PERSPECTIVES OF OCCUPATIONAL SAFETY AND HEALTH PROFESSIONALS ON TOTAL WORKER HEALTH® COMPETENCIES: A THREE-PAPER DISSERTATION

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ABSTRACT

Occupational safety and health (OSH) practice is transitioning from a regulatory compliance focus to a more expansive paradigm called *Total Worker Health*® that holistically addresses worker safety, health, and well-being. New competencies are required but little empirical evidence is available to guide the design of in *Total Worker Health* (TWH) training curricula. This study was motivated by the need to understand what competencies should be addressed in TWH education and whether interprofessional education (IPE) pedagogy would align well with OSH professionals' learning needs. Three papers, together, addressed these questions.

This study used a descriptive, exploratory design involving mixed methods. Data were collected from a national sample of multi-disciplinary OSH professionals. All participants completed an anonymous online survey to assess levels of TWH education, experience, skill, and IPE readiness. Survey participants were invited to a virtual focus group if they reported intermediate or higher TWH experience. Focus group participants shared direct experiences with competencies and barriers relevant to five specific TWH practices, as well as motivators and barriers for IPE.

The first paper assessed OSH professionals' self-reported skills for specific TWH practices using a new 11-item scale. Two TWH competency constructs were identified through exploratory factor analysis – 1) Program Leadership, and 2) Risk Assessment and Control. Professionals reported greater competency gaps for the leadership domain than risk assessment and control. Advance career stage and TWH education were associated with higher TWH skill. OSH discipline, organization size, and collaborative climate were not correlated with TWH skill level. Overall low levels of TWH education were observed, even among some professionals implementing TWH practices.

The second paper explored the real-world TWH experiences of OSH professionals regarding competencies and barriers for five specific TWH practices. Communication and collaboration skills were relevant for most TWH practices. However, competency needs varied by TWH practice, suggesting a need for targeted curricula. OSH and TWH concepts were identified as foundational. TWH risk assessment and hazard control practices required specialized knowledge of instruments, evaluation methods, and interventions related to psychosocial risks and mental health outcomes. Organizational barriers were the most numerous and included: culture (lack of trust, top-down), competing priorities, cost/time, lack of leader TWH knowledge and buy-in. These may be useful to include in problem-based learning scenarios.

The third paper examined attitudes about IPE for TWH continuing education. Participants strongly endorsed IPE as beneficial to facilitate TWH workplace collaboration; learn different perspectives and best practices from people of diverse backgrounds; and develop "common ground" across disciplines. Using case studies for collaborative problem-solving was suggested as an effective tool to achieve IPE goals.

Overall, the findings suggest that much wider access to TWH education is needed to keep pace with practitioner TWH adoption. Introducing TWH concepts early in OSH training can set the stage for practical learning later. This study contributes empirical evidence to advance a tailored curricula and competency framework for TWH practice. Accomplishing the latter is urgent for ensuring that TWH curricula are standardized to support consistent practice across industrial settings.

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CHAPTER I: INTRODUCTION

Professionals in the workforce prepare for their roles by completing training to develop a specific set of practices, ethics, and behaviors, collectively referred to as standards or competencies. Once professionals enter the workforce, continuing professional education (required in some professions and voluntary in others) provides a means of maintaining and expanding knowledge and skills over time. In continuing education, professionals learn about emerging practices and behaviors that are needed for effective performance, based on changes over time in technology, economy, and society. Providers of continuing professional education use competency frameworks when setting learning objectives and designing learning activities and evaluation instruments. Having clearly defined statements that operationalize how professionals can demonstrate their knowledge and skills is foundational to effective education delivery and evaluation. As professions evolve, research is needed to identify specific emerging competencies and competency frameworks to lend consistency to ongoing continuing education.

The occupational safety and health profession has been evolving over the past two decades in response to the changing nature of work, workforce demographic shifts, and structural shifts in work arrangements (e.g., contingent, temporary, contract) that have fissured employment protections, in legal, health, and safety domains (Peckham et al., 2017; Weil, 2014). These changes have intensified work demands as well as decreased job security and job control, resulting in greater stress related illnesses, both mental and physical (Benach et al., 2014; Weil, 2014). Evidence has accumulated for causal

associations between job stressors and health conditions and health behaviors that previously were thought to be unrelated to working conditions (Punnett et al., 2009; Schnall et al., 2017). At the same time, a greater share of the workforce is older, with a higher prevalence of chronic health conditions (Centers for Disease Control and Prevention [CDC], 2021; Schill & Chosewood, 2013; Toossi & Torpey, 2017). Occupational Safety and Health (OSH) professionals, whose central role is to identify and mitigate workplace health and safety hazards, increasingly need to consider the role of workplace psychosocial stressors, worker health status, and other social factors as part of their risk assessment and hazard control practices. This expanded approach to OSH practices has implications for education and training.

