

The CDC/Council of State and Territorial Epidemiologists Applied Epidemiology Fellowship Program

Evaluation of the First 9 Years

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Background: The Council of State and Territorial Epidemiologists (CSTE) implemented the Applied Epidemiology Fellowship (AEF) in 2003 to train public health professionals in applied epidemiology and strengthen applied epidemiology capacity within public health institutions to address the identified challenges. The CSTE recently evaluated the outcomes of the fellowship across the last 9 years.

Purpose: To review the findings from the outcome evaluation of the first nine classes of AEF alumni with particular attention to how the fellowship affected alumni careers, mentors' careers, host site agency capacity, and competencies of the applied epidemiology workforce.

Methods: The mixed-methods evaluation used surveys and administrative data. Administrative data were gathered over the past 9 years and the surveys were collected in late 2013 and early 2014. Descriptive statistics and qualitative thematic analysis were conducted in early 2014 to examine the data from more than 130 alumni and 150 mentors.

Results: More than half the alumni (67%) indicated the fellowship was essential to their long-term career. In addition, 79% of the mentors indicated that participating in the fellowship had a positive impact on their career. Mentors also indicated significant impacts on host site capacity. A majority (88%) of alumni had worked for at least 1 year or more in government public health environments after the fellowship.

Conclusions: Evaluation findings support previous research indicating need for competency-based field-based training programs that include a strong mentoring component. These characteristics in a field-based training program can increase applied epidemiology capacity in various ways.

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Introduction

Developing a strong, competent workforce in the area of applied epidemiology has been a challenge recognized by the public health field for many years.^{1–6} Although previous assessments have found that the public health epidemiology workforce within state

and local agencies have proficiency in many of the core epidemiology competencies, there is a significant shortage in the necessary size of the workforce.^{3,7,8} Several reports point to the importance of additional training and mentoring to promote professional development and leadership among applied epidemiologists.^{2,5,8–13}

In response to this need for increased capacity within state and local public health agencies, the Council of State and Territorial Epidemiologists (CSTE) established the Applied Epidemiology Fellowship (AEF) in 2003 in collaboration with CDC and the Association of Schools and Programs of Public Health (ASPPH). The fellowship gives recent post-baccalaureate graduates advanced training opportunities and preparation for successful careers as epidemiologists at the state, territorial, local, and tribal

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(STLT) levels. The AEF¹⁴ focuses on three key elements: (1) creating and training a core group of public health workers; (2) strengthening capacity in applied epidemiology across public health institutions; and (3) providing service to host agencies.

Based on the impact of CDC's Epidemic Intelligence Service (EIS) program, the AEF program was developed with an emphasis on a similar competency-based mentorship structure.^{14–16} In addition to the EIS program, similar field epidemiology programs have demonstrated significant impact at the state level within the U.S.^{4,8,9,17,18} and other countries.^{12,19} Two key components that have been identified as crucial for successful field-based training programs are mentoring and a competency-based curriculum.^{2,5,7,8,10,11,13,18,19} Based on the information from the Epidemiology Capacity Assessments conducted by CSTE,^{3,4} more emphasis was needed to attract recent epidemiology graduates to fill the growing need for applied epidemiologists at the state and local level. The AEF focuses mainly on recent MPH graduates with a specific background in epidemiology and includes a greater emphasis on staying in STLT positions after program completion.^{14–16,20}

AEF fellows must have completed an accredited post-baccalaureate program in a public health–related field and at least three graduate-level epidemiology courses. From an initial pool of more than 500 applicants (per data for the past 3 years), reviews by CSTE and partner subject matter experts narrow the selection pool to a subgroup of approximately 40–50 applicants invited to interview for an opportunity to interview with host sites. During the 2-year AEF program, fellows fulfill a set of 28 competencies in epidemiologic methods and practice, communication, and public health law.^{14,21} The program provides flexibility by allowing fellows to concentrate on a subject area of interest. The host site provides two experienced mentors (who must have an advanced degree, formal epidemiology training, and preferably be a senior epidemiologist with the agency) who provide guidance and technical support for the fellow and design training opportunities at the agency. Additional training is provided by CSTE-supported professional development opportunities and program orientation. In the 9-year period between 2003 and 2011, the program has placed 235 fellows in 39 states, 15 local health departments, the Puerto Rico public health agency, the District of Columbia public health agency, and one tribal epidemiology center.¹⁴

