2011

# Final Report: Environmental Workforce Characteristics in the Rural Public Health Sector


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## Executive Summary

# Environmental Workforce Characteristics in the Rural Public Health Sector

**Background:** Environmental risks to rural populations are understudied relative to urban areas despite increasing recognition that rural populations are potentially exposed to these risks from agricultural, mining, industrial or other sources. These environmental risks and associated health problems carry corresponding implications for public health programs and services, and highlight the need for a rural public health workforce that includes appropriate environmental health specialists. However, documentation exists that the environmental workforce in rural areas is underdeveloped. This project analyzed the environmental workforce characteristics of the rural public health sector to inform policy relative to coordination of rural environmental health services.

**Methods:** The study incorporated survey approaches with analysis of existing secondary data sources to characterize the environmental public health workforce in rural and urban settings. The aims of this study were to 1) *determine the number and qualifications of environmental specialists employed in rural (RUCA codes 4 and higher) versus urban public health settings (RUCA codes 1 through 3),* 2) *analyze environmental public health workforce capacity in rural versus urban settings*, and 3) *analyze collaboration and coordination between public health and environmental protection professionals at both state and local levels*.

**Aim 1:** Existing data were analyzed for Aim 1. This analysis included the National Association for County and City Health Officials (NACCHO) survey of local health departments, conducted most recently in 2008. The West Virginia Rural Health Research Center received permission to use the data for the purpose of this study, and NACCHO provided data. The Center collected all public information elements and received access to information regarding governance, partnerships, and workforce variables through a data use agreement.

**Aims 2 and 3:** The Center interviewed selected district and local public health agency representatives in 26 states. The agencies were selected to assure representation of the 6 jurisdictional models including City; County; City/County; Town/Township; Multi-county, district, region; and Other which represent different relationships between the State and local public health agencies. In addition, sites were selected based on census region and number of constituents served. Chief Executive Officers/Directors from selected jurisdictions were emailed an introductory letter from the Deputy Director of the West Virginia Rural Health Research Center to explain the study and request participation in a telephone research interview by a member of their agency. The research interview was conducted by an experienced research team member using a prepared script. Interviews ranged in length from approximately 30 to 60 minutes depending upon feedback provided. A total of 51 interviews were completed. Interviews included questions about general environmental issues in the state, severity of these issues for rural areas, current and anticipated workforce issues and needs, and perceptions of collaboration (working together to achieve a goal) and coordination (maintenance of an effective relationship) between local health departments and environmental protection agencies. Interview analysis involved identification and description of trends in responses and was carried out by the research team.

**Results:** Rural health departments were significantly less likely than their urban counterparts to employ environmental health

specialists (sanitarians), other environmental health scientists or technicians, and health educators. Rural health departments were also less likely to employ epidemiologists. Rural health departments employ significantly more registered nurses than their urban counterparts. Additionally, rural health departments are less likely to offer key environmental services than their urban counterparts, including key environmental surveillance, regulation, inspection, and licensing services.

Interview case studies revealed that the general environmental health issues of water quality, sewage, food safety, air quality, nuisance issues such as bed bugs, animal bites and rabies threats, and administrative and funding issues relative to environmental health service delivery were perceived by interviewees to be more pressing in rural areas. In many areas, economic conditions, hiring freezes and subsequent increased workloads have impacted the ability of health departments to meet their environmental protection mission.

**Future Research:** Environmental risks and associated health problems carry corresponding implications for public health programs and services, and highlight the need for a rural public health workforce that includes appropriate environmental health providers and specialists. Future research can help to determine the extent to which local public health systems in rural jurisdictions have the capacity to meet their communities' public health needs. Research could examine the competencies needed to provide population-appropriate rural environmental health services. A national study of actual environmental health services provided to rural populations could inform the development of these competencies. A method for estimating future workforce demand for rural environmental health workforce personnel could be developed using rigorous methodologies. The financial impact of local, state, and federal regulations on rural environmental health services can be examined, along with implications for future workforce demand to meet those regulations.

**Policy Implications:** Health care policy changes are needed to meet workforce needs to address evolving environmental health issues in rural settings. Policies and programs designed to fill gaps in the environmental workforce can have a significant impact on the health of rural communities. Policy implications that have emerged from this study include the following:

1. Isolated rural environmental health departments could be further integrated into local, regional, and state level public health systems in order to be successful. Fragmentation leads to challenges for environmental health workers. Partnerships can be established to advocate for environmental health services in rural areas by demonstrating the value of these services to the health of rural communities. The emergence of regional expertise in emerging environmental health issues may be capitalized upon, developing regional Centers of Excellence in particular environmental hazards. The HRSA Public Health Training Centers may be an additional resource. Regulatory and policy barriers to innovation may be evaluated and removed.
2. Model environmental health departments within a variety of jurisdictional types of public health agencies can be evaluated for best practices.
3. Emerging models of care may be evaluated for their efficacy in enhancing rural environmental health services. For instance, dense social networks, a strong belief in self- help, and shared life experiences may position rural areas well for the use of a community health worker or "*promotora*" model for identifying environmental risks and linking citizens to appropriate resources[9].
4. Efforts may be directed at evaluating the demand and need for fully qualified

environmental health workers in rural areas. Rigorously derived workforce formulas to determine the demand for particular classifications of environmental health workers on a per capita basis may be a helpful guide for local health departments. If rural health departments must rely on the registered nurse workforce for provision of many environmental health services, efforts can be made to enhance environmental health training in nursing curricula. Through appropriate curricular development, non-public health professionals and clinicians could be trained to provide the necessary rural environmental health services not currently available. However, the workforce implications for an already stretched rural public health workforce must be considered.

5. The environmental health education pipeline and continued professional education opportunities could be evaluated based on estimates of future anticipated need. Workforce development programs in public health may consider inclusion of the environmental health workforce as a particular area of emphasis.
6. Environmental regulation can be evaluated for its impact on the rural environmental health workforce. Additional competencies for emerging environmental health problems may require further training of the workforce. Increased inspections, additional reporting responsibilities, and subsequently increased workforce costs could be evaluated.

**Final Report #5**

**June 2011**

**Support for this report was provided by the Office of Rural Health Policy, Health Resources and Services Administration, PHS Grant No. 1 U1CRH10664-01-00.**

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# Final Report

## Environmental Workforce Characteristics in the Rural Public Health Sector

### Introduction

Health is influenced by a variety of genetic, behavioral, environmental, socioeconomic, and health services variables. Recently, the role of the environment has gained increased attention as a key threat to public health. Environmental health problems are of major concern due to the limited information about environmental exposures faced specifically by rural populations, as most prior research on environmental health risk has focused on urban populations. However, rural populations are potentially exposed to a variety of serious environmental risks from point and non-point pollution sources including industrial facilities, animal containment facilities, mining operations, logging and timber activities, petroleum refineries, agricultural activities, incinerators, landfills, sewage treatment facilities, and transportation routes. A recent study undertaken by the West Virginia Rural Health Research Center documents potential environmental hazards and mortality rates across rural-urban areas in the United States[1]. Rural counties in the US had significantly greater exposure to potential agriculture-related pollution. Both air and water pollution sources were significantly associated with greater total and cancer mortality in non-metropolitan areas. Air pollution in non-metropolitan areas was associated with greater respiratory disease rates. Coal mining areas also had higher adjusted mortality rates[1]. The total burdens of environmental exposures in rural populations are not known, but carry significant implications for both population health and health care treatment demands placed on rural health care systems.

