to understand what can be done to improve capacity in some of these remote and challenging settings. Examining successful efforts in remote areas of the US may provide some clues.

Overriding issue: alignment of priorities

In many states, there is a misalignment between needs and resources, and, because of external funding and organizational issues, state priorities are not being met.

- According to State Epidemiologists' comments on the critical problems they face, a misalignment of needs and resources has resulted from heavy reliance on federal funding, as well as lack of flexibility, hiring limitations, and lack of opportunity to step back and re-align state priorities with epidemiological activities.
- Periodic examination of priorities based on morbidity, mortality, and state public health mandates could serve as a basis for seeking additional funding from the state or other sources and thus better align workforce capacity to address priority and emerging problems, such as substance abuse.

Recommendations

The results of the 2017 ECA suggest several recommendations—to improve applied epidemiology capacity in state and territorial health departments.

1. Develop a strategy to increase epidemiology capacity, especially in evaluation, research and underdeveloped program areas such as substance abuse, mental health, and informatics and data translation. The next generation of epidemiologists needs the appropriate skillsets and subject-matter expertise to complement existing staff.
2. Review and develop new recruitment and retention strategies for state health department epidemiologists.
3. Maintain efforts to establish training standards and to provide training to ensure a highly qualified public health epidemiology workforce. In particular, CSTE and others must work closely with public health schools and programs to ensure a supply of graduates trained in emerging areas and in evaluation and applied research techniques.
4. Explore the gap between state public health mandates and state capacity to meet those mandates. Policy makers, especially at the state level, must provide adequate funding to close critical gaps—especially for epidemiology positions and training—if health departments are to meet the needs of their populations.
5. Conduct future assessments to monitor workforce trends and illuminate changes in the workforce and overall epidemiology capacity.

BACKGROUND

Background

Protecting and improving population health—the broad goals of public health practice—involve a host of stakeholders from many different sectors of society, including government agencies, nongovernmental organizations, health care providers, and businesses (Frieden, 2015).

State and local public health agencies play an important role in conducting surveillance and assessing community needs (National Consortium for Public Health Workforce Development, 2017). Surveillance produces essential information to create effective and efficient public health services (Groseclose & Buckeridge, 2017), while community needs assessments permit identification of at-risk groups and the subsequent prioritization of public health services. Epidemiologists are fundamental to both public health surveillance (Drehobl, Roush, Stover, & Koo, 2012) and community needs assessments.

Understanding the current applied epidemiology workforce situation is critical to state and national public health leaders and schools of public health. Leaders, for example, need timely workforce data to plan the delivery of these basic public health functions and to evaluate their progress. They wish to know how many public health epidemiologists are currently working in their jurisdictions and how they are distributed by program area. Leaders may also find it helpful to know how their jurisdiction stacks up against others with respect to staffing, epidemiologic competencies, salary, hiring practices, and staff retention.

Similarly, schools and programs of public health, which provide much of the training of the epidemiology workforce, need to know which program areas need more epidemiologists, the skills that need further strengthening in health departments, and what educational and experiential qualifications health agencies are seeking in new epidemiology recruits. This information can inform curricula design and student job counseling.

Public health has entered a period of rapid change, with massive budget and workforce cuts, a growing focus on accountability, health system changes, and the introduction of new technologies (Trust for America's Health, 2013). Adaptation to the modern public health landscape requires specialized knowledge and skill sets that promote systems thinking, effective change management, and cultural sensitivity (Brownson et al., 2015; Kaufman et al., 2014). In this context, an understanding of current workforce characteristics and perceived health department challenges is essential for long term planning.

One of the most important recent changes is a move toward greater standardization of public health services. The Ten Essential Public Health Services (EPHS)—a list of core public health responsibilities drafted by a Centers for Disease Control and Prevention (CDC) working group and based on the landmark Institute of Medicine report *The Future of Public Health* (1988)—constitute the national benchmarks for public health practice (Centers for Disease Control and Prevention, 2017b). Four of these depend on epidemiology capacity: monitoring health status (EPHS #1), investigating community health problems and hazards (EPHS #2), evaluating the effectiveness of public health interventions (EPHS #9), and conducting research (EPHS #10). According to the Council of State and Territorial Epidemiologists' (CSTE's) 2013 Epidemiology Capacity Assessment (ECA), overall US capacity for monitoring health status and investigating health problems was substantial, but public health capacity for research and evaluation is limited. Moreover, the assessment showed that at least 4,100 additional epidemiologists were needed to

achieve adequate capacity to successfully perform these four EPHS. The 2017 ECA provided the opportunity to assess whether these additional epidemiologists have been hired and whether the current ability to provide these four critical public health services has improved.

Another recent development is the further characterization of the epidemiologist's roles in the Applied Epidemiology Competencies (AECs) (Centers for Disease Control and Prevention, 2017a), which were developed by CDC and CSTE. They are based on the eight areas comprising the Core Competencies for Public Health Professionals (Birkhead et al., 2008). The AECs summarize the skills necessary for the four levels of applied epidemiology practice (i.e., entry-level, mid-level, senior-level and senior scientists/ subject area expert) and provide a framework for professional development. The 2017 ECA provides the opportunity to assess the extent to which this important resource has been used as the basis for job descriptions and performance assessments.

CSTE conducted its first comprehensive, nationwide assessment of core epidemiology capacity in state and territorial health departments in November 2001. This ECA was conducted in part to collect baseline data for monitoring progress for the Healthy People 2010 public health Infrastructure objective (Centers for Disease Control and Prevention, 2003). It also provided baseline data on national, state and territorial epidemiology capacity before the influx of approximately $1 billion in annual federal funding to state health departments for bioterrorism and emergency preparedness between 2001 and 2004 (Centers for Disease Control and Prevention, 2005). In this first assessment, the 39 responding states reported employing 1,366 epidemiologists, of whom 48% worked in infectious diseases and 62% were supported with federal funding (Centers for Disease Control and Prevention, 2003).

Building on the findings and interest generated by the 2001 ECA, CSTE conducted additional ECAs in 2004, 2006, 2009, and 2013. In addition to measuring core capacity, the 2004 ECA focused on the infrastructure of public health surveillance programs and training opportunities for epidemiologists employed in health departments. All states and the District of Columbia (DC) responded. Core capacity, as measured by the number of epidemiologists in the 39 states that responded to the 2001 ECA, jumped 20%, although the additional capacity was limited to bioterrorism and emergency preparedness and maternal and child health (MCH) program areas. Of note, 75% of all health department epidemiologists were supported with federal funds. Results also revealed that 29% of epidemiologists lacked formal epidemiology training or academic coursework in epidemiology at the time they were hired (Centers for Disease Control and Prevention, 2005; Council of State and Territorial Epidemiologists 2004).

The 2006 ECA measured applied epidemiology competencies and associated training needs as well as core epidemiology capacity. It measured applied epidemiology competencies and associated training needs, as well as core epidemiology capacity. Again, the response rate of the 50 states and DC was 100%. Key findings included a decrease (2.5%) in the total number of epidemiologists, of whom 75% were still supported with federal funds; an estimated need for a 34% increase in the total number of epidemiologists to be able to fully conduct core public health functions, and a reduction in the percentage who lacked any formal epidemiology training to 15% (Council of State and Territorial Epidemiologists, 2006; Boulton, Montgomery, & Beck, 2008; Boulton, Lemmings, & Beck, 2009; Lichtveld, Boulton, Lemmings, & Gale, 2008).

The 2009 ECA (Council of State and Territorial Epidemiologists, 2009; Centers for Disease Control and Prevention, 2009) was supplemented in 2010 by a more precise enumeration of state-level epidemiologists (Centers for Disease Control and Prevention, 2012). This assessment was conducted within the context of decreasing federal public health preparedness funding, the national economic recession that began in September 2008, and the appropriation of federal economic stimulus funding. It continued to monitor core epidemiology capacities, AECs, and associated training needs. The assessment added substance abuse as a new program area and included a module to measure overall technologic capacities that directly support disease surveillance and response. Additionally, the assessment included the

first enumeration of local (city and county) epidemiologists. Key findings included a further 10% drop in the total number of epidemiologists since 2006, low overall substance abuse epidemiology capacity, and lack of essential technologic capacity in many states. On the plus side, there was a further reduction in the percentage of epidemiologists who lacked formal epidemiology training to 13%.

The 2013 ECA—which, like previous assessments had a 100% response rate from DC and the 50 states—revealed continued improvements of epidemiology capacity in multiple program areas, along with further improvements in workforce training (Council of State and Territorial Epidemiologists, 2013). In fact, surveillance and epidemiology capacity in all well-established program areas were at their highest levels since 2004, likely owing to the increased size and skill level of the epidemiology workforce (Council of State and Territorial Epidemiologists, 2013). Even so, the assessment documented a lack of capacity in long-established program areas of environmental health, injury, occupational health, and oral health; low capacity in substance abuse and mental health (added for the first time in 2013); a need for additional competency-specific training; a loss of 11% of health department epidemiologists in 2012; and an increasing dependence on federal funding (Hadler et. al., 2013; Council of State and Territorial Epidemiologists, 2013).

These findings were echoed in the Public Health Workforce Interest and Needs Survey (PH WINS) conducted in 2014 by the Association of State and Territorial Health Officials (Liss-Levinson, Bharthapudi, Leider, & Sellers, 2015). PH WINS, which includes data from epidemiologists and other health department employees, documented a need to boost cross-cutting skills, such as project collaboration and persuasive communication (Liss-Levinson et. al., 2015); to enhance competency training: to increase investment in on-site training for employees; to strengthen partnerships with academic institutions; and to increase rates of membership in professional organizations such as CSTE (Liss-Levinson et. al., 2015). The survey also found that 26% of the state health department workforce intended to leave within the next year (Liss-Levinson et. al., 2015).

The 2017 ECA builds upon these earlier workforce assessments and features new questions to document the number of epidemiology vacancies and state health agencies' intention to fill them, to elucidate the impact of supplemental federal funding for recent public health threats, such as the Ebola and Zika viruses, and to assess public health informatics capacity.

Overall, the 2017 ECA was designed to achieve four goals:

1. Enumerate and describe the applied epidemiology workforce.
2. Describe the skills of the applied epidemiology workforce.
3. Describe the funding supporting the applied epidemiology workforce.
4. Describe the level of epidemiology capacity in state health departments.

METHODS

Methods

Instrument Development and Distribution

Assessment design and distribution were informed by two CSTE-convened focus groups held In the fall of 2016; the first with the CSTE national office staff and the second with CSTE members. Focus group participants discussed the purpose, value, content, and distribution of the 2017 ECA, as well as the training required to prepare State Epidemiologists to complete the assessment. Ultimately, nine items in the 2013 ECA were excluded from the 2017 ECA, primarily because they duplicated information collected through other CSTE assessments. In addition, nine questions were added, with their wording and response options informed by a literature review. Other changes include renaming the "bioterrorism and emergency response" program area as "preparedness" and adding a new program area, informatics. The individual assessment for each epidemiologist, which was part of the 2013 ECA, was not included in the 2017 version.

The resulting assessment was developed into an online format using Qualtrics® software and piloted in February 2017 by the Alaska, Massachusetts, and Nevada state health agencies. The pilot instrument was then revised based on their feedback. The final 2017 ECA (Appendix A) contained ten sections:

- Section 1: Epidemiology leadership within the state health department
- Section 2: Epidemiology staffing and funding sources within the state health department
- Section 3: Epidemiology and surveillance capacity within the state health department
- Section 4: Civil service annual salary ranges for epidemiologists in your state health department
- Section 5: Epidemiology training and the Applied Epidemiology Competencies (AECs)
- Section 6: Existing practices, incentives, and barriers aimed at strengthening the state epidemiology workforce
- Section 7: Vacancies and retention of the state epidemiology workforce
- Section 8: Preparedness within the state health department
- Section 9: Leadership feedback
- Section 10: Review of assessment

Most questions were short answer, multiple choice, scales (e.g., none, minor problem, moderate problem, major problem) or matrix tables, such as the fraction of full-time equivalent positions (FTEs) by program area and funding source. For the first time, two open-ended questions were included: (1) *As the State Epidemiologist, what are the most critical issues you face?* and (2) What other thoughts, comments, concerns or questions would you like to share with CSTE with regard to the epidemiology workforce and training?

On April 24, 2017, CSTE distributed electronic instructions and individual assessment links to the State Epidemiologist in all 50 state health departments, Washington, DC, and the five US territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and the US Virgin Islands) plus the Federated States of Micronesia, an independent nation that has a Compact of Association with the US. The online assessment also was converted into a PDF (Appendix A) for printing and attached to the instructional email. Additionally, two worksheets (Appendices B and C) were created and attached to the email to assist with information-gathering from other staff in the state health department, namely program area leads and human resources directors. Worksheet instructions were included in the overall assessment instructions provided online.

Each State Epidemiologist was provided a unique link and was asked to complete the online assessment by May 31, 2017. Potential respondents were also given the email address

and telephone number of CSTE staff, who were available to answer any questions that might arise. In addition, CSTE hosted a "How to Complete the 2017 ECA Webinar" on May 5, 2017 and held two virtual ECA office hours sessions on May 12 and 23, 2017. Each state or territory was also provided with a copy of its 2013 ECA State Reports results to assure responses considered previous staff enumeration methods. Upon request, CSTE provided states their exact responses from 2013 via email.

Because not all states were able to complete the assessment by May 31, the assessment deadline was extended to August 11, 2017. CSTE staff reached out to states via email to request necessary revisions for data validation and to address incomplete responses. State Epidemiologists were asked to revise and resubmit unclear or incomplete responses using a new electronic link with the previous responses pre-populated.

Definitions and response options

Epidemiologist

For purposes of the assessment, the definition of an epidemiologist remained unchanged between 2013 and 2017. State Epidemiologists were instructed to count as epidemiologists *"all those employed by the state; all those working at the state level who are either federal assignees (e.g. EISO, CEFO, PHAP) or contract employees (e.g. CSTE trainee, contracted from school of public health to work at or for the State Health Department); and state employees assigned to work at a local or regional level (e.g. to conduct investigations for a region of the state)."* The instructions also requested that *"[when] considering who should be counted, please focus on the functions performed by the individual rather than the job title. Reference the Applied Epidemiology Competencies (AECs) for examples of epidemiology job functions if you need assistance in determining the status of an employee."*

A pop-up tab link within the assessment instructions contained additional information regarding who should be counted as an epidemiologist. This link opened to a PDF document referencing John M. Last's definition (2001), which states that an epidemiologist is *"an investigator who studies the occurrence of disease or other health related conditions or events in defined populations. The control of disease in populations is often also considered to be a task for the epidemiologist."* The document defines epidemiology as the *"study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to control of health problems."*

In some states, epidemiologists are employed by agencies other than the health department. For example, occupational health epidemiology is sometimes housed in the department of labor. In such cases, the epidemiologists working at agencies outside the state health department were excluded from this analysis.

Capacity in the Essential Public Health Services (EPHS)

Adequate epidemiology capacity was defined as that which assures the state health department's ability to lead activities, provide subject matter expertise, and apply for, receive, and manage resources to conduct key activities. The following scale was used to measure both overall capacity to carry out the four epidemiology-related EPHS (i.e., monitoring health status, investigating community health problems and hazards, evaluating the effectiveness of public health interventions, and conduct research) and capacity within specific program areas:

- None: 0% adequate epidemiological capacity to provide this/the four EPHS.
- Minimal: 1-24% adequate epidemiological capacity to provide this/the four EPHS.
- Partial: 25-49% adequate epidemiological capacity to provide this/the four EPHS.
- Substantial: 50-74% adequate epidemiological capacity to provide this/the four EPHS.
- Almost full: 75-99% adequate epidemiological capacity to provide this/the four EPHS.
- Full: 100% adequate epidemiological capacity to provide this/the four EPHS.

For purposes of analysis and comparability with previous ECAs, responses were grouped as none to minimal, partial, and substantial to full.

Salaries
Respondents were asked to provide the civil service annual salary range for epidemiologists working in their department by degree and career level. If there was more one position for a given degree or job level, they were instructed to use the low end of the lowest position in that level to the high end of the highest position in that level.

Vacancies
The following definition was used to describe vacancies in epidemiology/surveillance positions at the Master's degree and above level in the state health department: *"A vacancy is defined as a position to be filled at the State Health Department that meets the following conditions: (1) there is work available for the position and (2) the job could start within 30 days."*

Intent to fill positions
"Intent to fill positions" were defined as vacant positions that human resources staff were working actively to fill.

Analytic techniques

Data were analyzed using Epi Info™ 7 and Microsoft Excel 2016. Because the three responding territories differ substantially from the 50 states and DC in their organization of epidemiology services, hiring practices, salary scales and population size (i.e., 106,000 for the most populous of the three territories compared with about 585,000 for the least populous state), data for the states and DC were analyzed separately from the data for the territories unless otherwise noted.

Some analyses were stratified by state population size, which was calculated based on 2016 US Census figures (US Census Bureau, 2016). As shown in Figure 1 below, the three population categories were *small* (<2 million; 14 states and DC), *medium* (2-6 million; 17 states), and *large* (>6 million; 19 states). In addition, some variables were examined by region using standard census categories: Northeast, South, Midwest, and West (Figure 2).

Figure 1 Categories based on state size

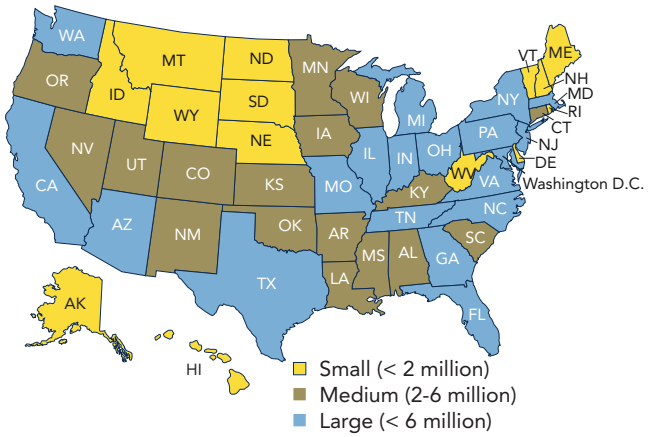
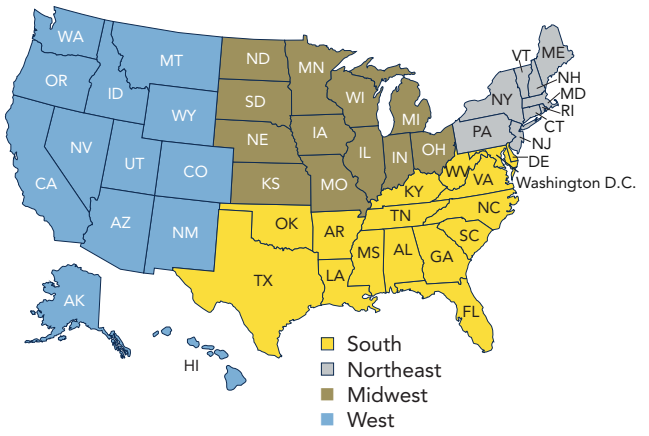


Figure 2 Categories based on U.S. census regions



The total number of epidemiologists was derived from a matrix in the questionnaire that asked for the number of FTEs by program area and source of funding. An *other* category was included for positions that did not fall within one of the 13 program areas. As in previous ECAs, two methods were used to calculate the number of *epidemiologists*/100,000 population by state population size and by region. In the first, expressed as epidemiologists/100,000, the total number of epidemiologists in the subgroup (e.g., Midwestern states) was divided by the total population of that subgroup (e.g., total Midwest population). In the second method, referred to as *median number of epidemiologists/100,000 population,* the number of epidemiologists/ 100,000 was first calculated for each individual state, and the median for all states in the subgroup was identified.

