

The Evaluation of Training Gaps among Public Health Practitioners in Washington State

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**Abstract**

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Identifying the training gaps in public health competencies and strategic skills is a first step in the development of effective workforce development plans and strategies. The purpose of this study was to identify training gaps in public health competencies and strategic skills among local, tribal, and State public health employees in Washington State using an online cross-sectional survey from 2016. Domains where participants reported to have low training confidence and high training needs were coded as “training gaps”. We investigated the associations between training gaps and demographic and work characteristics for two competencies and two skills with the highest training gaps. The largest training gaps among public health competencies were in financial planning (*Mean: 37.87, Standard Deviation (SD): 34.94*) and policy development (*Mean: 34.13, SD: 35.37*). For strategic skills, the largest training gaps were in quality improvement (*Mean: 37.02, SD: 39.44*) and developing effective communication campaign (*Mean: 30.54, SD: 34.70*). In multiple regression analyses, women had lower training gaps in financial planning (*Coefficient ( $\beta$ ): -9.97, Confidence Interval (CI): -16.8, -3.14*), policy development ( *$\beta$ : -8.39, CI: -14.1, -2.68*), and quality improvement ( *$\beta$ : -11.72, CI: -16.76, -6.68*) compared to men.

## **Introduction**

Training public health practitioners is pivotal for building effective public health practices and tackling a multitude of diverse tasks to improve population wellness. Undertrained staff may be less able to secure funds, identify community health needs, and prepare for and respond to a public health emergency. However, national survey such as the 2017 Public Health Workforce Interests and Needs Survey (PH WINS) reports that public health practitioners serving both rural and urban populations are having the highest training gaps in financial management, policy development, system thinking public health competencies, and skills in developing a vision for health.<sup>1,2</sup> Equivalently, the 2018 Accountable Community of Health (ACH) Participant Survey, conducted by Center for Community Health and Evaluation (CCHE), identifies that effective communication and quality improvement in communities need further improvements.<sup>3, 4</sup>

Nonetheless, many public health practitioners do not receive proper trainings due to time constraints, limited resources, and unavailability of training opportunities in their community.<sup>5,6</sup> These barriers are particularly impactful in local health departments in rural areas, where funding is limited and the demand for public health services is high. Since 2008, the 91% of state health department agencies have experienced job losses that have contributed to the decrease of the public health workforce.<sup>7</sup> Implementing training courses that meets with needs of public health practitioners and mitigate increase the workforce retention in local health departments.<sup>8</sup> Yet, there is limited research on the public health training gaps, particularly among local and tribal health departments serving rural populations.

Despite the large sample size of PH WINS, which includes participants from 47 state health departments and 26 large local health departments, smaller health departments serving rural populations are not well represented due to the sampling schemes.<sup>9</sup> In Washington State, most local health departments were not included in the sampling frame for a bigger survey. In the U.S., there are approximately 2,800 local health department agencies, and only six percent of them are classified as large departments, which serve about 51% of the population.<sup>10</sup> Thus, training needs of local health departments serving rural populations are not well understood. In addition, local health departments in rural areas are experiencing the shortage of public health workforce due to budgetary restrictions, the inability to pay competitive salaries, and difficulty in attracting candidates to a certain geographic area.<sup>11</sup>

In 2016, the Northwest Center for Public Health Practice (NWCPHP) conducted training needs assessment in Region 10, which includes Washington, Oregon, Alaska, and Idaho. This study specifically explored to identify training gaps in public health core competencies and strategic skills among public health professionals in Washington State.

## **Methods**

*Definition of key variables:* The questions related to the public health competencies were developed using the Council on Linkages between Academia and Public Health Practice's core competencies for public health professionals.<sup>14</sup> The questionnaire was organized into 11 domains based on the revised competency statements: 1) Data Management, 2) Communication, 3) Community Engagement, 4) Cultural Competency, 5) Financial Planning, 6) Program Planning, 7) Management, 8) Leadership in Systems Thinking, 9) Leadership in Strategic Planning, 10) Policy Development, and 11) Public Health Science.<sup>14</sup>

The questionnaire also included questions that were related to strategic skills. The eight strategic skills included, which were: 1) quality improvement, 2) ethnics and public health law, 3) technology use: computers & software Systems, 4) working efficiently, 5) working with others, 6) communication skills, 7) decision making, and 8) developing effective communication campaign.<sup>15</sup>

For the secondary aim, Washington health jurisdiction is determined by ACH, which includes 9 regions, and is presented in the appendices (Map 1).<sup>14</sup> Primary program area is defined by Public Health National Center for Innovations, which includes six program areas that are presented in Figure 5 in the appendices. The category of Administrative and Administrative support was added to in primary program area, reflecting the numerous responses for administrative and administrative support as primary program area. The conceptual models for primary aim and secondary aim are represented in the appendices.

*Sample and analysis:* Survey respondents included public health employees who worked in Washington State. Public health practitioners from Washington, Alaska, Oregon, and Idaho were invited to participate. We only reported results for Washington State in this study. The questionnaire was developed by the evaluation team at NWCPHP with the inputs from the Washington State Association of Local Public Health (WSALPHO) workforce development committee and other local and state partners.

Collection Method: The primary target population for this assessment were public health employees at the state, local, and tribal health departments. NWCPHP worked with WSALPHO to develop a communications kit, which included emails and newsletters. Health departments were able to choose from two survey dissemination methods: 1) provide email addresses of employees for NWCPHP to send individualized email links, or 2) send out a weblink to their employees.

Procedures and instruments: Survey data was collected using SurveyMonkey® (Palo Alto, CA). The survey instrument comprised of 72 items; most item response options were 5- or 4-point Likert scales.

Data on characteristics of the respondents included: 1) demographics (i.e., age, gender, race/ethnicity, education), 2) work-related characteristics (years in organization and in current position, part-time or full-time employment status, plans to retire and organizational roles); and 3) work setting characteristics (practice location, primary service area – rural, urban, suburban or all areas, primary program areas).

Statistical methods: Our main outcomes were the training gaps in public health competencies and strategic skills. For each domain within a public health core competency or strategic skill, respondents ranked their training confidence and training needs as “high”, “moderate”, “low”, “no”, or “not applicable”. Respondents were coded as having a training gap in that domain if their confidence was “low” or “no” and their need was “high” or “moderate”. For each respondent, the percentage of domains with training gaps was calculated to generate a training gap score for each competency and strategic skill. Training gap scores could range from 0 to 100 training gap scores, where 0 indicated no gaps and 100 indicates training gaps in all domains in that competency and skill.

