THE UNIVERSITY OF NORTH TEXAS

Recommendations and Frameworks to Guarantee a Certified Disease Intervention (DI) Workforce

CENTER FOR PUBLIC HEALTH
WORKFORCE
DEVELOPMENT
ASPPH

Contributors

This body of work was produced by the University of North Texas for reporting period November 12, 2024 - September 29, 2025:

Prepared by:
Diana Cervantes, MS, DrPH

Facilitators:
Diana Cervantes, MS, DrPH
Associate Professor, Director, MPH Epidemiology Program, School of Public Health

Emily Spence, MSW, PhD
Associate Dean for Community Partnerships and Practice, Associate Professor, College of Public Health: Department of Population and Community Health

Teresa Wagner, DrPH
Associate Professor, College of Public Health; Director UNT Fort Worth CHW/CHWI Training Center

Project Consultants:
Nicolette Janoski, MPH
Megan Wesley, MEd

Project Staff:
Darashagam Nahal
Graduate Research Assistant

Litzy Ocampos
Graduate Research Assistant

This body of work was overseen and coordinated by the Association of Schools and Programs of Public Health (ASPPH):

Emily Burke, EdD, MPH, CPH
Senior Director of Workforce Development and Applied Practice

Beth Handler, MPH
Director of Public Health Credentialing and Continuing Education

Sara McDowell, MPH, CPH
Senior Manager of Public Health Training and Credentialing

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Summary

The capacity and size of the DI workforce is affected by structural and relational factors that represent the benefits of and barriers to CDI certification. Describing and understanding these factors can promote the growth of the DI workforce by finding ways to increase the recruitment, training, and retention of a certified DI workforce. This is the purpose of the Disease Intervention Workforce Capacity Building and Sustainment model and framework described in this report. Key points of the model and framework are highlighted below.

Workforce Development and Career Growth

- **Leadership Support Matters:** Organizational and DI workforce leaders play a central role in certification success by preparing staff, providing resources, and embedding CDI certification into hiring and workforce development standards.
- **Embedding CDI Certification into Career Growth:** Certification should be tied to advancement opportunities, organizational recognition, and recertification requirements, ensuring skills remain current and valued over time.
- **Partnering with Academia and Training Programs:** Collaboration with schools and training programs prepares future candidates, strengthens workforce pipelines, and ensures sustained certification success.
- **Collecting Workforce Feedback:** Continuous evaluation of outcomes and workforce needs helps CDI certification remain relevant, credible, and effective as a long-term workforce development tool.

Recognition and Retention

- **Raising the Visibility of DI Work:** DI positions often go underrecognized until a crisis arises. Certification raises the profile of DI professionals, highlights their essential role, and builds public confidence in outbreak response.
- **Improving Retention in a High-Turnover Field:** Certification reduces burnout, supports career stability, and creates pathways for advancement, helping to offset turnover, which is exacerbated by budget cuts and limited hiring capacity.
- **Creating Champions and Peer Networks:** Sharing success stories, publishing testimonials, and developing CDI "champions" fosters professional pride, strengthens peer networks, and promotes long-term retention.

Standards and Practices

- **Providing a Targeted Credential:** Unlike broad public health certifications, CDI certification offers a profession-specific credential that reflects the diverse, specialized skills required for effective DI.
- **Establishing a Standard Framework:** Certification sets clear, evidence-based standards for outbreak investigation, surveillance, and contact tracing, ensuring more reliable, consistent, and data-driven practices.
- **Building a Professional Network:** CDI training supports mentorship, fosters ongoing learning, and strengthens the DI community of practice by combining technical skills with rapport building and resilience training.

Public Impact

- **Strengthening Skills, Building Trust:** The CDI program equips DI professionals with practical, evidence-based training in outbreak investigation, surveillance, and contact tracing. It enhances staff competence, credibility, and career growth while fostering public trust in a reliable, coordinated outbreak response.

Project Purpose and Background

Disease intervention (DI) professionals are an essential part of the public health workforce, supporting the prevention and control of infectious diseases through activities such as case investigation, contact tracing, partner services, care coordination, outbreak response, and community engagement. Although DI work has historically focused on sexually transmitted infections (STIs) and tuberculosis (TB), DI professionals increasingly support responses to emerging and re-emerging public health threats. As the scope of disease intervention has expanded, so has the need for a standardized approach to preparing, training, and recognizing this workforce.

To address this need, the Centers for Disease Control and Prevention (CDC), in collaboration with national public health partners, initiated efforts to establish the Certification in Disease Intervention (CDI) program. The CDI program is designed to standardize and validate the knowledge, skills, and abilities of DI professionals, improve the quality and consistency of disease intervention services, and strengthen recruitment, retention, and professionalization of the workforce.

The CDI project has advanced through several phases over more than a decade. In 2013, CDC and the National Association of County and City Health Officials (NACCHO) collaborated on a feasibility assessment to evaluate the potential for a national DI certification program. NACCHO supported stakeholder engagement and contracted with International Credentialing Associates to assess workforce needs, training gaps, operational requirements, and sustainability considerations. Beginning in 2014, the Public Health Accreditation Board (PHAB) served as the coordinating organization for the assessment phase, leading foundational activities such as the DI workforce registry, Job Task Analysis, workforce enumeration studies, and evaluation of certification models. This work helped define DI competencies and supported the selection of a test-based certification model.

In 2022, the Association of Schools and Programs of Public Health (ASPPH) assumed leadership of the CDI project through a CDC-funded cooperative agreement. In partnership with the National Board of Public Health Examiners (NBPHE), subject matter experts, and national public health partners, ASPPH has supported certification infrastructure, examination development, stakeholder engagement, and strategies to strengthen pathways into the DI workforce. As the CDI program moves toward implementation, understanding the factors that influence participation in certification is critical to ensuring broad adoption and long-term sustainability. While certification has the potential to strengthen workforce competency, professional recognition, and career advancement, barriers related to cost, employer support, awareness, and perceived value may affect participation among current and prospective DI professionals. Identifying effective strategies to encourage certification uptake and maintenance is essential to building and sustaining a robust, certified DI workforce.

To address this need, ASPPH awarded a subaward to the University of North Texas Health Science Center at Fort Worth College of Public Health to develop a model and framework for promoting participation in CDI certification. The purpose of this project was to identify factors that influence certification uptake and maintenance, assess barriers to participation, and develop research-informed recommendations for incentivizing CDI certification among DI professionals. The project sought to provide practical strategies that can be adopted by employers, public health agencies, and other stakeholders to support certification

participation and workforce development.

The resulting model and framework are intended to inform efforts to recruit, train, certify, and retain DI professionals while strengthening the long-term sustainability of the CDI program. By identifying approaches to increase participation in certification and maintenance of certification, this work contributes to the broader goals of the CDI initiative and supports the development of a competent, prepared, and resilient disease intervention workforce.

Overview

Public health professionals play a crucial role in preventing and controlling infectious diseases. Over 100 notifiable infectious diseases in the US require professionals specializing in public health DI in more than 3,000 health departments to conduct surveillance, investigations, contact tracing, and case management of more than 2 million events annually, safeguarding public health.[2] The magnitude and complexity of these tasks require a large workforce with varied knowledge, skills, and abilities (KSAs) for effective and efficient prevention and control. To address this, the CDC envisioned a CDI program that would enhance service delivery quality and consistency by standardizing and validating KSAs, improving training, and increasing recognition of the public health DI workforce.[1]

In 2013, the CDC, in collaboration with the International Credentialing Associates (ICA) and the National Association of County and City Health Officials (NACCHO), conducted a study to determine the feasibility of creating a CDI certification.[3] This led to the assessment of foundational activities for establishing a national CDI program by the Public Health Accreditation Board (PHAB), which defined the DI professional, enumerated the workforce, and analyzed DI job tasks.[3] In 2022, the ASPPH and the NBPHE began developing the structure for educational pathways to remove barriers to obtaining the CDI certification and establish a framework for developing and delivering the exam leading to CDI certification.[3]

Current Knowledge

The COVID-19 pandemic underscored the importance of professionals working with communities to prevent and control infectious diseases by conducting case investigations, contact tracing, disease surveillance, and risk communication.[4] Studies have demonstrated that DI, primarily conducted by field epidemiologists and Disease Intervention Specialists (DIS) during the COVID-19 pandemic,[4,5] have played an essential role in controlling the spread of infection agents such as Ebola, SARS, H1N1 influenza, HIV, and TB.[6,7]

The DI workforce traditionally refers to DIS, who manage and prevent the spread of STIs in communities.[5] In 2015, a registry of full- and part-time DIS positions revealed that 2,200 positions in 62 US states, cities, and territories were funded by the CDC.[1] In 2016, a survey of health departments in 49 US states and Washington, DC, identified 1,600 STI/HIV DIS positions.[8] More than half of these states reported that the number of DIS positions was insufficient, and that these positions were used in public health emergencies.[8]

A job task survey of 495 respondents assisted the PHAB in establishing a template for a DIS job description that includes position responsibilities, KSAs, preferred minimum education and experience requirements, and additional job-related considerations.[1]

DIS responsibilities include tasks related to:

1. Planning and preparation for fieldwork
2. Investigation activities
3. Client encounters and interviewing
4. Surveillance support activities
5. Health system collaboration and quality improvement
6. Clinical support services
7. Testing and field services
8. Case analysis
9. Outbreak response and emergency preparedness

KSAs focus on the ethical application of disease prevention strategies through critical thinking, case management, and effective communication. Community counseling or outreach experience is noted as the preferred experience. The amount of experience required varies based on education, with a high school diploma or equivalent requiring two years of experience, an associate's degree or equivalent requiring at least one year of experience, and a bachelor's degree or higher requiring no experience. Important job considerations included a state license to drive a vehicle, access to transportation, and the availability and flexibility of schedule to respond to emergencies.

The above-mentioned surveys were part of an extensive assessment coordinated by PHAB and funded by the CDC to determine the modalities and activities required for a national DIS certification program.[1] According to the assessment, certification aims to "…improve public health services provided to communities by DIS through a high-quality, standardized approach to the professional development of this [DIS] workforce. Certification can standardize and validate the knowledge, skills, and abilities of DIS; drive the standardization and improvement of training; increase the quality and consistency of service delivery; and increase recognition of the skills and abilities of DIS."[1] The assessment included short- and long-term recommendations to the CDC, including the development and implementation of a test-based certification in collaboration with suitable organizations to administer and manage the certification process. It also emphasized the importance of ongoing assessments of the DIS workforce's educational and training needs.

Subsequently, ASPPH—with funding from the CDC and in partnership with certification provider NBPHE—has been implementing the national CDI credential. A Disease Intervention Workforce Environmental Scan Report by ASPPH highlighted ongoing disparities and the burden of infectious diseases in specific populations and communities with which DIS consistently works to prevent and control the spread of disease. The report also highlighted challenges and variations in the DIS workforce. In an environment of ever-increasing knowledge and rising demand for skills, expanding workloads, and a lack of role standardization have led to variations in DIS position requirements and salaries.

The report was supported by a DIS job posting analysis of 32 web-based job postings from 18 states from August 4 to 5, 2022. Significant variations in salaries were noted across states, regions, and counties. Starting and average wages for DIS job postings ranged from $29,047 to $63,764 and from $44,173 to $56,995, respectively. This variation was observed by region, with Southern states having the lowest average salaries and Western states having the highest average salaries. For all positions, no specific credentialing or training was required.[5] While variations in KSAs, education, and experience requirements were found by geographic area, the analysis

supported the PHAB job description template KSAs but also found that phlebotomy and bilingual skills were required for several positions. It also concurred with the PHAB educational and experience requirements but noted experience in public health or healthcare as a standard.

Through a collaborative process with input from subject matter experts, including DI professionals and public health partners, six CDI exam domains were established:

- Planning and case analysis
- Interviewing and case management activities
- Field services and outreach activities
- Surveillance and data collection
- Collaboration
- Disease response and emergency preparedness[3]

Eligibility to sit for the CDI exam mirrors the PHAB experience and education requirements discussed above. In addition, the definition of a DI professional was updated to the following: "A disease intervention professional is primarily a non-licensed public health professional with applied expertise in preventing the spread of infectious disease at a community level. They deliver a comprehensive set of client-centered services necessary to provide equitable access to recommended testing, treatment, and prevention resources."[3]

The current CDI domains, eligibility, and DI professional definition expand the range of public health professions that may benefit from and be eligible for CDI certification, including epidemiologists, health educators, and community health workers. These professionals have also played a crucial role in infectious disease prevention and intervention. For example, a qualitative study of local health departments found that public health epidemiologists play a vital role in enhancing the quality of infectious disease investigations and the timeliness of reporting.[9] During the COVID-19 pandemic, community health workers in New York City provided education, combated misinformation, and connected communities to resources, addressing health disparities and equity gaps.[10]

In 2024, an extensive assessment conducted by the Council of State and Territorial Epidemiologists (CSTE) and the Big Cities Health Coalition (BCHC) found that most current and open positions for epidemiologists were in the field of infectious disease prevention and control. This suggests that ongoing training and retention could be critical to the ability to deliver these services.[11]

In developing the CDI certification, the ASPPH conducted professionally facilitated regional meetings in four locations (Fort Worth, TX; Chapel Hill, NC; Gainesville, FL; and New York City, NY) between July 2023 and May 2024. These regional meetings included representatives with expertise in DI from state and local health departments, academic institutions, and other agencies. These meetings aimed to gain a deeper understanding of the DI workforce and the opportunities and challenges associated with CDI certification. Participant input during these meetings highlighted several macro (structural)- and micro (relational)-level factors related to organizations, service populations, and the workforce, including the benefits and barriers to obtaining and maintaining professional certification. See Appendix 1 for details.

Project Goal

The primary goal of this project is to identify mechanisms with which to promote and sustain CDI certification and increase the recruitment, training, and retention of a certified DI workforce. By validating and further characterizing the macro (structural)- and micro (relational)-level factors that may represent benefits of and barriers to CDI certification, these factors can inform the development of a model and framework for building and sustaining DI workforce capacity. To identify the benefits of and barriers to CDI certification at the workforce, organizational, and service population levels, and to identify ways of developing CDI certification, the model links theory and practice. Meanwhile, the framework—which illustrates the relationships between the DI-certified workforce, agencies, employers, health providers, and other organizations, and the service populations related to recruitment, training, and retention—helps communicate and apply the model.

Recommendations for ways to increase the benefits of and lower the barriers to obtaining and maintaining the certification are based on data collected from three sources:

- A rapid scoping review
- A job classification scan
- Listening sessions

The data collected from these three sources were presented to a community advisory board (CAB) to further inform the model and framework and to provide recommendations for promoting the model's integration into DI workforce management processes to build and sustain DI workforce capacity.

Objectives & Methods

Rapid Scoping Review

The primary question for the rapid review was, "What are the benefits, barriers, and solutions for public health professionals in obtaining and maintaining a professional certification in infectious disease intervention?" The review sub-questions were:

1. What workforce, organizational, and service population benefits exist for building and sustaining a certified DI workforce?

2. What workforce, organizational, and service population barriers may prevent the DI workforce from obtaining and maintaining a CDI?

3. What no-cost, evidence-based solutions for obtaining and maintaining professional certification address the identified benefits and barriers, focusing on recruiting, training, and retaining a certified DI workforce?

The methodology of the rapid scoping review is detailed in Appendix 2. A literature search was conducted to identify white and gray literature (literature produced within and outside of standard commercial or academic publishing channels) on the possible benefits of certifying the DI workforce, as well as the barriers to certification and solutions to those barriers. The preliminary information obtained from ASPPH-led regional listening sessions (see Appendix 1) helped identify benefits, barriers, and solutions linked to the purpose and goals of certification. The purpose and goals of certification included:

- Standardization and validation of knowledge, skills, and abilities

- Standardization and improvement of training

- Increased quality and consistency of service delivery

- Increased recognition of professional skills and abilities

Two independent reviewers conducted all reviews and extractions for the scoping review.

Job Classification Scan

The job classification scan aimed to identify trends in the knowledge, skills, abilities, funding streams, and salary ranges the DI workforce needs to serve populations. It supplemented the previously conducted scan and provided insight into the benefits for the broader DI workforce of obtaining and maintaining CDI certification.

The objectives of this job scan were to identify and analyze DI workforce positions for the following:

1. Employer-defined knowledge, skills, abilities, and position focus areas to understand current workforce needs and expectations

2. Job characteristics, including preferences, requirements, and benefits, to understand workforce

capacity and priorities

3. Employers' organizational characteristics, including geographic location, staff size, and accreditation status, to understand structural factors that may influence workforce capacity and priorities

4. Service population characteristics, including demographic composition and access measures by geographic location, to understand resource and emergency preparedness needs

Appendix 3 details the methodology used in the job classification scan. Large job boards from public health professional organizations, private job boards specializing in public sector postings, and state and local health department websites were reviewed for positions with the following key terms: infectious disease intervention, infectious disease prevention, and infectious disease epidemiology. The ASPPH definition of a DI professional was used to select full-time job postings for DI professionals providing services in the US. Positions meeting the inclusion criteria were entered into a relational database (one in which linked tables make it easy to connect and analyze related information), and data were extracted on the agency posting the position, the service location of the position, and position details such as level, salary, educational and experience requirements, knowledge, skills, and abilities, and alignment with the CDI exam core domains.

Listening Sessions

Seven listening sessions were conducted to gather perceptions on factors influencing professionals' uptake of the CDI certification and their ability to maintain it over time. The objectives of the listening sessions were to identify:

1. The benefits of and motivations for obtaining and maintaining the CDI certification

2. The barriers to obtaining and maintaining CDI certification for the DI workforce and DI employers

3. Strategies for building a DI-certified workforce

The methodology of the listening sessions and the subsequent qualitative analysis are summarized in Appendices 4 and 5, respectively. The recruitment and engagement of seven organizations were conducted via email, virtually, and through in-person meetings. The organizations included conference attendees at the Texas Public Health Association (TPHA) and the Council of State and Territorial Epidemiologists (CSTE) annual meetings, four regional (county) health departments, and the Dallas-Fort Worth chapter of the Association for Professionals in Infection Control and Epidemiology (APIC). The listening sessions followed a semi-structured script that assessed participants' perceptions of the benefits of CDI certification, the motivators for certification, and the barriers to certification. The sessions also sought proposed solutions.

All sessions were recorded and transcribed. Transcription narratives were divided into text passages based on key ideas. Then each passage was coded at least three times using a single open code that mirrored the overall interpretation of the passage and two axial codes that further categorized the passages along the key domains (Axial code 1) and subcategories (Axial code 2). Coding was performed and verified independently by two individuals, under the supervision of a third. The coders and supervisor met numerous times to review codes, reconcile differences, and further organize and distill the coding structure. Emergent themes were generated by reviewing key axial-level patterns and reaching a consensus among three individuals.

Community Advisory Board (CAB)

A CAB was established with the primary objective of further developing the DI workforce capacity and the sus-

tainability of the model and framework, supported by the results of the rapid scoping review, job classification scan, and listening sessions. The composition of the 12-member CAB was determined *a priori*:

1. Seven members representing professionals currently working in or directly managing the DI workforce
2. One academic partner specializing in public health practice
3. One academic partner specializing in model and framework development
4. Three community members with possible professional interactions with or experiences of the DI workforce.

Members were recruited both from listening session participants and the facilitators' established professional networks.

Three CAB meetings were held with the following objectives:

1. Review the results of the rapid scoping review, job classification scan, and preliminary listening session themes to establish preliminary model constructs (Meeting #1)
2. Reach a consensus for the model constructs and establish preliminary framework elements (Meeting #2)
3. Reach consensus for the framework elements and recommendations for communicating and implementing the model and framework to increase uptake and participation for building and sustaining a certified DI workforce (Meeting #3).

To support ongoing engagement and provide a platform for asynchronous participation as needed, recordings of each meeting and related content were delivered using Rise 360, an interactive web-based platform. This platform served as a centralized hub for CAB members to access resources, meeting materials, and updates throughout the project.

After each CAB meeting, facilitators (Drs. Cervantes, Spence, and Wagner) discussed and compiled the feedback provided. Web-based feedback forms created through Monday.com were then sent to CAB members to input on the compiled meeting results. CAB members were given at least seven days to fill out post-meeting forms. Members who were unable to attend a CAB meeting were allowed to view the meeting materials asynchronously and provide feedback through the post-meeting forms. CAB members were provided with $50 gift cards for participating in each CAB meeting and completing feedback forms.

Results and Findings

Rapid Scoping Review

Summary of Sources

Thirty-five sources were included for final extraction and analysis. Table 1 summarizes these sources. The majority of the sources were published after 2020 (74%) and were peer-reviewed sources (77%). The final sources represented a variety of methodologies, with quantitative methods being the most frequently used. Several DI workforces were represented, with the majority reflecting positions from the COVID-19 pandemic response, such as contact tracers, case investigators, and COVID-19-specific responders. Each source was reviewed to refine and define macro (structural)- and micro (relational)-level categories, along with their associated benefits, barriers, and solutions, as described in Appendix 2.

Publication Year	n	%
2014-2019	9	25.7
2020-2024	26	74.3
Source Type	**n**	**%**
Commentary	1	2.9
Book/Thesis	2	5.7
Government or Professional Organization Document	5	14.3
Peer-Reviewed Article	27	77.1
Study Methodology	**n**	**%**
Quantitative	15	42.9
Qualitative	8	22.9
Mixed Methods	3	8.5
Other (narrative, recommendation, editorial)	9	25.7
DI Workforce Focus	**n**	**%**
Applied Epidemiologist	13	37.1
DIS	7	20.0
Other PH professionals performing PH-DI Tasks (nurse, general PH professional, case investigator, contact tracer, COVID-19 responder)	15	42.9

Table 1. Summary of Scoping Review Sources; N= 35.

CDI Certification Benefits

Thirty-seven possible benefits of certification were identified from one or more sources in each refined category, as shown in Table 2. “Professional standardization” (n=10) and “knowledge, skills, and abilities” (n=9) were the categories with the highest number of certification benefits. No certification benefits were directly found in the sources related to “career advancement and mobility.” Regarding possible outcomes of certification (Table 3), “quality and consistency of service” (n=17) and “recognition of the skills and abilities of the workforce” (n=9) were outcomes most aligned with sources in which certification benefits were identified.

Macro-Level	Organizational	Professional Standardization	10
		Policy & Funding Support	1
	Service Population	Public Outreach & Outcomes	4
		Service Capacity & Continuity	5
Micro-Level	Organizational	Employer Support & Appreciation	1
		Training & Professional Development	3
	Service Population	Community Confidence & Trust	2
		Community Access	2
	Workforce	Career Advancement & Mobility	0
		Knowledge, Skills, Abilities	9
			37

Table 2. Number of certification benefits identified in one or more sources by level and sub-level.

KSA	3
Training	1
Service	17
Recognition	11
	32

Table 3. Number of sources with certification benefits by certification outcomes.

The rapid scoping review synthesized the existing benefits of certification for building and maintaining a certified DI workforce at the organization, service population, and workforce sub-levels. Five key certification benefits were identified at the macro (structural)-level (Table 4) and six at the micro (relational)-level (Table 5), highlighting key findings. At the macro (structural)-level, organization sub-level, the DI workforce is highly qualified and competent, so its tasks may be more likely to be viewed as essential, and therefore more likely to be retained during funding fluctuations. This may make it easier for the workforce to become certified and deliver high-quality service, or may lead to a greater desire for certification. At the macro (structural)-level, service population sub-level, the DI workforce has clinically-relevant specializations such as infectious disease epidemiology and clinical care scope of work, such as phlebotomy, which may enable expanded outreach and response, and which may benefit from standardized knowledge and practices that are assessed through certification.

At the micro (relational)-level, organization sub-level, certification may enhance growth and fulfillment among DI professionals, which can increase retention. At the micro (relational)-level, service population sub-level, certification may increase the skills needed to build rapport, adaptability, and to expand service through the non-traditional points of care that help foster community confidence, trust, and access. At the micro (relational)-level, workforce sub-level, certification may benefit the workforce by building formal pathways for career growth and reinforcing the technical and community-building KSAs for which the DI workforce would like to be recognized.

Sub-Level	Category	Benefits	Key Finding
Organization	Professional Standardization	Certification Ready Workforce High-Quality Service Delivery	• A large portion of the existing DI workforce has graduate-level education and works in programs with lead positions. • The current DI workforce is competent in providing essential public health services through diverse services and skills.
Organization	Policy & Funding Support	Stabilizing Workforce Funding Practices	• DI positions are more likely to be retained beyond short-term funding cycles, contributing to the stability of the workforce.
Service Population	Public Outreach & Outcomes	Expanding Service Reach & Promotion	• Efforts to expand the clinical care scope of work of the DI workforce may further promote outreach to healthcare systems and communities, having a positive impact on health outcomes.
Service Population	Service Capacity & Continuity	Critical Workforce Capacity & Response	• DI specializations such as infectious disease epidemiology comprise a large portion of the public health workforce, supporting critical DI programs and services.

Table 4. Macro (structural)-level, existing benefits to certification with key rapid scoping review findings.

Sub-Level	Category	Benefits	Key Finding
Organization	Employer Support & Appreciation	Workplace Fulfillment & Growth	• Being part of meaningful public health work, particularly during a crisis, and gaining learning opportunities within a DI team can provide a positive and fulfilling experience for staff, potentially offsetting the stress and emotional toll of the work environment.
Organization	Training & Professional Development	Enhanced Career Development & Effectiveness	• Broadening responsibilities, including the incorporation of treatment and prevention services for a large range of infectious diseases, for effective DI requires delivering ongoing training and professional development opportunities (at times to a workforce with limited experience).
Service Population	Community Confidence & Trust	Building a Skilled, Locally Informed & Adaptable Workforce	• Fostering strong relationships and tailored social support for varied communities requires a workforce capable of balancing complex tasks with interpersonal rapport and skills in working across communities. This requires training on complex work with oversight.
Service Population	Community Access	Increased Reach & Fair Access to Care	• Supporting community health improvement and building consistent engagement with resource-limited areas or hard-to-reach populations requires access to non-traditional points of care, including a skilled DI workforce with current and expanding clinical care responsibilities such as specimen collection, phlebotomy, and performing CLIA-waived point-of-care testing in the field.
Workforce	Career Advancement & Mobility	Enhanced Career Visibility & Professional Growth	• Formalized career pathways can reinforce unique DI skills and enhance professional credibility, especially for workers who lack traditional credentials.
Workforce	Knowledge, Skills, Abilities	Technical & Community Serving Skills	• The DI workforce is recognized for competency in technical and practical, community service skills, playing a key role in supporting community partnerships and ensuring continuity of the essential public health services, resilience, and readiness.

Table 5. Micro (relational)-level, existing benefits to certification with key rapid scoping review findings.

CDI Certification Barriers

As shown in Table 6, 40 possible barriers of certification were identified from one or more sources in each refined category. Certification barriers were distributed evenly in each refined category, with four-to-six barriers identified. “Employer support and appreciation” was the category with the highest number of identified barriers (n=7), while no barriers were identified in the category of “community access”. For possible certification outcomes (Table 7), “quality and consistency of service” (n=16) was the outcome most aligned with sources in which certification barriers were identified.

Macro-Level	Organizational	Professional Standardization	5
		Policy & Funding Support	6
	Service Population	Public Outreach & Outcomes	5
		Service Capacity & Continuity	5
Micro-Level	Organizational	Employer Support & Appreciation	7
		Training & Professional Development	3
	Service Population	Community Confidence & Trust	4
		Community Access	0
	Workforce	Career Advancement & Mobility	4
		Knowledge, Skills, Abilities	1
			40

Table 6. Number of certification barriers identified in one or more sources by level and sub-level.

KSA	1
Training	3
Service	16
Recognition	2
	22

Table 7. Number of sources with certification barriers by certification outcomes.

Tables 8 and 9 synthesize the organization, service population, and workforce-level barriers that may prevent the DI workforce from obtaining and maintaining a certification in DI. At the macro (structural)-level, organization sub-level, a gap exists in standardized, structured, and well-defined job functions with clear job protocols for the DI workforce. This may create a barrier to retention and recruitment, hence the importance of obtaining and maintaining the CDI certification. A misalignment between public health curricula competencies and the real-world job functions and expectations of the DI workforce, along with unstable and reactive funding for DI positions, may exacerbate this.

At the macro (structural)-level, service population sub-level, the growing need for a DI workforce with a broad spectrum of skills—skills needed to build relationships with increasingly diverse and expanding communities while balancing professional standards of practice with local, jurisdiction regulations and demands—may prevent DI professionals from obtaining and maintaining CDI certification since they may believe that certification alone cannot provide the skills needed. Additionally, the public health sector finds it hard to deliver a stable DI workforce career infrastructure that nurtures professional growth, for which certification may be beneficial. Instead, this infrastructure supports the reactive, short-term, emergency-driven workforce building, for which CDI certification may not provide the rapid training and skills development needed.

In regard to micro (relational)-level barriers, at the organization sub-level, DI professionals face low salaries, high workloads with limited training and support, and work environments that can negatively affect their mental health. In addition, public health agency systems have limited ability to provide formalized training and structured career paths for a workforce that needs to keep pace with new technologies and emerging threats. All this may hinder retention and recruitment, and hence the obtaining and maintaining of CDI certification

For the service population sub-level within the micro (relational)-level, barriers to CDI certification include an overloaded DI workforce that is finding it difficult to provide services to communities with geographic, linguistic, person-centered, and technological barriers to receiving care. Delays in response and gaps in the DI workforce's training and experience in serving diverse communities may generate community mistrust, leading to reduced cooperation and even harassment. At the workforce sub-level, the DI workforce tends to respond by moving to resource-rich areas or to career paths that lie outside DI that offer better career mobility, higher salaries, and more skills-building opportunities. This trend limits career consistency and therefore the likelihood of DI professionals obtaining and maintaining a CDI certification.

> *"…we just have to be persistent and prepared and empathic, empathetic… To understand the client… and [have] the interest of the community…"*—Listening session participant

For the service population sub-level within the micro (relational)-level, barriers to CDI certification include an overloaded DI workforce that is finding it difficult to provide services to communities with geographic, linguistic, person-centered, and technological barriers to receiving care. Delays in response and gaps in the DI workforce's training and experience in serving diverse communities may generate community mistrust, leading to reduced cooperation and even harassment. At the workforce sub-level, the DI workforce tends to respond by moving to resource-rich areas or to career paths that lie outside DI that offer better career mobility, higher salaries, and more skills-building opportunities. This trend limits career consistency and therefore the likelihood of DI professionals obtaining and maintaining a CDI certification.