For some variables, trends were assessed using data from the four ECAs in the past 13 years (i.e., 2004, 2006, 2009/2010, 2013) plus data from 2017; for other variables, only 2013 and 2017 findings were examined. The 2001 data were excluded because only 39 states participated, making temporal comparisons problematic. Where relevant, prevalence rate ratios, chi square tests, and the Kruskal-Wallis tests were used to examine differences among groups.

Responses from the open-ended question, *As the State Epidemiologist, what are the most critical issues you face?,* were coded and grouped thematically by two CSTE staff and by a CSTE consultant. The three separate analyses were compared for intercoder reliability, and differences were discussed and addressed.

RESULTS

Results

Epidemiology leadership within the health department

Response rates and characteristics of participating State and Territorial Epidemiologists

State Epidemiologists from all 50 states, DC, American Samoa, the Northern Mariana Islands, and the Virgin Islands responded to the 2017 ECA, achieving a 100% response rate for the states and DC and a 50% response rate for the five territories and the Federated States of Micronesia.

About a quarter (24%) of the 54 respondents were in appointed positions. Overall, they had served in their current position a median of 5.8 years, with a range of <1 to 39 years. This compares with a median of 5.0 years in 2013. The distribution of years in current position is shown in Figure 3.

One in four State and Territorial Epidemiologists has been on the job less than one year. More than half have served in their current positions for at least five years.

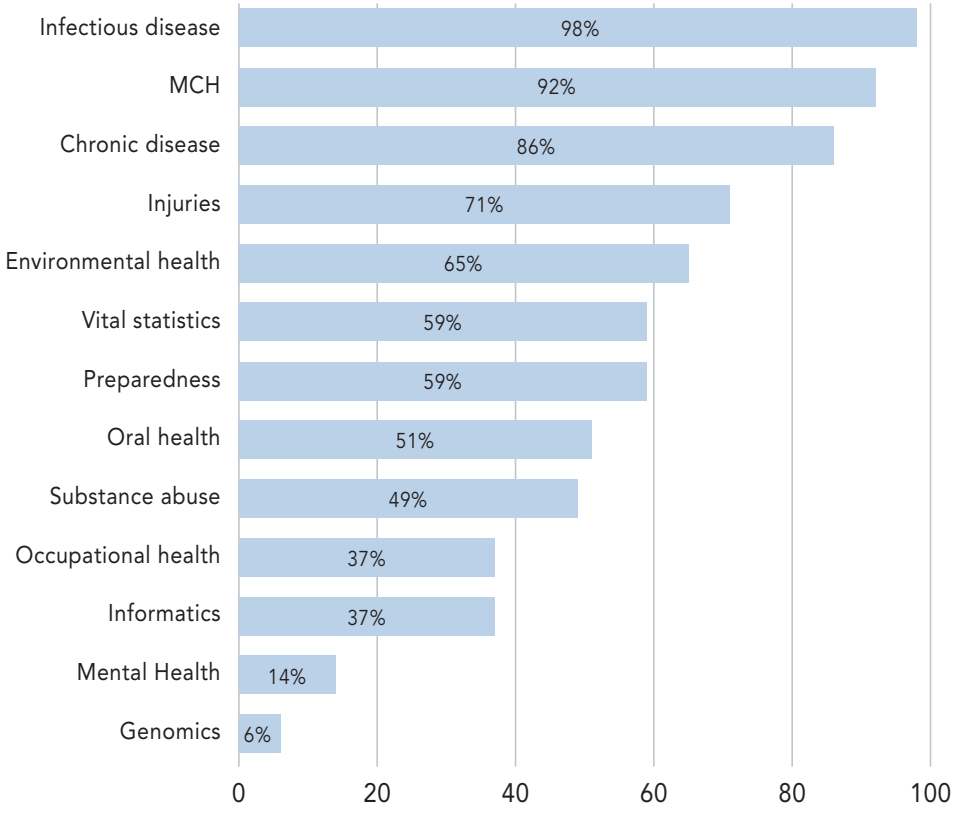
Figure 3 Number of years in current position among State and Territorial Epidemiologists, ECA, 2017 (n=54)

- **26%** <1 year
- **20%** 1-4 years
- **30%** 5-9 years
- **13%** 10-19 years
- **11%** 20+ years

Program area lead epidemiologists

As shown in Figure 4, almost all (98%) of the 50 states and DC had a lead infectious disease epidemiologist, and a large majority also had leads in MCH (92%) and chronic diseases (86%). Other program areas with relatively high coverage include injuries (71%), environmental health (65%), vital statistics (59%), preparedness (59%), and oral health (51%), all of which had coverage over 50%. In contrast, substance abuse, occupational health, and informatics had coverage between 37% and 49%, and mental health and genomics had coverage below 15%. The three territorial respondents had quite limited overall epidemiological coverage, except in infectious diseases. No significant relationship was found between state population size (<2 million, 2-6 million, and >6 million) and presence of a lead epidemiologist, except for environmental health programs, for which 33% of small states had lead epidemiologists, compared with 71% for medium states and 82% for large states (p=0.02).

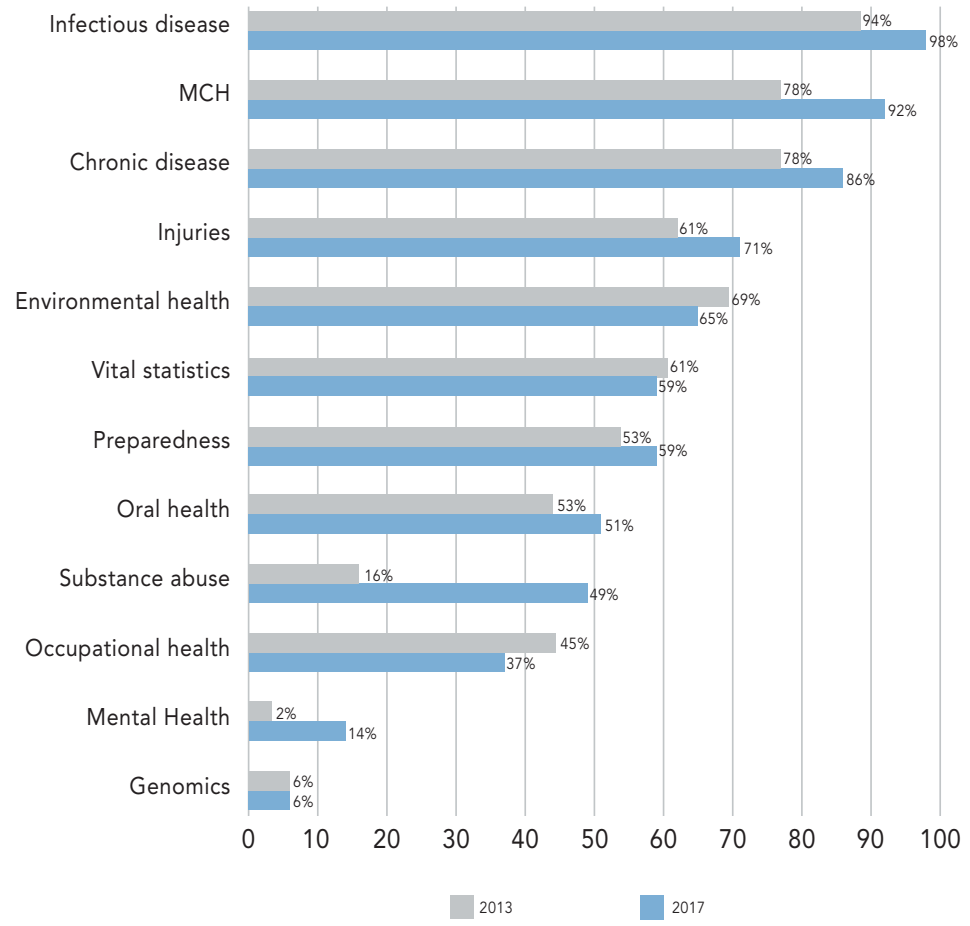
Figure 4 Presence of lead epidemiologists by program area, 50 states and DC, ECA 2017



Trends in the presence of program area leads

Between 2013 and 2017, the percentage of state jurisdictions with a lead substance abuse epidemiologist rose three-fold, from 16% to 49% (p=0.0003) (Figure 5). Similarly, the percentage of states with a mental health lead rose seven-fold, from 2% to 14% (p=0.03). MCH also experienced an increase, from 78% to 92% of states a program lead (p=0.05). There have been small but non-significant increases in most areas, and non-significant decreases have occurred in occupational health (from 45% to 37%) and environmental health (from 69% to 65%).

Figure 5 Trends in presence of program area leads, 2013 and 2017, 50 states + DC, ECA



State substance abuse and mental health programs saw the greatest increases in lead epidemiologists nationwide. In contrast, occupational health and environmental health programs lost epidemiology leads.

Epidemiology staffing and funding within health departments

Staffing

Numbers of epidemiologists and rates per 100,000 population

In 2017, US state health departments employed 3,370 epidemiologists, compared with 2,752 in 2013—a 22% increase (Table 1). The number of epidemiologists per state ranged from 5 to 208. And the overall number per 100,000 population was 1.04, 20% higher than in 2013, when the ECA documented 0.87 epidemiologists/100,000.

Table 1 Number and range of epidemiologists, median number of epidemiologists, rates/100,000 and median rates by state size and region.

Category	Number of states	Number of epidemiologists	Range, number epidemiologists/ state	Median number/ state	Rate/ 100,000‡	Median rate/ 100,000^
United States	51	3370	5-208	59	1.0	N/A
State size*						
Small#	15	406	8-102	23	2.4	2.3
Medium	17	997	5-118	55	1.5	1.4
Large	19	1967	29-208	93	0.8	0.9
Geographic area						
Northeast	9	711	19-208	58	1.3	1.8
Midwest	12	684	9-142	61	1.0	1.2
South	17	1209	13-136	71	1.0	1.2
West	13	766	5-195	59	1.0	1.5

*Small: < 2 million, medium: 2-6 million; large: >6 million; see Figure 1 for map. Population figures from 2016 US Census estimates
‡Based on sum of all epidemiologists within a category and total population in that category
^Median of state-specific rates/100,000
#Kruksal-Wallis for difference between median rate/100,000 = 0.002

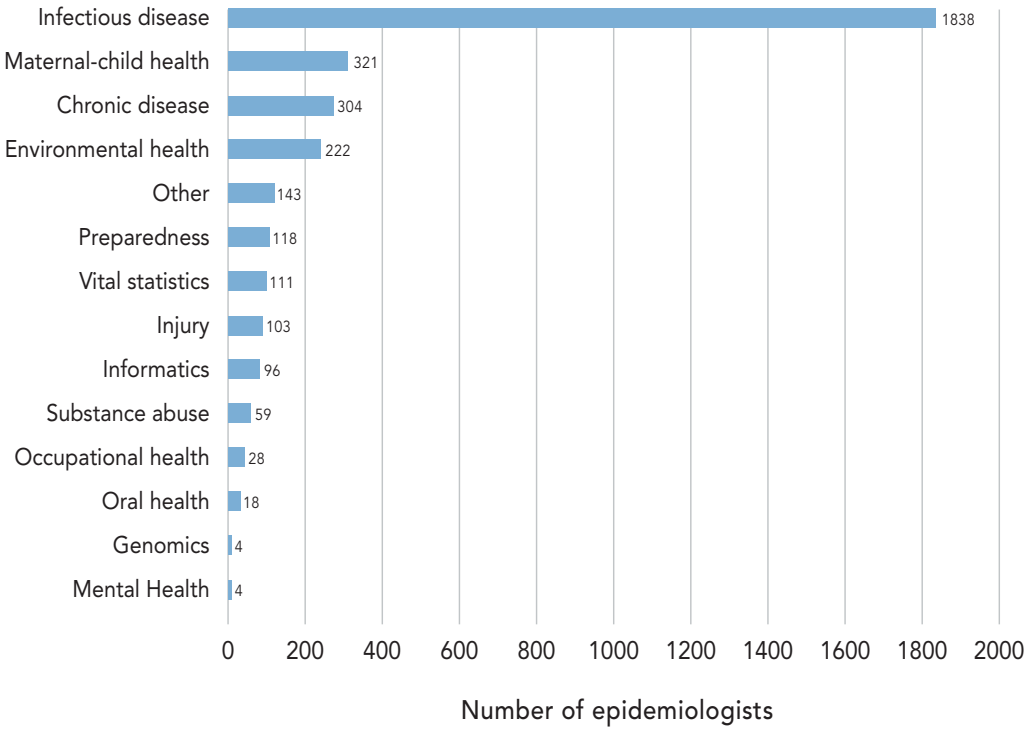
As shown in Table 1, more populous states had a higher median number of epidemiologists than less populous states, although the ranges varied widely and overlapped among the three size categories. Moreover, as state population increased, the number of epidemiologists per 100,000 population decreased: small states had three times as many epidemiologists/100,000 as large states, while medium-sized states had nearly twice as many. Of note, the South had a greater median number of epidemiologists per state, but the Northeast had a higher rate, at 1.3/100,000. Six states had ≤0.5 epidemiologists/100,000, four of which had populations over 6 million. Health departments in American Samoa, the Northern Mariana Islands, and the Virgin Islands reported having a combined total of 16 epidemiologists on staff.

Number of epidemiologists by program area

Overall, the greatest number of state health department epidemiologists—1,838 (55%)—worked in infectious diseases in 2017 (Figure 6). MCH and chronic diseases each accounted for approximately 9% of the total. In contrast, substance abuse, occupational health, oral health, genomics, and mental health together represented 3% of the total.

The number of epidemiologists increased by 22% between 2013 and 2017, while the number per 100,000 population increased 20%.

Figure 6 Number of epidemiologists by program area, 50 States + DC, ECA, 2017.



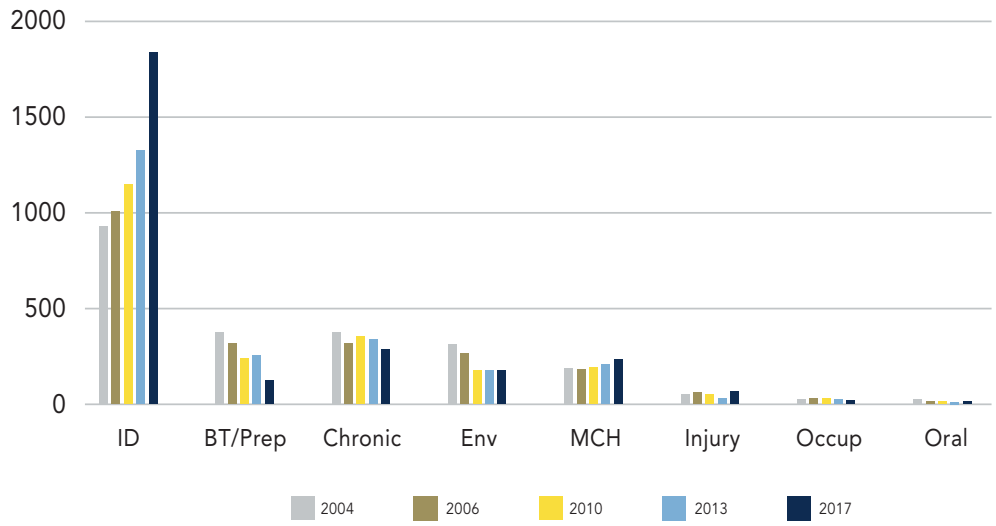
2013 ECA data were not available for genomics, vital statistics, and informatics; the first two were collected but were analyzed in an "other" category, while informatics was added in 2017. Between 2013 and 2017, state health agencies added 487 infectious disease epidemiology positions, a 36% increase and the largest numerical increase by program area. Similarly, health agencies added 48 injury prevention epidemiologists, an 88% increase and the largest relative increase by program area. In contrast, preparedness lost 144 epidemiologists, a 55% decrease. Chronic disease lost 50, representing a 14% decrease, and occupational health lost 10, a 26% decrease since 2013.

Fifty-five percent of all state health department epidemiologists work in infectious diseases, representing a 36% increase since 2013. The number of preparedness and chronic disease epidemiologists decreased since 2013.

Trends in the number of epidemiologists by program area

Longitudinal data were available for seven of the program areas for which there has been consistent data collection since 2004. As shown in Figure 7, the increase in infectious disease epidemiologists between 2013 and 2017 is part of an ongoing trend, although it accelerated over the past four years. MCH has experienced a much smaller, gradual increase, while the number of injury epidemiologists, after experiencing a gradual decline, is higher than at any previous time. In contrast, preparedness (formerly bioterrorism and emergency response) has been declining since first measured in 2004, with a more precipitous decline between 2013 and 2017. And chronic disease, environmental health, occupational health, and oral health have remained stable or declined over time.

Figure 7 Trends in number of epidemiologists by program area, 2004-2017, 50 States and DC and variable number of territories in 2004 and 2006, ECA



The number of infectious disease epidemiologists continues to increase dramatically, while preparedness positions declined abruptly in 2017.

Additional and ideal number of epidemiologists needed to achieve full capacity

Total additional and ideal positions

Participating epidemiologists were asked to estimate the number of additional epidemiologists at master's level or higher they would need to reach full capacity in each of the program areas. Overall, State Epidemiologists indicated a need for an additional 1,199 epidemiologists across all program areas, with the most needed for infectious disease (338), chronic diseases (137) environmental health (122), and MCH (122) positions (Table 2). The three territorial respondents reported needing 31 additional epidemiologists.

Three indicators were calculated to better understand the differences between current and ideal epidemiological capacity:

- The ideal number of epidemiologists (current + additional positions).
- The percent of need currently met (current/ideal positions*100).
- The percent increase in current positions needed to reach ideal levels ((ideal - current positions)/current positions*100).

Overall, the ideal number of epidemiologists was 4,568, constituting a 36% increase over the current number of epidemiologists (Table 2). Current staffing levels represent 74% of desired capacity. If the 2017 ideal were to be achieved, the number of epidemiologists per 100,000 population would be 1.4/100,000.

In comparison, the ideal number of epidemiologists in 2013 was 4,126, representing a 51% increase over the actual number of 2,732.

State population size affected the need for additional positions. The percentage increase needed to achieve ideal staffing levels was 45% for small states, compared with 29% for medium-sized and 37% for large states. For the territories, a 200% increase would be needed (16 current epidemiologists versus an ideal number of 48).

Table 2 Current, additional, and ideal numbers of epidemiologists overall and by program area, 50 states and DC, ECA, 2017

Program area	Current	Additional	Ideal (current + additional)	Need currently met (%)*	Increase needed to reach ideal (%)‡
Infectious disease	1838	338	2177	84%	18%
MCH	321	122	443	72%	38%
Chronic disease	304	137	441	69%	45%
Environmental health	222	122	344	65%	55%
Informatics	96	91	187	51%	95%
Vital statistics	111	62	173	64%	56%
Injury	103	57	159	64%	56%
Preparedness	118	36	153	77%	30%
Substance abuse	59	64	122	48%	109%
Occupational health	28	38	67	43%	134%
Mental health	4	42	46	9%	1058%
Oral health	18	25	43	42%	139%
Genomics	4	20	25	18%	459%
Other	143	45	189	76%	31%
TOTAL	**3370**	**1199**	**4569**	**74%**	**36%**

*current/ideal *100
‡ (ideal-current)/current *100

Additional and ideal positions by program area

As shown in Table 2, the greatest additional number of epidemiologists to achieve ideal capacity was in infectious diseases (338), followed by chronic diseases (137), MCH (122), and environmental health (122). Percentage-wise, however, mental health needed a 1,058% increase, from 4 to 46 epidemiologists, followed by genomics (459% increase needed), oral health (139%) and occupational health (134%).

