

Big Cities Health Coalition Epidemiology Capacity Assessment, 2021



COUNCIL OF STATE AND
TERRITORIAL EPIDEMIOLOGISTS





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Big Cities Health Coalition

The Big Cities Health Coalition (BCHC or the Coalition) is a forum for leaders of America's largest metropolitan health departments to exchange strategies and work together to promote and protect the health and safety of the 62 million people they serve. Together, these public health officials directly affect the health and well-being of 1 in 5 Americans. For more information about BCHC, please visit www.bigcitieshealth.org.

Council of State and Territorial Epidemiologists

The Council of State and Territorial Epidemiologists (CSTE) is the professional organization representing state and territorial public health epidemiologists. CSTE works to establish more effective relationships among state and other health agencies. It also provides technical advice and assistance to partner organizations and to federal public health agencies, such as the Centers for Disease Control and Prevention (CDC). CSTE members have surveillance and epidemiology expertise in a broad range of areas, including occupational health, infectious diseases, environmental health, chronic diseases, injury prevention, and maternal and child health. CSTE supports effective public health surveillance and sound epidemiologic practice through training, capacity development, and peer consultation. For more information about CSTE, please visit www.cste.org.

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EXECUTIVE SUMMARY

Executive Summary



Background

Since 2001, the Council of State and Territorial Epidemiologists (CSTE) has conducted periodic Epidemiology Capacity Assessments (ECAs) to assess numeric and functional applied public health epidemiology capacity in the United States and its territories. CSTE first collaborated with the Big Cities Health Coalition (BCHC) in 2017 to conduct an ECA in BCHC-member jurisdictions. In 2021, the ECA instrument was again tailored for big city health department use and administered in collaboration with the BCHC to its member health departments. The 2021 ECAs were designed to achieve five goals:

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

Methods

The state ECA was modified by CSTE and BCHC staff to tailor the instrument for large, local health departments. The 30 BCHC members were invited to participate. Data were collected from January to May 2021. Quantitative data were analyzed using SAS 9.4 and Excel 2008, and qualitative data were coded and grouped thematically. Where relevant, data were compared with those from the 2021 state ECA.

Key Findings

A total of 26 of the 30 eligible BCHC members participated in the assessment.¹ The combined population served by the participating health departments was over 62 million or about 19% of the total US population.

Health department structure and leadership

More than a quarter of jurisdictions (28%) do not have a dedicated lead who oversees epidemiology activities. The vast majority of these jurisdictions (72%) have generalist epidemiologists who support several or all public health program areas.

Presence of programs and lead epidemiologists by program area

All 26 health departments have programs in infectious disease (100%), COVID-19 (100%), and preparedness (100%), and most have programs in maternal and child health (MCH, 96%), chronic disease (88%), environmental health (85%), and vital statistics (77%). Fewer have programs in mental health (33%), occupational health (8%), and genomics (3%).

Programs that were most likely to have lead epidemiologists were COVID-19 (96%), infectious disease (88%), MCH (65%), and vital statistics (46%).

Staffing

There are 1,284 full time equivalent (FTE) epidemiologists working in the 26 participating BCHC departments (range 5-316; median 26). The median rate among the 26 BCHC jurisdictions is 1.8 epidemiologists per

¹At the time this report was published, the BCHC had 29 member jurisdictions.

100,000 people, with a range of 0.4 to 13.7. In comparison, the total number of epidemiologists in state health departments is 4,135, and the median rate is 1.2/100,000. A total of 48% of the BCHC epidemiologists work in COVID-19, 27% in infectious disease, with an additional 8% as generalists. To reach full capacity, BCHC departments reported they would need to increase epidemiology staff by 47% over current numbers (n=602). Specifically, the greatest number of positions needed were in COVID-19 (127) and infectious disease (174), followed by generalists (45). In terms of the percentage increase over current positions needed to achieve ideal levels of staffing, the greatest needs were in chronic disease (205%), informatics (116%), injury (148%), mental health (149%), and preparedness (118%). Epidemiology capacity is defined as “the ability of your health department to lead epidemiologic activities, provide subject matter expertise, and apply for, receive, and manage resources to conduct key epidemiologic activities.”

Funding for epidemiologic activities

On average, 35% of funding for epidemiology activities comes from local sources. Federal and state governments add an additional 30% and COVID-19 supplemental funds account for 25% of total funding. Values were similar for epidemiology personnel, with 32% of funding coming from local sources, 18% from federal sources, and 14% from state sources. Federal and state supplemental funds for personnel accounted for 18% and 8% of total funding for epidemiology personnel. In comparison, state health departments received 85% of funding for all epidemiologic activities from federal funds, including COVID-19 supplemental funds. States contributed an average of 12% and other sources accounted for only a small percentage of the total in most states.

Essential Public Health Services

Health departments were asked to rate their capacity to conduct the 3 Essential Public Health Services (EPHS) most closely related to epidemiology. Virtually all participating BCHC departments (92%) reported having substantial to full capacity for monitoring health status (EPHS 1). Most (76%) also have

substantial to full capacity for diagnosing and investigating health problems (EPHS 2). In contrast to the high capacity for EPHS 1 and 2, only 40% reported substantial to full capacity for research and evaluation (EPHS 9). The corresponding levels of substantial to full capacity in the states were 76% for monitoring health status, 88% for diagnosing and investigating problems, and 43% for research and evaluation.

Hiring

More than half of BCHC member departments (60%) use contractors to fill vacancies for epidemiology/surveillance positions. There are currently 177 vacant positions, including 85 civil service positions and 92 contractor positions, with the greatest number of vacancies in COVID-19 response (70), infectious disease (60), and general epidemiology (12). However, vacancies represent a small fraction (29%) of the number of epidemiologists needed to achieve full capacity.

Critical issues facing health departments

Responding BCHC member departments reported major challenges communicating the value and role of epidemiologists to various audiences, obtaining adequate funding, and achieving and maintaining adequate functional capacity to carry out essential tasks. Departments were also challenged with balancing routine activities with emerging problems and recruiting and training staff (especially in important areas like social determinants of health and health equity).

Discussion

BCHC jurisdictions are heavily focused on infectious disease and the COVID-19 response.

The ECA found that 100% of participating BCHC jurisdictions have program areas in preparedness, infectious disease and COVID-19 response, whereas only 38% of jurisdictions have a program area in mental health. Existing program areas least likely to be served by a lead epidemiologist are oral health (8%) and genomics (4%). Similarly, the program areas with the smallest number of staff across

the participating jurisdictions are vital statistics (n=13), mental health (n=11), injury (n=9), oral health (n=3), occupational health (n=0) and genomics (n=0). These results may reflect that some BCHC jurisdictions may have state or other local support for certain program areas (i.e., it may not be in their health department's scope of work). Additionally, the COVID-19 response demonstrates the need for cross-training that enables staff to flexibly respond to an emergency and be trained in appropriate methods to shift easily across program areas.

Outside of the COVID-19 response, all program areas experienced a decline in the number of epidemiologists. There are currently zero epidemiologists in genomics and occupational health in participating Big Cities jurisdictions.

Because of the loss of staff and reallocations to pandemic response, many non-COVID program areas struggled to keep funding and continue projects during the pandemic. Despite this, infectious disease and COVID-19 response had the highest number of additional epidemiologists needed to deliver public health services, with an additional 174 and 127, respectively. While there is great need for additional epidemiologists in BCHC jurisdictions, it is equally important to retain the current workforce. Many staff are dealing with burnout from the increased workload and extended hours during the COVID-19 response. Competitive salaries and benefits are important tools for recruiting and retaining epidemiologists, as well as for implementing strategies that address hiring freezes and reduce delays in the hiring process. Jurisdictions should also consider the right balance of contractors and FTEs to ensure they are meeting the agency's long-term needs and building institutional knowledge.

Most BCHC jurisdictions have substantial to full capacity for monitoring health status (EPHS 1) and diagnosing and investigating health problems (EPHS 2) whereas fewer than half have substantial capacity for research and evaluation (EPHS 9).

Similar to states, most BCHC agencies have substantial capacity for monitoring health status and investigating health problems but lag behind in capacity for research and evaluation. Although the percentage of BCHC departments with substantial capacity for

EPHS 1 increased from 84% to 92% between 2017 and 2021, the percentage of departments with substantial capacity for EPHS 2 decreased from 92% to 76%. The decline in EPHS 2 most likely reflects the stress on local public health staffing given the enormity of scale for diagnosing and investigating COVID-19. In 2017, 39% of jurisdictions had substantial capacity for EPHS 9 (research) and 22% for EPHS 10 (evaluation). However, the updated EPHS included both research and evaluation into EPHS 9. In 2021, only 40% of participating BCHC jurisdictions had substantial capacity for EPHS 9 (research and evaluation). The ability to provide the EPHS are critical as they are foundational functions of public health.

Most BCHC jurisdictions have substantial capacity to provide the EPHS in infectious disease, COVID-19 response, MCH and chronic disease but less capacity in other program areas, such as mental health, oral health, occupational health, and genomics.