Sub-Level	Category	Barriers	Key Finding
Organization	Professional Standardization	Workforce Attrition Challenges Educational Alignment Gaps	• Public health agencies struggle to recruit and retain DI staff, particularly in the absence of structured protocols, clearly defined job functions, and a determination of how to balance DI priorities and needs. • The lack of alignment between public health degree curricula and the competencies required for DI practice contributes to skills gaps.
Organization	Policy & Funding Support	Unstable Funding Sources	• While local entities largely fund DI activities, significant reliance on time-limited state and federal funding creates instability and affects salary growth, job security, satisfaction, morale, and retention.
Service Population	Public Outreach & Outcomes	Multi-Skilled Workforce Challenges Jurisdictional Requirements & Needs	• Challenges exist in recruiting and training a multi-perspective, multi-skilled workforce that can balance the continuing need to build critical rapport and relationships with case patients while managing a large caseload, interpreting and implementing state public health guidance, and helping build and deliver a unified message to communities. • The scope of activities of the DI workforce depends on local jurisdiction regulations, such as licensing requirements for the administration of vaccines.
Service Population	Service Capacity & Continuity	Insufficient Career Infrastructure	• Despite increasing demands for DI services, a decrease in DI positions and open vacancies points to inadequate infrastructure that relies on the rapid preparation of a workforce with limited experience in DI to fill the workforce gap during emergencies.

Table 8. Macro (structural)-level, existing barriers to certification with key rapid review findings.

Sub-Level	Category	Barriers	Key Finding
Organization	Employer Support & Appreciation	Workforce Well-being Challenges	• The DI workforce experiences low morale, burnout, and mental health issues due to factors such as public harassment, lack of support from leadership, toxic workplaces, heavy caseloads, insufficient training, and limited agency capacity to support staff. This is compounded by limited salary ranges, inadequate onboarding, and constrained HR capacity.
Organization	Training & Professional Development	Limited Training & Career Support	• The DI workforce may face challenges in adapting and responding to new technologies, data systems, software, and emerging threats. This may be exacerbated by PH agencies' limitations in developing and implementing training. Many PH agencies lack formalized training systems and structured career pathways.
Service Population	Community Confidence & Trust	Community Disconnect & Mistrust	• Differences in worldviews and communication styles between DI professionals and the populations they serve can lead to misunderstandings, mistrust, reduced cooperation, harassment, and limited disclosure of key health information.
Service Population	Community Access	Disproportionate Workload & Access to Services	• Geographic, linguistic, person-centered, and technological barriers can reduce the public's access to DI services. These gaps disproportionately affect rural, low-income, or high-need populations, leading to delayed responses and underreporting, affecting the DI workload.
Workforce	Career Advancement & Mobility	Location-Based Advancement & Retention Gaps	• Smaller and rural health agencies face significant challenges in retaining DI staff due to salary caps, limited benefits, and fewer advancement opportunities. Highly educated DI workers often leave for private sector jobs or further education. Career mobility, salary growth, and skills application are especially limited during non-emergency periods, weakening long-term retention.
Workforce	Knowledge, Skills, Abilities	Job Skills Consolidation Gaps	• The DI workforce may face a challenge in retaining and reinforcing skills. Filling this gap would entail time and resources.

Table 9. Micro (relational)-level, existing barriers to certification with key rapid review findings.

CDI Certification Solutions

Twenty-seven certification solutions were identified from one or more sources in each refined category (Table 10). The highest number of solutions was identified in the "training & professional development" category (n=10); no "community access" solutions were directly identified from the sources. Of the 23 sources with certification solutions aligned with certification outcomes, the greatest number of sources aligned with the "standardization and improvement of training" and "quality and consistency of service" outcomes (Table 11). Certification solutions were also largely focused on training, and were less focused on recruitment and retention (Table 12).

Macro-Level	Organizational	Professional Standardization	3
		Policy & Funding Support	3
	Service Population	Public Outreach & Outcomes	0
		Service Capacity & Continuity	1
Micro-Level	Organizational	Employer Support & Appreciation	4
		Training & Professional Development	10
	Service Population	Community Confidence & Trust	2
		Community Access	0
	Workforce	Career Advancement & Mobility	2
		Knowledge, Skills, Abilities	2
			27

Table 10. Number of certification solutions identified in one or more sources by level and sub-level

KSA	4
Training	7
Service	7
Recognition	5
	23

Table 11. Number of sources with certification solutions by certification outcomes.

Recruitment	7
Training	11
Retention	7
	25

Table 12. Number of sources with certification solutions aligned to recruitment, training, and retention focused solutions.

Tables 13 and 14 synthesize the evidence-based solutions for obtaining and maintaining professional certification, addressing the identified benefits of and barriers to certification. At the macro (structural)-level, organization sub-level, the CDI certification can be promoted through academic partnerships to provide DI experiences and training to the prospective and current DI workforce. This training can be based on CDI domains, standardizing competencies while turning to public-private partnerships to address logistical and policy barriers. Additionally, public-private partnerships may help provide grant and other funding opportunities for the DI workforce to support training and community projects that promote community trust and collaboration through the services offered. Academic and private partners can work strategically to promote policies for student loan repayment or debt reduction programs that provide workforce stability and also build community partnerships and trust. This can foster workforce fulfillment and increase the likelihood of obtaining and maintaining certification.

At the macro (structural)-level, service population sub-level, developing regionally adaptable training that is rapid and is aligned with the community's needs and health priorities, based on certification standards, may lead to an increase in obtaining and maintaining certification. Certification domains can also be enhanced and promoted through strategies that focus on developing standard operating procedures and training of the current and future DI workforce. These strategies, which are integrated into the certification of the DI workforce, can include a platform for communities of practice that support operations during public health emergencies, thereby maintaining the institutional knowledge that is critical to public health responses.

At the micro (relational)-level, organization sub-level, certification plays an essential role in promoting and providing tools for employer champions, who can strengthen DI workforce retention and recruitment efforts through workforce wellness initiatives such as mentoring and coaching, task diversity promotion, work-life balance initiatives, public and private recognition of DI work, and trauma-informed care. Certification training efforts can also help develop training programs that build transferable skills such as interviewing, data management, and navigating sensitive conversations. Additionally, training efforts focused on building structured and sustained recruitment programs that provide field-based training and develop skills such as informed practices, safe practices, and effective communication in challenging situations, can create pathways for obtaining and maintaining CDI certification.

At the micro (relational)-level, service population sub-level, certification efforts can help promote DI roles by explaining these roles in terms that resonate with the community. For example, framing DI roles and tasks as providing community support and empowerment—for example, using "community outreach" instead of "contact tracing" (which can suggest governmental invasion of privacy)—may increase community confidence and trust. In addition, certification training that focuses on expanding a community-aware, multi-lingual, person-centered DI workforce could increase retention and recruitment, which would also foster the growth of a DI workforce that obtains and maintains certification.

> *"So one… of the big things that we're pushing for this year, especially as DIS, is provider education so that we can… remind them… what the patient is going to go through."*
> *—Listening Session participant*

At the micro (relational)-level, workforce sub-level, certification promotion efforts should advocate for the DI workforce and implement strategies that enable public health organizations to formally recognize the unique, transferable skills of DI professionals and their distinct yet complementary medical credentials. To support this, certification training efforts must reinforce DI domains and competencies through problem-based, practice-focused approaches to improving the DI workforce's understanding and application of core DI skills such as case investigation, contact tracing, and outbreak management. Lastly, certification promotion efforts

should provide recommendations for expanding entry-level roles that have less stringent educational and experience requirements. All these workforce-focused solutions can help increase retention and recruitment, and by extension certification of the DI workforce.

Sub-Level	Category	Solutions	Key Finding
Organization	Professional Standardization	Competency Integration Through Strategic Academic Partnerships Facilitating Workforce Growth Through Public-Private Partnerships	• Partnerships between academic institutions and health departments can promote DI applied competencies through integration into academic curricula and hands-on experiences. • Public-private partnerships can support DI workforce expansion to overcome logistical and regulatory barriers to certification, training, and employment.
Organization	Policy & Funding Support	Proactive Policy & Program Promotion	•Student loan repayment policies, debt reduction programs, and flexible funding mechanisms, such as block grants, can lead to stability in the DI workforce's financial outlook and a proactive versus reactive response to disease threats, fostering community trust and collaboration.
Service Population	Public Outreach & Outcomes	Rapid Regional Adaptable Training Development	• Training programs for certification standards can be regionally tailored to support rapid onboarding and training aligned with local community needs and public health priorities.
Service Population	Service Capacity & Continuity	Building Strategies for Standard Operations & Retention	• Developing standard operating procedures, internal training, professional development opportunities, and preceptorship or practicum programs can improve coordination and increase capacity during routine operations and public health emergencies while maintaining institutional knowledge.

Table 13. Macro (structural)-level, solutions addressing certification benefits and barriers with key rapid review findings.

Sub-Level	Category	Solutions	Key Finding
Organization	Employer Support & Appreciation	Employer Championed Workforce Wellness	• Employers can strengthen DI workforce retention and service continuity through efforts such as counseling benefits, vacation days, public and private recognition of DI work, mentoring and coaching, task diversity promotion, work-life balance initiatives, trauma-informed support, and the promotion of meaningful workplace relationships.
Organization	Training & Professional Development	Building Transferable Skills Training Programs Building Structured & Sustained Recruitment Programs	• Asynchronous, skills-based training can focus on transferable competencies such as interviewing, surveillance, outbreak response, data management, and navigating sensitive conversations. • Recruitment efforts may benefit from scholarships, early student exposure to DI roles, and skills-based interviewing. Field-based training should also build essential, experience-driven skills such as informed practices, safe practices, and communication in challenging situations.
Service Population	Community Confidence & Trust	Creating Community-Focused Communication & Framing	• Using shared, community-centered language to describe DI roles as beneficial rather than terminology that reinforces ideas of government surveillance and invasion of privacy (e.g., “community outreach specialist” instead of “contact tracer”) and emphasizing empowerment and support can improve engagement.
Service Population	Community Access	Expanding A Deployable & Community-Aware Workforce	• Certification promotion efforts can expand access by training and certifying a mobile, multilingual DI workforce equipped to serve diverse communities, improving community reach, responsiveness, and trust, especially when combined with outreach that is embedded in trusted local institutions.
Workforce	Career Advancement & Mobility	Building Supportive Career Pathways and Credential Recognition	• Certification promotion efforts can implement strategies that increase formal recognition of DI professionals’ unique, transferable skills, promoting public health credentials over medical credentials, and encouraging reevaluation of stringent educational and experience requirements for entry-level roles.
Workforce	Knowledge, Skills, Abilities	Expanding Flexible Problem-Based Curriculum	• Integrating DI-specific competencies into online, virtual practice, and problem-based grand round training may improve the DI workforce's understanding of and confidence in applying their case investigation, contact tracing, and outbreak management skills.

Table 14. Micro (relational)-level, solutions addressing certification benefits and barriers with key rapid review findings.

Job Classification Scan

Summary of Job Postings

Between February 11, 2025 and June 6, 2025, a job scan of 545 websites was completed, including 450 local jurisdictions, 77 state, and 18 professional job board sites. Forty-one positions meeting the inclusion criteria were reviewed to extract information related to the job scan objectives. See Appendix 3 for methodology details. The positions originated from 19 states in eight Health and Human Service regions, representing 30 service counties, and 24 public health agencies. The greatest number of postings was identified in Texas, with 10 (24%). See Table 15 for a summary of results.

State	Service Location County	Agency Name	Number of Positions
Alabama	Montgomery County	Alabama Public Health	1
California	Marin County	Marin County Department of Health and Human Services	1
	San Mateo County	San Mateo County Health	1
Colorado	El Paso County	El Paso County Public Health	1
Connecticut	Fairfield County	Bridgeport Department of Health & Social Services	1
Florida	Duval County	Florida Department of Public Health	1
	Hillsborough County	Florida Department of Public Health	2
	Leon County	Florida Department of Public Health	1
	Orange County	Florida Department of Public Health	1
Georgia	Clarke County	Georgia Department of Public Health	2
Hawaii	Hawaii County	Hawaii Department of Health	1
Illinois	St. Clair County	St. Clair County Health Department	1
Iowa	Polk County	Polk County Health Department	1
Louisiana	Lafourche Parish	Louisiana Department of Health	1
	Rapides Parish	Louisiana Department of Health	1
Minnesota	Dakota County	Dakota County Public Health Department	2
Nebraska	Lancaster County	Nebraska Health and Human Services	1
Nevada	Clark County	Southern Nevada Health District	2
New Mexico	Bernalillo County	New Mexico Department of Health	2
Pennsylvania	Montgomery County	Montgomery County Health and Human Services-Office of Public Health	2
Rhode Island	Providence County	Rhode Island Department of Health	1
South Carolina	Florence County	South Carolina Department of Public Health	1
	Richland County	South Carolina Department of Public Health	1
	Spartanburg County	South Carolina Department of Public Health	1
Texas	Bexar County	San Antonio Metropolitan Health District	1
	El Paso County	El Paso Department of Public Health	1
		Texas Department of State Health Services	2
	Harris County	Harris County Public Health	4
	McLennan County	Waco-McLennan County Public Health	1
	Travis County	Texas Department of State Health Services	1
Wisconsin	Dane County	Public Health for Madison and Dane County	1
		Grand Total	41

Table 15. Job positions identified and included in the job scan by state, service location county, and agency name.

Thirty-seven unique job titles were identified, in five major categories: Biological Scientist, Communicable Disease Coordinator/Outreach, Disease Intervention Specialist, Epidemiologist/Epidemiology Specialist, and Public Health Nurse (Table 16). The Epidemiologist/Epidemiology Specialist group contained the most position postings (15, 37%), followed by the Disease Intervention Specialist group (12, 29%).

Position Group	Position Titles and Count	Total
Biological Scientist	Biological Scientist I (2) Biological Scientist III (1) Biological Scientist IV (1)	**4**
Communicable Disease Coordinator/Outreach	Communicable Disease Coordinator (1) Communicable Disease Specialist (1) Communicable Disease Investigator-STI/HCV/HIV Program (1) Community Outreach Specialist (1) HIV Linkage Coordinator (1) Public Health Disease Prevention and Control Program Coordinator (1) Public Health Intervention & Outreach Specialist (1)	**7**
Disease Intervention Specialist	Case Worker II/Disease Intervention Specialist (1) Disease Data Collection Specialist II (1) Disease Intervention Specialist (2) Disease Intervention Specialist 1-3 (1) Disease Intervention Specialist- Emerging and Resurgent Disease Program (1) Disease Intervention Specialist- Waterborne Disease Program (1) Disease Investigation & Intervention Specialist I (1) Disease Prevention Supervisor (1) Health Program Specialist II- Disease Intervention Specialist (1) STD/HIV Disease Intervention Specialist (1) STD/HIV Lead Disease Intervention Specialist (1)	**12**
Epidemiologist/Epidemiology Specialist	Epidemiological Specialist I - III (1) Epidemiologist II (2) Epidemiologist- Communicable Disease (1) Epidemiology Investigator (2) HAI Epidemiologist (1) Healthcare Associated Infections/Infection & Prevention Control (HAI IPC Lead) (1) Immunization Epidemiologist II (1) Lead Epidemiologist (1) Public Health Epidemiologist (1) Public Health Epidemiologist Tech 2/Public Health Epidemiologist (1) Respiratory Disease Epidemiologist (1) Surveillance Epidemiologist (2)	**15**
Public Health Nurse	Public Health Nurse - Disease Prevention and Control (1) Public Health Nurse I (1) Senior Public Health Nurse (1)	**3**
	Grand Total	**41**

Table 16. Job posting titles identified by job group.

Agency Name	State	HHS Region	Level	Accredidation Status	Staff Size	Approximate Service Population Size	NACCHO LHD Size
Alabama Public Health	AL	4	State	Yes	2,700	5,000,000	Large
Bridgeport Department of Health & Social Services	CT	1	City	Yes	100	148,000	Medium
Dakota County Public Health Department	MN	5	County	Yes	10	443,000	Medium
El Paso County Public Health	CO	8	County	Yes	201	740,000	Large
El Paso Department of Public Health	TX	6	City	No	280	827,000	Large
Florida Department of Public Health	FL	4	State	Yes	10,001	22,200,000	Large
Georgia Department of Public Health	GA	4	State	Yes	7,286	10,900,000	Large
Harris County Public Health	TX	6	County	Yes	807	4,700,000	Large
Hawaii Department of Health	HI	9	State	No	2,800	1,400,000	Large
Louisiana Department of Health	LA	6	State	Yes	6,500	4,600,000	Large
Marin County Department of Health and Human Services	CA	9	County	No	650	260,000	Medium
Montgomery County Health and Human Services- Office of Public Health	MD	3	County	No	500	1,100,000	Large
Nebraska Health and Human Services	NE	7	State	Yes	4,807	1,960,000	Large
New Mexico Department of Health	NM	6	State	Yes	3,000	2,100,000	Large
Polk County Health Department	IA	7	County	No	45	75,000	Small
Public Health for Madison and Dane County	WI	5	County	No	225	550,000	Large
Rhode Island Department of Health	RI	1	State	Yes	539	1,100,000	Large
San Antonio Metropolitan Health District	TX	6	District	Yes	643	1,540,000	Large
San Mateo County Health	CA	9	County	No	5,800	760,000	Large
South Carolina Department of Public Health	SC	4	State	Yes	2,900	5,200,000	Large
Southern Nevada Health District	NV	9	District	Yes	866	2,300,000	Large
St. Clair County Health Department	IL	5	County	Yes	70	250,000	Medium
Texas Department of State Health Services	TX	6	State	No	3,844	30,000,000	Large
Waco-McLennan County Public Health	TX	6	District	No	100	260,000	Medium

Table 17. Characteristics of the public health agencies representing the position postings included. The National Association of County and City Health Officials (NACCHO) categorization for health department size was utilized.

Position postings were identified from 24 public health agencies. Many were large (75%), PHAB-accredited (63%), state-level agencies (42%). Several agencies were county-level (38%) and city or district health-level (21%) public health agencies. Half of these agencies were PHAB-accredited, with 43% classified as medium-sized health departments. Utilizing the National Association of County and City Health Officials (NACCHO) classification of health department size,[12] only one agency, the Polk County Health Department, was classified as small. Public health agencies were primarily located in the South Central (29%), Southeastern (16%), and Southwestern (16%) regions of the US. See Table 17 below for details. These findings highlight that large and mid-sized, PHAB-accredited, state, county, city, and district-level agencies located in the South may be able to sustain or build their DI workforce despite shifts in public health funding priorities.

Service Population Characteristics

The Diversity Index and the Social Vulnerability Index (SVI) of the position posting service county were collected. See Appendix 3 for details regarding the Diversity Index and SVI. For state-level positions, the county location of the state health department was used as the basis for determining the Diversity Index and SVI. The majority of posting positions would be providing services at the county level (26, 63%) in counties with a medium-high to high index percentage (27, 66%), with a diversity index position ranging from 0.30 to 0.78. Figure 1 displays the average county-level diversity index based on each position by state. Similarly, approximately three out of four posting positions (31, 76%) would be providing services in counties with medium-high to high SIV, ranging from 0.15 to 0.98. Figure 2 displays the average county-level SVI based on each position by state. These findings suggest that the need for a DI workforce is high in diverse, resource-limited geographic areas that are most likely to be affected during public health emergencies.

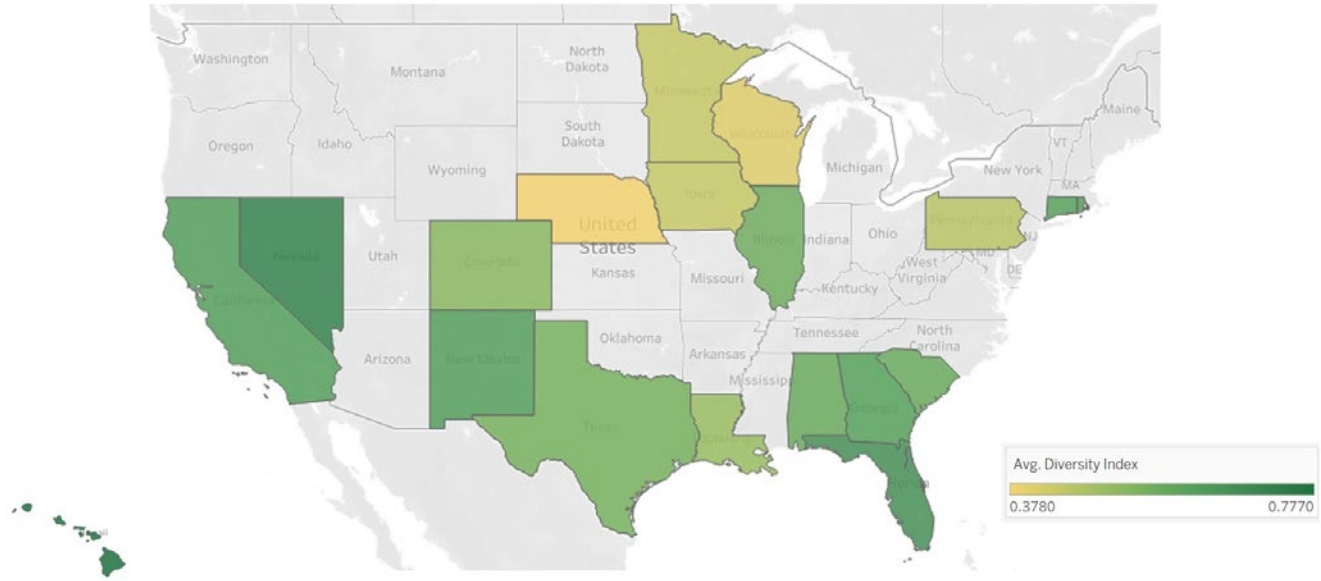

Figure 16. Average diversity index by state.

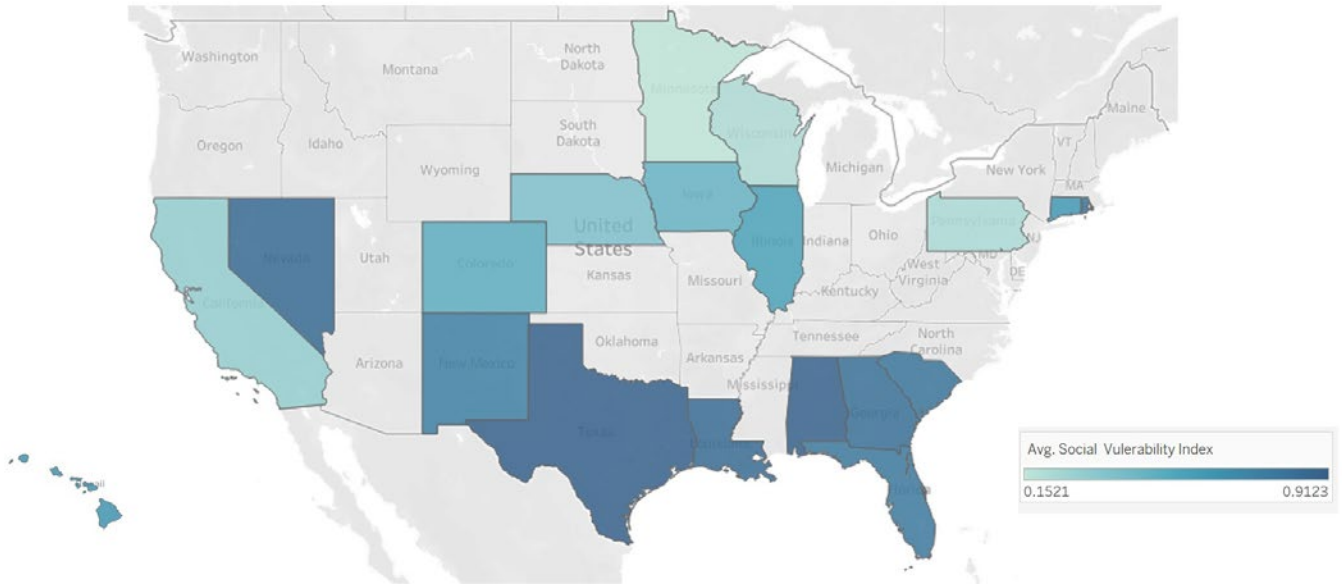

Figure 17. Average social vulnerability index by state.

Position Posting Characteristics

Focus Area, Position Level, and Hours

The position postings represented seven focus areas, with the greatest number of positions in the Adult Health Services/STI area (19, 46%). The greatest number of focus areas for position postings was in the Epidemiologist/Epidemiology Specialist group, with six focus areas represented (Table 18).

The majority of position postings were entry-level (15, 37%) and mid-level (18, 44%) positions, with the greatest number of position postings in mid-level, non-supervisory positions in Disease Intervention Specialist and Epidemiologist/Epidemiology Specialist groups (Table 19).

Position Focus Area	Epidemiologist/ Epidemiology Specialist	Disease Intervention Specialist	Communicable Disease Coordinator/Outreach	Biological Scientist	Public Health Nurse	Total
Adult Health Services/STIs	2	8	6	2	1	**19**
TB Prevention/Control	1	0	0	1	2	**4**
Emerging Infections	2	1	0	0	0	**3**
Healthcare-Associated Infections	2	0	0	0	0	**2**
Vaccine-Preventable Diseases	1	0	1	0	0	**2**
Waterborne Diseases	0	1	0	0	0	**1**
Respiratory/Invasive Illnesses	1	0	0	0	0	**1**
Focus Area Not Specified	6	2	0	1	0	**9**
	15	**12**	**7**	**4**	**3**	**41**

Table 18. Position focus area by position groups. Highlighting indicates higher values.

Position Group	Entry-Level	Mid-Level	Mid-Level Supervisor	Senior-Level	Senior-Level Supervisor	Total
Epidemiologist/Epidemiology Specialist	3	7	2	3	0	**15**
Disease Intervention Specialist	3	7	2	0	0	**12**
Communicable Disease Coordinator/Outreach	4	3	0	0	0	**7**
Biological Scientist	3	1	0	0	0	**4**
Public Health Nurse	2	0	0	0	1	**3**
	15	**18**	**4**	**3**	**1**	**41**

Table 19. Position group by position level. Highlighting indicates higher values.

Most position postings specified work hours (65%), with roughly one in three (34%) requiring weekend and holiday availability, and 43% requiring on-call availability.

These findings highlight the diversity of specialties within the epidemiologists/epidemiology specialist position group, as well as the ongoing need for this position group and the DIS position group, as identified in position postings. The ability to provide services outside of traditional work hours was an expectation in most positions.

Education, Experience, Licensing, and Certification

The top three education fields most specified in position postings were general public health, epidemiology, and nursing; this did not vary greatly by position group (Table 20). The minimum number of years of experience required ranged from zero to four, with an average of 1.27 years of experience required. The maximum number of years of experience required ranged from zero-to-10 years, with an average of 2.17 years of experience. This aligns with the fact that most positions are entry- or mid-level positions. The minimum years of required experience did not vary by position posting group or focus area. The most frequent licensing requirement was a driver's license; two positions required a nursing license in the Epidemiologist/Epidemiologist and Biological Scientist position groups. One position in the Disease Intervention Specialist position group required laboratory certification, and one position focusing on healthcare-associated infections listed a preference for certification in infection control. These certification findings highlight the

Education Field	Position Group					Total**
	Biological Scientist	Communicable Disease Coordinator/Outreach	Disease Intervention Specialist	Epidemiologist/ Epidemiology Specialist	Public Health Nurse	
General Public Health	1	4	7	9	1	22
Epidemiology		2	3	11	1	17
Nursing		2	1	3	3	9
General Science	2	2	2	2		8
Statistics/Biostatistics				7		7
Health Education		1	3			4
Psychology/Behavioral Health		1	1	2		4
Biology		1	2	1		4
General Medical			2			2
Microbiology			1	1		2
Administration or Management			1			1
Emergency Preparedness		1				1

Table 20. Education field by position group. Highlighting indicates higher values. ** Totals represent the number of position postings listing the educational field. Totals are not mutually exclusive; one posting may have listed one or more educational field.

Salary and Benefits

Average salaries for position postings varied by geographic location, ranging from $48,546.08 (HHS Region 4) to $84,810.62 (HHS Region 9) (Table 21). Salaries also varied by position groups (Table 22). The Biological Scientist position group had the lowest average annual salaries, ranging from $37,837.80 to $51,500.04. The highest average annual salaries were in the Public Health Nurse group, ranging from $74,907.96 to $137,924.76. Disease Intervention Specialist and Communicable Disease Coordinator/Outreach groups had the largest ranges of average annual salaries.

Most position postings listed provided medical, dental, and vision benefits (Table 23). Training opportunities, teleworking, and maternal/paternal leave were the least listed benefits.

The geographic salary ranges are in alignment with previously released job scans. However, those behind certification efforts may want to provide employers with training that promotes certification as a benefit of employment.

HHS Region	Average Annual Salary
9	$84,810.62
5	$84,133.71
1	$78,011.76
8	$74,000.04
7	$71,408.34
3	$61,983.96
6	$51,138.97
4	$48,546.08

Table 21. Position postings average annual salary by HHS region.

Position Group	Total Number of Positions	Minimum Average Annual Salary	Maximum Average Annual Salary
Epidemiologist/Epidemiology Specialist	9	$56,519.04	$84,125.04
Disease Intervention Specialist	11	$43,665.00	$108,309.48
Communicable Disease Coordinator/Outreach	7	$38,800.08	$101,184.00
Biological Scientist	4	$37,837.80	$51,500.04
Public Health Nurse	3	$74,907.96	$137,924.76

Table 22. Position postings average annual salary by position group.

Benefits	Total**
Dental	38
Medical	38
Vision	38
Leave-Holiday	37
Leave-Personal	37
Retirement-Pension	37
Leave-Medical	35
Life Insurance	32
Retirement- Private	24
Tuition Reimbursement	22
Employee Discounts	14
Flexible Schedule	11
Training Opportunities	9
Telework/Remote Work	7
Maternal/Paternal Leave	6

Table 23. Position postings benefits. ** Totals represent the number of position postings listing the benefit. Totals are not mutually exclusive; one posting may have listed one or more benefit.

