

SCERC Needs Assessment Survey – FY 2015/16

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INTRODUCTION

The continuous quality improvement process of our academic programs in the Southern California Educational and Research Center (SCERC) involves the analysis of our performance, identification of educational needs, design of intervention plans, and further evaluation of outcomes. This process is carried out by the SCERC Center Administration in collaboration with the External Advisory Committee and the Executive Committee. The analysis of our performance involves review of program evaluations by current trainees, alumni feedback, and program evaluations by our schools, as well as statements on competencies and skills required by the accrediting organizations for each of the academic programs (e.g., ABET for IH and the ACGME for OMR) and by the leading professional societies (e.g., AAOHN for OEHN and ACOEM for OMR). Another core component of the evaluation process is to conduct needs assessment surveys. This report summarizes findings of the SCERC needs assessment surveys that were conducted during 2015-2016.

In addition, the SCERC monitors peer-reviewed publications about occupational health workforce needs and reviews documents published by OSHA and NIOSH, such as the “National Assessment of the Occupational Safety and Health Workforce” (Westat 2011) that was sponsored by NIOSH and conducted by Westat. Our SCERC is familiar with the NIOSH report in part because the Deputy Director, Dr. Dean Baker, was a member of the NIOSH Workforce Assessment Task Force that provided guidance to NIOSH and Westat for the workforce assessment. Information and data from the NIOSH/Westat surveys are included in this report to complement the findings of our needs assessment surveys.

For the purpose of the SCERC needs assessment surveys in 2015-16, we identified three survey target audiences: (1) Potential employers of our graduates in the private and public sector. This group included EHS managers who work in the private sector for companies located in Federal Region nine based on an email list provided by Pinpoint Technologies, and public OH workers affiliated with the Western States Occupational Network (WestON). (2) Practicing professionals who are members of major professional organizations in the OH field (e.g., American Association of Occupational Health Nurses (AAOHN), American Industrial Hygiene Association (AIHA), and Western Occupational and Environmental Medicine Association (WOEMA). We also targeted the Human Factors and Ergonomics Society (HFES) members for assessment of continuing education needs. (3) Alumni from our three core academic programs: Industrial Hygiene (IH), Occupational and Environmental Health Nursing (OEHN), and the Occupational Medicine Residency (OMR).

Our goal in conducting these needs assessment surveys was to identify unmet needs among potential employers in the region, practicing occupational health (OH) professionals, and our program alumni. The surveys asked private and public employers for information about their organizations’ expected future needs for trained OH professionals and what specific qualifications and skills they consider when hiring OH professionals. The surveys

asked practicing professionals about their level of educational training, practice setting, important job skills needed, and their needs for continuing education. The surveys asked our alumni if they are currently working in the OH field, about any barriers to finding a job, their perceptions about important competencies and skills, and their views on how our programs prepared them for their job. We are using the survey results to assist us in assessing the need for modifications or enhancements of our academic programs and continuous education courses.

METHODS

Survey development

Eight questionnaires for the target groups were developed by Center Administration with the participation of the academic program directors. The private employers (EHS managers) survey comprised questions about current job, academic training, the skills needed for working as an industrial hygienist, occupational health nurse, and occupational medicine physician, the need for and supply of occupational health professionals, the importance of a professional certification, and CE needs. The survey for the public occupational health program employers included questions about current job, academic training, the need for and supply of occupational health professionals, the importance of a professional certification, CE needs, and a specific set of questions regarding the skills for the work as an occupational epidemiologist and the preferred educational level for hiring a professional in this field. For the members of the professional organizations, similar sets of questions were formulated for comparison purposes. For Continuing Education, we wanted to identify the preferred type of courses, days and time. In order to answer these questions, we surveyed the HFES members. The alumni survey included questions about the type of program pursued, certifications obtained, current job, importance of specific skills for the job, quality of the training received for those skills, and questions about CE needs.

Questions for the surveys were developed using prior SCERC needs assessment surveys with additional questions on employer needs and OH professional skills modified from the NIOSH/Westat survey questions. The surveys also included questions based on the statements of expected competencies and skills delineated by the programs' accrediting organizations and professional societies for each OH discipline. Questions about needed competencies and skills were asked using the same wording for the surveys of employers, practicing professionals, and program alumni in each discipline. Responses were structured as four or five item Likert scale (ordinal) responses. Program directors reviewed the draft surveys and provided comments.

An online survey tool (Survey Monkey) was used for the creation of the eight surveys. Alumni and private employers were invited to participate via e-mail. As noted in the introduction, the sampling frame for private employers was EHS program managers who work in the private sector for companies located in Federal Region nine based on an email list provided by Pinpoint Technologies. The sampling frame for public sector OH programs was an email list of public sector OH workers affiliated with the Western States Occupational Health Network (WestON). WestON is a network of state-based occupational

health epidemiologists and administrators, NIOSH and OSHA federal partners, and representatives of western region ERC and NIOSH agricultural centers. The survey was distributed to occupational health program managers. For practicing OH professionals, we contacted the American Industrial Hygiene Association (AIHA) for IH, the American Association of Occupational Health Nurses (AAOHN) for OEHN, and the Western Occupational and Environmental Medicine Association (the largest regional affiliate of the ACOEM) to request that the societies either provide us with email lists of their members or distribute email notices of the survey with a link to the online survey. The HFES members were contacted by mail using a mail list provided for the association. The alumni were notified by email about the survey, since each academic program maintains contact information for their alumni. All communications provided a hyperlink to the online survey. Two survey reminders were sent to all target groups approximately two and four weeks after the first email had been sent. The HFES members did not receive mail reminders due to cost limitations.

Data analysis

While conducting the surveys, we learned that more than one-third of the members of the Western Occupational and Environmental Medicine Association are not physicians. They include exhibitors at the annual meeting, mid-level practitioners, and other non-physician OH professionals. We did receive some responses from non-physicians, so we restricted the survey only to physician respondents. For the AAOHN, it became apparent that a large majority of the survey respondents did not have formal training in occupational health nursing or had completed only an associate degree or bachelor's degree in nursing. Because the SCERC OEHN program provides training at the master and doctoral level, the analysis of responses for the AAOHN were examined both for all respondents (N=678) and restricted to respondents who reported having academic training at the master or doctoral level (n=44).

Descriptive statistics were calculated for each survey questionnaire by target group. For questions with Likert scale responses, we examined the distribution of responses by response category and also calculated average rating using scores of 1 to 4 for questions with four response categories or 1 to 5 for questions with five response categories. For example, responses to the questions about importance of skills in the job had five response categories from "not important" to "very important", which were scored from 1 to 5. The average rating was the numerical average of the response scores by all respondents to the question.

To identify training needs by academic program, comparisons were done between members of the respective professional organization and alumni. This comparison allowed us to identify agreement or differences in terms of the importance of the skills for the job and the quality of the training received between the groups. Comparisons between employers and alumni were done to identify particular employers' needs in terms of certain professional skills.

Employers perception of current need for and supply of occupational health professionals by discipline. To assess private and public employers need for and supply of occupational health professionals, responses to the question “thinking about the next 5 years, what is the likelihood that your company will search for an occupational health professional in the following areas?” were tabulated. A four point Likert scale with responses that ranged from “not at all” to “very high” (scored from 1 to 4) was used to calculate average ratings.

Regarding the employers perception of the supply for well-trained professionals in EHS, responses to the question “do you believe that the supply of well-trained professionals is:” were tabulated. A four point Likert scale with responses that ranged from “clear shortage” to “over supply” was used to calculate average ratings.

Employers anticipated need for academically trained OH professionals. In order to identify employers anticipated future needs of OH professionals with academic training, responses to the question “if you are hiring in these areas, how important is it for you to hire professionals with formal training in that discipline?” were tabulated. A four point Likert scale with responses that ranged from “not at all” to “very high” was used to calculate average ratings.

Importance of the skills for the job. Responses to the question “how important are these skills for the work as”: industrial hygienist, occupational health nurses, and occupational medicine were tabulated. A five point Likert scale with responses that ranged from “not important” to “extremely important” was used to calculate average ratings. Comparisons were done between private employers, the practicing professionals, and program alumni for each discipline (IH, OEHN, and OM) to evaluate consistency in the perceptions of the important skills.

Quality of the training received. To assess the quality or quantity of the training received by the IH, OEHN, and OMR alumni, responses to the question “At the time of your graduation, how well were you trained in the following skills?” were tabulated. A five point Likert scale with responses that ranged from “no training”, “limited training”, “good training”, “very good training”, and “excellent training” was used to calculate the average ratings.

We also evaluated whether the skills considered to be most important to practicing professionals (scored: “not important”, “slightly important”, “moderately important”, “important”, and “very important”) corresponded to the program’s quality and emphasis on training in these specific skills based on alumni responses (scored: “no training”, “some training”, “good training”, “very good training”, and “excellent training”). Because the response categories to these two sets of questions were different, we standardized the average ratings by calculating a Z-score for each question based on the average ratings for all of the questions (>20 questions in each survey related to skills and training). The Z-score is a transformation, so the average of the average ratings score is zero and the scale is in standard deviations. As an example, a score of 0.25 would be an average rating of 0.25 standard deviations above the average rating score, while a score of -1.00 would be an

average rating of minus one standard deviation for the respondents rating for that question. The Z-score transformation allows comparisons between the average ratings of importance scored by the practicing professionals with the average ratings of teaching quality scored by the alumni by adjusting for any systematic difference in the rating tendencies by the different respondent groups or the wording of the different five-point Likert Scales. Indeed we observed that the average of the average ratings for the importance questions was somewhat higher than the average of the average ratings for the training quality questions, which we believe was likely due to the different response categories.

Continuing education. Our SCERC provides training in a broad range of EHS topics. These courses are targeted to different audiences including students, occupational hygienist, nurses, physicians, and professionals interested in occupational health and safety issues. All of the surveys asked the target populations about the importance of a list of EHS topics for continuing education. A five point Likert scale with responses that ranged from “not at all” to “very high” was used to calculate rating averages.

RESULTS

1. Response Rates and Respondent Characteristics

A total of 886 professionals in the occupational health and safety field answered the needs assessment survey. The response rate ranged from 2.3% (Human Factors and Ergonomics Society) to 58% (Occupational Medicine Residency alumni). The largest number of participants (n=628) was recruited through AAOHN and the smallest (n=12) through OEHN alumni (Table 1).

Private Employers. A total of 1215 EHS manager were contacted through e-mail and 73 (6%) of them answered the survey. Among them, their highest academic degree was an associate or bachelor degree (62.5%), master degree (29.2%), or certificate program (8.3%). Only 10% of the participants were certified as industrial hygiene professionals and 10% as safety professionals. Most of them were working in the manufacturing sector (32.9%), followed by construction (15.7%), other (14.3%), professional, scientific and technical services (8.6%), and health care and social assistance (7.1%).

Public Employers. A total of 91 WestON affiliated occupational health program managers were contacted through e-mail and 17 (18.7%) of them completed the survey. Among them, their highest academic degree were bachelor degree (15.4%), master degree (30.8%), or doctoral degree (53.8%). One was a certified industrial hygienist and two were board certified occupational medicine physicians. The respondents reported working in the following industry sectors: state public health department (41.2%), university or education organization (41.2%), national occupational health or public health department (23.5%), or regulatory agency (11.8%) (multiple responses allowed so total is greater than 100%).

Table 1: SCERC needs assessment survey response rates by target population.

| Survey | Survey Invitations (N) | Completed surveys (N) | Response rate (%) |
|--|------------------------|-----------------------|-------------------|
| Private employers (EHS managers) | 1215 | 73 | 6.0 |
| Public employers (WestON) | 91 | 17 | 18.7 |
| AIHA (American Industrial Hygiene Association) | 300 | 32 | 10.7 |
| IH alumni | 153 | 52 | 34.0 |
| AAOHN (American Association of Occupational Health Nurses) | 4227 | 678 | 16.0 |
| OEHN alumni | 47 | 12 | 25.5 |
| WOEMA (Western Occupational & Environmental Medical Association) | 400* | 14 | 3.5 |
| OM residency alumni | 24 | 14 | 58.3 |
| HFES (Human Factors and Ergonomics Society) | 2146 | 49 | 2.3 |

* WOEMA has approximately 600 active members of whom 2/3 thirds are physicians.

AIHA Members. A total of 300 members were contacted through e-mail and 32 (10.7%) of them answered the survey. Among them, their highest academic degree was a master degree (66.7%) or doctoral degree (25.0%). Three quarters of the participants were certified as industrial hygiene professionals (75%) and one quarter were certified as safety professionals (25%). Most of them (93.1%) were working in the IH field doing consulting (48.3%), corporate occupational or environmental health (31.0%), governmental agencies (24.1%), or academic education (20.7%) (multiple responses allowed, so total is greater than 100%).

Industrial Hygiene Alumni. A total of 153 alumni were contacted through e-mail and 52 (34%) of them answered the survey. Among them, their highest academic degree was a master's (74.5%) or a doctoral degree (23.5%). More than half of the participants were certified as industrial hygiene professionals (60%) and nearly a quarter were certified as safety professionals (23%). Almost three quarters (73.4%) were working in the IH field in corporate occupational or environmental health (38.8%), governmental agencies (18.4%), consulting (12.2%), or academic education (12.2%) (multiple responses allowed).

American Association of Occupational Health Nursing. A total of 4227 members were contacted through e-mail and 678 (16%) of them answered the survey. Only 22.6% of the participants completed formal training; among them, their highest academic degree was

bachelor (25.7%), master's (25.7%), or doctorate (10.8%). A total of 44 respondents reported that they had completed a master or doctoral degree. From the professionals with formal training, 76% of them were certified; more than half were COHN-S (58.7%) and about a fifth were COHN (17.3%). Most of the participants worked at a clinical occupational health (53.1%), followed by corporate occupational health (35.5%), and management (16%).

Occupational Environmental Health Nursing Alumni. A total of 47 alumni were contacted through e-mail and 12 (25.5%) of them answered the survey. Among them, their highest academic degree was a master's (91.7%) or family nurse practitioner (8.3%). One third of the participants were certified as an Occupational Health Nurse Specialist. Lastly 27.3% of the alumni respondents were currently working in a job with occupational health nursing responsibilities.

Western Occupational and Environmental Medicine Association (WOEMA). The WOEMA Board of Directors agreed to include a notice of the survey in a monthly WOEMA membership newsletter. The notice was included in two monthly newsletters. WOEMA has approximately 600 active members of whom two-thirds or 400 are physicians (MDs or DOs). The survey responses were restricted to respondents who reported having a MD or DO. A total of 14 physicians (3.5%) responded to the survey. Of the respondents, 13 were MDs and 1 was a DO. Ten (71.4%) had completed an occupational medicine residency (one at UC Irvine). Eleven (78.6%) were board certified in occupational medicine. Eleven were working full-time or part-time in an occupational medicine position, while two were working in a field other than occupational medicine and one was retired.

Occupational Medicine Residency Alumni. A total of 24 OM Residency alumni during the past 10 years were sent e-mail request to participate in the survey. A total of 14 alumni (58%) responded to the survey. The alumni included 12 MD's and 2 DO's, all of whom also had received a MPH or MS degree. All of them (100%) were board certified in Occupational Medicine and eight (57.1%) were also certified in another medical specialty – mostly Internal Medicine or Family Medicine. All of the alumni (100%) pursued jobs in occupational medicine following completion of the residency, none (0%) reported having difficulty finding a job in occupational medicine, and all of them (100%) were currently working full-time or part-time in an occupational medicine position. Practice settings included clinical occupational medicine (64.3%), consulting (35.7%), governmental public health or regulatory agency (28.6%), corporate occupational medicine (21.4%), or academic organization (14.3%) (multiple responses allowed).

2. Employer Need and Supply of Occupational Health Professionals

A core objective of the needs assessment survey is to determine the perceived need for and supply of academically trained OH professional by private and public employers in the region. This section reports on these issues.

A. Private Employers

According to the private employer survey, the likelihood that a private company will search for an occupational health professional by discipline in the next five years is moderately high for safety, moderate industrial hygienist and ergonomist, and relatively low for occupational medicine physicians, occupational health nurses, and environmental and occupational epidemiologists (Table 2).

Table 2. Likelihood that a private employer will search for an EHS professional in certain areas during the next five years.

| Need for professionals | Average Rating* | Response Count |
|-------------------------------|------------------------|-----------------------|
| Safety | 2.9 | 34 |
| Industrial Hygiene | 2.3 | 34 |
| Ergonomics | 2.2 | 34 |
| Occupational Medicine | 1.4 | 33 |
| Occupational Health Nursing | 1.4 | 32 |
| Environmental Epidemiology | 1.2 | 32 |
| Occupational Epidemiology | 1.1 | 32 |

*Numerical average of Likert scale responses: not at all (1), fairly low (2), moderately high (3), and very high (4).

Private employers also perceive that the supply of well-trained professionals is low in safety, industrial hygiene, and ergonomics. They identify clear shortages in the areas of occupational medicine, occupational health nursing, occupational epidemiology and environmental epidemiology (Table 3).

Table 3. Private employers perception about the supply of EHS professional in certain areas

| Supply of Professionals | Average Rating* | Response Count |
|--------------------------------|------------------------|-----------------------|
| Safety | 2.2 | 34 |
| Industrial Hygiene | 2.0 | 33 |
| Ergonomics | 1.9 | 34 |
| Occupational Medicine | 1.3 | 32 |
| Occupational Health Nursing | 1.3 | 33 |
| Occupational Epidemiology | 1.0 | 33 |
| Environmental Epidemiology | 1.0 | 33 |

* Numerical average of Likert scale responses: clear shortage (1), low supply (2), sufficient supply (3) and over supply (4).

B. Public Employers

The likelihood that a public employer will search for an occupational health professional (industrial hygiene, safety, ergonomics, occupational health nursing, occupational medicine, occupational epidemiology, and environmental epidemiology) during the next five years is moderately high for environmental and occupational epidemiology. In contrast, likelihood is moderate for occupational medicine and industrial hygiene, and fairly low for occupational health nursing and ergonomics (Table 4).

Table 4. Likelihood that a public employer will search for an occupational health professional in certain areas during the next five years.

| Need for professionals | Average Rating* | N=10 |
|-------------------------------|------------------------|-------------|
| Environmental Epidemiology | 2.6 | |
| Occupational Epidemiology | 2.5 | |
| Occupational Medicine | 2.4 | |
| Industrial Hygiene | 2.2 | |
| Safety | 1.7 | |
| Occupational Health Nursing | 1.6 | |
| Ergonomics | 1.4 | |

* Average of Likert scale responses: not at all (1), fairly low (2), moderately high (3), and very high (4)

Public employers reported that the supply of well-trained professionals is reasonably sufficient in safety and ergonomics, but low in industrial hygiene and occupational health nursing. They reported a clear shortage of trained professionals in occupational medicine and in environmental and occupational epidemiology (Table 5).

Table 5. Public employers perception about the supply of EHS professional in certain areas

| Supply of Professionals | Average rating* | Response count |
|--------------------------------|------------------------|-----------------------|
| Safety | 2.5 | 4 |
| Ergonomics | 2.3 | 4 |
| Industrial Hygiene | 2.0 | 4 |
| Occupational Health Nursing | 2.0 | 4 |
| Environmental Epidemiology | 1.8 | 6 |
| Occupational Medicine | 1.7 | 7 |
| Occupational Epidemiology | 1.6 | 8 |

*Likert scale includes: clear shortage (1), low supply (2), sufficient supply (3) and over supply (4).