Capacity to provide the EPHS across program areas varies greatly by jurisdiction, further highlighting the importance of collaboration with state partners to deliver public health services. As the field of public health transforms, there is a need to invest equally in non-COVID priorities and bolster capacity across program areas, including dedicated leads in every program area and focusing on diversity in experience and skillsets when hiring to provide expertise in lesser represented program areas.

Across BCHC jurisdictions, over a third of funding for epidemiology activities and personnel is provided by local sources with fewer federal dollars available than are to states.

The range of funding sources varies substantially across BCHC agencies, making a notable difference in implementation and the services available in each jurisdiction. On average, BCHC jurisdictions received 36% of funding from federal sources, 19% from state sources, 35% locally, and an additional 2% from other sources. COVID-19 supplemental funding accounts for nearly a quarter of funding for BCHC jurisdictions. In comparison, states received 85% of funding from federal sources, 12% from states and 3% from other sources. Departments need flexible funding to be able to assist with all program areas affected by COVID-19, including injury, mental health and

substance use. However, heavy reliance on COVID-19 supplemental funding creates gaps when these temporary funding sources end. Sustainable funding is needed to support data modernization efforts and secure resources for long-term investments and planning. Funding should be flexible enough to allow personnel to have diverse responsibilities across program areas, particularly for preparedness efforts and to respond to local needs and priorities.

Over 40% of BCHC jurisdictions do not have access to peer-reviewed literature protected by a paywall, limiting their ability to deliver evidence-based services.

It is critical for departments to deliver evidence-based practice but that is challenged by inaccessible peer-reviewed literature. The rates of access by BCHC departments are similar to 2017 rates and have not improved significantly. It is necessary to explore innovative strategies to access the peer-reviewed literature to ensure evidence-based delivery of epidemiology services.

Most BCHC jurisdictions operated a COVID-19 response separate from their state response and more than half rated their COVID-19 based surveillance system as good on a scale of poor, fair or good.

Although 76% of participating BCHC departments implemented an additional contact tracing system for the pandemic, the majority were unsure of their plans to continue use of the system after the response is over. Looking to future surveillance of COVID-19, it will be important to have a national strategy that state and local agencies can feasibly support for collecting surveillance data.

Similar to 2017, the highest training priority for BCHC jurisdictions remains data analytics.

Additional training priorities include software skills (e.g., Epi Info, SAS, SPSS, R), leadership development and continuing education (e.g., basic epi refreshers, new methods, updates to the field/literature). As epidemiology and the public health system modernizes, staff with specialized skillsets are needed as well as the cross-training of all staff to streamline and support public health reporting. Further collaboration with healthcare partners, academic partners and laboratories is particularly necessary as the field improves

how data are stored and disseminated to the public, even with data sources outside public health (i.e., law enforcement data for the opioid epidemic). Academic partners can also aid in the training of students and connecting them to applied epidemiology experiences in the field. The state ECA revealed similar results, with 34 states citing data analytics as the highest training priority in 2021.

Recommendations

1. Provide cross-training that enables epidemiologists to shift across program areas as needed, particularly during public health emergencies.
2. Enhance skills in data analytics to support data modernization efforts.
3. Streamline onboarding training to assist with surge and/or temporary staffing and alleviate the burden on existing staff while preparing new staff to qualify for FTE positions if interested.
4. Update salary scales to be competitive with other industries.
5. Collaborate with Human Resources staff and health department leadership to be able to hire temporary and permanent staff in a timely manner.
6. Recruit additional epidemiologists, especially for emerging program areas (i.e., genomics) and with advanced knowledge and skills for research and evaluation.
7. Develop a plan to build epidemiology capacity and staffing internally to reduce reliance on contractors and reduce costs in procurement, decrease project delays and increase institutional knowledge.
8. Foster relationships with universities and schools of public health to harness the pipeline of incoming epidemiologists and ensure reliable access to the peer-reviewed literature.
9. Facilitate opportunities for students to be exposed to public health practice at a health department.
10. Explore opportunities for academic institutions to support health departments for special projects or subject matter expertise, particularly during an emergency response.
11. Ensure reliable access to the peer-reviewed literature.

BACKGROUND

Background



In 2001, the Council of State and Territorial Epidemiologists (CSTE) began periodic assessments of the numeric and functional applied public health epidemiology capacity in US state and territorial health departments. So far, seven assessments—formally known as Epidemiology Capacity Assessments (ECAs)—have been conducted, in 2001, 2004, 2006, 2009, 2013, 2017, and 2021. In addition, in 2014 and 2017, CSTE and the National Association of County and City Health Officials conducted a preliminary assessment of epidemiology capacity within local health departments. CSTE first assessed epidemiology capacity of Big Cities Health Coalition (BCHC) agencies specifically in 2017 (McGinty M.D., et al. 2019).

These ECAs serve several functions. They provide policymakers information about current epidemiology workforce strength and capacity. They permit State and Territorial Epidemiologists, and now big cities' health leaders, to compare their jurisdictions with others with respect to staffing, salaries, performance on key epidemiology competencies, and the relative contribution of federal, state, and local funds to their budgets. And, by highlighting the skills and program area expertise students need to respond to changing workforce priorities, the ECAs can inform the curricula of public health training programs and graduate schools.

The 2021 ECA was launched in January 2021 and completed in May 2021, with participation from all 50 states, DC, and four territories, as well as 26 Big Cities Health Coalition member health departments. Building upon recommendations from the 2017 Big Cities ECA and the 2017 Public Health Workforce Interest and Needs Survey (known as PH WINS and conducted by the Association of State and Territorial Health Officials and the de Beaumont Foundation), the 2021 ECA was designed to achieve 5 goals:

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

Although these ECAs provide critical data for BCHC local health departments, they do not reflect total epidemiology capacity in the United States. As these data show, some large local health departments have even more staff and greater epidemiology capacity than their state health department, others do not. The data from these BCHC health departments are not representative of all local health departments. This report summarizes findings from the 26 of 30 BCHC member health departments (87%) that participated in this assessment, including Washington D.C. which was included in both the state ECA and the BCHC ECA.

METHODS

Methods

Assessment instrument

The 2021 ECA was modified for local health departments in Fall 2020. CSTE and BCHC solicited input from local epidemiologists within BCHC member health departments to ensure the instrument's relevance for their use. The final local assessment was organized into four sections:

- Section 1: Health department structure and resources.
- Section 2: Health department epidemiology capacity.
- Section 3: Health department staffing capacity.
- Section 4: Leadership feedback.

Specifically, the assessment solicited information on health department epidemiology leadership, epidemiology staffing and funding sources; capacity to perform the three Essential Public Health Services (Centers for Disease Control and Prevention [CDC], September 2021) most closely linked to epidemiology, perceived training needs, and epidemiology vacancies and intended hires. Most questions were short answer, multiple choice, scales, or matrix tables, such as the fraction of full-time equivalent (FTE) positions by program area. Wherever possible, questions, response categories, and definitions were consistent with the state ECA to ensure comparability. Two open-ended questions were included: (1) "With respect to epidemiologic staffing and capacity, what are the most critical issues your department faces?" and (2) "What other thoughts, comments, concerns or questions would you like to share with BCHC and CSTE with regard to the epidemiology workforce and training?" A final section asked respondents to confirm that all information provided is accurate.

Study population

BCHC is comprised of leaders of America's largest metropolitan health departments. At the time of the ECA, to be eligible for BCHC membership, a city must *either* (1) have at least 400,000 residents and be among the top 30 most populous US urban areas (as defined by the US Census Bureau, 2010) or (2) have at least 800,000 residents. Additionally, the health department must be locally controlled and cannot be a state agency. Membership is extended to the health department with primary responsibility for public health within the jurisdiction, whether it is a city or county agency. As of January 2021, when the BCHC ECA began, there were 30 BCHC member health departments, all of which were invited to participate (Big Cities Health Coalition, 2021). Respondents are hereafter described as "BCHC departments."

Recruitment and administration

The "lead official" (i.e., the local health officer, health director, or health commissioner) for each BCHC department approved the department's participation in this assessment and designated a single person to coordinate the department's response—26 of the 30 BCHC member departments (87%) participated. In 2021, the combined population served by the 30 BCHC departments was roughly 62 million or about 19% of the total US population.

A hyperlink to the assessment instrument, which was administered on the Qualtrics platform (Qualtrics, Provo, UT), was emailed to the designated individual, who was asked to (1) coordinate with programmatic and human resources staff within their department as necessary to complete the questionnaire and

(2) review all responses and certify their accuracy and completeness before submitting the assessment.

Data collection occurred from January to May 2021.

Definitions and response options

Epidemiology and epidemiologists within the health departments

Respondents were asked to enumerate the current epidemiology workforce within their health department and to describe their health department's epidemiology capacity. The discipline of epidemiology was defined 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." An epidemiologist was defined as "an investigator who studies the occurrence of disease or other health-related conditions or events in defined populations" (Last, 2001). The assessment noted "the control of disease in populations is also considered to be a task for the epidemiologist (Last, 2001)."