Current civil service and contractor vacancies and intent to fill positions by program area

In addition to asking about the current and additional positions needed, respondents also provided data on the number of current vacancies and positions for which they were actively recruiting (intent to fill) for civil service and contractor positions. Vacancies were defined as positions for which work is available and could start within 30 days, while intent to fill added the additional requirement that human resources were actively recruiting for the position.

Participating jurisdictions were asked to report whether they used contractors to fill positions. Thirty states and DC (58%) reported using contract epidemiologists, as did one territory. A greater percentage of large states (71%) reported using contractors than medium-sized (59%) or small (47%) states, and Northeastern states were more likely to use them (87%) than Southern (56%), Midwestern (58%), and Western states (46%), but none of these differences were statistically significant.

Table 3 Vacant and intent-to-fill civil service and contractor positions, 50 states and DC, ECA, 2017

	Civil Service		Contractor		Total Vacant	Total Intent to Fill
Program area	Vacant	Intent to Fill	Vacant	Intent to Fill		
Infectious disease	131	114	28	27	159	141
MCH	41	34	4	4	45	38
Chronic disease	36	32	6	5	42	37
Environmental health	18	13	5	5	23	18
Informatics	14	13	1	1	15	14
Vital statistics	12	12	1	1	13	13
Injury	10	11	1	2	11	13
Preparedness	9	10	0	0	10	11
Substance abuse	9	6	0	0	9	6
Occupational health	6	4	2	2	8	6
Mental health	6	6	0	0	6	6
Oral health	2	1	1	1	3	2
Genomics	1	2	0	1	1	3
Other	10	7	0	0	10	7
TOTAL	**305**	**265**	**49**	**49**	**353**	**314**

Of 353 vacant epidemiology positions nationally, health departments are actively recruiting for 314 (89%), which they "intend to fill"—including 87% of the 305 vacant civil service positions and 100% of the 49 vacant contractor positions (Table 3). Collectively, infectious disease programs have the greatest number of epidemiology vacancies (159), followed by chronic diseases (45) and MCH (42). All 11 territorial vacancies were in infectious diseases; 100% were intended to be filled.

The 1,199 new positions State Epidemiologists report necessary to achieve full epidemiologic capacity far outnumber the 353 vacancies (Table 3). Overall, the 314 positions in the process of being filled represent 26% of this unmet need. Adding in the 39 vacant positions that health agencies do not intend to fill would raise this figure to 29% of unmet need.

Filling *all* current vacancies would eliminate 47% of unmet need for infectious disease programs nationwide, 37% of unmet need for preparedness, 34% for MCH, 33% for chronic disease, 14% for substance abuse, 12% for informatics, 8% for occupational health and 3% for mental health.

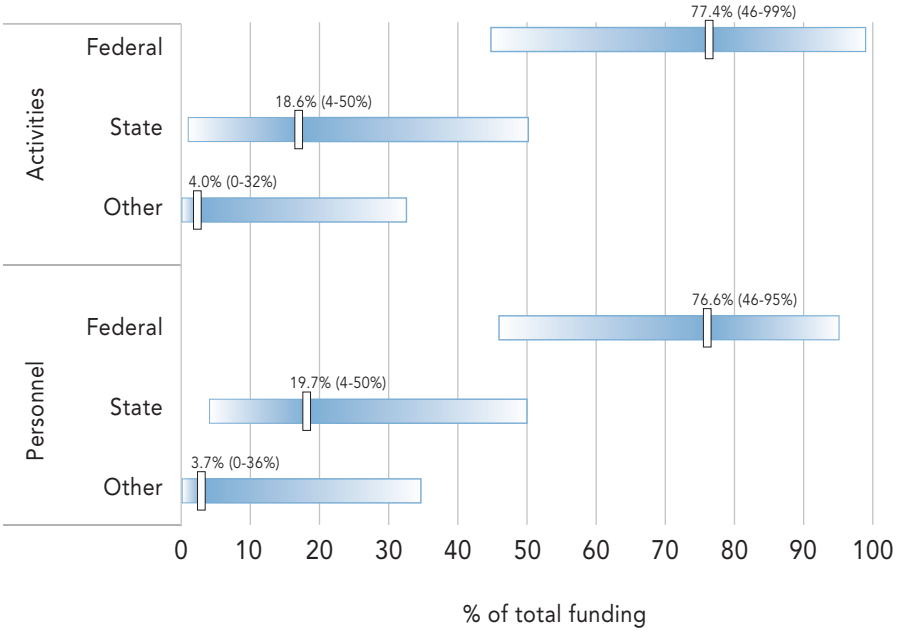
If all currently vacant epidemiologist positions were filled, the gap between current and ideal numbers of epidemiologists would narrow by almost 30%.

Funding

Epidemiology activities

As shown in Figure 8, federal funds constituted more than three-quarters (77%) of funding for all epidemiologic activities in state public health programs, with a range of 46% to 99%. States contributed an average of 19% (4% to 50%) of epidemiologic funding, while other external sources accounted for a small fraction of the total in most states. Sources of funding of epidemiologic personnel were virtually identical to those for epidemiologic activities. Only 23 states and DC received funds from other sources for epidemiologic activities, and 25 received such funds for epidemiology personnel. The three territorial respondents received nearly 100% of their funding from the federal government.

Figure 8 Mean percent and range of sources of funding for activities and epidemiological personnel, 50 states + DC, ECA, 2017



Three out of every four dollars for epidemiologic activities and funding come from federal sources. State contributions average only 20%.

Trends in funding, 2001-2017
Federal funding for state epidemiology programs increased dramatically between 2001 and 2004, with an influx of preparedness funding after 9/11 and gradual funding increases between 2004 and 2013 (Figure 9). In 2017, there was a slight drop in federal funding for the first time, from 79% to 77%. As federal funds increased over time, the state contribution declined by nearly half, from a peak of 37% in 2001 to 19% in both 2013 and 2017. Although funding from other sources increased in 2017, it still represents less than 5% of total state epidemiology funds.

Figure 9 Trends in sources of funding for epidemiology activities, 2001-2017, 50 states and DC and variable number of territories in 2004 and 2006, ECA

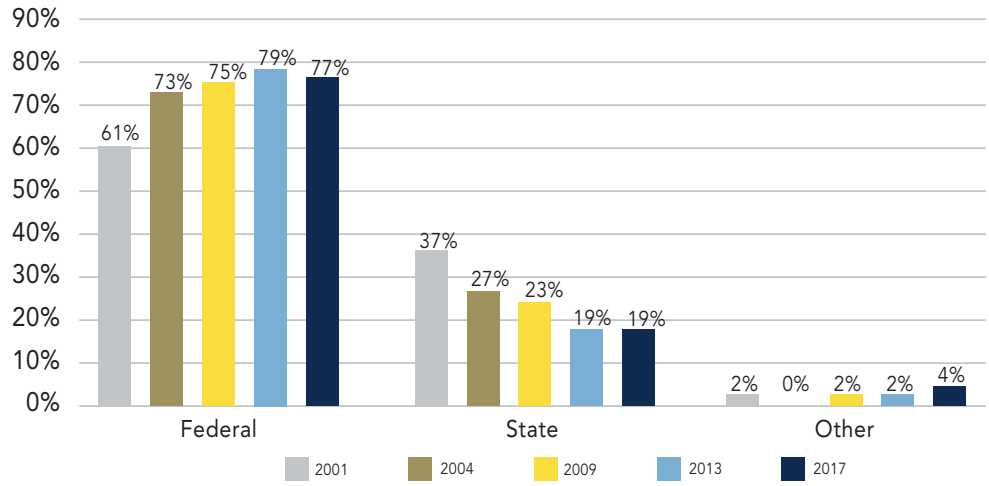
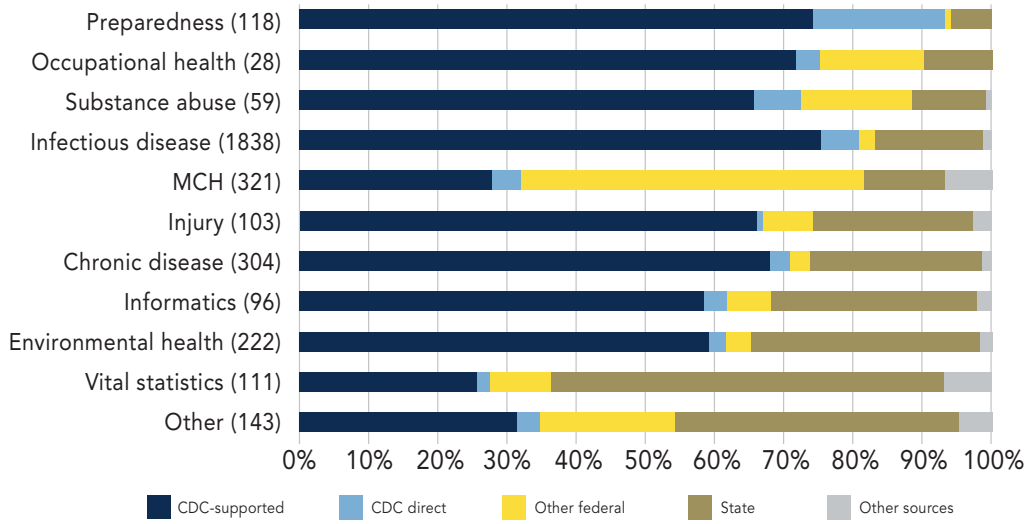


Figure 10 Source of funding by program area, 50 states and DC, ECA, 2017*‡



*Numbers in parentheses represent total positions nationally in each program area.
‡Occupational health, mental health, oral health, and genomics are excluded from the figure, as they have fewer than 25 positions, nationally.

In most program areas, the federal government, especially CDC, continues to support three out of every four epidemiology positions.

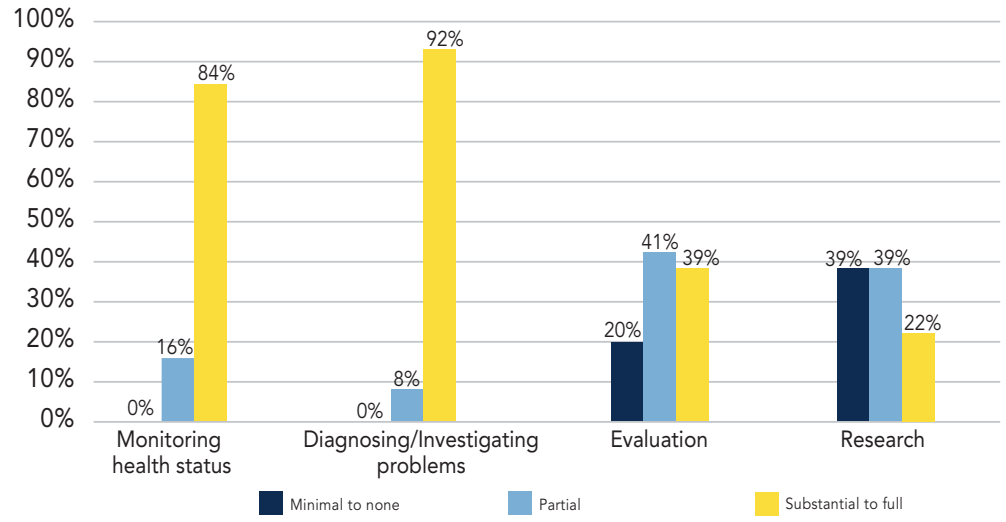
State health department capacity in Essential Public Health Services, access to the literature, and presence of an outbreak management system

Overall capacity

As shown in Figure 11, the vast majority of states reported having *substantial to full* capacity to conduct EPHS #1 (84%)—monitoring health status to identify and solve community health problems—and EPHS #2 (92%)—diagnosing and investigating community health problems and health hazards. The remainder had at least partial capacity. In contrast, only 39% of states reported *substantial to full capacity* to carry out EPHS #9—evaluating effectiveness, accessibility, and quality of personal and population-based health service—and 20% reported minimal to no capacity. Even fewer respondents (22%) reported *substantial to full capacity* to conduct research for new insights and innovative solutions to health problems—EPHS #10—with 39% reporting minimal to no capacity. Patterns were similar among the three territorial respondents, with greater capacity for EPHS #1 and #2 and lower capacity for EPHS # 9 and #10. No consistent or statistically significant pattern emerged with regard to either state size or region.

States report substantial or better capacity in monitoring health status and diagnosing and investigating health problems, but more limited capacity in evaluation and research.

Figure 11 EPHS capacities, 50 states and DC, ECA, 2017*



*Capacity defined as "the ability to lead activities, provide subject matter expertise, and apply for, receive, and manage resources to conduct the key activities for each EPHS."

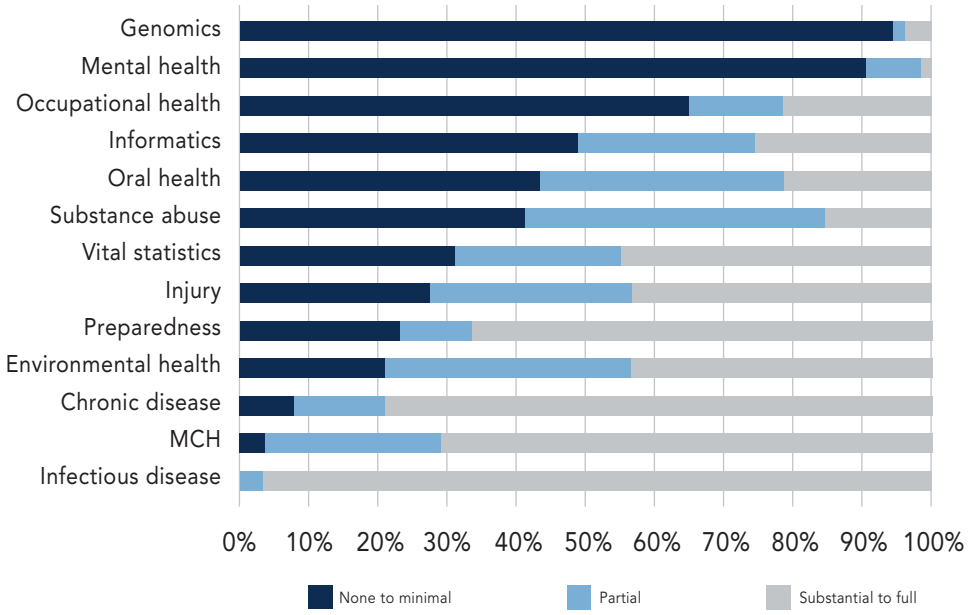
Compared with 2013, there have been modest increases in capacity for EPHS #1 (monitoring health status), from 82% to 84% reporting substantial to full capacity and for EPHS #2 (diagnosing/investigating health problems), from 90% to 92%. Capacity in EPHS #3 (evaluation) rose from 35% to 39%, but EPHS #4 capacity (research) declined from 29% to 22%. None of these changes were statistically significant.

State health department research capacity fell between 2013 and 2017, while capacity for the other three EPHS rose slightly.

Overall capacity in program areas

Respondents reported having least capacity in the areas of genomics (94% reporting *none to minimal* capacity), mental health (90%), and occupational health (65%) (Figure 12). Conversely, they reported having most capacity for infectious diseases (96% reporting *substantial to full* capacity), followed by chronic disease (78%), MCH (75%) and preparedness (57%). Between 2013 and 2017, there was no statistically significant difference in levels of *substantial to full* capacity for any of the programmatic areas listed in Figure 12.

Figure 12 EPHS capacity by program area, 50 states and DC, ECA, 2017*‡



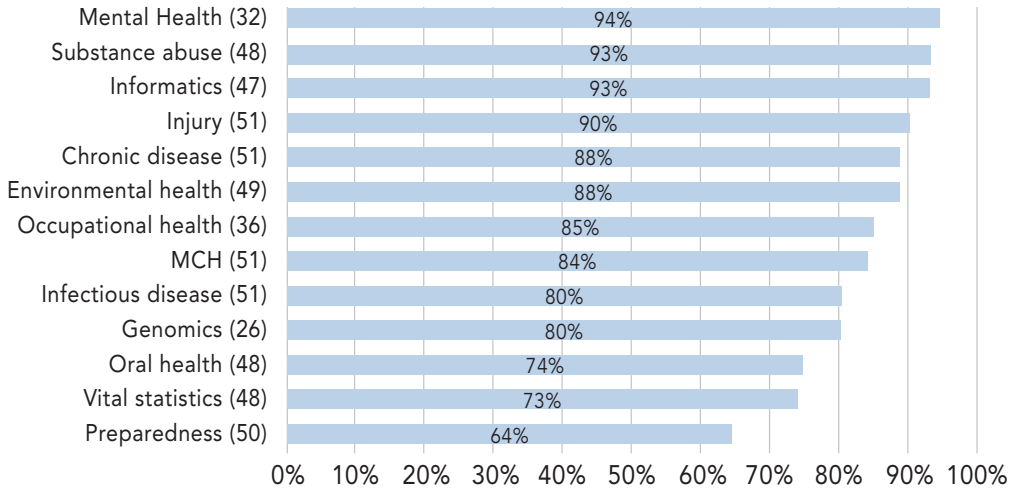
*Capacity defined as *"the ability to lead activities, provide subject matter expertise, and apply for, receive, and manage resources to conduct the key activities for each EPHS."*

‡State health departments reporting no programs in a specific area were considered to have no capacity in that area.

Capacity is high in well-established program areas including infectious diseases, MCH, and chronic diseases but is lower for newer areas such as genomics and informatics and for areas with low and waning numbers of epidemiologists, such as oral health and environmental health.

The program areas reported to have greatest need for improved capacity to carry out the four epidemiology-dependent EPHS (#1, 2, 9, 10) are mental health (94% of state respondents citing a need), substance abuse (93%), informatics (93%) and injury (90%) (Figure 13). Overall, perceived need for improved epidemiologic capacity ranged from 64% (preparedness) to 94% (mental health). Even well-established programs with relatively large numbers of epidemiologists, such as infectious diseases, MCH, and chronic diseases, had a high perceived need for improved capacity, with at least 80% of respondents noting a need for improvement. There was a strong statistical association ($p \leq 0.02$) between perceived capacity and need to improve for all areas except oral health, mental health, and informatics.