C. Employers Future Need for Formally Trained OH Professionals

Private employers reported that hiring professional with formal training in the industrial hygiene, occupational health nursing, occupational medicine, occupational epidemiology, safety, environmental epidemiology, and ergonomics is very important (Table 6). On the other hand, public employers think that formal training is very important primarily in occupational medicine, occupational epidemiology, industrial hygiene, and safety. Formal training was considered of average importance for environmental epidemiology, occupational health nursing, and ergonomics (Table 7).

Table 6. Private employers importance of hiring professionals with formal training in a specific discipline

| Need for academic training of professionals | Average Rating* | Response Count |
|--|------------------------|-----------------------|
| Industrial Hygiene | 4.1 | 26 |
| Occupational Health Nursing | 4.0 | 24 |
| Occupational Medicine | 4.0 | 24 |
| Occupational Epidemiology | 4.0 | 21 |
| Safety | 3.9 | 29 |
| Environmental Epidemiology | 3.8 | 22 |
| Ergonomics | 3.8 | 27 |

*Likert scale includes: not at all important (1), of little importance (2), of average importance (3), very important (4), extremely important (5).

Table 7. Public employers rating of the importance of hiring professionals with formal training in a specific discipline

| Need for academic training of professionals | Average Rating* | Response Count |
|--|------------------------|-----------------------|
| Occupational Medicine | 4.0 | 8 |
| Occupational Epidemiology | 4.0 | 9 |
| Industrial Hygiene | 3.9 | 9 |
| Safety | 3.6 | 9 |
| Environmental Epidemiology | 3.4 | 9 |
| Occupational Health Nursing | 3.4 | 8 |
| Ergonomics | 3.1 | 9 |

*Likert scale includes: not at all important (1), of little importance (2), of average importance (3), very important (4), extremely important (5).

D. National and Regional Estimates of Need based on NIOSH/Westat Survey

The SCERC needs assessment surveys provide limited information on future employer needs for two reasons. One is that the sampling frame of private employers was limited to

an email list of EHS program managers. These managers tended to have bachelor or master degree training and were trained in industrial hygiene or safety. It would be generally unlikely that such managers would be involved in employer decisions to hire a master or doctoral degree trained occupational health nurse or an occupational medicine physician. We believe this limitation is a reason why the likelihood of future hiring of these latter OH professional was reported to be low by the EHS managers. A second reason is that the sampling frame was not necessarily based on a formal representative or random sample of EHS program managers and the response rates were fairly low.

Therefore, as a component of the SCERC needs assessment process, we reviewed data and findings from the NIOSH/Westat surveys reported in the “National Assessment of the Occupational Safety and Health Workforce” (Westat 2011). Westat conducted a national survey of private employers based on a nationally representative multi-stage cluster sample. This formal sampling method allowed Westat to develop quantitative estimates of the future need for OH professionals by discipline at the national and western region levels.

According to surveys conducted by Westat, the estimate of employers’ expectation for hiring industrial hygiene, occupational medicine, and occupational health nursing professionals in the United States, during the period 2011-2016 is 3,890 professionals. The highest number of professionals is industrial hygienist with 2,244, most of them at the bachelor level (68.5%) and the rest at the master level (31.5%). In the middle there was occupational health nursing, with a total expected number of 1,193 professionals. The majority would be trained at the bachelor degree (71.0%), followed by master degree (16.4%), and doctoral degree (12.6%). The lowest number of professionals is for Occupational Medicine with 453 physicians, but Westat only estimated the need for OM residency trained physicians, not for all physicians who provide occupational medicine care (Table 8).

Table 8. Employer expectations for hiring OH professionals by discipline and degree level in the United States. (Westat 2011)

| Discipline | Estimate | Standard Error |
|------------------------------------|-----------------|-----------------------|
| Industrial Hygiene | | |
| Bachelor degree | 1538 | 547 |
| Master degree | 706 | 308 |
| Occupational Health Nursing | | |
| Bachelor degree | 847 | 167 |
| Master degree | 195 | 75 |
| Doctoral degree | 151* | 150 |
| Occupational Medicine | | |
| OM residency | 453 | 172 |

In the West region of the country, the total expected number of industrial hygiene, occupational medicine, and occupational health nursing professionals is 984. The expected

numbers of professionals by discipline are industrial hygiene – 649, occupational health nursing – 281, and occupational medicine – 54 (Table 9). The report did not provide a breakdown by discipline and degree level for the West region estimate of OH professional need. Therefore, we calculated a discipline-specific estimate by multiplying the West region estimate of OH professionals by discipline by the percentage by degree at the national level (shown in Table 8). These discipline-specific estimates are shown in Table 9.

Table 9. Total number of OS&H professionals that employers expect to hire over the next five years (2011-2016) in West region by discipline. (Westat 2011)

| Discipline | Estimate | Standard Error |
|------------------------------------|-----------------|-----------------------|
| Industrial Hygiene | 649 | 274 |
| Master level* | 204 | |
| Occupational Health Nursing | 281 | 116 |
| Master level* | 46 | |
| Doctoral level* | 35 | |
| Occupational Medicine | 54 | 33 |
| OM Residency trained | 54 | |

* These numbers were estimated by multiplying the percent discipline-specific national need by degree level (shown in Table 8) by the West region estimate for the same discipline.

Employers’ expectations for requiring professional certification among future hires by discipline showed that most employers expect their hires to have certification in the specific discipline. The expectations for certified professionals in industrial hygiene were 56%, occupational medicine – 80%, and occupational health nursing – 67% (Table 10).

Table 10. Employer expectations for requiring professional certification among future hires by discipline. (Westat 2011)

| Discipline | Estimate | Standard Error |
|------------------------------------|-----------------|-----------------------|
| Industrial Hygiene | | |
| None | 30% | 9% |
| Some | 14% | 10% |
| All | 56% | 11% |
| Occupational Health Nursing | | |
| None | 27% | 8% |
| Some | 6% | 3% |
| All | 67% | 8% |
| Occupational Medicine | | |
| None | 13% | 9% |
| Some | 7% | 4% |
| All | 80% | 10% |

3. Assessment of Skills and Training by SCERC Academic Program Discipline

The SCERC needs assessment surveys asked equivalent questions to employers, practicing professionals, and program alumni for each discipline about the importance of specific skills in the job position. This section will report on the responses for each discipline for each group of respondents. It will also include some side-by-side comparisons of responses to the same questions by employers, practicing professionals, and alumni to assess whether the perceptions about the importance of specific skills are consistent or different.

After presenting findings related to the importance of specific skills, this section will then report on the alumni ratings of the quality of training in the same specific skill domains.

A. Industrial Hygiene

Industrial Hygiene Skills

The surveys asked equivalent questions about the importance of skills to private employers, AIHA members, and the IH program alumni.

Private Employers. The five skills ranked as most important for the job as an industrial hygienist on a five-point Likert scale were: proper interpretation of exposure or monitoring data (4.6), identify potentially hazardous agents or work conditions (4.6), exposure assessment and risk characterization (4.5), understand workers' jobs (4.3), and understand the fundamentals of occupational safety (4.3) (Table 11). In contrast, the five skills ranked as least important were: hazards associated with nanotechnology (2.2), understand workers compensation insurance issues (2.7), program budget and finance skills (2.9), hazardous waste management (3.0), and emergency response planning (3.0) (Table 11).

Table 11. Private employers rating of importance of job skills for an industrial hygienist

| | Skills | Average Rating* (n=33) |
|---|--|-------------------------------|
| 1 | Proper interpretation of exposure or monitoring data | 4.6 |
| 2 | Identify potentially hazardous agents or work conditions | 4.6 |
| 3 | Exposure assessment and risk characterization | 4.5 |
| 4 | Understand workers' jobs | 4.3 |
| 5 | Understand the fundamentals of occupational safety | 4.3 |
| 6 | Evaluation and control of physical, mechanical, chemical, and biological hazards | 4.2 |
| 7 | Interpret and apply state or federal regulations | 4.2 |

| | | |
|----|--|-----|
| 8 | Apply qualitative and quantitative risk assessment tools from ACGIH, NIOSH, and others to identify unacceptable risk | 4.2 |
| 9 | Evaluate and recommend personal protective equipment | 4.0 |
| 10 | Communicating with mid-level management - supervisors | 4.0 |
| 11 | Communicating with colleagues | 4.0 |
| 12 | Understand the need for working as part of an interdisciplinary team. | 4.0 |
| 13 | Evaluate and recommend administrative controls | 3.9 |
| 14 | Understand professional and ethical responsibilities of an industrial hygienist | 3.9 |
| 15 | Ability to write technical reports and summaries | 3.9 |
| 16 | Communicating with management | 3.8 |
| 17 | EH&S training for employees | 3.8 |
| 18 | Communicating with workers, union reps, or the public | 3.8 |
| 19 | Evaluate indoor air quality | 3.7 |
| 20 | Prevent work accidents and manage safety programs | 3.6 |
| 21 | Recognize the need for life-long learning | 3.5 |
| 22 | Attain recognized professional certification after the required period of professional practice | 3.5 |
| 23 | Apply statistical concepts and tools appropriate to professional practice in the field | 3.5 |
| 24 | Program leadership and management | 3.5 |
| 25 | Evaluate and manage ergonomic factors | 3.5 |
| 26 | Critically analyze and evaluate scientific literature | 3.2 |
| 27 | Emergency response planning | 3.0 |
| 28 | Hazardous waste management | 3.0 |
| 29 | Program budget and finance skills | 2.9 |
| 30 | Understand workers compensation insurance issues | 2.7 |
| 31 | Hazards associated with nanotechnology | 2.2 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

AIHA Members. The first five skills ranked as most important for the job as an industrial hygienist were: identify potentially hazardous agents or work conditions (4.8), interpret and apply state or federal regulations (4.7), understand workers' jobs (4.7), exposure

assessment and risk characterization (4.7), and evaluate and control of physical, mechanical, chemical, and biological hazards (4.6) (Table 12). The five skills ranked as least important were: hazard associated with nanotechnology (3.1), understand workers compensation insurance issues (3.6), program budget and finance skills (3.8), apply statistical concepts and tools appropriate to professional practice in the field (3.8), and critically analyze and evaluate scientific literature (4.0) (Table 12). It should be noted that even the lower rated skills were considered to be at least moderately important by the AIHA members.

Table 12. AIHA members rating of importance of job skills for an industrial hygienist.

| | Skills | Average Rating* (n=23) |
|----|---|---------------------------------------|
| 1 | Identify potentially hazardous agents or work conditions | 4.7 |
| 2 | Interpret and apply state or federal regulations | 4.7 |
| 3 | Understand workers' jobs | 4.7 |
| 4 | Exposure assessment and risk characterization | 4.7 |
| 5 | Evaluate and control of physical, mechanical, chemical, and biological hazards | 4.6 |
| 6 | Proper interpretation of exposure monitoring data | 4.5 |
| 7 | Understand professional and ethical responsibilities of an industrial hygienist | 4.5 |
| 8 | Evaluate and recommend personal protective equipment | 4.5 |
| 9 | Evaluate indoor air quality | 4.4 |
| 10 | Communicating with management | 4.4 |
| 11 | Communicating with mid-level management - supervisors | 4.4 |
| 12 | Ability to write technical reports and summaries | 4.4 |
| 13 | Understand the need for working as part of an interdisciplinary team. | 4.4 |
| 14 | Recognize the need for life-long learning | 4.4 |
| 15 | Understand the fundamentals of occupational safety | 4.4 |
| 16 | Prevent work accidents and manage safety programs | 4.4 |
| 17 | Communicating with colleagues | 4.4 |
| 18 | Attain recognized professional certification after the required period of professional practice | 4.3 |
| 19 | Program leadership and management | 4.3 |

| | | |
|----|--|-----|
| 20 | Communicating with workers, union reps, or the public | 4.3 |
| 21 | EH&S training for employees | 4.3 |
| 22 | Evaluate and recommend administrative controls | 4.2 |
| 23 | Evaluate and manage ergonomic factors | 4.1 |
| 24 | Emergency response planning | 4.0 |
| 25 | Apply qualitative and quantitative risk assessment tools from ACGIH, NIOSH, and others to identify unacceptable risk | 4.0 |
| 26 | Hazardous waste management | 4.0 |
| 27 | Critically analyze and evaluate scientific literature | 4.0 |
| 28 | Apply statistical concepts and tools appropriate to professional practice in the field | 3.8 |
| 29 | Program budget and finance skills | 3.8 |
| 30 | Understand workers compensation insurance issues | 3.6 |
| 31 | Hazard associated with nanotechnology | 3.1 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

Industrial Hygiene Alumni. The first five skills ranked as most important for the job as an industrial hygienist were: exposure assessment and risk characterization (4.8), identify potentially hazardous agents or work conditions (4.8), proper interpretation of exposure monitoring data (4.8), evaluate and control of physical, mechanical, chemical, and biological hazards (4.8), and evaluate and recommend personal protective equipment (4.6) (Table 2). In contrast, the five skills ranked as least important were (scale from 1-5): hazards associated with nanotechnology (3.1), understand workers compensation insurance issues (3.3), critically analyze and evaluate scientific literature (3.5), hazardous waste management (3.5), and emergency response planning (3.7) (Table 2).

Table 13. IH Alumni rating of importance of job skills for an industrial hygienist.

| | Skills | Average Rating* (n=36) |
|---|--|------------------------|
| 1 | Exposure assessment and risk characterization | 4.8 |
| 2 | Identify potentially hazardous agents or work conditions | 4.8 |
| 3 | Proper interpretation of exposure monitoring data | 4.8 |
| 4 | Evaluate and control of physical, mechanical, chemical, and biological hazards | 4.8 |
| 5 | Evaluate and recommend personal protective equipment | 4.6 |

| | | |
|----|--|-----|
| 6 | Ability to write technical reports and summaries | 4.6 |
| 7 | Understand workers' jobs | 4.6 |
| 8 | Communicating with mid level management - supervisors | 4.5 |
| 9 | Interpret and apply state or federal regulations | 4.5 |
| 10 | Communicating with management | 4.5 |
| 11 | Understand professional and ethical responsibilities of an industrial hygienist | 4.5 |
| 12 | Evaluate and recommend administrative controls | 4.4 |
| 13 | Communicating with colleagues | 4.4 |
| 14 | Understand the fundamentals of occupational safety | 4.4 |
| 15 | Communicating with workers, union reps, or the public | 4.3 |
| 16 | EH&S training for employees | 4.3 |
| 17 | Program leadership and management | 4.3 |
| 18 | Recognize the need for life-long learning | 4.2 |
| 19 | Understand the need for working as part of an interdisciplinary team. | 4.2 |
| 20 | Prevent work accidents and manage safety programs | 4.2 |
| 21 | Apply qualitative and quantitative risk assessment tools from ACGIH, NIOSH, and others to identify unacceptable risk | 4.2 |
| 22 | Attain recognized professional certification after the required period of professional practice | 4.2 |
| 23 | Evaluate indoor air quality | 4.1 |
| 24 | Evaluate and manage ergonomic factors | 3.9 |
| 25 | Apply statistical concepts and tools appropriate to professional practice in the field | 3.8 |
| 26 | Program budget and finance skills | 3.8 |
| 27 | Emergency response planning | 3.7 |
| 28 | Hazardous waste management | 3.5 |
| 29 | Critically analyze and evaluate scientific literature | 3.5 |
| 30 | Understand workers compensation insurance issues | 3.3 |
| 31 | Hazards associated with nanotechnology | 3.1 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

Comparisons among Private Employers, AIHA members, and IH alumni. A

comparison of rating of importance of job skills for an industrial hygienist by private employers, AIHA members, and IH alumni ordered by employer rating showed that in general, private employers gave generally lower scores on importance of specific skills than AIHA members and IH alumni (Table 14).

Table 14. Average ratings of importance of skills for the work as Industrial Hygienist by private employers, AIHA members, and IH alumni (ordered by employer rating).

| | Skills for the work as IH | Private Employers* (n=33) | AIHA* (n=23) | IH Alumni* (n=47) |
|----|--|----------------------------------|---------------------|--------------------------|
| 1 | Proper interpretation of exposure or monitoring data | 4.6 | 4.5 | 4.8 |
| 2 | Identify potentially hazardous agents or work conditions | 4.6 | 4.7 | 4.8 |
| 3 | Exposure assessment and risk characterization | 4.5 | 4.7 | 4.8 |
| 4 | Understand workers' jobs | 4.3 | 4.7 | 4.6 |
| 5 | Understand the fundamentals of occupational safety | 4.3 | 4.4 | 4.4 |
| 6 | Evaluation and control of physical, mechanical, chemical, and biological hazards | 4.2 | 4.6 | 4.8 |
| 7 | Interpret and apply state or federal regulations | 4.2 | 4.7 | 4.5 |
| 8 | Apply qualitative and quantitative risk assessment tools from ACGIH, NIOSH, and others to identify unacceptable risk | 4.2 | 4.0 | 4.2 |
| 9 | Evaluate and recommend personal protective equipment | 4.0 | 4.5 | 4.6 |
| 10 | Communicating with mid level management – supervisors | 4.0 | 4.4 | 4.5 |
| 11 | Communicating with colleagues | 4.0 | 4.4 | 4.4 |
| 12 | Understand the need for working as part of an interdisciplinary team. | 4.0 | 4.4 | 4.2 |
| 13 | Evaluate and recommend administrative controls | 3.9 | 4.2 | 4.4 |
| 14 | Understand professional and ethical responsibilities of an industrial hygienist | 3.9 | 4.5 | 4.5 |
| 15 | Ability to write technical reports and summaries | 3.9 | 4.4 | 4.6 |
| 16 | Communicating with management | 3.8 | 4.4 | 4.5 |

| | | | | |
|----|---|-----|-----|-----|
| 17 | EH&S training for employees | 3.8 | 4.3 | 4.3 |
| 18 | Communicating with workers, union reps, or the public | 3.8 | 4.3 | 4.3 |
| 19 | Evaluate indoor air quality | 3.7 | 4.4 | 4.1 |
| 20 | Prevent work accidents and manage safety programs | 3.6 | 4.4 | 4.2 |
| 21 | Recognize the need for life-long learning | 3.5 | 4.4 | 4.2 |
| 22 | Attain recognized professional certification after the required period of professional practice | 3.5 | 4.3 | 4.2 |
| 23 | Apply statistical concepts and tools appropriate to professional practice in the field | 3.5 | 3.8 | 3.8 |
| 24 | Program leadership and management | 3.5 | 4.3 | 4.3 |
| 25 | Evaluate and manage ergonomic factors | 3.5 | 4.1 | 3.9 |
| 26 | Critically analyze and evaluate scientific literature | 3.2 | 4.0 | 3.5 |
| 27 | Emergency response planning | 3.0 | 4.0 | 3.7 |
| 28 | Hazardous waste management | 3.0 | 4.0 | 3.5 |
| 29 | Program budget and finance skills | 2.9 | 3.8 | 3.8 |
| 30 | Understand workers compensation insurance issues | 2.7 | 3.6 | 3.3 |
| 31 | Hazards associated with nanotechnology | 2.2 | 3.1 | 3.1 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

The difference in the skills rating average between private employers and industrial hygiene professionals (IH alumni and AIHA members combined) showed that for most of the skills, private employers gave a lower score. The bigger rating differences were for: program budget and finance skills (-0.9), hazards associated with nanotechnology (-0.9), program leadership and management (-0.79), emergency response planning (-0.8), and recognize the need for life-long learning (-0.8). The smaller rating differences were for: apply qualitative and quantitative risk assessment tools from ACGIH, NIOSH, and others to identify unacceptable risk (0.0), understand the fundamentals of occupational safety (-0.1), proper interpretation of exposure monitoring data (-0.1), identify potentially hazardous agents or work conditions (-0.2), and exposure assessment and risk characterization (-0.3) (Table 15).