Environmental risks and associated health problems carry corresponding implications for public health programs and services, and highlight the need for a rural public health workforce that includes appropriate environmental health providers and specialists. However, documentation exists that the

environmental workforce in rural areas is underdeveloped. HRSA has published two reports: "Public Health Workforce: Enumeration 2000"[2] and "Public Health Workforce Study" in 2005 each documenting a shortage in the environmental public health workforce in at least some states[3]. In these HRSA studies, rural public health agencies in most states appeared to have more problems recruiting staff to their agencies than their urban or suburban counterparts. They reported drawing their staff from the local labor market and had greater difficulty recruiting more educated, skilled public health workers. These agencies cited both budget constraints and lack of qualified candidates as their two biggest barriers to recruitment, an urban concern as well as a rural one. In these HRSA studies, staff who obtained master's degrees in public health (MPH) were more likely to move to larger public health agencies, attracted by better pay. Rural public health agencies were the least likely to report a strong relationship with schools of public health and they were most likely to identify lack of access to training and advanced education (both undergraduate and graduate programs) as a substantial barrier to upgrading their workforce.

In a 2008 report, the National Association for County and City Health Officials (NACCHO)[4] recognized that although the characteristics and needs of any community are unique, all communities should reasonably expect a consistent and robust set of public health services, regardless of rural or urban designation. A study of activities and workforce of small town rural local health departments[5](defined by NACCHO small towns with a population of less than 10,000 and frontier areas) documented that approximately 40 percent of the local health departments in the United States serve small town rural areas. However, small town rural local health departments are less likely to provide environmental health services than other local health departments. In fact, in a 2005 survey, 68% of small town rural designated health departments provided environmental health services, while 80% of all other local health departments provided these services, a statistically significant difference. Specifically, small town rural local health departments are less likely to provide environmental services such as food safety education, vector control, groundwater protection, indoor air quality, pollution

prevention, hazmat response, and land use planning, than all other local health departments surveyed. Small town rural health departments employ more nurses and fewer environmental health specialists than other local health departments. The NACCHO recommended further research in this area to determine the extent to which the local public health systems in these rural jurisdictions have the capacity to meet their communities' public health needs.

In areas where local public health departments are unable to provide environmental health services, dependence on other levels of care may occur. However, NACCHO reports that many environmental health services are less likely to be provided by any governmental agency in small town rural local health department jurisdictions than in other jurisdictions[5]. NACCHO has recently issued a report calling for improved coordination between public and environmental health professionals including the need for a "revitalized public health workforce" to strengthen public heath perspectives in environmental health issues.

Given what we currently know of the environmental health workforce, the aims of this study were to:

1. Determine the number and qualifications of environmental specialists employed in rural (RUCA codes 4 and higher) versus urban public health settings (RUCA codes 1 through 3).
2. Analyze environmental public health workforce capacity in rural and urban settings.
3. Analyze collaboration and coordination between public health and environmental protection professionals at both state and local levels.

**Human Subjects Research**

Human subjects were involved in this study. The study was considered exempt from review. West Virginia University's Institutional Review Board (IRB) has acknowledgement of this study on file.

Confidentiality of responses to interview questions was discussed with all subjects who participated in interviews. Those who participated in interviews were assured that no identifying information, except the type of agency, and the rural or urban nature of the population served, was collected with the interview. Subjects were informed that they did not have to answer all interview questions, and could quit the study at any time.

## Aims, Methods, and Data Analysis

The study incorporated survey approaches with analysis of existing secondary data sources to characterize the environmental public health workforce in rural and urban settings.

***Aim 1***: Existing data were analyzed for Aim 1. This analysis included the NACCHO survey of local health departments, conducted most recently in 2008. NACCHO has conducted five Profile studies to date: 1989, 1993, 1996, 2005 and 2008. The Centers for Disease Control and Prevention sponsored each of the Profile studies, and the Robert Wood Johnson Foundation co-sponsored the 2008 Profile study.

In 2000, NACCHO and CDC agreed that a small number of items would be made publicly available, while release of other data would be protected. In 2000, NACCHO and CDC agreed to provide basic information about local health departments (LHDs) in a database that is publicly available. The Profile data elements included in this resource are:

- LHD name, contact information, and geographic identifier (zip code)
- Name, title and degrees of top agency executive
- Type of jurisdiction (city, county, district, etc.) and population estimate (and year)
- Presence of local board of health
- Number of FTEs
- Services provided by LHD (including environmental services)

The profile studies also contained other information, including governance, funding, partnerships, performance improvement, workforce, information technology, and other topics. The WV Rural Health Research Center completed an application for research collaboration with the National Association of County and City Health Officials (NACCHO), received permission to use the data for the purpose of this study, and NACCHO provided data and weighting protocols. The Center collected all public information elements and received access to information regarding governance, partnerships, and workforce variables through the data use agreement.

To overcome disproportionate representation of the population of LHDs as well as to account for non-response and sampling methodology, we applied weighting information to the dataset that was provided to us by NACCHO. The sum of all records when weighted was 2,794, with fractional records for certain variables. Null variables were not included in the percent calculations. Data were cleaned, looking for any impossible values, including zip code values that did not match the zip code database used to transform zip code to RUCA code. Zip codes were corrected in consultation with NACCHO when necessary.

We selected various elements in the dataset related to environmental health or environmental health workforce for analysis. Using SAS v 9.1.3, frequency distributions and percents were analyzed for these elements sorted by urban (1-3) and rural (4+) RUCA categories. Additional analyses for significant differences between rural and urban workforce and services were conducted when appropriate using Pearson's chi-square. The p-value for significance was set at 0.05.

***Aims 2 and 3***: The Center interviewed selected local public health agency representatives in 26 states to analyze environmental public health workforce capacity in rural and urban settings . Using the 2008 NACCHO profile survey data, a random sample of 114 public health agencies was selected by census regions and jurisdiction type. A list of replacement agencies was randomly selected for each

jurisdiction and region in the event of refusals by the original selections. Census regions included the Northeast, Midwest, South, and West regions. Agencies were selected to assure representation of the 6 jurisdictional models in the original NACCHO study including City; County; City/County; Town/Township; Multi-county, district, region; and Other which represent different relationships between state and local public health agencies. Not all regions had agencies representing all (6) jurisdiction models. The Town/Township model was not present in the South or West regions and had a limited number in the Midwest region. Please see **Appendix 1** for a review of respondent agency characteristics and **Appendix 2** for a summary of the population characteristics for each agency service area. Purely rural analyses were a challenge in this part of the study, as many respondents reported that their agencies have rural, suburban and urban catchment areas. Therefore, summary results will be provided, and when possible, issues specific to rural areas of the respondents' jurisdictional areas are reported.

Because of the significant diversity of local public health agencies within states, including the population size and density in the areas served, at least five local or district public health agencies in each census region, (including at least one urban, one small town rural, one large town rural, and where appropriate, one agency on an international border), were selected to be in this interview case study. This allowed for collection of data across the rural-urban spectrum, across differing operating environments, and under different models of sharing responsibility between state and local governments. Of note, most jurisdictions covered rural, suburban, and/or urban environments. Interviews included:

- general environmental issues in the state;
- environmental workforce staffing and functions;
- adequacy of supply of environmental health workforce, needs for future workforce, anticipated hires in next 12 months;

- shared staff across agencies and use of contracted services;
- funding sources for environmental workforce;
- difficulties experienced in recruitment and retention of environmental workforce;
- training and continuing education availability and needs of the environmental workforce;
- availability of information technology for workforce development, and
- collaboration (working together to achieve a goal) and coordination (maintenance of an effective relationship) between public health and environmental protection professionals at both state and local levels.