Respondents enumerated epidemiologists by program area to the nearest tenth of an FTE. Respondents were instructed to count each epidemiologist only once and to include not only all epidemiologists employed by the health department, but also those epidemiologists working in the department as state or federal assignees or contract employees, including trainees. When considering who should be counted as an epidemiologist, respondents were asked to focus on job functions rather than job titles (i. e., employees did not need to have the title of epidemiologist to be enumerated but needed to serve the function of an epidemiologist). Respondents were provided a link to the Applied Epidemiology Competencies, which contain examples of epidemiology job functions. For the purpose of this assessment, jurisdictions were asked to count only COVID-19 response staff serving as an epidemiologist or performing functions consistent with an epidemiologist. Contact tracers or case investigator staff were not included.

A formal lead epidemiologist was defined as someone who leads activities and is a subject-matter expert within a designated program area within the health department.

Epidemiology capacity

Respondents were asked to describe their health department's capacity to provide the 3 Essential Public Health Services (EPHS) most closely related to epidemiology:

EPHS 1. Monitor health status to identify and solve community health problems.

EPHS 2. Diagnose and investigate health problems and health hazards in the community.

EPHS 9. Improve and innovate public health functions through ongoing evaluation, research, and continuous quality improvement.

Previous ECAs measured epidemiology capacity using EPHS 1, 2, 9, and 10. The updated EPHS combined research and evaluation into EPHS 9. Therefore, the 2021 ECA measured EPHS 1, 2, and 9. Epidemiology capacity was defined as "the ability of the health department to lead epidemiologic activities; provide subject matter expertise; and apply for, receive, and manage resources to conduct key epidemiologic activities." Capacity for each of the three EPHS listed above was described according to the following scale:

- None: 0% adequate epidemiologic capacity.
- Minimal: 1%–24% adequate epidemiologic capacity.
- Partial: 25%–49% adequate epidemiologic capacity.
- Substantial: 50%–74% adequate epidemiologic capacity.
- Almost full: 75%–99% adequate epidemiologic capacity.
- Full: 100% adequate epidemiologic capacity.

For purposes of analysis and to ensure comparability with data from the 2021 state ECA, responses were further grouped as *none to minimal, partial, and substantial to full*.

Program areas, generalists

Respondents were presented with a list of program areas and asked (1) whether the health department has each program area and (2) if so, whether it has epidemiology capacity within that area. Response options for both questions were “yes” and “no.” Respondents were further instructed that “generalists” are epidemiologists who support several or all program areas within the health department (i.e., they are not specialists in any single program area).

Employees

Respondents were asked to differentiate between civil service epidemiologists and contractors. Civil service employees were defined as FTE staff (either salaried or paid on an hourly basis) employed by the health department or federal or state assignees (such as Epidemic Intelligence Service officers or CDC public health associates). Non-civil service employees included contract employees and temporary employees (e.g., CSTE trainees or individuals contracted from schools of public health or from private companies to work at or for the health department). The use of the term civil service did not connote anything related to whether the employee was a member of a labor union or in a permanent or provisional civil service position.

Vacancies and intent to fill positions

A vacancy was defined as an unfilled health department position that (1) could start within 30 days and (2) had work available to carry out. Respondents were instructed not to include unfilled positions that must be left vacant because of hiring freezes or other requirements. Respondents were also asked how many of these vacancies their department intended to fill (i.e., those for which human resources was actively recruiting).

Analytic Techniques

Data were analyzed using SAS 9.4 and Microsoft Excel 2008. Where relevant, results have been compared with findings from the BCHC 2017 ECA and the 2021 state ECA, which contains data from the 50 US states and DC, hereafter collectively referred to as “the states” or “state health departments.”

Qualitative data from an open-ended question asking about the most critical problems and challenges faced by departments were coded and grouped thematically by CSTE staff. Quotations illustrative of key themes were selected for inclusion.

RESULTS

Results



A total of 26 (87%) of the 30 BCHC member health departments responded to the assessment. In 2017, 27 of the 30 (90%) BCHC member health departments participated in the ECA; however, some of the departments that participated in 2021 did not participate in 2017 and vice versa. Participating departments in the 2021 BCHC ECA include the following:

Table 1 Big Cities Health Coalition Member Departments

BCHC Health Department Name (City, if Different)*	State
Alameda County Public Health Department (Oakland)	CA
Austin Public Health	TX
Baltimore City Health Department	MD
Boston Public Health Commission	MA
Chicago Department of Public Health	IL
Columbus Public Health	OH
Denver Department of Public Health and Environment	CO
District of Columbia Department of Health	DC
Florida Department of Health in Miami-Dade County	FL
Houston Health Department	TX
Long Beach Department of Health and Human Services	CA
Los Angeles County Department of Public Health	CA
Maricopa County Department of Public Health (Phoenix)	AZ
Marion County Public Health Department (Indianapolis)	IL
Mecklenburg County Public Health (Charlotte)	NC
Minneapolis Health Department	MN
Philadelphia Department of Public Health	PA
Public Health Seattle-King County	WA
San Antonio Metropolitan Health District	TX
San Diego County Public Health	CA
San Francisco Department of Health	CA
Santa Clara County Public Health Department (San Jose)	CA
Southern Nevada Health District (Las Vegas)	NV

*Cleveland, OH; Multnomah County (Portland), OR; New York City; and Tarrant County (Fort Worth), TX did not participate in the 2021 BCHC ECA. At the time this report is being published, Miami-Dade County is no longer a BCHC member.

Health Department Structure and Leadership

Structure and general organization

Respondents were asked to describe the structure of their epidemiology workforce. Approximately 28% do not have a dedicated lead to oversee all epidemiology activities

in their departments. About a third of respondents (32%) reported having a single lead epidemiologist who oversees all program areas, and the rest (40%) reported having multiple

leads across program areas. A total of 72% of BCHC respondents reported that they have “generalist” epidemiologists who support several or all program areas in the health department.

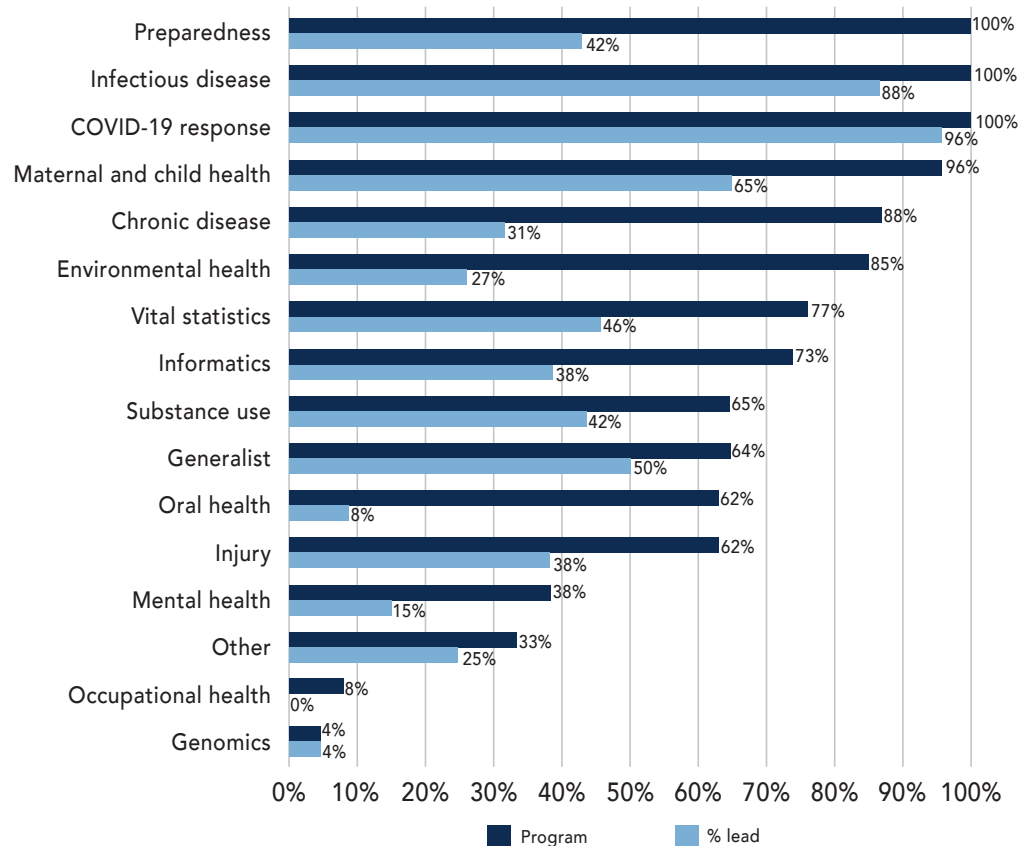
Presence of programs and lead epidemiologists by program area

All respondents (100%) have programs in infectious disease, COVID-19, and preparedness (Figure 1). Most also have programs in MCH (96%), chronic disease (88%), and environmental health (85%). In contrast, fewer have programs in mental health (33%), occupational health (8%), and genomics (3%).