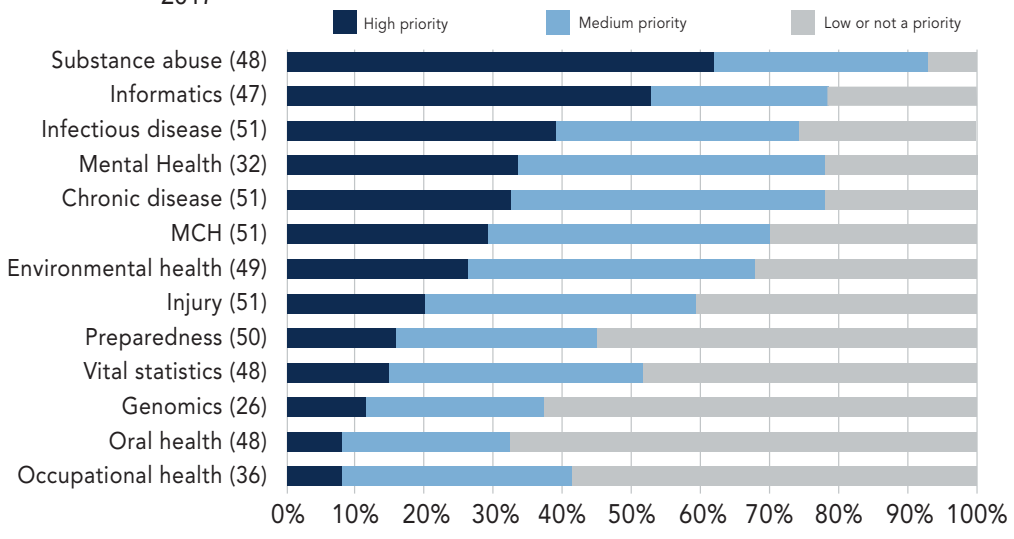
Figure 13 Perceived need to improve EPHS capacity by program area, 50 states and DC, ECA, 2017*



*Values in parentheses represent number of states responding.

As shown in Figure 14, the programmatic areas most frequently identified as a *high priority* for improving capacity were substance abuse (63%) and informatics (53%), while those identified least frequently were genomics (12%), oral health (8%), and occupational health (8%). Perceived need for improvement and high priorities were not closely linked, although programs with greatest perceived need were, with some exceptions, also accorded high priority status for improvement and those with lower perceived need with lower priority status.

Figure 14 Priority to improve EPHS capacity by program area, 50 states and DC, ECA, 2017*



*Values in parentheses represent number of states responding.

Perceived need for improvement exceeded 60% in all program areas and was highest for mental health, substance abuse, and informatics. State Epidemiologists most frequently cite substance abuse and informatics programs as a "high priority" for improvement.

Access to the literature

Rapid access to articles from peer-reviewed journals that require a paid subscription (non-open access journals) is essential to research evidence-based practices and to inform the response to community health problems. However, more than a quarter of respondents (27%) lack access to the non-open access literature. Among those who did have access, the time required to obtain articles varied considerably, from 2 hours or less to more than 72 hours (Figure 15).

Less than half the states and DC have access to non-open access literature within 24 hours, while more than one in four have no access at all.

Figure 15 Time required to access literature, 50 states and DC, ECA, 2017

- 25% ≤ 2 hours
- 22% 12-23 hours
- 20% 24-72 hours
- 6% > 72 hours
- 27% No access

Large states were more likely to lack access to non-open access literature (41%) than medium (29%) or small (13%) states, but the differences are not statistically significant. The lowest rate of "no access" was found in the 12 Midwestern states (8%), while the highest rate was in the 16 Southern states (50%; p=0.02). Two of the three territorial respondents lacked access to the peer-reviewed literature, while the remaining one had access, but only after a delay of at least 72 hours from the time of the initial request.

Outbreak management system

More than half (69%) the states and DC reported using an outbreak management system—a substantial and statistically significant increase from the 45% of states reporting such usage in 2013 (p=0.02). The three participating territories also used outbreak management systems. No significant differences were noted by state population size or region.

Salaries for civil service epidemiologists

Salaries by degree and career level

Respondents were asked to provide the minimum and maximum salaries for six degree-title categories and five career-level categories. Table 4 shows the medians of the minimum and maximum salaries as well as the ranges of the minimum and maximum values in each category. Minimum and maximum epidemiology salaries increased with educational attainment, although physician pay, which topped out at $291,000/year, was considerably higher than that for PhDs (who earned a maximum of $159,000/year) and DVMs ($180,000/year). Salaries also increased with increasing career level, though deputy and State Epidemiologists had substantially higher median salary ranges than epidemiologists at senior level and below. No consistent pattern emerged in minimum and maximum salary levels by state population size or by region. Although data were limited for the three participating territories, in general, territorial epidemiology salaries were lower than those for the states.

Table 4 Median minimum and maximum salaries and ranges by degree title and career level, 50 states and DC, ECA, 2017

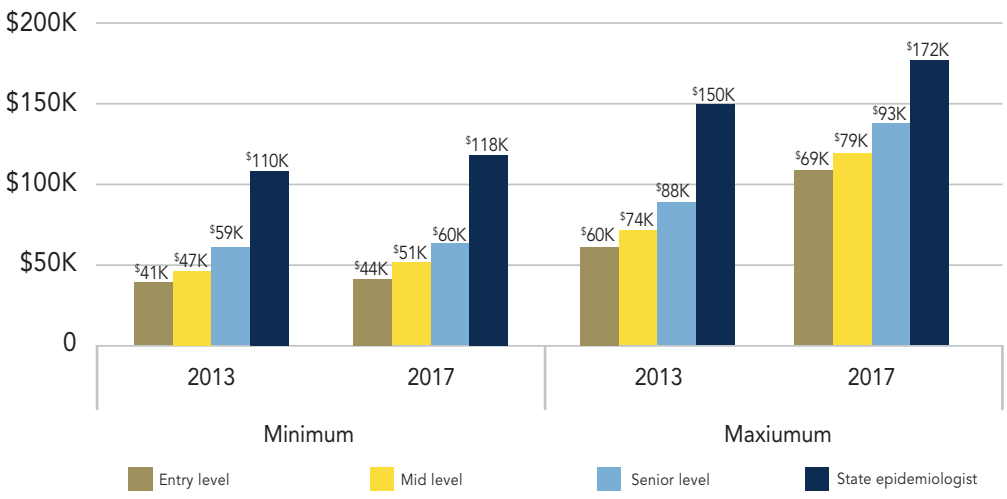
Category*	Salary			
	Median minimum	Range, minimum	Median maximum	Range, maximum
By degree				
AA (12)	$39K	$24K - $44K	$47K	$30K - 84K
BA/BS (37)	$45K	$29K - $48K	$74K	$36K - $150K
MPH (45)	$47K	$35K - $75K	$82K	$49K - $150K
PhD (44)	$58K	$38K - $69K	$98K	$52K - $159K
DVM (40)	$65K	$38K - $110K	$100K	$68K - $180K
MD (41)	$105K	$38K - $164K	$174K	$76K-$291K
By title				
Entry level (49)	$44K	$30K - $70K	$69K	$35K - $110K
Mid level (48)	$51K	$35K - $84K	$79K	$49K - $224K
Senior level (50)	$60K	$40K - $117K	$93K	$65K - $250K
Deputy (35)	$91K	$40 - $169K	$140K	$73K - $291K
State Epidemiologist (50)	$118K	$42K - $219K	$172K	$84K - $291K

*Number of respondents shown in parentheses

Changes in career-level salaries, 2013 and 2017

Between 2013 and 2017—when the total US inflation rate was 4.5%—the median minimum salary increases ranged from 2% for senior-level epidemiologists to 8% for mid-level epidemiologists (Figure 16). Median maximum salaries increased more substantially, with a range of 7% for senior-level positions to 15% for entry-level epidemiologists, and for State Epidemiologists.

Figure 16 Minimum and maximum median salaries by career level, 50 states and DC, ECA, 2013 and 2017*



*Values for deputy epidemiologists were not included because of the large number of missing values (34 in 2013, 16 in 2017)

Epidemiology training and the Applied Epidemiology Competencies

Training in epidemiology

As seen in Table 5, almost all states and DC (94%) reported the availability of health department funding for formal training or education outside the organization, such as at conferences and seminars. On-site staff training (e.g., seminars) and state health agency training/education for local epidemiologists were also commonly provided (by 86% and 82% of states, respectively), and 39% of states had one or more staff positions responsible for internal training. Three quarters of states (76%) considered education and training objectives in the performance review process; just 6% required continuing education in epidemiology.

In general, epidemiology training practices did not differ by state population size. However, 94% of medium-sized and large population states provided training to local epidemiologists, while only 57% of small states did so (p=0.009).

Two of the three responding territories paid for outside training and had staff positions for internal training. One of the three territories provided training for local epidemiologists, and another included education/training objectives in staff performance reviews.

Table 5 Agency efforts to provide and encourage training in epidemiology, 50 states and DC, ECA, 2017

Activity	%
Paid outside formal training (conferences/seminars)	94%
On-site training (epidemiology seminars, etc.)	86%
Training or education for local epidemiologists	82%
Staff position(s) for internal training	39%
Education/training objectives in performance review	76%
Required continuing education	6%

Cross-training in informatics

As shown in Table 6, 80% of state health departments pay for formal informatics training. Almost half (47%) provide on-site training, and about a third (32%) provide informatics cross-training for local epidemiologists. In addition, nearly a quarter of state health departments (22%) have staff positions responsible for internal informatics cross-training. However, just 8% of states require cross-training in informatics. Overall, informatics cross-training practices did not differ by state size, and there was no association between an agency's perceived informatics capacity and its support for informatics training. Territorial respondents offered few or no informatics cross-training activities.

Table 6 Agency efforts to provide and encourage cross-training in informatics for epidemiologists, 50 states and DC, ECA, 2017

Activity	%
Paid outside formal training (conferences/seminars)	80%
Provide on-site informatics training (seminars, etc)	47%
Informatics cross-training for local epidemiologists	32%
Staff position(s) responsible for internal cross-training	22%
Required cross-training in informatics	8%

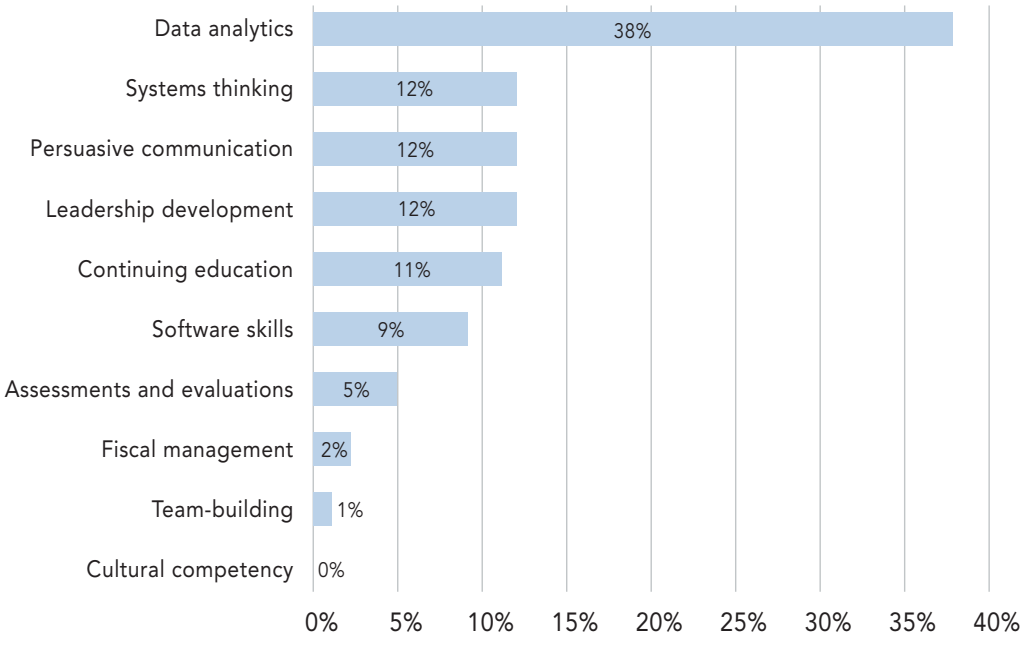
Comparison of training and cross-training activities, 2013 and 2017

Between 2013 and 2017, the portion of states providing support for paid external informatics training for health department epidemiologists increased from 67% to 80%; and the portion providing on-site informatics training rose from 25% to 32%, though neither finding was statistically significant. Rates of other state informatics training activities—cross-training for local epidemiologists, staff support for internal cross-training and requirements for informatics cross-training—were similar in 2013 and in 2017.

Training priorities

Respondents were asked to identify their two top training needs. As seen in Figure 17, the most frequently identified training priority, by a considerable margin, is data analytics, defined as *informatics and applying and translating public health data* (cited as a top training need by 38 respondents). Other training priorities included systems thinking (*systems development, change management, strategic planning, and/or flexibility*), persuasive communication (*articulating a message to the public, communicating public health research and data, policy engagement, etc.*) and leadership development (*identifying future leaders, coaching/mentoring programs, retention of current leaders*), each of which was mentioned by 12 respondents, followed by continuing education (11 respondents). Less frequently cited training needs include software skills, assessment/evaluation, fiscal management, team building, and cultural competency.

Figure 17 Top training needs identified by State Epidemiologists, 50 states and DC, ECA, 2017*



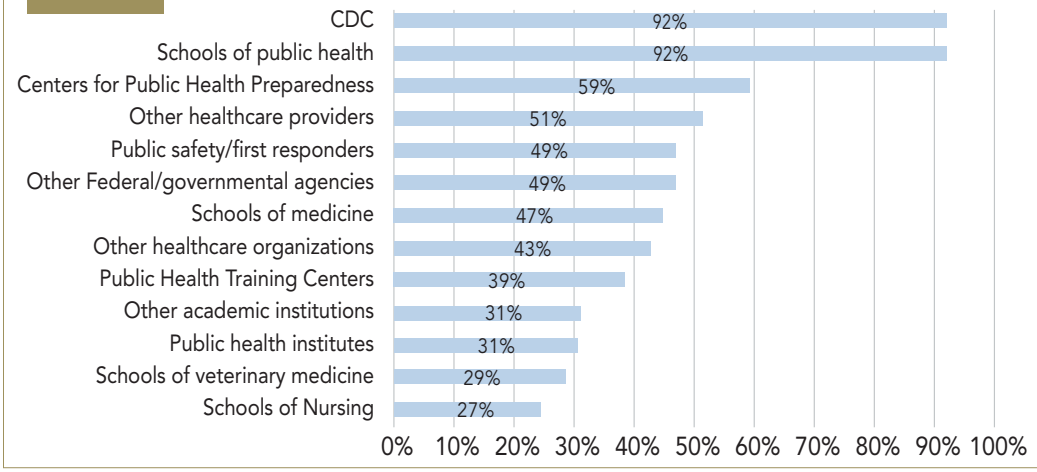
*Each of the 51 respondents identified their two most pressing training needs, for a total of 102 responses.

Data analytics is a top training need for the majority of states.

Collaboration in training

The most commonly cited training partners for state health agency epidemiology programs are CDC and schools of public health (each mentioned by 92% of respondents). However, as shown in Figure 18, state epidemiology programs collaborate on training with a wide variety of national and local entities, ranging from first responders to schools of veterinary medicine. All three territorial respondents collaborate on training with CDC, but with few other partners.

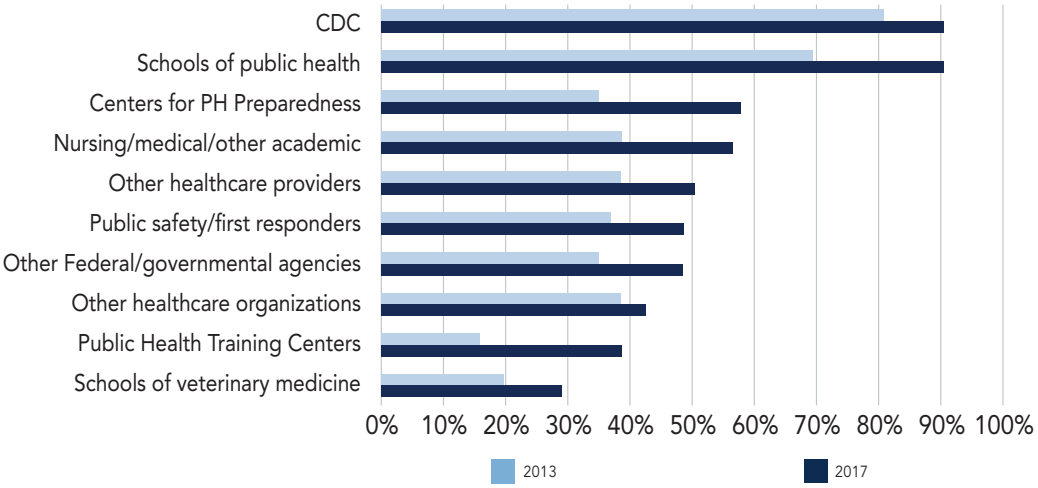
Figure 18 Health department training partners, 50 states and DC, ECA, 2017



Changes in collaborating partners between 2013 and 2017

Since 2013, state epidemiology program collaboration has increased across a broad range of partners, as shown in Figure 19. The increases were statistically significant ($p < 0.05$) for collaborations with schools of public health (from 72% to 92%), the Centers for Public Health Preparedness/Preparedness and Emergency Response Learning Centers (from 35% to 59%) and for Public Health Training Centers (from 16% to 39%).

Figure 19 Changes in collaborating partners between 2013 and 2017, 50 states and DC, ECA



Collaboration with other organizations for training has increased markedly since 2013.

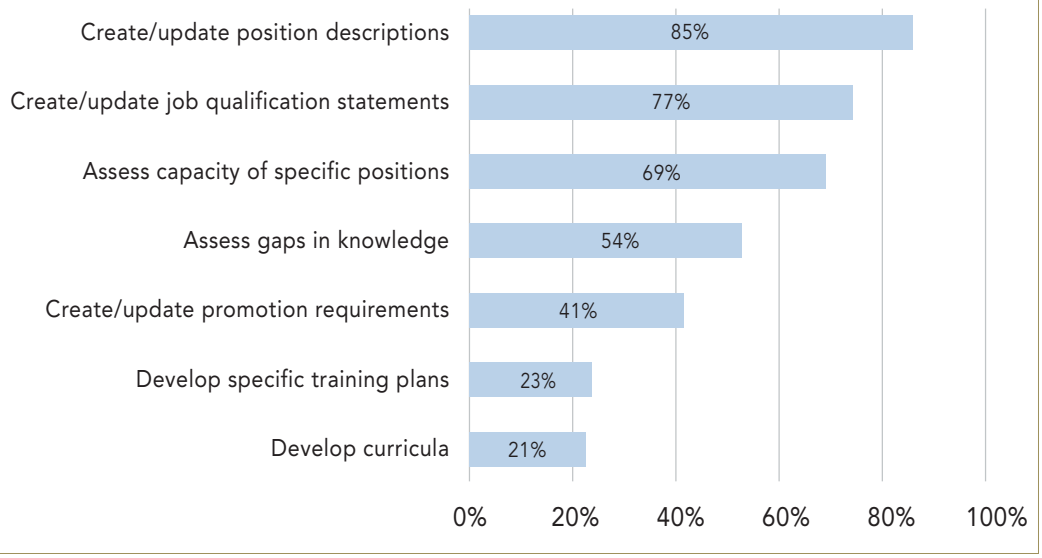
Use of Applied Epidemiology Competencies (AECs) to define epidemiology career paths

State Epidemiologists were asked how their health departments used the AECs, which were developed in 2008 by CDC and CSTE, to define career paths for applied epidemiologists. About three-quarters of state respondents (76%) reported using the AECs for one or more purposes; the remaining 24% either did not use them or were unsure if they had.

As shown in Figure 20, among the 39 jurisdictions reporting AECs usage, the most common uses were to create or update position descriptions (85%), creating or updating job qualification statements (77%), assessing the epidemiological capacity of specific positions (69%), and assessing gaps in knowledge. The AECs were less frequently used to create/update promotion requirements (41%), develop specific training plans to address knowledge gaps (23%) and to develop curricula for continuing education or training programs (21%).

Only one of the three participating territories reported using the AECs for any purpose.