An evaluation was conducted to develop a more thorough understanding of the impact of AEF, including how well the fellowship prepared alumni for applied epidemiology careers, how mentors and host sites were affected by the fellowship, and the impact of the fellowship

on national applied epidemiology capacity. Expectations for the evaluation are that it can improve AEF and provide insights into how to strengthen similar fellowships.

Methods

The evaluation of the AEF was designed to examine the impacts of the fellowship on fellow and mentor careers and does not include an analysis of the individual competencies. Drawing on evaluation approaches that emphasize utilizing existing data, minimizing data requests and intrusion on participants, and creating useful reports from the findings,^{22–24} the evaluation was designed to specifically address broad questions of impact while recognizing challenges inherent in gathering information from 9 years of alumni and mentors, such as maintaining contact records and memory effects. The evaluation employed a mixed-methods approach, including analyses of existing data regarding alumni employment history, geographic placement, host site applications, and two recently completed surveys of mentors and alumni about the impact of the fellowship.

Survey questions were developed on the basis of previous research on mentoring and field epidemiology training programs,^{12,13,25,26} which discuss the importance of professional networks, mentoring impacts on mentors and mentees, and professional development impacts of field-based training programs. The alumni survey included 16 questions about the impact of the fellowship on career outcomes, relationships with mentor and fellows, current employment, and publications. The mentor survey included 16 questions about the mentor experience, professional quality of the fellows, ongoing relationships with previous fellows, impact on the mentor's career, and overall impact on the host agency. To pilot test the surveys, each survey was reviewed by CSTE program staff and administrators using cognitive interviewing to ensure that the questions were interpreted as intended. Following the recommended survey processes from Dillman,²⁷ the initial e-mail invitation to the web-based survey was sent to all mentors and alumni in December 2013, followed by three reminders through January 2014.

In addition to the surveys, administrative data (i.e., employment and continuing education) collected annually by CSTE as part of the fellowship management process were analyzed. These data allowed for longitudinal analysis of alumni employment trends. The administrative data on host site applications and placement of fellows provided data for geographic analysis. CSTE staff collect this information on an ongoing basis to maintain communication records and documentation of fellow and alumni positions over time. It included material generated during the fellowship as well as self-submitted resume information, social media (e.g., LinkedIn) documentation, and internally developed geographic location databases for placement and employment history. All data analysis was conducted in early 2014.

When possible, multiple sources of data were examined addressing the same question of interest to provide validation and a more comprehensive, nuanced answer. This approach allowed triangulation of data to confirm findings by examining the same question using multiple data sources.^{22–24}

Basic descriptive statistics were calculated for all relevant variables. When appropriate, variations by fellowship class were examined using chi-square analysis. Qualitative data were analyzed via theme analysis, using multiple independent coders.

Coders used a CSTE-provided coding scheme, and their responses were compared to ensure a minimum 75% agreement rate.

The evaluation received an exempt status from an external IRB (Solutions IRB, Inc., Little Rock AR).

Results

Alumni and mentors from nine classes (2003–2011) were included in the evaluation. The alumni survey was sent to all 163 alumni; administrative data were also available for these 163 alumni. The survey had an overall response rate of 90% (N=146). By class, response rates ranged from 67% (2003) to 100% (2006 and 2007). Based on administrative data analysis, 92% (n=142 of 163 fellows) held an MS, MPH, or MSPH; 8% held a PhD, MD, or DVM; and 74% were women (120 of 163). CSTE did not collect race or age information for alumni; however, fellows entering the fellowship are within 3–5 years of graduate program completion.