Knowledge, Skills, and Abilities

Knowledge

Knowledge of disease characteristics, transmission, and treatment was listed most frequently, accounting for 58% of position posting descriptions (Table 24). Knowledge of ethical and professional conduct (49%) and counseling techniques (46%) was also frequently listed. Many position postings listed knowledge of the organization and function of government and public health (46%) and public health laws and regulations (44%). Knowledge of cultural competency was listed in only two position postings.

When categorized by position group, the Disease Intervention Specialist group listed the most knowledge items in position postings, followed by the Epidemiologist/Epidemiology Specialist group (Table 25).

Knowledge	Total**
Disease characteristics, transmission, treatment	24
Ethical & professional conduct	20
Counseling techniques	19
Organization/function of government & public health	19
Public health laws & regulations	18
Privacy practices & reporting procedures	17
Clinic/lab policies & procedures	13
Lab: tests, locations, protocols	12
Healthcare policies & procedures	10
Community resources & stakeholders	7
Universal safety precautions & protocols	6
Cultural competency	2

Table 24. Position posting knowledge. ** Totals represent the number of position postings listing the specific knowledge. Totals are not mutually exclusive; one posting may have listed one or more knowledge.

Knowledge	Position Group				
	Biological Scientist	Communicable Disease Coordinator/Outreach	Disease Intervention Specialist	Epidemiologist/ Epidemiology Specialist	Public Health Nurse
Disease characteristics, transmission, treatment	2	3	9	8	2
Ethical & professional conduct	1	3	7	7	2
Counseling techniques	3	2	11	1	2
Organization/function of government & public health	2	2	6	7	2
Public health laws & regulations	2	1	8	5	2
Privacy practices & reporting procedures	1	3	8	4	1
Clinic/lab policies & procedures	2		5	3	3
Lab: tests, locations, protocols	1	2	5	3	1
Healthcare policies & procedures		1	6	1	2
Community resources & stakeholders		1	2	3	1
Universal safety precautions & protocols			3	1	2
Cultural competency		1	1		

Table 25. Position posting knowledge by position group. ** Totals represent the number of position postings listing the specific knowledge. Totals are not mutually exclusive; one posting may have listed one or more knowledge.

Skills

Communication (78%), and collaboration and teamwork (76%) were the skills most frequently listed in position postings, along with case investigation and contact tracing (73%) (Table 26). Technology use (63%) and data software and management (61%) were more frequently listed than specimen collection, handling, and processing (24%). Critical thinking and problem-solving were the skills listed least frequently in position postings (22%).

Again, position postings in the Disease Intervention Specialist group listed the most skills, but the Epidemiologist/Epidemiology specialist position postings more frequently included skills in their descriptions (Table 27).

Skills	Total**
Communication	32
Collaboration and teamwork	31
Case investigation and contact tracing	30
Technology use	26
Data software and management	25
Specimen collection/handling/processing	10
Critical thinking and problem solving	9

Table 26. Position posting skills. ** Totals represent the number of position postings listing the specific skill. Totals are not mutually exclusive; one posting may have listed one or more skills.

Skills	Position Group				
	Biological Scientist	Communicable Disease Coordinator/Outreach	Disease Intervention Specialist	Epidemiologist/ Epidemiology Specialist	Public Health Nurse
Communication	4	4	11	10	3
Collaboration and teamwork	2	5	7	14	3
Case investigation and contact tracing	3	5	9	11	2
Technology use	2	3	7	13	1
Data software and management	2	4	5	13	1
Specimen collection/handling/processing	2	2	4	2	
Critical thinking and problem solving	1	1	5	1	1

Table 27. Position posting skills by position group. ** Totals represent the number of position postings listing the specific skill. Totals are not mutually exclusive; one posting may have listed one or more skills.

Abilities

The ability to prepare and maintain confidential records and reports was listed in 68% of position postings, and the ability to conduct interviews of a highly personal nature was listed in 56% of position postings (Table 28). The ability to adapt to unfamiliar or changing environments and work with diverse populations was listed in 37% of position postings. The ability to solve problems in the field or in-house (20%) and to assess non-verbal communication (5%) were the least listed in position postings.

Again, position postings in the Disease Intervention Specialist position group more frequently listed abilities in their position postings (Table 29).

Abilities	Total**
Prepare and maintain confidential records/reports	28
Conduct interviews of highly personal nature	23
Adapt to unfamiliar/changing environments	15
Work with diverse populations	15
Problem solve in the field and in-house settings	8
Assess non-verbal communication	2

Table 28. Position posting abilities. **Totals represent the number of position postings that list the specific abilities. Totals are not mutually exclusive; one posting may have listed one or more abilities.

Abilities	Position Group				
	Biological Scientist	Communicable Disease Coordinator/Outreach	Disease Intervention Specialist	Epidemiologist/ Epidemiology Specialist	Public Health Nurse
Prepare and maintain confidential records/reports	2	4	10	10	2
Conduct interviews of highly personal nature	3	4	10	5	1
Adapt to unfamiliar/changing environments		4	5	5	1
Work with diverse populations	1	5	5	2	2
Problem solve in the field and in-house settings			6	1	1
Assess non-verbal communication			1	1	

CDI Domains

The CDI domains encompassed in the position postings by frequency are listed in Table 30. Collaboration (85%), Interviewing & Case Management Activities (78%), and Surveillance & Data Collection (71%) were the domains captured by the position posting descriptions. The domains of Planning & Case Analysis and Field Service & Outreach Activities (58%) were also described in several position postings. The domain of Outbreak Response & Emergency Preparedness was the least frequently described in position postings (41%).

As with knowledge, skills, and abilities, the Disease Intervention Specialist position group posting descriptions included all CDI domains with the highest frequency (Table 31).

CDI Domains	Total**
Collaboration	35
Interviewing & Case Management Activities	32
Surveillance & Data Collection	29
Planning & Case Analysis	25
Field Services & Outreach Activities	24
Outbreak Response & Emergency Preparedness	17

Table 30. CDI domains described in position postings. ** Totals represent the number of position postings describing the CDI domain. Totals are not mutually exclusive; one posting may have described one or more CDI domain.

CDI Domains	Position Group				
	Biological Scientist	Communicable Disease Coordinator/Outreach	Disease Intervention Specialist	Epidemiologist/ Epidemiology Specialist	Public Health Nurse
Collaboration	4	6	11	12	2
Interviewing & Case Management Activities	3	5	12	10	2
Surveillance & Data Collection	3	3	9	12	2
Planning & Case Analysis	3	5	8	7	2
Field Services & Outreach Activities	3	6	11	3	1
Outbreak Response & Emergency Preparedness	1	1	8	5	2

Table 31. CDI domains described in position postings by position group. ** Totals represent the number of position postings describing the CDI domain. Totals are not mutually exclusive; one posting may have described one or more CDI

Listening Sessions

Summary of Listening Sessions

Seven listening sessions were held between May 14 and July 8, 2025, involving individuals from local, state, regional, and federal public health agencies. Across all listening sessions, a total of 90 people registered, and 62 attended, resulting in an overall attendance rate of 70%.

All listening sessions featured individuals from a broad range of career stages. Among the 62 attendees (Table 32), the majority were currently working in the DI workforce, had worked in local public health agencies, and were mid-level DI professionals with three-to-seven years of experience in DI. The participation of individuals with diverse professional backgrounds and varying levels of expertise enabled a range of perspectives on the benefits of and barriers to implementing this certification, as well as solutions to those barriers.

DI Workforce Status	**n**	**%**
Former	8	12.9
Current	54	87.1
Level of Public Health Organization	**n**	**%**
Local	47	75.8
State	14	22.6
Regional	6	9.7
Federal	1	1.6
Level of DI Experience	**n**	**%**
Entry-Level (0-2 yrs.)	14	22.6
Mid-Level (3-7 yrs.)	31	50
Senior-Level (• •8 yrs).	17	27.4

Table 32. Composition of listening session attendees. For the level of public health organization, respondents were able to select all that apply for the question “At which level did/do you work in public health disease intervention?”.

Qualitative Data: Themes

The qualitative data were organized around the seven prompts most frequently used in the listening sessions: introductions, benefits, barriers, solutions, likelihood of certification, motivations, and curiosities/considerations. Axial Code 1 was the listening session’s prompts. For each prompt, open codes were refined into Axial Code 2, which were further refined into the themes reported below.

Professional Backgrounds (n=81)

Participants came from a variety of professional backgrounds (Table 33). The largest professional groups represented in the listening sessions were DIS (n=23), epidemiology (n=17), and public health (n=17). Other individuals worked in infectious epidemiology (n=9), with HIV/STDs (n=5), and as senior-level employees (n=4). The smallest reported professions were nursing (n=3) and first-line supervisors (n=3).

Introductions	Count (n)
DIS	23
Epidemiology	17
Public health	17
Infectious epidemiology	9
HIV/STD	5
Senior-level employees	4
Nursing	3
First-line supervisors	3

Table 33. Summary of professional backgrounds provided by listening session participants.

Benefits (n=144)

Across all listening sessions, participants reported 14 different benefits to certification (Table 34). The most common benefits were standardization of knowledge (n=24), professional recognition (n=21), career advancement (n=17), and competitive differentiation (n=17). Other benefits mentioned include public trust/awareness (n=14), patient-centered care (n=10), disease investigation preparedness (n=8), increased knowledge (n=6), and increased skills (n=6). Additional benefits mentioned included professional growth (n=5), increased personal confidence (n=4), skills transferability (n=4), increased salary (n=4), and interprofessional networking (n=4).

Benefits	Count (n)	**Example Quotes**
Standardization of knowledge	24	"I think the only benefit is causing the work to be standardized across a big area."
Professional recognition	21	"Getting certified allows you to be recognized for a specific skill or education."
Career advancement	17	"It has an opportunity to ensure career advancement."
Competitive differentiator	17	"I think this can add something and set you apart."
Public trust/awareness	14	"I would say it increases trust in traffic as well."
Patient-centered care	10	"…very important this program because it's gonna help us also to understand a little bit more about the population that doesn't [have insurance] ... and they're located in underserved areas."
Disease investigation preparedness	8	"...ensuring that our workforce remains equipped with the latest knowledge and skills in disease surveillance, prevention, and response."
Increased knowledge	6	"...we can be more prepared for what could come again in the future and have a better baseline of knowledge of being able to start up something quickly and be successful with our communication"
Increased skills	6	"This can help you probably continue to just strengthen your skill set and... professional development."
Professional growth	5	"I think .... networking is always like a plus... to meet other people from different areas that are doing the same thing. Again, it could be...career advancement in a sense, [and]... new opportunities"
Increased personal confidence	4	"It makes you feel more like a person of authority to speak on that topic. And whenever you're engaging with clients or patients, they can see you as a person that knows what they're talking about"
Skills transferability	4	"You've got the certification, so you can now get... a position... more easily in another area."
Increased salary	4	"I can think of financial benefits… having the certification could add extra pay"
Interprofessional networking	4	"I'm thinking maybe it could be an opportunity for networking... with others... doing similar work."

Table 34. Summary of themes and associated quotes related to certification benefits.

Barriers (n=113)

The most frequently mentioned barriers to certification were balancing commitments (n=22), cost burden (n=18), course infrastructure (n=14), and the challenging nature of DI work (n=13) (Table 35). Other barriers include Continuing Education Unit (CEU) availability (n=8), competitive job market (n=7), employee readiness (n=7), and testing barriers (n=7). Other cited barriers included time (n=5), exam resources (n=4), employee retention (n=3), limited training opportunities (n=3), and lack of public trust (n=2).

Barriers	Count (n)	**Example Quotes**
Balancing commitments	22	“My concern, our department, we're on clinic duty and clinic duty is every day. And so how can you take a course then when you're called to go interview someone who's positive and the interview may take an hour or so.”
Cost burden	18	“I think for me the only thing would be potential financial burden.”
Course infrastructure	14	“Is it going to be... [asynchronous] where you can do your courses whenever you have time?
Challenging nature of DI work	13	“We have to do a lot of mental gymnastics to try and figure out exactly what it is that people's concerns are and how to address them”
CEU availability	8	“I don’t know what the continuing education component looks like… for the certifications I have, there's a variety of continuing education stuff, but it's not always necessarily very specific to a skill.”
Competitive job market	7	"It’s really scary right now... your experience actually doesn’t matter because there's people that are more qualified and have a lot more experience that are trying to find jobs right now.”
Employee readiness	7	“I've had a mixed response with some of the people I work with about the importance of getting certified and I guess it might be [viewed as] a waste of time.”
Testing barriers	7	Standardized testing in general... some people still get PTSD from high school. Would this be a one and done? And you feel bad because the organization paid for it.”
Time	5	“The time commitment required to complete the certificate could be a challenge for professionals already balancing demanding workloads.
Exam resources	4	“Just finding the right tools to be able to study for an exam like this... just the resources so that it can be pretty streamlined”
Employee retention (if CDI certification was to be mandated)	3	“Potential loss of employees. People just deciding not to do it and leaving.”
Limited training opportunities	3	“A large part of our initial starting barrier was training and scaling up training.”
Lack of public trust	2	“Someone that doesn't know you or is not expecting a call from you... they'd be like, who is this on the phone? Why are you asking me to verify my date of birth? We need to break that barrier.”

Table 35. Summary of themes and associated quotes related to certification barriers.

Solutions (n=38)

The most reported solution to the barriers to certification was communication transparency (n=12), which included suggestions related to clear communication of certification testing content, requirements, and expectations (Table 36). Other solutions mentioned by participants included organizational support and collaboration (n=10), discounted educational materials (n=7), and flexible course infrastructure (n=6). A final solution suggested was promoting employer demand for CDI certification (n=3) by, for example, including CDI certification in hiring requirements or preferred backgrounds.

Solutions	Count (n)	Example Quotes
Communication transparency	12	“Having a pre-packaged description of what it is and what people obtain once they do the training... so then we don't have to do the sales pitch ourselves.”
Organizational support and collaboration	10	“Exploring partnerships with local health departments or community organizations could expand accessibility and potentially offer localized support.”
Discounted educational materials	7	“I guess... free [or] discount training materials would be great also.”
Flexible course infrastructure	6	“It could also be a self-paced scenario where... you will cover these modules by the end of the week.”
CDI employer preference	3	“I was thinking maybe if employers listed it as... not necessarily required.”

Table 36. Summary of themes and associated quotes related to certification solutions.

Certification Likelihood (n=37)

Listening session participants reviewed the CDI testing domains and discussed the likelihood of obtaining the CDI certification once it became available (Table 37). Participants’ confidence in the likelihood of obtaining certification varied. A moderate likelihood was the most frequently reported confidence level (n=16), followed by high confidence (n=13), and low confidence (n=8).

Certification Likelihood	Count (n)	Percentage
High confidence	13	35%
Moderate confidence	16	43%
Low confidence	8	22%

Table 37. Confidence level of listening session participants in obtaining the CDI. N=37

Motivations (n=12)

Motivations for taking the CDI exam were discussed, and the results fell into two primary categories: career advancement (n=8) and increased salary (n=4) (Table 38).

Motivations	Count (n)	Example Quotes
Career advancement	8	“I think it’s more letters behind my name... It looks good.”
Increased salary	4	“If you got a certificate that was outside of your scope... there was a pay incentive.”

Table 38. Summary of themes and associated quotes related to certification motivators.

Curiosities and Considerations (n=38)

In numerous listening sessions, the facilitator’s question prompts would be met with clarifying questions from the participants. We classified these as curiosities and considerations, as they demonstrated participants’ efforts to clarify the purpose and proposed structure of the planned CDI certification (Table 39). The subject that gave rise to the most questions was test preparation (n=25). Other questions from participants were focused on DIS role differences (n=7), professional client interaction (n=4), and the idea of being grandfathered in (n=2).

Curiosities and Considerations	Count (n)	Example Quotes
Test preparation	25	"I believe that three hours a week is reasonable. Maybe not all in one day. Maybe it can be broken down into an hour a day."
DIS role differences	7	"The work is slightly different... of course specific to the disease or diseases that they're working on"
Professional client interaction	4	As DIS, I feel like sometimes we do a better job at explaining the diseases than the clinicians do. Because we're able to communicate on that level."
Grandfathering in	2	"My thought was grandfathering in those who are DIS or have previous DIS experience."

Table 39. Summary of themes and associated quotes for other considerations and curiosities.

Community Advisory Board (CAB)

Meeting #1: Introduction and Model Development

This meeting served as the initial session for the CAB. It focused on introducing members to the project goals and preliminary findings from the scoping review, job scan analysis, and listening sessions. Members then worked collaboratively develop the constructs for a model that would communicate the factors that might affect the building and maintaining of the CDI workforce. The session was attended by nine of the 12 CAB members (75%).

Initial model constructs (concepts such as "professional identity" and "policy support" that CAB members described as "building blocks" that could help visualize the model) were captured during a whiteboard brainstorming session (Appendix 6). After the meeting, the facilitators organized these building blocks into five categories (Table 40) and asked CAB members to rate them in order of priority, providing additional feedback (Table 41). Post-meeting feedback was provided by eight CAB members (67%). Overall, "professional identity, support, and mentorship" was the construct that the highest number of members ranked as "critical" (n=5), followed by "policy support" (n=4), and "CDI infrastructure" (n=3).

Building Block (BB)	Description
BB1: Academic Networks	Collaborating with academic institutions, including high schools, community colleges, and universities, to support and promote CDI certification to targeted audiences
BB2: Preparation and Training	Using tools from external entities (e.g., certification boards such as NBPHE and universities) and internal entities (e.g., workplaces) to support preparation and training for the exam and recertification
BB3: Professional Identity, Support, and Mentorship	Acknowledgement and valuation of the CDI-certified profession, including levels of expertise; exposure, support, mentorship, and reinforcement from the existing CDI-certified workforce and professional organizations; and establishment of CDI-specific professional communities
BB4: CDI Infrastructure Support	Infrastructure support from governing bodies and employers, including position descriptions with CDI preferences and requirements, safe work conditions, burnout prevention measures, and opportunities for professional advancement
BB5: Policy and Funding Support	Policies (e.g., programs to reach rural communities, expectations for CDI certification to support all geographic regions); State policies requiring baseline criteria and workforce staffing requirements/needs for performing DI roles in varied geographic regions; Funding mechanisms to support certification and continuing education (e.g., grant funding)

Table 40. Initial model constructs (building blocks) developed from CAB Meeting #1.

BB1: Academic Networks		%
Critical	1	13%
High	4	50%
Medium	2	25%
Low	1	13%
TOTAL	**8**	

BB2: Preparation and Training		%
Critical	2	25%
High	1	13%
Medium	5	63%
Low	0	0%
TOTAL	**8**	

BB3: Professional Identity, Support, and Mentorship		%
Critical	5	63%
High	1	13%
Medium	1	13%
Low	1	13%
TOTAL	**8**	

BB4: CDI Infrastucture Support		%
Critical	3	38%
High	3	38%
Medium	2	25%
Low	0	0%
TOTAL	**8**	

BB5: Policy and Funding Support		%
Critical	4	50%
High	3	38%
Medium	1	13%
Low	0	0%
TOTAL	**8**	

Table 41. Model constructs (building blocks) priority rankings from CAB members.

Meeting #2: Model Refinement and Framework Development

The second CAB meeting focused on refining the DI workforce model and co-developing a framework of actionable strategies to support recruitment, training, and retention. Seven out of 12 CAB members attended the session (58%). Before the meeting, facilitators incorporated feedback from the Meeting #1 Feedback Form into a model, which was presented during CAB Meeting #2. During the session and when soliciting feedback on the model and the framework, CAB members were informed that:

1. The purpose of the model is to highlight the broad, primary constructs (building blocks) that can support efforts to identify the benefits of and barriers to a CDI-certified workforce as well as solutions to the barriers.

2. The purpose of the framework is to communicate focus areas in recruitment, training, and retention to put the enhanced DI capacity and response model into action.

The revised DI Workforce Model presented during Meeting #2 integrated both micro- and macro-level components:

- **Micro (Relational) Level**:
  - Employer recognition
  - Career mobility and skills development
  - Trust-building with communities

- **Macro (Structural) Level**:
  - Policy and funding infrastructure
  - Public outreach and service standardization
  - System-wide professional recognition

The framework expanded on recruitment, training, and retention, which were components influenced by the macro (structural) and micro (relational) levels above:

Core Strategy Area	Focus
Recruitment	Pipeline development and targeted outreach
Training	Certification, preparation, and continuing education support
Retention	Mentoring, career growth, and an organizational culture that promotes leadership and engagement

Together, these components formed a comprehensive vision of what is needed to build, strengthen, and maintain the DI workforce while supporting broader public health outcomes. The framework called for strong partnerships with academic institutions to integrate DI practices into curricula and offer internships, fellowships, and continuing education opportunities. Additionally, it advocated for support for current workforce engagement through funding, mentorship, and integration of ongoing learning and leadership development into daily practice.

As in the first meeting session, framework elements were captured during a collaborative whiteboard brainstorming session (Appendix 6). Post-meeting feedback was provided by nine CAB members (75%). Following the meeting, facilitators organized CAB-generated strategies into a three-by-three matrix for continued refinement. The matrix placed Recruitment, Training, and Retention as columns, and used the following row themes:

- Building a Professional Pathway
- Partnering with Academic Institutions
- Current Workforce Engagement and Outreach

The model and framework presented to CAB members in Feedback Form #2 are shown in Appendix 6.

Meeting #3: Model and Framework Refinement and Promotion

The third CAB meeting focused on validating the final versions of the model and framework. This session aimed to confirm that the visual and conceptual design of the model and framework aligned with the feedback provided in earlier CAB sessions and reflected the real-world needs of the DI workforce. Before the third CAB meeting, member feedback was incorporated into the model and framework diagrams. Changes included sentence revisions to promote clarity of ideas—switching the labels “Macro (structural)-Level” and “Micro (relational)-Level” to “structural factors” and “relational factors”—and clarification of how standardization was defined in the two sets of factors. Additionally, facilitators further refined the model and framework using input from two project consultants. These project consultants provided guidance on visual clarity, professional relevance, and alignment with best practices in workforce development. See Appendix 6 for the final model and framework presented to CAB members.

Four CAB members participated in this meeting in person, and one participated asynchronously for a total of five CAB member participants (42%). Overall, feedback from members confirmed that the model and framework had incorporated input from previous CAB meetings and the feedback provided. CAB members suggested the name “The Disease Intervention Workforce Capacity Building and Sustainment Model” for the model and framework. The updated model and framework outline the factors influencing the development of a CDI-certified workforce. The model identifies motivators (e.g., standard practices, professional recognition, and job market advantages) and barriers (e.g., lack of funding, public misunderstanding, and employee readiness) under structural and relational categories. To address these barriers, solutions focused on fostering professional communities, implementing policy and training standards, and offering accessible, location-sensitive training and mentorship. The framework serves to outline solutions related to recruitment, training, and retention, addressing the barriers and motivators outlined in the model. Both the model and framework highlight the impact and outcomes on the CDI-certified workforce and the populations they serve.

Disease Intervention Workforce Capacity Building and Sustainment Model and Framework

The Disease Intervention Workforce Capacity Building and Sustainment Model and Framework are illustrated below (Figures 18 and 19). As the model and framework are intended for use by those in the DI workforce, a final feedback form was sent to CAB members and participants in the listening session (n=58). Overall, 27 participants provided feedback (47%). Participants were asked to provide their general impressions of the model and framework and to rate their level of agreement with statements related to the model and framework's appearance and their usefulness in practice. See Table 42 for feedback results. Overall, the majority of respondents agreed that the model (n=20, 74%) and framework (n=19, 70%) were visually appealing and easy to understand. More than 90% of respondents agreed that the model and framework (n=25, 93%) would be useful in practice and served its intended purpose. One respondent stated of the model, "I like that the model is clear and shows the full picture from motivators to barriers, solutions, and outcomes. It is helpful that it considers both structural and relational factors and connects them to workforce capacity and community trust." Another respondent stated of the framework, "The framework offers a detailed overview of the barriers and solutions that can impact the development and maintenance of a DI workforce across various disciplines. It helps to confirm the value of the CDI while also providing organizations with an effective guide on how to get started." Participant feedback on possible improvements to the model and framework included comments that the model and framework were "too busy" or "cluttered" and could benefit from the addition of clearly defined stakeholders and a feedback loop. To link the model and framework components clearly, improvements in graphics and colors were recommended.

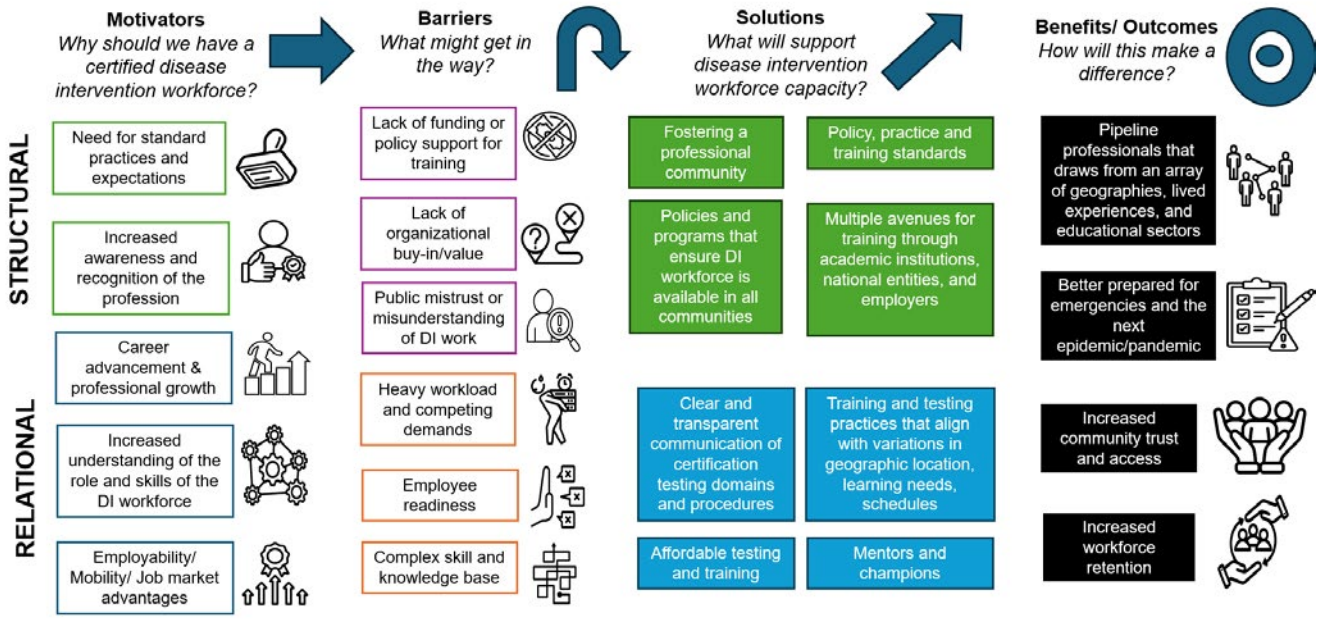

Figure 18. Final Disease Intervention Workforce Capacity Building and Sustainment Model

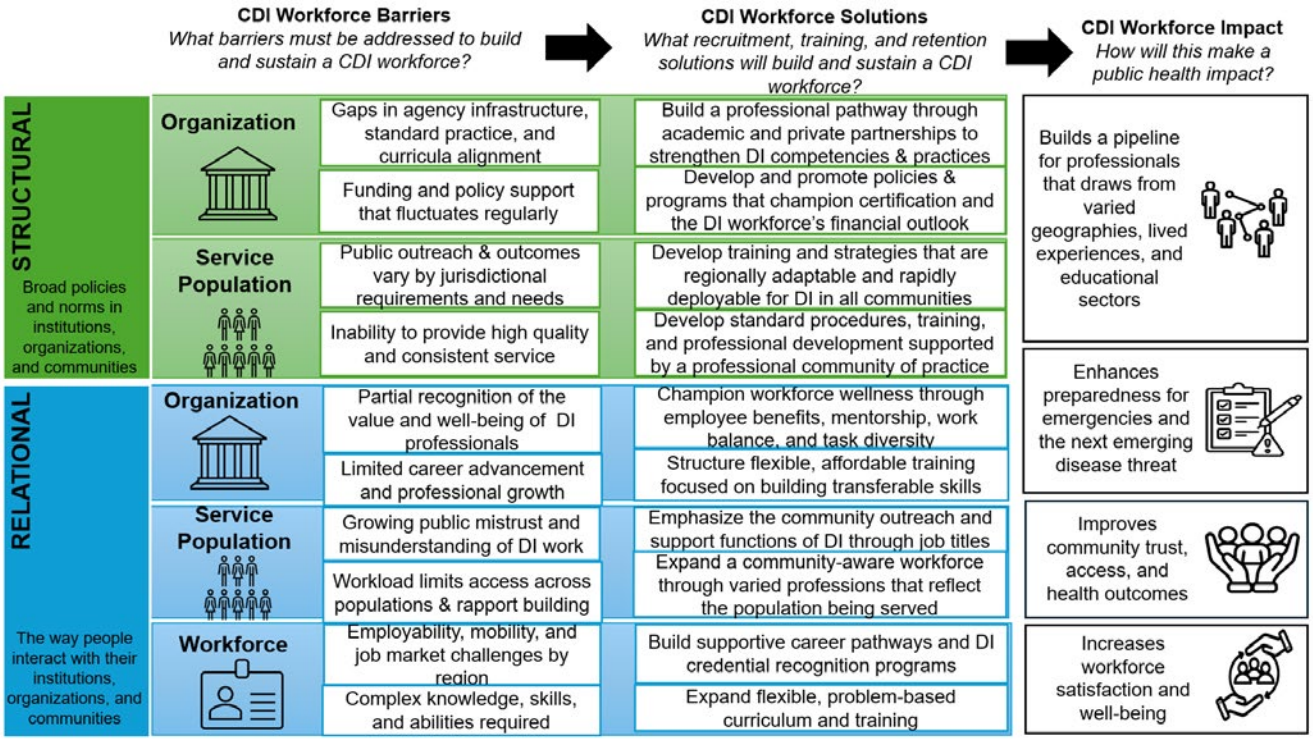

Figure 19. Final Disease Intervention Workforce Capacity Building and Sustainment Framework

Please state your level of agreement with the following statement: "The **model** is visually appealing and easy to understand."		%
Agree	20	74%
Neither agree nor disagree	2	7%
Disagree	5	19%
TOTAL	**27**	

Please state your level of agreement with the following statement:"The **model** will be useful in practice. It highlights broad factors that can serve as barriers, benefits, and solutions to build and sustain the CDI workforce."		%
Agree	25	93%
Neither agree nor disagree	2	7%
Disagree	0	0%
TOTAL	27	

Please state your level of agreement with the following statement: "The **framework** is visually appealing and easy to understand."		%
Agree	19	70%
Neither agree nor disagree	3	11%
Disagree	5	19%
TOTAL	**27**	

Please state your level of agreement with the following statement:"The **framework** will be useful in practice. The framework communicates major focus areas important for recruiting, training, and retaining the CDI workforce."		%
Agree	25	93%
Neither agree nor disagree	1	4%
Disagree	1	4%
TOTAL	**27**	

Table 42. Final model and framework feedback. "Agree" includes respondents who completely and somewhat agreed with the statements. "Disagree" includes respondents who completely and somewhat disagreed with the statements.