Training gap scores for a public health competency or skill were coded as missing if respondents answered less than half of the domains within that competency. Demographic and work characteristic were summarized for the sample using descriptive frequencies for categorical or continuous variables and means and standard deviations.

Primary Aim: Means and standard deviations (*SD*) were calculated for training gap scores for each public health core competency variable and selected strategic skills, independently. Boxplots were created to visually compare training gap scores between public health core competencies and strategic skills.

Analytical statistics: We selected two competencies and two strategic skills with the highest training gaps for the secondary aim. In univariate analyses, unadjusted associations between training gap scores for the selected competencies and skills, and demographic and work characteristics were calculated using linear regression. To determine independent associations between demographic and work characteristics and training gap scores, we also used multivariate regression models that included all variables associated with training gaps at  $p < 0.2$  in unadjusted analyses. We reported adjusted regression coefficients ( $\beta$ ) and 95% confidence intervals (CIs). P values less than 0.05 were considered significant in adjusted analyses. Data were analyzed using Stata Statistics/Data Analysis, version 14 (Stata Corp LP, College Station, Texas).

## **Results**

Table 1 describes the study population ( $n=2,612$ ). Sixty-four percent of survey respondents self-identified as white and more than half were female. The average of age of public health employee was between 40 and 49 years old. Almost half of the respondents (47.1%) had some college and 28.3% of them had graduate degrees. Half of the respondents worked in state health departments. Full time positions were held by 87.1 % of the respondents. More than half of the respondents executed duties as frontline or entry level staff. Overall, 82.9% of the survey respondents were planning to retire in more than 5 years.

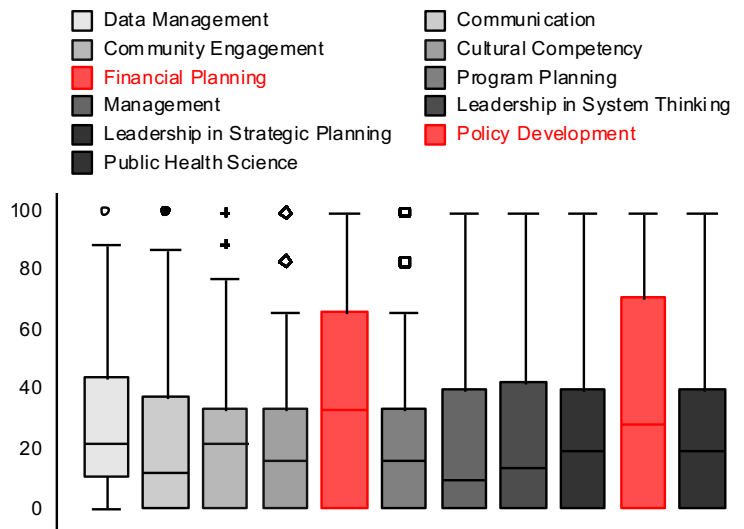
Figure 1 shows boxplots of training gap scores for all public health competencies. The highest training gap scores were in financial planning (*Mean: 37.87, SD: 34.94*), and policy development (*Mean: 34.13, SD: 35.37*). Leadership and Strategic Planning (*Mean: 26.27, SD: 30.02*) and data management (*Mean: 25.22, SD: 23.52*) had moderate training gap scores. Management (*Mean: 23, SD: 27.09*) had the lowest training gap scores.

Figure 2 shows boxplot for training gap scores for strategic skills. Quality improvement (*Mean: 37.02, SD: 39.44*) and developing effective communication campaign (*Mean: 30.54, SD: 34.70*) had the highest training gap scores. Ethics and public health law (*Mean: 22.12, SD: 31.40*) and technology use in computers and software systems (*Mean: 21.79, SD: 22.30*) had moderate training gap scores. Working efficiently (*Mean: 9.06, SD: 18.70*) and decision making (*Mean: 8.77, SD: 23.13*) had the lowest training gap scores.

**TABLE 1: Overall Number and Estimated Percentage of Demographic Characteristics**

		N	%
<u>Ethnicity/Race</u>	African American/Blacks	96	3.7%
	Asian	108	4.1%
	Hispanic (All Races)	106	4.1%
	Multi-Race	82	3.1%
	Caucasian/White	1674	64.1%
	Others	71	2.7%
	Missing	475	18.2%
<u>Age</u>	19-29 years	165	6.3%
	30-39 years	450	17.2%
	40-49 years	536	20.5%
	50-59 years	640	24.5%
	60 or more years	381	14.6%
	Missing	440	16.8%
<u>Gender</u>	Female	1605	61.4%
	Male	571	21.9%
	Missing	436	16.7%
<u>Highest Education</u>	High school /Equivalent	165	6.3%
	Some College/Bachelor's Degrees	1231	47.1%
	Graduate Degrees	740	28.3%
	Others	86	3.3%
	Missing	390	14.9%
<u>WA Health Jurisdiction</u>	King County	435	16.7%
	Better Health Together	195	7.5%
	North Sound ACH	183	7.0%
	Pierce County	151	5.8%
	Other Regions in WA	251	9.6%
	State Department	1224	46.9%
	Non jurisdictional Institution	108	4.1%
	Missing	65	2.5%
<u>Primary Service Area:</u>	Rural	349	13.4%
	Urban	791	30.3%
	Suburban	299	11.4%
	All area	1050	40.2%
	Missing	123	4.7%
<u>Division of Primary Work</u>	Communicable Disease Control	156	6%
	Chronic Disease and Injury Prevention	133	5.1%
	Environmental Public Health	448	17.2%
	Maternal, Child, and Family Health	254	9.7%
	Access to and Linkage with Clinical Care	385	14.7%
	Administration and Admin Support	654	25%
	Other	569	21.8%
	Missing	13	0.5%
<u>Years at Current Organization</u>	Under 4 years	950	36.4%
	4-6 years	333	12.7%
	6-10 years	334	12.8%
	More than 10 years	975	37.3%
	Missing	20	0.8%
<u>Years in Current Role</u>	Under 4 years	1368	52.4%
	4-6 years	383	14.7%
	6-10 years	318	12.2%
	More than 10 years	523	20%
	Missing	20	0.8%
<u>Employment Status</u>	Full -time	2292	87.7%
	Part -time	251	9.6%
	Others	59	2.3%
	Missing	10	0.4%
<u>Plan to Retire in Years</u>	Less than 3 years	199	7.6%
	3-4 years	222	8.5%
	More than 5 years	2165	82.9%
	Missing	26	1%
<u>Role by Organizational Level</u>	Frontline/Entry Level	1694	64.9%
	Program Management/Supervisory Level	766	29.3%
	Senior Management/Executive Level	152	5.8%
	Missing	n/a	n/a
<u>Supervisory Role</u>	Yes	1998	76.5%
	No	614	23.5%
	Missing	n/a	n/a