Figure 20 Uses of AECs by state health departments, 38 states and DC, ECA, 2017*



*Excludes states that did not use or were not sure they used the AECs.

Three quarters of the states and DC have used the AECs, most commonly for creating and updating position descriptions and job qualification statements.

Existing practices, incentives, and barriers aimed at strengthening the state epidemiology workforce

Obstacles to recruitment

The factors State Epidemiologists most frequently cited as *major* and *moderate* recruitment problems relate primarily to compensation and advancement opportunity: restrictions on offering competitive pay, salary scale, hiring quickly enough, and opportunity for promotion (Table 7). In contrast, required travel, job interest and fulfillment, job security, and training opportunities were either *not a problem* or only a *minor problem* for recruitment. All three territorial respondents cited salary, hiring quickly enough, and recruiting outside the organization as *major* or *moderate* problems. Two of the three added to this list competitive pay, promotion opportunities, location, restriction on choosing candidates, benefits, and job security.

Table 7 Factors affecting recruitment, 50 States and DC, ECA, 2017

Factor	Major problem	Moderate problem	Minor problem	Not a problem
Restriction on offering competitive pay	47%	33%	16%	4%
Salary scale	31%	45%	22%	2%
Opportunity for promotion	24%	49%	25%	2%
Hiring quickly enough	31%	31%	25%	12%
Location	16%	31%	16%	37%
Hiring freezes	16%	27%	22%	35%
Personnel policies and procedures	6%	25%	29%	39%
Restriction on choosing best candidate	8%	14%	33%	45%
Opportunities for training	2%	20%	45%	33%
Recruiting outside your organization	4%	14%	45%	37%
Travel permitted	2%	14%	20%	65%
Job interest/fulfillment	0%	14%	41%	45%
Job security	2%	10%	35%	53%
Job benefits	2%	6%	25%	67%
Travel required	0%	2%	8%	90%
Another factor	15%	15%	0%	71%

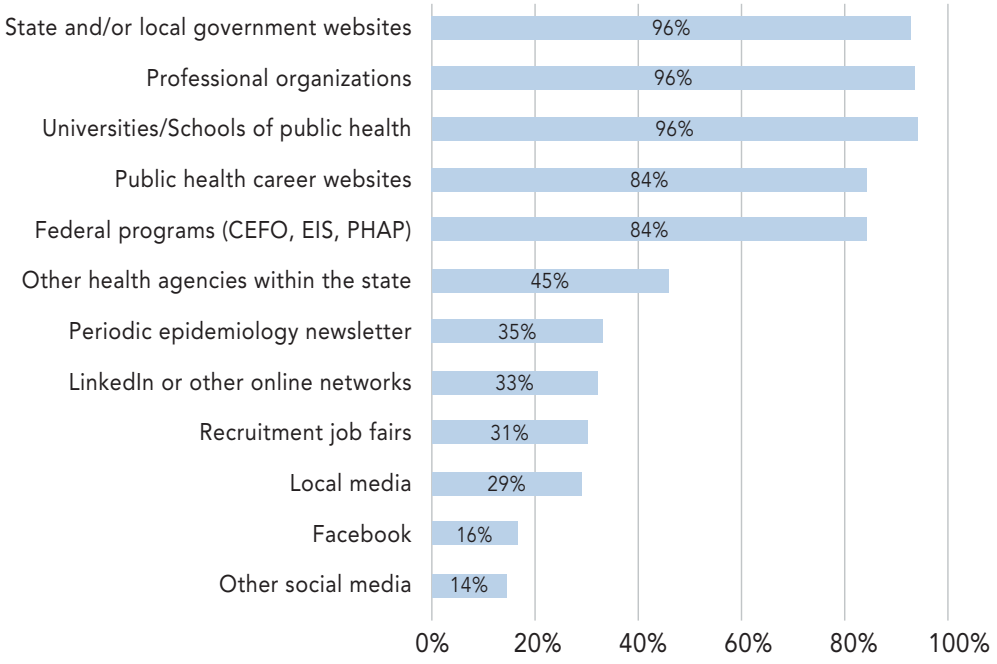
There were no statistically significant differences between the recruitment problems noted in 2013 and in 2017.

Competitive pay, salary scale, hiring delays and lack of promotion opportunities continue to be serious recruitment obstacles.

Sources for recruitment

As seen in Figure 21, state and local government websites, professional organizations and universities/schools of public health were the most commonly cited recruitment sources, each used by 96% of states. Additionally, public health career websites and federal programs like the Epidemic Intelligence Service were used by 84% of state health departments. LinkedIn and other online networks were used by 33% of respondents, followed by Facebook (16%) and other social media (14%). Compared with previous years, the use of online sources has increased significantly; in 2013, only one state mentioned social networks (including LinkedIn) as a recruitment vehicle, compared with 17 in 2017.

Figure 21 Recruitment sources, 50 states and DC, ECA, 2017

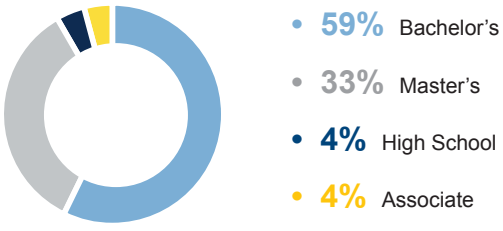


Recruitment through online networks and social media is increasing, although conventional mechanisms, such as job postings on websites and recruitment at meetings and in academic settings, were more frequently used.

Minimum hiring requirements

Most state health agencies require a bachelor's degree (59%) or master's degree (33%) for entry-level epidemiologists (Figure 22). About half of the states (49%) require less than a year's experience for these entry-level positions, while 26% require two years, and 10% require more than two years. The most commonly cited acceptable experiences were full time work (96%), paid work (94%), internships (71%) and volunteer work (53%).

Figure 22 Minimum educational attainment required for hiring, 50 states and DC, ECA, 2017



Moreover, states accepting bachelor's-level candidates were more likely to ask for more than one year of experience than states requiring a master's degree for entry-level epidemiology positions (67% versus 29%; p=0.01).

One of the three territories requires only a high school degree for entry-level epidemiology positions, and the remaining two require a master's degree. All require less than one year of experience.

Retention and continuity planning

Obstacles to retention

The factors State Epidemiologists most frequently cite as *major* and *moderate* problems for staff retention were salary, opportunity for promotion, restriction on merit raises, and loss to the private or government sector (Table 8). In contrast, required travel and job benefits were most frequently cited as *not a problem*. All three of the responding territories report *opportunity for promotion* as a *major* or *moderate* problem, and two of the three also cite salary, restrictions on raises, location, policies and procedures, and job security as at least a *moderate problem.*

Table 8 Factors affecting recruitment, 50 States and DC, ECA, 2017

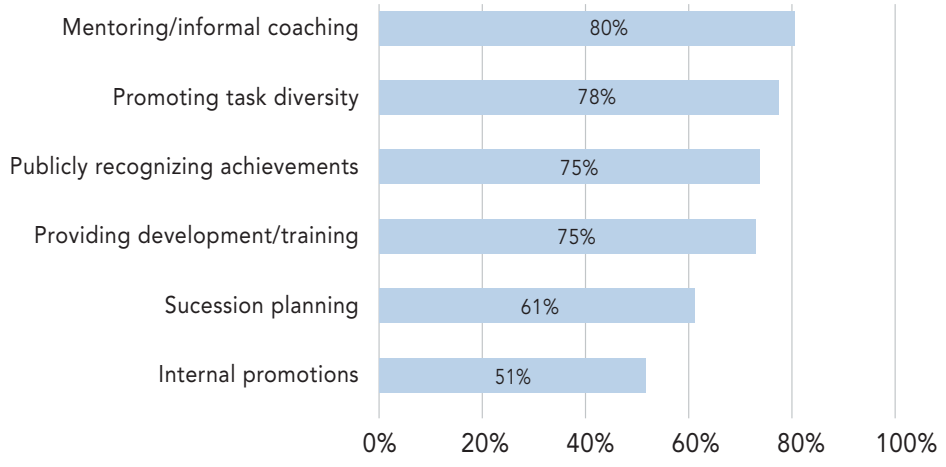
Factor	Major problem	Moderate problem	Minor problem	Not a problem
Salary	39%	41%	16%	4%
Opportunity for promotion	37%	51%	8%	4%
Restrictions on merit raises	35%	35%	25%	4%
Loss to private or government sector	12%	53%	27%	8%
Travel outside jurisdiction	8%	16%	33%	43%
Job location	8%	27%	29%	35%
Personnel policies and procedures	6%	20%	31%	43%
Travel permitted	4%	10%	33%	53%
Job security	4%	6%	39%	51%
Layoffs from budget restrictions	2%	14%	35%	49%
Opportunities for training	2%	20%	47%	31%
Job benefits	2%	8%	29%	61%
Job interest/fulfillment	0%	14%	63%	24%
Travel required	0%	2%	12%	86%

Although there were no statistically significant differences in retention obstacles between 2013 and 2017, it is notable that 88% of 2017 respondents reported *opportunity for promotion* as a *major or moderate* problem, compared with 74% in 2013. Other factors affecting retention remained stable over this five-year period or were less likely to be cited as problematic.

Strategies to minimize staff turnover

As shown in Figure 23, most State Epidemiologists report using a variety of methods to minimize staff turnover, including mentoring and coaching, promoting task diversity, publicly recognizing employee achievements, and providing professional development and training. No method was used by more than one of the three territorial respondents.

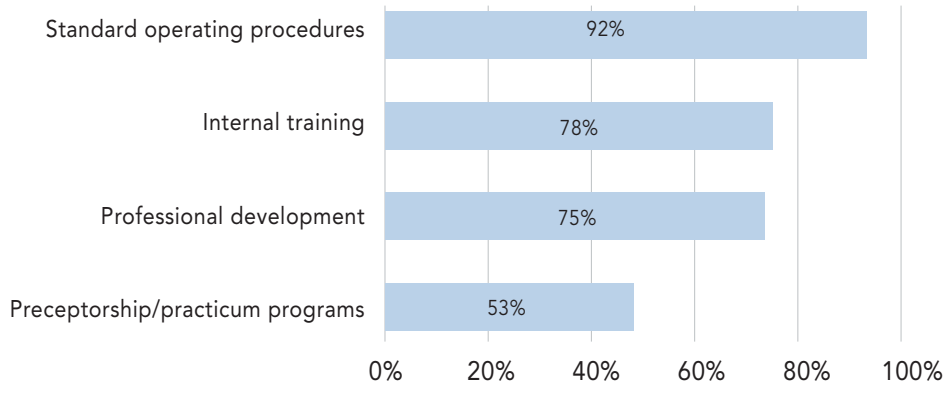
Figure 23 Methods to minimize turnover, 50 states and DC, ECA, 2017



Maintaining institutional knowledge

Virtually all state respondents (92%) reported developing standard operating procedures to maintain institutional knowledge and most also used internal training (78%) and professional development (75%) (Figure 24). Over half (53%) also reported participating in preceptorship or practicum programs, and several noted the use of cross-training, legacy manuals and/or double-filled high-level positions. All three territorial respondents reported using internal training, and two of the three have developed standard operating procedures.

Figure 24 Methods to maintain institutional knowledge, 50 states and DC, ECA, 2017



Remarks from State and Territorial Epidemiologists on Critical Issues

For the first time in 2017, the ECA included an open-ended question: *As the State Epidemiologist, what are the most critical issues you face?* Several themes emerged from their answers, including recruitment and retention, developing and maintaining a competent and qualified workforce, addressing emerging issues, funding and unfunded mandates, and leadership. The comments in this section reinforce the quantitative findings as well as provide additional details concerning the magnitude and seriousness of many of these issues. In this section, we summarize some of the responses and provide illustrative quotes.

Overall, current staffing levels are inadequate to meet the needs to maintain basic epidemiological functions and emerging problems.
Respondents cited problems with recruitment and retention, heavy reliance on vertical federal funding, and lack of flexibility to deal with changing needs. These challenges appear to be particularly acute in states with hard-to-reach, rural populations and with limited local health department capacity.

> *"[There is a] lack of funding and state positions to expand capacity in areas with existing epidemiologic activities and to create capacity in areas without current epidemiologic activities."*

> *"[A challenge is] balancing resources to meet emerging issues, basic responsibilities and cooperative agreement deliverables."*

> *"We are challenged with continued increasing reporting and work requirements in most program areas despite level or decreasing federal funding."*

Recruitment of high-quality epidemiology staff is a challenge.
Respondents frequently mentioned hiring freezes, inability to hire quickly, and lack of adequate funds for recruitment. Some reported limited ability to create new positions to address emerging public health problems such as Zika virus and the opioid epidemic. Several respondents reported having to use contractors because of state hiring restrictions.

An additional issue cited by respondents is finding epidemiology candidates with appropriate skillsets, especially nurses, physicians, individuals with existing public health experience, and individuals with expertise in important emerging fields, such as informatics.

> *"Our hiring process is too lengthy not only to fill federally funded positions, but for those we are hiring, and we lose qualified candidates due to the process."*

Organizational issues adversely affect retention and turnover and threaten programmatic continuity and institutional memory.
Among the factors identified as contributing to high staff turnover are limited opportunities for promotion, lack of competitive compensation, loss of pension programs, uncertain funding for staff positions, and undefined career paths. As a result of these organizational problems, respondents report having MPH epidemiologists leave the workforce for PhD programs and both MPH and PhD-level staff leave public health for the private sector. Frequent loss of staff, in turn, leaves insufficient supervisory-level epidemiologists—a problem respondents expect to worsen as a cohort of experienced, long-time staff members retire.

> *"[A] high level of epidemiologist staff turnover [is] leaving a workforce of relatively young and new epidemiologists, with less experience and institutional knowledge."*

> *"There is need for attractive salaries, there is need for job security, there is need for career pathways for progression."*

> *"Years of service for our most experienced [epidemiologists] means that we stand to lose a great deal of experience to retirement within the next 5 years."*

New or different knowledge and skillsets are needed to meet to current gaps in capacity, to respond to emerging public health challenges, and to adapt to new technologies.
The need to improve skills in evaluation, communication with the public, and risk communication were frequently cited by respondents. They also frequently identified emerging fields of informatics and data analytics as high priority for training. At the same time, however, respondents stressed the importance of maintaining traditional epidemiological skillsets and developing the ability to step back and look at the bigger picture.

"One of my main concerns is having a workforce prepared to function in the new world of public health epidemiology. We are facing big changes right now in how we receive information, the volume of data/information, emerging programs related to [hospital acquired infections] with large expectations [and] rapid changes in lab testing.... that affect the information we receive and the need to adapt all our investigation protocols accordingly. It is challenging to keep the workforce well prepared in the face of so much change at such a rapid pace."

"We need improvements in our informatics abilities, so we can capture and efficiently utilize all our data…There should be formally trained informaticians."

"[Epidemiologists] need to be able to assess not only the 'how' of data analysis, but also be able to evaluate the work that is being performed by the various programs they support to address questions of health impact and use the published evidence-base to help direct and steer the work being performed. This often is in the realm of 'program evaluation' and utilizes a slightly different skill set, but epidemiologists need to be cross-trained in these skills as their work overlaps with that of evaluation."

"Transitioning from a number of one-off data systems to a more efficient interoperable system with enterprise-wide approaches to data collection, data parsing, data provisioning, data preparing, data analysis and data visualization requires additional training in informatics and data analytics."

"[Building informatics capacity within the agency is important to] ensure that we have data on the health status of the population to inform programs and policies. For example, with legalized retail marijuana, we need surveillance, and use, attitudes and health impacts. People are increasingly concerned about the effects of environmental toxins on health – we need adequate health data on exposures and outcomes to help address this issue."

"The field of 'informatics,' while important, is unintentionally overshadowing how important bread and butter epidemiology is to our field."

"There is a need for epidemiologists to be able to think critically about the diseases and risk factors under surveillance and to be able to look beyond the mechanics of just data analysis."

Training and mentoring are essential to ensure programmatic continuity, institutional memory, and a high level of expertise (especially in areas requiring unique skillsets) but require considerable resources.
Respondents reported that high staff turnover, evolving health department priorities, and emerging disciplines (e.g., informatics) have all exacerbated the need for training, mentoring and continuing education. At the same time, restrictions on travel and educational funding have created new impediments to training. The reported result is an increased burden on experienced epidemiologists to fill the training gap, sometimes at the expense of carrying out routine activities in understaffed agencies.

"It is challenging to keep the workforce well prepared in the face of so much change at such a rapid pace."

"Emerging diseases or PH threats would not be as disruptive if the staff were more seasoned and more comfortable with the day-to-day activities before the crisis hits."

"Constantly training new staff prevents us from improving upon, or even sustaining key public health activities."

"Hiring entry level [epidemiologists] requires a good deal of training and mentoring that taxes existing staff. It is vital that new epidemiologists overlap as much as possible with our experienced [epidemiologists] in the next 2-3 years to retain institutional memory and be public health savvy."

Dealing with emerging and re-emerging problems that often distract from routine epidemiologic functions represents a serious challenge

New and resurgent infectious diseases, healthcare- acquired infections, antimicrobial resistance, violence, and the opioid crisis have gained increasing prominence in recent years. Respondents reported that the ability to deal with these emerging threats is limited by several factors, including lack of staff, lack of training and skills in these areas, and limited financial and human resource management flexibility to create positions. In addition, positions in these areas are vulnerable to changes in federal funding priorities. Finally, although important, some reported that the emphasis on emerging problems distracts from conducting routing critical epidemiological activities.

"We have a small staff overwhelmed with growing responsibilities, including prescription drug overdose, syndromic surveillance, healthcare associated infections, and others."

"Continuous response mode to ID and other issues limits time for evaluating effectiveness, research, publications, disseminating data in reports etc."

"Recent public health threats (H1N1, Ebola, Zika, etc.) have exacerbated the cycle of increased attention and funding to specific program areas followed by loss of attention and funding, but these threats have not results in acknowledgement of the need to maintain a basic level of readiness for all existing and emerging threats."

"[There is] a lack of flexibly funded senior level epidemiologists who can take on emergent issues."

Uncertain funding for applied epidemiology harms staff morale/retention and public health preparedness.

Respondents reported that heavy reliance on federal funding in an uncertain fiscal environment has a negative impact on perceived job security, job satisfaction, staff morale and staff retention, especially in jurisdictions that are also experiencing their own budget deficits. By straining the capacity of existing staff, unfunded—or inconsistently funded—mandates undercut readiness to respond to new threats. Additionally, the public health laboratories that supply critical data to epidemiologists are also experiencing budget problems.

"We have shrinking resources as our department becomes larger, yet we are expected to fill roles that we are not funded for."

"Increased attention and funding to specific program areas [is] followed by loss of attention and funding, but these threats have not resulted in acknowledgment of the need to maintain a basic level of readiness for all existing and emerging threats."

"The high level of dependency on federal funding sources limits the flexibility of the state to respond to emerging public health threats and increases vulnerability of the workforce to reductions in federal appropriations."

