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# Survey of Occupational Hygiene Professional Practice in Spanish-Speaking Countries

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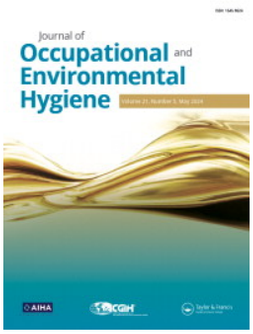

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REPORT

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# Survey of occupational hygiene professional practice in Spanish-speaking countries

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**ABSTRACT**

Professional credentialing schemes based on experience and examination are used to clarify the scope and required competencies associated with the practice of a profession. National occupational hygiene (OH) credentials developed in 17 nations have been recognized by the International Occupational Hygiene Association (IOHA) to meet or exceed the requirements of a model certification program. To date, there is no credentialing or certification scheme for occupational hygienists in Spanish-speaking regions. To fill this void, a new credentialing body has been created named the Iberoamerican Board of Occupational Hygiene (JIHO). As a first step to the development of a certification exam for a profession, it is necessary to determine the interest in an occupational hygiene certification exam in Spanish and to clarify the most common work practices for those practicing the profession. To determine the proper exam weightings for occupational hygiene competencies needed to practice in Spanish-speaking regions JIHO conducted a comprehensive survey of professional practice of occupational hygiene in nations where Spanish is spoken as the primary language. Surveys were sent to 456 practicing occupational hygienists in nine different countries on a variety of topics. Results indicated that 79% of respondents felt the need for an OH certification exam in Spanish was very or extremely important. The most frequent and important technical competencies utilized in practice were (1) awareness about the health effects of hazardous agents to make decisions about workplace activities and exposures, (2) application of the hierarchy of controls, control banding, hazard communication, training of employees and other methods to reduce worker exposure and workplace risks, and (3) application of principles to recognize and control biohazards in the workplace. The study results have been used to guide the weighting and importance of various technical topics and rubrics on the JIHO exam. Data from this study can be used in the development of certification examinations, to improve international coherence in the profession, and the development of educational programs in OH.

**KEYWORDS**

Certification; credentialing; exam development; examination; international standards of practice; professional practice

## Introduction

The profession of occupational hygiene is the practice of anticipating, recognizing, evaluating, and controlling workplace hazards (IOHA 2023a). With an estimated 2.3 million occupational fatalities that occur globally each year a strong argument can be made that there are not enough experienced and qualified occupational hygienists in the world to adequately ensure the health and safety of workers (ILO 2019). Although exposure levels may vary by region, the workplace hazards of chemicals, dust, metals, and noise—for example—are the same worldwide. In addition, risk assessments and control management require the same skills and competency internationally. Hence, broad networking and collaboration and capacity building of the profession are required to improve worker health protection to prevent disease, disabilities, or death globally.

One way to improve worker health and safety is to develop laws at national and regional levels that require employers to protect workers. But to write, promulgate, and enforce regulations, local capacity must be increased through education and qualifications. International cooperation and recognition of foreign qualifications that align with the practice of the profession are significant tools for expanding the capacity of a profession globally (Sumption et al. 2013). Negotiated agreements between national professional associations can help expand the awareness and

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capacity of a profession globally. The development of systems to compare and recognize certification or qualification schemes internationally can be an effective way to build capacity regionally, even where formal regulations do not yet exist. Acceptance of recognized professional credentials from different nations or regions could enhance capacity internationally and allow professionals to move more freely across borders, such as between the European Union nations.

National regulators attempting to improve occupational health and safety standards and national capacity can benefit from mutual recognition platforms that verify generally accepted levels of competence in working professionals (Hawthorne 2013). Internationally accepted qualifications can allow professionals from one nation or region to migrate or travel to provide professional services to other regions. Even without specific regulations, governments and businesses can identify occupational hygiene professionals with the necessary qualifications to perform required tasks with certainty and competence (Sweetman et al. 2015).