Challenges

Challenges were encountered during the execution of this project. First, a significant change in political administration had an impact on the availability and allocation of funds for CDI-certified positions. For the job scan, this led to difficulty in finding positions that matched the focus of the project. As a result, the number of relevant job postings was limited. Additionally, position titles not typically associated with the DI workforce, such as Biological Scientist, may have been used to overcome funding challenges, reflecting situational rather than CDI-specific titles. It was also noted that after-hours and weekend work would likely expand due to the staffing and funding cuts, and this might not be reflected in position postings.

To overcome this challenge, job searches were conducted over a more extended period and included a variety of organizational types. Secondly, regarding the scoping review, a considerable amount of the literature reviewed was from the COVID-19 period. Many of the findings from the rapid scoping review were influenced by circumstances specific to the COVID-19 pandemic and may not accurately reflect current global conditions. This challenge was overcome by holding listening sessions and soliciting CAB feedback from participants who have experience of the DI workforce during current times. During the listening sessions, it emerged that several participants were unaware of the certification. Since CDI program updates were continually being released throughout the duration of the project, some of the participants comments were based on outdated information so concerned issues that had in fact already been addressed . This was overcome by presenting participants with the most up-to-date CDI program information during each listening session.

Next Steps

The Disease Intervention Workforce Capacity Building and Sustainment Model and Framework will continue to evolve. Infographics and simplified versions of the model and framework will be developed to address the feedback provided. Additionally, the first version of the framework (Appendix 6) included several action items for DI certification. These, along with guidance on how the DI workforce can use these items to promote sustained gains in the overall growth of the current and future DI workforce, will be incorporated into the suggested promotional materials and policy recommendations.

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APPENDIX 1

Preliminary Macro (structural)- and Micro (relational)-Level Categories and Associated Benefits and Barriers to CDI Certification

Boudon's Theory of Social Change and James Coleman's Diagram emphasize the bidirectional relationship between larger social and organizational environments—macro (structural)-level—and individual and interpersonal relationships—micro (relational)-level—in influencing macro (structural)- and micro (relational)-level outcomes.[13] These theories informed the macro (structural)- and micro (relational)-level organizational, service, and workforce benefits and the barriers to CDI certification. For this project, macro (structural)-level elements include broader policies and norms in communities, organizations, and institutions. In contrast, micro (relational)-level elements consist of personal factors and interpersonal relationships among individuals and their respective communities, organizations, and institutions.

Using this framework, a review of notes from four professionally facilitated regional meetings (Fort Worth, TX; Chapel Hill, NC; Gainesville, FL; and New York City, NY conducted by ASPPH between July 2023 and May 2024) was completed by Dr. Diana Cervantes with the assistance of generative artificial intelligence (ChatGPT). During these sessions, benefits and barriers were identified by representatives with expertise in DI from state and local health departments, academic institutions, and other agencies. Dr. Cervantes then identified key categories based on these benefits and barriers; this was reviewed by other project personnel and adjusted to meet consensus (see table below). The categories and their associated benefits and barriers guided the identification of possible benefits and barriers for the scoping review; however, there were no specific exclusions to these terms.

Level	Sub-Level	Factors	Benefits	Barriers
Macro-Level	Organizational	Professional recognition and standardization	Improved professional reputation, job legitimacy, and standardized practices	Resistance from organizations to adopting certification due to costs and resource allocation
		Policy and funding support	Increased funding opportunities and role clarity	Limited funding, especially for smaller jurisdictions or non-profits
	Service Population	Public trust and access to health services	Enhanced trust in DIS roles through transparency and improved access to health services	Challenges in engaging specific communities with new interventions
		Disease control outcomes	Measurable reductions in disease prevalence and healthcare costs	Limited community awareness of the value of certified professionals
		National consistency	Uniformity in training, job descriptions, and expectations nationwide	Variability in state and local requirements may undermine standardization efforts
Micro-Level	Organizational	Employer buy-in	Recognition of certification value increases morale and staff retention	Employers may undervalue certification without direct financial incentives
		Training and professional development	Improved training quality and opportunities for advancement	Time and workload required for preparation and recertification
	Workforce	Career advancement and mobility	Expanded career pathways, pay increases, and recognition	High cost of certification and potential inequities in access
		Knowledge, skills, and confidence	Enhanced capabilities in outbreak management and client engagement	Stress and burnout from balancing certification demands with job roles
	Service Population	Community engagement and trust	Increased public understanding of disease prevention measures	Lack of resources to foster community relationships
		Increased access to interventions	More person-centered and regionally relevant health interventions	Barriers in reaching and engaging remote or other specific communities

APPENDIX 2

Rapid Scoping Review Methodology

Participants

The inclusion and exclusion criteria were established to ensure that the outcome, CDI certification, was limited to the target population as defined by the NBPHE and ASPPH, the organizations responsible for developing the CDI program.

The population targeted for the review included the public health workforce focused on preventing the spread of infectious diseases at the community level through activities defined by ASPPH as: "…person-centered interviews, collection of enhanced surveillance and community assessment data, partner services to include contact tracing, field investigation, directly observed therapy, field specimen collection, field investigation in outbreaks and emergency preparedness, community outreach, collaboration with medical providers, and navigation of healthcare systems to ensure evaluation and treatment of people diagnosed with or potentially exposed to infectious disease."

The workforce excluded from the review included any non-public health workforce whose professional tasks were limited to prevention and control activities in non-community settings, such as healthcare facilities (e.g., infection preventionist). Any part of the workforce that did not focus on public or community health but instead focused on direct patient care (e.g., community health nurse, nurse practitioner, physician) or veterinary care was excluded.

Any part of the public health workforce focused on conditions, diseases, and injuries unrelated to infectious disease prevention and control, such as those addressing chronic or non-communicable diseases, was also excluded.

Workforces focusing on environmental health (e.g., sanitarians, vector control) and laboratory science (e.g., micro (relational) biologists, laboratory technicians) were excluded. Workforces focusing on data analysis, such as surveillance analysts and informaticians, were also excluded. Specific certifications exist for these professions. A workforce focused on senior administrative, or management was excluded.

Event: Benefits, Barriers, and Solutions

Categories identified during ASPPH listening sessions (Appendix 1) were used to determine general areas impacting the uptake and maintenance of CDI certification. These categories, along with their associated factors, guided the identification of possible benefits of and barriers to CDI uptake and maintenance. Specific exclusions to these terms were not applicable. Solutions that could reinforce the benefits of and address possible barriers to the DI workforce obtaining and maintaining CDI certification—such as recruitment, training, and retention—were included; solutions unrelated to these were excluded.

Outcome

Professional certification in disease intervention (CDI certification) is currently under development. Therefore, the benefits, barriers, and solutions were considered in the context of the purpose and goals of certification as defined by the PHAB. These include:

- Standardization and validation of knowledge, skills, and abilities (KSAs)
- Standardization and improvement of training (training)
- Increased quality and consistency of service delivery (service)
- Increased recognition of professional skills and abilities (recognition)

Outcomes not related to these items were excluded.

Context

According to the NBPHE, because the CDI certification validates the knowledge, skills, and abilities of professionals nationally (in the US), searches were limited to sources within the US. To inform the CDI program's assessment and development, this exclusion criteria aligns with previous surveys and scans.

Types of Sources

This rapid scoping review considered sources that met the inclusion and exclusion criteria, including published, peer-reviewed experimental and observational quantitative, qualitative, and mixed-methods studies and grey literature. As white literature on the topic may be limited, surveys, public opinion articles, media articles, targeted websites, technical reports, practice guidelines, policy papers and reviews, dissertations, and conference abstracts were also considered for inclusion as they have been identified as potentially beneficial when conducting reviews of public health topics.

Published reviews (narrative, systematic, and scoping) were reviewed to identify additional sources that met the inclusion criteria.

Methods

The rapid review was conducted following the *a priori* protocol detailed here, utilizing the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR).[14] Following the interim guidance for rapid reviews,[15] deviations or omissions from the PRISMA-ScR protocol were reported and justified in the results.

Search Strategy

A preliminary search of Google, PubMed, and Scopus was conducted to identify and validate keywords for searches related to the population, event, and outcome of interest. Additionally, search terms from a recent literature review related to the public health workforce were used to identify preliminary terms.[16] Subsequently, terms in the titles, abstracts, and keywords of relevant articles were used to inform a comprehensive search strategy for PubMed, MEDLINE Complete, Scopus, CINAHL, Web of Science, and PsycINFO databases. Searches were limited to studies conducted in the US and published in English between 2014 and 2025. These search constraints were implemented so as to better reflect the target population of the CDI program and to enhance the relevance of the search results. The search strategy, including all identified keywords and index terms, was adapted as needed for each included database and/or information source:

- "public health workforce" AND ("disease investigation" OR "contact tracing" OR "outbreak response" OR "case management" OR "community outreach" OR "emergency response" OR "COVID-19") AND (barrier OR benefit OR need OR challenge OR opportunities OR development OR advancement OR mobility OR training OR retention OR recruit OR recruitment OR resources OR roles OR responsibilities OR funding OR support OR satisfaction OR "public trust" OR "community engagement" OR "health equity") AND (competency OR competencies OR knowledge OR skills OR abilities OR quality OR consistency OR capacity OR recognition OR validation OR standardization)

- "disease intervention specialist" AND (barrier OR benefit OR need OR challenge OR opportunities OR development OR advancement OR mobility OR training OR retention OR recruit OR recruitment OR resources OR roles OR responsibilities OR funding OR support OR satisfaction OR "public trust" OR "community engagement" OR "health equity") AND (competency OR competencies OR knowledge OR skills OR abilities OR quality OR consistency OR capacity OR recognition OR validation OR standardization)

References from reviews and highly relevant sources were searched for additional information. The first 100 results of a Google Scholar custom search were also examined for the exact phrase "public health workforce," which needed to include the term "infectious disease." A second search was conducted for the exact phrase "disease intervention specialist," which needed to include the term "public health workforce." All dates were between 2014 and 2025.

Based upon preliminary online searches on the topic, the following websites were reviewed for sources using site-specific searches for "workforce":

- Council of State and Territorial Epidemiologists (CSTE)
- Association of State and Territorial Health Officials (ASTHO)
- National Association of County and City Health Officials (NACCHO)
- National Coalition of STD Directors (NCSD)
- Public Health Accreditation Board (PHAB)

Lastly, articles related to reports identified in a recent literature review on the public health workforce were included,[16] as well as articles provided by subject matter experts. When articles could not be located, the report itself was included. The reports were the following:

- The Public Health Workforce Interests and Needs Survey administered by the de Beaumont Foundation, 2021
- The Profile Survey administered by the National Association of County and City Health Officials, 2022
- The Profile Survey administered by the Association of State and Territorial Health Officials, 2022
- The Epidemiology Capacity Assessment administered by the Council of State and Territorial Epidemiologists, 2024
- The Public Health Indian Country Capacity Scan administered by the National Indian Health Board, 2024

Source of Evidence Selection

Upon completing the searches described, all identified citations were uploaded into EndNote version 21 and imported into Covidence, a web-based platform that supports systematic literature reviews and meta-analyses. Covidence automatically de-duplicated references upon import. A screening tool was created in Covidence to review titles and abstracts detailing this protocol's eligibility and inclusion criteria. To ensure consistency and accuracy, two reviewers pilot tested 20% of the sources by independently screening titles and abstracts for inclusion or exclusion. Any disagreements were resolved through discussion until a consensus was reached or, if needed, through the decision of a third reviewer.

As with the screening of titles and abstracts, a tool for full-text review of sources was pilot tested by having two independent reviewers review the full text for 20% of the sources to ensure consistency and accuracy. Two reviewers independently conducted full-text reviews of the sources included in the preliminary title and abstract screening using the same inclusion and exclusion criteria. Any disagreements were resolved through discussion until a consensus was reached or through the decision of a third reviewer, as needed.
An initial review of the literature identified 597 sources. After removing duplicates, reviewing titles and abstracts, and conducting a full-text review to exclude sources not meeting the predefined inclusion criteria, 35 sources met the requirements, and information was extracted from these sources to answer the questions. See figure 2.1 below for details on the screening and inclusion process.

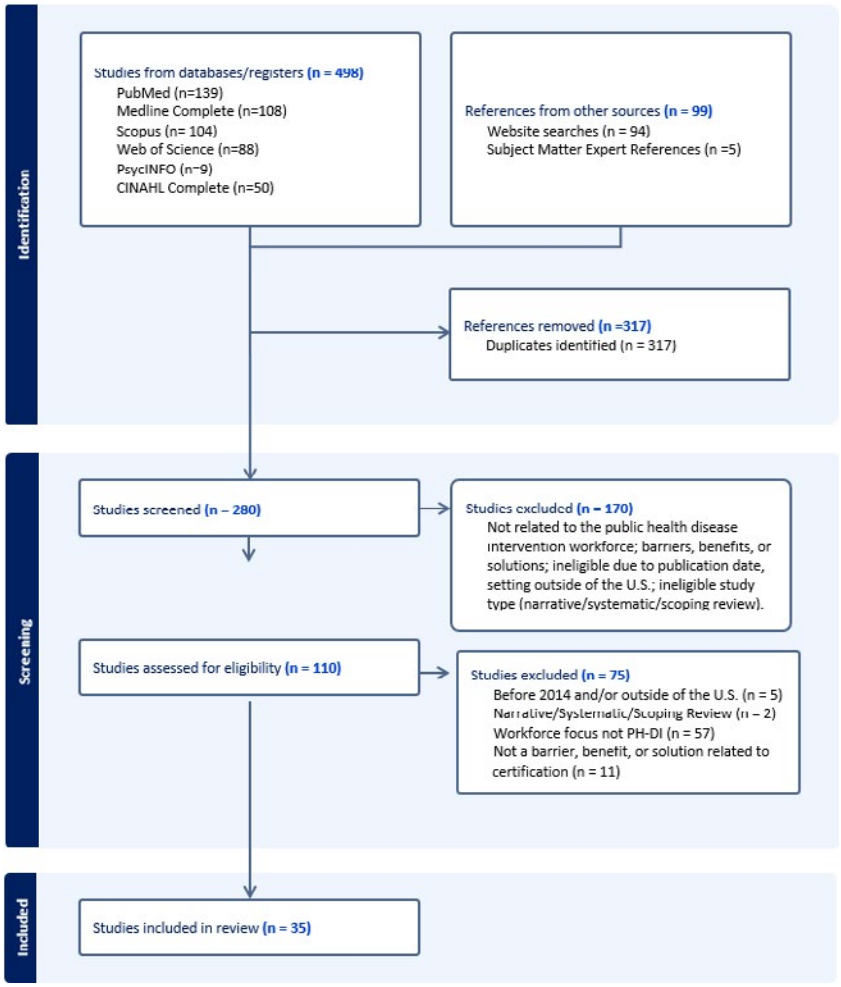


Figure 2.1. Flow diagram of study identification, screening, and selection.

Data Extraction, Analysis, and Synthesis

Data was extracted from sources meeting the inclusion and exclusion criteria (those that had been identified through a full-text review) by one reviewer using a data extraction tool developed by the reviewers. A second reviewer independently verified the data extracted. The data extraction included: study ID, source title, authors (first three), year of publication, source type, DI workforce focus of the source, goal or purpose of the source, as well as design, data source, and population setting. A formal, standardized critical appraisal and risk of bias assessment was not performed, as this is not required for a scoping review.

Additionally, inductive content analysis was conducted concurrently with data extraction. Inductive content analysis is a systematic approach to deriving coding categories from identified patterns and relationships within text and quantifying their frequency, allowing for exploration of an unknown phenomenon.[17] The process involved reviewing the source text, selecting text (unit of analysis) that reflected the benefits, barriers, and solutions within pre-defined categories (Appendix 1), assigning an event type (benefit, barrier, or solution) and certification outcome (KSA, training, service, or recognition as previously described) to the unit of analysis, and quantifying the events and outcomes. An overview of the sources and extraction by categories and certification outcomes can be seen in Table 2.2. Categories were refined and defined throughout this process, with the final categories as shown in Tables 2.3 and 2.4. The quantification of events and outcomes is shown in Tables 2, 3, 6, 7, 10, and 12 within the main report.

Key findings were then summarized within each refined category (Tables 2.5a-j). Lastly, a synthesis of results, which were further reviewed with the assistance of generative AI (ChatGPT), was completed to summarize findings as shown in Tables 2.6a-d. Additional synthesis resulted in the final certification benefits, barriers, and solutions at the macro (structural)- and micro (relational)-levels shown in Tables 4, 5, 8, 9, 13, and 14 within the main body of the report. Dr. Cervantes carried out the inductive content analysis process; a second reviewer, Darashagam Nahal, reviewed and adjusted categories and assignments until consensus was met. Project personnel also reviewed and approved the refined categories. As described by Levac and colleagues,[18] the findings will be reviewed in consultation with stakeholders, who will use their content expertise and perspectives to validate or further refine the categories.

Authors/ Publication Year	Source Type	DI Population	Purpose	Design, Data Source & Population	Certification Benefit(s) & Associated Level/Sub-Level[++]	Certification Barrier(s) & Associated Level/ Sub-Level[++]	Certification Solution(s) & Associated Level/Sub-Level[++]
Arrazola J, Israel M, and Binkin, N (2019)[19]	Peer-reviewed Journal	Applied epidemiology workforce, including infectious disease epidemiologists	Describe funding sources, staffing and capacity, recruitment, retention, and challenges in the current public health environment.	Cross-sectional survey Epidemiology Capacity Assessment (CSTE), 2017; 50 state epidemiologists in 50 states and the District of Columbia (100% participation)	**Service Benefit:** 55% of the state health department epidemiologists worked in infectious diseases. (***service quality & consistency- M***) **Recognition Benefit:** Most state health departments require a bachelor's degree (59%) or master's degree (33%) for an entry-level position. ***(professional recognition & standardization- M)*** **Recognition Benefit:** 84% of states reported substantial to full capacity in Essential Public Health Services 1 (EPHS 1), monitoring health status, and 92% in EPHS 2, diagnosis and investigating health problems. ***(knowledge, skills, and abilities- m***)	**Service Barrier:** Approximately 77% of epidemiology activities were funded by federal sources, which harmed perceived job security, job satisfaction, staff morale, and staff retention. (***policy & funding support- M***) **Service Barrier:** "The most frequently reported major and moderate problems for staff retention were opportunities for promotion (88%), salary (80%), restrictions on merit raises (70%), and loss to the private or government sector (65%). Respondents reported that epidemiologists with an MPH [Master of Public Health] degree tended to leave the workforce to start PhD programs, and staff with MPH and PhD degrees were inclined to leave public health for the private sector." (***career advancement & mobility- m***)	**Service Solution (retention focus):** Mentoring and coaching (80%), promoting task diversity (78%), publicly recognizing employee achievements (75%), and providing professional development and training (75%) were the most frequently reported methods of retaining employees and maintaining continuity. (***training & professional development- m; employer recognition & value- m***) **Service Solution (retention focus):** To cope with staff turnover, almost all states (92%) reported standard operating procedures to maintain institutional knowledge; 78% used internal training (78%) and professional development (75%); 53% reported participating in preceptorship or practicum programs. (***service quality & consistency- M***)

Arrazola J, Israel M, and Binkin, N (2019)[19]	Peer-reviewed Journal	Applied epidemiology workforce, including infectious disease epidemiologists	Describe funding sources, staffing and capacity, recruitment, retention, and challenges in the current public health environment.	Cross-sectional survey Epidemiology Capacity Assessment (CSTE), 2017; 50 state epidemiologists in 50 states and the District of Columbia (100% participation)	**Service Benefit:** 55% of the state health department epidemiologists worked in infectious diseases. (***service quality & consistency- M***) **Recognition Benefit:** Most state health departments require a bachelor's degree (59%) or master's degree (33%) for an entry-level position. ***(professional recognition & standardization- M)*** **Recognition Benefit:** 84% of states reported substantial to full capacity in Essential Public Health Services 1 (EPHS 1), monitoring health status, and 92% in EPHS 2, diagnosis and investigating health problems. ***(knowledge, skills, and abilities- m***)	**Service Barrier:** Approximately 77% of epidemiology activities were funded by federal sources, which harmed perceived job security, job satisfaction, staff morale, and staff retention. (***policy & funding support- M***) **Service Barrier:** "The most frequently reported major and moderate problems for staff retention were opportunities for promotion (88%), salary (80%), restrictions on merit raises (70%), and loss to the private or government sector (65%). Respondents reported that epidemiologists with an MPH [Master of Public Health] degree tended to leave the workforce to start PhD programs, and staff with MPH and PhD degrees were inclined to leave public health for the private sector." (***career advancement & mobility- m***)	**Service Solution (retention focus):** Mentoring and coaching (80%), promoting task diversity (78%), publicly recognizing employee achievements (75%), and providing professional development and training (75%) were the most frequently reported methods of retaining employees and maintaining continuity. (***training & professional development- m; employer recognition & value- m***) **Service Solution (retention focus):** To cope with staff turnover, almost all states (92%) reported standard operating procedures to maintain institutional knowledge; 78% used internal training (78%) and professional development (75%); 53% reported participating in preceptorship or practicum programs. (***service quality & consistency- M***)

McGinty MD, Binkin N, Arrazola J, et al. (2019)[20]	Peer-reviewed Journal	Applied epidemiology workforce including infectious disease epidemiologists	Describe the applied epidemiology workforce, including their skills, capacity, and funding sources for their positions and activities.	Cross-sectional survey modified Epidemiology Capacity Assessment (CSTE) survey for Big City Health Coalition (BCHC) member health departments, 2017; 27 (90%) of BCHC member health departments, representing 20% of the total US population	**Service Benefit:** All Big City Health Coalition (BCHC) respondents (100%) reported that they provided programs and services for infectious disease. (***service quality & consistency- M).*** **Recognition Benefit:** 85% of respondents reported having lead epidemiologist in their infectious disease programs. ***(professional recognition & standardization- M***) **Recognition Benefit:** Most BCHC departments required a graduate degree for an entry-level epidemiologist positions required) master's degree or higher for most BCHC departments, 60%); Fewer required a BS or less :33% required a bachelor's degree, 7% required an associate's degree or less. (***professional recognition & standardization- M)*** **Recognition Benefit:** 100% of BCHC respondents reported adequate capacity to conduct four core essential services (EPHS 1 through 4) in their infectious disease program areas. ***(knowledge, skills, and abilities- m)***	**Service Barrier:** Almost half (47%) of funding for epidemiology activities and personnel was received by local sources, while 27% and 24% originated from federal and state sources. (***policy & funding support-M***) **Service Barrier:** The largest number of vacant epidemiology positions was in infectious disease programs (19/83= 23%). (***service quality & consistency-M***) **Service Barrier:** Three critical issues reported include: 1) lack of predictable and sustained funding (***policy & funding support- M***), 2) epidemiologist recruitment and retention (***professional recognition & standardization-M***) and 3) ability of the epidemiology workforce to adapt and respond to new technologies and emerging public health threats. ***(training & professional development- m***)	NA

Auer S, Arrazola J, Masters A., et al. (2023)[21]	Peer-reviewed Journal	Applied epidemiology workforce including infectious disease epidemiologists	Highlight CSTE workforce program priorities based on the 2021 EAC results and recommendations for strengthening the applied epidemiology workforce.	Cross-sectional survey Epidemiology Capacity Assessment (CSTE), 2021; 50 state epidemiologists in 50 states and the District of Columbia (100% participation)	NA	NA	**Recognition Solution (Training & Recruitment Focus):** "Enhance professional visibility by updating applied epidemiology competencies, partnering with academia to embed practical skills in curricula, and leveraging the Academic Health Department model." ***(professional recognition & standardization – M)*** **Service Solution (Recruitment Focus):** "Attract new professionals through scholarships, mentoring, enhanced student exposure, and skills-based interview scenarios." ***(training & professional development – m)*** **Service & Recognition Solution (Retention Focus):** "Support retention through peer communities, regional mentorships, resilience-building activities, succession planning tools, and surge staffing support". ***(career advancement & mobility, m)*** **Training Solution (Training Focus):** "Strengthen workforce capacity with post-grad training, onboarding, continuing education, skill-specific sessions, and on-the-job training. Promote system-level support through advocacy for policies like loan forgiveness, better pay, and sustained funding." ***(training & professional development-m)***

Arrazola, J and Auer, S (2022)[22]	Professional organization report	Applied epidemiology workforce including infectious disease epidemiologists	Describe the status and trends in state health departments' applied epidemiology workforce size, funding, and epidemiology capacity.	Cross-sectional survey Epidemiology Capacity Assessment (CSTE), 2021; 50 state epidemiologists in 50 states and the District of Columbia (100% participation)	**Service Benefit:** Infectious disease accounted for 36% of epidemiology positions; COVID-19 response (24%)- these were the two program areas with the highest number of epidemiologists. ***(service quality & consistency-M)***. **Recognition Benefit**: 75% of jurisdictions reported substantial to full capacity in Essential Public Health Services 1 (EPHS 1), monitoring health status, and 88% in EPHS 2, diagnosis and investigating health problems; substantial to full capacity was highest for infectious diseases (88%). **(knowledge, *skills, and abilities- m*)**	**Service Barrier:** 85% of epidemiology activities were primarily supported by federal funds, 39% were designated for COVID-19 activities with time-limited funding. (***policy & funding support-M***) **Service Barrier:** Between 2017 and 2021, infectious disease positions decreased by 19%; state epidemiologists expressed the need for additional epidemiologists, with the largest number of positions needed in infectious disease. (***service quality & consistency-M***)	NA
Council of State and Territorial Epidemiologists (2024)[11]	Professional organization report	Applied epidemiology workforce including infectious disease epidemiologists	"Enumerate and describe the applied epidemiology workforce; describe the training needs of the applied epidemiology workforce; describe the funding that supports the applied epidemiology workforce; describe the level of epidemiology capacity in state and DC health departments, and assess the impact of the COVID-19 pandemic on epidemiologic capacity and staffing."	Cross-sectional survey modified Epidemiology Capacity Assessment (CSTE) survey, 2024. A 100% response rate was obtained from states, DC, eight US territories, and freely associated states; the survey was sent and completed by state/territorial epidemiologists.	**Service Benefit:** The largest program area is infectious disease, with 2,541 epidemiologists of 5,706 (44.5%). ***(service quality & consistency- M)*** **Recognition Benefit:** "In 2024, the percentage of states and DC with substantial to full capacity for Essential Public Health Services 1 (EPHS 1) increased to 84% from 76% in 2021. The percentage of states and DS with substantial to full capacity in EPHS 2, diagnosis and investigating health problems, was 90%. This is an increase from 88% in 2021." ***(knowledge, skills, and abilities- m)***	**Service Barrier:** The most needed positions were in infectious disease areas combined (1,019 positions). ***(service quality & consistency- M).*** **Service Barrier:** **"**As in 2021, 83% of federal funds constituted funding for all epidemiologic activities; when salaries are adjusted for inflation, there was a decrease in all position salaries except mid-level epidemiologists, which experienced a less than 2% increase since 2021." (***policy & funding support- M)***;	**Service Solution (Recruitment & Retention Focus)**: "Of 50 states and DC, the most cited assets for recruiting and retaining epidemiologists were job interest and fulfillment (38), the opportunity to work remotely (26), and job benefits (20). Of 50 states and DC, allowing telework (30), flexible work schedules (30), and promoting meaningful relationships at work (26) was cited as a major strategy for minimizing burnout." (***employer recognition & value- m)*** **Service Solution (Recruitment & Retention Focus):** For recruiting and retaining epidemiologists, recommendations include collaborative partnerships with academic institutions, including the 2023 applied epidemiology competencies to undergraduate and graduate curricula, timely processing, competitive compensation, education on civil service testing, supporting public loan services forgiveness efforts, and investing in training programs. ***(employer recognition & value- m)***

Auer S, Simmons A, Arrazola, J et al. (2024)[11]	Professional organization report	Applied epidemiology workforce including infectious disease epidemiologists	"Enumerate and describe the applied epidemiology workforce; describe the training needs of the applied epidemiology workforce; describe the funding that supports the applied epidemiology workforce; describe the level of epidemiology capacity in Big Cities Health Coalition health departments, and assess the impact of the COVID-19 pandemic on epidemiologic capacity and staffing."	Cross-sectional survey modified Epidemiology Capacity Assessment (CSTE) survey for (BCHC) member health departments, 2024; 35 (100%) of BCHC member health departments, representing 1/5th of the total US population, or more than 61 million.	**Service Benefit:** Almost all 35 health departments reported programs in infectious disease (94%), HIV (91%); 49% of the workforce is concentrated in infectious diseases. (***service quality & consistency- M)*** **Recognition Benefit:** General infectious disease (80%) and COVID-19 (74%) were the programs most likely to have a formal lead epidemiologist. (***professional recognition & standardization- M***) **Recognition Benefit:** 94% of BCHC departments reported full capacity in Essential Public Health Services 1 (EPHS 1), monitoring health status, and 89% in EPHS 2, diagnosis, and investigating health problems. (***knowledge, skills, and abilities- m***)	**Service Barrier:** "For epidemiology personnel, 40% of funding comes from local sources, 39% from federal sources, and 17% from state sources; in state health departments, more than 80% of funds are provided by the federal government. 4% of funding for epidemiologic activities and personnel came from non-governmental funding sources such as private organizations, non-profit grants, donations, or corporate sponsorships. (***policy & funding support-M***) **Service Barrier:** "The greatest number of vacancies, 201, are within the program areas of sexually transmitted disease (25) and HIV (21)." (***service quality & consistency-M***) Critical issues reported include: **Service Barrier:** Three critical challenges reported included 1) challenges for securing sustainable funding for epidemiologists (***policy & funding support-M***), 2) recruiting a diverse workforce (***public outreach & outcomes- M***), and 3) ensuring that staff are adequately trained for new data systems and software. (***training and professional development- m***)	NA