DISCUSSION

Discussion

Key Findings

Numbers of epidemiologists

- **The overall number of state health department epidemiologists continues to rise.** In 2017, 3,370 epidemiologists were employed by state health agencies (including DC)—a 22% increase over 2013 and the highest number yet observed in the ECA. A parallel 20% increase occurred in the number of epidemiologists per 100,000 population nationwide (now 1.04/100,000), with a stepwise increase in the number of epidemiologists/100,000 population from small to large states. These composite values, however, mask rates ≤0.5/100,000 in six states, four of which have with populations greater than 6 million. Although the number of epidemiologists may be higher than reported here in states with large city and county health agencies (which were not assessed as part of the ECA), this finding is nonetheless concerning and merits further monitoring of capacity.
- **Much of the increase in epidemiology staffing is limited to infectious disease, which already has many epidemiologists.** Infectious diseases added 487 positions, compared with 2013. The only other areas for which added a substantial number of epidemiologists were injury (48) and MCH (39). In contrast, preparedness, chronic diseases, environmental health, occupational health and a few other areas continued to lose positions as part of an ongoing trend. Since 2014, CDC's Epidemiology and Laboratory Capacity for Infectious Diseases (ELC) Cooperative Agreement has awarded states supplemental funding for Ebola, Zika, healthcare associated infections, and antimicrobial resistance (Chung, Fischer, O'Connor, & Schultz, 2017). CDC has also recently increased funding to injury programs for opioid surveillance. These supplemental awards may have contributed to increases in infectious disease and injury epidemiologist positions.
- **There is a perceived need for additional staffing, even in program areas that already have many epidemiologists.** Participating State Epidemiologists expressed the need for nearly 1,200 additional epidemiologists at a master's level or higher to reach full capacity to carry out EPHS #1, 2, 9 and 10, representing a 36% increase over current levels. Nearly 600 of the additional epidemiologists are needed for infectious disease, MCH, and chronic disease programs, which already represent 75% of the epidemiology workforce. Although the additional need as a percentage of current staffing levels is high for many of the small program areas, nationally, the number of additional positions perceived necessary is small (e.g., 64 for substance abuse, 42 for mental health, and 20 for genomics). While supplemental awards such as the ELC and Public Health Emergency Preparedness (PHEP) Cooperative Agreements have contributed to increases in epidemiologist positions and overall capacity to monitor health status and diagnose public health problems and hazards, their short-term nature may be reflected in responses indicating that more epidemiologists are needed across all program areas.
- **Staffing may not be proportionate to needs in emerging areas, such as substance abuse.** Substance abuse is now a leading cause of death for US adults, with more than 64,000 substance abuse deaths reported in 2016 (Centers for Disease Control and Prevention, 2016). Epidemiologic surveillance, investigation, evaluation, and research are critical to describe and control factors contributing to substance abuse. Despite alarming recent trends, however, the area remains poorly staffed, and over 60% of states perceived the need for additional epidemiologic capacity. Of note, in the eight states with 2015 age-adjusted opioid mortality rates exceeding 25 per 100,000 population, the median number of substance abuse epidemiologists was two, with a range of 1-7.

EPHS capacity

- **Perceived EPHS capacity by program area correlates closely with the number of epidemiologists working in that area.** More than 90% of jurisdictions reported *substantial to full* epidemiologic capacity for infectious diseases, MCH, and chronic diseases—areas that employ nearly three-quarters of state health department epidemiologists. In contrast, many of the areas with few epidemiologists report having *none, minimal or partial* capacity. For example, just 3% of all epidemiologists were employed in substance abuse, occupational health, oral health, genomics, and mental health—areas in which the vast majority of jurisdictions reported insufficient capacity.
- **The perceived need for enhanced EPHS capacity exceeded 60% in all program areas, including those that appear to be well staffed.** Perceived need was highest for mental health, substance abuse, and informatics, with the latter two most frequently designated as highest priority for improvement. However, respondents' perceived need for expanded capacity even in areas with substantial numbers of epidemiologists suggests that the current workforce may lack the skillsets needed to achieve adequate EPHS capacity.
- **EPHS capacity for evaluation and research remains low.** In 2017, capacity for EPHS #1 (surveillance) and #2 (public health investigations) was high and little changed since 2013 (84% and 92%, respectively, with *substantial to full* capacity). Yet, only 39% of jurisdictions had *substantial to full* capacity for EPHS #9 (evaluation), up slightly from 35% in 2013, and just 22% had *substantial to full* capacity for EPHS #10 (research), down from 29% in 2013. These findings may impact jurisdictions' ability to respond to funding opportunity announcements. They suggest that health agencies focus more on hiring epidemiologists with evaluation and research skills, providing existing staff with evaluation and research training, and diversifying funding to support evaluation and research activities.
- **Changes in the number of staff have not been accompanied by substantive improvements in overall and program-specific EPHS capacity.** A jump in the overall number of state health department epidemiologists between 2009 and 2013 was associated with contemporaneous improvements in capacity for the four epidemiology-dependent EPHS. This effect, however, was not replicated between 2013 and 2017. In fact, in 2017, there were no statistically significant changes in the percentage of jurisdictions reporting *substantial to full* capacity in any specific program area despite changes (mostly increases) in the number of epidemiologists. These findings suggest that the current epidemiology staff shortage is not a problem of numbers alone and that epidemiologists are needed who have different skillsets who can complement existing health department strengths in monitoring, diagnosing and investigating health problems. Moreover, a competent applied epidemiology workforce will benefit from partnerships to access training and multi-disciplinary strategies to improve analysis of complex data and efficient resource utilization.
- **Access to non-open-access, peer-reviewed literature is suboptimal.** More than a quarter of states report that they do not have full access to the scientific literature, and an additional quarter report that access was delayed by more than 24 hours. Such access is essential to inform the response to emerging issues and to ensure that ongoing activities are evidence-based. Understanding how states with rapid access have arranged to obtain literature may assist states with slow or no access by illuminating potential solutions, such as university partnerships or participation in the National Network of Libraries of Medicine.

Training and the Applied Epidemiology Competencies

- **By a considerable margin, the greatest training priority was in analytics, defined as *informatics and the application and translation of public health data.*** Other training priorities included systems thinking, persuasive communication, and leadership development. The 2017 ECA demonstrated that while training is readily available in epidemiology, training in informatics is less well developed. As noted for other training needs, partnerships and collaboration with schools and programs of public health to incorporate analytics into their curricula could contribute to developing these much-needed skills in the applied epidemiology workforce.

- **Collaboration with outside groups increased since 2013, with CDC and schools of public health the most important collaborating partners.** As public health practice continues to transcend disciplinary siloes, it becomes ever more important to emphasize inter-professional education and collaboration. Additional exploration is needed to better understand the relationships among collaborating partners to determine how these relationships are initiated and sustained.
- **A quarter of jurisdictions have not used the 2008 Applied Epidemiology Competencies.** The use of the AECs—a comprehensive, four-tiered list of competencies that defines the discipline of applied epidemiology and describes the skills needed by epidemiologists at progressive levels of practice—not optimal. Their use has been limited primarily to develop or update position descriptions and job qualification statements and to assess epidemiology capacity of specific positions. They were less commonly used to develop training plans to address knowledge gaps or to develop training or continuing education activities. Previous data on AEC use are not available for comparison purposes.

Funding

- **Federal funding continues to pay for most epidemiology activities and personnel in state health agencies and limits adequate coverage of underserved program areas.** Nationwide, nearly 80% of funding for epidemiologic activities and personnel comes from the federal government, primarily from CDC, with less than 20% coming from the states themselves. Although the federal contribution is slightly less than in the past, it constitutes the vast majority of funds for most public health program areas and, according to ECA respondents, drives priorities and creates programmatic "silos." The overall effect is to leave some essential functions—e.g., maintaining surveillance systems and conducting routine health department investigations—underfunded. Respondents also reported that reliance on federal funds limits flexibility to adjust resources to deal with emerging issues, such as the opioid epidemic. Although increased state funding may help solve these problems, the states' contribution to epidemiology activities and personnel remained unchanged between 2013 and 2017.

Recruitment and retention

- **The biggest recruitment and retention challenges are similar: salaries, opportunities for promotion, and restrictions on pay and merit raises.** While several states report they are working to improve epidemiology career paths, funding remains a sticking point for salaries and raises. In most, if not all states, salaries and raises are fixed by the state government. Between 2013 and 2017, salaries increased by more than the rate of inflation, but for several of the career levels, salaries remain low. In an era of increasing student debt, health department salaries are likely to become less and less competitive with other employers (Baum and Ma, 2016). Although non-financial rewards—stimulating work environment, the opportunity to contribute to community health, and employee recognition—may improve retention, efforts are needed to both highlight the unique and rewarding aspects of epidemiology practice and to achieve more competitive compensation.
- **Most state epidemiology positions require a bachelor's degree or higher, and half require at least one year of experience.** Data on academic qualifications were not collected in 2017, but in 2013, almost all state health department epidemiologists had at least a master's degree. Yet even with the requirements of a graduate degree and experience, newer staff may not bring the needed skills in evaluation and research, as well as data analytics and systems thinking, which tend to require advanced training and for which on-the-job training may be difficult. Thus, it is likely that the training and experience required for hiring will increase over time—a finding that suggests the need to work with schools and programs of public health to strengthen epidemiology curricula in these core areas.

Territorial challenges

- **Territories face special challenges related to geographic isolation, high turnover, slow hiring, and, in some cases, low salaries and poor access to the literature.** Maintaining continuity and capacity in these remote settings represents a particularly difficult challenge. Further efforts, such as examining successful epidemiology programs in rural US states, are needed to learn what can be done to improve capacity.

Overriding issues: alignment of priorities

- **In many states, there is a misalignment between needs and resources. Moreover, heavy reliance on external funding, coupled with internal organizational issues, hamper states as they seek to meet designated priorities.** Periodic examination of priorities based on morbidity, mortality, and state public health mandates could serve as a basis for seeking additional funding from state coffers or other sources, and thus better align workforce capacity with state needs.

Limitations

The 2017 ECA has several limitations:

- Although all states and DC responded to the assessment, two of the larger territories—Puerto Rico (the largest US territory in terms of population and area) and Guam—did not. Thus, the data do not provide a comprehensive overview of territorial challenges and opportunities.
- Because a substantial portion of State Epidemiologists (39%) have been hired since the 2013 ECA, the individuals completing the 2013 and 2017 ECAs may be different, potentially influencing questions with a subjective element, such as perceived epidemiological capacity.
- Although the ECA defines epidemiologist and the definition has remained essentially unchanged over time, it does not necessarily align with job titles and has a subjective component to it, which may affect comparisons among states and in the same state over time, especially if there have been changes in the personnel completing the assessment.
- If a state did not currently have a program in a specific area, the response to the question regarding whether that program area was a priority was coded as "not a priority," potentially underestimating interest in that area.
- Questions regarding desired staffing were limited to epidemiologists at the MPH level or above, which may underestimate total program needs.
- It is not possible to determine whether observed changes in the numbers of epidemiologists in program areas reflect gains or losses in previously hired and experienced staff members or changes in the funding channels used to support them. For example, some epidemiologists previously working in preparedness may have shifted to infectious disease positions because of decreased preparedness funding and the concomitant increases in infectious disease funds.
- Counts of the total number of epidemiologists within each state health agency overall, and by program area, may have excluded generalists not dedicated to a specific program. Additionally, the assessment excludes any epidemiologists working outside the state health agency (e.g., some states may have separate mental health agencies that employ epidemiologists).
- Calculations of the total number of epidemiologists/100,000 population exclude epidemiologists employed by city and county health departments within the state, and thus should be considered minimum estimates.

RECOMMENDATIONS

Recommendations

The 2017 ECA findings point to several ways to improve applied epidemiology capacity in state and territorial health departments.

1. **Develop a strategy to increase epidemiology capacity, especially in evaluation and research and in underdeveloped program areas such as substance abuse, mental health, and informatics.**
   - Representatives from CDC, CSTE, and other relevant national, state, and local agencies should meet to better define a strategy to enhance evaluation and research capacity and develop expertise in emerging program areas. They should define what subject matter knowledge and applied epidemiology skills are needed in these emerging areas and develop model position descriptions that include these skills.
   - Stakeholders should work closely with schools and programs of public health and other relevant academic programs to encourage the incorporation of evaluation and practical research skills, as well as systems thinking and applied public health informatics training, in degree-granting programs.
   - CSTE steering committees should collaborate to advise on how informatics can be leveraged and integrated to support applied epidemiology activities.
   - CSTE should review the status of its recommendations and subcommittee activities in areas such as injury prevention, occupational health, and oral health, and apply the lessons learned to efforts to develop skills in substance abuse and informatics.

2. **Review and develop new recruitment and retention strategies for state health department epidemiologists.**
   - Engage a variety of stakeholders—CDC, CSTE, ASTHO, NACCHO, and others—to further explore causes of high state epidemiology turnover and to explore possible solutions.
   - Increase epidemiology internship and fellowship programs to help attract new professionals and aspiring professionals.
   - Revisit how informatics fits into the AECs to facilitate the development of position descriptions that might entice qualified informatics candidates from a variety of backgrounds and inspire them to work in governmental public health.
   - Look to the handful of states that have provided more generous funding for epidemiologic activities to glean useful strategies for how to approach decision-making bodies.

3. **Maintain efforts to establish training standards for applied public health epidemiologists and to provide training to ensure a sustained, qualified and competent public health epidemiology workforce.**
   - CSTE should develop a leadership training and mentoring strategy for new State Epidemiologists and share lessons on successful succession strategies.
   - Federal, state, and local agencies should more aggressively promote the AECs as a basis for developing training standards and training programs that meet these standards.
   - As the AECs were developed before the emergence of informatics and data analytics as applied epidemiology tools, the AEC process should be reactivated to define appropriate skillsets and training standards in these important and growing fields.
   - Working with schools and programs of public health, CSTE and CDC should develop informatics training materials geared for self-study or short courses to increase the informatics skills of the current epidemiology workforce.
   - CSTE and CDC should work with schools and programs of public health

through their national associations and organizations to better ensure that the AECs become an integral part of epidemiology graduate programs.
- CSTE and CDC should work with partners to develop opportunities—such as internship programs and short courses taught by health department staff—to expose graduate students to aspects of applied epidemiology that may lie outside the realm of expertise of university programs.

4. **Explore the gap between state public health mandates and state capacity to meet those mandates.**
   - Public health is a core state responsibility, but nationally, states provide less than 20% of funding for epidemiology activities and personnel, contributing to difficulties carrying out routine public health functions. CDC and CSTE, or a private foundation, should further investigate state public health mandates and the current and projected ability to meet their core mandates. The information gathered could be used for advocacy with key state stakeholders and decision-makers.

5. **Conduct future assessments.**
   - CSTE should conduct future assessments to continue to monitor functional and numeric epidemiology capacity in US states and territories, by program area and overall.
   - CSTE should consider expanding the ECA—or beginning an analogous, parallel assessment—to document epidemiological capacity at large city and county health departments to better capture true national epidemiological capacity.

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APPENDIX A

CSTE

Council of State and Territorial Epidemiologists

Assessment Instructions

2017 Epidemiology Capacity Assessment

The Council of State and Territorial Epidemiologists (CSTE) appreciates your support in completing the 2017 Epidemiology Capacity Assessment (ECA). The ECA aims to assess the overall State Health Department epidemiology capacity from the perspective of the State Epidemiologists. Your responses will be kept confidential and shared only in de-identified, aggregate form.

CSTE has periodically assessed epidemiology capacity in State Health Departments since 2001. CSTE's 2017 ECA is a follow-up to the 2013 ECA and will provide important information about the current capacity of epidemiology programs in State Health Departments. For more information about previous ECAs, visit the CSTE website: http://www.cste.org/group/ECA.

Please use the following as guidelines when completing this assessment:

We strongly recommend reviewing and completing the PDF version of the assessment before proceeding with this online form. It may be helpful to consult State Health Department staff, organizational charts, or other documents to complete portions of the ECA.

Assessment Functionality: The link received by the State Epidemiologist may be forwarded to other health department staff to complete. It should not be shared outside of the State Health Department. The assessment cannot be completed by two individuals simultaneously.

Using the Online Tool

The assessment is designed so that it can be completed in multiple sittings and/or by several people. Please keep the following in mind as you navigate through the assessment:

- It is possible to move back and forth throughout the assessment.

- A limited number of questions will "request a response" before allowing you to move forward.
    - Messages will appear if question(s) within a section have not been completed, and the unanswered question(s) will be highlighted in pale blue.
    - It is still possible to move forward to the next section.
- For questions that require responses in multiple columns and rows, the TAB key can be used to navigate quickly from cell to cell.

Because no questions require a response to move forward, it is essential that the State Epidemiologist go though the entire assessment a final time before submission to confirm that all questions and all parts within questions have been answered.

Who completes the ECA? Some State Health Departments will want different staff members, such as program area leads or Human Resources staff, to complete various sections of the assessment. These individuals can record their responses directly in the assessment or they can be compiled by you or your designee using the worksheets provided below prior to completing the assessment online.

- Program Area Leads Worksheet
- Human Resources Worksheet

Others Adding Directly to the Assessment

If multiple staff will assist with completing the assessment online, please adhere to the following guidelines:

- The initial recipient should open the assessment, move through the assessment, and record responses.
- Upon completion, the browser tab should be closed. Closing the browser tab automatically saves all the responses.
- The email containing the assessment link can be forwarded to other recipients. Only one recipient at a time can open the assessment and record responses, and the browser tab must then be closed in order for each recipient's responses to be recorded.

Only the State Epidemiologist or their designee should review and submit the completed assessment.

Others Completing the Worksheets for the State Epidemiologist to Add to the Assessment

If you wish to compile the responses from other staff and limit the number of individuals entering information directly in the online assessment, optional worksheets have been prepared that can be modified according to your needs.

- The worksheets contain all possible questions where either information or input from program area leads or from Human Resources may be useful.
- Those questions to which you prefer to respond yourself or have others respond can be deleted before sending out the worksheet.
- One question appears on both worksheets since the necessary information may rest with different groups among health departments.
- The numbering and format on the worksheets corresponds to what appears on the screen to facilitate data entry.
- Instructions for modifcation can be found within the first tab of each worksheet.

Who should be counted as an epidemiologist? Some questions will require an enumeration of the current epidemiology workforce within the State Health Department. Please count each epidemiologist only once.

State level epidemiologists include:

- All those employed by the state
- All those working at the state level who are either federal assignees (e.g. EISO, CEFO, PHAP) or contract employees (e.g. CSTE trainee, contracted from school of public health to work at or for the State Health Department)
- State employees assigned to work at a local or regional level (e.g. to conduct investigations for a region of the state).

When considering who should be counted, please focus on the functions performed by the individual rather than the job title. Reference the Applied Epidemiology Competencies (AECs) for examples of epidemiology job functions if you need assistance in determining the status of an employee.

Please note that this is the same definition that was used in 2013. You may wish to review your state's individual report from the previous assessment as a point of reference. Further instructions on who should be counted as an epidemiologist can be found here.

The following is an outline of the ten assessment sections:

- Section 1: Epidemiology leadership within the State Health Department
  - This section can be completed by the State Epidemiologist without additional input.
- Section 2: Epidemiology staffing and funding sources within the State Health Department
  - Question 7 (number of epidemiologists and source of funding by program area) and Question 8 (ideal number of epidemiologists by program area) have been included as options in the Program Area Leads worksheet.
  - Question 7 is also included as an option in the Human Resources Worksheet.
- Section 3: Epidemiology and surveillance capacity within the State Health Department
  - Question 10 (perceived capacity) has been included as an option in the Program Area Leads Worksheet.
- Section 4: Civil service annual salary ranges for epidemiologists in your State Health Department
  - Please consult with your Human Resources or other hiring director when completing this section.
  - Questions 12 and 13 have been included as options in the Human Resources Worksheet.
- Section 5: Epidemiology training and the Applied Epidemiology Competencies (AECs)
  - Please consult other State Health Department epidemiologists for questions pertaining to domains not under your area of responsibility.
  - Question 18 (pressing training needs) has been included as an option in the Program Area Leads Worksheet.
- Section 6: Existing practices, incentives and barriers aimed at strengthening the state epidemiology workforce
  - All questions within this section should be completed by the State Epidemiologist or a senior level health official within your agency. It may be helpful to consult with a Human Resources or other hiring director.
  - Question 21 (minimum hiring requirements) has been included as an option in the Human Resources Worksheet.
- Section 7: Vacancies and retention of the state epidemiology workforce
  - All questions within this section should be completed by the State Epidemiologist or a designated senior level health official within your agency. It may be helpful to consult with a Human Resources director or other State Health Department staff by specific program areas.
  - Question 23 (vacancies by program area) has been included as an option in the Human Resources Worksheet.