**Figure 1. Training Gap Scores in Public Health Competencies**



**Figure 2. Training Gap Scores in Strategic Skills**



With financial planning, public health employees in local Washington departments had higher training gaps compared the state health department ( $\beta: 12.50, CI: 3.17, 21.83$ ). Public health employees serving rural populations had higher training gap scores than employees serving non-rural populations in Washington State ( $\beta: 9.06, CI: 0.93, 17.18$ ). Compared to employees in the Administrative and Administrative Support program area, employees in Maternal, Child, and Family Health Program had higher training gaps in financial planning ( $\beta: 21.96, CI: 9.04, 34.90$ ). Employees who had worked and held their positions for more than ten years had lower training gap scores compared to employees who had

worked at their organizations and held their positions for less than four years ( $\beta$ : -10.37, CI: -16.33, -4.10 &  $\beta$ : -11.58, CI: -18.85, -4.31). Public health practitioners who were planning to retire in less than three years had higher training gaps scores compared to the respondents who were planning to retire in more than five years ( $\beta$ : -12.97, CI: 25.74, -0.31). Senior or executive level employees had lower training gap scores compared to employees in frontline or entry level ( $\beta$ : -11.11, CI: 18.76, -3.47). Public health practitioners who had supervisory role had lower training gap scores compared to those who did not possess supervisory roles ( $\beta$ : -8.74, CI: -14.19, -3.30). Female employees had lower training gap scores compared to their male counterparts ( $\beta$ : -14.34, CI: -20.47, -8.22). Survey respondents who had degrees other than bachelor's and graduate degrees had higher training gap scores compared to practitioners who completed high school or equivalent ( $\beta$ : 24.25, CI: 2.62, 45.88). Public health employees who were between 50 and 60 years old had lower training gaps compared to younger employees who were between 30 and 39 years old ( $\beta$ : -10.04, CI: -17.88, -2.19 &  $\beta$ : -11.17, CI: -20.27, -2.07). In multiple regression analyses, health jurisdiction, program areas, gender, age, and highest education remained associated with financial planning gap scores significantly (Table 2). Female respondents had lower training gap scores relative to men ( $\beta$ : -9.54, CI: -16.29, -2.80). Survey respondents with other than high school, some college or graduate degree had higher training gaps than those with high school or equivalent education ( $\beta$ : 30.43, CI: 8.39, 52.47).

With policy development, public health employees serving urban and suburban population had higher training gap scores compared to employees serving all the state population ( $\beta$ : 9.06, CI: 3.29, 14.84 &  $\beta$ : 12.47, CI: 3.80, 21.14). Compared to public health employees who worked at their organization and held the same position in less than four years, the respondents who worked at their organizations and held the same position in more than ten years had lower training gaps ( $\beta$ : -12.44, CI: -17.85, -7.03 &  $\beta$ : -12.84, CI: -18.76, -7.00). Public health employees who were planning to retire in less than three years and between three and five years had lower training gap scores compared to professionals who planned to retire in more than five years ( $\beta$ : -19.80, CI: -27.98, 11.60 &  $\beta$ : -11.76, CI: -19.52, -4.00, respectively). Senior or executive level employees had lower training gap scores in policy development compared to frontline or entry level professionals ( $\beta$ : -18.10, CI: -25.17, -10.97). Employers who possessed supervisory role had lower training gap scores compared to those who did not ( $\beta$ : -11.18, CI: -16.07, -6.30). Female public health employees

had lower training gap scores relative to their male counterparts ( $\beta$ : -11.73, CI: -16.90, -6.56). Compared to employers who were between age 30 and 39 years old, older employers who were between 50 and 59 years old or older than 60 years old had higher training gap scores in policy development ( $\beta$ : -12.37, CI: -19.18, -5.56 &  $\beta$ : -20.08, CI: -27.42, -12.74). In multiple regression model, years in current organization, retirement plans, and gender remained significant (Table 3), where female professionals had lower training gap scores compared to male employees ( $\beta$ : -8.39, CI: -14.10, -2.68).

For quality improvement strategic skill, public health employees who worked in King County, North Sound ACH, and other local Washington health departments had higher training gap scores compared to employees working at state health departments ( $\beta$ : 11.81, CI: 5.41, 18.21 &  $\beta$ : 14.38, CI: 6.00, 22.77, &  $\beta$ : 17.20, CI: 9.23, 25.17). Public health practitioners who served urban populations had higher training gap scores relative to practitioners who served for all the population in the state ( $\beta$ : 8.12, CI: 2.90, 13.33). Employees who were planning to retire in less than three years had lower training gap scores compared to employees who were planning to retire in more than five years ( $\beta$ : -15.50, CI: -23.15, -7.86). Senior or executive level employees had lower training gap scores compared to frontline or entry level employees ( $\beta$ : -12.95, CI: -21.63, -4.27). Public health practitioners who had supervisory role had lower training gap scores ( $\beta$ : -8.78, CI: -13.34, -4.22). Female employees had lower training gap scores relative to their male counterparts ( $\beta$ : -13.85, CI: -18.50, -9.20). In multiple regression analyses, program area, retirement plan, supervisory role, and gender remained significant (Table 4). Public health employees who worked in local health departments had higher training gap scores compared to employees from the state health departments ( $\beta$ : 18.88, CI: 8.84, 28.92). Employees who had supervisory role and were female had lower training gap scores compared to employers who did not pose supervisory role and were male ( $\beta$ : -11.38, CI: -17.68, -5.10 &  $\beta$ : 11.72, CI: -16.76, -6.68).

For developing effective communication campaign, public health employees in Maternal, Child and Family Health had higher training gap scores compared to practitioners in Administrative and Administrative support program area ( $\beta$ : 15.98, CI: -5.85, 26.11). Public health employees who were not full time or part time had high training gap scores compared to full time employers ( $\beta$ : 19.10, CI: 1.82, 36.31). In multiple regression, program area remained significant, where public health professionals in Maternal,

Child and Family Health had higher training gap scores ( $\beta$ :15.31, CI:4.05, 26.59), which is illustrated in

Table 5.