Table 15. Differences in the skills rating average between private employer and IH professionals (IH alumni and AIHA members combined).

| | Skills for the work as IH | Rating Difference (Employers - Professionals) |
|----|---|--|
| 1 | Program budget and finance skills | -0.9 |
| 2 | Hazards associated with nanotechnology | -0.9 |
| 3 | Program leadership and management | -0.8 |
| 4 | Emergency response planning | -0.8 |
| 5 | Recognize the need for life-long learning | -0.8 |
| 6 | Attain recognized professional certification after the required period of professional practice | -0.7 |
| 7 | Prevent work accidents and manage safety programs | -0.7 |
| 8 | Hazardous waste management | -0.7 |
| 9 | Communicating with management | -0.6 |
| 10 | Understand workers compensation insurance issues | -0.6 |
| 11 | Ability to write technical reports and summaries | -0.6 |
| 12 | Understand professional and ethical responsibilities of an industrial hygienist | -0.6 |
| 13 | Evaluate and recommend personal protective equipment | -0.6 |
| 14 | Evaluate indoor air quality | -0.5 |
| 15 | Evaluate and manage ergonomic factors | -0.5 |
| 16 | Critically analyze and evaluate scientific literature | -0.5 |
| 17 | Communicating with workers, union reps, or the public | -0.5 |
| 18 | Evaluate and control of physical, mechanical, chemical, and biological hazards | -0.5 |
| 19 | EH&S training for employees | -0.5 |
| 20 | Communicating with mid level management – supervisors | -0.5 |
| 21 | Evaluate and recommend administrative controls | -0.4 |
| 22 | Communicating with colleagues | -0.4 |

| | | |
|----|--|------|
| 23 | Understand the need for working as part of an interdisciplinary team. | -0.3 |
| 24 | Interpret and apply state or federal regulations | -0.3 |
| 25 | Understand workers' jobs | -0.3 |
| 26 | Apply statistical concepts and tools appropriate to professional practice in the field | -0.3 |
| 27 | Exposure assessment and risk characterization | -0.3 |
| 28 | Identify potentially hazardous agents or work conditions | -0.2 |
| 29 | Proper interpretation of exposure monitoring data | -0.1 |
| 30 | Understand the fundamentals of occupational safety | -0.1 |
| 31 | Apply qualitative and quantitative risk assessment tools from ACGIH, NIOSH, and others to identify unacceptable risk | 0.0 |

Quality of the Training Received by the IH Alumni

The IH alumni were asked to rate the quality of the training received during the academic program in skills for the job as industrial hygienist. The five higher rate skills by numerical average of the 5-point Likert scale responses were: critically analyze and evaluate scientific literature (4.1), recognize the need for life-long learning (4.0), ability to write technical reports and summaries (4.0), understand professional and ethical responsibilities of an industrial hygienist (4.0), and evaluate and control of physical, mechanical, chemical, and biological hazards (4.0). On the other hand, lower evaluations were for: hazards associated with nanotechnology (2.0), program budget and finance skills (2.0), understand workers compensation insurance issues (2.0), communicating with management (2.5), and communicating with mid-level management – supervisors (2.6) (Table 16).

Table 16. IH Alumni evaluation of the quality of the training received during their academic program in the skills for the job as industrial hygienist.

| | Skills | Average Rating* (n=42) |
|---|---|-------------------------------|
| 1 | Critically analyze and evaluate scientific literature | 4.1 |
| 2 | Recognize the need for life-long learning | 4.0 |
| 3 | Ability to write technical reports and summaries | 4.0 |
| 4 | Understand professional and ethical responsibilities of an industrial hygienist | 4.0 |
| 5 | Evaluate and control of physical, mechanical, chemical, and biological hazards | 4.0 |

| | | |
|----|--|-----|
| 6 | Proper interpretation of exposure monitoring data | 3.9 |
| 7 | Identify potentially hazardous agents or work conditions | 3.9 |
| 8 | Apply statistical concepts and tools appropriate to professional practice in the field | 3.8 |
| 9 | Attain recognized professional certification after the required period of professional practice | 3.8 |
| 10 | Exposure assessment and risk characterization | 3.7 |
| 11 | Understand the need for working as part of an interdisciplinary team. | 3.6 |
| 12 | Evaluate and recommend personal protective equipment | 3.6 |
| 13 | Evaluate and recommend administrative controls | 3.6 |
| 14 | Understand the fundamentals of occupational safety | 3.5 |
| 15 | Apply qualitative and quantitative risk assessment tools from ACGIH, NIOSH, and others to identify unacceptable risk | 3.4 |
| 16 | Interpret and apply state or federal regulations | 3.4 |
| 17 | Understand workers' jobs | 3.3 |
| 18 | Evaluate indoor air quality | 3.3 |
| 19 | EH&S training for employees | 3.2 |
| 20 | Evaluate and manage ergonomic factors | 3.2 |
| 21 | Prevent work accidents and manage safety programs | 3.1 |
| 22 | Communicating with colleagues | 3.1 |
| 23 | Hazardous waste management | 2.7 |
| 24 | Program leadership and management | 2.7 |
| 25 | Communicating with workers, union reps, or the public | 2.6 |
| 26 | Emergency response planning | 2.6 |
| 27 | Communicating with mid level management - supervisors | 2.6 |
| 28 | Communicating with management | 2.5 |
| 29 | Understand workers compensation insurance issues | 2.0 |
| 30 | Program budget and finance skills | 2.0 |
| 31 | Hazards associated with nanotechnology | 2.0 |

*Average of responses scored: no training (1), limited training (2), good training (3), excellent training (4), and outstanding training (5).

A comparison of the rating average of the importance of the skills for the work as an industrial hygienist ranked by AIHA members and the quality of the training received in those skills by the IH alumni is shown in Table 17.

Table 17. Comparison of the average ratings of the importance of skills for work as an industrial hygienist ranked by AIHA members, and the quality of the training received in those skills by the IH alumni.

| | Skills for the work as IH | AIHA - Importance* of the skills (n=23) | IH alumni - Quality^Y of training (n=42) |
|----|---|--|---|
| 1 | Identify potentially hazardous agents or work conditions | 4.7 | 3.9 |
| 2 | Interpret and apply state or federal regulations | 4.7 | 3.4 |
| 3 | Understand workers' jobs | 4.7 | 3.3 |
| 4 | Exposure assessment and risk characterization | 4.7 | 3.7 |
| 5 | Evaluate and control of physical, mechanical, chemical, and biological hazards | 4.6 | 4.0 |
| 6 | Proper interpretation of exposure monitoring data | 4.5 | 3.9 |
| 7 | Understand professional and ethical responsibilities of an industrial hygienist | 4.5 | 4.0 |
| 8 | Evaluate and recommend personal protective equipment | 4.5 | 3.6 |
| 9 | Evaluate indoor air quality | 4.4 | 3.3 |
| 10 | Communicating with management | 4.4 | 2.5 |
| 11 | Communicating with mid-level management - supervisors | 4.4 | 2.6 |
| 12 | Ability to write technical reports and summaries | 4.4 | 4.0 |
| 13 | Understand the need for working as part of an interdisciplinary team. | 4.4 | 3.6 |
| 14 | Recognize the need for life-long learning | 4.4 | 4.0 |
| 15 | Understand the fundamentals of occupational safety | 4.4 | 3.5 |
| 16 | Prevent work accidents and manage safety programs | 4.4 | 3.1 |
| 17 | Communicating with colleagues | 4.4 | 3.1 |

| | | | |
|----|--|-----|-----|
| 18 | Attain recognized professional certification after the required period of professional practice | 4.3 | 3.8 |
| 19 | Program leadership and management | 4.3 | 2.7 |
| 20 | Communicating with workers, union reps, or the public | 4.3 | 2.6 |
| 21 | EH&S training for employees | 4.3 | 3.2 |
| 22 | Evaluate and recommend administrative controls | 4.2 | 3.6 |
| 23 | Evaluate and manage ergonomic factors | 4.1 | 3.2 |
| 24 | Emergency response planning | 4.0 | 2.6 |
| 25 | Apply qualitative and quantitative risk assessment tools from ACGIH, NIOSH, and others to identify unacceptable risk | 4.0 | 3.4 |
| 26 | Hazardous waste management | 4.0 | 2.7 |
| 27 | Critically analyze and evaluate scientific literature | 4.0 | 4.1 |
| 28 | Apply statistical concepts and tools appropriate to professional practice in the field | 3.8 | 3.8 |
| 29 | Program budget and finance skills | 3.8 | 2.0 |
| 30 | Understand workers compensation insurance issues | 3.6 | 2.0 |
| 31 | Hazard associated with nanotechnology | 3.1 | 2.0 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

∇ Average of responses scored: no training (1), limited training (2), good training (3), excellent training (4), and outstanding training (5).

In addition, Z-scores were calculated for comparisons between the two ratings because the questions were asked of different target audiences (practicing professionals and IH alumni) using different response categories (importance of skills and quality of training, respectively (Table 18). A Z-score is a standardized score in which the average of the average rankings is scored as zero and differences from this average are scored in standard deviation units.

Table 18. Comparison of Z-scores for the average ratings of the importance of skills for the work as an industrial hygienist ranked by AIHA members, and the quality of the training received in those skills by the IH alumni.

| | Skills for the work as IH | AIHA - Importance of skills (n=23) | IH alumni - Quality of training (n=42) |
|----|---|---|---|
| 1 | Identify potentially hazardous agents or work conditions | 1.2 | 1.0 |
| 2 | Interpret and apply state or federal regulations | 1.2 | 0.2 |
| 3 | Understand workers' jobs | 1.2 | 0.1 |
| 4 | Exposure assessment and risk characterization | 1.2 | 0.7 |
| 5 | Evaluate and control of physical, mechanical, chemical, and biological hazards | 1.0 | 1.2 |
| 6 | Proper interpretation of exposure monitoring data | 0.7 | 1.0 |
| 7 | Understand professional and ethical responsibilities of an industrial hygienist | 0.7 | 1.2 |
| 8 | Evaluate and recommend personal protective equipment | 0.7 | 0.5 |
| 9 | Evaluate indoor air quality | 0.4 | 0.1 |
| 10 | Communicating with management | 0.4 | -1.2 |
| 11 | Communicating with mid-level management and supervisors | 0.4 | -1.1 |
| 12 | Ability to write technical reports and summaries | 0.4 | 1.2 |
| 13 | Understand the need for working as part of an interdisciplinary team. | 0.4 | 0.5 |
| 14 | Recognize the need for life-long learning | 0.4 | 1.2 |
| 15 | Understand the fundamentals of occupational safety | 0.4 | 0.4 |
| 16 | Prevent work accidents and manage safety programs | 0.4 | -0.3 |
| 17 | Communicating with colleagues | 0.4 | -0.3 |
| 18 | Attain recognized professional certification after the required period of professional practice | 0.1 | 0.9 |
| 19 | Program leadership and management | 0.1 | -0.9 |

| | | | |
|----|--|------|------|
| 20 | Communicating with workers, union reps, or the public | 0.1 | -1.1 |
| 21 | EH&S training for employees | 0.1 | -0.1 |
| 22 | Evaluate and recommend administrative controls | -0.2 | 0.5 |
| 23 | Evaluate and manage ergonomic factors | -0.5 | -0.1 |
| 24 | Emergency response planning | -0.8 | -1.1 |
| 25 | Apply qualitative and quantitative risk assessment tools from ACGIH, NIOSH, and others to identify unacceptable risk | -0.8 | 0.2 |
| 26 | Hazardous waste management | -0.8 | -0.9 |
| 27 | Critically analyze and evaluate scientific literature | -0.8 | 1.3 |
| 28 | Apply statistical concepts and tools appropriate to professional practice in the field | -1.3 | 0.9 |
| 29 | Program budget and finance skills | -1.3 | -2.0 |
| 30 | Understand workers compensation insurance issues | -1.9 | -2.0 |
| 31 | Hazard associated with nanotechnology | -3.4 | -2.0 |

* Z-scores were calculated for the average ratings given by the AIHA members and IH alumni. A Z-score of 0 is the transformed average of the average ratings for all 31 questions. The score is a standard deviation unit deviation from the overall average.

The differences in the Z-scores average ratings for the importance of skills reported by the AIHA members and the quality of the training received in the skills reported by the IH alumni are shown in table 19. (This table shows the differences between the Z-scores reported in Table 18 to facilitate comparison.) The skills with one or more than positive standard deviation difference for the importance of the skill compared to the quality of the training: communicating with management (1.6), communicating with mid-level management and supervisors (1.4), understand workers' jobs (1.2), communicating with workers, union reps, or the public (1.1), interpret and apply state or federal regulations (1.0), and program leadership and management (1.0). These scores mean that the AIHA members tended to rate these skills as being highly important, but the IH alumni tended to rate the quality of training in these skills as being somewhat limited. In contrast, the skills with one or more than one negative standard deviation difference for the importance of the skill compared to the quality of the training were: apply statistical concepts and tools appropriate to professional practice in the field (-2.2), critically analyze and evaluate scientific literature (-2.1), hazards associated with nanotechnology (-1.3), and apply qualitative and quantitative risk assessment tools from ACGIH, NIOSH, and others to identify unacceptable risk (-1.0) (Table 19). These latter scores mean that the IH alumni

thought the training was outstanding quality, although the skills were not necessarily rated by the AIHA members to be highly important skills. It is interesting that the AIHA members consistently reported that communication skills are very important, although the IH program alumni tended to consider the training to be limited in this area.

Table 19. Differences in the Z-scores average ratings of the importance of skills for work according to the AIHA members compared to the quality of the training received in the skills reported by the IH alumni.

| | Skills for the work as IH | Z-scores AIHA - Alumni |
|----|--|-----------------------------------|
| 1 | Communicating with management | 1.6 |
| 2 | Communicating with mid-level management and supervisors | 1.4 |
| 3 | Understand workers' jobs | 1.2 |
| 4 | Communicating with workers, union reps, or the public | 1.1 |
| 5 | Program leadership and management | 1.0 |
| 6 | Interpret and apply state or federal regulations | 1.0 |
| 7 | Program budget and finance skills | 0.7 |
| 8 | Communicating with colleagues | 0.6 |
| 9 | Exposure assessment and risk characterization | 0.6 |
| 10 | Prevent work accidents and manage safety programs | 0.6 |
| 11 | Evaluate indoor air quality | 0.3 |
| 12 | Emergency response planning | 0.3 |
| 13 | Identify potentially hazardous agents or work conditions | 0.2 |
| 14 | EH&S training for employees | 0.2 |
| 15 | Evaluate and recommend personal protective equipment | 0.1 |
| 16 | Understand workers compensation insurance issues | 0.1 |
| 17 | Hazardous waste management | 0.1 |
| 18 | Understand the fundamentals of occupational safety | -0.0 |
| 19 | Evaluate and control of physical, mechanical, chemical, and biological hazards | -0.2 |
| 20 | Understand the need for working as part of an interdisciplinary team. | -0.2 |

| | | |
|----|--|------|
| 21 | Proper interpretation of exposure monitoring data | -0.3 |
| 22 | Evaluate and manage ergonomic factors | -0.4 |
| 23 | Understand professional and ethical responsibilities of an industrial hygienist | -0.5 |
| 24 | Evaluate and recommend administrative controls | -0.7 |
| 25 | Ability to write technical reports and summaries | -0.8 |
| 26 | Recognize the need for life-long learning | -0.8 |
| 27 | Attain recognized professional certification after the required period of professional practice | -0.8 |
| 28 | Apply qualitative and quantitative risk assessment tools from ACGIH, NIOSH, and others to identify unacceptable risk | -1.0 |
| 29 | Hazard associated with nanotechnology | -1.3 |
| 30 | Critically analyze and evaluate scientific literature | -2.1 |
| 31 | Apply statistical concepts and tools appropriate to professional practice in the field | -2.2 |

* Z-scores were calculated for the average ratings based on responses to all 31 questions.

B. Occupational and Environmental Health Nursing

Occupational and Environmental Health Nursing Skills

The surveys asked equivalent questions about the importance of skills to private employers, AAOHN members, and the OEHN program alumni.

Private Employers. The five skills ranked as most important for the job as an occupational health nurse were: managing sprains and strains (4.7), conducting health and injury assessments (4.6), communicating with mid-level management – supervisors (4.6), managing occupational health surveillance programs (4.5), and assessing the health needs of workers and worker populations (4.4) (Table 20). In contrast, the five skills ranked as less important were: managing workplace violence programs (2.9), EH&S training for employees (3.0), program budget and finance skills (3.0), managing emergency preparedness plan (3.1), and developing injury and illness prevention programs (3.1) (Table 20).

Table 20. Private employers rating of importance of job skills for an occupational health nurse.

| | Skills | Average Rating* (n=14) |
|----|--|-----------------------------------|
| 1 | Managing sprains and strains | 4.7 |
| 2 | Conducting health and injury assessments | 4.6 |
| 3 | Communicating with mid-level management - supervisors | 4.6 |
| 4 | Managing occupational health surveillance programs | 4.5 |
| 5 | Assessing the health needs of workers and worker populations | 4.4 |
| 6 | Analyzing risks associated with worksite hazards | 4.4 |
| 7 | Managing workers compensation cases | 4.2 |
| 8 | Clinical practice | 4.1 |
| 9 | Communicating with colleagues | 4.1 |
| 10 | Communicating with workers, union reps, or the public | 4.1 |
| 11 | Evaluating and manage ergonomic factors | 4.0 |
| 12 | Case management programs | 4.0 |
| 13 | Developing return to work programs | 4.0 |
| 14 | Interpreting and applying state and federal regulations | 3.9 |
| 15 | Communicating with management | 3.9 |
| 16 | Evidence-based practice | 3.9 |
| 17 | Participating in health care quality improvement | 3.7 |
| 18 | Managing substance abuse programs | 3.6 |
| 19 | Managing health promotion programs | 3.6 |
| 20 | Program leadership and management | 3.5 |
| 21 | Technical writing | 3.5 |
| 22 | Critically analyze and evaluate scientific literature | 3.3 |
| 23 | Managing travel health programs | 3.2 |
| 24 | Developing injury and illness prevention programs | 3.1 |
| 25 | Managing emergency preparedness plan | 3.1 |
| 26 | Program budget and finance skills | 3.0 |

| | | |
|----|--------------------------------------|-----|
| 27 | EH&S training for employees | 3.0 |
| 28 | Managing workplace violence programs | 2.9 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

AAOHN Members. Among the AAOHN respondents who had completed a master or doctoral degree, the five skills ranked as most important for work as an Occupational Health nurse were: communicating with management (4.7), assessing the health needs of works and worker populations (4.7), analyzing risks associated with worksite hazards (4.7), communicating with mid-level management and supervisors (4.6), and communicating with colleagues (4.6) (Table 21). In contrast, the five skills ranked as less important were: managing substance abuse programs (3.4), managing travel health programs (3.4), managing workplace violence programs (3.7), managing emergency preparedness plan (3.8), and participating in health care quality improvement (3.8) (Table 21).