    - Question 24 (obstacles to retention) has been included as an option in the Program Area Leads Worksheet.
- Section 8: Preparedness within the State Health Department
    - This question should be completed by the State Epidemiologist or a senior level health official within your agency.
- Section 9: Leadership feedback
    - The two open-ended questions within this section should be completed by the State Epidemiologist or a senior level health official within your agency.
- Section 10: Review of assessment
    - All questions within this section should be completed by the State Epidemiologist or a senior level health official within your agency.

The assessment must be completed in its entirety before it can be submitted. A confirmation that all parts of the assessment have been completed is required.

Please complete the entire assessment by 11:59pm EST on Wednesday, May 31, 2017.

For questions, contact Jessica Arrazola at ECA@cste.org.

Section 1: Epidemiology Leadership

Section 1: Epidemiology leadership within the State Health Department (Questions 1-4)

This section can be completed by the State Epidemiologist without additional input.

Q1. How long has the State Epidemiologist been in his/her current position?

Please indicate half years in increments of 0.5

Years in current position:

Q2. Is the State Epidemiologist an appointed position in your state?

- ◯ Yes
- ◯ No

Q3. Is there a formal lead epidemiologist for each program area below?

If the "Other" category is not relevant to your situation, please select "No."

	Yes	No
Chronic Disease	◯	◯
Environmental Health	◯	◯
Genomics	◯	◯
Infectious Disease	◯	◯
Informatics	◯	◯
Injury	◯	◯
Maternal and Child Health	◯	◯
Mental Health	◯	◯
Occupational Health	◯	◯
Oral Health	◯	◯
Preparedness	◯	◯
Substance Abuse	◯	◯
Vital Statistics	◯	◯
Other (please specify)	◯	◯

Q4. Do epidemiologists at the State Health Department have easy access to peer-reviewed literature that is not open access? *Open access is defined as available online to the reader without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself.*

Select option from the dropdown scale.

▼

▼

Yes, within 2 hours
Yes, the same day (2-23 hours)
Yes, within 24-72 hours
Yes, but >72 hours
No access

Section 2: Epidemiology Funding Sources

Section 2: Epidemiology staffing and funding sources within the State Health Department (Questions 5-8)

Question 7 (number of epidemiologists and source of funding by program area) and Question 8 (ideal number of epidemiologists by program area) have been included as options in the Program Area Leads Worksheet.

Question 7 is also included as an option in the Human Resources Worksheet.

Q5. What are the funding sources for all epidemiology activities within the State Health Department?

***Note:* This question will not automatically validate total percent. Total must equal 100%. Please do not leave any box blank- if necessary, indicate 0%.**

Federal Funds %	0
State Funds %	0
Other %	0
Total	0

Q6. What are the funding sources for all epidemiology personnel within the State Health Department?

For more information on who should be counted as an epidemiologist, please click here.

***Note:* This question will not automatically validate total percent. Total must equal 100%. Please do not leave any box blank- if necessary, indicate 0%.**

Federal Funds %	0
State Funds %	0

Other %	0
Total	0

Q7. Please indicate the total number of epidemiologists (FTEs) currently working for your State Health Department by program area and funding source. If an epidemiologist has responsibilities divided over more than one program area, please attribute the fraction of the time the epidemiologist works in any given program area to the nearest 0.1 FTE (e.g. 0.2 ID, 0.4 PR, 0.4 EH).

For enumeration purposes state-level epidemiologists include all those employed by the state, all those working at the state level who are either federal assignees (e.g. EISO, CEFO, PHAP) or contract employees (e.g. CSTE trainee, contracted from school of public health to work at or for the State Health Department), and state employees assigned to work at local or regional level (e.g. to conduct investigations for a region of the state).

When considering who should be counted, please focus on the functions performed by the individuals rather than the job title.

You may wish to consult the 2013 responses from your state in completing this form.

***Note:* Only numbers are accepted. Please round to one decimal place.**

To navigate across rows, use the TAB key. All cells should be completed even if you do not have a program in this area.

If the "Other" category is not relevant to your situation, please also indicate "0" for each value in that row.

The "Total" column can be used to validate responses by program area rows.

	Number supported with federal funds from CDC	Number directly funded by CDC (e.g., CEFO, EIS, PHAP, etc.)	Number supported with federal funds from other agencies	Number supported with state funds	Number supported with funds from other sources (e.g., foundations)	Total
Chronic Disease	0	0	0	0	0	0
Environmental Health	0	0	0	0	0	0
Genomics	0	0	0	0	0	0
Infectious Disease	0	0	0	0	0	0
Informatics	0	0	0	0	0	0
Injury	0	0	0	0	0	0
Maternal and Child Health	0	0	0	0	0	0
Mental Health	0	0	0	0	0	0
Occupational Health	0	0	0	0	0	0
Oral Health	0	0	0	0	0	0
Preparedness	0	0	0	0	0	0
Substance Abuse	0	0	0	0	0	0
Vital Statistics	0	0	0	0	0	0
Other (please specify)	0	0	0	0	0	0

Q8. Please estimate the ideal number of additional epidemiologists needed to reach full capacity for your State Health Department by program area (the number of epidemiologists in addition to the current number regardless of resources- it may be helpful to reference Question 7). Please attribute the fraction of capacity in each program area to the nearest 0.1 FTE if less than one FTE is needed.

Note: Only numbers are accepted. Please round to one decimal place.

To navigate down the column, use the TAB key. All cells should be completed even if you do not have a program in this area.

If the "Other" category is not relevant to your situation, please indicate "0" for that row.

	Estimate of ideal number of additional epidemiologists needed to reach full capacity
Chronic Disease	
Environmental Health	
Genomics	
Infectious Disease	
Informatics	
Injury	
Maternal and Child Health	
Mental Health	
Occupational Health	
Oral Health	
Preparedness	
Substance Abuse	
Vital Statistics	
Other (please specify)	

Section 3: Epidemiology and Surveillance Capacity

Section 3: Epidemiology and surveillance capacity within the State Health Department (Questions 9-11)

This section focuses on the four key Essential Public Health Services (EPHS) that have been identified as significant for epidemiologists:

- **EPHS 1: Monitoring health status to identify and solve community health problems**
- **EPHS 2: Diagnosing and investigating health problems and health hazards in the community**
- **EPHS 9: Evaluating effectiveness, accessibility and quality of personal and population-based health services**

- **EPHS 10: Researching for new insights and innovative solutions to health problems**

For further details on the EPHS, please click here.

If necessary, please seek the guidance of other State Health Department staff within program specific areas when completing this section.

Question 10 (perceived capacity) has been included as an option in the Program Area Leads Worksheet.

Q9. Does your State Health Department have adequate epidemiological capacity to provide the following four Essential Public Health Services (EPHS), such that the Department is able to lead activities, provide subject matter expertise, and apply for, receive, and manage resources to conduct key activities?

See below for a definition of scales used in this question.

None: 0% adequate epidemiological capacity to provide this EPHS.

Minimal: 1-24% adequate epidemiological capacity to provide this EPHS.

Partial: 25-49% adequate epidemiological capacity to provide this EPHS.

Substantial: 50-74% adequate epidemiological capacity to provide this EPHS.

Almost full: 75-99% adequate epidemiological capacity to provide this EPHS.

Full: 100% adequate epidemiological capacity to provide this EPHS.

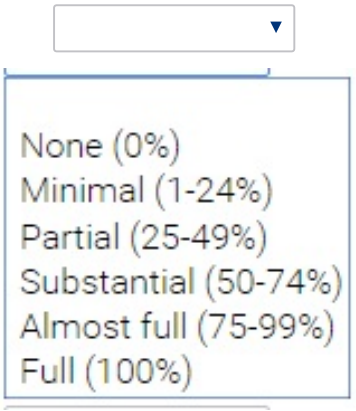
Select capacity option from the dropdown scale.

EPHS #1 Monitoring health status to identify and solve community health problems

EPHS #2 Diagnosing and investigating health problems and health hazards in the community

EPHS #9 Evaluating effectiveness, accessibility and quality of personal and population-based health services

EPHS #10 Researching for new insights and innovative solutions to health problems



Q10. What best describes the overall current epidemiological capacity to provide the four Essential Public Health Services (EPHS) in the each of the following program areas in your

State Health Department, such that the Department is able to lead activities, provide subject matter expertise, and apply for, receive, and manage resources to conduct key activities?

See below for a definition of scales used in this question.

None: 0% epidemiological and surveillance capacity to provide the four EPHS.

Minimal: 1-24% epidemiological and surveillance capacity to provide the four EPHS.

Partial: 25-49% epidemiological and surveillance capacity to provide the four EPHS.

Substantial: 50-74% epidemiological and surveillance capacity to provide the four EPHS.

Almost full: 75-99% epidemiological and surveillance capacity to provide the four EPHS.

Full: 100% epidemiological and surveillance capacity to provide the four EPHS.

We do not have this program area.

Select capacity option from the dropdown scale.

If the "Other" category is not relevant to your situation, please select "We do not have this program area."

Chronic Disease	
Environmental Health	
Genomics	
Infectious Disease	
Informatics	
Injury	
Maternal and Child Health	
Mental Health	
Occupational Health	
Oral Health	
Preparedness	
Substance Abuse	
Vital Statistics	
Other (please specify)	

None (0%)
Minimal (1-24%)
Partial (25-49%)
Substantial (50-74%)
Almost full (75-99%)
Full (100%)
We do not have this program area

Q11. From your perspective as State Epidemiologist, please identify:

A. If there is a need to improve capacity for the four Essential Public Health Services (EPHS) in each of the following program areas in your State Health Department.

B. To what extent it is a priority to improve capacity for the four Essential Public Health Services (EPHS) in each of the following program areas in your State Health Department.

Select options from the dropdown scales.

If you do not have any programs in the "Other" category, please select "We do not have this program area" in columns A and B.

	A. Is there a need to improve capacity for the four EPHS in this program area?	B. To what extent is it a priority to improve capacity for the four EPHS in this program area?
Chronic Disease		
Environmental Health		
Genomics		
Infectious Disease		
Informatics		
Injury		
Maternal and Child Health		
Mental Health		
Occupational Health		
Oral Health		
Preparedness		
Substance Abuse		
Vital Statistics		
Other (please specify)		

Yes
No
We do not have this program area

High priority
Medium priority
Low priority
Not a priority
We do not have this program area

Section 4: Civil Service Annual Salary Ranges

Section 4: Civil service annual salary ranges for epidemiologists in your State Health Department (Questions 12-13)

It may be helpful to consult with your Human Resources or other hiring director for Questions 12 and 13. It may also be helpful to reference the Applied Epidemiology Competencies (AECs) to answer Question 13.

Questions 12 and 13 have been included as options in the Human Resources Worksheet.

Please include only civil service employees. Further instructions for who should be counted as an epidemiologist can be found *here*.

Q12. Describe the civil service annual salary range for epidemiologists working in your State Health Department by degree (state employees only). If you have more than one position for a given degree below, please use the low end of the lowest position in that level to the high end of the highest position in that level. *Example: If an entry level epidemiologist with an MD makes $75,000 to $100,000 and a senior level epidemiologist with an MD makes $125,000 to $150,000 the salary scale is: $75,000-$150,000.*

Please include only civil service employees.

Note: ***Commas are not permitted in response boxes. Only numbers are accepted. Please round to the nearest whole number.***

	Salary Range (Minimum)	Salary Range (Maximum)
MD, DO		
DVM		
PhD, DrPH, other doctoral		
MPH, MSPH, other Master		
BA, BS, BSN, other Bachelor		
Associate or no post high school degree		

Q13. Describe the official Human Resources civil service annual salary range for epidemiologists working in your State Health Department by career level according to the Applied Epidemiology Competencies (AECs). If you have more than one position in a given career level below, please use the low end of the lowest position in that level to the high end of the highest position in that level.

Please include only civil service employees.

***Note:** Commas are not permitted in response boxes. Only numbers are accepted. Please round to the nearest whole number.*

	Salary Range (Minimum)	Salary Range (Maximum)
State Epidemiologist		
Deputy State Epidemiologist		
Senior Level Epidemiologist		
Mid Level Epidemiologist		
Entry Level Epidemiologist		

Section 5: Epidemiology Training and the AECs

Section 5: Epidemiology training and the Applied Epidemiology Competencies (AECs) (Questions 14-18)

Please consult other State Health Department epidemiologists for questions pertaining to domains not under your area of responsibility.

Question 18 (pressing training needs) has been included as an option in the Program Area Leads Worksheet.

Q14. Does your public health agency do the following in order to provide access to training in epidemiology?

	Yes	No
Include education and training objectives in performance review?	○	○
Pay for formal training or education outside your organization (conferences or seminars)?	○	○

	Yes	No
Provide on-site training (epidemiology seminars, etc)?	○	○
Provide epidemiology training or education to epidemiologists at the local level?	○	○
Have staff position(s) responsible for internal training?	○	○
Require continuing education in epidemiology and surveillance?	○	○

Q15. Does your public health agency do the following in order to provide access to cross-training in informatics?

	Yes	No
Require cross-training in informatics?	○	○
Pay for formal informatics training or education outside your organization (conferences or seminars)?	○	○
Provide on-site informatics training (seminars, etc)?	○	○
Provide informatics cross-training or education to epidemiologists at the local level?	○	○
Have staff position(s) responsible for internal informatics cross-training?	○	○

Q16. Does your public health agency provide epidemiology training in collaboration with any of the following organizations/groups?

If no "Other" is specified, please select "No."

	Yes	No
Centers for Disease Control and Prevention (CDC)	○	○
Schools of Public Health	○	○
Public Health Institutes	○	○
Schools of Medicine	○	○
Schools of Nursing	○	○
Schools of Veterinary Medicine	○	○
Other Academic Institutions	○	○
Centers for Public Health Preparedness/Preparedness and Emergency Response Learning Centers	○	○
Public Health Training Centers	○	○
Other Healthcare Organizations	○	○
Other Federal/governmental agencies	○	○
Public Safety/First Responders	○	○
Other Healthcare Providers	○	○
Other (please specify)	○	○

Q17. How does the State Health Department utilize the Applied Epidemiology Competencies (AECs) to define the career path for applied epidemiologists?

For more information on who should be counted as an epidemiologist, please click here.

Select all that apply.

- [ ] Assess epidemiological capacity of specific positions
- [ ] Assess gaps in knowledge
- [ ] Create/update job qualification statements
- [ ] Create/update position descriptions
- [ ] Create/update promotion requirements
- [ ] Develop curricula for continued education/training programs

- [ ] Develop specific training plans to address gaps in knowledge
- [ ] Not sure if we have used the AECs
- [ ] We have not used the AECs

Q18. From your perspective, what are the most pressing training needs among your epidemiology staff?

For more information on who should be counted as an epidemiologist, please click here.

Please select the top two most pressing training needs.

- [ ] Assessments and evaluations (development and distribution)
- [ ] Continuing education (basic epi refreshers, novel methodologies, updates to the field/literature, etc.)
- [ ] Cultural competency (diversity and inclusion, improving knowledge and attitudes to promote culturally responsive work, community collaboration, etc.)
- [ ] Data analytics (informatics, translating and applying public health data, etc.)
- [ ] Fiscal management (planning, budgeting, and/or monitoring resources)
- [ ] Leadership development (identifying future leaders, coaching/mentoring programs, retention of current leaders)
- [ ] Persuasive communication (articulating a message to the public, communicating public health research and data, policy engagement, etc.)
- [ ] Systems thinking (systems development, change management, strategic planning, and/or flexibility)
- [ ] Software skills (Epi Info, SAS, SPSS, R, etc.)
- [ ] Team-building (improving interpersonal relations and collaboration among staff)
- [ ] _____ Other (please specify)

Section 6: Existing Practices, Incentives and Barriers of the Workforce

Section 6: Existing practices, incentives and barriers aimed at strengthening the state epidemiology workforce (Questions 19-21)

All questions within this section should be completed by the State Epidemiologist or a senior level health official within your agency. It may be helpful to consult with a Human Resources or other hiring director.

Question 21 (minimum hiring requirements) has been included as an option in the Human Resources Worksheet.

Q19. To what extent is each of these factors a problem in recruiting epidemiologists?

If the "Other" category is not relevant to your situation, please select "Not a Problem" in that row.

Salary scale	
Personnel policies and procedures	
Job benefits	
Job security	
Job location	
Opportunity for promotion	
Travel required	
Travel permitted	
Job interests/fulfillment	
Opportunities for training	
Limitations recruiting outside your organization	
Restrictions on choosing the best candidate	
Restrictions on hiring quickly enough	
Restrictions on offering competitive pay	
Hiring freezes	
Other factor (please specify)	

Not a Problem
Minor Problem
Moderate Problem
Major Problem

Q20. The following are useful recruitment settings or activities implemented by our organization:

If the "Other" category is not relevant to your situation, please select "No" in that row.

	Yes	No
Universities/Schools of Public Health	○	○
Recruitment job fairs	○	○

	Yes	No
Professional organizations (ACE, APHA, ASPPH, ASTHO, CSTE, NACCHO- including newsletters and conferences)	○	○
Federal programs (CEFO, EIS, PHAP)	○	○
Other health agencies within the state	○	○
Local media	○	○
Periodic epidemiology newsletters	○	○
State and/or local government websites	○	○
Public Health career websites (e.g. Emory Public Health Employment Connection)	○	○
LinkedIn or other online networks	○	○
Facebook	○	○
Other social media	○	○
Other (please specify)	○	○

Q21. In general (regardless of program area), what are your minimum hiring requirements for entry level epidemiology positions at the State Health Department?

For more information on who should be counted as an epidemiologist, please click here.

A. Educational Attainment: ***Please select option from dropdown list.***

▼
- High School Diploma
- Associate Degree
- Bachelors Degree
- Masters Degree
- Doctorate Degree

B. Years Experience: ***Please select option from dropdown list.***

▼
- Less than 1
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- More than 9

C. What qualifies as experience? ***Select all that apply.***

- [ ] Internships
- [ ] Volunteering
- [ ] Paid work
- [ ] Full time experience
- [ ] _____ Other (please specify)

Section 7: Retention of the Workforce

Section 7: Vacancies and retention of the state epidemiology workforce (Questions 22-26)

All questions within this section should be completed by the State Epidemiologist or a designated senior level health official within your agency. It may be helpful to consult with a Human Resources director or other State Health Department staff by specific program areas.

Question 23 (vacancies by program area) has been included as an option in the Human Resources Worksheet.

Question 24 (obstacles to retention) has been included as an option in the Program Area Leads Worksheet.

Q22. Does your State Health Department utilize contractors to fill vacancies for epidemiology/surveillance positions at the Master's degree and above level?

A vacancy is defined as a position to be filled at the State Health Department that meets the following conditions: (1) there is work available for the position and (2) the job could start within 30 days.