The International Occupational Hygiene Association (IOHA) is a global professional organization with the mission to "Enhance the international network of occupational hygiene organizations that promote, develop and improve occupational hygiene worldwide, providing a safe and healthy working environment for all" (IOHA 2022). The IOHA National Accreditation Recognition Committee (NARC) has developed a formal process by which credentialing bodies can be recognized as meeting or exceeding the NARC "IOHA Model Certification Programme." The first credentialing systems were recognized in 1999 when the NARC program was initiated. Today there are 17 globally recognized occupational hygiene certification programs.

Globally there are about 3.32 to 3.5 billion workers (Statista.com and Dyvik 2022). According to the World Health Organization, approximately 1.9 million people died from work-related diseases and injuries in 2016 (WHO 2016). Work-related health problems result in an economic loss of 4–6% of GDP for most countries (WHO 2017). However, globally there are only approximately 8,000 occupational hygienists who hold an accreditation or certification formally recognized by the IOHA NARC (IOHA 2023b). The latest estimate of the number of certified occupational hygienists per the IOHA NARC accreditation scheme in each of the approved countries is provided in Table 1. Unfortunately, the majority of certified occupational hygienists practice in primarily highly developed and economically advanced nations. There are about 7,000 credentialed industrial hygienists in the United States.

As indicated in Table 1, there is a significant lack of occupational hygienists in economically developing nations. Two regions in particularly short supply of certified occupational hygienists are South and Latin America. A variety of factors have led to the lagging advancement of occupational hygiene certification in these regions including economic challenges, low regulatory development and enforcement, cultural differences that impact the management of business operations, and the lack of a certification exam written in Spanish.

In 2018, the IOHA Education Committee created a Task Force to study the viability of and interest in creating an occupational hygiene certification examination written in Spanish as a means to advance the profession in Spanish-speaking nations. IOHA board members from Spanish-speaking nations were invited to the Task Force and regular meetings were conducted to discuss whether the development of a Spanish certification scheme would be of interest or possible.

Over the next year Task Force members communicated with and surveyed their national member association executive directors and members to assess whether there was interest in pursuing and supporting an occupational hygiene certification scheme in Spanish. The general response was very enthusiastic and supportive as a means to fill the void for Spanish-speaking occupational hygienists who never had the opportunity to take a professional exam before. Rough estimates at the time indicated that it could be possible to eventually solicit and qualify up to 300 Spanish-speaking professionals globally after a few years of operation.

The development of the certification scheme moved forward on several fronts in the next couple of years. One of the first activities conducted by the Task Force was the development and implementation of a survey of professional practice in the relevant nations where Spanish-speaking occupational hygienists tended to practice.

The use of professional practice surveys follows standards for certification exam development. Job analyses aid in the validation of such examinations by identifying activities and knowledge required for "readiness for the type of work for which a license or certification is being awarded" (Kane et al. 1989, 18). Surveys provide content validity and the ability to define the concepts that should be included in a given certification exam. A job task analysis enables the creation of a link between the content of the exam and job tasks required in the profession (Wang et al. 2005, 16).

**Table 1.** IOHA NARC recognized credentialing programs and number of certificants.

| | Country | Organization | Number of certificants |
|---|---|---|---|
| 1 | Australia | Australian Institute of Occupational Hygienists (AIOH) | 197 |
| 2 | Canada | Canadian Registration Board of Occupational Hygienists (CRBOH) | 124 |
| 3 | Finland | Finnish Occupational Hygiene Society (FOHS) | 0 |
| 4 | France | French Society of Occupational Hygiene (SOFHYT) | 28 |
| 5 | Germany | German Society for Occupational Hygiene (DGAH) | 8 |
| 6 | Hong Kong | Hong Kong Institute for Occupational and Environmental Hygiene (HKIOEH) | 12 |
| 7 | Italy | Institute of the Certification of the Figures of Prevention (ICFP) | 129 |
| 8 | Japan | Japanese Association for Working Environment Measurement (JAWE) | 52 |
| 9 | Malaysia | Malaysian Industrial Hygiene Association (MIHA) | 15 |
| 10 | Netherlands | Dutch Occupational Hygiene Society (NVVA) | 196 |
| 11 | Norway | Norwegian Occupational Hygiene Association (NYF) | 82 |
| 12 | Singapore | Occupational and Environmental Health Society (OEHS) | 18 |
| 13 | South Africa | South African Institute of Occupational Hygiene (SAIOH) | 223 |
| 14 | Switzerland | Swiss Society of Occupational Hygiene (SSOH) | 45 |
| 15 | Sweden | Swedish Occupational and Environmental Certification Board (SOECB) | 12 |
| 16 | United Kingdom | British Occupational Hygiene Society (BOHS) | 143 |
| 17 | United States | Board for Global EHS Credentialing (BGC) | 6,880 |