		Model I		Model II	
		Coeff	95 % CI	Coeff	95% CI
<b>Work Characteristics</b>					
Accountable Community Health:	King County	8.74	0.71, 16.78**	8.17	-1.51, 17.84
	Better Health Together	6.38	-5.79, 18.55	3.41	-9.12, 15.94
	North Sound ACH	6.66	-2.87, 16.20	12.63	0.52, 24.74**
	Pierce County	1.84	-9.50, 13.18	0.88	-13.23, 14.87
	Other Regions	12.50	3.18, 21.83**	11.11	-1.90, 24.13
	State Department	Ref	Ref	Ref	Ref
	Non-Jurisdiction Institution	11.94	-3.42, 27.30*	12.75	-6.50, 32.00
Primary Population Service	Rural	9.06	0.93, 17.18**	2.70	-8.66, 14.06
	Urban	6.91	-0.05, 13, 88*	3.13	-5.30, 11.55
	Suburban	7.40	-1.69, 16.49*	6.71	-2.95, 16.37
	All Populations	Ref	Ref	Ref	Ref
Primary Program Area:	Communicable Disease Control	11.77	0.48, 23.06**	5.78	-6.74, 18.30
	Chronic Disease and Injury Prevention	4.94	-6.12, 16.00	3.18	-8.92, 15.28
	Environmental Public Health	2.63	-5.85, 11.12	5.14	-4.26, 14.54
	Maternal, Child and Family Health	21.96	9.04, 34.90***	18.52	4.50, 32.53**
	Access to and Linkage with Clinical Care	8.62	-0.03, 17.28*	7.41	-2.19, 17.01
	Administrative and Administrative Support	Ref	Ref	Ref	Ref
	Other Areas	9.44	1.30, 17.58**	9.78	1.22, 18.34
Years at Current Organization:	Less than 4 years	Ref	Ref	Ref	Ref
	4-7 years	-9.66	-18.25, -1.08*	-4.25	-14.42, 5.91
	7-10 years	2.93	-6.25, 12.11	3.49	-7.27, 14.24
	More than 10 years	-10.37	-16.63, -4.10***	-0.09	-9.00, 9.18
Years in Current Position:	Less than 4 years	Ref	Ref	Ref	Ref
	4-7 years	-7.30	-15.64, 1.04*	-1.78	-11.51, 7.94
	7-10 years	4.59	-5.37, 14.54	6.22	-5.95, 18.21
	More than 10 years	-11.58	-18.85, -4.31**	-8.14	-18.46, 2.18
Employment Status	Full-time	Ref	Ref	Ref	Ref
	Part-time	8.50	-2.46, 19.44*	-2.15	-9.79, 14.10
	Others	3.83	-11.18, 18.85	6.06	-12.61, 24.73
Plan to Retire:	Less than 3 years	-12.97	-25.64, -0.31**	-7.26	-22.68, 8.15
	3-5 years	-5.57	-9.57, 3.44	2.46	-10.66, 15.58
	More than 5 years	Ref	Ref	Ref	Ref
Organizational Role:	Frontline/Entry Level	Ref	Ref	Ref	Ref
	Program Management/Supervisory Level	-2.36	-8.31, 3.60	2.50	-5.26, 10.24
	Senior /Executive Level	-11.11	-18.76, -3.47**	-0.73	-12.42, 10.96
Supervisory Role	Yes	-8.74	-14.19, -3.30***	-6.77	-14.93, 1.38
	No				
<b>Demographic Characteristics</b>					
Gender:	Female	-14.34	-20.48, -8.21***	-9.54	-16.29, -2.80**
	Male				
Age:	19 – 29 years	13.14	-0.57, 26.86*	17.73	2.94, 32.53**
	30 – 39 years	Ref	Ref	Ref	Ref
	40 – 49 years	-5.52	-13.40, 2.36	-1.74	-10.28, 6.80
	50 – 59 years	-10.04	-17.89, -2.20**	-8.27	-16.95, 0.42
	60 years or older	-11.17	-20.27, -2.07**	-7.21	-19.23, 1.93
Ethnicity/Race	Asians	-1.82	-15.86, 12.22		
	Blacks/African Americans	8.10	-6.04, 22.24		
	Hispanic (All Race)	6.02	-10.93, 22.97		
	Multiracial	9.07	-5.52, 23.67		
	White/Caucasians	Ref	Ref		
	Other Ethnicity or Races	-7.82	-34.77, 19.12		
Highest Level of Education:	High School/Equivalent	Ref	Ref	Ref	Ref
	Some College/ Bachelor's Degree	5.31	-8.41, 19.03	4.61	-9.80, 19.01
	Graduate Degrees	9.74	-3.97, 23.46	10.24	-4.60, 25.07
	Other Degrees	24.26	2.63, 45.87**	30.43	8.39, 52.47***

**Abbreviation:** Coeff: Coefficient and CI: Confidence Interval

**Model I:** Linear regression was used to calculate unadjusted coeff and 95% CI. +  $p < 0.2$  \* $p < 0.05$  \*\* $p < 0.01$  \*\*\* $p < 0.001$

**Model II:** Multiple linear regression was used to calculate adjusted coeff and 95% CI. \*  $p < 0.05$  \*\* $p < 0.01$  \*\*\* $p < 0.001$