Table 21. AAOHN members (with master or doctoral degree) rating of the importance of the skills for the job as an occupational health nurse.

| | Skills | Average Rating * (n=44) |
|----|--|------------------------------------|
| 1 | Communicating with management | 4.7 |
| 2 | Assessing the health needs of works and worker populations | 4.7 |
| 3 | Analyzing risks associated with worksite hazards | 4.7 |
| 4 | Communicating with mid-level management & supervisors | 4.6 |
| 5 | Communicating with colleagues | 4.6 |
| 6 | Communicating with workers, union reps, or the public | 4.6 |
| 7 | Managing occupational health surveillance program | 4.5 |
| 8 | Interpreting and applying state and federal regulations | 4.5 |
| 9 | Managing workers compensation cases | 4.4 |
| 10 | Conducting health and injury assessments | 4.4 |
| 11 | Developing injury and illness prevention programs | 4.4 |
| 12 | Program leadership and management | 4.4 |
| 13 | Evidence-based practice | 4.3 |
| 14 | Developing return to work programs | 4.3 |

| | | |
|----|---|-----|
| 15 | Evaluating and managing ergonomic factors | 4.2 |
| 16 | Clinical practice | 4.2 |
| 17 | Program budget and finance skills | 4.1 |
| 18 | Managing health promotion programs | 4.1 |
| 19 | Case management programs | 4.0 |
| 20 | Critically analyzing and evaluating scientific literature | 4.0 |
| 21 | Technical writing | 3.9 |
| 22 | EH&S training for employees | 3.9 |
| 23 | Managing sprains and strains | 3.9 |
| 24 | Participating in health care quality improvement | 3.8 |
| 25 | Managing emergency preparedness plan | 3.8 |
| 26 | Managing workplace violence programs | 3.7 |
| 27 | Managing travel health programs | 3.4 |
| 28 | Managing substance abuse programs | 3.4 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

Occupational and Environmental Health Nursing Alumni. The five skills ranked as most important for work as an Occupational Health nurse were: managing workers compensation cases (4.8), assessing the health needs of worker populations (4.6), conducting health and injury assessments (4.6), managing sprains and strains (4.6), and managing workplace violence programs (4.6) (Table 22). In contrast, the five skills ranked as less important were: EH&S training for employees (4.0), program budget and finance skills (4.0), technical writing (4.1), managing substance abuse programs (4.1), and communicating with workers, union reps, or the public (4.3) (Table 22).

Table 22. OEHN Alumni rating of the importance of the skills for the job as an occupational health nurse.

| | Skills | Average Rating * (n=8) |
|---|--|---------------------------|
| 1 | Managing workers compensation cases | 4.8 |
| 2 | Assessing the health needs of worker populations | 4.6 |
| 3 | Conducting health and injury assessments | 4.6 |

| | | |
|----|---|-----|
| 4 | Managing sprains and strains | 4.6 |
| 5 | Managing workplace violence programs | 4.6 |
| 6 | Managing health promotion programs | 4.6 |
| 7 | Developing return to work programs | 4.6 |
| 8 | Program leadership and management | 4.6 |
| 9 | Managing occupational health surveillance program | 4.5 |
| 10 | Participating in health care quality improvement | 4.5 |
| 11 | Developing injury and illness prevention programs | 4.5 |
| 12 | Communicating with management | 4.5 |
| 13 | Communicating with mid-level management and supervisors | 4.5 |
| 14 | Communicating with colleagues | 4.5 |
| 15 | Interpreting and applying state and federal regulations | 4.5 |
| 16 | Clinical practice | 4.4 |
| 17 | Analyzing risks associated with worksite hazards | 4.4 |
| 18 | Evaluating and managing ergonomic factors | 4.4 |
| 19 | Managing emergency preparedness plan | 4.4 |
| 20 | Critically analyzing and evaluating scientific literature | 4.4 |
| 21 | Evidence-based practice | 4.4 |
| 22 | Case management programs | 4.4 |
| 23 | Managing travel health programs | 4.3 |
| 24 | Communicating with workers, union reps, or the public | 4.3 |
| 25 | Managing substance abuse programs | 4.1 |
| 26 | Technical writing | 4.1 |
| 27 | Program budget and finance skills | 4.0 |
| 28 | EH&S training for employees | 4.0 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

Comparison among Private Employers, AAOHN members, and OEHN Alumni. The comparison of rating of importance of job skills for an occupational health nurse by private employers, AAOHN members and OEHN alumni, ordered by employer rating is shown in table 23.

Table 23. Comparison of average ratings of the importance of the skills for the work as an occupational health nurse, by private employers, AAOHN members (with master or doctoral degree), and OEHN alumni (ordered by employer rating).

| | Skills for the work as OHN | Private employers (n=14) | AAOHN (n=44) | OEHN alumni (n=8) |
|----|--|-------------------------------------|-------------------------|------------------------------|
| 1 | Managing sprains and strains | 4.7 | 3.9 | 4.6 |
| 2 | Conducting health and injury assessments | 4.6 | 4.4 | 4.6 |
| 3 | Communicating with mid-level management - supervisors | 4.6 | 4.6 | 4.5 |
| 4 | Managing occupational health surveillance programs | 4.5 | 4.5 | 4.5 |
| 5 | Assessing the health needs of workers and worker populations | 4.4 | 4.7 | 4.6 |
| 6 | Analyzing risks associated with worksite hazards | 4.4 | 4.7 | 4.4 |
| 7 | Managing workers compensation cases | 4.2 | 4.4 | 4.8 |
| 8 | Clinical practice | 4.1 | 4.2 | 4.4 |
| 9 | Communicating with colleagues | 4.1 | 4.6 | 4.5 |
| 10 | Communicating with workers, union reps, or the public | 4.1 | 4.6 | 4.3 |
| 11 | Evaluating and manage ergonomic factors | 4.0 | 4.2 | 4.4 |
| 12 | Case management programs | 4.0 | 4.0 | 4.4 |
| 13 | Developing return to work programs | 4.0 | 4.3 | 4.6 |
| 14 | Interpreting and applying state and federal regulations | 3.9 | 4.5 | 4.5 |
| 15 | Communicating with management | 3.9 | 4.7 | 4.5 |
| 16 | Evidence-based practice | 3.9 | 4.3 | 4.4 |
| 17 | Participating in health care quality improvement | 3.7 | 3.8 | 4.5 |
| 18 | Managing substance abuse programs | 3.6 | 3.4 | 4.1 |
| 19 | Managing health promotion programs | 3.6 | 4.1 | 4.6 |
| 20 | Program leadership and management | 3.5 | 4.4 | 4.6 |
| 21 | Technical writing | 3.5 | 3.9 | 4.1 |

| | | | | |
|----|---|-----|-----|-----|
| 22 | Critically analyze and evaluate scientific literature | 3.3 | 4.0 | 4.4 |
| 23 | Managing travel health programs | 3.2 | 3.4 | 4.3 |
| 24 | Developing injury and illness prevention programs | 3.1 | 4.4 | 4.5 |
| 25 | Managing emergency preparedness plan | 3.1 | 3.8 | 4.4 |
| 26 | Program budget and finance skills | 3.0 | 4.1 | 4.0 |
| 27 | EH&S training for employees | 3.0 | 3.9 | 4.0 |
| 28 | Managing workplace violence programs | 2.9 | 3.6 | 4.6 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

The difference in the skills rating average between private employers and AAOHN members with master or doctoral degree showed that for most of the skills, private employers gave a lower score. The biggest negative (employers rate lower than AAOHN members) rating differences were for: developing injury and illness prevention programs (-1.2), program budget and finance skills (-1.1), EH&S training for employees (-0.9), program leadership and management (-1.1), and managing workplace violence programs (-0.8). On the other hand, the largest positive (employers rate higher than AAOHN member) rating differences were for: managing sprains and strains (0.8), managing substance abuse programs (0.3), conducting health and injury assessments (0.2), case management programs (0.0), and managing occupational health programs (0.0) (Table 24).

Table 24. Differences in the skills rating average between Private Employers and AAOHN members with master or doctoral degree.

| Rank | Skills for the work as OHN | Rating Difference* |
|------|---|--------------------|
| 1 | Developing injury and illness prevention programs | -1.2 |
| 2 | Program budget and finance skills | -1.1 |
| 3 | EH&S training for employees | -0.9 |
| 4 | Program leadership and management | -0.9 |
| 5 | Managing workplace violence programs | -0.8 |
| 6 | Communicating with management | -0.8 |
| 7 | Managing emergency preparedness plan | -0.7 |
| 8 | Critically analyze and evaluate scientific literature | -0.7 |

| | | |
|----|--|------|
| 9 | Interpreting and applying state and federal regulations | -0.6 |
| 10 | Managing health promotion programs | -0.5 |
| 11 | Evidence-based practice | -0.5 |
| 12 | Communicating with colleagues | -0.4 |
| 13 | Technical writing | -0.4 |
| 14 | Communicating with workers, union reps, or the public | -0.4 |
| 15 | Analyzing risks associated with worksite hazards | -0.4 |
| 16 | Assessing the health needs of workers and worker populations | -0.3 |
| 17 | Developing return to work programs | -0.3 |
| 18 | Evaluating and manage ergonomic factors | -0.2 |
| 19 | Managing workers compensation cases | -0.2 |
| 20 | Managing travel health programs | -0.2 |
| 21 | Participating in health care quality improvement | -0.1 |
| 22 | Communicating with mid-level management and supervisors | -0.1 |
| 23 | Clinical practice | -0.1 |
| 24 | Managing occupational health surveillance programs | 0.0 |
| 25 | Case management programs | 0.0 |
| 26 | Conducting health and injury assessments | 0.2 |
| 27 | Managing substance abuse programs | 0.3 |
| 28 | Managing sprains and strains | 0.8 |

* Average rating by private employers – average rating by AAOHN members.

Comparison of importance of skills between private employers and OEHN alumni is not presented because most private employers tend to hire OHN who have had certificate or bachelor degree training (see Westat report data in Table 8) which is comparable to the AAOHN respondents because the vast majority of AAOHN members reported certificate or bachelor degree training; only 8.3% had completed a master degree or doctoral degree. In contrast, the SCERC provides advanced OEHN leadership training at the master degree and doctoral degree levels.

The following table shows the comparison of importance of skills between AAOHN members with master or doctoral degree with the OEHN program alumni. The biggest

negative (AAOHN members rate lower than OEHN program alumni) rating differences were for: managing workplace violence (-0.9), managing travel health programs (-0.9), managing substance abuse programs (-0.8), managing sprains and strains (-0.7), and participating in health care quality improvement (-0.7). In contrast, the biggest positive (AAOHN member rate higher than OEHN program alumni) rating differences were for: analyzing risks associated with worksite hazards (0.3), communicating with workers, union representatives, or the public (0.3), communicating with management (0.2), communicating with mid-level management and supervisors (0.1), and program budget and finance (0.1). It is interesting that the AAOHN members with master or doctoral degree seemed to consistently rate the skill of communicating as being relatively more important than did the OEHN program alumni.

Table 22. Difference between AAOHN members with master or doctoral degree and OEHN program alumni in the rating of the importance of the skills for the job as an occupational health nurse.

| | Skills | Rating Difference* |
|----|---|---------------------------|
| 1 | Managing workplace violence programs | -0.9 |
| 2 | Managing travel health programs | -0.9 |
| 3 | Managing substance abuse programs | -0.8 |
| 4 | Managing sprains and strains | -0.7 |
| 5 | Participating in health care quality improvement | -0.7 |
| 6 | Managing emergency preparedness plan | -0.6 |
| 7 | Managing health promotion programs | -0.6 |
| 8 | Critically analyzing and evaluating scientific literature | -0.4 |
| 9 | Case management programs | -0.4 |
| 10 | Developing return to work programs | -0.4 |
| 11 | Managing workers compensation cases | -0.3 |
| 12 | Program leadership and management | -0.3 |
| 13 | Clinical practice | -0.2 |
| 14 | Conducting health and injury assessments | -0.2 |
| 15 | Technical writing | -0.2 |
| 16 | Evaluating and managing ergonomic factors | -0.1 |
| 17 | Developing injury and illness prevention programs | -0.1 |
| 18 | Evidence-based practice | -0.1 |

| | | |
|----|---|------|
| 19 | EH&S training for employees | -0.1 |
| 20 | Interpreting and applying state and federal regulations | 0.0 |
| 21 | Managing occupational health surveillance program | 0.0 |
| 22 | Communicating with colleagues | 0.1 |
| 23 | Assessing the health needs of worker populations | 0.1 |
| 24 | Program budget and finance skills | 0.1 |
| 25 | Communicating with mid-level management and supervisors | 0.1 |
| 26 | Communicating with management | 0.2 |
| 27 | Communicating with workers, union reps, or the public | 0.3 |
| 28 | Analyzing risks associated with worksite hazards | 0.3 |

*Difference between average of responses of AAOHN members and OEHN program alumni.

Quality of the Training Received by the OEHN Alumni

Regarding the evaluation done by the OEHN alumni to the quality of the training received during the academic program in the skills for the job as an occupational health nurse, the five higher scores were: analyzing risks associated with worksite hazards (4.1), evidence-based practice (4.0), critically analyzing and evaluating scientific literature (3.9), assessing the health needs of worker populations (3.8), and managing sprains and strains (3.8). On the other hand, the lower evaluations were for: managing travel health programs (2.6), program budget and finance skills (2.6), managing substance abuse programs (2.6), EH&S training for employees (2.8), and case management programs (2.8) (Table 25)

Table 25. Ranking of the quality of the training received in the skills for the work as an Occupational Health Nurse by the OEHN alumni.

| | Skills for the work as an Occupational Health Nurse | Average Rating* (n=7) |
|---|--|------------------------------|
| 1 | Analyzing risks associated with worksite hazards | 4.1 |
| 2 | Evidence-based practice | 4.0 |
| 3 | Critically analyzing and evaluating scientific literature | 3.9 |
| 4 | Assessing the health needs of worker populations | 3.8 |
| 5 | Managing sprains and strains | 3.8 |

| | | |
|----|---|-----|
| 6 | Evaluating and managing ergonomic factors | 3.6 |
| 7 | Conducting health and injury assessments | 3.6 |
| 8 | Managing occupational health surveillance program | 3.6 |
| 9 | Clinical practice | 3.6 |
| 10 | Communicating with colleagues | 3.6 |
| 11 | Program leadership and management | 3.5 |
| 12 | Managing health promotion programs | 3.4 |
| 13 | Participating in health care quality improvement | 3.4 |
| 14 | Communicating with management | 3.4 |
| 15 | Communicating with mid level management - supervisors | 3.4 |
| 16 | Developing injury and illness prevention programs | 3.3 |
| 17 | Managing emergency preparedness plan | 3.2 |
| 18 | Developing return to work programs | 3.1 |
| 19 | Communicating with workers, union reps, or the public | 3.1 |
| 20 | Technical writing | 3.0 |
| 21 | Interpreting and applying for state and federal regulations | 3.0 |
| 22 | Managing workers compensation cases | 2.9 |
| 23 | Managing workplace violence programs | 2.9 |
| 24 | Case management programs | 2.8 |
| 25 | EH&S training for employees | 2.8 |
| 26 | Managing substance abuse programs | 2.6 |
| 27 | Program budget and finance skills | 2.6 |
| 28 | Managing travel health programs | 2.6 |

*Average of responses scored: no training (1), limited training (2), good training (3), excellent training (4), and outstanding training (5).

A comparison of the rating average of the importance of the skills for the work as an occupational health nurse ranked by AAOHN members with a master's or doctoral degree and the quality of the training received in those skills by the OEHN alumni is shown in

Table 26. Z-scores were calculated for comparisons between the two ratings because they were based on different Likert score responses (Table 27).

Table 26. Comparison of average ratings of the importance of the skills for the work as an occupational health nurse ranked by AAOHN members with master or doctoral degree, and the quality of the training received in those skills by the OEHN program alumni.

| | Skills for the work as an Occupational Health Nurse | AAOHN - Importance of the skills* (n=44) | OEHN alumni - Quality of the training received^y (n=7) |
|----|--|---|---|
| 1 | Communicating with management | 4.7 | 3.4 |
| 2 | Assessing the health needs of works and worker populations | 4.7 | 3.8 |
| 3 | Analyzing risks associated with worksite hazards | 4.7 | 4.1 |
| 4 | Communicating with mid-level management - supervisors | 4.6 | 3.4 |
| 5 | Communicating with colleagues | 4.6 | 3.6 |
| 6 | Communicating with workers, union reps, or the public | 4.6 | 3.1 |
| 7 | Managing occupational health surveillance program | 4.5 | 3.6 |
| 8 | Interpreting and applying state and federal regulations | 4.5 | 3.0 |
| 9 | Managing workers compensation cases | 4.4 | 2.9 |
| 10 | Conducting health and injury assessments | 4.4 | 3.6 |
| 11 | Developing injury and illness prevention programs | 4.4 | 3.3 |
| 12 | Program leadership and management | 4.4 | 3.5 |
| 13 | Evidence-based practice | 4.3 | 4.0 |
| 14 | Developing return to work programs | 4.3 | 3.1 |
| 15 | Evaluating and managing ergonomic factors | 4.2 | 3.6 |
| 16 | Clinical practice | 4.2 | 3.6 |
| 17 | Program budget and finance skills | 4.1 | 2.6 |
| 18 | Managing health promotion programs | 4.1 | 3.4 |
| 19 | Critically analyzing and evaluating scientific literature | 4.0 | 3.9 |

| | | | |
|----|--|-----|-----|
| 20 | Case management programs | 4.0 | 2.8 |
| 21 | Technical writing | 3.9 | 3.0 |
| 22 | EH&S training for employees | 3.9 | 2.8 |
| 23 | Managing sprains and strains | 3.9 | 3.8 |
| 24 | Managing emergency preparedness plan | 3.8 | 3.2 |
| 25 | Participating in health care quality improvement | 3.8 | 3.4 |
| 26 | Managing workplace violence programs | 3.7 | 2.9 |
| 27 | Managing travel health programs | 3.4 | 2.6 |
| 28 | Managing substance abuse programs | 3.4 | 2.6 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

∇ Average of responses scored: no training (1), limited training (2), good training (3), excellent training (4), and outstanding training (5).