The value of a survey of professional practice is to verify and designate the rubrics and weightings of an exam that would be representative of the profession in terms of the activities performed and the technical areas of practice. It would be inconsistent to examine topics that are not part of the normal practice of occupational hygiene in a particular region or nation. This is particularly important in cases where there are large geographic, cultural, and technological differences between participating nations. Discrepancies in professional practice between regions need to be understood to create a fair examination and representative of Spanish-speaking practicing occupational hygienists.

The evaluation of occupational hygiene professional practice in Spanish-speaking countries was also useful to make comparisons with the examination rubrics and weightings in other nations that already had credentialing schemes. That is, the rubrics and relative weightings of the exams in other NARC-approved certification schemes could be assumed to be representative of the professional practice in those nations, whether they have conducted published surveys, or however they conduct their assessments. It is useful to compare the practice of the profession in Spanish-speaking nations against that in other nations as a means to help define and codify the profession on a global scale. In addition, if occupational hygienists desire job mobility throughout the EU, there is a need to equalize the certification exams and credentialing schemes.

The goals of this survey were to identify not only the need and value of a certification exam in Spanish-speaking countries but also to determine the common areas of practice and the activities typically performed by professionals practicing in the field. Not only do the survey results supply information as to what the professionals do in the regions studied, but they also provide important information regarding what these professionals do NOT do. These results can then guide the appropriate weighting of topics within the certification exam given in these geographic areas with more common areas of practice or more frequently performed job tasks weighted more heavily. However, given that the ultimate goal is to standardize practice and to ensure workplace safety globally, the identification of lesser-practiced job tasks is also important. In comparing the results of this survey with rubrics of certification exams given in other nations, it is possible to identify topics in which additional education and experience could be required to enhance the likelihood of equitable certification. For example, if the study finds that Spanish-speaking professionals do not perform nonionizing radiation surveys or protect those workers from such occupational hazards, it may signal that additional training may be warranted before these topics are added to the JIHO exam in these regions.

## Methods

The process of development of a certification examination in Spanish followed "a common core of procedures typically employed by a task inventory job analysis" (Wang et al. 2005, 15). This included using subject matter experts to develop an initial list of job tasks, development of a survey related to these job tasks, distribution of the survey to professionals in the field, analysis of the survey data, and use of the survey results in the development of the examination. An important component of this process is to include the frequency and importance of each task as a part of the survey questionnaire. This information is integral

in the weighting of activities in the job analysis (Kane et al. 1989, 18; Wang et al. 2005, 19).

Thus, the determination of professional practice began with meetings of Task Force member representatives from Spanish-speaking nations including Peru, Argentina, Columbia, Mexico, Spain, Puerto Rico, Costa Rica, and Guatemala. Several other academic faculty and experts were brought into discussions to include a broad range of viewpoints and experiences to lay the fundamental foundations of what the general areas of practice were determined to be for Iberoamerican nations. Working as a group, long lists of professional rubrics of practice were developed to include a broad variety of industries and fields of practice. General categories of industrial hygiene activity were broken down further into subsets of functional roles, tasks, and specific jobs. This list represented the breadth of the Task Force members' experience in the practice of the field of occupational hygiene in their nations over several decades.

Other sources of guidance for professional practice were also consulted. Knowledge competencies required under the IOHA NAR scheme were used as a basis for the JIHO survey to include the rubrics of basic sciences, toxicology, epidemiology, hazard assessment, biological hazards, statistics, occupational exposure limits, hazard control, personal protective equipment, management systems, and environmental health (IOHA 2008). The AIHA (2018) publication Core Competencies for the Practice of Industrial/Occupational Hygiene provided an additional fundamental structure for the topics contained in the practice survey questionnaire (AIHA 2018). Publications regarding university curricula in occupational health and safety were also used to form the basis for survey questions and rubrics (Adams 2003). Studies that evaluated employer expectations for occupational hygiene knowledge and skill were also consulted (Brosseau and Fredrickson 2009).