**Table 3: Coefficients and 95% Confidence Interval Estimates for Training Gap Scores in Policy Development**

		Model I		Model II	
		Coeff	95 % CI	Coeff	95% CI
<b>Work Characteristics</b>					
Accountable Community Health:	King County	8.00	1.00, 15.00**	4.24	-4.21, 12.70
	Better Health Together	6.56	-2.74, 15.85	6.56	-3.57, 16.69
	North Sound ACH	2.81	-5.21, 10.82	3.18	-6.57, 12.93
	Pierce County	0.10	-11.03, 11.23	2.12	-12.72, 16.96
	Other Regions	5.28	-2.58, 13.14	4.67	-6.57, 15.90
	State Department	Ref	Ref	Ref	Ref
	Non-Jurisdiction Institution	15.51	0.32, 30.71*	12.48	-4.47, 29.44
Primary Population Service	Rural	6.68	-0.71, 13.45*	1.82	-7.90, 11.54
	Urban	9.06	3.29, 14.84**	-0.52	-8.11, 7.07
	Suburban	12.47	3.80, 21.14**	9.10	-0.63, 18.84
	All Populations	Ref	Ref	Ref	Ref
Primary Program Area:	Communicable Disease Control	14.42	2.74, 26.12**	8.56	-4.00, 21.18
	Chronic Disease and Injury Prevention	-2.28	-11.43, 6.86	-0.95	-11.72, 9.82
	Environmental Public Health	-5.40	-12.59, 1.78*	-6.13	-14.33, 2.08
	Maternal, Child and Family Health	7.36	-2.72, 17.45*	5.31	-5.34, 15.97
	Access to and Linkage with Clinical Care	6.74	-1.01, 14.50*	2.57	-5.90, 11.02
	Administrative and Administrative Support	Ref	Ref	Ref	Ref
	Other Areas	5.87	-1.54, 13.27*	3.40	-5.10, 11.90
Years at Current Organization:	Less than 4 years	Ref	Ref	Ref	Ref
	4-7 years	-1.94	-9.79, 6.00	3.45	-6.86, 13.76
	7-10 years	-6.16	-13.40, 1.08*	-1.36	10.64, 7.92
	More than 10 years	-12.44	-17.85, -7.03***	-2.90	-11.30, 5.50
Years in Current Position:	Less than 4 years	Ref	Ref	Ref	Ref
	4-7 years	-6.32	-13.40, 0.76*	-5.91	-14.94, 3.11
	7-10 years	-3.47	-11.33, 4.38	0.55	-9.15, 10.24
	More than 10 years	-12.84	-18.76, -7.00***	-9.27	-17.80, -0.74**
Employment Status	Full-time	Ref	Ref	Ref	Ref
	Part-time	9.45	0.83, 18.10**	3.37	-6.32, 13.07
	Others	11.01	-5.33, 27.35	3.31	-14.90, 21.59
Plan to Retire:	Less than 3 years	-19.80	-27.98, 11.60***	-11.57	-21.96, 1.19*
	3-5 years	-11.76	-19.52, -4.00**	-4.24	-14.96, 21.59
	More than 5 years	Ref	Ref	Ref	Ref
Organizational Role:	Frontline/Entry Level	Ref	Ref	Ref	Ref
	Program Management/Supervisory Level	-5.98	-10.97, -0.97*	-1.22	-7.89, 5.45**
	Senior /Executive Level Frontline/Entry Level	-18.10	-25.17, -10.97***	-7.02	-17.76, 3.72
Supervisory Role	Yes	-11.18	-16.07, -6.30***	-5.06	-12.48, 2.37
	No				
<b>Demographic Characteristics</b>					
Gender:	Female	-11.73	-16.90, -6.56***	-8.39	-14.10, -2.68**
	Male				
Age:	19 – 29 years	5.10	-5.74, 15.93	1.70	-10.24, 13.64
	30 – 39 years	Ref	Ref	Ref	Ref
	40 – 49 years	-6.07	13.14, 1.00*	-0.14	-8.32, 8.03
	50 – 59 years	-12.37	-19.18, -5.56***	2.80	-10.80, 5.22
	60 years or older	-20.08	-27.42, -12.74***	6.18	-16.72, 4.37
Ethnicity/Race	Asians	7.96	-6.38, 22.29	8.06	-7.65, 23.77
	Blacks/African Americans	15.38	3.73, 27.03**	9.28	-3.09, 21.64
	Hispanic (All Race)	6.02	-6.56, 18.60	7.71	-6.23, 21.65
	Multiracial	10.00	-2.40, 22.40*	2.16	-10.52, 14.84
	White/Caucasians	Ref	Ref	Ref	Ref
	Other Ethnicity or Races	-4.97	-18.00, 8.04	-3.78	-16.28, 8.71
Highest Level of Education:	High School/Equivalent	Ref	Ref	Ref	Ref
	Some College/ Bachelor's Degree	-0.80	-13.12, 11.51	1.77	-11.91, 15.44
	Graduate Degrees	-3.40	-15.70, 8.91	0.63	-13.16, 14.43
	Other Degrees	-19.84	-36.04, -3.63**	-15.28	-34.56, 4.00

**Abbreviation:** Coeff: Coefficient and CI: Confidence Interval

**Model I:** Linear regression was used to calculate unadjusted coeff and 95% CI. +  $p < 0.2$  \* $p < 0.05$  \*\* $p < 0.01$  \*\*\* $p < 0.001$

**Model II:** Multiple linear regression was used to calculate adjusted coeff and 95% CI. \* $p < 0.05$  \*\* $p < 0.01$  \*\*\* $p < 0.005$

**Table 4: Coefficient and 95% Confidence Interval Estimates for Training Gap Scores in Quality Improvement**

		Model I		Model II	
		Coeff	95 % CI	Coeff	95% CI
<b>Work Characteristics</b>					
Accountable Community Health:	King County	11.81	5.41, 18.21***	-7.58	0.05, 15.11
	Better Health Together	9.48	1.10, 17.86**	5.96	-3.21, 15.12
	North Sound ACH	14.38	6.00, 22.77***	13.08	2.79, 23.67**
	Pierce County	13.43	3.61, 23.26**	12.12	0.08, 24.16
	Other Regions	17.20	9.23, 25.17***	18.88	8.84, 28.92****
	State Department	Ref	Ref	Ref	Ref
	Non-Jurisdiction Institution	8.82	-3.70, 21.34	8.70	-5.06, 22.45
Primary Population Service	Rural	8.80	1.91, 15.69**	-3.20	-11.93, 5.53
	Urban	8.12	2.90, 13.33***	5.11	-1.30, 11.52
	Suburban	6.57	-0.60, 13.72*	3.37	-5.55, 10.28
	All Populations	Ref	Ref	Ref	Ref
Primary Program Area:	Communicable Disease Control	3.87	-5.58, 13.34	-2.52	-12.87, 7.83
	Chronic Disease and Injury Prevention	8.13	-1.17, 17.42*	2.60	-7.34, 12.54
	Environmental Public Health	3.33	-3.16, 9.81	3.32	-3.83, 10.46
	Maternal, Child and Family Health	9.31	0.65, 18.00**	3.65	-5.64, 12.93
	Access to and Linkage with Clinical Care	11.26	4.14, 18.39***	9.77	1.84, 17.70*
	Administrative and Administrative Support	Ref	Ref	Ref	Ref
Years at Current Organization:	Other Areas	9.11	2.69, 15.54**	8.39	1.56, 15.21*
	Less than 4 years	Ref	Ref	Ref	Ref
	4-7 years	-2.00	-9.00, 5.10	0.28	-8.58, 9.15
	7-10 years	0.66	-6.49, 7.82	2.13	-6.36, 10.62
Years in Current Position:	More than 10 years	-4.00	-8.96, 1.03*	-0.32	-7.58, 6.93
	Less than 4 years	Ref	Ref	Ref	Ref
	4-7 years	-0.21	-6.89, 6.46	1.30	-7.47, 10.07
Employment Status	7-10 years	5.69	-1.21, 12.58*	5.67	-2.61, 13.95
	More than 10 years	-5.36	-11.06, 0.34*	-3.00	-11.12, 5.29
	Full-time	Ref	Ref	Ref	Ref
Plan to Retire:	Part-time	1.78	-6.02, 9.76		
	Others	-3.74	-17.30, 9.81		
	Less than 3 years	-15.50	-23.15, -7.86***	-13.48	-23.46, -3.51**
Organizational Role:	3-5 years	0.32	-8.21, 8.84	-1.05	-11.25, 9.16
	More than 5 years	Ref	Ref	Ref	Ref
	Frontline/Entry Level	Ref	Ref	Ref	Ref
Supervisory Role	Program Management/Supervisory Level	-2.08	-6.57, 2.40	5.10	-0.77, 10.95
	Senior /Executive Level	-12.95	-21.64, -4.27**	-4.80	-15.81, 6.22
Supervisory Role	Yes	-8.78	-13.34, -4.22***	-11.38	-17.68, -5.10***
	No				
<b>Demographic Characteristics</b>					
Gender:	Female	-13.85	-18.50, -9.20***	-11.72	-16.76, -6.68***
	Male				
Age:	19 – 29 years	1.74	-8.29, 11.78	1.25	-9.70, 12.20
	30 – 39 years	Ref	Ref	Ref	Ref
	40 – 49 years	-3.83	-10.25, 2.59	-2.62	-9.62, 4.38
	50 – 59 years	-3.00	-9.15, 3.35	-0.70	-7.71, 6.31
	60 years or older	-6.11	-13.72, 1.50*	-0.85	-10.83, 9.13
Ethnicity/Race	Asians	-6.80	-16.56, 2.87	-6.80	-17.04, 3.45
	Blacks/African Americans	1.47	-9.16, 12.10	0.06	-12.28, 12.41
	Hispanic (All Race)	-2.47	-12.83, 7.90	-4.60	-15.90, 6.72
	Multiracial	-1.93	-13.13, 9.26	-0.36	-12.39, 11.57
	White/Caucasians	Ref	Ref	Ref	Ref
	Other Ethnicity or Races	-14.30	-26.23, 2.36**	-13.39	-26.70, -0.09
Highest Level of Education:	High School/Equivalent	Ref	Ref		
	Some College/ Bachelor's Degree	-2.79	-13.23, 7.66		
	Graduate Degrees	-7.05	-17.65, 3.56		
	Other Degrees	-3.88	-18.90, 11.14		