Chief Executive Officers/Directors from selected jurisdictions were emailed an introductory letter from the Deputy Director of the West Virginia Rural Health Research Center to explain the study and request participation in a telephone research interview by a member of their agency. An electronic *Interview Contact Form* was attached in the email for follow-up. Research interview dates were then scheduled via email or by telephone. An email confirmation was sent to the interviewee with scheduled interview date, time and the toll-free telephone number for call-in. The research interview was conducted by an experienced research team member using a prepared script. Interviews ranged in length from approximately 30 to 60 minutes depending upon feedback provided. Interviews scheduled but missed by the interviewee were rescheduled at the interviewee's convenience.

If no response to the request for interview was received, a follow-up correspondence was initiated. A second or third contact was placed via email if there was no communication. Seven additional public health agencies were obtained from the replacement list to substitute for those agencies who did not respond to our request for interview. The same procedure to request the replacement agency participation was followed as with the original selection. A total of 51 interviews were completed.

## Results

**Environmental workforce employment characteristics:** In the 2008 NACCHO survey, LHDs were asked a series of workforce questions about the types of occupations that were currently employed by the LHD. The respondent was prompted to categorize staff according to their primary job responsibilities. Table 1 shows the results for urban and rural LHDs for select environmental health related occupations. Rural LHDs were significantly less likely than their urban counterparts to employ environmental health specialists (sanitarians), other environmental health scientists or technicians, health educators and epidemiologists. Rural LHDs were significantly more likely than their urban counterparts to employ registered nurses. Given the finding that rural LHDs are less likely to employ occupations specifically trained in environmental health sciences, it seems likely that these LHDs are dependent upon other professions to carry out these functions. Reliance on other professions, including registered nurses, to carry out these functions requires attention to specialized education and training for these professions who may not be exposed to environmental health content in their basic education programs.

**Table 1: Occupations employed by local health departments: Urban and rural comparisons***

| Occupation | | No<br>Number (%) | Yes<br>Number (%) | Pearson's chi-square results |
|---|---|---|---|---|
| Registered Nurse (e.g., public health nurse, school nurse, community health nurse, nurse practitioner) | Urban | 117.69 (10.9%) | 960.31 (89.1%) | Employing Registered Nurse: $X^2(1)=67.23$, $p<.001$ |
| | Rural | 50.83 (3.1%) | 1573.64 (96.9%) | |
| Environmental health specialist (sanitarian) | Urban | 126.12 (11.5%) | 966.30 (88.5%) | Employing Environmental Health Specialists: $X^2(1)=76.72$, $p<.001$ |
| | Rural | 389.27 (25.3%) | 1149.43 (74.7%) | |
| Other environmental scientists or technicians | Urban | 587.39 (60.6%) | 382.47 (39.4%) | Employing Other environmental scientists or technicians: $X^2(1)=132.23$, $p<.001$ |
| | Rural | 1143.22 (81.9%) | 253.18 (18.1%) | |
| Epidemiologist | Urban | 597.25 (60.9%) | 383.10 (39.1%) | Employing Epidemiologist: $X^2(1)=253.35$, $p<.001$ |
| | Rural | 1248.44 (88.7%) | 159.59 (11.3%) | |
| Health educator | Urban | 393.69 (37.8%) | 648.47 (62.2%) | Employing Health |

| | | | | |
|---|---|---|---|---|
| | Rural | 738.53 (49.2%) | 763.81 (50.8%) | educator: $X^2(1)=32.28$, $p<.001$ |

**Fractional numbers are a result of weighting schema.*

**Environmental surveillance, regulation, license, and inspection activities:** Local health departments were asked to indicate the types of activities performed in their jurisdiction during the past year. Respondents had (6) categories plus the option of stating "unknown" to choose from. They were asked to categorize whether they 1) perform the activities directly, 2) contracted out the activities, if they were completed by 3) state or 4) local agencies or 5) by someone else. They were also asked to indicate if that activity was 6) not available in their jurisdiction. LHDs had the opportunity to check all of the categories that applied. For the purpose of this report, only performance of the activities, contractual arrangement for services, and not available in the jurisdiction responses are reported.

Table 2 illustrates the weighted number and percentage of urban and rural LHDs who reported the categories of performing the service directly, contracting out the service, or were reported as not available in their jurisdiction during the past year. In these categories, with the exception of communicable/infectious disease surveillance, rural local health departments were less likely to perform these environmental health services than their urban counterparts. As the table below indicates, most of these differences are statistically significant. In many categories, rural LHDs contracted out these key environmental health services more often than their urban counterparts. In many cases, when environmental health services are not available in an urban or rural jurisdiction, causes may be related more to the prevalence of activities in certain geographic areas, rather than a lack of services, so in these areas, results should be interpreted with caution. For instance, while there is a statistically significant difference between the lack of services for milk processing inspections between urban and rural LHDs, this is likely a result of less milk processing sites in urban areas than a function of urban/rural workforce availability differences.

**Table 2: Environmental surveillance, regulation, licensing and inspection activities performed by LHD, contracted out, and not available in jurisdiction**

| Activity | | Performed by LHD directly | Contracted out by LHD | Not available in jurisdiction |
|---|---|---|---|---|
| **Epidemiology and Surveillance** | | | | |
| **Communicable/ infectious disease** | Urban | 946.79(84.7%) | 93.47 (8.4%) | 5.53 (0.5%) |
| | Rural | 1464.70 (89.5%) | 27.29 (1.7%) | 8.13 (0.5%) |
| *Chi square* | | *$X^2$ (1)=13.94, p<.001* | *$X^2$ (1)=71.03, p<.001* | *$X^2$ (1)= .000 p=0.997* |
| **Environmental health** | Urban | 893.64 (80.5%) | 20.69 (1.9%) | 24.15 (2.2%) |
| | Rural | 1170.16 (71.4%) | 49.94 (3.1%) | 22.49 (1.4%) |
| *Chi square* | | *$X^2$ (1)=28.87, p<.001* | *$X^2$ (1)=3.73, p=0.054* | *$X^2$ (1)=2.51, p=0.113* |
| **Regulation, Inspection and/or Licensing Activities** | | | | |
| **Mobile homes** | Urban | 396.51 (36.4%) | 5.21 (0.5%) | 207.59 (19.1%) |
| | Rural | 424.35 (26.3%) | 19.11 (1.2%) | 155.25 (9.6%) |
| *Chi square* | | *$X^2$ (1)=30.96, p<.001* | *$X^2$ (1)=3.66, p=0.056* | *$X^2$ (1)=50.28, p<.001* |
| **Campgrounds & RVs** | Urban | 521.15 (47.6%) | 6.64 (0.6%) | 193.30 (17.7%) |
| | Rural | 604.32 (37.6%) | 24.08 (1.5%) | 87.19 (5.4%) |
| *Chi square* | | *$X^2$ (1)=27.09, p<.001* | *$X^2$ (1)=4.59, p=0.032* | *$X^2$ (1)=106.12, p<.001* |
| **Solid waste disposal sites** | Urban | 420.06 (38.1%) | 10.03 (0.9%) | 95.67 (8.7%) |
| | Rural | 395.94 (24.5%) | 29.00 (1.8%) | 43.17 (2.7%) |
| *Chi square* | | *$X^2$ (1)=57.73, p<.001* | *$X^2$ (1)=3.63, p=0.057* | *$X^2$ (1)=48.86, p<.001* |
| **Solid waste haulers** | Urban | 414.10 (37.6%) | 11.26 (1.0%) | 50.89 (4.6%) |
| | Rural | 373.58 (23.3%) | 26.26 (1.6%) | 42.55 (2.6%) |
| *Chi square* | | *$X^2$ (1)=65.29, p<.001* | *$X^2$ (1)=1.79, p=0.181* | *$X^2$ (1)=7.69, p=0.006* |
| **Septic systems** | Urban | 859.15 (76.7%) | 16.80 (1.5%) | 49.35 (4.4%) |
| | Rural | 997.81 (61.3%) | 54.77 (3.4%) | 14.27 (0.9%) |
| *Chi square* | | *$X^2$ (1)=72.42, p<.001* | *$X^2$ (1)=9.07, p=0.003* | *$X^2$ (1)=36.76, p<.001* |
| **Hotels/motels** | Urban | 621.63 (56.4%) | 3.78 (0.3%) | 112.13 (10.2%) |
| | Rural | 779.02 (48.0%) | 31.91(2.0%) | 74.51 (4.6%) |
| *Chi square* | | *$X^2$ (1)=18.34, p<.001* | *$X^2$ (1)=13.39, p<.001* | *$X^2$ (1)=32.13, p<.001* |
| **Schools/daycare** | Urban | 825.74 (74.0%) | 15.69 (1.4%) | 6.27 (0.6%) |
| | Rural | 1048.42 (64.2%) | 34.79 (2.1%) | 11.50 (0.7%) |
| *Chi square* | | *$X^2$ (1)=29.23, p<.001* | *$X^2$ (1)=1.93, p=0.165* | *$X^2$ (1)=0.21, p=0.646* |
| **Children's camps** | Urban | 693.03 (62.8%) | 9.63 (0.9%) | 81.78 (7.4%) |
| | Rural | 615.10 (38.5%) | 13.56 (0.8%) | 167.67 (10.5%) |