### Survey tool development

Following the initial identification of job tasks, the Task Force further defined them into discrete actions and grouped them into appropriate categories. A survey tool was created from this list of tasks that questioned respondents about the activities being performed by Spanish-speaking professionals in their country or region. The survey also asked respondents to rate how important professional certification in Occupational Hygiene is in the development of their career and to their current employer. Respondents were able to rate these on a five-point scale of irrelevant to extremely important. In addition, the survey questioned respondents about the frequency with which they employed each task, the importance of each task, and how they were involved in each task. Frequency was assessed using a dropdown menu with 0–31 days per month that the respondent had been personally involved (in any way) with the activity over the past year. Importance was assessed using a scale of 0–4 (0—not at all important; 4—extremely important) with the respondent rating the level of importance associated with performing the activity with skill and precision in terms of potential health and safety outcomes, or property damage if the activity was not performed correctly. Finally, as a measure of the skill level at which the worker was performing at, how the respondent was involved was assessed using a scale of 0–3 (0 – no involvement; 1—assist others, 2—perform myself, 3—supervise/manage others).

In addition to task-related questions, demographic information requested on the survey included: nation of residence, age, years of experience, and highest level of education. This information was collected to enable specific analysis of data by country, respondent experience, and respondent education. The survey was created in English and then translated into Spanish. The survey was pilot-tested by Spanish-speaking Occupational Health professionals to ensure correct translation. Before survey distribution, the study was reviewed by the Illinois State University Institutional Review Board and was granted exempt status.

The survey was sent to 456 professionals in nine Spanish-speaking countries. Participants for the survey came from the membership of IOHA Spanish-speaking existing member nations. These included Argentina, Brazil, Colombia, Mexico, Puerto Rico, and Spain. Singular surveys were also completed by individual representatives from Honduras, Costa Rica, and Chile. The survey was distributed via a link to a Qualtrics survey through the IOHA member email network. Participants' responses were saved in the Qualtrics survey deployed by the researchers at Illinois State University and were able to be downloaded and analyzed through the Qualtrics system.

Basic descriptive statistics such as frequencies and means were used to analyze the data. Correlation coefficients were also utilized to dig deeper into specific data items. Demographic items were analyzed using frequencies and means. The task data was analyzed by calculating the means for each task for importance, frequency, and ways involved, then further through correlation coefficients and the use of a

multiplicative model. To determine the common areas of practice and the activities typically performed by professionals practicing in the field, the demographic data as well as the task data was analyzed. This enabled an examination of the types of respondents as well as their areas of professional practice. This data could then be used to determine common areas of practice that would be integral to appropriate certification examinations.

After evaluating each task and the individual ratings of frequency, importance, and ways involved, it was determined that a multiplicative model would be used. Such a multiplicative model is useful for quantifying the criticality of an activity based on frequency and the perceived importance of that activity (Kane et al. 1989). Thus, the final analysis of data was completed using the multiplicative model by multiplying frequency, importance, and ways involved to determine the overall criticality of the tasks. This enabled a single number through which frequency, importance, and involvement could be compared.

## Results

One hundred and one professionals (22%) from nine different countries responded to the survey. Not all respondents answered all questions so in some areas fewer responses were analyzed. The respondents had a variety of levels of education, from "no higher education beyond high school" to a "doctoral degree." However, the majority (84%) had a Bachelor's or Master's Degree. Table 2 shows the breakdown of respondents by level of education and country.

The respondents ranged in age from between 25 and 40+. The majority (65%) were over 40. Respondents had between less than 5 and over 40 years of experience. Based on categorical data, almost half of the respondents (46%) had between 6 and 15 years of experience.

Respondents worked for companies of various sizes. Thirty-six percent worked for employers with 11–100 employees; another third (31%) worked for employers with 101–1,000 employees. Eleven percent worked for employers with 10 or fewer employees and 23% worked for large employers with over 1,000 employees.