Bork RH, Robins M, Scaffer K, et al. (2022)[23]	Governmental public health surveillance and communication bulletin	Governmental PH agency workers-working fully or partially in a COVID-19 response role	Provide insight into demographic characteristics and experiences during the COVID-19 pandemic, including COVID-19 response needs.	Cross-sectional survey Public Health Workforce Interest and Needs Survey (PH WINS), 2021. 41,890 staff members from 47 state health agency central offices, 190 local health departments servicing populations >250,000, and 249 medium local health departments serving populations of 25,000-250,000	NA	**Service Barrier:** 44% of respondents considered leaving their organization to retire or for other reasons; 76% began thinking about leaving the organization since the start of the COVID-19 pandemic. (***career advancement & mobility-m***) **Service Barrier:** The top three needs reported to respond to the COVID-19 pandemic effectively include 1) staffing capacity (51% (***professional recognition & standardization-M***), 2) more community support (30%) (***community confidence & trust- m***), and 3) more support from elected leaders (26%) (***employer recognition & value-m***)	NA

McCullough JM and Robins M (2023)[24]	Peer-reviewed Journal	Governmental PH agency workers- working fully or partially in a COVID-19 response role	Describe the COVID-19 workforce including demographics, characteristics, hiring patterns, and utilization rates.	Cross-sectional survey Public Health Workforce Interest and Needs Survey (PH WINS), 2021; 41,890 staff members from 47 state health agency central offices, 288 local health departments servicing populations >250,000, and 249 medium local health departments serving populations of 25,000-250,000	**Recognition Benefit:** 91% of the COVID-19 response workforce reported their primary program area as communicable disease. From Q1 2020 to Q4 2021, this workforce devoted the most considerable effort (65% to 80% full-time employees) to the COVID-19 response. ***(professional recognition & standardization, M)***	NA	NA
Madsen ER, Schaffer K, Bork RH, et al. (2024)[25]	Peer-reviewed Journal	Governmental PH agency workers- working fully or partially in a COVID-19 response role	Identify themes related to thoughts and experiences in serving during the COVID-19 pandemic related to on-the-job learning.	Mixed Methods (survey & qualitative response) Public Health Workforce Interest and Needs Survey (PH WINS), 2021; 41,890 staff members from 47 state health agency central offices, 190 local health departments and 249 medium local health departments serving populations of 25,000-250,000. 91 qualitative responses coded as positive disposition for "on-the-job-learning"	**KSA Benefit:** Technical/ practical skills theme: " Working on COVID-19 teams has been exceptional in broadening my understanding of communicable disease services and the meticulous dedication to detail by those who work in this field". (***knowledge, skills, abilities- m)*** **Service Benefit:** Collaboration theme: "I enjoyed being part of contact tracing to work with other members of public health, the opportunity to learn something new, to be part of something critically important, and build teamwork within our department, but it was very stressful at the same time." ***(employer recognition & value- m)***	**Service Barrier:** New roles/responsibilities theme: "It was stressful being trained so intensely to do case investigation in December 2020, while also conducting my regular work tasks. I definitely had to work extra hours to keep up with both tasks." ***(employer recognition & value-m)***	NA

Bachmann LH, and Kerani RP (2023)[26]	Peer-reviewed Journal	Disease Intervention Specialists (DIS)	Explore approaches to expanding DIS's role to maximize its impact on the STI/HIV field and public health.	Narrative article with a focus on DIS	**Service Benefit: "**Linkage to care is now an outcome for which DIS providing HIV partner services is responsible, and PrEP referral has been increasingly incorporated into routine partner service activities. 88% of recently surveyed high HIV morbidity states and local jurisdictions endorse this practice; Some STD programs have DIS directly deliver medication to patients or patients' partners, for example, in California and Texas, where there is field delivery by DIS for CG and CT infection under medical orders." (***public outreach & outcomes- M***) **Service Benefit**: "DIS are often trained to perform phlebotomy and collect specimens for laboratory testing. In some jurisdictions, DIS are allowed to perform CLIA-waived point-of-care testing in the field. For example, Denver Health DIS performs rapid hepatitis C antibody and point-of-care syphilis testing. The skills that DIS develops in conducting investigations, eliciting partners, ensuring partner testing and treatment, and working with people from marginalized populations are invaluable." (***knowledge, skills, abilities- m; community access-m***)	**KSA Barrier**: "The scope of activities that DIS may engage in depends on regulations in local jurisdictions, including licensing requirements, for example, the administration of vaccinations such as the COVID-19 vaccine." ***(public outreach & outcomes, M***).	**KSA Solution (Training Focus):** "Although it may not be efficient to train all field staff to successfully work across multiple areas (i.e., communicable diseases, TB, STIs), consideration should be given to which skills are easily transferable across disease areas. For example, utilization of databases to find patients and contacts, drawing blood and administering medications, and discussing sensitive topics such as sexual and drug use behaviors." (***training & professional development-m***)

Chung C, Fischer LS, O'Connor A, et al. (2017)[27]	Governmental public health surveillance and communication bulletin	Infectious disease epidemiologists (flexible epidemiologists, FE)	Describe how FEs were used to strengthen epidemiology capacity for infectious diseases and understand perceived value of this use from the health department perspective.	Qualitative study with 15 participants interviewed (five principal investigators, three supervisors, and seven FEs) representing eight health departments in the US.	**Service Benefit: "**FEs were most commonly employed to conduct activities that spanned across various disease areas rather than one disease or category of diseases. The FE was assigned less often to work on specific diseases, such as foodborne diseases and healthcare-associated infections, where major gaps have been identified. Regardless, these FEs helped support other activities and types of outbreak investigations as needed. The majority of FEs interviewed said they spent most of their time conducting outbreak investigations in an assistant or consultant role; this was the most prevalent gap FEs helped address. Most of the PIs and supervisors said flexibility in establishing the responsibilities and role of the FE was of greatest value, allowing them to utilize FEs to "cross silos", target "crucial gaps" and "plug" the person where they needed them." (***professional recognition & standardization- M***) **Service Benefit: "**By having a wider variety of experiences compared with more specialized epidemiologists, FEs can apply the skills and knowledge they gain to other programs more quickly and efficiently, when necessary, which is important when there is turnover or an urgent need for surge capacity. ***(knowledge, skills, abilities- m)***	**Service Barrier:** "The main challenge was related to workplace turf issues, FEs experienced some pushback when providing help or support; others discussed challenges with balancing a heavy workload associated with the crosscutting responsibilities." (***employer recognition & value-m***)	NA

Crowley JS, Geller AB, and Vermund SH (2021)[28]	Book chapter	Disease Intervention Specialists (DIS)	Outline a plan to expand, develop, and sustain a strong and responsive sexually transmitted infection (STI) workforce.	Recommendations from the National Academies of Science, Engineering, and Medicine; Committee on Prevention and Control of Sexually Transmitted Infections in the US	**KSA Benefit:** "The existing framework could be extended to incorporate a range of infectious diseases and entail larger, broader responsibilities for DIS, including STI field testing and treatment, such as expedited partner treatment." (***training & professional development- m)*** **Service Benefit:** **"**Training initiatives designed to expand the DIS workforce could draw on the existing pool of clinical and non-clinical health and human services professionals and paraprofessionals, representing an opportunity to diversify the workforce with STI specialty training and expertise." (***professional recognition & standardization- M***)	**Recognition Barrier:** **"**Traditionally, the cadre of STI administrators in local, state, and federal public health agencies has come up through the DIS and STI field staff ranks, and schools of public health have been an important academic resource for these professionals. Despite STIs representing a leading cause of morbidity in the United States, however, public health training tends to place little emphasis on STIs." (***training & professional development- m***)	**Service Solution (Recruitment Focus):** "Mechanisms to attract and train clinical and nonclinical health professionals to STI specialty professions are warranted, including programs comparable to HRSA's Loan Repayment Program, which provides financial incentives for health care providers in selected disciplines to provide services in medically underserved communities." (***policy & funding support- M***) **Service Solution (Retention Focus):** "Block grants administered from the CDC STI Division are largely earmarked for surveillance and epidemiology, and to support disease intervention specialist staff who offer public services to persons with reportable STIs". ***(policy & funding support- M)*** **Training Solution (Training Focus): "**CDC has funded four regional partner service training centers since 1995; these offer a variety of in-person and online training courses to the DIS workforce. As of April 2020, these centers are in California, Colorado, Indiana, and New York. CDC has developed a core training curriculum, Passport to Partner Services, in collaboration with these training centers." ***(policy & funding support- M)*** **Service Solution (Recruitment Focus):** "The Centers for Medicare & Medicaid Services, the Health Resources and Services Administration, the CDC, and other agencies should explore public-private partnerships to address logistical and regulatory barriers to workforce expansion." (***professional recognition & standardization- M)***

Edelman EJ, Cole CA, Richardson W, et al. (2014)[29]	Peer-reviewed Journal	Disease Intervention Specialists (DIS)	Understand factors affecting sexual risk behaviors, disclosure practices, and partner notification (PN) among men who have sex with men (MSM).	Qualitative, community-based participatory research; personal interviews with seven DIS (7) and MSM (24, living with and without HIV); focus groups with 14 case managers	NA	**Service Barrier:** The perceived pressures by DIS to meet the quantitative goals of the health department (i.e., interview as many partners as possible) may influence their approach to client interviews to be more direct and task-oriented rather than focused on relationship building, which may ultimately impact outcomes. ***(public outreach & outcomes, M).*** **Service Barrier:** Clients (MSM) and DIS perspectives differed regarding determinants of sexual risk behaviors among MSM and considerations affecting MSMs' HIV status disclosure to partners. ***(community confidence & trust-m)***	NA
Enanoria WT, Crawley A, Hunter JC, et al. (2014)[30]	Peer-reviewed Journal	Applied infectious disease epidemiology workforce	Describe the public health workforce involved in public health surveillance and epidemiologic activities among local health departments in California.	Cross-sectional survey: 61 local health jurisdictions (58 county and three city health departments) invited, 31 participated (51% response rate)	**Recognition Benefit:** Communicable disease investigators and epidemiologists were among the top job titles that performed routine case and contact investigations, 48% and 36%, respectively. ***(professional recondition & standardization- M)***	NA	NA

Fischbach L, Smith LV, King J, et al. (2024)[31]	Peer-reviewed Journal	Applied infectious disease epidemiology workforce	Describe and evaluate a 16-session, practice- and problem-based Grand Rounds learning training to teach knowledge and skills for COVID-19 outbreak management in different sectors.	Rapid-assessment, post-training survey 132 Grand Rounds series participants	**Training Benefit:** The Los Angeles County Department of Public Health added more than 250 contract workers, including more than 100 data monitors and epidemiologists in a three-month period during Fall 2020; a training plan was devised to effectively and efficiently prepare this workforce to manage outbreaks in a variety of sectors including healthcare, skilled nursing, worksites, and educational settings. ***(training & professional development- m)***	NA	**Training Solution (Training Focus)**: 109 participants (82%) indicated that the training improved their job performance, and 118 indicated that it improved their understanding of outbreak management/epidemiology. ***(knowledge, skills, abilities- m)***
Kiernan B, Alonis A, Diala JA, et al. (2022)[32]	Peer-reviewed Journal	School Specialist (local health department staff) supporting schools with COVID-19 guidance, prevention, and control	Describe and assess School Specialist training on the learner's knowledge and readiness and deployment. Online virtual training was developed to train a large, diverse workforce rapidly and included basic principles of outbreak prevention and data management systems.	Pre- and post-training surveys of 353 attendees (262, 74% completed both); three-month post-training field activation status survey (60, 17% completion). Of 553 enrollees, 57% were from local health departments, 36% from the state health department in California.	NA	**Service Barrier:** The governor's office of the state of California prioritized opening K-12 schools during the COVID-19 pandemic, and these institutions turned to local health departments for assistance in interpreting and implementing state public health guidance. Rapid and effective training was needed to deploy a workforce with specialized knowledge and skills to address this need. ***(public outreach & outcomes, M)***.	**Training Solution (Training Focus):** In the virtual training academy, participants who completed pre- and post-training surveys, a significant difference was noted pre- and post-training in both knowledge (P<0.001) and self-perceived confidence level (P<0.001). 45% of field survey respondents reported being deployed as School Specialists; their skill was maintained or increased slightly. Trainees indicated case investigation/ contact tracing as the lowest need for additional training, while outbreak management was reported as the area of highest additional skill practice needed. (**knowledge, skills, abilities- m**)

Liebel, AM (2020)[33]	Peer-reviewed Journal	Contact Tracers	Describe the complex nature and skills of contact tracers; discuss options for effective contact tracer training.	Commentary of contact tracers	**Recognition Benefit:** "A former CDC Director remarked that effective contact tracers play the role of psychiatrists, detectives, and problem solvers... contact tracers build trust with people, a delicate and time-consuming process under the best conditions. Contact tracing involves different kinds of speaking, listening, helping, responding, learning, and thinking… it is essential that contact tracer training reflect these complexities. In the US, there is no formal federal oversight of the training of contact tracers". ***(community confidence and trust- m)***	NA	**Training Solution (Training Focus)**: "Contact tracing is social, contextualized, shifting, and uncertain. It involves professional decision-making, negotiation, and deliberation…The education and support of contact tracers can be a learning environment, involving the community of contact tracers." ***(training & professional development- m)***
Machavariani E, Miceli J, Altice FL, et al. (2024)[34]	Peer-reviewed Journal	Disease Intervention Specialists (DIS)	Examine the effectiveness of the Cooperative Re-Engagement Control Trial (CoRECT), a trial comparing standard care (phone calls, text reminders, certified mail, or email outreach) to DIS-delivered outreach and care on re-engagement in HIV care and viral suppression treatment.	Multi-site, randomized control trial. 655 participants (persons living with HIV not engaged in HIV care) were randomized to DIS (333) or standard care (323).	**Service Benefit:** A larger proportion of participants in the DIS arm versus the standard of care arm achieved engagement at 90 days (51.1% vs. 41.9%), retention at 12 months (52.9% vs. 51.9%), and viral suppression at 12 months (67.6% vs. 61.5%). ***(community confidence & trust- m)***	NA	NA

Mase WA, Hansen AR, Smallwood SW, et al. (2018)[35]	Peer-reviewed Journal	Disease Intervention Specialists (DIS)	Describe the gaps between the currently available public health training in an accredited college of public health and the required DIS workforce job tasks and competencies.	Gap analysis of the Georgia Southern University, Jiann-Ping Hsu College of Public Health curriculum and the Public Health Accreditation Board's Job Task Analysis and Specifications Report	NA	**Training Barrier:** For DIS job tasks and competencies, 56 job tasks, in nine domains, and 103 competencies, in 10 domains, were identified. The Bachelor's in Public Health in health education and promotion core curriculum aligned with 75% (42/56) job tasks and 43% (43/103) competencies, while the MPH core curriculum aligned with 55% (31/56) job tasks and 41% (42/103) competencies. ***(professional recognition & standardization- M)***	**Training Solution (training focus)*:*** Recommendations for addressing the gaps in job tasks and competency alignment include course adjustment, course electives, practicum, and on-the-job training. ***(training & professional development- m***
Pertowski CA, Cahill K, Aguilar TJ, et al. (2024)[36]	Peer-reviewed Journal	COVID-19 response workers in state, tribal, and territorial public health	Describe hiring and workforce gaps filled by the Workforce/Vaccine Initiative, a CDC-funded initiative, 2021.	Case Study of the Workforce/Vaccine Initiative in 2021; 3,014 staff hired in 91 jurisdictions	**Recognition Benefit:** Of the 2,991 positions assigned to the field, 743 (28%) were in epidemiology, contact tracing/case investigation, or infection prevention and control. Overall, 19% of positions were retained through other funding mechanisms after the initiative ended. ***(policy & funding support- M)***	NA	NA

Royster JM, Jack A, Cunningham MC, et al. (2024)[37]	Peer-reviewed Journal	COVID-19 response workers in local health departments	Describe harassment and its impact on local health department leaders and staff during the pandemic; purpose strategies for future threats.	Qualitative study: Focus groups consisting of 16 leaders from 16 LHDs (3% of 575 eligible LHDs)	NA	**Service Barrier:** "The epidemiologist doing the contact tracing… was beat up so bad on phone calls, not just hung up on- but called all sorts of names- and you do that as your primary job for a year and a half… We diverted him to a different job for a while, but he was so traumatized he left public health". ***(employer recognition & value- m; community confidence & trust- m)***	**Service Solution (Recruitment & Retention Focus):** Consistent funding to build capacity and reduce LHDs from being reactive to emerging threats. This reactive response was reported as possibly leading to community distrust, potentially leading to harassment. ***(policy & funding support- M)***
Ruebush E, Dennison A, Lane JT, et al. (2022)[38]	Peer-reviewed Journal	COVID-19 contact tracers in public health departments	Describe an online COVID-19 contact tracer course for workers with limited public health experience (Making Contact); summarize evaluations.	Post-course evaluation survey: 71,124 participants completing the post course survey (80% of the 88,468 U.S.-based participants completing the course (April 28 to December 31, 2020)	**Service Benefit:** 100,000 contact tracers were added to expand the workforce to meet pandemic response needs; training was needed to prepare a workforce with little to no public health experience. ***(training & professional development, m)***	NA	**KSA Solution (Training Focus):** 94.8% of participants reported the training as useful/ extremely useful, 93% somewhat/strongly agreed that they better understood what it meant to be a contact tracer, and 91% agreed that the training was easy to understand. This indicates an asynchronous, knowledge-based training that can be flexible to adapt to jurisdiction-specific needs, which is effective for learners and local jurisdictions. (***training and professional development- m)***

Ruebush EF, Michael R, Poulin A, et al. (2021)[39]	Peer-reviewed Journal	COVID-19 case investigators and contact tracers	Describe the challenges and opportunities experienced by governmental public health in 2020 related to case investigation and contact tracers.	Narrative article with a focus on contact tracing and case investigation	NA	**Service Barrier:** Major challenges faced by public health agencies in developing and implementing COVID-19 contact tracing and case investigation programs included 1) establishing program structure and protocols; 2) characterizing job functions; 3) expanding the case investigation and contact tracing workforce; 4) balancing case investigation, contact tracing, and outbreak mitigation priorities and needs. ***(professional recognition & standardization-M);*** 5) Training new contact tracers, case investigators, and DIS staff ***(training & professional development- m*)**; and 6) public acceptance and participation. ***(community confidence & trust-m)***	NA

Sakamoto S, Terashita D, and Balter S (2020)[40]	Peer-reviewed Journal	Liaison public health nurses (LPHNs) and public health healthcare outreach unit staff	Describe the impact of the Healthcare Outreach Unit's public health hospital outreach initiatives and outcomes.	Case study of the Healthcare Outreach Unit at the Los Angeles County Department of Public Health: five LPHNs, six epidemiologists, four high-level nurses, a physician specialist, a laboratorian, and a staff assistant	**Service Benefit:** The number of hospitals reporting through the health department system increased from four in 2003 to 77 in 2007, and the number of outbreaks investigated increased from 146 to 201 during the seven years of the unit's initiation. Outreach was provided to skilled nursing facilities, jail medical services, dialysis centers, psychiatric facilities, and ambulatory surgery centers. LPHNs helped identify three outbreaks of CRE associated with scopes, leading to a national recall of duodenoscopes. ***(public outreach & outcomes- M)***	NA	NA

Schenk KD, Lankau EW, Todd J, et al. (2023)[41]	Online health policy commentary editorial	Applied epidemiology workforce including infectious disease epidemiologists	Detail challenges faced by the public health workforce and provide recommendations for change.	Narrative article focusing on the public health workforce	NA	**Service Barrier:** Five challenges confronting the public health workforce: burnout and an uninspired workforce; normalization of toxic, dysfunctional workplaces; poor treatment of job candidates during recruitment. ***(employer recognition & value- m);*** Loss of funding and unified messaging have had an impact on public health outcomes. ***(policy & funding support- M, public outreach & outcomes- M***) **Recognition Barrier:** Lack of career mobility, salary, and skills consolidation also challenge the public health workforce. ***(career advancement & mobility- m; knowledge, skills, abilities- m)***	**Service Solution (Recruitment & Retention Focus):** Promotion of work-life balance while addressing the effect of work on the workforce (psychological trauma) ***(employer recognition- m)***; Student loan debt reduction opportunities coupled with salary increases (***policy & funding support- M***); Identify development routes for professionals through career guidance and mentoring ***(training & professional development- m)***; **Recognition Solution (recruitment & retention focus):** Requiring public health over medical credentials; value transferable skills and experience; reevaluate and remove experience requirements for entry-level positions and degree requirements as appropriate; consider criteria for public health professionals to certify a recognize each other in the workforce (***career advancement & mobility, m***);
Stone KW, Felkner M, Perez-Patron M, et al. (2019)[42]	Peer-reviewed Journal	Infectious disease epidemiologists	Detail the function, role, and impact of state-funded epidemiologists at local health departments.	Qualitative study: 45 interviews from 20 key informants working in state, regional, and local health departments in Texas	**Service Benefit:** Key themes identified include increased epidemiologic capacity, timeliness in disease reporting, quality of disease investigation, building community relationships, increased points of contact with state and regional offices. ***(professional recognition & standardization- M)***	**Service Barrier:** Smaller, rural health departments experience difficulties in retaining qualified epidemiologists, who typically do not stay for longer than one year, moving to less rural areas, with increased pay and benefits once they gain sufficient experience. (***career advancement & mobility- m)***	NA

Summer L (2019)[43]	Thesis	Infectious disease program staff in STI/TB	Evaluate the infectious disease program staff self-rated competencies to deliver 10 essential services and determine training needs.	Mixed methods: Core competency skills questionnaires (4-scale) and key informant interviews	**Recognition**: From 2014 to 2018, self-rated competencies for eight domains increased but remained average, ranging from 2.65 to 3.33 on a four-point scale. ***(knowledge, skills, abilities, m)***	NA	**Training Solution (Retention Focus):** Interviews revealed a unanimous request for training related to safe practices in the field, as well as a high request for cultural competency and having difficult conversations. ***(training & professional development- m).***
Tributino A, Montgomery MC, Bertrand T, et al. (2019)[44]	Peer-reviewed Journal	Disease Intervention Specialists (DIS)	Evaluate the effectiveness of incorporating DIS into standard clinical care on partner notification outcomes.	Case study for integrating DIS into standard care in a Rhode Island STD Clinic: 2,745 patients, 527 diagnosed with any STI and therefore requiring follow-up	**Service Benefit:** DIS integration increased the number of index patients interviewed (from 76% to 92%); additionally, the number of patients interviewed onsite at the clinic increased from 11% to 64%, and lastly, the number of interviews occurring in the same day increased (85% compared to 61%). ***(public outreach & outcomes- M)***	NA	NA
Westfall M, Forster M, Golston O, et al. (2022)[45]	Peer-reviewed Journal	COVID-19 case investigators and contact tracers	Evaluate the effectiveness of virtual training academy (VTA), a weeklong remote program with diverse training modalities including self-study modules, didactic webinars, and skills development labs.	Post-training survey (three weeks following training); 5-point scale; Self-perceived comfort and proficiency of 1,522 participants (8,141 individuals, 29 cohorts of trainees, 19% response rate)	**Training Barrier:** The contact tracing workforce gap in California was estimated to be 100,000; training was needed to prepare a workforce with limited public health experience. ***(service quality & consistency- M)***	NA	**KSA Solution (Training Focus):** The highest rated, self-perceived confidence score was in provided for the ability to provide guidance on self-isolation and quarantine (proficiency score 4.2. while referring individuals to social support was the lowest score, 3.7. Overall, were above average. ***(training & professional development, m)***

White AE, Torok MR, Smith KE, et al. (2024)[46]	Peer-reviewed Journal	Foodborne and enteric disease public health professionals in an epidemiology role	Describe competencies for public health professionals to detect and investigate foodborne and enteric disease outbreaks; summarize the perceptions of public health professionals involved in this work regarding these competencies.	Focus groups with subject matter experts and practicing epidemiologists at different levels of experience (≤ two years to > 10 years) to finalize competencies; surveys to assess competencies from 99 state health departments and 187 local health department practitioners representing 45 states, DC, and Puerto Rico	**KSA Benefit:** Fifteen competencies in three tiers for the epidemiology role, from foundational to advanced, were identified as core knowledge and skills required to detect and investigate enteric disease outbreaks. ***(professional recognition & standardization, M)***	NA	**KSA Solution (Training Focus):** Of 15 core competencies identified, the competencies most selected as training priorities were interview skills, outbreak detection, surveillance, hypothesis generation, and data analysis ***(training & professional development- m)***
Woodward A and Rivers C (2023)[47]	Peer-reviewed Journal	Case investigators and contact tracers	Characterize case investigation and contract tracing capabilities for future outbreaks, lessons learned from COVID-19 and Mpox outbreaks, and assess existing gaps in these capabilities.	Key informant interviews, qualitative analysis: 19 key informants from local, state, and federal public health agencies. Key informant organizations were assessed for the workforce capacity of 30 contact tracers per 100,000 population.	**Service Benefit:** "16 interviewees expressed being confronted with the tradeoff between having a workforce that can handle a high volume of cases and contacts at a rapid pace and taking time during interviews to provide tailored social support and build rapport... All 19 interviewees expressed the sentiment that to build trust with the affected community, case investigation/ contact tracing staff need to be culturally and linguistically appropriate for the community they serve." ***(community confidence & trust- m)***	**Service Barrier:** "Case investigation/ contact tracer staff need appropriate compensation, benefits (including counseling and sufficient vacation days), and recognition of the value of their work… All 19 interviewees discussed burnout and declining morale among the case investigation/contract tracer workforce as the pandemic progressed." ***(employer recognition & value, m)***	**Recognition Solution (Retention Focus):** "To better communicate, engage, and build trust with communities, health agencies should develop a shared language around case investigation/ contact tracing that resonates with communities and should offer an outcome that benefits individuals when conducting case investigation/ contact tracing...an interviewee recommended the use of alternative terms such as 'COVID-19 care specialist' or 'community outreach specialist', as the term 'contact tracing' may connote ideas of government surveillance and invasion of privacy." ***(community confidence & trust, m)***

Woodward A and Rivers C (2023)[48]	Peer-reviewed Journal	Case investigators and contact tracers	Define the capabilities, capacities, outcomes, and impacts of case investigation/ contact tracer programs to develop a conceptual framework describing the relationships between these components.	Narrative review and qualitative interviews semi-structured interviews with 10 state and local public health departments in the US and four public health experts	**Service Benefit:** Capacities, including organizational (governance, funding, partnerships, workforce), technical, and social resources, are required to support a case investigation/contact tracer program's capabilities, or actions for prevention and control. These actions include 1) isolation and quarantine of cases/contacts, 2) educating cases/contacts, 3) building community trust, 4) using case investigation/contact tracing to drive decision making, and 5) providing adjacent public health services. Action then informs outcomes, such as reduction of disease transmission, leading to an impact on health, such as reducing morbidity and mortality from disease. ***(professional recognition & standardization- M)***	NA	NA
Wu TY, Hoffman JL, Chow CM, et al. (2024) [49]	Peer-reviewed Journal	COVID-19 community health navigators (community health workers)	Describe engagement, training development, and training evaluation for community health workers focusing on COVID-19 community outreach initiatives	Mixed methods: listening sessions with community health navigators to understand community and develop training; pre- and post-test survey with open-response questions 18 community health navigators trained for COVID-19 outreach in Kent County, Michigan	**Service Benefit:** 18 community health navigators from different racial/ethnic backgrounds were embedded in their communities with varied educational backgrounds used to inform training priorities and provide outreach to their communities during the COVID-19 pandemic. (***public outreach & outcomes, M)***	NA	**Recognition Solution (Training Focus)**: 13 of 18 community health navigator trainees complete the pre- and post-test evaluation. Knowledge increased for nine of 20 questions (mean increase 17.3 vs. 18.0, not stat. sig.) and a slight increase in five confidence items (4.17 vs. 4.50 not stat. sig.); while the quantitative results were small, analysis of the open-ended questions, community health navigators expressed they would apply and use their knowledge by 1) sharing information and educating the community and 2) encouraging and empowering community members to vaccinate "I can share information that I learned, I feel confident to answer questions, encourage families who have doubts about vaccines, empower them and share the knowledge that I learned." ***(community confidence & trust, m***)

Zarella O, White AE, Ramsey E, et al. (2024) [50]	Peer-reviewed Journal	Foodborne and enteric disease public health professionals in an epidemiology role	Describe the impact of the COVID-19 pandemic on the enteric disease workforce and enteric disease prevention and control program activities	Qualitative key informant interviews: 17 state health department representatives, the majority enteric disease managers (64%) West and Central US	NA	**Service Barrier:** Staff attrition due to burnout and workload was a common theme. "We lost staff with double-digit years of experience"; "It was like the exodus kept going, and it's like 'Stop. Stop leaving us here, we still have to do all this work." Lack of funding, pay, delays in job postings, insufficient onboarding, and prioritization of COVID-19 positions were commonly reported barriers to hiring new staff to focus on enteric diseases. ***(employee recognition & value, m)***	NA
Zauche LH, Pomeroy M, Demeke HB, et al. (2022)[51]	Peer-reviewed Journal	Public health nurses performing disease intervention work during the COVID-19 pandemic	Describe the contribution of public health nurses at the CDC during the COVID-19 pandemic in population-level, prevention and control measures	Editorial article	**Recognition Benefit:** "Nurses at CDC perform a variety of roles, serving as clinicians, health scientists, epidemiologists, public health advisors, nurse consultants, and communication and education specialists."***(professional recognition & standardization- M)***	NA	**Recognition Solution (Recruitment Focus)**: " The COVID-19 pandemic has increased the visibility of both the nursing and the public health professionals and has highlighted incredible, multifaceted roles that nurses have in responding to public health crises. However, the COVID-19 pandemic has exposed vulnerabilities in our public health systems globally and nationally at the federal, state, and local levels, rooted in a lack of public health investment, which has contributed to a shortage of public health nurses." ***(professional recognition & standardization- M)***

Table 2.2. Information extracted from final sources (n=35). Benefits, barriers, and solutions by outcome type, level (M= macro (structural), m=micro (relational)), and sublevel. For solutions, focus was also noted (recruitment, training, and/ or retention).