| | | | | |
|---|---|---|---|---|
| *Chi square* | | *$X^2$ (1)=154.28, p<.001* | *$X^2$ (1)=0.00, p=0.948* | *$X^2$ (1)=7.21, p=0.007* |
| **Cosmetology businesses** | Urban | 190.17 (17.5%) | 1.43 (0.1%) | 68.71 (6.3%) |
| | Rural | 138.88 (8.6%) | 14.53 (0.9%) | 121.59 (7.6%) |
| *Chi square* | | *$X^2$ (1)=47.58, p<.001* | *$X^2$ (1)=6.56, p=0.010* | *$X^2$ (1)=1.52, p=0.217* |
| **Body art (tattoos, piercing)** | Urban | 676.99 (61.9%) | 6.51 (0.6%) | 145.05 (13.3%) |
| | Rural | 681.70 (42.1%) | 19.55 (1.2%) | 209.02 (12.9%) |
| *Chi square* | | *$X^2$ (1)=102.08, p<.001* | *$X^2$ (1)=2.58, p=0.108* | *$X^2$ (1)=0.07 p=0.788* |
| **Swimming pools (public)** | Urban | 930.61 (83.2%) | 14.11 (1.3%) | 31.78 (2.8%) |
| | Rural | 910.49 (55.9%) | 35.03 (2.1%) | 72.35 (4.4%) |
| *Chi square* | | *$X^2$ (1)=223.53, p<.001* | *$X^2$ (1)=2.98, p=0.084* | *$X^2$ (1)=4.68, p=0.030* |
| **Tobacco retailers** | Urban | 444.27 (40.3%) | 57.19 (5.2%) | 50.62 (4.6%) |
| | Rural | 290.66 (18.1%) | 22.21 (1.4%) | 86.69 (5.4%) |
| *Chi square* | | *$X^2$ (1)=162.12, p<.001* | *$X^2$ (1)=33.14, p<.001* | *$X^2$ (1)=0.89, p=0.344* |
| **Smoke-free ordinances** | Urban | 760.08 (68.3%) | 17.83 (1.6%) | 54.03 (4.9%) |
| | Rural | 809.92 (50.0%) | 19.48 (1.2%) | 181.55 (11.2%) |
| *Chi square* | | *$X^2$ (1)=90.67, p<.001* | *$X^2$ (1)=0.78, p=0.376* | *$X^2$ (1)=33.59, p<.001* |
| **Lead inspection** | Urban | 687.36 (62%) | 49.14 (4.4%) | 25.70 (2.3%) |
| | Rural | 659.80 (40.6%) | 92.54 (5.7%) | 71.34 (4.4%) |
| *Chi square* | | *$X^2$ (1)=119.86, p<.001* | *$X^2$ (1)=2.16, p=0.141* | *$X^2$ (1)=8.24, p=0.004* |
| **Food processing** | Urban | 399.95 (36.1%) | 12.54 (1.1%) | 61.13 (5.5%) |
| | Rural | 401.37 (24.8%) | 20.43 (1.3%) | 55.05 (3.4%) |
| *Chi square* | | *$X^2$ (1)=40.70, p<.001* | *$X^2$ (1)=0.09, p=0.762* | *$X^2$ (1)=7.23, p=0.007* |
| **Milk processing** | Urban | 153.45 (13.9%) | 7.14 (0.6%) | 119.69 (10.9%) |
| | Rural | 101.12 (6.3%) | 13.47 (0.8%) | 102.22 (6.4%) |
| *Chi square* | | *$X^2$ (1)=44.74, p<.001* | *$X^2$ (1)=0.31, p=0.577* | *$X^2$ (1)=17.68, p<.001* |
| **Public drinking water** | Urban | 385.23 (34.5%) | 12.23 (1.1%) | 11.78 (1.1%) |
| | Rural | 449.97 (27.7%) | 25.18 (1.5%) | 2.67 (0.2%) |
| *Chi square* | | *$X^2$ (1)=14.56, p<.001* | *$X^2$ (1)=1.01, p=0.315* | *$X^2$ (1)=10.01, p=0.002* |
| **Private drinking water** | Urban | 723.65 (64.8%) | 16.43 (1.5%) | 67.18 (6.0%) |
| | Rural | 895.43 (55.3%) | 38.96 (2.4%) | 44.22 (2.7%) |
| *Chi square* | | *$X^2$ (1)=24.87, p<.001* | *$X^2$ (1)=2.91, p=0.088* | *$X^2$ (1)=18.48, p<.001* |
| **Food service establishments** | Urban | 994.77 (87.9%) | 25.24 (2.2%) | 0 |
| | Rural | 1133.50 (69.0%) | 40.18 (2.4%) | 2.67 (0.2%) |
| *Chi square* | | *$X^2$ (1)=133.83, p<.001* | *$X^2$ (1)=0.14, p=0.712* | *$X^2$ (1)=1.84, p=0.174* |
| **Health-related facilities** | Urban | 443.64 (39.8%) | 10.85 (1.0%) | 30.57 (2.7%) |