Table 3 shows the breakdown of respondents by job management level. Approximately half of the respondents were in mid to senior-level management positions; 31% were in entry-level or early career positions and 17% were in chief executive positions. The job positions corresponded with age as can be seen in the fact that the majority (83%) of respondents over 40 were in mid-level management or higher positions.

When asked how important professional certification in Occupational Hygiene is for the development of their career, the vast majority (79%) stated that professional certification was very or extremely important. The results were slightly more mixed regarding how important professional certification is to the respondents' current employers with 58% stating very or extremely important, 25% stating somewhat important, and 18% stating not at all or minimally important.

The majority of the survey consisted of responses related to the various job tasks, their importance, the frequency in which they were used, and how the respondents were involved with the tasks. Due to the requirement that individuals have at least five years of experience to sit for the certification exam, only respondents with at least five years of experience were included in the analysis of this data. Therefore, the job task analysis portion of the survey was based on the responses from 79 respondents who met this criterion.

The responses to the survey were analyzed through the calculation of means for the frequency, importance, and involvement of each task as outlined previously. Table 4 includes the means and product of the means for each task. Mean values were calculated for importance, ways involved, and frequency of involvement based on the question scales or days/month. Using the previously described multiplicator model, a product of these three means was calculated for each job task. The products for job tasks ranged from a

**Table 2.** Survey respondents by level of education and country.

| Country | Associate's (2-year technical training) | Bachelor's (4-year university degree) | Master's (2 years in addition to a 4-year degree) | Doctoral (4 years in addition to a 4-year degree) | No higher education | Total |
|---|---|---|---|---|---|---|
| Argentina | 1 | 2 | 6 | 0 | 0 | 9 |
| Chile | 0 | 0 | 0 | 1 | 0 | 1 |
| Colombia | 0 | 7 | 8 | 0 | 0 | 15 |
| Spain | 0 | 0 | 2 | 5 | 0 | 7 |
| Guatemala | 0 | 0 | 2 | 0 | 0 | 2 |
| Honduras | 1 | 1 | 0 | 0 | 0 | 2 |
| México | 1 | 15 | 33 | 5 | 3 | 57 |
| Peru | 0 | 1 | 3 | 0 | 0 | 4 |
| Puerto Rico | 0 | 1 | 3 | 0 | 0 | 4 |
| Total | 3 | 27 | 57 | 11 | 3 | 101 |

**Table 3.** Survey respondents by job management level and age.

| Job description | 25–29 | 30–34 | 35–39 | Over 40 | Total number of respondents |
|---|---|---|---|---|---|
| Entry Level Technician | 2 | 2 | 1 | 4 | 9 |
| Early Career Professional | 4 | 5 | 6 | 7 | 22 |
| Mid-Level Management | 1 | 1 | 5 | 21 | 28 |
| Senior Management | 1 | 3 | 2 | 18 | 24 |
| Chief Executive | 0 | 2 | 1 | 14 | 17 |
| Total | 8 | 13 | 15 | 64 | 100 |

$n = 100$.

minimum of 20.56 to a maximum of 102.57 with a mean value of 54.14.

Further analysis of the products for each job task enabled the identification of tasks that stand out as being more important, used more often, and utilizing more involvement of respondents. These include: basic science use of general scientific concepts (100.32); application of biohazard principles (102.57); application of health risk analysis and hazard communication hierarchy of controls, communication, and training (101.56); and use of toxicology awareness for appropriate decision making (101.02). These are followed by areas such as air sampling and instrumentation strategy and program development (90.03); health risk analysis (97.95); and hazard communication exposure assessment results (92.80). Job tasks with a lower product included analytical chemistry performance of laboratory analyses (28.69); biostatistics and epidemiology application of basic principles (36.89); community exposure emergency planning and response (33.63); and radiation-related tasks (20.56–33.06), including those related to both ionizing and nonionizing radiation. A review of the final column of Table 4 provides a clear insight into which tasks the respondents felt were most important, were performed most often, and in which they were most deeply involved.

Further analysis of the job tasks showed very little variation in the importance of job tasks based on respondents' nation of residence. Frequency of involvement was correlated closely with ways of involvement, with higher frequency correlated with higher levels of involvement by the respondents. Likewise, importance was also correlated closely with ways of involvement.