Level	Sub-Level	Category
Macro (structural)-Level Broader factors that include policies and norms in communities, organizations, and institutions	**Organization** Agencies or institutions providing public health services	**Professional Standardization** Policies or practices that standardize the DI workforce.
		Policy & Funding Support Policy development or refinement, and funding mechanisms that support the DI workforce
	Service Population Population served by organizations providing public health services	**Public Outreach & Outcomes** Policies or practices focused on outreach to the service population and/or affecting their health outcomes.
		Service Capacity & Continuity Policies or practices that have an impact on the capacity and continuity of services provided to the service population by the DI workforce.

Table 2.3. Refined categories and definitions of benefits, barriers, and solutions at the macro (structural)-level by sub-levels.

Level	Sub-Level	Category
Micro (relational)-Level Personal factors and interpersonal relationships among individuals and their representative communities, organizations, and institutions	**Organization** Agencies or institutions providing public health services	**Employer Support & Appreciation** Support and/or appreciation by an employer of the DI workforce and other practices demonstrating the employer's valuation of the DI workforce.
		Training & Professional Development Training and professional development practices by the employer for the DI workforce
	Service Population Population served by organizations providing public health services	**Community Confidence & Trust** Demonstration of confidence and trust of the DI workforce by the service population
		Community Access Access by the service population to the DI workforce and/or organizations to obtain DI services.
	Workforce Individuals or groups of individuals working in organizations providing public health services	**Career Advancement & Mobility** Individual career advancement and mobility factors of the DI workforce
		Knowledge, Skills, Abilities Individual knowledge, skills, and abilities of the DI workforce

Table 2.4. Refined categories and definitions of benefits, barriers, and solutions at the micro (relational)-level by sub-levels.

Authors/Publication Year	Certification Benefit/ Barrier/Solution Type	Macro (structural)-Level Category: Professional Standardization	Key Findings
Arrazola J, Israel M, and; Binkin, N (2019)	Recognition Benefit	Most state health departments (HDs) require a bachelor's degree (59%) or a master's degree (33%) for an entry-level position.	BS and MS degrees are required for entry-level jobs (State health departments)
McGinty MD, Binkin N, Arrazola J, et al. (2019)	Recognition Benefit	85% of respondents reported having a lead epidemiologist in their infectious disease programs. Most BCHC departments require a graduate degree for entry-level epidemiologist positions. Master's degree or higher was required for most BCHC departments (60%); Fewer required a Bachelor's in Public Health (BS) or less: 33% required a bachelor's degree, 7% required an associate's degree or less.	Large metro area health departments required graduate-level degrees for entry-level jobs; Most infectious disease (ID) epidemiology programs in these departments have a lead epidemiologist.
Auer S, Simmons A, Arrazola, J et al. (2024)	Recognition Benefit	General infectious disease (80%) and COVID-19 (74%) were the programs most likely to have a formal lead epidemiologist.	ID programs, including COVID-19, were most likely to have a formal lead epidemiologist.
McCullough JM and Robins M. (2023)	Recognition Benefit	91% of the COVID-19 response workforce reported their primary program area as communicable disease. From Q1 2020 to Q4 2021, this workforce devoted the most considerable effort (65% to 80% full-time employees to the COVID-19 response.	The communicable disease workforce dedicated the most time and effort to the COVID-19 response.
White AE, Torok MR, Smith KE, et al. (2023)	KSA Benefit	Fifteen competencies in three tiers for the epidemiology role, from foundational to advanced, were identified as core knowledge and skills required to detect and investigate enteric disease outbreaks.	Foundational and advanced competencies are needed for the knowledge and skills required for enteric disease DI.
Enanoria WT, Crawley A, Hunter JC, et al. (2014)	Recognition Benefit	Communicable disease investigators and epidemiologists were among the top job titles that performed routine case and contact investigations, 48% and 36%, respectively.	Case investigation is conducted primarily by communicable disease investigators and epidemiologists.
Zauche LH, Pomeroy M, Demeke HB, et al. (2022)	Recognition Benefit	"Nurses at CDC perform a variety of roles, serving as clinicians, health scientists, epidemiologists, public health advisors, nurse consultants, and communication and education specialists."	Nurses can serve in several titles performing critical DI work.
Chung C, Fischer LS, O'Connor A, et al. (2022)	Service Benefit	"FEs were most commonly employed to conduct activities that spanned across various disease areas rather than one disease or category of diseases. The FE was assigned less often to work on specific diseases, such as foodborne diseases and healthcare-associated infections, where major gaps have been identified. Regardless, these FEs helped support other activities and types of outbreak investigations as needed. The majority of FEs interviewed said they spent most of their time conducting outbreak investigations in an assistant or consultant role; this was the most prevalent gap FEs helped address. Most of the PIs and supervisors said flexibility in establishing the responsibilities and role of the FE was of greatest value, allowing them to utilize FEs to "cross silos", target "crucial gaps," and "plug" the person where they needed them."	ID epidemiologists conduct activities across various diseases, including outbreak investigation and consulting.
Stone KW, Felkner M, Perez-Patron M, et al. (2019)	Service Benefit	Key themes identified included increased epidemiologic capacity, timeliness in disease reporting, quality of disease investigation, building community relationships, and increased points of contact with state and regional offices.	ID epidemiologists increase capacity, disease reporting timeliness, quality of disease investigation, building community relationships, and enhancing points of contact with state and regional offices

Woodward A and Rivers C (2023)	Service Benefit	Capacities, including organizational (governance, funding, partnerships, workforce), technical, and social resources, are required to support a case investigation/contact tracer program's capability, or actions for prevention and control. These actions include 1) isolation and quarantine of cases/contacts, 2) educating cases/contacts, 3) building community trust, 4) using case investigation/contact tracing to drive decision making, and 5) providing adjacent public health services. Action then informs outcomes, such as reduction of disease transmission, leading to an impact on health, such as reducing morbidity and mortality from disease.	Resource needs include governance, funding, partnerships, workforce, technical, and social resources needed to support DI work that will have an impact on morbidity and mortality outcomes. DI work includes not just isolation/quarantine but also building community trust, educating, and providing adjacent services.
McGinty MD, Binkin N, Arrazola J, et al. (2019)	Service Barrier	Three critical issues reported included epidemiologist recruitment and retention.	Recruitment and retention are critical issues.
Bork RH, Robins M, Scaffer K, et al. (2022)	Service Barrier	The top three needs reported to respond to the COVID-19 pandemic effectively included 1) staffing capacity (51%).	Staffing capacity is another critical issue.
Mase WA, Hansen AR, Smallwood SW, et al. (2018)	Training Barrier	For DIS job tasks and competencies, 56 job tasks were identified in nine domains, and 103 competencies were identified in 10 domains. The core curriculum of the BS in health education and promotion aligned with 75% (42/56) job tasks and 43% (43/103) competencies, while the Master of Public Health (MPH) core curriculum aligned with 55% (31/56) job tasks and 41% (42/103) competencies.	DI job tasks may align with bachelor-level public health core curriculum to a greater extent than master-level public health core curriculum; both may align equivalently to DI competencies. For both bachelor's and master's level core curriculum, a gap exists in aligning with DI job tasks and competencies.
Ruebush EF, Michael R, Poulin A, et al. (2021)	Service Barrier	Major challenges faced by public health agencies in developing and implementing COVID-19 contact tracing and case investigation programs included 1) establishing program structure and protocols; 2) characterizing job functions; 3) expanding the case investigation and contact tracing workforce; and 4) balancing case investigation, contact tracing, and outbreak mitigation priorities and needs.	Public health (PH) agencies' challenges to establishing DI programs may include providing a program structured protocols, characterizing job functions, expanding the workforce, and balancing the priorities and needs of the DI
Crowley JS, Geller AB, and Vermund SH (2021)	Training Barrier	"Traditionally, the cadre of STI administrators in local, state, and federal public health agencies has come up through the DIS and STI field staff ranks, and schools of public health have been an important academic resource for these professionals. Despite STIs representing a leading cause of morbidity in the United States, however, public health training tends to place little emphasis on STIs."	PH training gaps in schools of public health exist despite the meaningful PH impact of infectious diseases, such as STIs, and the utilization of these programs by DI workforce as resources for career advancement.
Auer S, Arrazola J, Masters A., et al. (2023)	Recognition Solution (Training & Recruitment Focus)	"Enhance professional visibility by updating applied epidemiology competencies, partnering with academia to embed practical skills in curricula, and leveraging the Academic Health Department model."	DI applied competencies establishment and visibility, embedded these competencies and associated skills into the curriculum through academic and HD partnerships (academic HD).
Crowley JS, Geller AB, and Vermund SH (2021)	Service Solution (Recruitment Focus)	"The Centers for Medicare & Medicaid Services, the Health Resources and Services Administration, the CDC, and other agencies should explore public-private partnerships to address logistical and regulatory barriers to workforce expansion."	Expansion of the workforce can be facilitated through public-private partnerships that focus on logistic and regulatory barriers.
Zauche LH, Pomeroy M, Demeke HB, et al. (2022)	Recognition Solution (Recruitment Focus)	" The COVID-19 pandemic has increased the visibility of both the nursing and the public health professionals and has highlighted incredible, multifaceted roles that nurses have in responding to public health crises. However, the COVID-19 pandemic has exposed vulnerabilities in our public health systems globally and nationally at the federal, state, and local levels, rooted in a lack of public health investment, which has contributed to a shortage of public health nurses."	Expanding outreach to clinical professionals may facilitate or promote investing in public health systems.

Table 2.5a. Key findings by category (professional standardization, macro (structural)-level) and certification benefit, barrier, or solution type.

Authors/Publication Year	Certification Benefit/ Barrier/Solution Type	Macri-Level Category: Policy & Funding Support	Key Findings
Pertowski CA, Cahill K, Aguilar TJ, et al. (2024)	Recognition Benefit	Of the 2,991 positions assigned to the field, 743 (28%) were in epidemiology, contact tracing/ case investigation, or infection prevention and control. Overall, 19% of positions were retained through other funding mechanisms after the initiative ended.	DI positions may be more likely to be retained when short-term funding initiatives end.
Arrazola J, Israel M, Binkin, N (2019)	Service Barrier	Approximately 77% of epidemiology activities were funded by federal sources, which harmed perceived job security, job satisfaction, staff morale, and staff retention.	Reliance on federal funding harms perceived job security, job satisfaction, staff morale, and staff retention.
Arrazola J, Israel M, Binkin, N (2019)	Service Barrier	Almost half (47%) of funding for epidemiology activities and personnel was received by local sources, while 27% and 24% originated from federal and state sources. Three critical issues reported included 1) lack of predictable and sustained funding.	While DI activities and personnel are funded to a large extent by local sources, a significant portion is still funded by federal and state sources; this results in the critical issue of unpredictable and unstable funding for the DI workforce.
Arrazola, J and Auer, S (2022)	Service Barrier	85% of epidemiology activities were primarily supported by federal funds, 39% were designated for COVID-19 activities with time-limited funding.	DI activities may be supported by federal funds that are often time-limited.
Council of State and Territorial Epidemiologists (2024)	Service Barrier	"As in 2021, 83% of federal funds constituted funding for all epidemiologic activities; when salaries are adjusted for inflation, there was a decrease in all position salaries except mid-level epidemiologists, which experienced a less than 2% increase since 2021."	Reliance on federal funds for DI activities may result in stagnant salary levels.
Auer S, Simmons A, Arrazola, J et al. (2024)	Service Barrier	"For epidemiology personnel, 40% of funding comes from local sources, 39% from federal sources, and 17% from state sources; in state health departments, more than 80% of funds are provided by the federal government. 4% of funding for epidemiologic activities and personnel came from non-governmental funding sources such as private organizations, non-profit grants, donations, or corporate sponsorships. Three critical challenges reported included 1) challenges for securing sustainable funding for epidemiologists.	While DI activities and personnel are funded to a large extent by local sources, a significant portion is still funded by federal and state sources; this results in the critical issue of unpredictable and unstable funding for the DI workforce.
Schenk KD, Lankau EW, Todd J, et al. (2023)	Service Barrier	Five challenges confronting the public health workforce included loss of funding, which has affected public health outcomes.	Funding instability for DI workforce may have an impact on health outcomes.
Schenk KD, Lankau EW, Todd J, et al. (2023)	Service Solution (Recruitment Focus)	"Mechanisms to attract and train clinical and nonclinical health professionals to STI specialty professions are warranted, including programs comparable to HRSA's Loan Repayment Program, which provides financial incentives for health care providers in selected disciplines to provide services in medically underserved communities."	Recruitment and training of clinical and non-clinical professionals to DI is through loan repayment programs.
Schenk KD, Lankau EW, Todd J, et al. (2023)	Service Solution (Retention Focus)	"Block grants administered from the CDC STI Division are largely earmarked for surveillance and epidemiology, and to support disease intervention specialist staff who offer public services to persons with reportable STIs".	Block grants are available for public service.
Schenk KD, Lankau EW, Todd J, et al. (2023)	Training Solution (Training Focus)	"CDC has funded four regional partner service training centers since 1995; these offer a variety of in-person and online training courses to the DIS workforce. As of April 2020, these centers are in California, Colorado, Indiana, and New York. CDC has developed a core training curriculum, Passport to Partner Services, in collaboration with these training centers."	Regional training centers offer in-person and online training through core curriculum developed in partnership with HDs.
Royster JM, Jack A, Cunningham MC, et al. (2024)	Service Solution (Recruitment & Retention Focus)	Consistent funding to build capacity could enable LHDs to move from being reactive to being proactive in addressing emerging threats. This reactive response was reported as possibly leading to community distrust, potentially leading to harassment.	Consistent funding streams for proactive versus reactive response can foster community trust and collaboration.
Schenk KD, Lankau EW, Todd J, et al. (2023)	Service Solution (Recruitment & Retention Focus)	Student loan debt reduction opportunities coupled with salary increases could provide opportunities for professional growth in public health.	Student loan debt reduction and salary increases can support career advancement and job security.

Table 2.5b. Key findings by category (policy & funding support, macro (structural)-level) and certification benefit, barrier, or solution type.

Authors/Publication Year	Type	Macro (structural)-level Category: Public Outreach & Outcomes	Key Findings
Bachmann LH, and Kerani RP (2023)	Service Benefit	"Linkage to care is now an outcome for which DIS providing HIV partner services is responsible, and PrEP referral has been increasingly incorporated into routine partner service activities. 88% of recently surveyed high HIV morbidity states and local jurisdictions endorse this practice; Some STD programs have DIS directly deliver medication to patients or patients' partners, for example, in California and Texas, where there is field delivery by DIS for CG and CT infection under medical orders."	The DI workforce can play a critical and expanded role in care linkage, including referral for preventative care (for example, PrEP) and direct delivery of interventions in the field, such as medication delivery to cases and contacts.
Sakamoto S, Terashita D, and Balter S (2020)	Service Benefit	The number of hospitals reporting through the health department system increased from four in 2003 to 77 in 2007, and the number of outbreaks investigated increased from 146 to 201 during the seven years of the unit's initiation. Outreach was provided to skilled nursing facilities, jail medical services, dialysis centers, psychiatric facilities, and ambulatory surgery centers. LPHNs helped identify three outbreaks of CRE associated with scopes, leading to a national recall of duodenoscopes.	The DI workforce can be critical in outreach to healthcare systems, including hospitals, ambulatory clinics, long-term care, jail medical services, dialysis centers, and psychiatric facilities, to support prevention and control measures, increase reporting of notifiable conditions, and decrease outbreaks.
Tributino A, Montgomery MC, Bertrand T, et al. (2018)	Service Benefit	DIS integration increased the number of index patients interviewed (from 76% to 92%); additionally, the number of patients interviewed onsite at the clinic increased from 11% to 64%, and lastly, the number of interviews occurring in the same day increased (85% compared to 61%).	DI workforce service integration with healthcare facilities can increase the quantity and timeliness of case patient outreach and investigation.
Wu TY, Hoffman JL, Chow CM, et al. (2024)	Service Benefit	A total of 18 community health navigators from different racial/ethnic backgrounds were embedded in their communities with varied educational backgrounds used to inform training priorities and provide outreach to their communities during the COVID-19 pandemic.	A DI workforce embedded in the community and reflective of the service population can enhance service delivery, gain insight into training priorities, and expand community outreach efforts.
Auer S, Simmons A, Arrazola, J et al. (2024)	Service Barrier	Three critical challenges reported included 2) recruiting a diverse workforce.	Critical challenges include recruiting a diverse workforce.
Bachmann LH, and Kerani RP (2023)	KSA Barrier	"The scope of activities that DIS may engage in depends on regulations in local jurisdictions, including licensing requirements, for example, the administration of vaccinations such as the COVID-19 vaccine."	The DI workforce scope of activities is dependent on local jurisdiction regulations, such as licensing requirements (administration of vaccines)
Edelman EJ, Cole CA, Richardson W, et al. (2024)	Service Barrier	The pressure perceived by DIS to meet the quantitative goals of the health department (i.e., interview as many partners as possible) may influence their approach to client interviews, making them more direct and task-oriented rather than focused on relationship building. This may ultimately have an impact on outcomes.	Pressure to meet quantitative goals with case investigation and interviewing may result in a direct, task-driven focus versus building relationships with case patients; this can affect outcomes.
Kiernan B, Alonis A, Diala JA, et al. (2022)	Service Barrier	The governor's office of the state of California prioritized opening K-12 schools during the COVID-19 pandemic, and these institutions turned to local health departments for assistance in interpreting and implementing state public health guidance. Rapid and effective training was needed to deploy a workforce with specialized knowledge and skills to address this.	Communities rely on PH agencies and the DI workforce to interpret and implement state public health guidance, requiring rapid and effective training to deploy a knowledgeable and skilled workforce to meet these expectations.
Schenk KD, Lankau EW, Todd J, et al. (2023)	Service Barrier	Five challenges confronting the public health workforce included lack of unified messaging has affected public health outcomes.	Unified messaging has been a challenge, affecting health outcomes

Table 2.5c. Key findings by category (public outreach & outcomes, macro (structural)-level) and certification benefit, barrier, or solution type.

Authors/Publication Year	Type	Macro (structural)-level Category: Service Capacity & Continuity	Key Findings
Arrazola J, Israel M, and Binkin, N (2019)	Service Benefit	55% of the state health department epidemiologists worked in infectious diseases.	More than half of epidemiologists at state HDs work in DI.
Arrazola J, Israel M, and Binkin, N (2019)	Service Benefit	All BCHC respondents (100%) reported that they provided programs and services for infectious disease.	All large metropolitan HDs have programs and services in DI.
Arrazola, J and Auer, S (2022)	Service Benefit	Infectious disease accounted for 36% of epidemiology positions; COVID-19 response (24%)- these were the two program areas with the highest number of epidemiologists.	The highest number of epidemiologists in state HDs work in DI.
Council of State and Territorial Epidemiologists (2024)	Service Benefit	The largest program area was infectious disease, with 2,541 epidemiologists of 5,706 (44.5%).	The highest number of epidemiologists in state HDs work in DI.
Auer S, Simmons A, Arrazola, J et al. (2024)	Service Benefit	Almost all 35 HDs reported programs in infectious disease (94%), HIV (91%); 49% of the workforce is concentrated in infectious diseases.	Almost all large metropolitan HDs have programs and services in DI, with half of the workforce concentrated in DI.
McGinty MD, Binkin N, Arrazola J, et al. (2019)	Service Barrier	The largest number of vacant epidemiology positions was in infectious disease programs (19/83= 23%).	Largest number of vacant positions was in DI focused programs.
Arrazola, J and Auer, S (2022)	Service Barrier	Between 2017 and 2021, infectious disease positions decreased by 19%; state epidemiologists expressed the need for additional epidemiologists, with the largest number of positions needed in infectious disease.	DI epidemiology workforce positions decreased despite the state epidemiologists' expressed need for a larger DI workforce.
Council of State and Territorial Epidemiologists (2024)	Service Barrier	The most needed positions were in infectious disease areas combined (1,019 positions).	The workforce with the highest number of open positions is the DI workforce (infectious diseases combined).
Auer S, Simmons A, Arrazola, J et al. (2024)	Service Barrier	"The greatest number of vacancies, 201, are within the program areas of sexually transmitted disease (25) and HIV (21)."	The DI workforce specializing in STIs/HIV experiences a large number of vacancies.
Westfall M, Forster M, Golston O, et al. (2022)	Training Barrier	The contact tracing workforce gap in California was estimated to be 100,000; training was needed to prepare a workforce with limited public health experience.	The large gap in the DI workforce, especially during PH emergencies involving infectious diseases, results in reactive preparation of individuals with limited DI experience to fill the workforce gap.
Arrazola J, Israel M, and Binkin, N (2019)	Service Solution (retention focus)	To cope with staff turnover, almost all states (92%) reported standard operating procedures to maintain institutional knowledge; 78% used internal training (78%) and professional development (75%); 53% reported participating in preceptorship or practicum programs.	PH agencies rely on standard operating procedures, internal training, professional development opportunities, and preceptorship or practicum programs to maintain institutional knowledge need for DI, resulting from staff turnover.

Table 2.5d. Key findings by category (service capacity & continuity, macro (structural)-level) and certification benefit, barrier, or solution type.

Authors/Publication Year	Type	Micro (relational)-level Category: Employer Support & Appreciation	Key Findings
Madsen ER, Schaffer K, Bork RH, et al. (2024)	Service Benefit	Collaboration theme: "I enjoyed being part of contact tracing to work with other members of public health, the opportunity to learn something new, to be part of something critically important, and build teamwork within our department, but it was very stressful at the same time."	Being part of work critical to the public's health and learning opportunities as part of a DI team may provide a positive experience for the DI workforce, compensating for a stressful event or environment.
Bork RH, Robins M, Scaffer K, et al. (2022)	Service Barrier	The top three needs reported as factors that would have enabled an effective response to the COVID-19 pandemic included more support from elected leaders (26%).	The DI workforce needs more support from elected leaders to respond to emergency and emergent DI needs
Madsen ER, Schaffer K, Bork RH, et al. (2024)	Service Barrier	New roles/responsibilities theme: "It was stressful being trained so intensely to do case investigation in December 2020, while also conducting my regular work tasks. I definitely had to work extra hours to keep up with both tasks."	The DI workforce experienced stress and long work hours, balancing routine tasks, training, and completing tasks to respond to emergency DI needs.
Chung C, Fischer LS, O'Connor A, et al. (2022)	Service Barrier	"The main challenge was related to workplace turf issues, FEs experienced some pushback when providing help or support; others discussed challenges with balancing a heavy workload associated with the crosscutting responsibilities."	Heavy workloads from crosscutting responsibilities and workplace turf issues when providing support to other DI areas challenged the DI workforce in responding to DI needs.
Royster JM, Jack A, Cunningham MC, et al. (2024)	Service Barrier	"The epidemiologist doing the contact tracing…was beat up so bad on phone calls, not just hung up on- but called all sorts of names- and you do that as your primary job for a year and a half… We diverted him to a different job for a while, but he was so traumatized he left public health".	DI response needs may limit the ability of PH agencies to protect the DI workforce from harassment from the public, negatively affecting the mental health of the DI workforce.
Schenk KD, Lankau EW, Todd J, et al. (2023)	Service Barrier	Five challenges confront the public health workforce: burnout; an uninspired workforce; normalization of toxic, dysfunctional workplaces; and poor treatment of job candidates during recruitment.	The DI workforce faces challenges such as burnout, feeling uninspired, the normalization of toxic and dysfunctional workplaces, and poor recruitment practices.
Woodward A and Rivers C (2023)	Service Barrier	"Case investigation/contact tracer staff need appropriate compensation, benefits (including counseling and sufficient vacation days), and recognition of the value of their work…All 19 interviewees discussed burnout and declining morale among the case investigation/contract tracer workforce as the pandemic progressed."	While providing DI needs, the DI workforce may experience low morale and burnout.
Zarella O, White AE, Ramsey E, et al. (2024)	Service Barrier	Staff attrition due to burnout and workload was a common theme. "We lost staff with double-digit years of experience." "It was like the exodus kept going, and it's like 'Stop. Stop leaving us here, we still have to do all this work." Lack of funding, pay, delays in job postings, insufficient onboarding, and prioritization of COVID-19 positions were commonly reported barriers to hiring new staff to focus on enteric diseases (infections of the stomach and intestines).	Burnout reduced DI retention rates, increasing the workload for the remaining DI workforce. Funding shortages, salary ranges, gaps in human resource capacity, prioritization on specific DI specialization (COVID-19), and insufficient onboarding processes also adversely affected the recruitment of the DI workforce.
Woodward A and Rivers C (2023)	Service Solution	"Case investigation/contact tracer staff need appropriate compensation, benefits (including counseling and sufficient vacation days), and recognition of the value of their work…All 19 interviewees discussed burnout and declining morale among the case investigation/contract tracer workforce as the pandemic progressed."	The DI workforce needs appropriate compensation, benefits such as counseling and vacation days, and recognition by employers of the value of DI work.
Arrazola J, Israel M, and Binkin, N (2019)	Service Solution (Retention Focus)	Mentoring and coaching (80%), promoting task diversity (78%), publicly recognizing employee achievements (75%), and providing professional development and training (75%) were the most frequently reported methods of retaining employees and maintaining continuity.	Mentoring, coaching, promoting task diversity, public recognition of employee achievements, and providing professional development and training are critical to retain the DI workforce and maintaining continuity.
Council of State and Territorial Epidemiologists (2024)	Service Solution (Recruitment & Retention Focus)	"Of 50 states and DC, the most cited assets for recruiting and retaining epidemiologists were job interest and fulfillment (38), the opportunity to work remotely (26), and job benefits (20). Of 50 states and DC, allowing telework (30), flexible work schedules (30), and promoting meaningful relationships at work (26) was cited as a major strategy for minimizing burnout." For recruiting and retaining epidemiologists, recommendations include forming collaborative partnerships with academic institutions, including the 2023 applied epidemiology competencies in undergraduate and graduate curricula, timely processing, competitive compensation, education on civil service testing, supporting public loan services forgiveness efforts, and investing in training programs.	Factors needed for recruiting and retaining the DI workforce may include job interest and fulfillment, as well as remote work options. Burnout minimization strategies include remote working and promoting meaningful work relationships.
Schenk KD, Lankau EW, Todd J, et al. (2023)	Service Solution (Recruitment & Retention Focus)	Promotion of work-life balance is essential, while addressing the effect of work on the workforce (psychological trauma).	Promoting work-life balance while addressing psychological trauma from DI work is critical for the DI workforce.

Table 2.5e. Key findings by category (employer support & appreciation, micro (relational)-level) and certification benefit, barrier, or solution type.

Authors/Publication Year	Type	Micro (relational)-level Category: Training & Professional Development	Key Findings
Schenk KD, Lankau EW, Todd J, et al.	KSA Benefit	"The existing framework could be extended to incorporate a range of infectious diseases and entail larger, broader responsibilities for DIS, including STI field testing and treatment, such as expedited partner treatment."	DI workforce responsibilities may be broadened to incorporate treatment and prevention services for a wider range of infectious diseases.
Fischbach L, Smith LV, King J, et al. (2024)	Training Benefit	The Los Angeles County Department of Public Health added more than 250 contract workers, including more than 100 data monitors and epidemiologists in a three-month period during Fall 2020; a training plan was devised to effectively and efficiently prepare this workforce to manage outbreaks in a variety of sectors including healthcare, skilled nursing, and worksites, and in educational settings.	The DI workforce can be rapidly expanded and trained to effectively and efficiently provide DI services, such as outbreak management, in various settings.
Ruebush E, Dennison A, Lane JT, et al. (2022)	Service Benefit	A total of 100,000 contact tracers were added to expand the workforce to meet pandemic response needs; training was needed to prepare a workforce with little-to-no public health experience.	A DI workforce can be prepared from a workforce with little to no PH experience to meet DI emergency needs.
McGinty MD, Binkin N, Arrazola J, et al. (2019)	Service Barrier	Three critical issues reported included the ability of the epidemiology workforce to adapt and respond to new technologies and emerging public health threats.	Adapting and responding to new technologies and emerging PH threats are critical issues facing the DI workforce.
Auer S, Simmons A, Arrazola, J et al. (2024)	Service Barrier	Three critical challenges reported included ensuring that staff are adequately trained for new data systems and software.	Adequate training for new data systems and software is a critical challenge facing the DI workforce.
Ruebush EF, Michael R, Poulin A, et al. (2021)	Service Barrier	Major challenges faced by public health agencies in developing and implementing COVID-19 contact tracing and case investigation programs included training new contact tracers, case investigators, and DIS staff.	Limitations in developing and implementing training for DI is a challenge faced by PH agencies.
Arrazola J, Israel M, and Binkin, N (2019)	Service Solution (Retention Focus)	Mentoring and coaching (80%), promoting task diversity (78%), publicly recognizing employee achievements (75%), and providing professional development and training (75%) were the most frequently reported methods of retaining employees and maintaining continuity.	Providing professional development and training is a commonly used method for retaining the DI workforce and maintaining continuity.
Auer S, Arrazola J, Masters A., et al. 92023)	Recognition Solution (Training & Recruitment Focus)	"Enhance professional visibility by updating applied epidemiology competencies, partnering with academia to embed practical skills in curricula, and leveraging the Academic Health Department model."	Using an academic health department model is needed to increase visibility and growth of the profession.
Auer S, Arrazola J, Masters A., et al. 92023)	Service Solution (Recruitment Focus)	"Attract new professionals through scholarships, mentoring, enhanced student exposure, and skills-based interview scenarios."	Recruiting an entry-level workforce from a student population may be enhanced through scholarships, mentoring, exposing students to DI practice, and skill-based interviewing.
Auer S, Arrazola J, Masters A., et al. 92023)	Training Solution (Training Focus)	"Strengthen workforce capacity with post-grad training, onboarding, continuing education, skill-specific sessions, and on-the-job training. Promote system-level support through advocacy for policies like loan forgiveness, better pay, and sustained funding.	DI workforce capacity may be increased through programs such as post-graduate training, onboarding, continuing education, on-the-job training, and advocating for policies such as loan forgiveness, salary adjustments, and sustained funding.
Bachmann LH, and Kerani RP (2023)	KSA Solution (Training Focus)	"Although it may not be efficient to train all field staff to successfully work across multiple areas (i.e., communicable diseases, TB, STIs), consideration should be given to which skills are easily transferable across disease areas. For example, utilization of databases to find patients and contacts, drawing blood and administering medications, and discussing sensitive topics such as sexual and drug use behaviors."	Identification of skills that are easily transferable across disease areas, such as use of databases and discussing sensitive topics, may address limitations in training the DI workforce across multiple diseases.
Liebel, AM (2020)	Training Solution (Training Focus)	"Contact tracing is social, contextualized, shifting, and uncertain. It involves professional decision-making, negotiation, and deliberation…The education and support of contact tracers can be a learning environment, involving the community of contact tracers."	A community of DI workforce can help support and educate emerging DI workers in critical, experience-based skills that required ongoing decision-making, negotiation, deliberation in a situational environment that is social, contextualized, and uncertain.