| | | | | |
|---|---|---|---|---|
| | Rural | 404.01 (24.9%) | 14.97 (0.9%) | 24.59 (1.5%) |
| *Chi square* | | *$X^2$ (1)=68.30, p<.001* | *$X^2$ (1)=0.02, p=0.895* | *$X^2$ (1)=5.06, p=0.024* |
| **Housing (inspections)** | Urban | 512.89 (45.8%) | 14.71 (1.3%) | 32.27 (2.9%) |
| | Rural | 269.86 (16.7%) | 19.0 (1.2%) | 110.58 (6.9%) |
| *Chi square* | | *$X^2$ (1)=275.12, p<.001* | *$X^2$ (1)=0.11, p=0.744* | *$X^2$ (1)=21.13, p<.001* |
| **Other Environmental Health Activities** | | | | |
| **Indoor air quality** | Urban | 494.64 (44.9%) | 44.64 (4.0%) | 64.15 (5.8%) |
| | Rural | 343.49 (21.2%) | 35.73 (2.2%) | 163.89 (10.1%) |
| *Chi square* | | *$X^2$ (1)=171.66, p<.001* | *$X^2$ (1)=7.74, p=0.005* | *$X^2$ (1)=15.87, p<.001* |
| **Food safety education** | Urban | 900.28 (80.2%) | 32.92 (2.9%) | 20.95 (1.9%) |
| | Rural | 1144.94 (70.0%) | 39.69 (2.4%) | 24.45 (1.5%) |
| *Chi square* | | *$X^2$ (1)=36.26, p<.001* | *$X^2$ (1)=0.67, p=0.414* | *$X^2$ (1)=0.58, p=0.447* |
| **Radiation control** | Urban | 150.43 (13.8%) | 12.26 (1.1%) | 61.53 (5.6%) |
| | Rural | 150.18 (9.3%) | 11.99 (0.7%) | 121.01 (7.5%) |
| *Chi square* | | *$X^2$ (1)=13.19, p<.001* | *$X^2$ (1)=1.06, p=0.303* | *$X^2$ (1)=3.69, p=0.055* |
| **Vector control** | Urban | 721.69 (64.7%) | 45.56 (4.1%) | 40.39 (3.6%) |
| | Rural | 762.79 (47.0%) | 26.44 (1.6%) | 94.43 (5.8%) |
| *Chi square* | | *$X^2$ (1)=83.33, p<.001* | *$X^2$ (1)=15.57, p<.001* | *$X^2$ (1)=6.92, p=0.009* |
| **Land use planning** | Urban | 259.42 (23.3%) | 6.32 (0.6%) | 20.20 (1.8%) |
| | Rural | 208.22 (12.8%) | 16.70 (1.0%) | 58.20 (3.6%) |
| *Chi square* | | *$X^2$ (1)=51.24, p<.001* | *$X^2$ (1)=1.68, p=0.195* | *$X^2$ (1)=7.46, p=0.006* |
| **Groundwater protection** | Urban | 582.66 (52.2%) | 8.58 (0.8%) | 7.68 (0.7%) |
| | Rural | 534.80 (33.0%) | 22.34 (1.4%) | 23.77 (1.5%) |
| *Chi square* | | *$X^2$ (1)=101.12, p<.001* | *$X^2$ (1)=2.20, p=0.138* | *$X^2$ (1)=3.51, p=0.061* |
| **Surface water protection** | Urban | 477.72 (42.7%) | 6.38 (0.6%) | 15.93 (1.4%) |
| | Rural | 402.52 (24.9%) | 19.05 (1.2%) | 23.13 (1.4%) |
| *Chi square* | | *$X^2$ (1)=96.22, p<.001* | *$X^2$ (1)=2.65, p=0.103* | *$X^2$ (1)=0.00, p=0.996* |
| **Hazmat response** | Urban | 299.25 (26.8%) | 14.43 (1.3%) | 7.32 (0.7%) |
| | Rural | 189.62 (11.7%) | 12.04 (0.7%) | 32.15 (2.0%) |
| *Chi square* | | *$X^2$ (1)=102.68, p<.001* | *$X^2$ (1)=2.09, p=0.149* | *$X^2$ (1)=8.21, p=0.004* |
| **Hazardous waste disposal** | Urban | 265.52 (23.8%) | 55.25 (5.0%) | 17.37 (1.6%) |
| | Rural | 160.31 (9.9%) | 43.25 (2.7%) | 43.49 (2.7%) |
| *Chi square* | | *$X^2$ (1)=98.05, p<.001* | *$X^2$ (1)=10.05, p=0.002* | *$X^2$ (1)=3.84, p=0.050* |
| **Pollution prevention** | Urban | 462.65 (41.6%) | 14.16 (1.3%) | 19.75 (1.8%) |
| | Rural | 265.26 (16.4%) | 14.57 (0.9%) | 77.43 (4.8%) |

| | | | | |
|---|---|---|---|---|
| *Chi square* | | *$X^2$ (1)=213.52, p<.001* | *$X^2$ (1)=0.87, p=0.350* | *$X^2$ (1)=17.43 p<.001* |
| **Air pollution** | Urban | 343.47 (30.9%) | 13.13 (1.2%) | 23.21 (2.1%) |
| | Rural | 134.13 (8.3%) | 18.12 (1.1%) | 91.53 (5.7%) |
| *Chi square* | | *$X^2$ (1)=232.86, p<.001* | *$X^2$ (1)=0.02, p=0.886* | *$X^2$ (1)=20.97, p<.001* |
| **Noise pollution** | Urban | 365.16 (33.0%) | 13.39 (1.2%) | 63.43 (5.7%) |
| | Rural | 62.03 (3.9%) | 8.04 (0.5%) | 184.98 (11.5%) |
| *Chi square* | | *$X^2$ (1)=418.91, p<.001* | *$X^2$ (1)=4.21, p=0.040* | *$X^2$ (1)=26.39, p<.001* |
| **Collection of unused pharmaceuticals** | Urban | 127.97 (11.7%) | 19.68 (1.8%) | 210.53 (19.1%) |
| | Rural | 127.52 (7.9%) | 21.88 (1.4%) | 273.44 (17.0%) |
| *Chi square* | | *$X^2$ (1)=10.86, p=0.001* | *$X^2$ (1)=0.83, p=0.361* | *$X^2$ (1)=2.14, p=0.144* |
| **Other Activities** | | | | |
| **Occupational safety and health** | Urban | 194.35 (17.6%) | 15.00 (1.4%) | 23.90 (2.2%) |
| | Rural | 168.12 (10.4%) | 10.67 (0.7%) | 71.62 (4.4%) |
| *Chi square* | | *$X^2$ (1)=29.06, p<.001* | *$X^2$ (1)=3.39, p=0.066* | *$X^2$ (1)=10.09, p=0.001* |
| **Asthma prevention and/or management** | Urban | 320.35 (29.2%) | 28.18 (2.6%) | 71.72 (6.6%) |
| | Rural | 386.88 (23.9%) | 7.47 (0.5%) | 237.40 (14.7%) |
| *Chi square* | | *$X^2$ (1)=9.41, p=0.002* | *$X^2$ (1)=22.37, p<.001* | *$X^2$ (1)=42.82, p<.001* |

*"There's a significant amount of natural gas development drilling and a lot of controversy over the methods that are related to that both for the environment and health reasons. Hence, there's a great amount … of inquiries … related to both natural gas development and the infrastructure that goes with it."*

*"The fugitive dust problem is more so in rural areas … where there's a lot of growth…. The expansion of subdivisions … that were basically all desert land at one time, now … they're infringing on areas that…if you disturb the vegetation …, it creates a problem where we have more dust. This is becoming a definite problem …."*

*"…we're still battling some of the vestiges of hurricanes Katrina, Rita and Gustav from '05 and '08. Although I was not particularly impacted by the oil spill … that was a tremendous burden … for the public agencies in the state this past year."*

**Interview Results**

**General Environmental Health Issues:** During the interviews, respondents were asked to discuss general environmental health issues in their state. General environmental health issues noted most commonly by respondents included issues with water quality, sewage, food safety, air quality, nuisance issues such as bed bugs, animal bites and rabies threats, and administrative and funding issues relative to environmental health service delivery. A complete summary of the responses to this question is found in **Table 3**.

When asked if the general environmental issues of concern to their department were particular to rural areas of their states, their local area or their entire state, respondents indicated that most were issues for the entire state (59%), while 18% thought that most environmental issues were primarily rural issues, and 12.2% believed that these were local issues. Most felt that the issues were more "pressing" or urgent in rural areas (68.9%). The primary issues of concern for rural areas were water quality, administrative issues including funding, and sewer and septic systems. In addition, many respondents discussed the impact of rural industry on environmental health in their areas. Respondents discussed issues of air quality related to agricultural industry, as well as "fugitive dust" and air and water discharges. Some discussed the impact of particular types of industries in their rural areas, including smolder plants, the oil industry, and natural gas drilling.