The program areas most likely to be served by a formal lead epidemiologist are COVID-19 (96% of respondents reported having a program lead) and infectious disease (88%), followed by MCH (65%). Existing program areas least likely to be served by a lead epidemiologist are oral health (8%) and genomics (4%).

There were no (0%) occupational health program leads at any of the participating jurisdictions. The Other category includes additional subject areas like health equity, health disparities, aging, and others.

Figure 1 Percentage of BCHC departments with specific program areas and formal lead epidemiologists in these areas, BCHC ECA 2021



Staffing

Number of epidemiologists and rates per 100,000 population

There are 1,284 FTE epidemiologists working in the responding BCHC departments, compared with 1,091 in 2017. The number of epidemiologists per health department ranged from 5 to 316, with a median of 26. The median rate of epidemiologists per 100,000 people among the 26 responding BCHC jurisdictions is 1.8 (range

0.4–13.7). When COVID-19 response epidemiologists are omitted, the median rate of epidemiologists per 100,000 people decreases to 1.13. To calculate this metric, the rate per 100,000 is calculated for each jurisdiction and then the median is taken of all jurisdictional rates. Overall, the number of epidemiologists per 100,000 population is 2.64. However,

when COVID-19 response epidemiologists are removed from the calculations, the number of epidemiologists per 100,000 population decreases to 1.38, which is slightly lower than the 1.40 enumerated in the 2017 BCHC ECA. In comparison, the total number of epidemiologists in state health departments is 4,135, with a rate of 1.26/100,000 population.

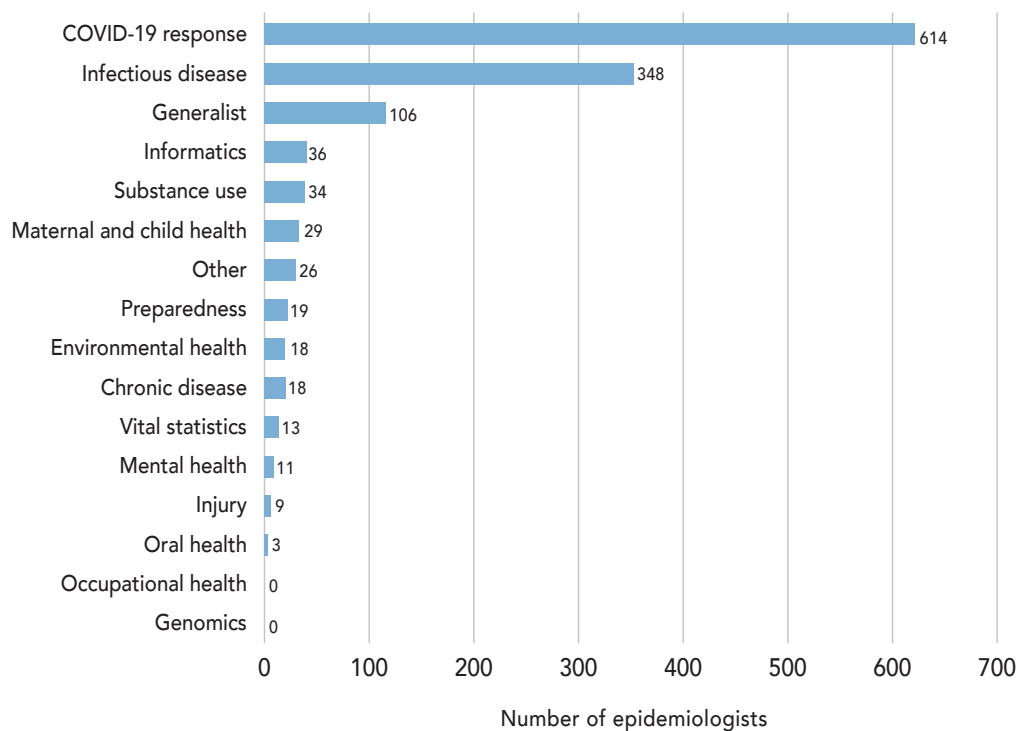
Numbers of epidemiologists by program area

Most BCHC epidemiologists currently work in COVID-19 programs (n=614) (Figure 2); positions in this area accounted for 48% of the 1,284 epidemiologists in participating BCHC departments. There are 346

epidemiologists working in infectious disease (27%) and 106 generalists (8%) who support several or all program areas in their departments. Program areas supported by the fewest epidemiology FTEs are injury (n=9), oral health

(n=3), occupational health (n=0), and genomics (n=0), which together accounted for 1% of the total number of epidemiologists working in participating departments.

Figure 2 Number of epidemiologists by program area, 26 jurisdiction, BCHC ECA 2021



Since 2017, nearly every program area saw a decrease in epidemiologists. The program areas with the largest percent decreases were

occupational health (100%), environmental health (80%), mental health (67%), and vital statistics (67%) (Table 2). Comparatively, infectious

disease (126), generalist (95), and environmental health (72) had the largest decrease in the number of epidemiologists (Table 2).

Table 2 Number of epidemiologists in BCHC jurisdictions, 2017 and 2021, BCHC ECA 2021

Program area	Number of Epidemiologists, 2017	Number of Epidemiologists, 2021	Difference, no.	Difference, %
Genomics	0	0	0	N/A
Occupational health	1	0	1	- 100%
Oral health	5	3	- 2	- 38%
Injury	16	9	- 7	- 45%
Mental health	34	11	- 23	- 67%
Vital statistics	40	13	- 27	- 67%
Chronic disease	40	18	- 22	- 55%
Environmental health	90	18	- 72	- 80%
Preparedness	31	19	- 12	- 39%
Other	46	26	- 20	- 43%
Maternal and child health	35	29	- 6	- 17%
Substance use	40	34	- 6	- 14%
Informatics	38	36	- 2	- 6%
Generalist	201	106	- 95	- 47%
Infectious disease	474	348	- 126	- 27%
COVID-19 response	N/A	614	N/A	N/A

Number of epidemiologists needed to achieve full capacity

Overall, respondents reported a need for an additional 602 epidemiologists across all the program areas to achieve full epidemiology capacity. The ideal number of epidemiologists, defined as the sum of current and additional, was 1,886. Approximately 32% of the current perceived need is unmet. To effectively deliver the EPHS, BCHC departments would collectively need at least a 47% increase in epidemiologists (Table 3).

Table 3 Current, additional, and ideal numbers of epidemiologists overall and by program area, 26 jurisdictions, BCHC ECA 2021

Program area	Current	Additional	Ideal (current + additional)	Unmet need*	Increase needed to reach ideal*
COVID-19 response	614	127	740	17%	21%
Infectious disease	348	174	522	33%	50%
Generalist	106	45	151	30%	42%
Informatics	36	41	77	54%	116%
Substance use	34	25	60	42%	74%
Maternal and child health	29	23	52	44%	80%
Preparedness	19	22	41	54%	118%
Environmental health	18	24	42	57%	133%
Chronic disease	18	37	55	67%	205%
Vital statistics	13	12	25	48%	92%
Mental health	11	17	28	60%	149%
Injury	9	13	22	60%	148%
Oral health	3	7	10	–	–
Genomics	0	12	12	–	–
Occupational health	0	6	6	–	–
Other	26	17	44	–	–
TOTAL	1284	602	1886	32%	47%

*Additional/ideal*100; Percent unmet is calculated only for program areas with >5 FTE epidemiologists
 Additional/current*100; Percent increase in FTEs needed to reach ideal is calculated only for program areas with >5 epidemiologists.

Additional and ideal positions by program area

To achieve full capacity, participating BCHC departments reported that they need the greatest number of epidemiologists in infectious disease (n=174), followed by COVID-19 response (n=127), generalist (n=45), informatics (n=41), and chronic disease (n=37) (Table 3). Among program areas currently served by >5 epidemiologists, the greatest percentage increase needed to achieve ideal levels of staffing are in chronic disease (205%), mental health (149%), and injury (148%).

Funding for epidemiologic activities and personnel

Table 4 shows the mean percentage of federal, state, local, and other nongovernment funding sources for epidemiology activities and for personnel, as well as the highest and lowest percentages reported for each funding source among participating BCHC departments. On average, 35% of funding for epidemiology activities comes from local sources, with the federal and state governments providing an additional 19% and 11%, respectively,

whereas federal and state COVID-19 supplemental funds accounted for 17% and 8%, respectively. Values were similar for epidemiology personnel, with 32% of funding coming from local sources, 18% from federal sources, and 14% from state sources. Federal and state supplemental funds for personnel accounted for 18% and 8% of total funding for epidemiology personnel, respectively. These findings are in sharp contrast to state health departments, where,

on average, more than two thirds of funds are provided by the federal government. Other nongovernment funding sources—such as private foundation or nonprofit grants, donations, or corporate sponsorships—represented an average of 2% of funding for epidemiologic activities and 2% of funding for epidemiology personnel in BCHC departments. For all sources, however, the ranges were wide, from 0% to, in the case of local funds, 100%.