Mase WA, Hansen AR, Smallwood SW, et al. (2018)	Training Solution (training focus)	Recommendations for addressing the gaps in job tasks and competency alignment included course adjustments, course electives, practicum, and on-the-job training.	Gaps in DI job task and competency alignment in current PH curriculum can be addressed through course adjustments, practicum, on-the-job training, and course electives.
Ruebush E, Dennison A, Lane JT, et al. (2022)	KSA Solution (Training Focus)	Some 94.8% of participants reported the training as useful/extremely useful, 93% somewhat/strongly agreed that they better understood what it meant to be a contact tracer, and 91% agreed that the training was easy to understand. This indicates an asynchronous, knowledge-based training that can be flexible to adapt to jurisdiction-specific needs, which is effective for learners and local jurisdictions.	Training that is asynchronous, knowledge-based, and flexible enough to adapt to jurisdiction-specific needs may be effective for the local DI workforce.
Schenk KD, Lankau EW, Todd J, et al. (2023)	Service Solution (Recruitment & Retention Focus)	Recommendations included identifying development routes for professionals through career guidance and mentoring.	Retention of the DI workforce would be enhanced through professional development including career guidance and mentoring.
Summer L (2019)	Training Solution (Retention Focus)	Interviews produced a unanimous request for training related to safe practices in the field, as well as a high request for training in cultural competency and having difficult conversations.	Training that incorporates safe practices in the field, cultural competency, and having difficult conversations may benefit the DI workforce.
Westfall M, Forster M, Golston O, et al. (2022)	KSA Solution (Training Focus)	The highest rated, self-perceived confidence score was in the ability to provide guidance on self-isolation and quarantine (proficiency score 4.2.), while referring individuals to social support was the lowest score, 3.7. Overall, scores were above average.	Increasing the DI workforce's confidence in critical areas, such as providing guidance and social support referral, may better address DI needs.
White AE, Torok MR, Smith KE, et al. (2024)	KSA Solution (Training Focus)	Of 15 core competencies identified, the competencies most selected as training priorities were interview skills, outbreak detection, surveillance, hypothesis generation, and data analysis.	Increasing the DI workforce's competence in interview skills, outbreak detection, surveillance, hypothesis generation, and data analysis, may better address DI needs.

Table 2.5f. Key findings by category (training & professional development, micro (relational)-level) and certification benefit, barrier, or solution type.

Authors/Publication Year	Type	Micro (relational)-level Category: Community Confidence & Trust	Key Findings
Liebel, AM (2020)	Recognition Benefit	"A former CDC Director remarked that effective contact tracers play the role of psychiatrists, detectives, and problem solvers... contact tracers build trust with people, a delicate and time-consuming process under the best conditions. Contact tracing involves different kinds of speaking, listening, helping, responding, learning, and thinking… it is essential that contact tracer training reflect these complexities. In the US, there is no formal federal oversight of the training of contact tracers".	Oversight of DI training is essential to reflect the complexities of DI work, which requires building trust with people, a time-consuming and delicate process requiring varied skills to serve as detectives and problem solvers.
Woodward A and Rivers C (2023)	Service Benefit	"Sixteen interviewees expressed being confronted with the tradeoff between having a workforce that can handle a high volume of cases and contacts at a rapid pace and taking time during interviews to provide tailored social support and build rapport... All 19 interviewees expressed the sentiment that to build trust with the affected community, case investigation/contact tracing staff need to be culturally and linguistically appropriate for the community they serve."	The DI workforce needs to balance management and rapid resolution of high case volumes with providing tailored social support and building rapport in a culturally and linguistically appropriate manner to build trust with the service population.
Bork RH, Robins M, Scaffer K, et al. (2022)	Service Barrier	The top three needs reported to respond to the COVID-19 pandemic effectively included more community support (30%)	The DI workforce needs more community support to respond to DI needs.
Edelman EJ, Cole CA, Richardson W, et al. (2014)	Service Barrier	Clients (MSM) and DIS perspectives differed regarding determinants of sexual risk behaviors among MSM and considerations impacting MSMs' HIV status disclosure to partners.	DI workforce perspectives may differ from those of the service population regarding the determinants of risky behaviors affecting disclosure of partners/contacts.
Royster JM, Jack A, Cunningham MC, et al. (2024)	Service Barrier	"The epidemiologist doing the contact tracing… was beat up so bad on phone calls, not just hung up on- but called all sorts of names- and you do that as your primary job for a year and a half… We diverted him to a different job for a while, but he was so traumatized he left public health".	DI public outreach may result in harassment by the service population.
Ruebush EF, Michael R, Poulin A, et al. (2021)	Service Barrier	Major challenges faced by public health agencies in developing and implementing COVID-19 contact tracing and case investigation programs included public acceptance and participation.	The DI workforce faces challenges in obtaining public acceptance and participation.
Woodward A and Rivers C (2023)	Recognition Solution (Retention Focus)	"To better communicate, engage, and build trust with communities, health agencies should develop a shared language around case investigation/contact tracing that resonates with communities and should offer an outcome that benefits individuals when conducting case investigation/contact tracing...an interviewee recommended the use of alternative terms such as 'COVID-19 care specialist' or 'community outreach specialist', as the term 'contact tracing' may connote ideas of government surveillance and invasion of privacy."	A shared language that resonates with communities and conveys the benefit of DI work may better communicate, engage, and build trust with them; this includes addressing the DI workforce using terms that reflect care and outreach (care or community outreach specialists) as opposed to terminology that reinforces ideas of government surveillance and invasion of privacy (contact tracing).
Wu TY, Hoffman JL, Chow CM, et al. (2024)	Recognition Solution (Training Focus)	Thirteen of 18 community health navigator trainees complete the pre- and post-test evaluation. Knowledge increased for nine of 20 questions (mean increase 17.3 vs. 18.0, not stat. sig.) and a slight increase in five confidence items (4.17 vs. 4.50 not stat. sig); while the quantitative results were small, analysis of the open-ended questions, community health navigators expressed they would apply and utilize their knowledge by 1) sharing information and educating the community and 2) encouraging and empowering community members to vaccinate. "I can share information that I learned, I feel confident to answer questions, encourage families who have doubts about vaccines, empower them and share the knowledge that I learned."	Educating and empowering communities through knowledge sharing and encouragement may increase the confidence of the service population and the DI workforce.

Table 2.5g. Key findings by category (community confidence & trust, micro (relational)-level) and certification benefit, barrier, or solution type.

Authors/Publication Year	Type	Micro (relational)-level Category: Community Access	Key Findings
Bachmann LH, and Kerani RP (2023)	Service Benefit	"DIS are often trained to perform phlebotomy and collect specimens for laboratory testing. In some jurisdictions, DIS are allowed to perform CLIA-waived point-of-care testing in the field. For example, Denver Health DIS performs rapid hepatitis C antibody and point-of-care syphilis testing. The skills that DIS develops in conducting investigations, eliciting partners, ensuring partner testing and treatment, and working with people from marginalized populations are invaluable."	The clinical skills of certain DI workforce—including specimen collection, phlebotomy, performing CLIA-waived point of care testing in the field in addition to working with marginalized populations, conducting investigations, and identification, testing, and treatment of partners/contacts—are critical
Machavariani E, Miceli J, Altice FL, et al. (2024)	Service Benefit	A larger proportion of participants in the DIS arm versus the standard of care arm achieved engagement at 90 days (51.1% vs. 41.9%), retention at 12 months (52.9% vs. 51.9%), and viral suppression at 12 months (67.6% vs. 61.5%).	The inclusion and support of the DI workforce (DIS specifically) can increase engagement, retention, and adherence of the service population.

Table 2.5h. Key findings by category (community access, micro (relational)-level) and certification benefit, barrier, or solution type.

Authors/Publication Year	Type	Micro (relational)-level Category: Career Advancement & Mobility	Key Findings
Arrazola J, Israel M, and Binkin, N (2019)	Service Barrier	"The most frequently reported major and moderate problems for staff retention were opportunities for promotion (88%), salary (80%), restrictions on merit raises (70%), and loss to the private or government sector (65%). Respondents reported that epidemiologists with an MPH degree tended to leave the workforce to start PhD programs, and staff with MPH and PhD degrees were inclined to leave public health for the private sector."	DI workforce retention issues most commonly reported include opportunities for promotion, salary, and restrictions on merit-based raises. Loss to the private sector and furthering education were more common in the workforce with graduate-level degrees (master's/doctoral).
Bork RH, Robins M, Scaffer K, et al. (2024)	Service Barrier	Almost half (44%) of respondents considered leaving their organization to retire or for other reasons; 76% had been thinking about leaving the organization since the start of the COVID-19 pandemic.	A large proportion of the DI workforce has considered leaving their organization since the COVID-19 pandemic
Schenk KD, Lankau EW, Todd J, et al. (2023)	Recognition Barrier	Lack of career mobility, salary, and skills consolidation also challenge the public health workforce.	Lack of career mobility, salary, and skills reinforcement are challenges faced by the DI workforce
Stone KW, Felkner M, Perez-Patron M, et al. (2019)	Service Barrier	Smaller, rural health departments experience difficulties in retaining qualified epidemiologists, who typically do not stay for longer than one year, moving to less rural areas, with increased pay and benefits once they gain sufficient experience.	Smaller, rural public health agencies have greater difficulty retaining qualified DI workers, who leave for positions in larger, urban areas offering increased pay and benefits after gaining sufficient experience (typically no longer than one year).
Auer S, Arrazola J, Masters A., et al. (2023)	Service & Recognition Solution (Retention Focus)	"Support retention through peer communities, regional mentorships, resilience-building activities, succession planning tools, and surge staffing support".	Retention of the DI workforce can be enhanced through peer communities, succession planning, surge support staff, mentorship, and resilience-building activities.
Schenk KD, Lankau EW, Todd J, et al. (2023)	Recognition Solution (recruitment & retention focus)	Recommendations that may build capacity and institutional memory include: 1) requiring public health over medical credentials, 2) valuing transferable skills and experience, 3) reevaluating and removing experience requirements for entry-level positions and degree requirements as appropriate, 4) considering criteria for public health professionals to certify and recognize each other in the workforce.	DI certification may strengthen recognition of the unique, transferable skills and experience of the DI workforce. This certification should promote public health over medical credentials and result in a reevaluation that reduces the experience and educational requirements for entry-level positions.

Table 2.5i. Key findings by category (career advancement & mobility, micro (relational)-level) and certification benefit, barrier, or solution type.

Authors/Publication Year	Type	Micro (relational)-level Category: Knowledge, Skills & Abilities	Key Findings
Arrazola J, Israel M, and Binkin, N (2019)	Recognition Benefit	84% of states reported substantial to full capacity in Essential Public Health Services 1 (EPHS 1), monitoring health status, and 92% in EPHS 2, diagnosis and investigating health problems.	The DI workforce specializing in infectious disease epidemiology provides substantial/full capacity to monitor the health status of the service population and diagnose and investigate health problems, which are essential public health services.
McGinty MD, Binkin N, Arrazola J, et al. (2019)	Recognition Benefit	All (100%) of BCHC respondents reported adequate capacity to conduct four core essential services (EPHS 1 through 4) in their infectious disease program areas.	The DI workforce specializing in infectious disease epidemiology provides substantial/full capacity to monitor the health status of the service population, diagnose and investigate health problems, inform and educate the service population, support and strengthen community partnerships, which are essential public health services.
Arrazola, J and Auer, S (2022)	Recognition Benefit	Some 75% of jurisdictions reported substantial to full capacity in Essential Public Health Services 1 (EPHS 1), monitoring health status, and 88% in EPHS 2, diagnosis and investigating health problems; substantial to full capacity was highest for infectious diseases (88%).	The DI workforce specializing in infectious disease epidemiology provides substantial/full capacity to monitor the health status of the service population and diagnose and investigate health problems, which are essential public health services.
Council of State and Territorial Epidemiologists (2024)	Recognition Benefit	"In 2024, the percentage of states and DC with substantial to full capacity for Essential Public Health Services 1 (EPHS 1) increased to 84% from 76% in 2021, The percentage of states and DS with substantial to full capacity in EPHS 2, diagnosis and investigating health problems, was 90%. This is an increase from 88% in 2021."	The DI workforce specializing in infectious disease epidemiology provides substantial/full capacity to monitor the health status of the service population and diagnose and investigate health problems, which are essential public health services.
Auer S, Simmons A, Arrazola, J et al. (2024)	Recognition Benefit	Some 94% of BCHC departments reported full capacity in Essential Public Health Services 1 (EPHS 1), monitoring health status, and 89% in EPHS 2, diagnosis, and investigating health problems.	The DI workforce specializing in infectious disease epidemiology provides substantial/full capacity to monitor the health status of the service population and diagnose and investigate health problems, which are essential public health services.
Madsen ER, Schaffer K, Bork RH, et al. (2024)	KSA Benefit	Technical/practical skills theme: " Working on COVID-19 teams has been exceptional in broadening my understanding of communicable disease services and the meticulous dedication to detail by those who work in this field".	Those in the DI workforce recognize the workforce's dedication to detail in providing communicable disease services through technical and practical skills application.
Bachmann LH, and Kerani RP (2023)	Service Benefit	"DIS are often trained to perform phlebotomy and collect specimens for laboratory testing. In some jurisdictions, DIS are allowed to perform CLIA-waived point-of-care testing in the field. For example, Denver Health DIS performs rapid hepatitis C antibody and point-of-care syphilis testing. The skills that DIS develops in conducting investigations, eliciting partners, ensuring partner testing and treatment, and working with people from marginalized populations are invaluable."	The clinical skills of certain DI workforce members, including specimen collection, phlebotomy, and performing CLIA-waived point of care testing in the field, in addition to working with marginalized populations, conducting investigations, and identifying, testing, and treating partners/contacts, are critical to the engagement, retention, and adherence of the service population.
Chung C, Fischer LS, O'Connor A, et al. (2017)	Service Benefit	"By having a wider variety of experiences compared with more specialized epidemiologists, FEs can apply the skills and knowledge they gain to other programs more quickly and efficiently, when necessary, which is important when there is turnover or an urgent need for surge capacity.	A DI workforce with a wider variety of experiences can more quickly and effectively apply their skills and knowledge, which is important when there is turnover or a need for surge capacity.
Summer L (2019)	Recognition Benefit	From 2014 to 2018, self-rated competencies for eight domains increased but remained average, ranging from 2.65 to 3.33 on a four-point scale.	The DI workforce consistently demonstrates confidence in its competency in most essential public health services (8 out of 10).
Schenk KD, Lankau EW, Todd J, et al. (2023)	Recognition Barrier	Lack of career mobility, salary, and skills consolidation are also challenges for the public health workforce.	Skills consolidation, which includes the retention and reinforcement of skills, is a challenge the DI workforce may face.
Fischbach L, Smith LV, King J, et al. (2024)	Training Solution (Training Focus)	A total of 109 participants (82%) indicated that the practice- and problem-based Grand Rounds learning improved their job performance, and 118 indicated that it improved their understanding of outbreak management/epidemiology.	Practice and problem-based Grand Rounds training may improve the DI workforce's job performance and understanding of outbreak management and epidemiology.
Kiernan B, Alonis A, Diala JA, et al. (2022)	Training Solution (Training Focus)	In the virtual training academy, among participants who completed pre- and post-training surveys, a significant difference was noted pre- and post-training in both knowledge ($P<0.001$) and self-perceived confidence level ($P<0.001$). 45% of field survey respondents reported being deployed as School Specialists; their skill was maintained or increased slightly. Trainees indicated case investigation/contact tracing as having the lowest need for additional training, while outbreak management was reported as the area needing the highest additional skill practice.	Online, virtual training may help the DI workforce's confidence in applying and retaining case investigation, contact tracing, and outbreak management skills.

Table 2.5j. Key findings by category (knowledge, skills & abilities, micro (relational)-level) and certification benefit, barrier, or solution type.

Level	Sub-Level	Category	Benefits	Barriers	Solutions
Macro (structural)-Level *Broader factors that include policies and norms in communities, organizations, and institutions*	**Organization** *Agencies or institutions providing public health services*	**Professional Standardization** *Policies or practices that standardize the PH-DI workforce*	**Recognition:** Graduate-level degrees are preferred, especially at the local level. This may help support a large PH-DI workforce and the lead positions needed for this workforce. This workforce serves as the frontline for infectious disease response, with titles ranging from communicable disease investigator to epidemiologist to public health nurse. **Service:** Quality and timely PH-DI, including disease investigation, building community trust, professional networking, education, and facilitating adjacent services to the public, is needed to address morbidity and mortality. **KSA:** The knowledge and skills required for PH-DI can be obtained through foundational and advanced competencies.	**Service:** PH agencies face critical issues in recruiting and retaining the PH-DI workforce. If there is a need to expand PH-DI programs and the workforce, PH agencies may face challenges, including providing structured protocols and clearly defined job functions and determining how to balance the priorities and needs of PH-DI. **Training:** The core curriculum in schools of public health at the bachelor's and master's levels lacks alignment with PH-DI job tasks and competencies despite the meaningful PH impact of infectious diseases, such as STIs, and the use of these programs by the PH-DI workforce as resources for career advancement.	**Recognition:** Establishing PH-DI applied competencies, promoting their visibility through integration in educational curriculum, and skills application through academic and HD partnerships is critical. **Service:** Expansion of the workforce can be facilitated through public-private partnerships that focus on logistical and regulatory barriers.
		Policy & Funding Support *Policy development or refinement, and funding mechanisms that support the PH-DI workforce*	**Recognition:** PH-DI positions may be more likely to be retained when short-term funding initiatives end.	**Service:** While local sources largely fund PH-DI activities and personnel, a significant portion is still funded by federal and state sources that are often time-limited; this unpredictable and unstable funding for the PH-DI workforce impacts the workforce's salary increase potential, perceptions of job security, job satisfaction, morale, and retention, which ultimately affects the public's health outcomes.	**Service:** Policies that promote student loan repayment or debt reduction programs and block grants for public service may result in more consistent funding streams. This can lead to stability in the PH-DI workforce's financial outlook and a proactive versus reactive response, fostering community trust and collaboration.
Level	Sub-Level	Category	Benefits	Barriers	**Solutions**
Macro (structural)-Level *Broader factors that include policies and norms in communities, organizations, and institutions*	**Service Population** *Population served by organizations providing public health services*	**Public Outreach & Outcomes** *Policies or practices focused on outreach to the service population and/ or affecting their health outcomes*	**Service:** Linking and expanding the PH-DI workforce that is reflective of the service population to clinical care (preventative care referrals, field delivery of interventions), healthcare systems (hospitals, ambulatory clinics, long-term care, dialysis centers, jail medical services, and psychiatric facilities), and communities can result in increased reporting of notifiable conditions, decreased outbreaks, and increased quality and timeliness of case patient outreach/investigation. This can also generate insights into training priorities and expand community outreach efforts.	**Service:** The PH-DI workforce faces challenges in rapidly and effectively recruiting and training a diverse workforce that can balance the ongoing need to build critical rapport and relationships with case patients while managing a large caseload, interpreting and implementing state public health guidance, and helping build and deliver a unified message to communities, ultimately affecting health outcomes. **KSA:** The PH-DI workforce scope of activities depends on local jurisdiction regulations, such as licensing requirements for the administration of vaccines.	None were identified directly from the literature.
		Service Capacity & Continuity *Policies or practices that affect the capacity and continuity of services provided to the service population by the PH-DI workforce*	**Service:** Epidemiologists focusing on PH-DI at state level and in large metropolitan areas comprise a large proportion of the workforce, which supports PH-DI programs and services.	**Service:** Despite the growing need for the PH-DI workforce, particularly infectious disease epidemiologists and DIS, there has been a decrease in positions and open vacancies. **Training:** The PH-DI workforce gap creates a need to rapidly prepare a workforce that currently has limited experience in PH-DI so that this workforce can fill the gaps during emergencies.	**Service:** PH agencies rely on standard operating procedures, internal training, professional development opportunities, and preceptorship or practicum programs to maintain the institutional knowledge needed for PH-DI, which can otherwise be lost as a result of staff turnover.

Table 2.6a. Synthesis of findings by level (macro (structural)-level), sub-level (organization and service population), and category.

Level	Sub-Level	Category	Benefits	Barriers	Solutions
Micro (relational)-Level *Personal factors and interpersonal relationships among individuals and their representative communities, organizations, and institutions*	**Organization** *Agencies or institutions providing public health services*	**Employer Support & Appreciation** *Support and/or appreciation by an employer of the PH-DI workforce and other practices demonstrating the employer's valuation of the PH-DI workforce*	**Service:** Being part of work critical to the public's health and learning opportunities as part of a PH-DI team may provide a positive experience for the PH-DI workforce, compensating for a stressful event or environment.	**Service:** PH-DI workforce low morale, burnout, feeling uninspired, stress, and mental health issues may result from public harassment, lack of support from elected leaders, long work hours from heavy caseloads, toxic and dysfunctional workplaces with "turf issues," and the need for rapid training when responding to PH-DI emergencies and needs. The need to provide PH-DI services may prevent PH agencies from supporting the PH-DI workforce. This may lead to attrition. Filling the workforce gaps caused by this attrition may be affected by salary ranges, human resource department capacity, and insufficient onboarding practices.	**Service:** Several strategies for retaining the PH-DI workforce are needed to meet PH-DI needs and to maintain continuity. These include compensation, counseling benefits, vacation days, recognition (public and private) by employers of the value of PH-DI work, mentoring, coaching, promotion of task diversity, providing professional development and training, nurturing job interest and fulfillment, remote work options, promoting work-life balance while addressing the psychological trauma of PH-DI work, and promoting meaningful work relationships.
	Organization *Agencies or institutions providing public health services*	**Training & Professional Development** *Training and professional development practices by the employer for the PH-DI workforce*	**KSA:** PH-DI workforce responsibilities may be broadened to incorporate treatment and prevention services for a larger range of infectious diseases. **Training:** The PH-DI workforce can be rapidly expanded and trained to effectively and efficiently provide PH-DI services, such as outbreak management, in various settings. **Service:** A PH-DI workforce can be prepared from a workforce with little-to-no PH experience to meet PH-DI emergency needs.	**Service:** The PH-DI workforce may face challenges adapting and responding to new technologies, data systems, software, and emerging threats. This may be exacerbated by PH agencies' limitations in developing and implementing training.	**KSA:** Using asynchronous, knowledge-based, training that is sufficiently flexible to adapt to jurisdiction-specific needs should focus on skills that are easily transferrable across diseases such as providing guidance, social support referral, interviewing skills, discussing sensitive topics, outbreak detection, surveillance, and database management and analysis. This can address limitations that may exist in training the PH-DI workforce across multiple diseases. **Service:** Professional development, including career guidance and mentoring may help retain the PH-DI workforce; recruitment for entry-level positions from a student population may be enhanced through scholarships, mentoring, exposing students to PH-DI practice, and skills-based interviewing. **Training:** Training that is supported through on-the-job training and a PH-DI workforce community can help the emerging PH-DI workforce to develop critical, experience-based skills such as safe field practices, cultural competency, and having difficult conversations in a situational work environment.

Table 2.6b. Synthesis of findings by level (micro (relational)-level), sub-level (organization), and category.

Level	Sub-Level	Category	Benefits	Barriers	Solutions
Micro (relational)-Level *Personal factors and interpersonal relationships among individuals and their representative communities, organizations, and institutions*	**Workforce** *Individuals or groups of individuals working in organizations providing public health services*	**Knowledge, Skills, Abilities** *Individual knowledge, skills, and abilities of the PH-DI workforce*	**KSA:** Those in the PH-DI workforce recognize the workforce's dedication to detail in providing communicable disease services through technical and practical skills application. **Recognition:** The PH-DI workforce specializing in infectious disease epidemiology has substantial/full capacity and confidence in the ability to monitor the health status of the service population, to diagnose and investigate health problems, to inform and educate the service population, and to support and strengthen community partnerships, which are essential public health services. **Service:** A PH-DI workforce with a wider variety of experiences, including clinical skills, can more quickly and effectively apply skills and knowledge, which is important whenever there is staff turnover or a need for surge capacity.	**Recognition:** Skills consolidation, which includes the retention and reinforcement of skills, is a challenge the PH-DI workforce may face.	**Training:** Online, virtual practice, and problem-based, Grand Rounds training may improve the PH-DI workforce's understanding, retention, and confidence in applying their skills in case investigation, contact tracing, and outbreak management.

Table 2.6d. Synthesis of findings by level (micro (relational)-level), sub-level (service population and workforce), and category.

APPENDIX 3

Job Classification Scan Methodology

Inclusion and Exclusion Criteria

Inclusion

The job scan included DI professionals providing services in the US. DI professionals consisted of positions in which job titles and descriptions encompassed the public health workforce focused on preventing the spread of infectious diseases at the community level through activities as defined by ASPPH: "…person-centered interviews, collection of enhanced surveillance and community assessment data, partner services to include contact tracing, field investigation, directly observed therapy, field specimen collection, field investigation in outbreaks and emergency preparedness, community outreach, collaboration with medical providers, and navigation of healthcare systems to ensure evaluation and treatment of people diagnosed with or potentially exposed to infectious disease." This also encompasses the work experience eligibility criteria for the CDI certification.

Postings included those accessible through publicly accessible and professional organizations' websites.

Positions included those listed in the previous 30 days from the search date, as well as position statements with any date indicating positions not posted for immediate employment, but rather job descriptions for future employment opportunities. Positions listed as full-time (40 hours per week) were included.

Organizations included those that provide services focusing on preventing and controlling the spread of infectious diseases at the community level. These include governmental agencies, non-profit organizations, academic institutions, and health organizations.

Exclusion

Incomplete or outdated postings (dated more than 30 days prior to the search date) were excluded.
Postings for infection preventionists or infection control in healthcare settings or other settings focused on direct patient care were excluded, as a specific certification exists for this workforce. Any posting that does not focus on public or community health but instead emphasizes direct patient care (e.g., community health nurse, nurse practitioner, physician) or veterinary care was excluded.
Positions focusing on environmental health (e.g., sanitarians, vector control) and laboratory science (e.g., micro (relational)biologists, laboratory technicians) will be excluded. Positions focusing on data analysis (e.g., surveillance data analyst, informatician). were excluded. Specific certifications exist for these professions.

Any public health workforce focused on conditions, diseases, and injuries unrelated to infectious disease prevention and control (e.g., chronic disease or non-communicable disease workforce) was also excluded.

Senior administrative or management positions with descriptions that exclusively involve management or administrative work, and not the application of DI, were excluded.
Postings related to and from agencies outside the US were excluded, as were positions listed as temporary,

seasonal, internships, or volunteer opportunities.

Search Terms and Strategy

Search Terms

Searches included:

- Infectious disease intervention
- Infectious disease prevention
- Infectious disease epidemiology

Search terms were removed and added based on the results generated. Additionally, Recurring position titles that fit the inclusion criteria were added to the search terms and documented.

Search Strategy

First, a primary search was conducted on major job boards, including those commonly used for posting public sector positions and professional organization job boards. Filters were used to apply the inclusion and exclusion criteria as applicable. If more than 100 positions were identified, review and inclusion of the first 100 postings was completed.

Secondly, the geographic locations of identified positions were reviewed; for any states with fewer than five postings, state, local, regional, and district websites were examined to find additional postings.

Data Sources

Data sources included major job boards and health department websites.

Job Boards

- https://www.governmentjobs.com/: Managed and operated by NEOGOV, specializing in public sector job postings.
- https://www.apha.org/professional-development/public-health-careermart: Hosted by the American Public Health Association.
- https://publichealthjobs.aspph.org/: Managed by the Association of Schools & Programs of Public Health.
- https://jobs.cste.org/: Managed by the Council of State and Territorial Epidemiologists.
- https://cdc.usajobs.gov/: An official website by the US government.
- https://careers.naccho.org/jobs: Managed by the National Association of County and City Health Officials.

Health Departments

State, tribal, regional, district, and local health departments' websites were located through the following websites:

- USA.gov: https://www.usa.gov/state-health
- The Centers for Disease Control and Prevention: https://www.cdc.gov/public-health-gateway/php/communications-resources/health-department-directories.html
- National Association of County and City Health Officials: https://www.naccho.org/membership/lhd-directory

Data Collection

Tool

Data was collected using Microsoft Access, a relational database. The database contains tables and forms to collect data on three key aspects: 1) the agency posting the position, 2) the service location of the position, and 3) position details. As the database is relational, positions from multiple agencies and positions serving the same population (i.e., positions with the same service locations) did not require duplicate entries.