**Table 3: General Environmental Health Issues**

| Environmental Health Issue | Number of responses (percent)* |
|---|---|
| Water quality, well water, ground water, primary surface water, algae bloom | 32 (17.3%) |
| Food safety including food borne illnesses, restaurant inspections | 26 (14.1%) |
| Sewage, septic tank, straight pipe discharges | 24 (12.9%) |
| Air quality including indoor air quality, issues related to agriculture, smoking enforcement | 23 (12.4%) |
| Administrative issues, including adequate funding, qualified personnel, enforcement of rules, emergency preparedness, quality services, educational programs | 20 (10.8%) |
| Nuisance issues including animals, rabies, bed bugs, vector control | 20 (10.8%) |
| Inspections including home, radon, lead | 13 (7.0%) |
| Garbage and solid waste disposal | 10 (5.4%) |
| Miscellaneous including medical marijuana (3), hazardous waste (2), natural gas drilling (2), soil contaminants (2) | 9 (4.8%) |
| Healthy homes, adequate housing | 4 (2.1%) |
| Infectious disease surveillance | 4 (2.1%) |

n = 51

** Each respondent could note more than one concern, therefore percent values reflect the percent of total responses, not respondents.*

**Environmental Health Workforce:** To gain clarity around the job titles for environmental health workers across a variety of agencies, respondents were asked to discuss who they classified as members of their environmental health workforce. The job classifications differed based on the type of agency, its scope of authority and services, and the issues of the state. Most agencies reported inclusion of environmental

health specialists, sanitarians, inspectors and investigators, engineers, environmental health administrators, program managers and coordinators as part of their environmental health workforce. However, many additional job categories were noted to be included in the environmental health workforce by respondents. Some of these are likely driven by local environmental issues and regulatory authority, such as the inclusion of geologists, epidemiologists, and toxicologists as part of the environmental health workforce. Additionally, individual agencies included health educators, nursing staff, and field staff as a part of their workforce. Technicians in a variety of fields, including vector control and animal control, were also noted by individual agencies. Finally, a variety of clerical workers, aides, and support staff were included in individual agency reports of their environmental health workforce.

**Environmental workforce supply and demand issues:** A series of questions were asked of interview respondents related to the adequacy of supply of environmental health staff, vacancies, changes to programs or services related to environmental workforce staffing issues, and recruitment concerns. Over half of respondents (60.8%) reported that they did not have an adequate supply of environmental health staff to address the environmental health issues in their jurisdiction. While a third (33.3%) of the respondents indicated that they did have an adequate supply of environmental health staff, 3 (5.9%) indicated that they only had adequate staff due to the economic changes in their jurisdiction, which resulted in less work for the environmental health workforce. Some of the explanations for this included closure of businesses in their jurisdiction leading to decreased inspections, as well as a slowing of the construction industry diminishing their need for staff to review plans, sewer and water systems, and housing inspections.

While respondents indicated that they did not have an adequate supply of environmental health staff, most also indicated that they did not have vacancies in their departments (72.5%). Respondents discussed issues of hiring freezes and budget cuts as responsible for their reported lack of vacancies. For those respondents who reported vacancies, the highest reported vacancy rates were in the environmental health sanitarian job classification (47.1%), followed by food and childcare inspectors (20.6%), and environmental health specialists (20.6%). Respondents reported the most difficult positions to recruit (defined as a vacancy for more than 3 months) were sanitarians, engineers and specialists. Nurses at a variety of levels were also mentioned by respondents as difficult to recruit into environmental health departments in their agencies. Perceived reasons for prolonged vacancies included applicants without the proper qualifications, lack of applicants, and salaries. Salary was noted by a majority of respondents (53.8%) as leading to difficulties in recruitment, followed by the location of positions (23%). The need for certification for certain job categories, and difficulties with the hiring approval process due to administrative processes were mentioned by individual respondents. Most (83.3%) felt that problems with recruitment were not a new problem, historic difficulties were discussed. Most agencies (77.6%) did not expect to hire in the next 12 months in their

***"The economic downturn … has really made an impact on our office in trying to get repairs to (failing) septic tanks, people are either in foreclosures or they don't have the money. In past years, …we'd say – you've got a problem, you need to fix it, and people took care of it. What we are finding now is that we are having to make multiple visits. We have to write our notes of violations, … issue citations, and …take legal action. It's time consuming and not particularly effective because achieving compliance is very low…"***

***"… a whole host of smaller programs that we … have the authority to respond to and … regulations that exist but we discontinued doing routine inspections in … programs to include swimming pools, body art facilities, assisted living residences and emergency medical vehicles. And that's due to the lack of resources."***

***"I think overall this profession is becoming more … challenging. There is some disparity between … what service demands …and resources are … we receive more complaints now and yet I have fewer health inspectors than I've ever had. The challenge is … how do we continue to do as much as we have … with less. I think we need to think outside … to meet that challenge."***

*"There are … services … no longer offered and a few that are contracted out. For the most part … the program that takes the biggest hit during budgetary times in environmental health and in sanitarian services specifically is always routine food inspections."*

*"Routine food service inspections are usually what suffer when the workforce is low."*

*"I would say that the difficulty of reaching communities and providing services is probably one of the greatest challenges."*

*"I think our biggest challenge here is being able to provide a full range of public health services with shrinking budgets. Dwindling resources, growing populations, and shrinking budgets are not – that's not a good match."*

*"Right now I'm struggling … to make some changes. We haven't done it formally, and we haven't changed our code, but … we're not able to keep up with our own expectations or the public's either. If you do something for a number of years, the expectation is that you will continue to do that, and so we're not going to meet the public's expectations either. We have a prioritization scale for inspection. So we've … backed that down a notch or two. The inspection frequencies have been lowered."*

environmental health staff. Of those who did expect to hire, most were to fill existing vacancies (72.7%). Only 3 agencies anticipated new or expanded environmental health positions in the next year.

Retention of environmental health staff was a problem for a minority of respondents (19.6%). Of those who indicated that they had difficulty with retention, most felt that the issues were related to salary, including loss of trained workers to competing industries and state government, where higher salaries are offered.

Close to a third (29.4%) indicated that they had recent workforce reductions (over the last year) because of budget cuts, economic downturn issues, hiring freezes, disability and retirement. Responses to these workforce reductions have included limiting services, layoffs, and consolidation of workforce staff with other areas of the agency. Changes to programs or services provided because of inadequate staffing in the environmental health area of respondents' agencies were reported by a majority (87.5%) of respondents. These changes included limiting services, streamlining departments and prioritizing services, cuts in workload, contracting services to external agencies, and the use of interns for certain services. One respondent indicated concern over lack of quality due to these changes.

Respondents were asked to predict demand for environmental health staff over the next year in their jurisdiction. Most indicated that they would need additional staff (48.9%), while

14.3% felt that there was a possibility of additional demand. When asked if there was a specific environmental issue or trend that would impact their need for additional environmental health staff in the future, respondents indicated an increase in the need for inspections (food, septic, spa, school, lead) as the most pressing area of need. Additional local, state, and federal legislation which impacts regulatory authority was also cited as an area impacting an increased need for staff in the future.