Table 4 Funding sources for epidemiology activities and personnel, range, and mean, 26 jurisdictions, BCHC ECA 2021

Funding Source	Epidemiology Activities			Epidemiology Personnel		
	Range	Mean	Median	Range	Mean	Median
Federal	0%-82%	19%	14%	0%-82%	18%	13%
COVID-19 Federal	0%-92%	17%	0%	0%-90%	18%	4%
State	0%-75%	11%	6%	0%-75%	14%	10%
COVID-19 State	0%-83%	8%	0%	0%-42%	8%	0%
Local	0%-100%	35%	37%	0%-88%	32%	33%
Other	0%-17%	2%	0%	0%-17%	2%	0%

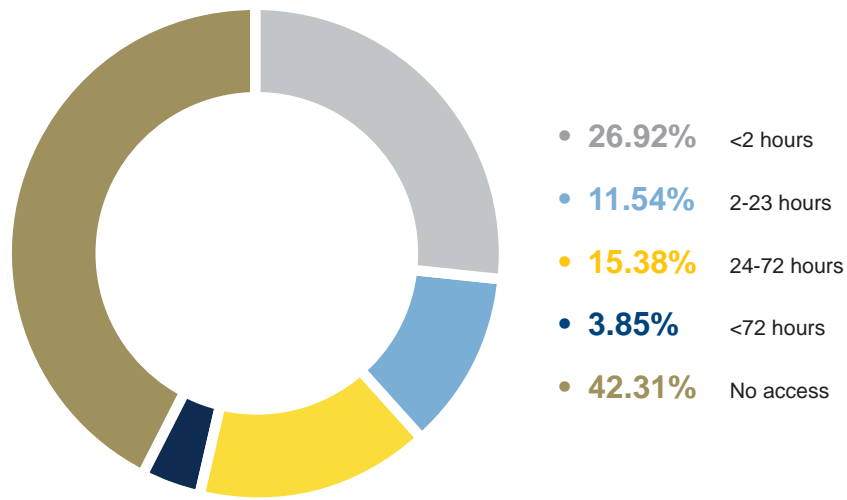
Access to peer-reviewed literature

Having ready access to peer-reviewed literature that is not published in open-access journals is important to inform the response to emerging and ongoing health issues and to identify evidence-based practices. Fifty-eight percent

of BCHC departments had access to peer-reviewed literature that is not published in open-access journals, although 19% of departments had delayed access, needing at least 24 hours to obtain articles (Figure 3). These rates

of access to the peer-reviewed literature are similar to rates reported in the 2017 BCHC ECA. In comparison, 86% of state health departments had such access, although 41% required at least 24 hours.

Figure 3 Time required to access peer-reviewed literature, 26 jurisdictions, BCHC ECA 2021



Use of an outbreak management system and case-based surveillance during the COVID-19 response

Sixty-five percent of the participating BCHC departments use an outbreak management system to collect and analyze data to support the initial characterization, investigation, response, and containment of outbreaks. This compares with 78% of state health departments. Most

(84%) BCHC departments operated a COVID-19 response separate from their state response. About half (52%) of BCHC departments rated their COVID-19 case-based surveillance system as good; 38% reported it to be fair and 9% said their system was poor. Most

BCHC departments (76%) implemented an additional contact tracing system for COVID-19, and 21% of departments plan to continue using their contact tracing system post-COVID-19, while 68% of departments were unsure of their plans.

Health department epidemiology capacity

Overall health department capacity to conduct Essential Public Health Services

Respondents were asked to assess their department's overall capacity to conduct each of the following three EPHS:

- **EPHS 1:** Assess and monitor population health status, factors that influence health, and community needs and assets
- **EPHS 2:** Investigate, diagnose, and address health problems and hazards affecting the population
- **EPHS 9:** Improve and innovate public health functions through ongoing evaluation, research, and continuous quality improvement.

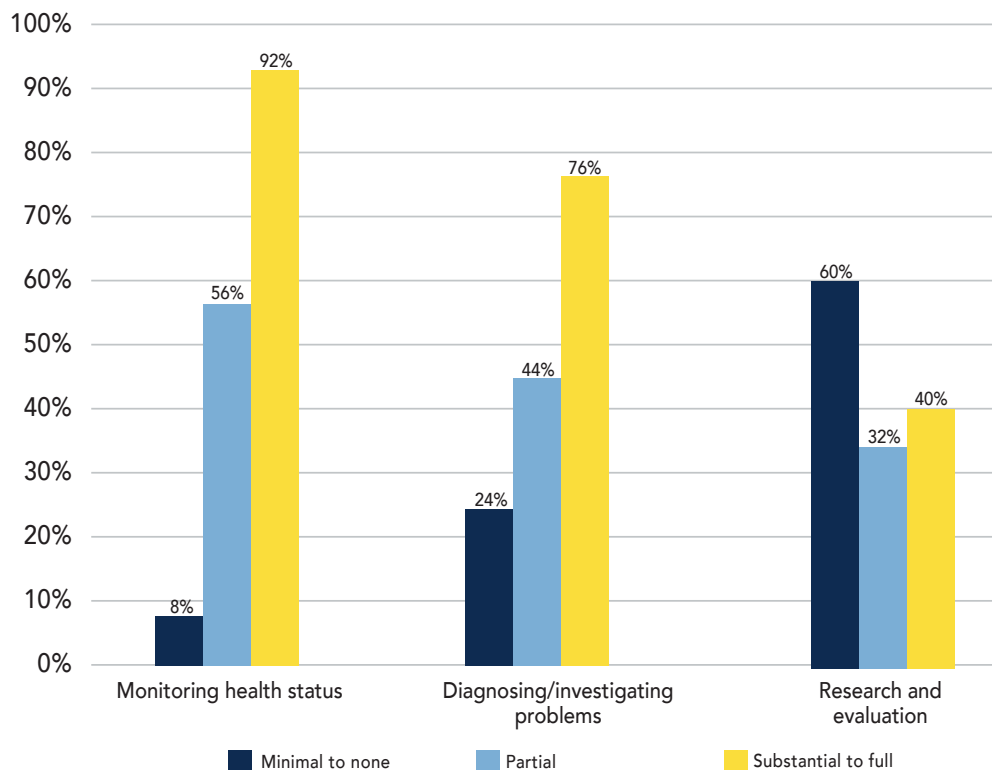
Nearly all participating BCHC departments (92%) reported having substantial to full capacity for monitoring health status (EPHS 1), an increase from the 84% recorded in 2017 (Figure 4). Most (76%) also have substantial to full capacity for diagnosing and investigating health problems (EPHS 2), a decrease from the 92% recorded in 2017. Notably, 8% of jurisdictions reported minimal to no capacity to monitor health status, and 24% reported minimal to no capacity to diagnose and investigate health problems.

In contrast to the high capacity for EPHS 1 and 2,

only 40% reported substantial to full capacity for research and evaluation, and 32% reported partial capacity, and 60% reported minimal to no capacity. In 2017, 39% of jurisdictions reported substantial to full capacity for EPHS 9 (evaluation) and 22% reported substantial to full capacity for EPHS 10 (research).

The corresponding levels of substantial to full capacity in the states for the 2021 ECA were 76% for monitoring health status, 88% for diagnosing and investigating problems, and 43% for research and evaluation.

Figure 4 Essential Public Health Services capacities, 26 jurisdictions, BCHC ECA 2021