Table 27. Comparison of the z-scores for the average ratings of the importance of the skills for the work as an occupational health nurse ranked by AAOHN members with master or doctoral degree, and the quality of the training received in those skills by the OEHN program alumni.

| | Skills for the work as an Occupational Health Nurse | AAOHN - Importance of the skills (n=44) | OEHN alumni - Quality of the training received (n=7) |
|---|--|--|---|
| 1 | Communicating with management | 1.5 | 0.1 |
| 2 | Assessing the health needs of works and worker populations | 1.4 | 1.2 |
| 3 | Analyzing risks associated with worksite hazards | 1.3 | 1.9 |
| 4 | Communicating with mid level management - supervisors | 1.2 | 0.1 |
| 5 | Communicating with colleagues | 1.0 | 0.6 |
| 6 | Communicating with workers, union reps, or the public | 1.0 | -0.5 |
| 7 | Managing occupational health surveillance program | 0.8 | 0.6 |
| 8 | Interpreting and applying state and federal regulations | 0.8 | -0.7 |

| | | | |
|----|---|------|------|
| 9 | Managing workers compensation cases | 0.6 | -0.9 |
| 10 | Conducting health and injury assessments | 0.6 | 0.8 |
| 11 | Developing injury and illness prevention programs | 0.5 | -0.1 |
| 12 | Program leadership and management | 0.5 | 0.4 |
| 13 | Evidence-based practice | 0.3 | 1.7 |
| 14 | Developing return to work programs | 0.2 | -0.5 |
| 15 | Evaluating and managing ergonomic factors | 0.1 | 0.8 |
| 16 | Clinical practice | 0.0 | 0.6 |
| 17 | Program budget and finance skills | -0.3 | -1.6 |
| 18 | Managing health promotion programs | -0.3 | 0.1 |
| 19 | Critically analyzing and evaluating scientific literature | -0.5 | 1.5 |
| 20 | Case management programs | -0.5 | -1.1 |
| 21 | Technical writing | -0.7 | -0.7 |
| 22 | EH&S training for employees | -0.7 | -1.1 |
| 23 | Managing sprains and strains | -0.8 | 1.2 |
| 24 | Managing emergency preparedness plan | -1.0 | -0.3 |
| 25 | Participating in health care quality improvement | -1.0 | 0.1 |
| 26 | Managing workplace violence programs | -1.4 | -0.9 |
| 27 | Managing travel health programs | -2.2 | -1.8 |
| 28 | Managing substance abuse programs | -2.2 | -1.6 |

- Z-scores were calculated for the rating average given by the OEHN alumni and the AAOHN members.

The differences in the z-scores rating averages of the importance of those skills for the work according to the AAOHN members with a master's or doctoral degree and the quality of the training received in the skills for the work as an occupational health nurse by the OEHN program alumni is shown in table 28. (This table shows the differences between the Z-scores reported in Table 27 to facilitate comparison.)

The skills with one or more than one positive standard deviation difference for the importance of the skills compared to the quality of the training received were: interpreting and applying for state and federal regulations (1.5), managing workers compensation cases (1.5), communicating with workers, union reps, or the public (1.5), communicating with management (1.3), program budget and finance skills (1.3), and communicating with mid

level management – supervisors (1.1) (Table 28). In contrast, the skills with one or more than one negative standard deviation difference for the quality of the training received compared to the importance of the skills were: managing sprains and strains (-2.0), critically analyzing and evaluating scientific literature (-2.0), evidence-based practice (-1.4), and participating in health care quality improvement (11.2) (Table 28). Consistent with the findings for the Industrial Hygiene program, the AAOHN members (with master or doctoral degree) appeared to consistently rank communication skill as being very important, although the OEHN program alumni tended to rank the training as being somewhat limited. On the other hand, the OEHN program alumni ranked the quality of training in critically analyzing and evaluating the scientific literature and evidence-based practice as being very high quality training, although the AAOHN members did not rate these skills as being highly important for their work.

Table 28. Differences in the z-scores rating averages of the importance of those skills for the work according to the AAOHN members with master’s or doctoral degree and the quality of the training received in the skills for the work as an Occupational Health Nurse by the OEHN alumni.

| | Skills for Work as an Occupational Health Nurse | Z-scores* AAOHN- Alumni |
|----|--|--|
| 1 | Interpreting and applying state and federal regulations | 1.5 |
| 2 | Managing workers compensation cases | 1.5 |
| 3 | Communicating with workers, union reps, or the public | 1.5 |
| 4 | Communicating with management | 1.3 |
| 5 | Program budget and finance skills | 1.3 |
| 6 | Communicating with mid-level management and supervisors | 1.1 |
| 7 | Developing return to work programs | 0.7 |
| 8 | Developing injury and illness prevention programs | 0.6 |
| 9 | Case management programs | 0.6 |
| 10 | Communicating with colleagues | 0.4 |
| 11 | EH&S training for employees | 0.4 |
| 12 | Assessing the health needs of works and worker populations | 0.2 |
| 13 | Managing occupational health surveillance program | 0.2 |
| 14 | Program leadership and management | 0.1 |

| | | |
|----|---|------|
| 15 | Technical writing | 0.0 |
| 16 | Conducting health and injury assessments | -0.3 |
| 17 | Managing workplace violence programs | -0.4 |
| 18 | Managing travel health programs | -0.4 |
| 19 | Analyzing risks associated with worksite hazards | -0.5 |
| 20 | Managing health promotion programs | -0.5 |
| 21 | Clinical practice | -0.6 |
| 22 | Evaluating and managing ergonomic factors | -0.7 |
| 23 | Managing substance abuse programs | -0.7 |
| 24 | Managing emergency preparedness plan | -0.8 |
| 25 | Participating in health care quality improvement | -1.2 |
| 26 | Evidence-based practice | -1.4 |
| 27 | Critically analyzing and evaluating scientific literature | -2.0 |
| 28 | Managing sprains and strains | -2.0 |

* Z-scores were calculated for the average ratings based on responses to all of the questions.

C. Occupational Medicine Residency

Occupational Medicine Skills

The surveys asked equivalent questions about the importance of skills to private employers, WOEMA members, and the Occupational Medicine Residency program alumni.

Private Employers. The first five skills ranked as most important for the job as an occupational physician by private employers (EH&S managers) were: evaluate and manage work-related injuries and illnesses (4.2), determine fitness for work (4.2), evaluate effects of toxic chemical exposures (4.0), medical review officer functions (3.9), and communicating with workers, union reps, or the public (3.7) (table 29). In contrast, the five skills ranked as less important were: program budget and finance skills (2.2), disaster and emergency manage (2.4), travel medicine (2.5), program leadership and management (2.5), and EH&S training for employees (2.5) (Table 29).

Table 29. Private employers rating of importance of job skills for an occupational medicine physician.

| | Skills | Average Rating* (n=24) |
|----|---|-----------------------------------|
| 1 | Evaluate and manage work-related injuries and illnesses | 4.2 |
| 2 | Determine fitness for work | 4.2 |
| 3 | Evaluate effects of toxic chemical exposures | 4.0 |
| 4 | Medical Review Officer functions | 3.9 |
| 5 | Communicating with workers, union reps, or the public | 3.7 |
| 6 | Evaluate and manage ergonomic factors | 3.6 |
| 7 | Communicating with colleagues | 3.6 |
| 8 | Laws and regulations related to occupational medicine | 3.5 |
| 9 | Communicating with management | 3.5 |
| 10 | Critically analyze and evaluate scientific literature | 3.5 |
| 11 | Communicating with mid-level management and supervisors | 3.4 |
| 12 | Manage workers compensation cases | 3.4 |
| 13 | Interpret and apply state or federal regulations | 3.3 |
| 14 | Manage medical surveillance programs | 3.3 |
| 15 | Technical writing | 3.2 |
| 16 | Evaluate environmental health risks and regulations | 3.0 |
| 17 | Clinical preventive medicine | 2.8 |
| 18 | Manage health promotion programs | 2.7 |
| 19 | Manage mental health issues in the workplace | 2.6 |
| 20 | EH&S training for employees | 2.5 |
| 21 | Program leadership and management | 2.5 |
| 22 | Travel medicine | 2.5 |
| 23 | Disaster and emergency manage | 2.4 |
| 24 | Program budget and finance skills | 2.2 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

WOEMA Members. The first five skills ranked as most important for the job as an occupational physician by WOEMA members were: communicating with employees and co-workers (4.2), occupational medicine clinical practice (4.2), evaluate and manage work-related injuries and illnesses (4.2), manage workers compensation cases (4.2), and laws and regulations related to occupational medicine (4.0). In contrast, the skills ranked as least important for the job as an occupational medicine physician were: travel medicine (1.6), clinical preventive medicine (2.1), manage health promotion programs (2.2), disaster and emergency management (2.2), and evaluate environmental health risks and regulations (2.2) (Table 30).

Table 30. Average ratings by WOEMA members of importance of job skills for an occupational medicine physician.

| | Skills | Average Rating* (n=9) |
|----|---|----------------------------------|
| 1 | Communicating with employees and co-workers | 4.2 |
| 2 | Occupational medicine clinical practice | 4.2 |
| 3 | Evaluate and manage work-related injuries and illnesses | 4.2 |
| 4 | Manage workers compensation cases | 4.2 |
| 5 | Laws and regulations related to occupational medicine | 4.0 |
| 6 | Program leadership and management | 3.8 |
| 7 | Communicating with upper management | 3.8 |
| 8 | Interpret and apply state or federal regulations | 3.8 |
| 9 | Determine fitness for work | 3.4 |
| 10 | Manage medical surveillance programs | 3.3 |
| 11 | Program budget and finance skills | 3.1 |
| 12 | Evaluate effects of toxic chemical exposures | 3.1 |
| 13 | Evaluate and manage ergonomic factors | 3.1 |
| 14 | Technical writing | 3.0 |
| 15 | Critically analyze and evaluate scientific literature | 2.7 |
| 16 | Medical Review Officer functions | 2.7 |
| 17 | Manage mental health issues in the workplace | 2.6 |
| 18 | EH&S training for employees | 2.4 |
| 19 | Hazard recognition and evaluation | 2.3 |

| | | |
|----|---|-----|
| 20 | Evaluate environmental health risks and regulations | 2.2 |
| 21 | Disaster and emergency management | 2.2 |
| 22 | Manage health promotion programs | 2.2 |
| 23 | Clinical preventive medicine | 2.1 |
| 24 | Travel medicine | 1.6 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

Occupational Medicine Residency Alumni. The first five skills ranked as most important for the job as an occupational physician were: communicating with employees and co-workers (4.7), occupational medicine clinical practice (4.6), evaluate and manage work-related injuries and illnesses (4.6), laws and regulations related to occupational medicine (4.5), and communicating with upper management (4.5) (Table 31). In contrast, the five skills ranked as less important were: medical review officer functions (1.9), manage health promotion programs (2.9), travel medicine (2.9), disaster and emergency management (3.0), and program budget and finance skills (3.0) (Table 31).

Table 31. Average ratings of skills by Occupational Medicine Residency Program Alumni rating of importance of job skills for an occupational physician.

| | Skills | Average Rating* (n=14) |
|----|---|-------------------------------|
| 1 | Communicating with employees and co-workers | 4.7 |
| 2 | Occupational medicine clinical practice | 4.6 |
| 3 | Evaluate and manage work-related injuries and illnesses | 4.6 |
| 4 | Laws and regulations related to occupational medicine | 4.5 |
| 5 | Communicating with upper management | 4.5 |
| 6 | Determine fitness for work | 4.2 |
| 7 | Manage workers compensation cases | 4.2 |
| 8 | Evaluate and manage ergonomic factors | 4.1 |
| 9 | Interpret and apply state or federal regulations | 4.1 |
| 10 | Program leadership and management | 4.0 |
| 11 | Evaluate effects of toxic chemical exposures | 4.0 |
| 12 | Hazard recognition and evaluation | 3.9 |

| | | |
|----|---|-----|
| 13 | Manage medical surveillance programs | 3.4 |
| 14 | Critically analyze and evaluate scientific literature | 3.4 |
| 15 | Clinical preventive medicine | 3.3 |
| 16 | Evaluate environmental health risks and regulations | 3.3 |
| 17 | Manage mental health issues in the workplace | 3.2 |
| 18 | EH&S training for employees | 3.1 |
| 19 | Technical writing | 3.0 |
| 20 | Program budget and finance skills | 3.0 |
| 21 | Disaster and emergency management | 3.0 |
| 22 | Travel medicine | 2.9 |
| 23 | Manage health promotion programs | 2.9 |
| 24 | Medical Review Officer functions | 1.9 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

Comparisons of importance of skills between WOEMA members and Occupational Medicine Residency alumni. The comparison of ratings of importance of job skills for an occupational medicine physician did not include private employers because most of the respondents were EH&S program managers. Such managers would be more likely to contract with local primary care physicians for injury and illness treatment than with formally trained occupational medicine physicians. Also as a practical matter, the survey sent to private employers used different wording for some of the questions that the surveys sent to the WOEMA members and OM Residency alumni, so the answers may not be comparable.

The comparison of average ratings of importance of job skills for an occupational medicine physician by WOEMA members and OM Residency alumni, ordered by WOEMA member rating is shown in Table 32. The rank orderings of the average ratings are quite similar between the WOEMA members and the OM Residency alumni. For example, the three highest rated skills by both groups was communicating with employees and co-workers, occupational medicine clinical practice, and evaluate and manage work-related injuries and illnesses. Both groups also ranked managing workers compensation cases and knowing law and regulations related to occupational medicine as being very important skills. Both WOEMA members and the OM Residency alumni tended to consider the following skills to be among the least important: travel medicine, manage health promotion programs, and disaster and emergency management.

Table 32. Average ratings by WOEMA members and Occupational Medicine Residency alumni of importance of job skills for an occupational medicine physician.

| | Skills | WOEMA Rating* (n=9) | OMR alumni Rating* (n=14) |
|----|---|------------------------------------|--|
| 1 | Communicating with employees and co-workers | 4.2 | 4.7 |
| 2 | Occupational medicine clinical practice | 4.2 | 4.6 |
| 3 | Evaluate & manage work-related injuries & illnesses | 4.2 | 4.6 |
| 4 | Manage workers compensation cases | 4.2 | 4.2 |
| 5 | Laws and regulations related to occupational medicine | 4.0 | 4.5 |
| 6 | Program leadership and management | 3.8 | 4.0 |
| 7 | Communicating with upper management | 3.8 | 4.5 |
| 8 | Interpret and apply state or federal regulations | 3.8 | 4.1 |
| 9 | Determine fitness for work | 3.4 | 4.2 |
| 10 | Manage medical surveillance programs | 3.3 | 3.4 |
| 11 | Program budget and finance skills | 3.1 | 3.0 |
| 12 | Evaluate effects of toxic chemical exposures | 3.1 | 4.0 |
| 13 | Evaluate and manage ergonomic factors | 3.1 | 4.1 |
| 14 | Technical writing | 3.0 | 3.0 |
| 15 | Critically analyze and evaluate scientific literature | 2.7 | 3.4 |
| 16 | Medical Review Officer functions | 2.7 | 1.9 |
| 17 | Manage mental health issues in the workplace | 2.6 | 3.2 |
| 18 | EH&S training for employees | 2.4 | 3.1 |
| 19 | Hazard recognition and evaluation | 2.3 | 3.9 |
| 20 | Evaluate environmental health risks and regulations | 2.2 | 3.3 |
| 21 | Disaster and emergency management | 2.2 | 3.0 |
| 22 | Manage health promotion programs | 2.2 | 2.9 |
| 23 | Clinical preventive medicine | 2.1 | 3.3 |
| 24 | Travel medicine | 1.6 | 2.9 |

*Average of responses scored: not important (1), slightly important (2), moderately important (3), important (4), and very important (5).

There were some differences in the perception of importance of skills between the WOEMA members and the OM Residency alumni. It is somewhat difficult to see in Table 32 because the OM Residency alumni on average across all of the questions tended to give somewhat higher ratings on importance of skills (mean of ranks for the OM Residency alumni was 3.65 compared to 3.09 for the WOEMA members). Therefore, we calculated standardized scores (Z-scores) for the two groups and then the difference of the Z-scores (shown in Table 33). Again it is notable that there is very substantial agreement in perceptions between the WOEMA members and the OM Residency alumni with the z-score difference being less than one-half (0.5 to -0.5) standard deviations for 14 of the 24 skill categories. Nevertheless, the WOEMA members reported relatively higher importance for Medical Review Officer functions, program budget and finance skills, technical writing, and managing workers compensation cases. While the OM Residency alumni reported higher relatively higher importance for skills in hazard recognition and control, travel medicine, clinical preventive medicine, and evaluating environmental health risks and regulations. It is interesting that the OM Residency alumni, who were trained and board certified in preventive medicine-occupational medicine, tended to view skills in clinical preventive medicine and being able to evaluate environmental as well as occupational health risks as being relatively more important than viewed by the WOEMA members, some of whom did not complete full OM residency programs.

Table 33. Difference in standardize rating of skills (Z-scores) for WOEMA members compared to OM Residency alumni.

| | Skills | Z-score difference WOEMA-OMR * |
|----|---|---|
| 1 | Medical Review Officer functions | 2.0 |
| 2 | Program budget and finance skills | 0.9 |
| 3 | Technical writing | 0.8 |
| 4 | Manage workers compensation cases | 0.7 |
| 5 | Manage medical surveillance programs | 0.6 |
| 6 | Program leadership and management | 0.4 |
| 7 | Interpret and apply state or federal regulations | 0.3 |
| 8 | Occupational medicine clinical practice | 0.1 |
| 9 | Evaluate and manage work-related injuries and illnesses | 0.1 |
| 10 | Laws and regulations related to occupational medicine | 0.0 |
| 11 | Manage mental health issues in the workplace | 0.0 |
| 12 | Communicating with employees and co-workers | -0.1 |
| 13 | Manage health promotion programs | -0.1 |

| | | |
|----|---|------|
| 14 | EH&S training for employees | -0.1 |
| 15 | Critically analyze and evaluate scientific literature | -0.1 |
| 16 | Disaster and emergency management | -0.2 |
| 17 | Communicating with upper management | -0.3 |
| 18 | Determine fitness for work | -0.4 |
| 19 | Evaluate effects of toxic chemical exposures | -0.5 |
| 20 | Evaluate and manage ergonomic factors | -0.6 |
| 21 | Evaluate environmental health risks and regulations | -0.6 |
| 22 | Clinical preventive medicine | -0.8 |
| 23 | Travel medicine | -0.8 |
| 24 | Hazard recognition and evaluation | -1.4 |

*Difference in standardized score (Z-score) of average ratings on the importance of skills by WOEMA members – Occupational Medicine Residency alumni. The overall means of the Z-scores is zero and the units are in standard deviations from the mean.

Quality of Training Received in Occupational Medicine Skills

The Occupational Medicine Residency alumni were asked to rate the quality of the training received during the residency program for the skills in a job as an occupational physician. The five highest scores were: critically analyze and evaluate scientific literature (4.9), evaluate effects of toxic chemical exposures (4.6), evaluate environmental health risks and regulations (4.3), evaluate and manage work-related injuries and illnesses (4.3), and hazard recognition and evaluation (4.2). On the other hand, the lower scores were for: program budget and finance skills (2.0), medical review officer functions (2.1), travel medicine (2.3), manage mental health issues in the workplace (2.5), and disaster and emergency management (2.7) (Table 34).