It was not possible to conduct comparisons of outcomes between the different degree levels because of the small number of alumni with doctoral degrees. Comparative analysis also showed no statistically significant differences between fellows who had been placed in state locations compared to local or tribal locations. There were a few differences among classes, which are discussed below.

The mentor survey was sent to 258 mentors. There was a 61% response rate (n=156). Over the nine classes, the average number of fellows mentored was 2 (range=1–8).

Almost all (97%) alumni (n=142) reported that the fellowship had an impact on their long-term career. The majority (67%) indicated the fellowship was “essential,” and 30% indicated a “fair amount” of long-term career impact. In all but one class (2006), the majority of respondents felt that the fellowship experience was “essential” to their long-term career (Table 1).

Specific cited career impacts were mostly related to employability and career success, including providing “experiences necessary to excel in [the] field” (25%) and helping fellows obtain their current job (20%) (Table 2).

Quotes taken from the survey underscore the program’s impact on alumni careers:

This fellowship has been vital to my career. [...] I developed working relationships with many public health professionals.

Having the applied epi experience is very important [...] grounded me in the importance of epidemiology in directly impacting public health.

The fellowship confirmed for me that I would like to work at the state/local health department level for the rest of my career.

Nearly all mentors (90%) indicated that the mentoring experience was very positive. In a related open-ended

question, most mentors (79%, 123 of 156 respondents) noted that the fellowship had an impact on their own career, with over half of those respondents (53%) indicating that it improved their skills, added new perspective, or resulted in them becoming more active and engaged in projects (Table 2).

Quotes taken from the survey reinforce the program’s positive impact on mentors:

Participating has allowed me to build leadership and management skills [...] enhanced my own surveillance, analysis, and communication skills [...] afforded me extremely helpful career networking opportunities.

[...] more thoughtful about the evidence base for our approach [...] address specifically why and how we arrived at our methods. [...] helps strengthen connection with [...] larger epidemiology community.

[...] allows for time to reflect on practice of epidemiology at the state health department. [...] more in-depth involvement with projects.

The responses to another open-ended question on the mentor survey suggest that the fellowship led to a substantial increase in public health capacity in host sites, both through the work completed by fellows and fellows’ fresh perspectives and enthusiasm.

Specific mentor quotes include the following:

[...] expanded our capacity enabling us to be involved in a number of projects that we could not otherwise have been involved in and to meet several program objectives that we had not had the resources to accomplish [...].

[...] helps staff morale - people enjoy being involved with the projects and the fellows bring new energy to the Division[...].

Added epidemiology capacity; improved the competencies/skills of non-epidemiologists [...].

[...] One of the fellows now works as a supervisory epidemiologist for our agency.

Based on administrative data review of employment positions, most alumni (87%) remain in public health settings. This was also reflected in the alumni survey, where 58% reported currently working in STLT or federal public health agencies, 13% in academia, 13% in graduate programs, and 16% in other settings (such as medical centers and private industry). Sixteen alumni pursued fellowships or graduate programs and reported returning to full-time employment in public health. Eighty-one percent of alumni reported position titles that require a strong epidemiology background or for which it would be valuable: 36% were in epidemiologist-titled positions and 45% were in public health project manager, data analyst, and researcher positions.

Table 1. Impact by fellowship class

Impact of fellowship on long-term career (alumni survey; <i>n</i> =145)			
Class starting year	<i>n</i>	A fair amount or a little bit, <i>n</i> (%)	Essential, <i>n</i> (%)
2003	6	2 (33)	4 (67)
2004	6	2 (33)	4 (67)
2005	10	4 (40)	6 (60)
2006	10	6 (60)	4 (40)
2007	17	6 (35)	11 (65)
2008	18	7 (39)	11 (61)
2009	31	9 (29)	22 (71)
2010	22	6 (27)	16 (73)
2011	25	6 (24)	19 (76)
Total alumni respondents	145	44 (30)	97 (67)
Current employment (alumni survey; <i>n</i> =144)			
Class	<i>n</i>	STLT or Federal PH agency, <i>n</i> (%)	Other organization, <i>n</i> (%)
2003	6	4 (67)	2 (33)
2004	6	3 (50)	3 (50)
2005	10	4 (40)	6 (60)
2006	9	4 (44)	5 (56)
2007	17	9 (53)	8 (47)
2008	17	8 (47)	9 (53)
2009	32	12 (38)	20 (63)
2010	22	16 (73)	6 (27)
2011	25	22 (88)	3 (12)
Total alumni respondents	144	82 (57)	62 (43)