**Abbreviation:** Coeff: Coefficient and CI: Confidence Interval

**Model I:** Linear regression was used to calculate unadjusted coeff and 95% CI. +  $p < 0.2$  \* $p < 0.05$  \*\* $p < 0.01$  \*\*\* $p < 0.001$

**Model II:** Multiple linear regression was used to calculate adjusted coeff and 95% CI. \* $p < 0.05$  \*\* $p < 0.01$  \*\*\* $p < 0.005$

**Table 5: Coefficients and 95% Confidence Interval Estimates for Training Gap Scores in Developing Effective Communication Campaign**

		Model I		Model II	
		Coeff	95 % CI	Coeff	95% CI
<b>Work Characteristics</b>					
Accountable Community Health:	King County	10.17	1.38, 18.96**	9.60	-0.01, 19.22
	Better Health Together	3.76	-6.43, 13.95	2.87	-8.00, 13.71
	North Sound ACH	11.55	-1.13, 21.97**	7.68	-3.53, 18.90
	Pierce County	8.34	-3.08, 19.76	5.14	-7.86, 18.14
	Other Regions	5.60	-2.25, 13.45	7.38	-1.32, 16.08
	State Department	Ref	Ref	Ref	Ref
	Non-Jurisdiction Institution	10.74	-6.09, 27.56	10.71	-4.04, 25.45
Primary Population Service	Rural	2.63	-9.94, 4.70		
	Urban	-3.32	0.37, 10.34		
	Suburban	0.97	-8.03, 9.98		
	All Populations	Ref	Ref		
Primary Program Area:	Communicable Disease Control	16.40	-4.63, 28.15**	10.68	-0.01, 19.22
	Chronic Disease and Injury Prevention	1.16	-9.72, 12.04	-1.85	-13.28, 9.58
	Environmental Public Health	5.02	-3.00, 13.03	5.51	-3.22, 14.25
	Maternal, Child and Family Health	15.98	-5.85, 26.11***	15.31	4.05, 26.59**
	Access to and Linkage with Clinical Care	4.67	-4.02, 13.36	9.00	-0.89, 18.90
	Administrative and Administrative Support	Ref	Ref	Ref	Ref
Years at Current Organization:	Other Areas	6.58	-2.25, 15.42*	4.86	-4.61, 14.34
	Less than 4 years	Ref	Ref		
	4-7 years	1.16	-8.00, 10.32		
	7-10 years	3.94	-5.89, 13.76		
Years in Current Position:	More than 10 years	-0.40	-6.49, 5.69		
	Less than 4 years	Ref	Ref	Ref	Ref
	4-7 years	1.60	-6.41, 9.60	-2.67	-11.97, 6.64
	7-10 years	10.70	-1.40, 20.00**	6.70	-3.66, 17.04
Employment Status	More than 10 years	1.12	-5.84, 8.08	4.86	-11.68, 6.37
	Full-time	Ref	Ref	Ref	Ref
	Part-time	-1.00	-9.16, 7.34	-6.07	-14.93, 2.78
Plan to Retire:	Others	19.10	1.82, 36.31**	17.84	-0.24, 35.92
	Less than 3 years	-1.39	-12.27, 9.50		
	3-5 years	0.30	-10.00, 10.60		
Organizational Role:	More than 5 years	Ref	Ref		
	Frontline/Entry Level	Ref	Ref	Ref	Ref
	Program Management/Supervisory Level	-3.25	-9.46, 2.96	-0.28	-8.07, 7.50
Supervisory Role	Senior /Executive Level	-1.05	-20.83, -1.27*	-11.71	-25.77, 2.36
	Yes	-6.87	-13.36, -0.38**	-3.00	-12.13, 6.19
	No				
<b>Demographic Characteristics</b>					
Gender:	Female	-4.60	-10.91, 1.73		
	Male				
Age:	19 – 29 years	-7.57	-16.97, 1.83*	-8.97	-19.22, 1.28
	30 – 39 years	Ref	Ref	Ref	Ref
	40 – 49 years	5.49	-2.60, 13.57	7.01	-1.84, 15.87
	50 – 59 years	5.85	-1.52, 13.21*	6.25	-1.96, 14.45
	60 years or older	8.40	-1.16, 17.96*	7.37	-3.50, 18.24
Ethnicity/Race	Asians	-2.76	-14.36, 8.79	-5.11	-16.26, 6.05
	Blacks/African Americans	8.19	-6.07, 22.44	6.64	-7.22, 20.50
	Hispanic (All Race)	12.38	0.21, 24.56**	13.56	0.16, 26.96
	Multiracial	-10.70	-21.64, 0.24*	-6.73	-18.40, 4.94
	White/Caucasians	Ref	Ref	Ref	Ref
	Other Ethnicity or Races	-3.00	-17.84, 11.97	-3.74	-20.41, 12.93
Highest Level of Education:	High School/Equivalent	Ref	Ref	Ref	Ref
	Some College/ Bachelor's Degree	7.68	-2.76, 18.11*	9.73	-1.70, 21.17
	Graduate Degrees	4.86	-6.00, 15.69	10.70	-1.52, 22.92
	Other Degrees	7.61	-10.80, 26.02	1.60	-16.72, 20.00