Table 34. Occupational Medicine Residency alumni evaluation of the quality of the training received during their academic program in the skills for the job as occupational medicine physician (rating scale from 1 -5).

| Rank | Quality of Training in Skills for work as an Occupational Medicine Physician | Average Rating* (n=13) |
|------|--|------------------------|
| 1 | Critically analyze and evaluate scientific literature | 4.9 |
| 2 | Evaluate effects of toxic chemical exposures | 4.6 |
| 3 | Evaluate environmental health risks and regulations | 4.3 |

| | | |
|----|---|-----|
| 4 | Evaluate and manage work-related injuries and illnesses | 4.3 |
| 5 | Hazard recognition and evaluation | 4.2 |
| 6 | Occupational medicine clinical practice | 4.1 |
| 7 | Laws and regulations related to occupational medicine | 4.1 |
| 8 | Interpret and apply state or federal regulations | 4.1 |
| 9 | Manage workers compensation cases | 3.9 |
| 10 | Determine fitness for work | 3.9 |
| 11 | Evaluate and manage ergonomic factors | 3.8 |
| 12 | Manage medical surveillance programs | 3.7 |
| 13 | Technical writing | 3.3 |
| 14 | Communicating with employees and co-workers | 3.3 |
| 15 | Clinical preventive medicine | 2.9 |
| 16 | Manage health promotion programs | 2.9 |
| 17 | Communicating with upper management | 2.8 |
| 18 | EH&S training for employees | 2.8 |
| 19 | Program leadership and management | 2.8 |
| 20 | Disaster and emergency management | 2.7 |
| 21 | Manage mental health issues in the workplace | 2.5 |
| 22 | Travel medicine | 2.3 |
| 23 | Medical Review Officer functions | 2.1 |
| 24 | Program budget and finance skills | 2.0 |

*Average of responses scored: no training (1), some training (2), good training (3), very good training (4), and excellent training (5).

We also evaluated whether the OM Residency training has a similar emphasis to the perception of the importance of skills by the OM Residency graduates. Because the responses for the questions on importance of skills is a different Likert scale than responses to the questions on quality of training, we calculated standardized ratings (Z-scores) for the importance of skills questions ask of the OM Residency graduates members and standardized ratings for the quality of training questions ask of the OM Residency alumni. The Z-score standardizes the responses across all 24 questions, so the overall average of the average ratings is zero and the difference from this overall average is scored

in standard deviation units. We then subtracted the OM Residency alumni training quality z-score from the alumni rating on importance of skill score (Table 35).

The relative rankings by the OM Residency alumni were quite similar on the importance of skills and the quality of training, although some differences were observed between importance of skills compared to the quality of training. The largest positive ranking of importance relative to ranking of training quality were: communicating with upper management (2.0 standard deviations); communicating with employees and co-workers (1.6); program leadership and management (1.3); and program budget and finance skills (0.8). The largest negative differences (OM Residency alumni rating quality of training as being very high compared to rating of importance of the skill) were: critically analyze and evaluate the scientific literature (-2.2); evaluate environmental health risks and regulations (-1.6); and evaluate effects of toxic chemicals (-1.0). Nevertheless, the ratings of skill importance and the ratings of quality of training corresponded quite (less than one-half a standard deviation) for a majority of the 24 rated skills.

The high rankings of the alumni for critically analyzing the literature and evaluating environmental health risks and regulation reflect strengths of the UCI Occupational Medicine Residency program, which requires residents to complete a MS degree in Environmental Health Sciences (as a MPH-equivalent degree). The program offers a clinical case conference and seminars, and training in an occupational and environmental medicine consulting clinic, which provides strong training to evaluate effects of toxic chemical exposures and in hazard recognition and control.

Table 35. Difference in standardize (Z-scores) rating of importance of skills for compared to standardize rating of quality of training in skills reported by OM Residency alumni.

| | Skills | Z-score difference importance - quality* |
|----|---|---|
| 1 | Communicating with upper management | 2.0 |
| 2 | Communicating with employees and co-workers | 1.6 |
| 3 | Program leadership and management | 1.3 |
| 4 | Program budget and finance skills | 0.8 |
| 5 | Occupational medicine clinical practice | 0.5 |
| 6 | Manage mental health issues in the workplace | 0.5 |
| 7 | Laws and regulations related to occupational medicine | 0.4 |
| 8 | Evaluate and manage work-related injuries and illnesses | 0.3 |
| 9 | Travel medicine | 0.3 |
| 10 | Manage workers compensation cases | 0.2 |

| | | |
|----|---|------|
| 11 | Determine fitness for work | 0.2 |
| 12 | Clinical preventive medicine | 0.2 |
| 13 | EH&S training for employees | 0.0 |
| 14 | Disaster and emergency management | 0.0 |
| 15 | Evaluate and manage ergonomic factors | 0.1 |
| 16 | Interpret and apply state or federal regulations | -0.2 |
| 17 | Manage health promotion programs | -0.4 |
| 18 | Hazard recognition and evaluation | -0.6 |
| 19 | Manage medical surveillance programs | -0.7 |
| 20 | Technical writing | -0.8 |
| 21 | Medical Review Officer functions | -0.9 |
| 22 | Evaluate effects of toxic chemical exposures | -1.0 |
| 23 | Evaluate environmental health risks and regulations | -1.6 |
| 24 | Critically analyze and evaluate scientific literature | -2.2 |

*Difference in standardized score (Z-score) of average ratings on the importance of skills – quality of training.

4. Occupational Epidemiology Skills and Professional needs

During the past several years, the SCERC has provided research training in occupational epidemiology and in work organization through the Targeted Research Training (TRT) program. The Center anticipates that training in the affiliated disciplines, especially environmental epidemiology, will continue in the TRT Program even if it does not become separate academic training program within the SCERC. Therefore, the needs assessment survey asked public employers about the need for and importance of skills in the field of occupational epidemiology. The sampling frame of the Western States Occupational Network (WestON) was described in Section 1. In brief, WestON is a network of state-based occupational health epidemiologists and administrators from 19 western states, NIOSH and OSHA federal partners, NIOSH Education and Research Center (ERC) professionals, and NIOSH agricultural center professionals. A total of 91 members were contacted though e-mail and 17 (18.7%) of them answered the survey. Among the participants, 41.2% worked with a university or educational organization, 41.2% with a state public health department, and 23.5% with a national occupational health or public health department.

Need

The need for occupational epidemiologist reported by the public employers was presented in Section 2. Table 4 showed that public employers were most likely to search for OH professionals during the next five years in occupational epidemiology and environmental epidemiology more than any other OH discipline. Table 7 showed that the public employers rated it as being very important for occupational epidemiology to be formally trained in the field.

Public employers preferences for covering an open position in occupational epidemiology were: occupational epidemiologist 81.8%, and an environmental epidemiologist 27.3%. The preferred academic training for that position were masters 45.5%, and doctorate 36.4%. The likelihood that the organization will search for an occupational epidemiologist was moderately high and the supply of well-trained professionals was considered low.

Importance of Skills

According to the public employers responses, the first five skills ranked as most important for the job as an occupational epidemiologist were: draw appropriate inferences from epidemiologic data (4.6), identify key sources of data for epidemiologic purposes (4.5), apply the basic terminology and definitions of epidemiology (4.5), design and conduct an epidemiological study (4.4), and make reasonable inferences from statistical analysis (4.4). In contrast, the five skills ranked as less important were: health risk assessment (3.1), exposure assessment of workplace hazards (3.4), leadership and management (3.5), design and conduct an outbreak or cluster investigation (3.6), and communicating with department or organization leadership (3.8) (Table 36).

Table 36. Public employers rating of the importance* of job skills for the work as Occupational Epidemiologist

| | Skills for the work as Occupational Epidemiologist | Average Rating* |
|---|---|------------------------|
| 1 | Draw appropriate inferences from epidemiologic data | 4.6 |
| 2 | Identify key sources of data for epidemiologic purposes | 4.5 |
| 3 | Apply the basic terminology and definitions of epidemiology | 4.5 |
| 4 | Design and conduct an epidemiological study | 4.4 |
| 5 | Make reasonable inferences from statistical analysis | 4.4 |
| 6 | Evaluate the strengths and limitations of epidemiologic reports | 4.3 |
| 7 | Design and operate a surveillance system | 4.3 |
| 8 | Select and conduct appropriate statistical analyses | 4.3 |

| | | |
|----|---|-----|
| 9 | Deduce public health implications of research results | 4.3 |
| 10 | Writing technical reports and summaries | 4.3 |
| 11 | Describe a public health problem in terms of magnitude, person, time and place | 4.1 |
| 12 | Communicating with workers and community | 4.0 |
| 13 | Make appropriate policy recommendations on the basis on research results and interpretation | 3.9 |
| 14 | Interpret and apply local, state, or federal regulations | 3.9 |
| 15 | Communicating with department or organization leadership | 3.8 |
| 16 | Design and conduct an outbreak or cluster investigation | 3.6 |
| 17 | Leadership and management | 3.5 |
| 18 | Exposure assessment of workplace hazards | 3.4 |
| 19 | Health risk assessment | 3.1 |

*Likert scale includes: not at all important (1), of little importance (2), of average importance (3), very important (4), extremely important (5).

5. Continuing Education

Continuing Education is a core mission and program of the SCERC. Therefore, the needs assessment surveys asked each of the target populations about the topics the respondents thought were the most important to be available through Continuing Education. In addition to the employers, professional organization, and program alumni included in the assessment of future need and important skills for work as occupational health professionals in Industrial Hygiene, Occupational Health Nursing, and Occupational Medicine, the needs assessment for Continuing Education also include the Human Factors and Ergonomics Society (HFES) because the SCERC offers Continuing Education courses on ergonomics. We also used the new survey sent to the HFES to ask about preferences for course format and schedule.

A. Employers

Private Employers. Respondents for private employers were mostly EH&S program managers. Many of them were professionally trained in industrial hygiene and safety. Private employers consider that is very important for EH&S professionals to participate in continuing education programs (Table 37).

Table 37. Private employers importance of EH&S professionals participation in continuing education programs.

| Professional Area | Rating Average* | Response Count |
|---|------------------------|-----------------------|
| a. Industrial Hygiene (CIH) | 4.0 | 32 |
| b. Safety (CSP) | 3.9 | 33 |
| c. Ergonomics (CPE) | 3.8 | 31 |
| d. Occupational Health Nursing (COHN) | 3.9 | 26 |
| e. Occupational Medicine (OM board certified) | 4.0 | 27 |

*Answer options ranged from “not at all important” to extremely important on a 1-5 point Likert scale.

The survey also asked employers about the importance of topics for Continuing Education. The five topics ranked as the most important were: updates on laws, regulations, standards (4.1), chemical hazards (3.9), electric hazards (3.9), hazardous materials (3.9), and risk assessment (3.9). In contrast, the topics ranked as the least important were (scale from 1-5): epidemiology (2.5), patient handling (2.6), emerging issues - nanotechnology, green chemistry, climate change, etc. (2.8), bullying in the workplace (2.9), and shift work (2.9) (Table 38).

Table 38. Private employers rating of importance for Continuing Education topics.

| Topic | Average Rating* (n=33) |
|---|-------------------------------|
| 1 Updates on laws, regulations, standards | 4.1 |
| 2 Chemical hazards | 3.9 |
| 3 Electric hazards | 3.9 |
| 4 Hazardous materials | 3.9 |
| 5 Risk assessment | 3.9 |
| 6 Hazard communication | 3.9 |
| 7 Personal protective equipment | 3.8 |
| 8 Accident investigation | 3.8 |
| 9 Physical hazards | 3.8 |
| 10 Confined space | 3.8 |
| 11 Professional ethics | 3.7 |

| | | |
|----|---|-----|
| 12 | Emergency response | 3.7 |
| 13 | Ergonomic hazards | 3.7 |
| 14 | Manual material handling | 3.6 |
| 15 | Machine safety and mechanical hazards | 3.6 |
| 16 | Prevention and management of repetitive motion disorders | 3.6 |
| 17 | Topics indoor air quality, sampling and instrumentation, risk assessment | 3.6 |
| 18 | Return to Work/Stay at Work Accommodations | 3.6 |
| 19 | Prevention and management of low back pain | 3.5 |
| 20 | Biological hazards | 3.5 |
| 21 | Workers compensation | 3.4 |
| 22 | Prevention and management of neck and shoulder disorders | 3.4 |
| 23 | Review of basic topics (e.g. incident investigation, walkthroughs) | 3.4 |
| 24 | Review courses for professional certification | 3.4 |
| 25 | Prevention and management of upper extremity disorders | 3.4 |
| 26 | Prevention and management of lower extremity disorders | 3.4 |
| 27 | Business and Management skills (e.g. Risk Management, Risk Communication) | 3.3 |
| 28 | Program evaluation | 3.3 |
| 29 | Workplace violence | 3.3 |
| 30 | Toxicology and health effects | 3.3 |
| 31 | Infectious disease | 3.2 |
| 32 | Safety science, Systems Safety | 3.2 |
| 33 | Health surveillance | 3.2 |
| 34 | Total Worker Health | 3.1 |
| 35 | Mental health | 3.1 |
| 36 | Chronic pain management | 3.0 |
| 37 | Work organization | 3.0 |
| 38 | Productivity | 2.9 |
| 39 | Psychosocial Factors in the Workplace and their Health Effects | 2.9 |
| 40 | Shift work | 2.9 |

| | | |
|----|---|-----|
| 41 | Bullying in the workplace | 2.9 |
| 42 | Emerging issues - nanotechnology, green chemistry, climate change, etc. | 2.8 |
| 43 | Patient Handling | 2.6 |
| 44 | Epidemiology | 2.6 |

* Average of responses on Likert scale: not at all important (1), of little importance (2), of average importance (3), very important (4), and extremely important (5).

Public Employers. The five continuing education courses ranked as the most important were: epidemiology (4.0), biological hazards (3.9), emergency response (3.9), risk assessment (3.9), and hazard communication (3.9) (Table 42). In contrast, the topics ranked as the least important were (scale from 1-5): Chronic pain management (2.5), prevention and management of lower extremity disorders (2.6), prevention and management of low back pain (2.6), review courses for professional certification (2.6), prevention and management of repetitive motion disorders (2.8), and Prevention and management of neck and shoulder disorders (2.8) (Table 39)

Table 39. Public employers rating of importance for continuing education topics.

| | Topic | Average Rating* (n=9) |
|----|---|------------------------------|
| 1 | Epidemiology | 4.0 |
| 2 | Biological hazards | 3.9 |
| 3 | Emergency response | 3.9 |
| 4 | Risk assessment | 3.9 |
| 5 | Hazard communication | 3.9 |
| 6 | Toxicology and health effects | 3.9 |
| 7 | Health surveillance | 3.9 |
| 8 | Emerging issues - nanotechnology, green chemistry, climate change, etc. | 3.9 |
| 9 | Chemical hazards | 3.8 |
| 10 | Personal Protective Equipment | 3.8 |
| 11 | Physical hazards | 3.7 |
| 12 | Hazardous materials | 3.7 |

| | | |
|----|---|-----|
| 13 | Infectious disease | 3.7 |
| 14 | Topics in indoor air quality, sampling and instrumentation, risk assessment | 3.6 |
| 15 | Updates on laws, regulations, standards | 3.4 |
| 16 | Review of basic topics (e.g. incident investigation, walkthroughs) | 3.4 |
| 17 | Safety science, Systems Safety | 3.4 |
| 18 | Total Worker Health | 3.4 |
| 19 | Psychosocial Factors in the Workplace and their Health Effects | 3.4 |
| 20 | Workplace violence | 3.4 |
| 21 | Machine safety and Mechanical hazards | 3.2 |
| 22 | Electric hazards | 3.2 |
| 23 | Accident investigation | 3.1 |
| 24 | Return to Work/Stay at Work Accommodations | 3.1 |
| 25 | Mental health | 3.1 |
| 26 | Productivity | 3.1 |
| 27 | Shift work | 3.1 |
| 28 | Ergonomic hazards | 3.1 |
| 29 | Confined space | 3.0 |
| 30 | Professional ethics | 3.0 |
| 31 | Business Management Skills (e.g. Risk Management, Risk Communication) | 3.0 |
| 32 | Work Organization | 3.0 |
| 33 | Program evaluation | 3.0 |
| 34 | Bullying in the workplace | 3.0 |
| 35 | Patient Handling | 3.0 |
| 36 | Workers Compensation | 2.9 |
| 37 | Manual material handling | 2.9 |
| 38 | Prevention and management of upper extremity disorders | 2.8 |
| 39 | Prevention and management of neck and shoulder disorders | 2.8 |
| 40 | Prevention and management of repetitive motion disorders | 2.8 |
| 41 | Review courses for professional certification | 2.6 |

| | | |
|----|--|-----|
| 42 | Prevention and management of low back pain | 2.6 |
| 43 | Prevention and management of lower extremity disorders | 2.6 |
| 44 | Chronic pain management | 2.5 |

* Average of responses on Likert scale: not at all important (1), of little importance (2), of average importance (3), very important (4), and extremely important (5).

It may be noted that the priority topics for Continuing Education were different between the private employers and public employers. The most important topics for private employers (EH&S managers) were updates on laws, regulations, standards; chemical hazards; electric hazards; hazardous materials; and risk assessment. These topics reflect an emphasis on practical knowledge and skills to manage potential workplace hazards. In contrast, the most important topics for the public employers (OH programs) epidemiology, biological hazards, emergency response, risk assessment, and hazard communication. These topics reflect the public health mission of the public employers which includes occupational health surveillance, risk assessment and communication with the public, and managing emergencies and emerging infectious diseases even in the occupational setting.

B. Industrial Hygiene Professionals

AIHA Members. The continuing education courses ranked as the most important were: updates on laws, regulations, and standards (4.4), business and management skills (e.g. risk management, risk communication) (4.2), emerging issues - nanotechnology, green chemistry, climate change, etc. (4.1), ergonomic hazards (4.1), professional ethics (4.1). In contrast, the topics ranked as the least important were: patient handling (3.1), productivity (3.1), chronic pain management (3.2), bullying in the workplace (3.3), and mental health (3.3) (Table 40).