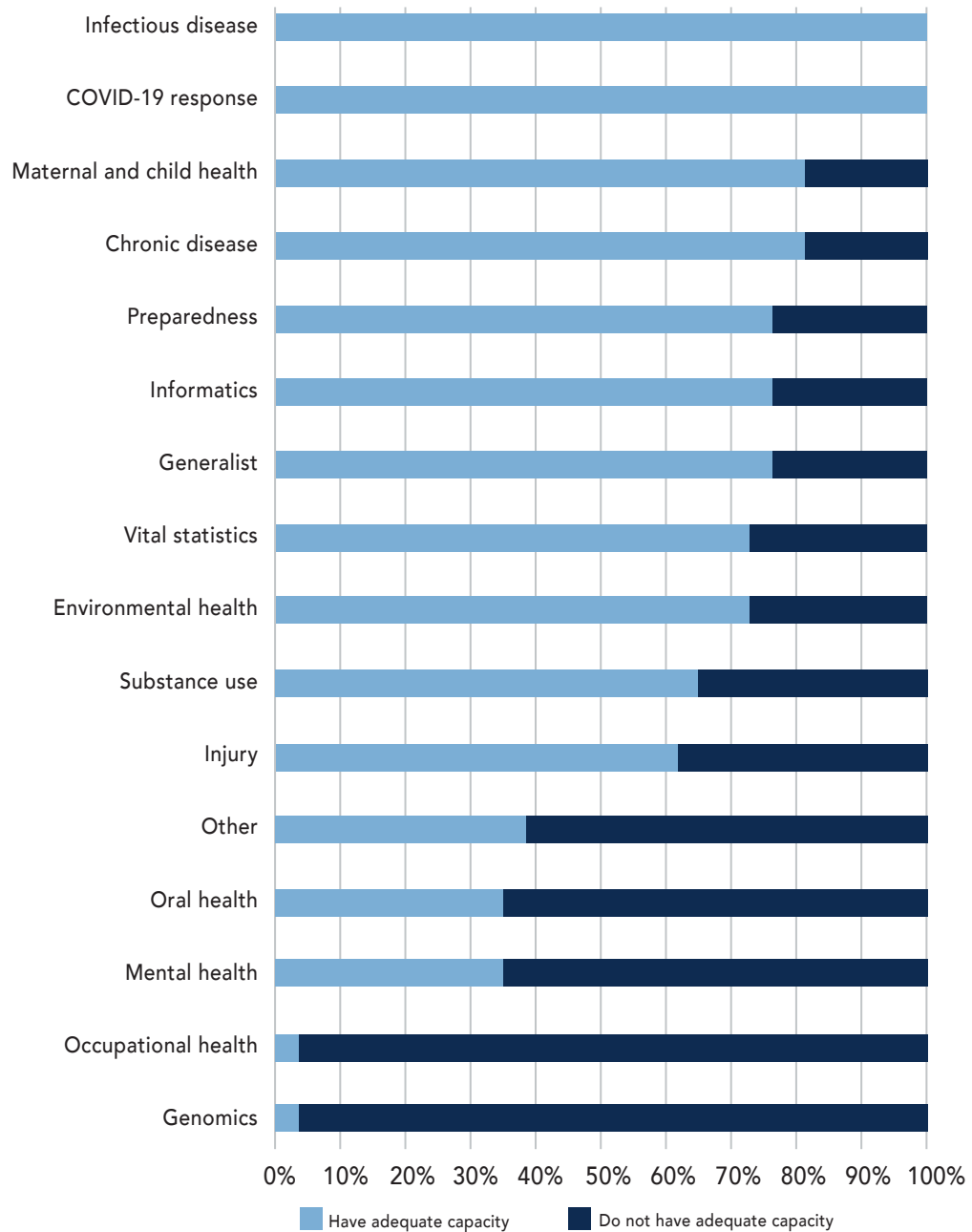
Program-level capacity

In the areas of infectious disease, COVID-19 response, MCH and chronic disease, at least 80% of the BCHC departments reported having adequate capacity to conduct the four key

public health epidemiology functions (Figure 5), where capacity was defined as the ability to lead epidemiologic activities; provide subject-matter expertise; and apply for, receive, and manage

resources to conduct key epidemiologic activities. Fewer than half reported having adequate epidemiology capacity in mental health, oral health, occupational health, and genomics.

Figure 5 Current capacity in the Essential Public Health Services by Program Area, 26 jurisdictions, BCHC ECA 2021



Hiring and Recruitment

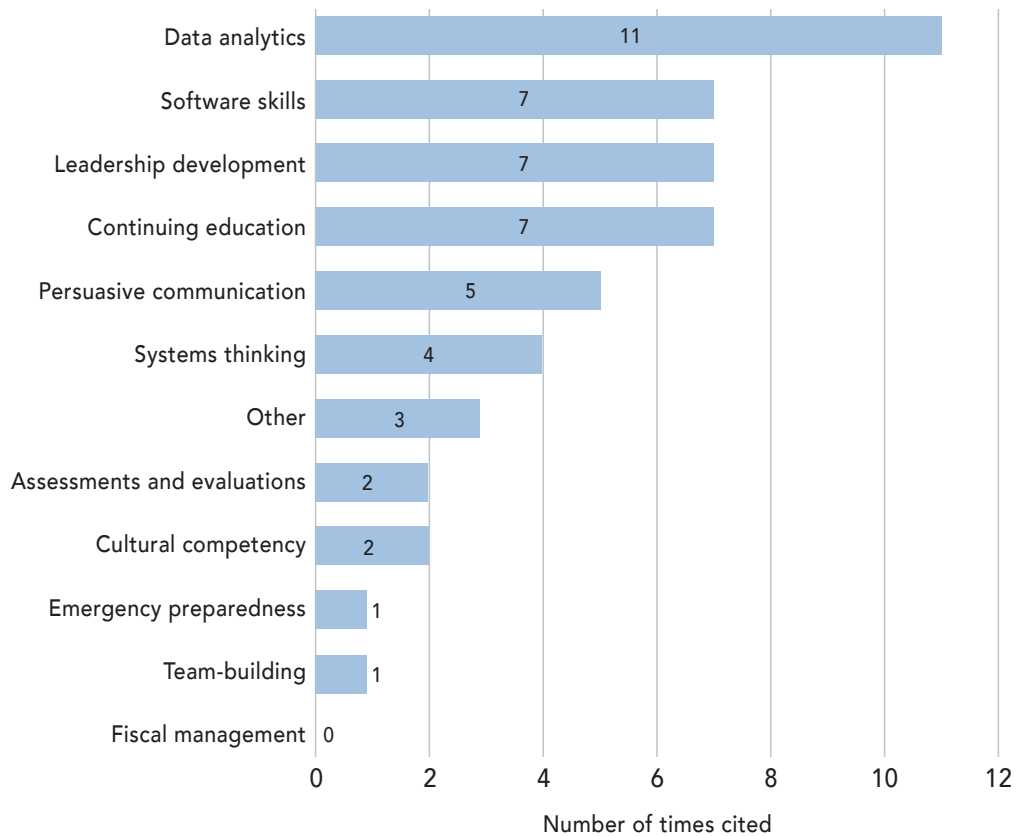
Training priorities

Each participating BCHC department selected its two most pressing staff training needs from a list of 12 broad training areas, so there were 52 possible votes for the 26 jurisdictions. The highest priority, by a considerable margin, was data analytics (e.g., informatics, translating

and applying public health data) (Figure 6). Other training priorities included software skills (e.g., Epi Info, SAS, SPSS, R), leadership development and continuing education (e.g., basic epi refreshers, newer methods, updates to the field/literature). Notably, no departments

reported fiscal management—including planning, budgeting, or monitoring resources—as a pressing training need for epidemiologists despite the large influx of funding for the field of public health. This may reflect that other personnel in the department are managing grants.

Figure 6 Top training needs identified, 26 jurisdictions, BCHC ECA 2021



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

More than half (60%) of the 26 participating BCHC departments use contractors to fill vacancies for epidemiology/ surveillance positions, similar to the 71% of state health departments that do so. There are an estimated 177 vacant positions in the participating BCHC departments, including 85 civil service positions (48%) and

92 (52%) contractor positions (Table 5). The greatest number of vacancies are in COVID-19 response (70), infectious disease (60), and generalist (12).

BCHC departments reported that they intend to fill 142 positions, 46% of which are civil service positions.

Vacancies reflect a small

portion of the number of epidemiologists needed to achieve full capacity. Overall, the 176 vacant positions and 142 intend- to-fill positions represent 29% and 24%, respectively, of the perceived 602 positions needed for BCHC departments to operate at full epidemiologic capacity.

Table 5 Vacant and intend-to-fill civil service and contractor positions, 26 jurisdictions, BCHC ECA 2021

Program Area	Civil Service		Contractor		Total	
	Vacant	Intent to Fill	Vacant	Intent to Fill	Total Vacant	Total Intent to Fill
Generalist	11.5	10.5	0	0	11.5	10.5
Chronic disease	8	8	0	2	8	10
COVID-19 response	8	2	61.5	46	69.5	48
Environmental health	1	0	0	0	1	0
Genomics	0	0	0	0	0	0
Infectious disease	36	29	24	26	60	55
Informatics	8	5	3	0	11	5
Injury	1	1	1	1	2	2
Maternal and child health	1	2	1	1	2	3
Mental health	1	0	0	0	1	0
Occupational health	0	0	0	0	0	0
Oral health	0	0	0	0	0	0
Preparedness	5	5	1	0	6	5
Substance use	2.5	0.5	0	1	2.5	1.5
Vital statistics	2	1	0	0	2	1
Other	0	1	0	0	0	1
TOTAL	85	65	91.5	77	176.5	142

Remarks from respondents on critical issues

This ECA included an open-ended question: “With respect to epidemiologic staffing and capacity, what are the most critical issues your department faces?” Several themes emerged from the responses including critical issues with funding, capacity (including balancing routine activities with emerging problems), recruitment and retention, and training. Below, we summarize themes from respondent’s comments and provide illustrative quotes.

“With respect to epidemiologic staffing and capacity, what are the most critical issues your department faces?”

Human Resources and Hiring

Big city health departments struggle to recruit and retain skilled epidemiologists.

Participating jurisdictions noted the challenges of finding skilled candidates with public health experience and with specialized skillsets (i.e., informatics). Additionally, many departments are competing for epidemiologists with state health departments, universities and hospitals who may have more competitive pay structures. Departments are struggling to retain current staff as many are leaving for private companies that pay better and don’t require time-consuming emergency response activities. Retention issues are further compounded by rigid work schedules, poor work environments and lack of continuing education opportunities. Many departments rely on local policy for working conditions to maximize tax dollars; however, it is not always conducive to work that occurs 7 days a week. Finally, many jurisdictions hired staff during the COVID-19 response and are concerned about laying off current employees when COVID-19 supplemental funding ends.