## Discussion

The results of the study provide detailed information about the most important activities being performed by occupational hygienists practicing in Spanish-speaking regions. This information can be used to help design an effective examination to test the competencies of professionals working in this field. Eventually, the development of this certification credential will help to build occupational hygiene professional capacity in nations where it is lacking. Candidates who pass the exam and receive certification will have the added benefit of having a professional credential recognized by the IOHA National Accreditation Recognition program.

The information from the study may also be useful to academics in the design of Bachelor's and Master's degree programs (Loushine and Feyen 2013). There is sometimes a notion that educators develop curricula to promote and influence the practice of a profession, but it is also useful for professors to consider what practicing professionals do while working in the field, and what employers expect of them. This study answers many of those questions for Spanish-speaking regions. The results of this study also suggest which academic topics may need to be added to the program curriculum to bring the program in closer alignment with rubrics being practiced globally.

In comparison with the rubrics of practice listed by the IOHA NAR committee, the AIHA, and other sources discussed in the introduction, the results of this study indicated that occupational hygienists working in regions where Spanish is the primary language tend to perform the same professional occupational hygiene activities as those encouraged in certification schemes in other regions and globally. This is good news for the advancement of occupational hygiene in general as it builds international coherence, consistency, and understanding of the profession.

It is clear from the results that Spanish-speaking occupational hygienists do not perform certain monitoring and control activities often. This does not mean that these areas do not present hazards to workers. If anything, it indicates that additional education and training may be needed in these rubrics. The fact that occupational hygienists do not do much measurement, risk assessment, or control in nonionizing radiation for example, may be an indication that unless the activities are covered by some other professional group these workers may be at elevated risk of injury or illness. Additionally, it may be justification for expanding training and awareness on these topics in educational curricula and programs.