Table 40. AIHA members rating of importance for continuing education topics.

| | Topic | Average Rating* (n=20) |
|---|---|------------------------|
| 1 | Updates on laws/regulations/standards | 4.4 |
| 2 | Business and Management Skills (e.g. Risk Management, Risk Communication) | 4.2 |
| 3 | Emerging Issues - nanotechnology, green chemistry, climate change, etc. | 4.1 |
| 4 | Ergonomic hazards | 4.1 |
| 5 | Professional ethics | 4.1 |

| | | |
|----|---|-----|
| 6 | Topics in indoor air quality, sampling and instrumentation, risk assessment | 4.0 |
| 7 | Chemical hazards | 4.0 |
| 8 | Risk assessment | 4.0 |
| 9 | Physical hazards | 4.0 |
| 10 | Personal Protective Equipment | 4.0 |
| 11 | Toxicology and health effects | 4.0 |
| 12 | Review courses for professional certification | 3.9 |
| 13 | Machine safety and mechanical hazards | 3.9 |
| 14 | Hazardous materials | 3.9 |
| 15 | Confined space | 3.9 |
| 16 | Hazard communication | 3.9 |
| 17 | Return to Work/Stay at Work Accommodations | 3.9 |
| 18 | Safety Science, Systems safety | 3.8 |
| 19 | Total Worker Health | 3.8 |
| 20 | Electric hazards | 3.8 |
| 21 | Emergency response | 3.8 |
| 22 | Health surveillance | 3.8 |
| 23 | Program evaluation | 3.8 |
| 24 | Manual material handling | 3.7 |
| 25 | Biological hazards | 3.7 |
| 26 | Infectious disease | 3.7 |
| 27 | Accident investigation | 3.7 |
| 28 | Psychosocial Factors in the Workplace and their Health Effects | 3.6 |
| 29 | Prevention and management of repetitive motion disorders | 3.6 |
| 30 | Epidemiology | 3.6 |
| 31 | Workers Compensation | 3.6 |
| 32 | Work Organization | 3.6 |
| 33 | Prevention and management of upper extremity disorders | 3.6 |
| 34 | Prevention and management of low back pain | 3.6 |

| | | |
|----|--|-----|
| 35 | Prevention and management of neck and shoulder disorders | 3.5 |
| 36 | Prevention and management of lower extremity disorders | 3.5 |
| 37 | Workplace violence | 3.5 |
| 38 | Review of basic topics (e.g. incident investigation, walkthroughs) | 3.4 |
| 39 | Shift work | 3.4 |
| 40 | Mental health | 3.3 |
| 41 | Bullying in the workplace | 3.3 |
| 42 | Chronic pain management | 3.2 |
| 43 | Productivity | 3.1 |
| 44 | Patient Handling | 2.7 |

* Average of responses on Likert scale: not at all important (1), of little importance (2), of average importance (3), very important (4), and extremely important (5).

Industrial Hygiene Alumni. The continuing education courses ranked as the most important were: updates on laws/regulations/standards (4.2), risk assessment (4.2), hazard communication (4.0), business and management skills (e.g. risk management, risk communication) (4.0), personal protective equipment (4.0) (Table 38). In contrast, the topics ranked as the least important were (scale from 1-5): bullying in the workplace (3.0), workplace violence (3.1), patient handling (3.1), chronic pain management (3.2), shift work (3.3) (Table 41).

Table 41. IH Alumni rating of importance for continuing education topics

| | Topic | Average Rating* (n=39) |
|---|---|-------------------------------|
| 1 | Updates on laws/regulations/standards | 4.2 |
| 2 | Risk assessment | 4.2 |
| 3 | Hazard communication | 4.0 |
| 4 | Business and Management Skills (e.g. Risk Management, Risk Communication) | 4.0 |
| 5 | Personal Protective Equipment | 4.0 |
| 6 | Confined space | 4.0 |
| 7 | Chemical hazards | 4.0 |
| 8 | Topics in indoor air quality, sampling and instrumentation, risk assessment | 3.9 |

| | | |
|----|---|-----|
| 9 | Physical hazards | 3.9 |
| 10 | Machine safety and mechanical hazards | 3.9 |
| 11 | Electric hazards | 3.9 |
| 12 | Hazardous materials | 3.9 |
| 13 | Professional ethics | 3.9 |
| 14 | Biological hazards | 3.8 |
| 15 | Review courses for professional certification | 3.8 |
| 16 | Toxicology and health effects | 3.8 |
| 17 | Program evaluation | 3.8 |
| 18 | Ergonomic hazards | 3.7 |
| 19 | Emergency response | 3.7 |
| 20 | Accident investigation | 3.7 |
| 21 | Review of basic topics (e.g. incident investigation, walkthroughs) | 3.6 |
| 22 | Emerging Issues - nanotechnology, green chemistry, climate change, etc. | 3.6 |
| 23 | Prevention and management of repetitive motion disorders | 3.6 |
| 24 | Safety Science, Systems Safety | 3.6 |
| 25 | Psychosocial Factors in the Workplace and their Health Effects | 3.6 |
| 26 | Prevention and management of low back pain | 3.6 |
| 27 | Total Worker Health | 3.6 |
| 28 | Prevention and management of upper extremity disorders | 3.5 |
| 29 | Prevention and management of neck and shoulder disorders | 3.5 |
| 30 | Return to Work/Stay at Work Accommodations | 3.5 |
| 31 | Work Organization | 3.5 |
| 32 | Infectious disease | 3.5 |
| 33 | Health surveillance | 3.5 |
| 34 | Workers Compensation | 3.5 |
| 35 | Prevention and management of lower extremity disorders | 3.5 |
| 36 | Manual material handling | 3.4 |
| 37 | Mental health | 3.3 |

| | | |
|----|---------------------------|-----|
| 38 | Productivity | 3.3 |
| 39 | Epidemiology | 3.3 |
| 40 | Shift work | 3.3 |
| 41 | Chronic pain management | 3.2 |
| 42 | Patient Handling | 3.1 |
| 43 | Workplace violence | 3.1 |
| 44 | Bullying in the workplace | 3.0 |

* Average of responses on Likert scale: not at all important (1), of little importance (2), of average importance (3), very important (4), and extremely important (5).

The rankings of topics for Continuing Education were fairly similar for the AIHA members and the IH alumni. In particular, both groups of respondents indicated that courses on updates on laws, regulations, and standards, as well as on business and management skills were high priorities. Both groups indicated that topics such as managing chronic pain, patient handling, and dealing with bullying or workplace violence were low priority topics. It seems reasonable that the industrial hygienists would rate these latter topics as being relatively lower priority because these latter issues are often handled by other OH professionals, such as occupational health nurses or occupational medicine physicians. In order to evaluate consistency across all of the respondents, the same list of topics was included in the surveys sent to the different target populations.

D. Occupational Health Nursing

AAOHN Members. The five continuing education courses ranked as the most important by members who had training in OHN at the master or doctoral degree level were: updates on laws, regulations, standards (4.3), Total Worker Health (4.2), business Management Skills (e.g. Risk Management, Risk Communication) (4.2), risk assessment (4.1), Infectious disease (4.1). In contrast, the topics ranked as least important were: Confined space (3.2), Review courses for professional certification (3.3), Review of basic topics (e.g. incident investigation, walkthroughs) (3.3), Electric hazards (3.4), Manual material handling (3.4) (Table 42).

Table 42. AAOHN members' rating of importance for continuing education topics among those who had training in OHN at the master or doctoral degree level.

| | Topic | Average Rating* (n=44) |
|---|---|------------------------|
| 1 | Updates on laws, regulations, standards | 4.3 |
| 2 | Total Worker Health | 4.2 |

| | | |
|----|---|-----|
| 3 | Business Management Skills (e.g. Risk Management, Risk Communication) | 4.2 |
| 4 | Risk assessment | 4.1 |
| 5 | Infectious disease | 4.1 |
| 6 | Return to Work/Stay at Work Accommodations | 4.1 |
| 7 | Program evaluation | 4.0 |
| 8 | Workers Compensation | 4.0 |
| 9 | Health surveillance | 3.9 |
| 10 | Emerging issues - nanotechnology, green chemistry, climate change, etc. | 3.9 |
| 11 | Prevention and management of low back pain | 3.9 |
| 12 | Prevention and management of repetitive motion disorders | 3.9 |
| 13 | Emergency response | 3.9 |
| 14 | Mental health | 3.9 |
| 15 | Personal Protective Equipment | 3.8 |
| 16 | Prevention and management of neck and shoulder disorders | 3.8 |
| 17 | Prevention and management of upper extremity disorders | 3.8 |
| 18 | Ergonomic hazards | 3.8 |
| 19 | Professional ethics | 3.8 |
| 20 | Psychosocial Factors in the Workplace and their Health Effects Mental health | 3.8 |
| 21 | Work Organization | 3.8 |
| 22 | Workplace violence | 3.8 |
| 23 | Prevention and management of lower extremity disorders | 3.7 |
| 24 | Biological hazards | 3.7 |
| 25 | Physical hazards | 3.7 |
| 26 | Toxicology and health effects | 3.7 |
| 27 | Chronic pain management | 3.7 |
| 28 | Chemical hazards | 3.6 |
| 29 | Epidemiology | 3.6 |
| 30 | Productivity | 3.6 |
| 31 | Shift work | 3.6 |

| | | |
|----|---|-----|
| 32 | Bullying in the workplace | 3.6 |
| 33 | Hazard communication | 3.6 |
| 34 | Patient Handling | 3.6 |
| 35 | Machine safety and mechanical hazards | 3.4 |
| 36 | Safety Science, Systems Safety | 3.4 |
| 37 | Topics in indoor air quality, sampling and instrumentation, risk assessment | 3.4 |
| 38 | Hazardous materials | 3.4 |
| 39 | Manual material handling | 3.4 |
| 40 | Electric hazards | 3.4 |
| 41 | Review of basic topics (e.g. incident investigation, walkthroughs) | 3.3 |
| 42 | Review courses for professional certification | 3.3 |
| 43 | Confined space | 3.2 |

* Average of responses on Likert scale: not at all important (1), of little importance (2), of average importance (3), very important (4), and extremely important (5).

OEHN Alumni. The five continuing education courses ranked as the most important were: workers Compensation (4.4), updates on laws, regulations, standards (4.3), professional ethics (4.3), health surveillance (4.3), and emergency response (4.1)(Table 40). In contrast, the topics ranked as the least important were: topics in indoor air quality, sampling and instrumentation, risk assessment (3.0), confined space (3.1), electric hazards (3.2), machine safety and mechanical hazards (3.2), and chemical hazards (3.2) (Table 43).

Table 43. OEHN alumni rating of importance for continuing education topics.

| | Topic | Average Rating* (n=9) |
|---|--|------------------------------|
| 1 | Workers Compensation | 4.4 |
| 2 | Updates on laws, regulations, standards | 4.3 |
| 3 | Professional ethics | 4.3 |
| 4 | Health surveillance | 4.3 |
| 5 | Emergency response | 4.1 |
| 6 | Return to Work/Stay at Work Accommodations | 4.1 |

| | | |
|----|---|-----|
| 7 | Business Management Skills (e.g. Risk Management, Risk Communication) | 4.1 |
| 8 | Infectious disease | 4.0 |
| 9 | Total Worker Health | 4.0 |
| 10 | Mental health | 4.0 |
| 11 | Workplace violence | 4.0 |
| 12 | Personal Protective Equipment | 3.9 |
| 13 | Risk assessment | 3.9 |
| 14 | Emerging issues - nanotechnology, green chemistry, climate change, etc. | 3.9 |
| 15 | Chronic pain management | 3.9 |
| 16 | Review of basic topics (e.g. incident investigation, walkthroughs) | 3.8 |
| 17 | Patient Handling | 3.8 |
| 18 | Safety science, Systems Safety | 3.8 |
| 19 | Psychosocial Factors in the Workplace and their Health Effects | 3.8 |
| 20 | Productivity | 3.8 |
| 21 | Prevention and management of upper extremity disorders | 3.8 |
| 22 | Prevention and management of neck and shoulder disorders | 3.8 |
| 23 | Prevention and management of low back pain | 3.8 |
| 24 | Prevention and management of lower extremity disorders | 3.8 |
| 25 | Prevention and management of repetitive motion disorders | 3.8 |
| 26 | Hazard communication | 3.6 |
| 27 | Toxicology and health effects | 3.6 |
| 28 | Epidemiology | 3.6 |
| 29 | Work Organization | 3.6 |
| 30 | Program evaluation | 3.6 |
| 31 | Shift work | 3.6 |
| 32 | Bullying in the workplace | 3.6 |
| 33 | Physical hazards | 3.4 |
| 34 | Ergonomic hazards | 3.4 |
| 35 | Review courses for professional certification | 3.3 |

| | | |
|----|---|-----|
| 36 | Biological hazards | 3.3 |
| 37 | Hazardous materials | 3.3 |
| 38 | Manual material handling | 3.3 |
| 39 | Chemical hazards | 3.2 |
| 40 | Machine safety and mechanical hazards | 3.2 |
| 41 | Electric hazards | 3.2 |
| 42 | Confined space | 3.1 |
| 43 | Topics in indoor air quality, sampling and instrumentation, risk assessment | 3.0 |

* Average of responses on Likert scale: not at all important (1), of little importance (2), of average importance (3), very important (4), and extremely important (5).

The rankings of topics by importance were somewhat similar between the AAOHN members and the OEHN program alumni, but the highest priority and lowest priority topics were mostly different between the two groups. Among the five highest priority topics, both groups included only update on laws, regulations, and standards. The master and doctoral degree-trained AAOHN respondents indicated high priority for Total Worker Health, Business Management Skills, Risk Assessment, and Infectious Diseases; while, the OEHN alumni indicated highest priority for Workers Compensation, Professional Ethics, Health Surveillance, and Emergency Response. Both groups indicated lowest priority for topics that might be considered related to the practice of industrial hygiene, although there were differences in the specific topics they rated among the lowest priority.

E. Occupational Medicine Physicians

Continuing Education offered to occupational medicine physicians is considered to be Continuing Medical Education (CME), which requires formal accreditation. Both the SCERC and the UC Irvine Occupational Medicine Program are accredited to offer CME lectures and courses. The CME topics must be relevant to physicians, so the questions on CME asked of the occupational medicine physicians were somewhat different than those asked of the employers and other OH professionals. The response categories were also somewhat different, being a four-point Likert scale rather than a five-point Likert scale.

WOEMA Members. The five continuing education courses ranked as the most important were: chronic pain management (3.1), Workers' Compensation (3.0), return-to-work/stay-at-work accommodations (2.9), business and management skills (2.9), and workplace psychosocial factors and health effects (2.8). In contrast, the topics ranked as being the least important were: bullying and workplace violence (2.0), review of basic clinical OM topics—e.g., lead, asbestos, lung diseases (2.0), travel medicine (2.1), risk assessment and communication (2.1), and disaster and emergency response (2.1) (Table 44).

Table 44. WOEMA Members' rating of importance for continuing education topics.

| | Topic | Average Rating* (n=10) |
|----|--|---------------------------|
| 1 | Chronic pain management | 3.1 |
| 2 | Workers' Compensation | 3.0 |
| 3 | Return-to-work/Stay-at-work accommodations | 2.9 |
| 4 | Business and management skills | 2.9 |
| 5 | Workplace psychosocial factors and health effects | 2.8 |
| 6 | Mental health | 2.7 |
| 7 | Toxicology and health effects | 2.6 |
| 8 | Prevention and management of low back pain | 2.6 |
| 9 | Infectious disease | 2.5 |
| 10 | Ergonomics | 2.5 |
| 11 | Updates on laws, regulations, standards | 2.5 |
| 12 | Emerging Issues–e.g., nanotechnology, green chemistry, climate change | 2.4 |
| 13 | Professional ethics | 2.4 |
| 14 | Indoor air quality | 2.1 |
| 15 | Disaster and emergency response | 2.1 |
| 16 | Risk assessment and communication | 2.1 |
| 17 | Travel medicine | 2.1 |
| 18 | Review of basic clinical OM topics–e.g., lead, asbestos, lung diseases | 2.0 |
| 19 | Bullying and workplace violence | 2.0 |

*Average of responses on a four-point Likert scale: not important (1), moderately important (2), important (3), or very important (4).

OM Residency Alumni. The five continuing education courses ranked as the most important were: review of basic clinical OM topics–e.g., lead, asbestos, lung diseases (3.4), workers' compensation (3.4), return-to-work/stay-at-work accommodations (3.3), workplace psychosocial factors and health effects (3.2), and updates on laws, regulations, standards (3.2). In contrast, the topics ranked as the least important were: travel medicine

(2.6), mental health (2.7), business and management skills (2.8), disaster and emergency (2.8), and bullying and workplace violence (2.8) (Table 45).

Table 45. OMR alumni' rating of importance for continuing education topics .

| | Topic | Average Rating* (n=13) |
|----|--|-----------------------------------|
| 1 | Review of basic clinical OM topics–e.g., lead, asbestos, lung diseases | 3.4 |
| 2 | Workers' Compensation | 3.4 |
| 3 | Return-to-work/Stay-at-work accommodations | 3.3 |
| 4 | Workplace psychosocial factors and health effects | 3.2 |
| 5 | Updates on laws, regulations, standards | 3.2 |
| 6 | Toxicology and health effects | 3.2 |
| 7 | Prevention and management of low back pain | 3.2 |
| 8 | Ergonomics | 3.1 |
| 9 | Professional ethics | 3.1 |
| 10 | Indoor air quality | 2.9 |
| 11 | Infectious disease | 2.9 |
| 12 | Chronic pain management | 2.9 |
| 13 | Risk assessment and communication | 2.9 |
| 14 | Emerging Issues–e.g., nanotechnology, green chemistry, climate change | 2.9 |
| 15 | Bullying and workplace violence | 2.8 |
| 16 | Disaster and emergency response | 2.8 |
| 17 | Business and management skills | 2.8 |
| 18 | Mental health | 2.7 |
| 19 | Travel medicine | 2.6 |

*Average of responses on a four-point Likert scale: not important (1), moderately important (2), important (3), or very important (4).

The ratings of topics for CME by the WOEMA members and the OM Residency alumni were similar with a few notable exceptions. Both groups of physicians rated the same three topics among their top five priorities: Workers Compensation, return-to-work/stay-at-

work accommodations, and workplace psychosocial factors and health. Both groups also rated the same three topics among their lowest five priorities: travel medicine, disaster and emergency response, and bullying and workplace violence. However, they also indicated some different priorities. The WOEMA members rated business and management skills as one of the top priorities, while indicating that review of basic clinical OM skills was a low priority. In contrast, the OM Residency alumni rated review of basic clinical OM skills as a top priority, while rating business and management skills as a low priority topic for Continuing Medical Education.

F. Ergonomic Professional

HFES Members. A survey that asked about Continuing Education was sent to members of the Human Factors and Ergonomics Society (HFES) because the SCERC provides CE training in ergonomics. As noted in the methods section, the survey was distributed by email once with no reminders because that was the method approved by the HFES. The survey was distributed to 2,146 members, of whom 49 (2.3%) completed the survey. Some caution in interpreting the findings is warranted because of the low response rate.

The five continuing education courses ranked as the most important were: updates on laws, regulations, standards (3.9), accident investigation (3.9), program evaluation (3.7), ergonomic hazards (3.7), and professional ethics (3.7). In contrast, the topics ranked as the least important were: bullying in the workplace (2.6), workplace violence (2.7), workers compensation (2.9), chronic pain management (2.9), and mental health (3.2) (Table 39).