Recruiting diverse candidates has not seemed to be an issue for us. Recruiting qualified candidates with work experience has. With COVID and teleworking we need to recruit candidates who do not need a lot of development but arrive with some experience in applied epidemiology, are flexible and ready to roll with the punches, are comfortable taking on new things and working autonomously. We are currently recruiting and finding that sort of candidate has proved challenging.

We are in direct competition with the state health department for epidemiologists.

Big city health departments struggle to hire new staff effectively and efficiently. The hiring process at Big city health departments is often lengthy and creates delays in hiring new staff promptly. This regularly results in little overlap between the staff leaving and the new staff member taking their place, resulting in further loss of institutional knowledge. Jurisdictions also noted the challenges of current minimum hiring requirements for entry-level epidemiologists and the need to value lived experience as well as education.

In addition to the initial loss of the skilled epidemiology staff, there are barriers to filling the vacancy in a timely manner, especially since the onset of the COVID-19 pandemic as many of our positions have been subjected to hiring freezes and there has been pressure to eliminate vacant positions to reduce our department’s overall budget.

When an epidemiology employee leaves a program, there is often a delay of at least a few months in acquiring a new employee to fill the vacancy. Due to the nature of how hiring occurs in the department, there is generally no overlap between the former and newly acquired staff to exchange knowledge of the program. This process may limit the epidemiologic capacity of a particular program within the department for an unspecified time frame.

Big city health departments lack clear paths of career advancement for epidemiologists.

Participating jurisdictions highlighted that staff are leaving for other opportunities that provide higher pay and better hours because there is not a clear path for career development at the department, particularly into supervisory roles. There are limitations within the structure and policies of the health department that make it difficult for epidemiologists to seek promotion.

There are limited positions of advancement available to these staff, and promotions within programs are not always an option. Therefore, after investing time and training into staff at both entry and advanced levels, they are often lost to other programs within the department or businesses outside the department that have opportunities for advancement.

Limited opportunities for promotion and advancement into supervisory roles...We often see staff leave, particularly those who are able to develop statistical skills, for private companies that pay more and don't have an emergency response role and requirements for 24/7 response.

Staff are experiencing burnout from the prolonged COVID-19 response. Staff in big city health departments have been working long hours since January 2020 when the COVID-19 response began and are now experiencing burnout and continued stress. Participants expressed that they have limited vacation leave and difficulty using the leave they do have for fear the work will not be accomplished in their absence. Additionally, numerous staff were hired during the height of the response and do not know what the department's environment is like during non-response times.

Thinking specifically about COVID and this extended response, we don't have the depth or the funds to provide staff opportunities for paid sabbaticals/extended time off to reduce impact of burnout.

The critical issue we are primarily facing right now is burnout because of COVID-19. Especially for new Epi[demiology] hires who came on within the last year, they have not seen what our program is "normally" like and have not had the opportunity to learn/respond to other types of diseases and outbreaks apart from COVID-19.

Big city health departments do not have competitive salaries to adequately recruit or retain a skilled workforce. The salaries offered at departments are not competitive with the private sector and many health departments are competing with one another for epidemiology staff based on the salary and benefits they can offer. Participating jurisdictions noted the challenge of recruiting a skilled workforce with the current pay structure and a lack of funds to offer extended time off or sabbaticals. Departments are navigating the challenge of heavily relying on contractors while not being able to develop the long-term commitment of FTEs.

We are located quite close to major medical and academic institutions. Staff often leave for infection practitioner roles or to support academic epi[demiology] programs due to perceptions of higher pay and better hours.

[One of the most critical issues we face is] recruiting skilled staff within the current pay structure.

Data Modernization

Data modernization efforts are critical for creating an interoperable system that streamlines data sharing and analysis across program areas. Epidemiologists are regularly managing large datasets with outdated systems. Departments require technical infrastructure that will aid in automating work and enhancing informatics capacity to manage data integration. Although these changes would address immediate needs, health departments require a strategic vision and coordination at the federal, state and local levels for widespread data modernization planning and implementation.

We must improve our informatics capacity to support incoming data, data integration, and data dashboards.

We are often faced with a number of different data sets from different sources and are challenged with how to combine them and manage them.

Big city health departments are lacking informatics capacity to drive decision-making and automate routine analyses. Participating jurisdictions noted the lack of technical infrastructure and personnel for informatics. Departments need informaticians that can lead the development of innovative health data systems and evaluate surveillance data for timeliness, utility, validity, and accuracy. Many systems were built hastily during the COVID-19 response, and additional planning must be implemented to create systems that are efficient, sustainable and accurate moving forward.

[One of the most critical issues we face is a] need to keep pace with new technology.

[One of the most critical issues we face is] using data for decision making and automating routine analysis using end to end automation...seamless integration with IT lacking.

As the field of public health transforms, departments need greater infrastructure to manage data and operations. With large influxes of funding entering the field of public health, there is a need for infrastructure that would allow jurisdictions to be able to handle epidemiology duties within transformed public health organizational structures. This involves transitioning COVID-19 functions back into “normal operations,” bolstering analytic infrastructure to support data from multiple sources, and updating IT systems.

[One of the most critical issues we face is] resources and the reintegration of COVID-19 functions back into “normal” operations.

We are able to provide a high level of support via trained epis with strong subject matter expertise in some, but not all, program areas. Ideally, we would have this level of capacity agency-wide. Designated epidemiologists provide ongoing access to the existing evidence base and conduct robust program evaluations, ad hoc analyses, and research.

Funding

The availability and reliance on federal and state funds varies by jurisdiction and affects plans for sustainability and growth. While there is a great deal of variability in federal vs. state funding sources for big city health departments, a lack of local funding and heavy reliance on siloed, often restrictive federal funds makes it difficult for departments to fill and create new FTE positions. There is also a lack of nongrant funding to support competitive salaries. Departments require funding to support cross-training so that all program areas are prepared for collaboration on future public health emergencies.

Local funding is critical for sustainability. However, the amount of funding for epidemiology program activities is minimal. The expectation is that we should be able to take advantage of federal funding to conduct our activities. The problem is that there are certain positions that we cannot easily find funding for through our federal grants, like the position of grants specialist.

Our biggest challenge is still the reliance of grant funds to enhance epidemiology capacity. [A] large percentage of epidemiology staff and support staff are grant funded.

Training Priorities

There is a need to use a health equity lens and the social determinants of health in all facets of public health. Participating jurisdictions noted a need to focus on health equity and the social determinants. However, infectious disease continues to be a main priority of many jurisdictions and their resources. During the COVID-19 response, many noninfectious disease projects were suspended or significantly delayed. While COVID-19 has spotlighted the skills of epidemiologists and required more of their work in other sectors, the field needs to focus on prevention of all diseases in the community and not just working in response to public health emergencies.

We need to shift staff effort toward chronic disease, health equity, and social determinants of health, but the urgent needs in acute disease and other day-to-day operations make this difficult.

COVID has put a spotlight on the many skills of our staff, which has actually increased the demand for epi[demiology] services from other program areas.

There is a need for epidemiologists with specialized skillsets and on-the-job training. Participating jurisdictions noted that different program areas require different skillsets and that many need additional staff with skills in mapping/GIS, informatics and/or data science, data matching and cleaning and written and oral communication. Current staff also require on-the-job training, particularly cross-training across program areas. Jurisdictions also noted the importance of maintaining affiliations with hospitals and universities for peer-reviewed literature access, which is critical to obtaining accurate information in a timely manner.

Epidemiologic skillsets are not uniform across all programs. Due to the varying nature of programs within the department, different skills are required for the operation of different programs. For example, one program requires the development of databases and survey methodology whereas another program may require GIS experience. While an epidemiology staffing item has minimum requirements to qualify for the position, there are desirable skills that may or may not be present in all candidates (and cannot be assumed are possessed).

The most critical issues my department faces is having enough epidemiologists trained in gathering data, matching and cleaning data from different data sources.

DISCUSSION

Discussion



- **Big city health jurisdictions are heavily focused on infectious disease and COVID-19 response.** The ECA found that 100% of participating BCHC jurisdictions have program areas in preparedness, infectious disease and COVID-19 response, whereas only 38% of jurisdictions have a program area in mental health, 8% have a program area in occupational health and 4% have a program area for genomics. Existing program areas least likely to be served by a lead epidemiologist are oral health (8%) and genomics (4%). At the time the BCHC ECA was fielded, there were no occupational health program leads at any of the participating jurisdictions. Similarly, the program areas with the smallest number of staff across the participating jurisdictions are vital statistics (n=13), mental health (n=11), injury (n=9), oral health (n=3), occupational health (n=0), and genomics (n=0). These results may reflect that some BCHC jurisdictions have state and local support for certain program areas. Additionally, the COVID-19 response demonstrates the need for cross-training that enables staff to flexibly respond to an emergency and be trained in appropriate methods to shift easily across program areas.
- **All program areas experienced a decline in the number of epidemiologists except for the new program area of COVID-19 response. There are currently zero epidemiologists in genomics and occupational health in participating BCHC jurisdictions.** Because of the loss of staff, many non-COVID program areas struggled to keep funding and continue projects during the pandemic. Despite this, infectious disease and COVID-19 response had the highest number of additional epidemiologists needed to deliver public

health services, with an additional 174 and 127, respectively. Although there is great need for additional epidemiologists in BCHC jurisdictions, it is equally important to retain the current workforce. Many staff are dealing with burnout from the increased workload and extended hours during the COVID-19 response. Competitive salaries and benefits are important tools for recruiting and retaining epidemiologists, as well as implementing strategies that address hiring freezes and reduce delays in the hiring process. Jurisdictions should also consider the right balance of contractors and FTEs to ensure they are meeting the agency's long-term needs and building institutional knowledge.