**Table 4.** Job tasks, importance, frequency, and involvement of respondents.

| | Job Task | Importance Mean (0–4) | Ways Involved Mean (0–3) | Frequency of Involvement (Days/ Month) Mean | Importance × Ways I nvolved × Frequency |
|---|---|---|---|---|---|
| **Air Sampling and Instrumentation** | | | | | |
| 1 | Select, calibrate, and use air sampling and monitoring equipment including direct-reading instruments | 2.95 | 1.77 | 11.60 | 60.57 |
| 2 | Perform analyses and calculations related to air sampling strategies and methods | 3.10 | 1.52 | 12.76 | 60.13 |
| 3 | Consider workplace conditions and hazardous agents to develop sampling strategies and programs. | 3.28 | 2.07 | 13.26 | 90.03 |
| **Analytical Chemistry** | | | | | |
| 4 | Perform laboratory analyses on workplace environmental samples and complete related calculations. | 2.96 | 1.03 | 9.41 | 28.69 |
| 5 | Follow procedures for laboratory sample workplace collection and associated quality assurance and chain of custody protocols. | 2.98 | 1.58 | 11.43 | 53.82 |
| **Basic Science** | | | | | |
| 6 | Use general scientific concepts, chemistry, biochemistry, biology, anatomy and physiology, general physics, and mathematics in performing normal job activities. | 3.11 | 2.19 | 14.73 | 100.32 |
| 7 | Use knowledge regarding properties of flammable, combustible, and reactive materials (compatibility), gas laws, and unit-of-measure conversions to complete calculations relative to workplace health and safety. | 3.14 | 2.00 | 10.74 | 67.45 |
| **Biohazards** | | | | | |
| 8 | Apply principles of sanitation, personal hygiene, the recognition, evaluation, and control of biological agents or materials having the capacity to produce deleterious effects upon other biological organisms, particularly humans (viruses, bacteria, fungi, molds, allergens, toxins, recombinant products, bloodborne pathogens, etc.) and infectious diseases that appear in workplaces including industry, agriculture, homes, offices, and health care facilities. | 3.27 | 2.15 | 14.59 | 102.57 |
| **Biostatistics and Epidemiology** | | | | | |
| 9 | Apply principles of epidemiology, including basic biostatistics and statistical and non-statistical interpretation of data in the evaluation of workplace hazards | 2.70 | 1.35 | 10.12 | 36.89 |
| **Community Exposure** | | | | | |
| 10 | Perform activities associated with air pollution, air cleaning technology, ambient air quality considerations, emission source sampling, atmospheric dispersion of pollutants, ambient air monitoring, health and environmental effects of air pollutants, and related calculations | 2.87 | 1.49 | 11.68 | 49.95 |
| 11 | Complete tasks related to emergency planning and response, water pollution, hazardous waste, and environmental fate and transport. | 2.73 | 1.40 | 8.80 | 33.63 |
| **Engineering Controls/Ventilation** | | | | | |
| 12 | Control chemical and physical exposures through engineering measures such as local exhaust ventilation, dilution ventilation, isolation, containment, and process change. | 3.14 | 1.59 | 11.50 | 57.41 |
| 13 | Evaluate airflow, perform ventilation measurements | 2.97 | 1.49 | 10.04 | 44.43 |
| 14 | Apply engineering control in areas of ionizing and non-ionizing radiation, thermal stressors, and noise and vibration subject areas | 2.98 | 1.49 | 10.21 | 45.33 |
| **Ergonomics** | | | | | |
| 15 | Apply principles from anthropometry, human factors engineering, biomechanics, work physiology, human anatomy, occupational medicine, and facilities engineering to the design and organization of the workplace to prevent injuries and illnesses | 2.89 | 1.53 | 12.34 | 54.56 |
| **Health Risk Analysis and Hazard Communication** | | | | | |
| 16 | Interpret exposure assessment results to compare with agent properties to analyze the risks to workers. | 3.41 | 2.03 | 14.15 | 97.95 |
| 17 | Apply the hierarchy of controls, control banding, hazard communication, training of employees, and other methods to reduce worker exposure and workplace risks | 3.27 | 2.03 | 15.30 | 101.56 |
| 18 | Actively communicate risks and recommendations by appropriate techniques to implement control actions to workers and management. | 3.24 | 2.04 | 14.04 | 92.80 |
| **IH Program Management** | | | | | |
| 19 | Acquire, allocate, and control resources to accomplish industrial hygiene anticipation, recognition, evaluation, and control objectives in an effective and timely manner. | 3.11 | 1.62 | 13.74 | 69.22 |
| 20 | Use a variety of management tools including auditing, investigation, data management and integration, establishment of policy, planning, delegation of authority, accountability, risk communication, organizational development, decision-making, and various codes of professional ethics. | 2.98 | 1.66 | 13.94 | 68.96 |

(*Continued*)