**Abbreviation:** Coeff: Coefficient and CI: Confidence Interval

**Model I:** Linear regression was used to calculate unadjusted coeff and 95% CI. + p < 0.2 \*p < 0.05 \*\*p < 0.01 \*\*\*p < 0.001

**Model II:** Multiple linear regression was used to calculate adjusted coeff and 95% CI. \* p < 0.05 \*\*p < 0.01 \*\*\*p < 0.005

## **Discussion**

We found that public health employees in Washington State reported the highest training gaps in financial planning, policy development, quality improvement, and developing effective communication campaign. We also found that female public health employees had lower training gaps compared to their male counterparts across the public health competencies and strategic skills.

Financial planning and policy development are important public health core competencies that impact public health professionals' ability to effectively manage limited monetary funds and engage in health policy. Domains within for financial planning contained items such as determining budget priorities, identifying funding sources, performing economic analyses, and developing sustainable financial models for programs. Our results aligned with prior literature, which details financial and budgetary management as having the highest training gaps.<sup>4,9</sup> Policy development domain contained questions such as understanding governmental structure, identifying areas for policy development, analyzing policy options, and interacting with policy makers. Given 64.9% of the survey respondents in our sample held frontline or entry level positions, it is possible that they are not heavily involved with policy development since, it requires understanding of government structure and experience in assessing policies.

Quality improvement and developing effective communication campaigns are important strategic skills in serving the community. Domains within of quality improvement included items such as establishing a performance management system, reporting systems for a program, developing performance indicators, and using quality improvement tools. We found that training gaps in quality improvement was differed by local health jurisdictions and supervisory roles. For instance, 76 % of survey respondents who had supervisory roles and worked in the state health department were less likely to have training gaps compared to non-supervisory employees who worked in local health departments. Developing effective communication campaign included skills related to press releases, social media interactions, and public service announcements.

We were surprised to see gender and its associations with training gaps in competencies and strategic skills, particularly since almost half of female survey respondents held front or entry level positions. In the U.S., women represent 79% of the public health workforce and 64% of executive level employees.<sup>12</sup> Only two female employees are likely to reach executive level for every 100 female

workers.<sup>2,16</sup> Concordantly, we found that out of the 1067 female respondents, only 4.5% of executive level positions is held by female, compared to 10.5% of the 571 male respondents. This is significant since our finding suggest that female employees are adequately trained, but less represented in executive and senior level positions.

Our research included data from local health departments serving rural populations that have been the subject of limited research. On a national level, 73% of public health employees work in urban health department, while only 13% of public health employees work in health departments serving rural populations.<sup>10</sup> However, almost half of our sample worked for the state health departments, with the remainders were equally distributed between health departments serving urban and rural populations. We found that state public health employees had lower training gaps in financial planning and quality improvement compared to employees in local health departments.

Workforce retention is another issue for both state and local health departments. About 25% of employees currently considering to leaving their organizations are planning to leave in the next year for reasons other than retirement.<sup>10,17</sup> This high turnover may be leading to training gaps in public health competencies and strategic skills. For instance, we found that public health employees planning to retire in more than five years had higher training gaps in financial planning and policy development than employers planning to retire in the next three years. Given that about eighty percent of our sample was public health employees planning to retire in more than five years and aged between 50 and 60 years old, adequate training maybe helpful to increase the public health workforce retention. While the public health workforce is aging for both state and local health departments with nearly a quarter of employees planning to retire by 2020, local health departments may especially face challenges in retaining appropriately trained workforce with limited resources in rural areas.<sup>18</sup>

Previous research suggests that organizational role is pivotal in training gaps, where front line or entry-level staff had higher training needs than program management or supervisory level employees.<sup>9</sup> However, we did not find any significant association between organization roles and public health competencies and strategic skills. In addition, our results did not find significant associations between educational attainment and public health training gaps. Although numerous literature reviews report leadership in systems thinking as the highest training gaps in the public health workforce, we did not find

significant difference in this competency.<sup>2,19</sup> This disparity might be due to the survey structure. Our survey included leadership in system thinking and leadership in strategic planning competencies as one competency opposed to two competencies in many studies.

This study has few limitations. First, this study utilized an online survey that was conducted by The Northwest Center for Public Health Practice at University of Washington and results only applied to public health employees who participated in the survey. Secondly, the long length of the survey contributed to missing data for the demographic questions since they were placed in the end of the survey questionnaire and often were left unanswered. Categorizing in-text options for demographic questions were not explored due to the significant number of in text answers. Lastly, the survey respondents self-reported their training confidence and needs for executing public health competencies and strategic skills. Respondents could have overestimated capacities of executing public health duties and underestimated needs of duties, which may have impacted the result of the study.

### **Conclusion**

Our study identified training gaps in public health competencies and strategic skills that are essential for the current and future workforce to be able to address evolving public health challenges in Washington State. These findings suggest that there are opportunities for state, local and tribal health departments to prioritize certain training courses that address gaps in financial planning, policy development, quality improvement and developing efficient communication campaign. Although female public health employees have lower training gaps across all competencies and strategic skills, they are less represented at the executive or senior level positions. We did not find differences in training gaps between rural and urban health departments. Thus, this relationship needs to be explored in future studies.

### **Implications**

The findings of this analysis provide further evidence on training gaps in public health competencies and strategic skills among public health professionals in Washington State. The findings of the analysis may be useful for implementation of public health training courses and plan activities. The largest training gaps are in financial planning and policy development competencies, and strategic skills in quality improvement and developing effective communication campaign.