- **Across BCHC jurisdictions, over a third of funding for epidemiology activities and personnel is provided by local sources with fewer federal dollars available than are to states.** The range of funding sources varies substantially across BCHC agencies, making a notable difference in implementation and the services available in each jurisdiction. Additionally, COVID-19 supplemental funding accounts for nearly a quarter of funding for BCHC jurisdictions. Departments need more, and more flexible, funding to be able to assist with all program areas affected by COVID-19, including injury, mental health, and substance use. However, heavy reliance on COVID-19 supplemental funding creates gaps when these temporary funding sources end. Sustainable funding is needed to support data modernization efforts and secure resources for long-term investments and planning. Funding should be flexible enough to allow personnel to have diverse responsibilities across program areas, particularly for preparedness efforts and to respond to local needs and priorities.

- **Over 40% of BCHC jurisdictions do not have access to peer-reviewed literature that is not open access, which is a detriment to agencies particularly during a pandemic.** It is critical for departments to deliver evidence-based practice but that is challenged by inaccessible peer-reviewed literature. The rates of access by BCHC departments are similar to 2017 rates and have not improved substantially. It is necessary to explore innovative strategies to access the peer-reviewed literature to ensure evidence-based delivery of epidemiology services.
- **Most BCHC jurisdictions operated a COVID-19 response separate from their state response, and more than half rated their COVID-19 based surveillance system as good on a scale of poor, fair, or good.** Although 76% of participating BCHC departments implemented an additional contact tracing system for the pandemic, most were unsure of their plans to continue use of the system after the response is over. Looking to future surveillance of COVID-19, it will be important to have a national strategy that states and locals can feasibly support for collecting surveillance data.
- **Most BCHC jurisdictions have substantial to full capacity for monitoring health status (EPHS 1) and diagnosing and investigating health problems (EPHS 2) whereas less than half have substantial capacity for research and evaluation (EPHS 9).** Similar to states, most BCHC agencies have substantial capacity for monitoring health status and investigating health problems but lag behind in capacity for research and evaluation. Although the percentage of BCHC departments with substantial capacity for EPHS 1 increased from 84% to 92% between 2017 and 2021, the percentage of departments with substantial capacity for EPHS 2 decreased from 92% to 76%. The decline in EPHS 2 is likely reflective of the stress on local public health staffing given the enormity of scale for diagnosing and investigating COVID-19. In 2017, 39% of jurisdictions had substantial capacity for EPHS 9 (research) and 22%

for EPHS 10 (evaluation). However, the updated EPHS included both research and evaluation into EPHS 9. In 2021, only 40% of participating BCHC jurisdictions had substantial capacity for EPHS 9 (research and evaluation). The ability to provide the EPHS are critical as they are foundational functions of public health.

- **Most BCHC jurisdictions have substantial capacity to provide the EPHS in infectious disease, COVID-19 response, MCH and chronic disease but less capacity in other program areas such as mental health, oral health, occupational health, and genomics.** Capacity to provide the EPHS across program areas varies greatly by jurisdiction, further highlighting the importance of collaboration with state partners to deliver public health services. As the field of public health transforms, there is a need to invest equally in non-COVID priorities and bolster capacity across program areas, including dedicated leads in every program area and focusing on diversity in experience and skillsets when hiring to provide expertise in lesser represented program areas.
- **Similar to 2017, the highest training priority for BCHC jurisdictions remains data analytics.** Additional training priorities include software skills (e.g., Epi Info, SAS, SPSS, R), leadership development and continuing education (e.g., basic epi refreshers, novel methodologies, updates to the field/literature). As the field of applied epidemiology modernizes, staff with specialized skillsets are needed as well as the cross-training of all staff to streamline and support public health reporting. Further collaboration with healthcare partners, academic partners and laboratories is particularly necessary as the field thinks through how data is stored and disseminated to the public, even with data sources outside public health (i.e., law enforcement data for the opioid epidemic). Academic partners can also aid in the training of students and connecting them to applied epidemiology experiences in the field.

Limitations

The 2021 BCHC ECA has several limitations:

- The results described in this report reflect the responses of participating BCHC member departments and may not be generalizable to the four BCHC departments that did not participate in the assessment or to local health departments that are not BCHC members. The Florida Department of Health may have included staff from Miami-Dade County when enumerating its epidemiology workforce; if so, the combined state and BCHC numbers would overestimate national capacity. Additionally, the DC health department staffing numbers were included in both the state and BCHC ECA estimates.
- Although the ECA defines epidemiologist for purposes of the assessment, it does not necessarily align with job titles and has a subjective component to it, which may affect comparisons among health departments.
- The 2021 BCHC ECA was fielded during the COVID-19 pandemic response, thus impacting the completeness of responses and the ability of all jurisdictions to fully participate.
- The data also should be considered a “snapshot” in time given the COVID response and unique needs of BCHC jurisdictions.

RECOMMENDATIONS

Recommendations



A number of recommendations were determined based on the results of the 2021 BCHC ECA. An overarching theme throughout the results and recommendations was the need for additional flexible, non–disease-specific funding. Additional funds would enable jurisdictions to offer on-the-job training, enhance recruitment and retention efforts and ensure adequate access to peer-reviewed literature.

Training

Training efforts are essential for ensuring the epidemiology workforce is equipped to respond to future outbreaks. Cross-training across infectious disease and noninfectious disease program areas would encourage knowledge sharing, bolster capabilities for emergency preparedness and enhance the smooth reallocation of staff to meet surge staffing needs. Furthermore, staff require on-the-job training in data analytics to ensure the ability to keep up with ongoing data modernization efforts.

Recommendations

- Provide cross-training that allows epidemiologists to shift across program areas as needed, particularly during public health emergencies.
- Enhance skills in data analytics to support data modernization efforts.
- Streamline onboarding training to assist with surge and/or temporary staffing and alleviate the burden on existing staff while preparing new staff to qualify for FTE positions if interested.

Salaries

Lengthy hiring delays and inadequate salary scales are detrimental to the recruitment and retention of epidemiologists in Big City jurisdictions. Jurisdictions require updated salary scales that are competitive with the private sector and expedited hiring practices, particularly during response efforts. By retaining the workforce long-term, jurisdictions

are able to preserve institutional knowledge and maintain continuity within projects. Participating jurisdictions noted the challenge of recruiting a skilled workforce with the current pay structure and a lack of funds to offer extended time off or sabbaticals.

Recommendations

- Update salary scales to be competitive with other industries.
- Collaborate with Human Resources staff and health department leadership to be able to hire temporary and permanent staff in a timely manner.

Recruitment and Retention

Additional epidemiologists are needed to deliver the EPHS, as indicated by the gap between the current number of epidemiologists and the ideal number of epidemiologists needed in big city jurisdictions. Jurisdictions need updated AECs for job descriptions, the opportunity to provide extended time off and opportunities for advancement to recruit and retain epidemiologists. This is particularly relevant for program areas with more limited staff. Departments are navigating the challenge of heavily relying on contractors while not being able to develop the long-term commitment of FTEs.

Recommendations

- Recruit additional epidemiologists, especially for emerging program areas (i.e., genomics) and with advanced knowledge and skills for research and evaluation.
- Develop a plan to build epidemiology capacity and staffing internally to reduce reliance on contractors and reduce costs in procurement, decrease project delays and increase institutional knowledge.

Academic Relationships

In an effort to grow the applied epidemiology workforce in Big City jurisdictions, it is necessary to collaborate with universities and schools of public health to ensure a sufficient pipeline of new epidemiologists. By maintaining relationships with public health institutions, jurisdictions can ensure that emerging epidemiologists are trained in needed methods and technologies. Big City jurisdictions should also foster relationships with state health departments and academic institutions for special projects and to aid in surge staffing during emergency response efforts.

Recommendations

- Foster relationships with universities and schools of public health to harness the pipeline of incoming epidemiologists and ensure reliable access to the peer-reviewed literature.
- Facilitate opportunities for students to be exposed to public health practice at a health department.
- Explore opportunities for academic institutions to support health departments for special projects or subject matter expertise, particularly during an emergency response.
- Ensure reliable access to the peer-reviewed literature.

Conclusion

Local public health is essential for collaboration with state and federal partners and relies heavily on their funding. Big City health departments are uniquely challenged with serving diverse populations and need skilled epidemiologists to understand and disseminate data to describe their communities and inform decision-making in the field.

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