Table 46. HFES members' rating of importance for continuing education topics.

| | Topic | Average Rating* (n=32) |
|---|---|-----------------------------------|
| 1 | Updates on laws/regulations/standards | 3.9 |
| 2 | Accident investigation | 3.9 |
| 3 | Program evaluation | 3.7 |
| 4 | Ergonomic hazards | 3.7 |
| 5 | Professional ethics | 3.7 |
| 6 | Physical hazards | 3.6 |
| 7 | Business and Management Skills (e.g. Risk Management, Risk Communication) | 3.6 |
| 8 | Prevention and management of repetitive motion disorders | 3.6 |
| 9 | Psychosocial Factors in the Workplace and their Health Effects | 3.6 |

| | | |
|----|--|-----|
| 10 | Productivity | 3.5 |
| 11 | Prevention and management of upper extremity disorders | 3.5 |
| 12 | Prevention and management of neck and shoulder disorders | 3.5 |
| 13 | Prevention and management of low back pain | 3.5 |
| 14 | Machine safety and mechanical hazards | 3.4 |
| 15 | Manual material handling | 3.4 |
| 16 | Prevention and management of lower extremity disorders | 3.4 |
| 17 | Review of basic topics (e.g. incident investigation, walkthroughs) | 3.4 |
| 18 | Total Worker Health | 3.4 |
| 19 | Shift work | 3.4 |
| 20 | Personal Protective Equipment | 3.3 |
| 21 | Review courses for professional certification | 3.3 |
| 22 | Other | 3.3 |
| 23 | Work Organization | 3.3 |
| 24 | Return to Work/Stay at Work Accommodations | 3.3 |
| 25 | Patient Handling | 3.2 |
| 26 | Mental health | 3.2 |
| 27 | Chronic pain management | 2.9 |
| 28 | Workers Compensation | 2.9 |
| 29 | Workplace violence | 2.7 |
| 30 | Bullying in the workplace | 2.6 |

* Average of responses on Likert scale: not at all important (1), of little importance (2), of average importance (3), very important (4), and extremely important (5).

Preferences in Continuing Education Course Format. The survey administered to the HFES members also asked about their preference for CE course format and schedule. According to the HFES members, their preferences for CE course format were in order: (1) in-person (69.7%), (2) webinars (66.7%), and (3) online courses (54.5%). The preferred days were weekdays (90.6%), in particular, Tuesday (72.4%), Wednesday (79.3%), and Thursday (79.3%). The afternoon was the preferred time (Table 47).

Table 47. HFES members’ preferences for type of continue education, day of the week, and time.

| Continuing Education | Response (%) |
|-------------------------------|---------------------|
| Type of continuing education: | |
| In-person | 69.7% |
| Webinars | 66.7% |
| Online courses (asynchronous) | 54.5% |
| Preferred days for CE: | |
| Weekdays: | 90.6% |
| Monday | 44.8% |
| Tuesday | 72.4% |
| Wednesday | 79.3% |
| Thursday | 79.3% |
| Friday | 37.9% |
| Preferred times on weekdays: | |
| Morning | 65.5% |
| Afternoon | 75.9% |
| Evening | 20.7% |
| Weekends: | 28.1% |
| Saturday | 70.0% |
| Sunday | 40.0% |
| Preferred times on weekends: | |
| Morning | 77.3% |
| Afternoon | 50.0% |
| Evening | 9.1% |

DISCUSSION

For the SCERC regional needs assessment survey, we developed questions regarding OH professionals skills and competencies based on the NIOSH/Westat survey and on the competency statements of the programs’ accrediting organizations (e.g., ABET for IH, ACGME for OM residency). We also collaborated with the SCERC program directors to incorporate questions about the quality of training, strong features, and areas for improvement that could be asked of the program alumni. The range of OH professional skills and competencies was broad and encompassing. It should be noted that some skills and competencies might be more relevant to specific OH disciplines than others, so it is not surprising that some responses by the OH professionals and alumni indicated that some skills were not particularly important for their discipline. It is more important to focus on the respondents reporting of skills that are most important for their OH discipline.

Participant Response

A total of 886 professionals in the occupational health and safety field answered the needs assessment survey. The response rate ranged from 2.3% (Human Factors and Ergonomics Society) to 58% (Occupational Medicine Residency alumni). The largest number of participants (n=628) was recruited through AAOHN and the smallest (n=12) through OEHN alumni. The response rates were generally low, as is typical for online surveys with only email notices about the surveys. Because the response rates tended to be low, it was important for the needs assessment study to include data from the NIOSH Occupational Health Professional Workforce Assessment study (Westat, 2011). In that study, Westat conducted two multi-stage systematic national surveys of employers and OH training programs to assess OH professional needs and supply. This study was able to provide quantitative estimates of national and regional need.

Challenging to develop sampling frames for private and public employers. This sampling frames include EHS managers who work in the private sector for companies located in Region IX based on an email list provided by Pinpoint Technologies, and public OH workers affiliated with the Western States Occupational Network (WestON). The sampling frames are not necessarily representative. The EH&S managers for the private employers tended to be ES&H program managers with bachelor or master level training. These ES&H managers may not be able to report accurately on their employer's future hiring plans, especially for positions such as doctoral level OH professionals or OM physicians.

The largest group of respondents was from the American Occupational Health Nurses Association. The large number reflects that the sampling frame for this group was the only group based on a national professional association, so the number of members is much larger. A complication of using this sampling frame is that the vast majority of the nurses reported that they had no prior formal training in occupational health nursing and many were trained at the associate or bachelor's level. Only 22.6% of the participants completed formal training; among them, their highest academic degree was bachelor (25.7%), master's (25.7%), or doctorate (10.8%). A total of 44 respondents reported that they had completed a master or doctoral degree. In order to provide a more valid comparison for the UCLA OEHN program, we used the sub-set respondents who had completed formal training in OHN at the master or doctoral degree level for most of the analyses.

The response rate was low for WOEMA (3.5%). We believe the low response rate is because due to long-standing policies on using email membership lists, the WOEMA Board of Directors agreed only to include a notice of the survey in a monthly WOEMA membership newsletter. The notice was included in two monthly newsletters. The WOEMA members did not receive a dedicated email message asking them to participate in the survey.

Regional need

According to the private employer survey, the likelihood that a private company will search for an occupational health professional by discipline in the next five years is moderately

high for safety, moderate industrial hygienist and ergonomist, and relatively low for occupational medicine physicians, occupational health nurses, and environmental and occupational epidemiologists (Table 2).

The likelihood that a public employer will search for an occupational health professional (industrial hygiene, safety, ergonomics, occupational health nursing, occupational medicine, occupational epidemiology, and environmental epidemiology) during the next five years is moderately high for environmental and occupational epidemiology. In contrast, likelihood is moderate for occupational medicine and industrial hygiene, and fairly low for occupational health nursing and ergonomics (Table 4).

Private employers reported that hiring professional with formal training in the industrial hygiene, occupational health nursing, occupational medicine, occupational epidemiology, safety, environmental epidemiology, and ergonomics is very important (Table 6). On the other hand, public employers think that formal training is very important primarily in occupational medicine, occupational epidemiology, industrial hygiene, and safety.”

These findings indicate that there is a clear need for additional training of OH professionals in each of the SCERC academic programs and for occupational epidemiology in the TRT program. The employer respondents also emphasized the importance of the OH professionals having formal training and certification.

Assessment of Skills by SCERC Academic Program Discipline

Industrial Hygiene

Among the Needs Assessment respondents, 122 (13.8%) were related to industrial hygiene from 4 subgroups, Public Employers (n=4), Private Employers (n=34), IH Alumni (n=52), and AIHA Members (n=32). The numbers in the Public Employers subgroup were adjudged to be too low for comparison. The following IH skills were agreed to be important on a 1 to 5 scale in order of decreasing importance by the 3 other subgroups: Exposure assessment & risk characterization; Identify potentially hazardous agents or work conditions; Proper interpretation of exposure monitoring data; Evaluation & control of physical, mechanical, chemical, & biological hazards; Evaluate & recommend personal protective equipment; Ability to write technical reports & summaries; Understand workers’ jobs. The Private Employers & AIHA Members indicated other important areas in their top seven like Understand the fundamentals of occupational safety; interpret & apply state or federal regulations (joint #1 for AIHA); Communicating with management, supervisors, workers, union reps, & colleagues; & Understand professional & ethical responsibilities of an industrial hygienist. There was also agreement for all groups on the 7 bottom rankings: Hazards associated with nanotechnology; Understand workers compensation issues; Program budget & finance skills; hazardous waste management; Emergency Response training; Critically analyze & evaluate the scientific literature; & Apply statistical concepts & tools appropriate to professional practice in the field.

The SCERC Needs Assessment data should be compared with those from the 2011 *National*

Assessment of the Occupational Safety and Health Workforce. That survey found the employer order for additional training in the specialized or technical aspects of some of their industrial hygienists to be: indoor air quality, 27%; radiation (electromagnetic fields, microwaves), 24%; recognition of workplace diseases, 19%; potentially hazardous agents, 19%; proper interpretation of exposure monitoring data, 18%; hazardous waste management, 18%; emergency response management/community right to know, 18%; reproductive health hazards in the workplace, 15%; evaluating & controlling lead and asbestos exposures in the workplace, 15%; detection & control of potential hazards due to noise & illumination, 12%. The employer order for non-technical additional training for some of their industrial hygienists to be: communicating with workers/training skills, 34%; leadership skills, 33%; communicating with upper management, 29%; technical writing, 25%; environmental regulations, 16%; organizational science, 15%; local, state, or federal regulations, 10%; worker's compensation, 10%; understanding workers' jobs, 8%; understanding of our industry, 5%. Altogether there is a need to strengthen safety & management content.

Occupational and Environmental Health Nursing

OEHN alumni from the past 15 years were contacted as part of the surveyed group. The response rate for OEHN alumni was low (27.3%) possibly because the timing followed within a few weeks of the annual SON alumni, new graduate and employer surveys and an SCERC of AAOHN members which looked very similar to the SCERC OEHN alumni survey. In addition, OEHN alumni had received a survey from the UCLA Centennial Campaign a month earlier. Multiple asks to complete surveys within a short time frame may have caused "survey fatigue."

The SCERC alumni and AAOHN surveys were useful along with the 2011 National Assessment of the Occupational & Health Workforce to identify skills and knowledge of value to working OEHNs and their employers that need to be incorporated into the curriculum. In our SCERC OEHN alumni survey, the importance of all the skills asked was rated highly (between 4.0 and 4.6 on a scale of 1-5) while the quality of training on a selected number of these skills was rated between 3.6 and 4.1, very good. Analyzing risks associated with worksite hazards, evidence-based practice, and critically analyzing and evaluating scientific literature were the most highly rated skills obtained in school. Four skills rated 3.6: communicating with colleagues; managing occupational health surveillance programs; conducting health and injury assessments; and clinical practice skills. We will work to improve on these in our training program recognizing that students need to develop more fully after graduation and we expect that they leave school with novice level competence and become more expert in their first few years of practice. The concept of novice to expert practice needs to be more fully explained to students so that they feel more comfortable in the transition to professional practice as they embark on their new NP journey following their educational journey.

Occupational Medicine

Among WOEMA members, the first five skills ranked as most important for the job as an occupational physician were: communicating with employees and co-workers, occupational medicine clinical practice, evaluate and manage work-related injuries and illnesses, laws and regulations related to occupational medicine, and communicating with upper management. The comparison of average ratings of importance of job skills for an occupational medicine physician by WOEMA members and OM Residency were quite similar.

The Occupational Medicine Residency alumni were asked to rate the quality of the training received during the residency program for the skills in a job as an occupational physician. The five highest scores were: critically analyze and evaluate scientific literature, evaluate effects of toxic chemical exposures, evaluate environmental health risks and regulations, evaluate and manage work-related injuries and illnesses, and hazard recognition and evaluation. The high rankings of the alumni for critically analyzing the literature and evaluating environmental health risks and regulation reflect strengths of the UCI Occupational Medicine Residency program, which requires residents to complete a MS degree in Environmental Health Sciences (as a MPH-equivalent degree).

The relative rankings by the OM Residency alumni were quite similar on the importance of skills and the quality of training, indicating that the program is addressing well the future skill and competencies needs. However, some differences were observed between importance of skills compared to the quality of training. The largest positive ranking of importance relative to ranking of training quality were: communicating with upper management; communicating with employees and co-workers; and program leadership and management. The ratings of skill importance and the ratings of quality of training corresponded quite for a majority of the 24 rated skills. These findings suggest that the OM residency program should increase practicum training opportunities that emphasize OM program management and communication. The program can also use the residency seminar series to provide training on these topics. The findings have been provided to the RAC and the Program Evaluation Committee for further consideration.

Continuing Education

The SCERC Needs Assessment survey asked each target population group about the need and supply of continuing education training for OH professional.

Industrial Hygiene

There were 39 responses from the IH alumni, 20 from AIHA and ASSE members, and 33 from the Occupational health and safety staff. In the past there have been more than 200 responses between the industrial hygienists and the safety professionals. Because these numbers are small, the analysis is based somewhat on aggregated results.

All three groups gave the highest or second rating to Updates on laws, regulations, standards (4.35, 4.15, 4.09). The other topics receiving the highest ratings were Indoor air quality/sampling and instrumentation (AIHA - 4.0), Chemical hazards (AIHA - 4.0), Risk Assessment (AIHA - 4.0, Alumni - 4.15), Professional ethics (AIHA - 4.05; Alumni - 4.25), Ergonomics hazards (AIHA - 4.05), Emerging issues (AIHA - 4.10), Business and Management skills (AIHA - 4.15; Alumni - 4.09), and Hazard communication (Alumni - 4.03). All of these training topics are offered at least once per year except emerging issues and business and management skills. Industrial hygienists and safety managers do attend them. The AIHA/ASSE and the Alumni respondents ranked no topics below Average Importance (3.) Among the OHS respondents, the lowest ratings were for Epidemiology (2.59), Patient handling (2.61), Emerging issues (2.75), bullying (2.87), Shift work (2.88), and Psychosocial factors in the workplace (2.91), Productivity (2.94), and Work Organization (2.97).

In general, the OEH&S managers did not seem that interested in continuing education. The ratings ranged from 2.59 for Epidemiology to 4.09 for Updates. Very few topics were rated as Extremely Important by significant numbers of respondents. The median rating was 3.44. The AIHA members and IH alumni seemed to be more in agreement with each other. The median rating for AIHA members was 3.64; the median for IH alumni was 3.64. It is difficult to know why safety managers in general would have less regard for these topics. People who are given the title of safety manager often do not have the education, training and credentials that either the professional association members or the alumni possess. One would think they are more in need of training, but then, people often do not know what they do not know. It is also possible that organizations that give the responsibility for workplace safety and health to less qualified individuals may be less likely to send them for additional training.

Occupational Health Nursing

Five hundred nineteen people from AAOHN responded to this section. Of those, 44 had training at the masters or doctoral level. The ratings by the 44 were very similar to those of all respondents and to the OHN alumni. Of all the possible types of CE courses listed, all were rated at least "Of average importance." The highest rating was for Updates on laws, regulations, standards (4.3%), the same as for all respondents and the alumni group.. The lowest rating for any course was 3.2 for Confined space. Thirty-four topics (79%) received a rating of 3.5 or above, with six receiving 3.4. The remaining three topics were rated 3.2 or 3.3.

With all topics scoring so well among all respondent groups, a wide variety of courses can be offered that would be suitable for this discipline. In fact, many of them are offered, which makes it more puzzling that attendance is so rare at any but the professional certification review course.

Five hundred nineteen people from AAOHN responded to this section. Of all the possible types of CE courses listed, all were rated at least "Of average importance." The lowest rating for any course was 3.51. Of the 44 types of courses listed, 19 (43%) scored between

“Very Important” and “Extremely Important.” The highest rating was 4.47. The highest rating (4.47) was received for Updates on laws, regulations and standards. While there were no respondents who thought the topic was a little importance, interestingly, 2 respondents thought it was not important at all. This topic also received the second highest rating (4.33) from the 6 OEHN alumni that responded the highest was Workers Compensation (4.38).

The following discussion is taken from the responses of AAOHN members, not the 9 alumni unless specifically noted. Of the 19 topics scoring 4.0 or above, the CE program offers training opportunities at least once per year in 11 of them. Yet, in spite of the importance assigned to them by the respondents, very few nurses attend these trainings.

Also of interest, the course most likely to actually be attended by nurses, Review courses for professional certification, rated only 3.98. It is likely that this is because most of the respondents already have their certification. Yet patient handling received the one of the lowest ratings (3.61); perhaps the respondents have already received sufficient training in this area. The respondents give high ratings to the following topics that are not offered on a regular basis:

- Updates on laws, regulations and standards
- Workers Compensation
- Emergency response
- Infectious disease
- Health surveillance
- Return to Work/Stay at Work accommodations
- Total worker health
- Mental health
- Psychosocial factors in the workplace

Of the topics written in by 34 respondents, there was little consistency or identification of any particular learning gap that can be addressed by a CE course. Return to Work, Stay at Work, and Family Medical Leave Act as a topic area were mentioned by a few respondents. While it may be possible to offer one or more of these courses, the lack of registration by nurses for the highly rated courses that are offered makes the case for introducing new courses less than compelling.

Occupational Medicine

Continuing Education offered to occupational medicine physicians is considered to be Continuing Medical Education (CME), which requires formal accreditation. Both the SCERC and the UC Irvine Occupational Medicine Program are accredited to offer CME lectures and courses. The CME topics must be relevant to physicians, so the questions on CME asked of the occupational medicine physicians were somewhat different than those asked of the employers and other OH professionals.

The ratings of topics for CME by the WOEMA members and the OM Residency alumni were similar. Both groups of physicians rated the same three topics among their top five priorities: Workers Compensation, return-to-work/stay-at-work accommodations, and

workplace psychosocial factors and health. Both groups also rated the same three topics among their lowest five priorities: travel medicine, disaster and emergency response, and bullying and workplace violence. There were some differences in the rankings. The WOEMA members rated business and management skills as one of the top priorities, while indicating that review of basic clinical OM skills was a low priority. In contrast, the OM Residency alumni rated review of basic clinical OM skills as a top priority, while rating business and management skills as a low priority topic for Continuing Medical Education.

CONCLUSION

Overall, the SCERC needs assessment surveys of employers, OH professionals, and program alumni showed that there is a clear regional need for OH professionals who are formally trained and certified in the OH disciplines. The SCERC academic programs in Industrial Hygiene, Occupational and Environmental Health Nursing, and Occupational Medicine Residency are providing training that is highly appropriate for the future skills and competencies of OH professionals in their discipline and the program alumni. The training by the programs are particularly strong in areas such as critical interpretation of the literature, study design and analysis, and exposure and risk assessment. These findings reflect the strength of programs based in strong graduate programs of two leading research universities.

On the other hand, based on responses by the OH professionals and program alumni, the surveys for all three programs also tended to indicate that the programs could provide more training in areas of program leadership and management, communication, and perhaps program budget and finance. It is relevant to note that similar findings were reported in the NIOSH OH Professional Workforce Assessment national surveys (Westat 2011), suggesting that it is a general issue with academic training of OH professional that is not limited to the SCERC. Indeed this issue has been discussed among the SCERC faculty and with the SCERC Advisory Committee during recent years. The challenge is that future employers of the program graduates expect the graduates to be fully qualified in the skills and competencies of the OH discipline – which our programs do extremely well. Yet as these alumni advance in their careers, they tend to assume increasing responsibility for program leadership and management, as well as possibly justifying the budgets of their programs. This pattern is why the continuing education program finds that OH professionals do seek training in these topics. The SCERC faculty continue to discuss the optimum balance between providing training in the important skills and competencies expected of OH professional in the academic programs with the need to prepare for the long-term development of their careers as future program leaders. The programs plan to enhance training in program leadership, management and communication, while recognizing that there remains an important role for these skills to be addressed through the Continuing Education program.