Diversity and Social Vulnerability Indices

The Diversity Index of the position posting state and service county, as well as the Social Vulnerability Index (SVI) of the position posting service county, were collected. For state-level positions, the county location of the state health department was used as the basis for determining the Diversity Index and SVI. As assigned by the U.S. Census Bureau, the Diversity Index is a value between 0 and 1 that indicates the probability that two individuals selected at random will belong to different ethnic and racial identities. The greater the value, the higher the likelihood that random individuals will be from different racial and ethnic groups.[52] The SVI, based on 16 US Census variables grouped into four themes (socioeconomic status, household characteristics, racial and ethnic minority status, and housing type and transportation), provides public health preparedness insights into a population's vulnerability to natural or human-caused disasters.[53] Ranging from 0 to 1, a higher index value indicates a greater vulnerability to these hazards.

Diversity Index was categorized into five groups based on the following ranges:[52] 0.00 to 0.349, very low; 0.350 to 0.449, low; 0.450 to 0.549, low-medium; 0.550 to 0.649, medium-high; and 0.650 and above, high. SVI was categorized into four groups based on the following ranges:[53] 0.00 to 0.249, low; 0.250 to 0.499, low-medium; 0.50 to 0.7499, medium-high; and 0.75 and above, high.

Experience Level

Positions were categorized based on work experience and supervisory positions requirements as follows: entry-level, zero-two years' experience, entry-level; three-seven years' experience, mid-level; three-seven years' experience and supervisor role, mid-level supervisor; eight or more years' experience, senior-level; and eight or more years' experience and supervisor role, senior-level supervisor.

Documentation

An Excel spreadsheet was used to log search queries. The log contained the following fields: search date, personnel name, search source, query, filters and sort applied, search criteria applied (checkbox), number of results, number included, and position titles or terms for additional searches.

To ensure no duplicate entries, the position ID and Agency ID were logged and checked before creating a new agency form entry.

APPENDIX 4

Listening Session Methodology

Listening Session Recruitment and Engagement

The listening sessions were conducted through engagement and recruitment with seven organizations with members or employees affiliated with public health disease intervention activities. The sessions included public health disease intervention professionals, their employers, and others interested in establishing a highly qualified and competent disease intervention workforce. Engagement and recruitment of the seven organizations occurred from May 1 through July 9, 2025. Listening sessions were held in collaboration with the following organizations and dates:

- Texas Public Health Association (May 14, 2025)
- Council of State and Territorial Epidemiologists. (June 11, 2025)
- Association for Professionals in Infection Control and Epidemiology, Dallas-Fort Worth Chapter (June 27, 2025)
- Tarrant County Public Health (June 30, 2025)
- Denton County Public Health (July 2, 2025)
- Dallas County Public Health (July 8, 2025)
- Seattle/King County Public Health (July 8, 2025)

Engagement and outreach efforts included customized flyers and email scripts for each entity. The engagement and recruitment process included the following:

1. An initial email was sent to a member of the organization's leadership or an individual whose job description includes membership, employee outreach, and engagement. The email was customized based on the sender's role and whether they had an existing relationship with the recipient. If the sender was not a member of the University of North Texas Health Science Center(UNTHSC) team, the recipient should direct future communication to the UNTHSC team via the project email address (DICertification@unthsc.edu).

2. Direct participant recruitment occurred through several mechanisms, including:

    A. On-site recruitment at an existing gathering: An organization's representative assisted our team in aligning a listening session with an existing meeting or gathering. In this instance, the represen-

tative sent out a flyer developed by the UNTHSC team or an email.

B. **Referring employees/members to the project team:** For this option, the organizational representative invited employees/members to contact the UNTHSC team. This was done via email, social media, in person, or other announcements.

C. **Receiving a list of emails of potential listening session participants from the organization**: In this scenario, the UNTHSC team reached out to the list with a pre-approved script.

Listening Session Process

Roles

Dr. Emily Spence primarily facilitated the listening sessions. However, Dr. Wagner and Dr. Cervantes were also trained to serve as primary facilitators. The virtual or in-person sessions were recorded using videoconferencing technology such as Zoom or Microsoft Teams. This allowed for consistency, ease of recording, and automatic transcription. The recordings were deleted at confirmation of successful transcription, within 30 days of recording.

Facilitators welcomed participants, explained the purpose and process of the sessions, asked questions, and generated appropriate follow-up probing questions. They managed the dynamics of the group, including eliciting participation from those who are minimally responsive, redirecting conversation, and minimizing excessive responses.

Graduate research assistants provided technical assistance during virtual sessions, coordinating pre-session communications with participants, managing the chat, and taking additional notes to augment the recordings.

Task List

Position	Tasks
Lead Facilitator	Lead: • Approve the invitation list. Facilitator: • Welcome Participants and orient all to the process and expectations.
2nd Facilitator (optional)	Facilitator: • Welcome Participant. • Support the lead facilitator in implementing the guide and managing the discussion. Assist with managing the chat.
Graduate Assistants / Technical assistants	• Send invitations and track responses. Provide participants with a detailed confirmation and instructions for their listening session. Send reminder email(s). • Provide technical assistance with Zoom, including troubleshooting technology issues and managing the chat. • Take notes, annotating who says what and any thoughts that come to mind during the listening session.

Listening Session Design

Seven listening sessions, with no more than 20 participants per session, were held. The preferred size is between five and 10 participants, but we often recruited up to 25 since not everyone invited was expected to attend and participate. Sessions lasted approximately 60 minutes and were facilitated in person or online.

Basic consent procedures were used to ensure that participants were aware of the purpose, voluntary nature, risks, and benefits, as well as the processes expected during the session, including the audio recording of sessions and procedures for transcription, de-identification, and aggregation of results. The facilitator led the listening session using the script below to conduct semi-structured interviews. A secondary facilitator was asked for additional probing questions to help illuminate responses and provide further context to other sources of project data, such as the scoping review and job analysis.

The graduate assistants offered technical assistance, managed the chat, took notes, and arranged to distribute the incentives. At the end of the listening session, the facilitator thanked the participants for their time, answered any additional questions, and provided further information (as needed) about the incentive.

Sample Script and Questions

Introduction
Hello, my name is [insert name] and I am a [describe position role] at the University of North Texas Health Science Center. We are conducting listening sessions to help develop a framework that supports and sustains national certification of the public health disease intervention workforce. As part of this project, we examine the benefits of disease intervention certification, identifying barriers to initiating and maintaining certification, and exploring solutions to address these barriers. As a point of clarification, we are talking about the workforce that engages, investigates, and intervenes in instances of infectious transmissible diseases. Sexually transmitted infections and COVID are common examples. We are not referring to the workforce that intervenes in chronic diseases, such as diabetes.

This project is supported by Cooperative Agreement CK20-2003 from the Centers for Disease Control and Prevention (CDC) through an award to the Association of Schools and Programs of Public Health (ASPPH). The contents of this listening session do not necessarily represent the official views of the CDC and ASPPH.

This listening session is not part of a research study, but we will be recording and transcribing the discussion. Your identifying information will be removed from those transcriptions, and we will destroy the recordings. The summarized results will be combined with the results of a scoping review and job analysis to create a model framework for a sustained program of national disease intervention certification.

Following this session, we will offer you a $50 electronic gift card in compensation for your time and willingness to share your expertise. You may wish to provide a personal email address to receive the gift card, or you may wish not to accept it; however, we are not able to transfer it to another person or entity. I want you to know that we see you as the expert on your experiences. We truly value your knowledge, your opinions, and your suggestions. I hope that you will feel comfortable giving me your authentic and genuine answers.

During the session, I will sometimes pose questions to the whole group and allow whoever wants to respond to speak up. Other times, I might go around the room and ask each person to respond to a question. You are always welcome to say "pass" and should not feel obligated to answer a question that makes you uncomfortable. The nice thing about a listening session is that sometimes one person's comment may trigger an idea for another person. You are welcome to speak up and say that you agree or disagree with a comment that someone else has made. There are no wrong or right answers here today. We want to know your thoughts and opinions, and we believe they are all "right" because they are yours. If you feel shy about jumping in with an answer but do have a thought you would like to share, I encourage you to raise your hand so that I know you have something to say. [In virtual groups, you may also utilize the chat function]. I will be recording the session today so that I can make

sure I have an accurate record of your answers. Since the audio recording will not capture silent communication, like nodding your head yes or no, we ask you to provide a verbal response. Does anyone have any questions or concerns before we get started? Okay, let's begin.

Topic: Introductions
1) Please introduce yourself and tell us about the roles you have held related to public health disease intervention. How long have you been involved with the public health disease intervention workforce? Have you supervised employees who perform public health disease intervention?

Topic: Perceived benefits and motivators
What might individuals gain by becoming certified in disease intervention? How could it be helpful for their career? How might it impact their ability to perform their job? How might it be helpful for organizations that employ the public health disease intervention workforce? What benefits do you see for community members? If the disease intervention certification were launched today and five years from now, a new pandemic had been initiated, what, if any, difference would it make to have a certified workforce?

Topic: Barriers
Current workforce: Imagine you have just been told you have to obtain disease intervention certification within the next 90 days. What are your first thoughts about things that might get in your way or concerns you have?
Current employers: Imagine your organization has just been informed that all disease intervention employees must become certified within the next six months. What potential barriers to accomplishing this come to your mind? In what ways might you need to support your employees to take and pass the exam?

Topic: Workforce solutions
We talked about some pros and cons of obtaining certification in disease intervention (briefly summarize the pros (benefits) and cons (barriers). First, is there anything we've missed or not considered?

Next, we want to explore ways to promote getting and maintaining certification. What kinds of things will motivate a current member of the DI workforce to take the exam and become certified? Are there particular incentives that are important? What might motivate employers to hire employees who hold a certification in disease intervention? Or to support their current employees to become certified?

Let's think about current training programs that might align with a certification in disease intervention.
What might be the pros and cons of marketing the certification to current Community Health workers?
What are the pros and cons of offering it as part of a community college degree program? What are the pros and cons of offering it as a high school program?

Is there anything else you would like to share with us about how we can support the initiation and maintenance of a disease intervention certification?

APPENDIX 5

Qualitative Data Analysis

Overview

A qualitative analysis was conducted using transcripts from seven listening sessions with public health DI practitioners and supervisors. The purpose of these sessions was to examine perceived benefits, barriers, and solutions associated with a national certification program and to identify practical measures that would support its uptake and long-term sustainability.

Transcription and Quality Review

Sessions were conducted in person or virtually and were audio-recorded with participant consent. Recordings were transcribed via Microsoft Teams or Zoom. Each transcript underwent a two-tiered quality review. The Graduate Research Assistant (GRA) who attended the session served as the primary reviewer, listening to the audio while reviewing the transcript to correct errors and clarify any unclear passages. The secondary reviewer repeated the process, assessing the primary edits and making additional changes as needed. Reviewer roles were rotated across sessions to reduce bias and maintain consistency.

Coding Process

To promote inter-coder reliability, the first full transcript was coded independently by two coders, then compared and reconciled. The remaining transcripts were coded by one coder, then combined into a master data set of all transcripts and reconciled between the two coders and a supervisor.

For each listening session, the transcript's primary reviewer also conducted the first round of open coding (i.e., line-by-line coding), which involved segmenting the text into sections representing distinct ideas and generating open codes to most closely capture the meaning of the passage. Microsoft Excel was used for coding and segmenting, with each row representing a segmented idea/narrative line of text, and columns representing prompts and layers of codes. For the initial listening session, both sets were open, and axial codes were compared; the most relevant codes were retained. Axial codes were used to categorize the open codes into two layers. The first layer (Axial code 1) represented the overall domains and constructs of interest, such as barriers and benefits. The second layer of axial codes represented the distinct groupings of ideas that fell under each domain and emerged from the content of the narrative text. Following the axial coding of all transcripts, pivot tables were used to further distill and refine the two layers of axial codes. This process occurred through collaboration among the coders and supervisor.

Theme Development

Themes emerged from the most frequent axial two codes in each Axial 1 domain. These were synthesized into overarching themes representing the most significant factors influencing certification uptake and sustainability and integrated into the final model and framework.

Coders

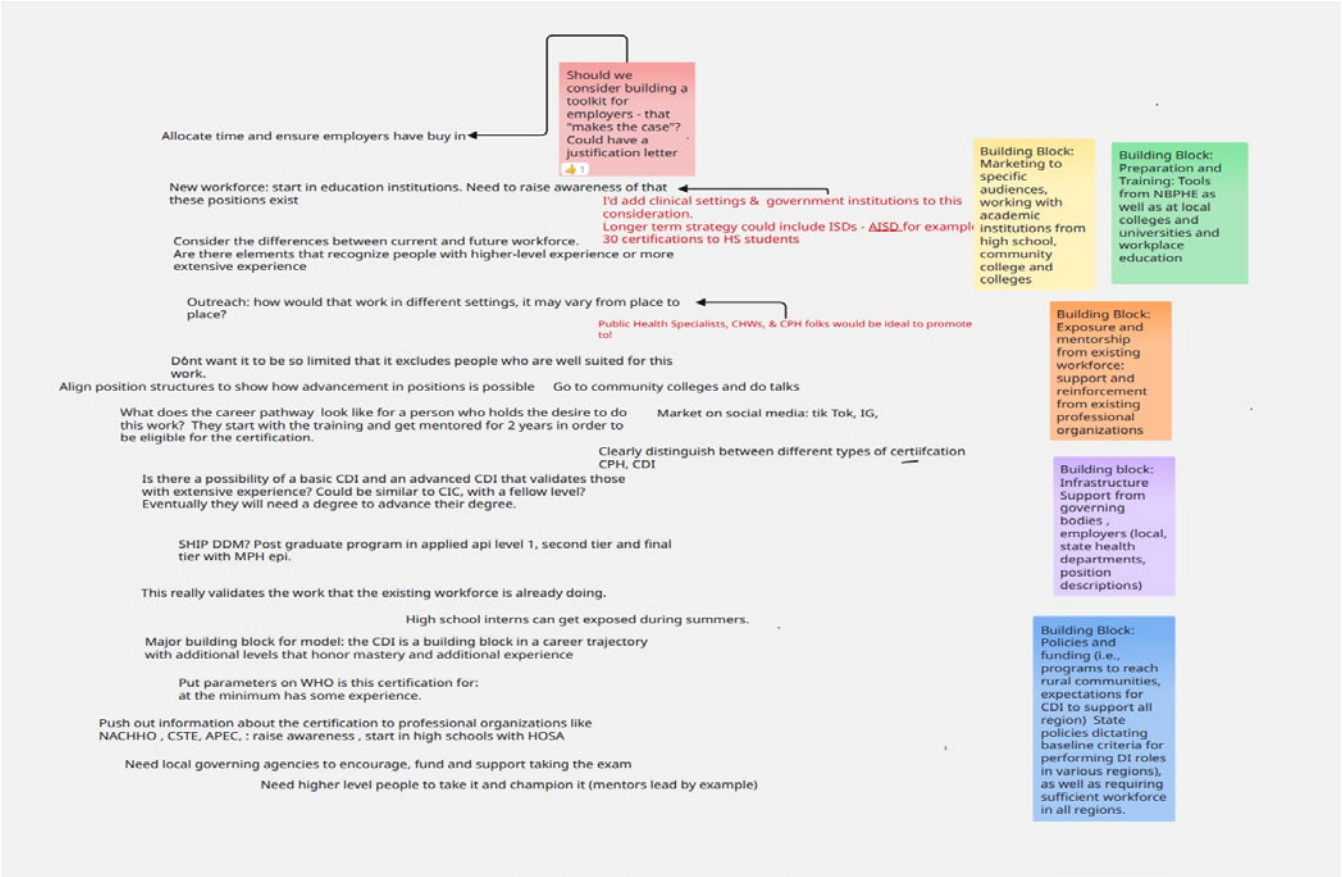
Darashagam served as the primary coder for five sessions (CSTE, APIC, Denton County, Tarrant County, and Dallas County) and as the secondary coder/reviewer for two sessions (TPHA and Seattle King). Litzy served as the primary coder for TPHA and Seattle King and as the secondary coder/reviewer for the remaining five sessions. Darashagam completed transcription and primary editing for CSTE, APIC, Denton County, and Dallas County. Litzy completed transcription and primary editing for TPHA, Seattle King, and Tarrant County.

APPENDIX 6

CAB Model and Framework Development

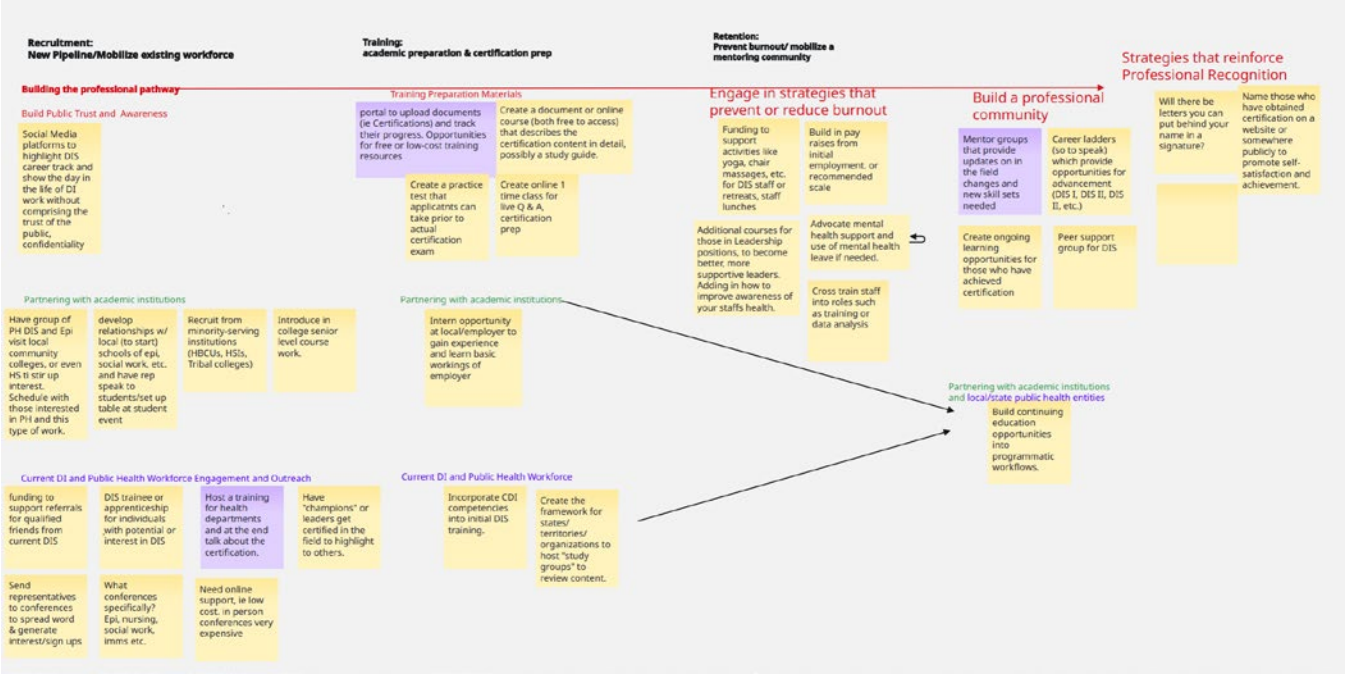
Meeting #1 Brainstorming

The image below shows the whiteboard used during Meeting #1 to develop the early model collaboratively. The brainstorming session surfaced themes that were later organized into building blocks.



Meeting #2 Brainstorming

The image below shows the whiteboard used during Meeting #2 to develop the early framework collaboratively. The brainstorming session surfaced major points that were later incorporated into framework elements.



Meeting #2 Model and Framework Draft

The model image below illustrates the model developed based on feedback from Meeting #1 and Feedback Form #1. This was presented, and minor updates were made from input received during CAB Meeting #2. The framework image below illustrates the framework developed by the facilitators based on feedback from Meeting #2. Feedback was solicited for both the model and framework shown below in Feedback Form #2.

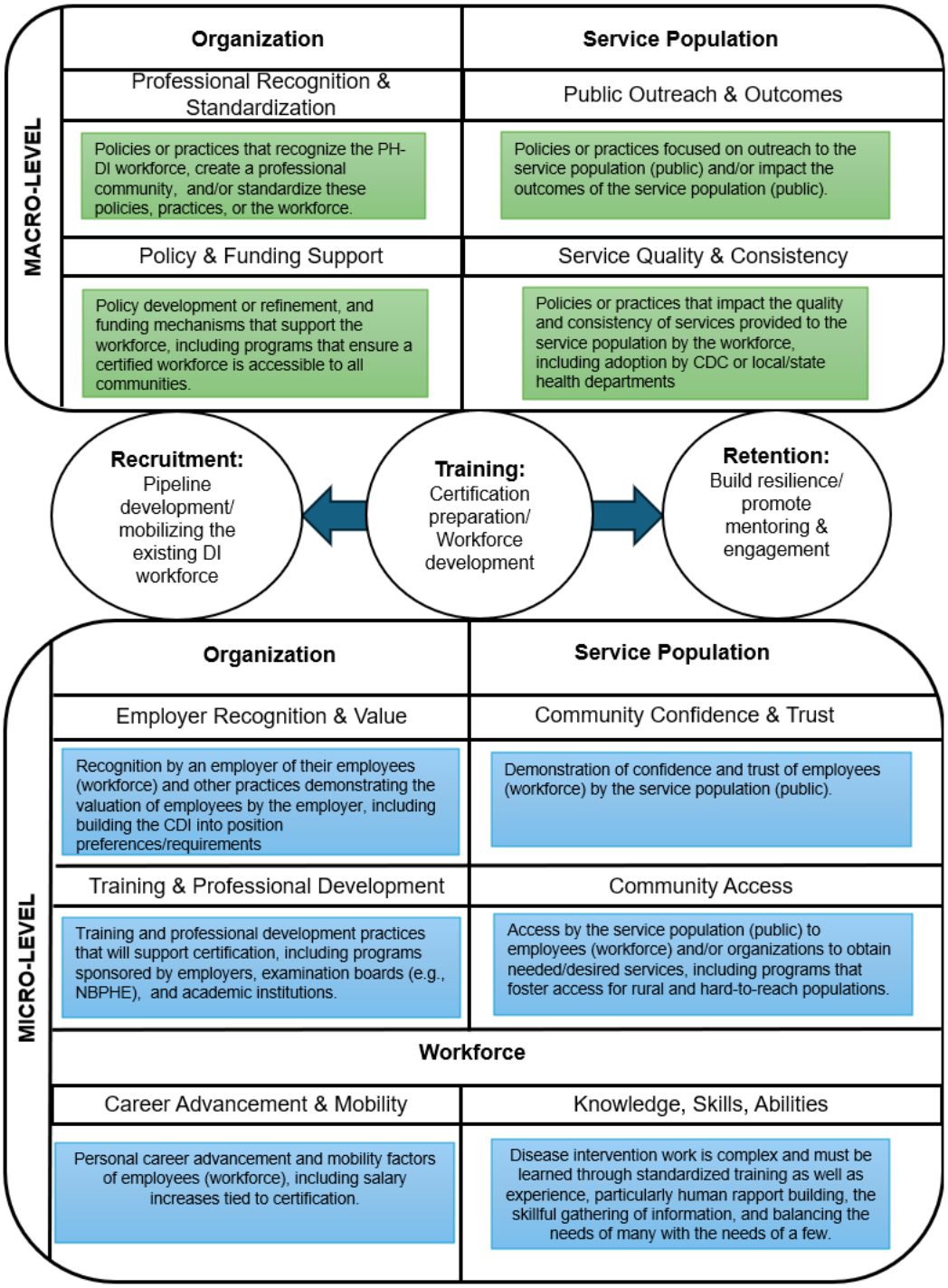


Table 6.1. Enhanced disease intervention and capacity model version 1.

Focus Areas	Recruitment	Training	Retention
Building a Professional Pathway	Promote awareness of the profession & build trust	Online certification platform with online & live training sessions, certification study guides, and document/CEU portal	Create a work culture that builds and highlights DI profession leaders (fellow status) through proactive strategies (e.g., peer support, advancement levels, interprofessional training)
Partnering with Academic Institutions	Integrate DI practice into a wide array of curricula /degree programs (e.g., public health, social work)	Provide internship and fellowship opportunities	Academic partners building continuing education opportunities considering the DI profession workflow
Current Workforce Engagement & Outreach	Champion certification through funding & learning opportunities (e.g., conference, apprenticeships, stipends)	Build a DI professional community of practice to support mentorship and foster ongoing learning based on both knowledge and applied practice, including basic disease intervention, rapport building, and resilience.	Leadership building continuing education opportunities into the programmatic workflow

Meeting #3 Final Model and Framework

The model and framework images below illustrate the final model and framework based on feedback from Meeting #2 and input from project consultants. These were presented in Meeting #3 and in Feedback Form #3.

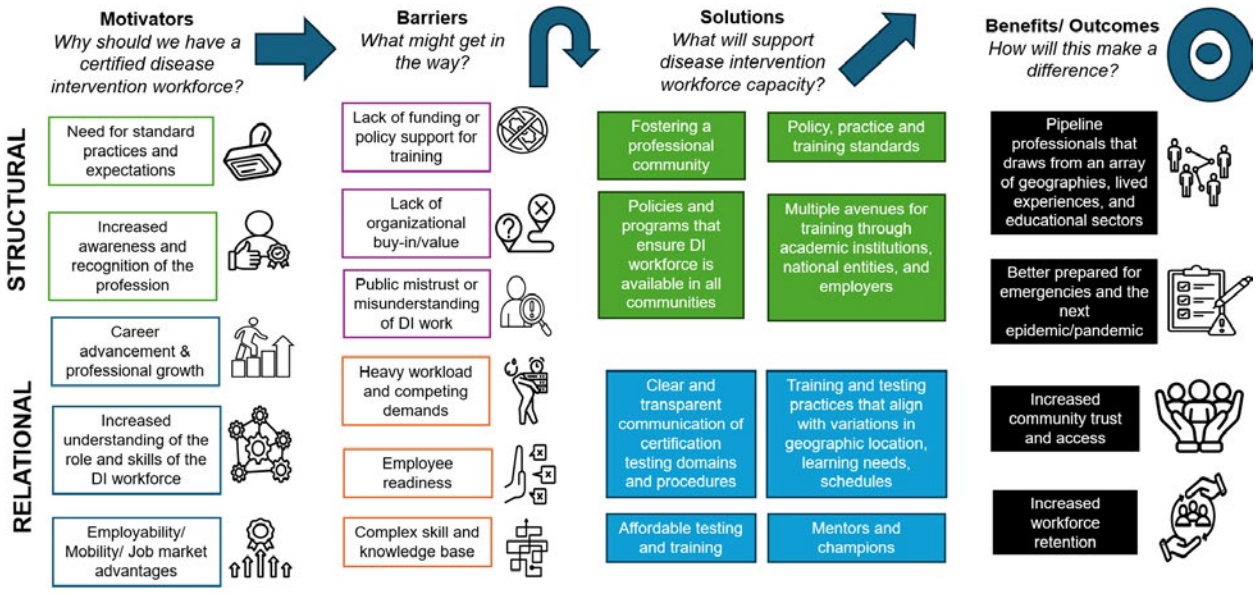


Figure 6.1. Enhanced disease intervention and capacity model final version

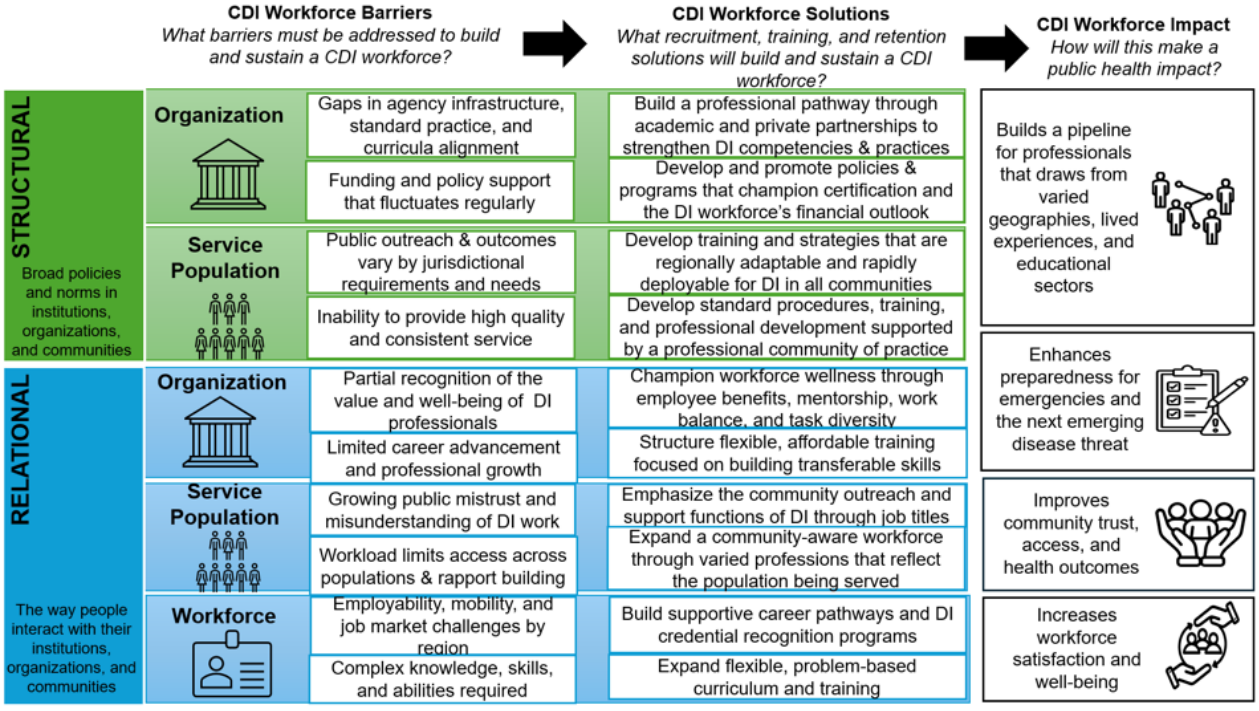


Figure 6.2. Enhanced disease intervention and capacity framework final version.