PH, public health; STLT, state, territorial, local, and tribal

Alumni retention in the field of public health is supported by administrative data. Of the 137 alumni for whom resumes were available, 88% had worked in government public health environments for at least 1 year beyond the fellowship. The average post fellowship public health tenure for alumni was 3 years of service, with a range of 0–9 years. According to survey data, most alumni (68%) have been in their current position 1–5 years, and 28% have been in their position for less than 1 year. These findings are consistent with alumni status as recent graduates who have not had time to accrue tenure in their current positions.

Cross-tab analysis examined differences across class years in current employment in government public health. As shown in Table 1, more than half of the alumni of five fellowship classes are still working in public

health agencies. The most recent class (2011) has 88% currently working in an STLT or federal public health agency.

Based on fellowship work, alumni have published more than 160 peer-reviewed articles in a wide variety of public health subject areas. Additionally, many alumni continue to present at national and international public health conferences. Alumni and mentors also reported that the fellowship contributed to collaborative public health work and publications after graduation.

Fellowship alumni and mentors were asked questions about continuing relationships with mentor/mentees after the program to determine the long-term impact of the fellowship on professional networking and relationships. Most alumni (85%) indicated in an open-ended survey question that they had a continuing professional

Table 2. What impact did fellowship participation have on your career?

Careers	n (%)
Alumni (data source: alumni survey; n=124)	
Provided experiences necessary to excel in field	31 (25)
Job placement/led to current job	25 (20)
Better understanding of personal/professional goals	19 (15)
More competitive on job market	19 (15)
Networking with other public health professionals	11 (9)
Knowledge and exposure to more career options	10 (8)
Opened career opportunities not otherwise available	8 (6)
Other	1 (1)
Mentor (data source: mentor survey; n=123)	
Generally positive impact	41 (33)
Improved skills	28 (23)
New perspective	16 (13)
Increased collaboration/professional development	14 (11)
No impact/neutral	14 (11)
More involved in projects	4 (3)
Working in new subject areas or fields	4 (3)
Other	2 (2)

relationship with their AEF mentor. The majority of mentors (86%) reported maintaining a relationship with at least one former fellow. Table 3 documents the variety of ways in which mentors and alumni (mentees) continue relationships after completing the program.

In addition to fostering relationships with established professionals, the fellowship program had a notable impact on fellows' relationships and networking with one another. A majority of fellows (84%, 112 of 134 respondents) indicated ongoing relationships with other fellows. Most of those relationships (56%) involve professional connections (14%), regular contact (21%), and networking (21%).

Discussion

Evaluation of a 9-year experience with the AEF clearly demonstrated that the fellowship is successfully meeting the goal of preparing recent post-baccalaureate epidemiology graduates for careers in STLT agencies and building the applied epidemiology capacity within STLT public health agencies. This evaluation focused on systemic impacts on host sites, alumni and mentor employment, and professional networks. Consistent with guiding evaluation frameworks,^{22,24} examining existing

data provided cost- and time-saving mechanisms while providing data to understand the impact of the program.

Based on the findings from this evaluation, field training programs that incorporate mentoring- and competency-based frameworks can produce highly capable epidemiologists, with a high retention rate in the STLT applied epidemiology field. In addition, emphasis on building professional networks and strong mentor-mentee relationships can have significant career impacts on both new professionals and experienced mentors. Field training programs have the added benefit of providing a marked positive impact on agency productivity and capacity.