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## Appendices

Figure 3: Conceptual Model for Primary Aim

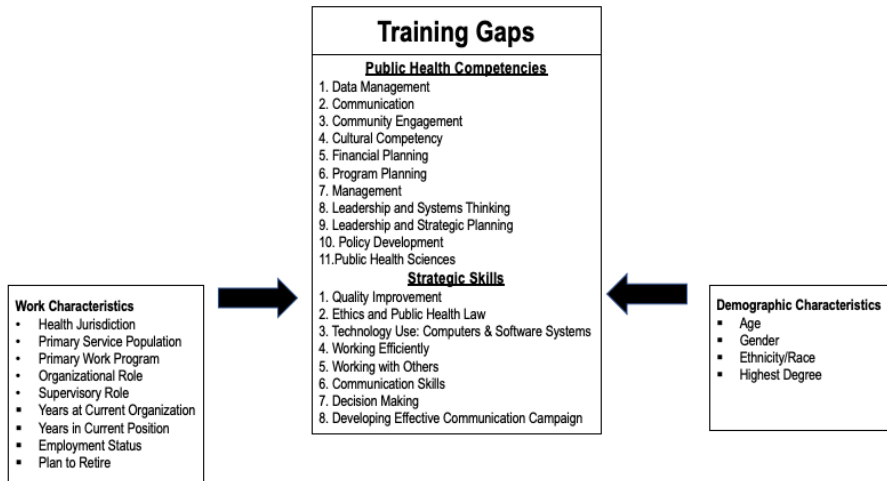


Figure 4: Conceptual Model for Secondary Aim

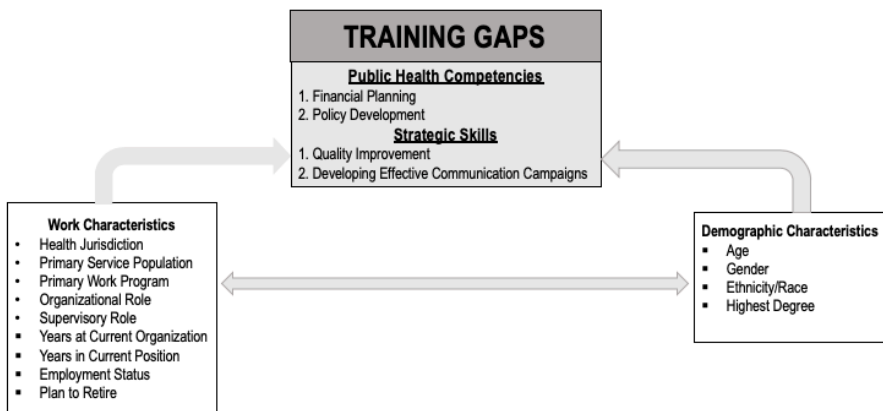
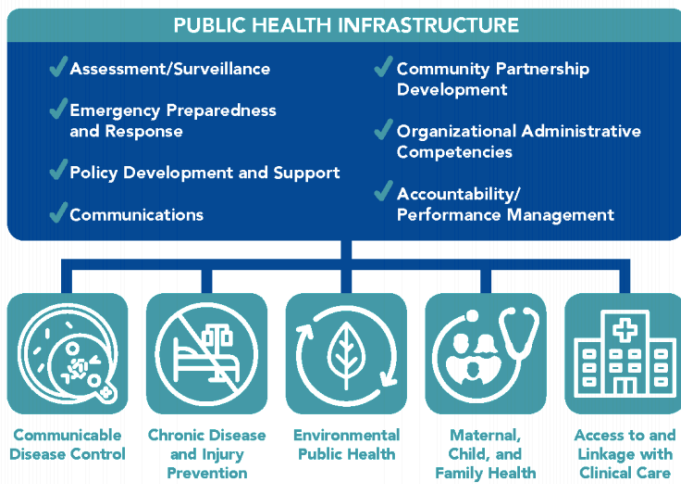
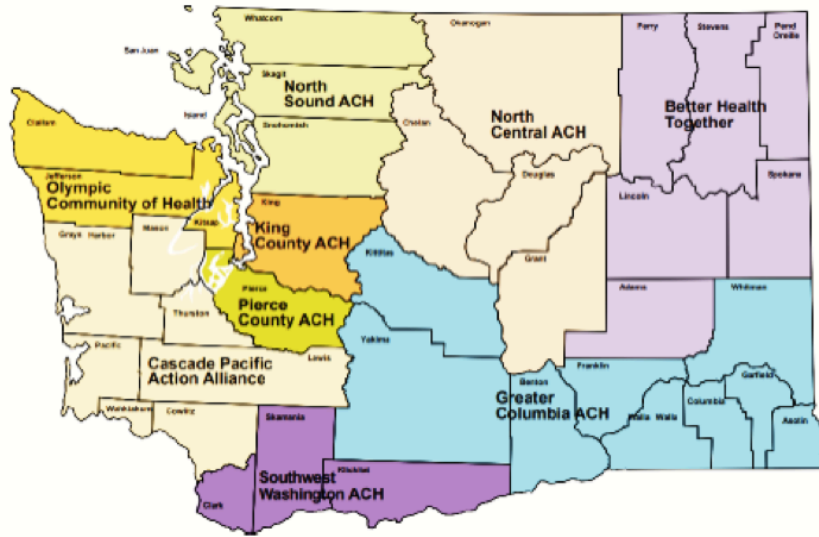


Figure 5: Foundational Public Health Services Area



**Map 1: Washington Health Jurisdictions by Accountable Community of Health**



**Table 6: Estimated Means & Standard Deviations for Public Health Competency & Strategic Skill**

		N	Mean	SD
<b>Public Health Competency:</b>	Data Management	890	25.21	23.51
	Communication	840	24.03	24.85
	Community Engagement	836	24.62	25.1
	Cultural Competency	655	24.35	29.65
	Financial Planning	621	37.86	34.94
	Program Planning	1057	23.39	29.73
	Management	704	23.90	27.08
	Leadership & Systems Thinking	1174	24.04	26.74
	Leadership & Strategic Planning	1101	26.26	30.02
	Policy Development	869	34.12	35.37
	Public Health Science	573	23.8	30.36
<b>Strategic Skill:</b>	Quality Improvement	1289	37.02	39.44
	Ethics and Public Health Law	1721	22.11	31.4
	Technology Use: Computers & Software Systems	2120	21.78	23.3
	Working Efficiently	2149	9.05	18.7
	Working with Others	2238	10.68	19.17
	Communication	2094	14.23	21.27
	Decision Making	2199	8.77	23.12
	Developing Effective Communication Campaign	633	30.54	30.7