**Funding for environmental health staff and programs:** To ascertain the multiple sources of funding for environmental health agencies which impact staffing and services, respondents were asked to report the source(s) of funding for environmental health staff and programs in their agencies. Respondents were asked to specify state or local funding sources, as well as grants or other funding streams. Depending on where the agency is positioned in state or local government, all agencies reported a majority of their funding from state, county, or local government. Funding was supplemented by fees, including those for inspections, permits, licensing, citations, fines and consultation. Additionally, environmental health agencies reported multiple grants, including those from counties and states, as well as a variety of other grants for specific purposes, including air quality, lead reduction, water and beach quality , junk vehicle management, mosquito control and encephalitis prevention, and recycling. Of those agencies who reported federal grants, these included public health emergency response funding, EPA grants, and federal pass-through grants.

**Models for environmental health staffing:** Respondents were asked to discuss any models of sharing or contracting staff for environmental health services in their jurisdiction. Most agencies (80.4%) indicated that they did not share staff with any other agency or agencies. Of those who did share staff, a variety of agencies were named, including the departments of environmental protection, children and family services, vital statistics, agriculture, and public health. Additionally, jurisdictions shared staff with county and local agencies such as fire departments. One agency indicated sharing staff with CDC. While

analyses of the 2008 NACCHO data set indicate a higher incidence of contracting for services by rural LHD's most interview respondents (78.4%) indicated that they did not contract for services for environmental health. Of those who did contract for services, most were for specialized services, such as environmental health specialists, sanitarians, lead inspectors, tattoo parlor inspectors, food inspectors, billers, water quality testing, pollution permitting, vector control, methamphetamine laboratory inspections, and lab technicians. Average length of contracts varied, including annual contracts and contracting on an as-needed basis.

**Training needs for environmental health staff:** Respondents were asked to discuss the adequacy of training opportunities to develop new environmental health professionals, as well as continuing education opportunities for environmental health staff. Most believed that there were adequate opportunities to train new staff in their local area (60.8%) and state (72.5%). However, respondents voiced concerns relative to the lack of funding for training, especially related to travel expenses. Most respondents (84.3%) also believed that there were sufficient continuing education opportunities for environmental health personnel once they are trained. Most respondents (92.2%) indicated that they used technology for environmental health workforce development. However, more than a third (37.2%) of respondents indicated that they had difficulties with using technology for education. Technology systems issues, such as slow internet connections, loss of connections, access challenges, systems incompatibilities, power outages, lack of IT support, audio issues and user errors were the most common issues for use of technology for education, and were more common for smaller rural jurisdictions. One respondent indicated that in-person education worked better for their staff, one indicated that the age of their workforce influenced the use of technology for education, and one felt that it was difficult for staff to stay engaged and to fit online training into their busy schedules. Respondents reported a variety of unmet training or professional development needs in their area and state **(Table 4)**.

**Table 4: Areas of unmet training or professional development needs for environmental health personnel**

| Areas of need for training or professional development | Number of Respondents |
|---|---|
| Specific environmental health topics including food safety, housing inspections, emergency preparedness, pest control, air quality, water, mold, sewage, disease surveillance, emissions | 18 |
| Competency development for environmental health standards | 9 |
| Professional development (stress reduction, networking, written and oral communication, leadership training, language barriers) | 8 |
| Regulations and enforcement | 5 |
| Emerging environmental health issues (hoarding, bed bugs, technology for inspections, obesity) | 5 |
| Preparation for certification (chemistry requirements, registered EHS requirements, sanitarian preparation) | 3 |

n = 51

** Each respondent could note more than one concern*

**Collaboration and coordination between public health and environmental protection professionals:**

Respondents were asked to rate the collaboration (working together to achieve a goal) and coordination (maintenance of an effective relationship) between public health and environmental protection professionals in both their local area and their state. Ratings are found in **Table 5**. Most respondents felt that local coordination and collaboration between public health and environmental protection professionals is very good to good. State coordination and collaboration between the groups was rated as average by the majority of respondents. One respondent indicated that since September 11, 2001, public health, environmental health, local and state agencies seem to be working together and better, and that H1N1 concerns enhanced relationships further. One indicated that current attempts at the

state level with public health and environmental protection leadership are improving conditions. Several respondents indicated that their statute doesn't promote or allow for collaboration or coordination with other agencies, creating barriers to collaboration. One indicated "there is no legal opportunity to coordinate public health responses with public health and environmental health officials outside of my community of employment".

**Table 5: Perceived collaboration and coordination between local and state public health and environmental protection professionals**

| | Very Good | Good | Average | Poor | Very Poor | Don't know/N/A | Total Respondents |
|---|---|---|---|---|---|---|---|
| **Local collaboration** | 21 **(41.2%)** | 20 (39.2%) | 6 (11.7%) | 3 (5.9%) | 1 (2.0%) | 0 (0%) | 51 |
| **Local coordination** | 11 (21.6%) | 23 **(46%)** | 14 (27.4%) | 2 (4%) | 0 (0%) | 0 (0%) | 51 |
| **State collaboration** | 11 (21.6%) | 12 (23.5%) | 19 **(37.25%)** | 5 (9.8%) | 2 (4%) | 2 (4%) | 51 |
| **State coordination** | 11 (21.6%) | 6 (11.7%) | 21 **(41.2%)** | 10 (19.6%) | 0 (0%) | 3 (5.9%) | 51 |

n=51

**Additional respondent comments:** Respondents were provided an opportunity to share any final thoughts with interviewers at the conclusion of the interview. Comments by the respondents were in the areas of budget and funding, workload, recruitment and retention, promotion of agencies and environmental health, new models of care, and continuing education and training. While the general tone of these comments has been captured elsewhere in this report, it is important to emphasize some particular positive and concerning statements shared by the respondents. For instance, in the area of budget and funding, respondents emphasized the need for funding in rural areas where the workload is

particularly heavy. A number indicated that they needed more access to public health grant opportunities. Frustrations were heard throughout the interview process from agencies that hired environmental health workers, trained them, and these workers were recruited away by state agencies and private industry who could offer higher salaries. Several participants discussed the need for investment in rural environmental health, and the rural environmental health workforce of the future. One participant suggested the need to realize not only the value but the potential of the environmental health workforce in improving rural environments. A respondent discussed "looking forward to the addition of community health workers to address our cultural competency issues—to provide outreach". Another participant suggested that some indicator or formula to help agencies understand environmental workforce needs based on population would be helpful. Many participants shared concern about the need to prioritize environmental health services within public health and fearing that "they will erode or be given away to other agencies". Some participants talked about successful models of care that have helped in a time of economic downturn. For instance, one participant discussed the benefits of specializing in certain areas of inspections. Another emphasized the use of competencies in hiring practices and how this has helped with retention. Another discussed working with the state legislature to enact a "pay grid" which has helped with salary concerns in their agency. Finally, participants expressed concern over the next generation of environmental health workers—including a need to delineate competencies and attract a very different generation into the field.

## Discussion

### Study Limitations

This study used existing NACCHO data from 2008 to examine the differences in the environmental health workforce and services in rural and urban areas. These data were self- reported by public health agencies, and only reflect the status of the workforce at the time of collection. Emerging or new

environmental health challenges, the economic downturn, and intervening policy and regulatory changes are not reflected in these data. Zip codes of lead agencies were used to assign RUCA codes, however it is impossible to know if catchment areas of those agencies included rural, suburban and/or urban codes. The 51 interviews were used in this study only as "case studies", attempting to capture a snapshot of the current status of environmental health issues and workforce across a variety of jurisdiction types, regions, and the urban/rural continuum. Further analysis of local issues can be undertaken to further illuminate rural environmental workforce issues. Purely rural analyses were a challenge in the interview portion of the study, as many respondents reported that their agencies have rural, suburban and urban catchment areas. The uniqueness of organizational structures, reporting mechanisms, and funding sources across agencies interviewed for this study makes any generalization impossible. Rather, interview findings can serve as directions for future research.