This evaluation demonstrated that AEF alumni often remain in STLT agencies. Placement of fellows directly within the host site agency and matching to strong mentors provides fellows with accelerated professional development opportunities that may be possible only with field experience. One factor in the selection of host sites was the ability to offer post-fellowship employment opportunities; hence, there is a bias towards host sites more likely to hire a fellow after participation in the program. Most alumni credit this experience with having a significant impact on their long-term career. As one fellow wrote, "Compared to an entry-level epidemiologist position at the state health department, I was able to work on broader and higher-level, more complex projects."

Based on the findings from this evaluation and previous research, field-based training programs that match young professionals to more senior mentors can have a significant impact on the career path of both groups. These programs impact those working directly in the field and influence perceptions of STLT and applied epidemiology. Many AEF alumni working outside governmental public health continue to collaborate with STLT public health professionals. One example of this was an alumna who had moved from a state public health office to an academic position but still worked closely with the state agency and introduced students to that environment.

Based on prior research on mentor-mentee programs^{25,26} and the findings from this evaluation, applied epidemiology training programs that utilize a mentor model can have a significant impact on senior applied epidemiology staff as well as enhance professional development of younger staff members. Similar programs

Table 3. Mentor–mentee relationship post-fellowship (data source: mentor and alumni surveys), *n* (%)

Relationship	Mentor (<i>n</i> =118)	Fellow (<i>n</i> =124)
Mentor/mentee is a colleague outside of host/mentor agency	66 (56)	15 (12)
I continued mentor/mentee relationship after program completion	29 (25)	51 (41)
Mentor/mentee is a collaborator on projects	29 (25)	21 (17)
Mentee has taken a position with host organization	51 (43)	13 (10)
Mentee is a direct report employee to mentor	22 (19)	18 (14)
Other	3 (3)	6 (5)

should focus on encouraging mentors and fellows to maintain professional relationships and encourage ongoing collaboration and partnership beyond the program.

Previous research^{5,8,13,26} and findings from this evaluation demonstrate that training programs that encourage networking among fellows and with mentors have a significant impact on professional development through the collaborations and partnerships established by both mentors and mentees. The findings from this evaluation about the influence of the fellow enthusiasm, flexibility, and skill provides support for the recommendation that field-based training programs should encourage flexibility so that fellows and mentors can pursue the combination of projects and experiences that provide the greatest professional benefit to fellow, host site, and mentors.

By keeping highly trained individuals in the field of public health epidemiology, the AEF program is strengthening the applied epidemiology workforce nationally. Based on the Epidemiology Capacity Assessment (ECA) findings,^{3,7} there is still a shortage of epidemiologists within STLT agencies. Therefore, programs that focus on encouraging new professionals to enter the STLT applied epidemiology field are critical. Although an evaluation of the EIS program²⁰ reported that 27% of field EIS officers went into STLT offices after completion, our AEF program evaluation found that 45% were working directly in an STLT public health office.

The findings from this evaluation are consistent with previous research demonstrating the importance of a rigorous set of core competencies. Similar field-based experiences should include both the mentorship component and an emphasis on established core competencies such as the Applied Epidemiology Competencies²¹ that are thoroughly vetted and supported by the field. Feedback from mentors and alumni indicated that the AEF fellowship emphasis on the core competencies resulted in highly competent new professionals and strengthening of skills among the existing workforce.

Conclusions

The CDC/CSTE Applied Epidemiology Fellowship has a significant impact on participating fellows, mentors, host sites, and national applied epidemiology capacity. The AEF and similar programs are crucial for building and sustaining the STLT applied epidemiology workforce as well as continuing to promote strengthening of core applied competencies among new professionals and the current workforce. Building the training model around a mentor-based design provides a mechanism for extending professional networks for both mentors and mentees. This in turn impacts long-term professional development for both groups and higher capacity for STLT public health agencies overall.

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