- ◯ Yes

◯ No

Q23. For epidemiology/surveillance positions at the Master's degree and above level, please estimate the number of vacancies by program area in civil service positions (columns A and B) and contract employees (columns C and D). Please attribute the fraction of time for vacancy by program area to the nearest 0.1 FTE if there is vacancy for a position over multiple program areas.

A vacancy is defined as a position to be filled at the State Health Department that meets the following conditions: (1) there is work available for the position and (2) the job could start within 30 days. Do not include positions that are required to be left vacant due to hiring freezes or other requirements.

To navigate across rows, use the TAB key.

Please do not leave any box blank, indicate "0" instead.

For columns C and D, if you do not use contractors, indicate "0."

	A. What is the number of vacant epidemiology positions at the health department for civil service employees?	B. How many civil service positions do you intend to fill (actively working with HR)?	C. What is the number of vacant epidemiology positions at the health department for contract employees?	D. How many contract positions do you intend to fill (actively working with HR)?
Chronic Disease				
Environmental Health				
Genomics				
Infectious Disease				
Informatics				
Injury				
Maternal and Child Health				
Mental Health				
Occupational Health				
Oral Health				

	A. What is the number of vacant epidemiology positions at the health department for civil service employees?	B. How many civil service positions do you intend to fill (actively working with HR)?	C. What is the number of vacant epidemiology positions at the health department for contract employees?	D. How many contract positions do you intend to fill (actively working with HR)?
Preparedness				
Substance Abuse				
Vital Statistics				
Other (please specify)				

Q24. To what extent is each of these factors a problem in retaining epidemiologists?

Please include only civil service employees.

If no "Other" is specified, please select "Not a Problem."

Salary scale	
Personnel policies and procedures	
Job benefits	
Job security	
Job location	
Opportunity for promotion	
Travel required	
Travel permitted	
Job interests/fulfillment	
Opportunities for training	
Loss to private or government sector	
Restrictions on merit raises	
Restrictions on travel outside jurisdiction	
Layoffs from budget restrictions	
Other factor (please specify)	

Not a Problem
Minor Problem
Moderate Problem
Major Problem

Q25. In light of the projected public health workforce shortage, how are you currently working with staff to minimize turnover?

Select all that apply.

- [ ] Internal promotions
- [ ] Mentoring/informal coaching
- [ ] Promoting task diversity in assignments
- [ ] Providing professional development and training
- [ ] Publicly recognizing employee achievements
- [ ] Succession planning
- [ ] _____ Other (please specify)

Q26. In light of the projected public health workforce shortage, how are you working with staff to maintain institutional knowledge?

Select all that apply.

- [ ] Documenting standard operating procedures
- [ ] Participating in preceptorship/practicum programs
- [ ] Providing internal training
- [ ] Providing professional development
- [ ] _____ Other (please specify)

Section 8: Preparedness

Section 8: Preparedness within the State Health Department (Question 27)

This question should be completed by the State Epidemiologist or a senior level health official within your agency.

Q27. Do you utilize an Outbreak Management System?

An outbreak management system supports the initial characterization, investigation, response, and containment of outbreaks through the collection and analysis of data.

- ◯ Yes
- ◯ No

Section 9: Leadership Feedback

Section 9: Leadership feedback (Questions 28-29)

All questions within this section should be completed by the State Epidemiologist or a designated senior level health official within your agency.

Q28. As the State Epidemiologist, what are the most critical issues you face?

Q29. What other thoughts, comments, concerns or questions would you like to share with CSTE with regard to the epidemiology workforce and training?

Section 10: Review Assessment

Section 10: Review of assessment (Questions 30-31)

All questions within this section should be completed by the State Epidemiologist or a designated senior level health official within your agency.

Please review the previous 9 sections of the assessment prior to completing this section to confirm all questions have been answered accurately.

Q30. As the State Epidemiologist, I confirm that all questions within this assessment have been answered.

◯ Click here to confirm

Q31. As the State Epidemiologist, I confirm that all parts of this assessment have been completed accurately, to the best of my knowledge. I have consulted with other State Health Department staff as needed.

◯ Click here to confirm

Submit Assessment

After you have completed a review of the responses to the 2017 Epidemiology Capacity Assessment and confirm that the assessment has been completed accurately to the best of your knowledge, please click the forward arrow below to submit your responses. Your responses cannot be reviewed after submission.

Click the next arrow to submit your responses.

If you have any additional questions or comments, please email Jessica Arrazola at ECA@cste.org.

APPENDIX B

Human Resources Worksheet

State Epidemiologist Instructions:

1. To facilitate feedback from your human resources group, we have created this worksheet, which allows you to gather information on specific questions of your choosing. These include **(1) question 7**, which examines the numbers of FTEs in each program area by funding source; **(2) questions 12 and 13**, which include salary ranges by highest degree and by job category; **(3) question 21** (minimum hiring criteria), and **(4) question 23** (vacancies by program area).

2. If you prefer not to obtain input from human resources on some of these topics, you may simply delete the individual worksheets. Question 7 might be filled out by the program area leads or by human resources. For large health departments with multiple epidemologists, the question 7 worksheet allows the development of a line listing for each epidemiologist including their program area and their funding, and provides an automatically generated table and sums the total FTEs by program area for inclusion on the actual assessment form.

3. Click the tabs at the bottom of the spreadsheet to navigate between questions. Note that some of the tabs include content outside the view from 100% zoom, so it is necessary to scroll down.

4. Please remove this tab before sending out. **Do not remove the tab marked "DO NOT DELETE"** since it contains the code to facilitate automatic entry of the program lead information.

5. If you wish to print this spreadsheet, please scale to one page to preserve formatting.

Human Resources Worksheet, Epidemiology Capacity Assessment
Identify HR Lead

HR Lead Name:	
HR Lead Email:	

HR Lead Name:	0
HR Lead Email:	0

Section 2, Question 7:

Please indicate the total number of epidemiologists (FTEs) currently working in your program area by funding source. Please round to the nearest 0.1 FTE.

For enumeration purposes State level epidemiologists include all those employed by the state, all those working at the state level who are either federal assignees (e.g. EISO, CEFO, PHAP) or contract employees (e.g. CSTE trainee, contracted from school of public health to work at or for the state health department), and state employees assigned to work at local or regional level (e.g. to conduct investigations for a region of the state). When considering who should be counted, please focus on the functions performed by individuals rather than the job title.

Instructions for Completion:

1. For each epidemiologist, complete the following table. Values will automatically populate the summary table found at A164 at the bottom of the worksheet.
2. If an epidemiologist's time is split between two program areas, do separate listings. For example, if Person X has a full FTE but works 0.2 time in chronic disease and 0.8 time in environmental health, list their name twice. In the first of the two rows, choose "chronic disease" from the popdown screen under program area and distribute the 0.2 FTE according to the appropriate funding source(s). On the second row, choose "environmental health" and distribute the 0.8 FTE according to funding source(s).
3. If there is a program area not listed specifically among the pop-down choices, please use the "other-1" category. There are additional "other" categories (other-2 and other-3) if you have more than one area that falls outside the options provided. Please make note below the summary table of what each of the "other" categories consist of.
4. The summary table headings and rows correspond to those in the Assessment form. Unfortunately, it is not possible to copy and paste the findings, but we suggest you print and transcribe the information on the Assessment form.

#	NAME	Program Area (choose from popdown menu)	Fraction of FTE supported with federal funds from CDC	Fraction of FTE directly funded by CDC (e.g., CEFO, EIS, PHAP, etc.)	Fraction of FTE supported with federal funds from other agencies	Fraction of FTE supported with state funds	Fraction of FTE supported with funds from other sources (e.g., foundations)	Total FTE
								0
								0

SUMMARY TABLE

If no values appear in SUMMARY TABLE or if you have added or removed names, click on the table, which brings up Pivot Table tabs then open Analzye, and hit Refresh

Row Labels	Sum of Fraction of FTE supported with federal funds from CDC	Sum of Fraction of FTE directly funded by CDC (e.g., CEFO, EIS, PHAP, etc.)	Sum of Fraction of FTE supported with federal funds from other agencies	Sum of Fraction of FTE supported with state funds	Sum of Fraction of FTE supported with funds from other sources (e.g., foundations)	Sum of Total FTE
(blank)						0.0
Grand Total						**0.0**

HR Lead Name:	0
HR Lead Email:	0

Section 4, Question 12:

Describe the civil service annual salary range for epidemiologists working in your State Health Department by degree (State employees only). If you have more than one position for a given degree below, please use the low end of the lowest position in that level to the high end of the highest position in that level.

Example: If an entry level epidemiologist with an MD makes $75,000 to $100,000 and a senior level epidemiologist with an MD makes $125,000 to $150,000 the salary scale is: $75,000-$150,000. Please include only civil service employees.

Instructions for Completion:

1. Click each cell to enter the minimum or maximum value of the range. Values will automatically appear as currency.
2. Only numbers are accepted. Please round to the nearest whole number.
3. Please do not leave any cell blank.

Degree	Salary Range (Minimum)	Salary Range (Maximum)
MD, DO	$ -	$ -
DDS	$ -	$ -
If no values appear in SUMMARY TABLE or if you have added or removed names, click on the table, which brings up Pivot Table tabs	$ -	$ -
then open Analzye, and hit Refresh	$ -	$ -
MPH, MSPH, other Master	$ -	$ -
BA, BS, BSN, other Bachelor	$ -	$ -
Associate or no post high school degree	$ -	$ -

Section 4, Question 13:

Describe the official Human Resources civil service annual salary range for epidemiologists working in your State Health Department by career level according to the Applied Epidemiology Competencies (AECs). If you have more than one position in a given career level below, please use the low end of the lowest position in that level to the high end of the highest position in that level. *Please include only civil service employees.*

Instructions for Completion:

1. Click each cell to enter the minimum or maximum value of the range. Values will automatically appear as currency.
2. Only numbers are accepted. Please round to the nearest whole number.
3. Please do not leave any cell blank.

Title	Salary Range (Minimum)	Salary Range (Maximum)
Deputy State Epidemiologist	$ -	$ -
Senior Level Epidemiologist	$ -	$ -
Mid Level Epidemiologist	$ -	$ -
Entry Level Epidemiologist	$ -	$ -

HR Lead Name:	0
HR Lead Email:	0

Section 6, Question 21:
In general (regardless of program area), what are your minimum hiring requirements for entry level epidemiology positions at the State Health Department?

Instructions for Completion:
1. For A and B, click the blue cell to reveal the dropdown options. Select one option from the list.
2. For C, select all that apply by replacing "m" with "X". Please leave the placeholder values if you do not wish to select that option.

A. Educational Attainment: Please select ONE from the dropdown options below.
High School Diploma

B. Years Experience: Please select ONE from the dropdown options below.

C. What qualifies as experience? Select all that apply by replacing the cell with an X.	
m	Internships
m	Volunteering
m	Paid work
m	Full time experience
m	Other:

HR Lead Name:	0
HR Lead Email:	0

Section 7, Question 23:

For epidemiology/surveillance positions at the Master's degree and above level, please estimate the number of vacancies by program area in civil service positions (columns A and B) and contract employees (columns C and D).

A vacancy is defined as a position to be filled at the State Health Department that meets the following conditions: (1) there is work available for the position and (2) the job could start within 30 days. Do not include positions that are required to be left vacant due to hiring freezes or other requirements.

I**nstructions for Completion:**

1. Cells within the table are restricted to numbers only.
2. Please attribute the fraction of time for vacancy by program area to the nearest 0.1 FTE if there is vacancy for a position over multiple program areas.
3. Please do not leave any cell blank, indicate "0" instead.
4. For columns C and D, if you do not use contractors, indicate "0."

Program Area	A. What is the number of vacant epidemiology positions at the health department for civil service employees?	B. How many civil service positions do you intend to fill (actively working with HR?)	C. What is the number of vacant epidemiology positions at the health department for contract employees?	D. How many contract positions do you intend to fill (actively working with HR?)
Chronic Disease				
Environmental Health				
Genomics				
Informatics				
Injury				
Maternal and Child Health				
Mental Health				
Occupational Health				
Oral Health				
Preparedness				
Substance Abuse				
Vital Statistics				
Other:				

APPENDIX C

Program Area Leads Worksheet

State Epidemiologist Instructions:

1. To facilitate feedback from your program area leads, we have created this worksheet, which allows you to gather information on specific questions of your choosing. These include **(1) question 7**, which examines the numbers of FTEs in each program area by funding source; **(2) question 8**, which concerns the ideal number of epidemiologists in the program area; **(3) question 10**, which concerns the capacity of each program area to achieve the four Essential Public Health Services most closely linked to epidemiology; and **(4) question 24**, which asks about problems with staff retention.

2. If you prefer not to obtain input from the program leads on some of these topics, you may simply delete the individual worksheets. For large health departments or program areas with multiple epidemologists, the question 7 worksheet allows the program area leads to develop a line listing for each epidemiologist in their group and sums the total FTEs for inclusion on the actual assessment form.

3. Click the tabs at the bottom of the spreadsheet to navigate between questions. Note that some of the tabs include content outside the view from 100% zoom, so it is necessary to scroll down.

4. Please remove this tab before sending out. **Do not remove the tab marked "DO NOT DELETE"** since it contains the code to facilitate automatic entry of the program lead information, as well as code for dropdown lists.

5. If you wish to print this spreadsheet, please scale to one page to preserve formatting.

Program Area Lead Worksheet, Epidemiology Capacity Assessment
Identify Program Area Lead

Your name:	
Your email:	
Program Area (click cell to view list):	

Your name:	0
Your email:	0
Program Area (click cell to view list):	0

Section 2, Question 7:

Please indicate the total number of epidemiologists (FTEs) currently working in your program area by funding source. Please round to the nearest 0.1 FTE.

For enumeration purposes State level epidemiologists include all those employed by the state, all those working at the state level who are either federal assignees (e.g. EISO, CEFO, PHAP) or contract employees (e.g. CSTE trainee, contracted from school of public health to work at or for the state health department), and state employees assigned to work at local or regional level (e.g. to conduct investigations for a region of the state). When considering who should be counted, please focus on the functions performed by individuals rather than the job title.

Instructions for Completion:

1. Table A below should reflect the total number of epidemiologists in the program area (last column) broken down by funding source (column categories).
2. Table B below should reflect individual staff members and their amount of FTE support in each funding source category. See specific Table B instructions in the box directly above it.
3. Please make sure that the first row from Table B (TOTALS) matches that of Table A (TOTAL EPIS IN PROGRAM AREA) exactly.

TABLE A	Number supported with federal funds from CDC	Number directly funded by CDC (e.g., CEFO, EIS, PHAP, etc.)	Number supported with federal funds from other agencies	Number supported with state funds	Number supported with funds from other sources (e.g., foundations)	Total
TOTAL EPIS IN PROGRAM AREA						0

If there are multiple epidemiologists in your program area, you may wish to develop a line list with the individual names of your staff members and the amount of FTE support in each category. The sums will appear automatically in line 13 above. If there are more than 10 epidemiologists in the group, please adjust the AutoSum formula to include all.

TABLE B	Fraction of FTE supported with federal funds from CDC	Fraction of FTE directly funded by CDC (e.g., CEFO, EIS, PHAP, etc.)	Fraction of FTE supported with federal funds from other agencies	Fraction of FTE supported with state funds	Fraction of FTE supported with funds from other sources (e.g., foundations)	Total FTE
TOTALS	0	0	0	0	0	0
Name 1						0
Name 2						0
Name 3						0
Name 4						0
Name 5						0
Name 6						0
Name 7						0
Name 8						0
Name 9						0
Name 10						0

Your name:	0
Your email:	0
Program Area (click cell to view list):	0

Section 2, Question 8:

Please estimate of ideal number of additional epidemiologists needed to reach full capacity in your program area (the number of epidemiologists in addition to the current number regardless of resources. Please attribute the fraction of capacity ito the nearest 0.1 FTE if less than one FTE is needed.

Instructions for Completion:

1. Insert estimated number into the blue cell.
2. Only numbers are accepted. Please round to one decimal place.

Estimate ideal number of additional epidemiologists needed to reach full capacity	

Your name:	0
Your email:	0
Program Area (click cell to view list):	0

Section 3, Question 10:

What best describes the current epidemiological capacity to provide the four Essential Public Health Services (EPHS), such that the Department is able to lead activities, provide subject matter expertise, and apply for, receive, and manage resources to conduct key activities in the each of the following program areas in your State Health Department?

Instructions for Completion:

1. Please answer only for your program area.
2. The four EPHS and the capacity scale response options are listed in the two tables immediately below.
3. Select capacity option from the dropdown scale of the third table below. Click on the cell to see the dropdown list.

Essential Public Health Services:
EPHS #1 Monitoring health status to identify and solve community health problems (1)
EPHS #2 Diagnosing and investigating health problems and health hazards in the community (2)
EPHS #9 Evaluating effectiveness, accessibility and quality of personal and population-based health services (3)
EPHS #10 Researching for new insights and innovative solutions to health problems (4)

Capacity scale response options:
None: 0% epidemiological and surveillance capacity to provide the four EPHS.
Minimal: 1-24% epidemiological and surveillance capacity to provide the four EPHS.
Partial: 25-49% epidemiological and surveillance capacity to provide the four EPHS.
Substantial: 50-74% epidemiological and surveillance capacity to provide the four EPHS.
Almost full: 75-99% epidemiological and surveillance capacity to provide the four EPHS.
Full: 100% epidemiological and surveillance capacity to provide the four EPHS.

Select capacity option for your program area:	None (0%)

Your name:	0
Your email:	0
Program Area (click cell to view list):	0

Section 5, Question 18:

What are the most pressing training needs among your epidemiology staff?

Instructions for Completion:

1. This question is included so that program leads can provide input to the State Epidemiologist. The State Epidemiologist will answer in the Assessment from their perspective.
2. Please select the top two most pressing training needs from the list.
3. Select by replacing "m" with "X". Please leave the placeholder values in the options you do not wish to select.

What are the top **two** most pressing training needs?	
m	Assessments and evaluations (development and distribution)
m	Continuing education (basic epi refreshers, novel methodologies, updates to the field/literature, etc.)
m	Cultural competency (diversity and inclusion, improving knowledge and attitudes to promote culturally responsive work, community collaboration, etc.)
m	Data analytics (informatics, translating and applying public health data, etc.)
m	Fiscal management (planning, budgeting, and/or monitoring resources)
m	Leadership development (identifying future leaders, coaching/mentoring programs, retention of current leaders)
m	Persuasive communication (articulating a message to the
m	Systems thinking (systems development, change
m	Software skills (Epi Info, SAS, SPSS, R, etc.)
m	Team-building (improving interpersonal relations and
m	Other (please specify)

Your name:	0
Your email:	0
Program Area (click cell to view list):	0

Section 7, Question 24:

To what extent is each of these factors a problem in retaining epidemiologists? *Please include only civil service employees.*

Instructions for Completion:

1. Please answer only for your program area.
2. Select option from the dropdown scale of the table below. Click on the right blue cell to see the dropdown list.

To what extent is each of these factors a problem in retaining epidemiologists in your program area?	
Salary scale	
Personnel policies and procedures	
Job benefits	
Job security	
Job location	
Opportunity for promotion	
Travel required	
Travel permitted	
Job interests/fulfillment	
Opportunities for training	
Loss to private or government sector	
Restrictions on merit raises	
Restrictions on travel outside jurisdiction	
Layoffs from budget restrictions	
Other factor (please specify)	