**Table 4.** Continued.

| Job Task | Importance Mean (0–4) | Ways Involved Mean (0–3) | Frequency of Involvement (Days/ Month) Mean | Importance × Ways I nvolved × Frequency |
|---|---|---|---|---|
| **Noise and Vibration** | | | | |
| 21 Perform noise and vibration surveys, evaluation, and design and implement required controls. | 3.11 | 1.69 | 12.52 | 65.80 |
| 22 Complete computations related to noise sources and octave band measurements. | 3.00 | 1.41 | 9.96 | 42.13 |
| **Non-Engineering Controls** | | | | |
| 23 Select and manage personal protective equipment programs and training, including the principles governing selection, use, and limitations of respirators and protective clothing. | 3.02 | 1.92 | 13.79 | 79.96 |
| 24 Perform or oversee respirator fit testing, breathing air specifications, glove permeability evaluations, and eye protection requirements. | 2.93 | 1.49 | 12.98 | 56.67 |
| 25 Identify and implement administrative controls useful to minimizing worker exposure to hazardous agents | 2.96 | 1.80 | 14.02 | 74.70 |
| **Radiation/Ionizing** | | | | |
| 26 Evaluate hazards associated with occupational exposures to ionizing radiation through the use of area monitoring and exposure assessment techniques | 2.77 | 1.14 | 10.47 | 33.06 |
| 27 Use time, distance, or shielding to reduce worker exposure to hazardous levels of radiation. | 2.78 | 1.00 | 8.88 | 24.69 |
| 28 Implement engineering, administrative, and personal protective equipment as a means to reduce worker exposure to hazardous ionizing radiation sources | 2.69 | 0.91 | 8.94 | 21.88 |
| **Radiation/Nonionizing** | | | | |
| 29 Evaluate hazards associated with occupational exposures to nonionizing radiation through the use of area monitoring and exposure assessment techniques | 2.65 | 1.19 | 8.25 | 26.02 |
| 30 Implement engineering, administrative, and personal protective equipment as a means to reduce worker exposure to hazardous nonionizing radiation sources. | 2.67 | 0.94 | 8.19 | 20.56 |
| **Thermal Stressors** | | | | |
| 31 Monitor workplace conditions associated with thermal stress to identify hazards. | 3.00 | 1.76 | 11.56 | 61.04 |
| 32 Based on monitoring results, identify and design necessary controls to protect workers from excessive thermal risks | 2.82 | 1.51 | 9.43 | 40.15 |
| 33 Implement thermal stress programs to train workers about adverse health effects associated with heat and cold, symptoms of temperature-related health effects, exposure control techniques, and first-aid/medical response. | 2.84 | 1.48 | 9.91 | 41.65 |
| **Toxicology** | | | | |
| 34 Use awareness about the health effects(including carcinogenic, mutagenic, teratogenic, and reproductive effects)resulting from exposure to chemical substances including single agents and mixtures, and natural and synthetic agents to make decisions about workplace activities and worker exposures to various chemical agents. | 3.55 | 2.13 | 13.36 | 101.02 |
| 35 Use understanding of symptomatology, pharmacokinetics, mode of action, additive, synergistic, and antagonistic effects, routes of entry, absorption, metabolism, excretion, target organs, toxicity testing protocols, and aerosol deposition and clearance in the respiratory tract to make decisions about worker activities and necessary controls to minimize exposure | 2.96 | 1.40 | 11.60 | 48.07 |
| **Work Environments and Industrial Processes** | | | | |
| 36 Evaluate the hazards associated with specific industrial or manufacturing processes, including but not limited to; confined space entry, spray-painting, welding, abrasive-blasting, vapor-degreasing, foundry operations, and hazardous waste site remediation, as well as general indoor environmental issues | 3.16 | 1.68 | 10.86 | 57.65 |

**Level of Importance**
Not at all important = 0
Minimally important = 1
Important = 2
Very important = 3
Extremely important = 4
**Ways Involved**
No involvement = 0
Assist others (help with this activity under direct supervision of someone else) = 1
Perform myself = 2
Supervise/Manage others = 3

## Conclusion

The results of this survey study provide great insight into the occupational hygiene professional practices in Spanish-speaking countries. Such insight can be used in the development of certification examinations, international coherence in the profession, and guidance in the development of educational programs in occupational hygiene.

Based on the need for additional certified occupational hygienists in South and Latin America, and also in Spain, the data gleaned from this study can be a significant step toward the development of a certification examination for these Spanish-speaking countries. The in-depth assessment of knowledge and skills needed will help to ensure that such a certification examination will have a high level of validity in testing and certifying individuals in the profession of occupational hygiene. This study helps direct the development of the JIHO certification exam and identifies levels of professional preparedness and needs for additional training and experience in specific areas of practice. To align with globally identified areas of importance more closely the results have shown some topic areas where expansion of training or education in Spanish-speaking regions may be warranted.

Based on the fact that the job task analysis did not find significant differences between Spanish-speaking countries and the rubrics tested in certification exams of other countries worldwide, the results aid in understanding the status of international consistency in occupational hygiene professional certification. This helps improve international cooperation and recognition of such certification and aids in the ability of certified professionals to migrate or travel to provide occupational hygiene services on a wider basis regionally and globally.

Finally, the results of this survey enable educators to focus on the knowledge needed to adequately perform the essential skills identified. This includes not only those used frequently or deemed most important but also skills that may be used less frequently or deemed less important but that may be needed to ensure the highest possible level of worker safety. The weighting of the JIHO exam was based on the importance and frequency of professional activities. However, activities not performed frequently were also identified by the survey indicating where more training and experience may be needed to better align with the practice of the profession globally.

## Disclosure statement

The authors report there are no competing interests to declare.

## Data availability statement

The data that support the findings of this study are available from the corresponding [TPF, JP], upon reasonable request.

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