**Implications for Future Research**

Environmental risks and associated health problems carry corresponding implications for public health programs and services, and highlight the need for a rural public health workforce that includes appropriate environmental health providers and specialists. Future research may determine the extent to which local public health systems in rural jurisdictions have the capacity to meet their communities' public health needs. Research could examine the competencies needed to provide population-appropriate rural environmental health services. A national study of actual environmental health services provided to rural populations could inform the development of these competencies. A method for estimating future workforce demand for rural environmental health workforce personnel could be developed using rigorous methodologies. The financial impact of local, state and federal regulations on rural environmental health services may be examined, along with implications for future workforce demand to meet those regulations.

**Policy Implications**

Health care policy changes are indicated to meet workforce needs to address evolving environmental health issues in rural settings. Policies and programs designed to fill gaps in the environmental workforce can have a significant impact on the health of rural communities. Policy implications that have emerged from this study include the following:

1. Isolated rural environmental health departments could be further integrated into local, regional, and state level public health systems in order to be successful. Fragmentation leads to challenges for environmental health workers. Partnerships can be established to advocate for environmental health services in rural areas by demonstrating the value of these services to the health of rural communities. The emergence of regional expertise in emerging environmental health issues can be capitalized upon, developing regional Centers of Excellence in particular environmental hazards. The HRSA Public Health Training Centers may be an additional resource. Regulatory and policy barriers to innovation can be evaluated and removed if indicated.

2. Model environmental health departments within a variety of jurisdictional types of public health agencies can provide valuable lessons and can be evaluated for best practices. Successful models of public health transformation, such as the *Turning Point: Collaborating for a New Century in Public Health*[8] can provide valuable lessons about how to transform the culture of environmental health care provision within the public health system. Specific lessons learned from this initiative that could inform future efforts to improve the rural environmental health landscape across the country include the importance of *collaboration* to advance environmental health systems, development of *broad-based partnerships* that engage in comprehensive planning to secure additional funds, *avoiding duplication* of health services, *using emergencies*

*as an opportunity* to increase the focus on environmental health, and *helping public policy makers understand the importance* of environmental health[8].

3. Emerging models of care may be evaluated for their efficacy in enhancing rural environmental health services. For instance, dense social networks, a strong belief in self-help, and shared life experiences may position rural areas well for the use of a community health worker or "*promotora*" model for identifying environmental risks and linking citizens to appropriate resources[9]. In a collaborative effort to improve environmental health along the border of Texas and Mexico, the National Institute of Environmental Health Sciences' Center for Environmental and Rural Health at Texas A&M worked with the South Texas Promotora Association and the Center for Housing and Urban Development to develop a successful environmental health curriculum for *promotoras* living and working in the *colonias* along the border[9]. Funding of the evaluation of models such as this one for replicability in other rural settings could be supported.

4. Efforts can be directed at evaluating the demand and need for fully qualified environmental health workers in rural areas. Rigorously derived workforce formulas to determine the demand for particular classifications of environmental health workers on a per capita basis may be a helpful guide for local health departments.

5. The environmental health education pipeline and continued professional education opportunities could be evaluated based on estimates of future anticipated need. Workforce development programs in public health may consider inclusion of the environmental health workforce as a particular area of emphasis. If rural health departments must rely on the registered nurse workforce and other disciplines for provision of many environmental health services, efforts should be made to enhance environmental health training in other health discipline curricula. Through appropriate curricular development, non-public health

professionals and clinicians could be trained to provide the necessary rural environmental health services not currently available. However, the workforce implications for an already stretched rural public health workforce must be considered.

6. Environmental regulation could be evaluated for its impact on the rural environmental health workforce. Additional competencies for emerging environmental health problems may require further training of the workforce. Increased inspections, additional reporting responsibilities, and subsequently increased workforce costs may be evaluated.

## Conclusion

Elevated adjusted mortality rates in rural areas in association with a variety of potential environmental sources carries important policy implications regarding the need for increased environmental monitoring and improved standards. Protecting the public against environmental hazards is one of the six specific functions of public health. Improved knowledge of environmental health workforce capacity, distribution, and potential needs or shortages in public health settings across the rural-urban continuum has implications for informing improved coordination of public health practice with environmental protection. Integration of rural environmental health services into local, regional and state public health systems is necessary to improve the health of the population. Unique models for rural environmental health and model public health programs provide opportunities for innovative partnerships and care delivery. Public policy can support the development of an environmental health workforce to meet the future needs of rural populations.

***A corresponding policy brief for this study can be found at*** **http://wvrhrc.wvu.edu/**

**Appendix 1: Jurisdiction type of agencies interviewed by census region**

| | **Jurisdiction Type** | | | | | | |
|---|---|---|---|---|---|---|---|
| | City | County | City/County | Town/Township | Multi-county, district, region | Other | Total Interviews |
| Northeast Interviews | 3 | 4 | 0 | 3 | 2 | 2 | 14 interviews - 6 states |
| Midwest Interviews | 3 | 1 | 2 | 0 | 1 | 4 | 11 interviews - 6 states |
| South Interviews | 1 | 6 | 2 | 0 | 3 | 2 | 14 interviews - 9 states |
| West Interviews | 2 | 3 | 1 | 0 | 3 | 3 | 12 interviews - 5 states |
| ***ALL*** *Interviews Combined* | *9* | *14* | *5* | *3* | *9* | *11* | *51 interviews* - 26 different states |
| **States Represented** | Massachusetts x 2, New Jersey, Ohio x 2, South Dakota, Virginia, Colorado, California | New York x 2, Vermont, New Jersey, Indiana, Florida, Arkansas, Alabama x 2, Kentucky, Oklahoma Colorado, Montana, California | Ohio x 3, Colorado, Texas, Georgia | Connecticut, New Jersey, Massachusetts | Maine, Vermont, Kansas, Louisiana x 2, Virginia, Colorado, Utah x 2 | Massachusetts, New Jersey, Iowa, Minnesota, Ohio x 2, Arkansas x 2, Texas, Montana x 2, Alaska | |

**Appendix 2: Population served by agencies interviewed by region***

| Population Analysis of Interviews | | | | | |
|---|---|---|---|---|---|
| | ***Northeast Region Interviews*** | ***Midwest Region Interviews*** | ***South Region Interviews*** | ***West Region Interviews*** | ***ALL Interviews*** |
| Average Population Served by Agencies Interviewed | 72,256 | 136,646 | 176,647 | 124,259 | 127,036 |
| Maximum Population Served by Agencies Interviewed | 286,627 | 749,160 | 751,891 | 578,062 | 751,891 |
| Minimum Population Served by Agencies Interviewed | 3909 | 9958 | 8716 | 4556 | 3909 |
| Median Population Served by Agencies Interviewed | 57,594 | 79,773 | 65,330 | 71,544 | 59,755 |
| **Number of Interviews** | | | | | |
| Population Served – 0 to 10,000 | 2 | 1 | 1 | 3 | 7 |
| Population Served – 10,001 to 25,000 | 1 | 0 | 5 | 2 | 8 |
| Population Served – 25,001 to 50,000 | 3 | 4 | 1 | 0 | 8 |
| Population Served – 50,001 to 100,000 | 5 | 2 | 0 | 2 | 9 |
| Population Served – 100,001+ | 3 | 4 | 7 | 5 | 19 |

**For many agencies, catchment areas were reported to cover large geographic areas, and include rural and urban populations*.

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