Leaders in OSH research and education have advocated for an expanded OSH paradigm that incorporates subject knowledge about worker health status and mental well-being, and skills in interprofessional collaborative practice (Chari et al., 2018; Peckham et al., 2017; Schill, 2017; Schulte et al., 2019; Tamers et al., 2019). This expanded OSH practice paradigm, coined in 2011 by the CDC as *Total Worker Health* (TWH), calls for OSH professionals and employers to adopt an integrated, comprehensive strategy to safeguard workforce safety, health, and wellbeing (Schill & Chosewood, 2013). A detailed description of the specific practice approaches of TWH is provided in Chapter II. However, three primary differences differentiate the new, expanded practice of TWH: (a) hazard assessment and intervention processes address a broader set of environment and personal health factors; (b) program management (typically siloed) becomes more integrated and coordinated; and (c) worker participation is elevated for enhancing self-efficacy and job control (Lee et al., 2016; Punnett et al.,

2020). It is important to understand the training needs of OSH professionals as they grapple with how to function in these new ways, and how program structures in the workplace need to evolve to facilitate the process. Professional education in TWH practices is essential to help OSH professionals gain the competencies needed for effective adoption of this emerging, expanded paradigm of OSH practice.

Challenges for Continuing Education in *Total Worker Health*

Although there is a clear need for education, several challenges exist for developing and scaling TWH education that meets the needs of different groups of OSH professionals. Three key challenges are listed below, including lack of a validated TWH competency framework, lack of information about TWH knowledge gaps, and lack of knowledge on pedagogies to facilitate TWH learning.

Lack of a Validated Framework

One of the challenges for designing education to help working OSH professionals adopt TWH practices is the lack of a validated TWH competency framework to guide continuing education curricula. Without validated competencies, no published standards are available to describe what OSH professionals need to learn to implement TWH practice. In other words, it is important to determine the specific knowledge, skills, and attitudes that OSH professionals need to learn to adopt TWH practice approaches. Newman et al. (2020) proposed a broad set of "cross-cutting" competencies for the emerging field of TWH (p. e386). These competencies were generated using an expert consensus panel and have not been validated empirically. The structure of the framework currently is theoretical, and the knowledge areas proposed within each competency domain are broad. Many of the proposed knowledge areas overlap with required

competencies contained in academic OSH training curricula and may not be unique to TWH practice. Understanding which competencies are uniquely needed for TWH practice would allow a targeted training curriculum that builds on prior OSH knowledge.

Lack of Information on TWH Knowledge Gaps

Another challenge for designing TWH continuing education is a lack of available information on TWH knowledge gaps. More specifically, it is important to know how OSH professionals see their level current level of competence in relation specific aspects of TWH practice approaches. Understanding the size of the knowledge gaps in relation to each other can help guide decisions about competencies that should be prioritized for TWH continuing education. Many TWH continuing education programs utilize published TWH program guidelines, which are intended to guide TWH program implementation and evaluation in a workplace context (Lee et al., 2016; McLellan et al., 2017; Punnett et al., 2020). However, these guidelines do not address learning goals for education. Little to no information has been published regarding current proficiency levels of OSH professionals in these areas. Scott et al. (2019) and Olszewski et al. (2021) reported high interest and or familiarity with TWH concepts among OSH professionals. However, these studies did not measure professionals' proficiency with TWH practices. Understanding perceived proficiency levels for diverse groups of OSH professionals can help customize learning goals for different continuing education settings.

Lack of Knowledge about Pedagogies

A third problem area for building professional TWH competency is the lack of knowledge regarding effective educational strategies (pedagogies) that can support TWH adoption. Given that TWH emphasizes the concept of "integration" for holistic

management of workforce safety, health, and well-being, interdisciplinary collaborative practice competency is needed to operationalize this idea on an organizational level. Interprofessional education (IPE) is a pedagogical approach that is specifically designed to develop skills in interprofessional collaborative practice (Oandasan & Reeves, 2005). IPE is widely advocated and used in health professions during pre-licensure and continuing education based on the need for interdisciplinary teams to function well in the healthcare environment (Canadian Interprofessional Health Collaborative [CIHC], n.d.; Gilbert et al., 2010; Interprofessional Education Collaborative [IPEC], n.d.; Oandasan & Reeves, 2005; Reeves et al., 2017). IPE pedagogy may offer a promising educational approach for training OSH professionals side-by-side with interdisciplinary collaborators (e.g., human resources, wellness professionals). Shared learning among professionals from diverse backgrounds may facilitate implementation of the integration concept and stimulate team building. The use of IPE with OSH professionals has not been widely reported in the US. No published studies are available that address the attitudes of OSH professionals towards IPE desirability and feasibility for TWH education.

Study Overview

This dissertation addresses the aforementioned challenges by using a three-paper format. The three articles address the overarching goals to understand what competencies should be addressed in TWH training curricula and whether interprofessional education (IPE) would align with OSH professionals' TWH learning needs. Brief descriptions of each paper and their specific research questions are provided below.

The First Paper

The first paper (P1), a quantitative study, presents perspectives of OSH professionals regarding current skills for TWH practice approaches. An education needs assessment survey was used to measure the perceived skill level for implementing specific TWH practice behaviors and examine associations with certain job and organizational characteristics.

P1's Research Questions. This study was guided by two research questions:

1. How do OSH professionals perceive their level of skill in relation to specific TWH practice approaches?
2. What occupational and organizational characteristics (e.g., OSH discipline, career stage, OSH experience, prior TWH education, climate for interdisciplinary collaboration) are associated with TWH skill level?

The Second Paper

The second paper (P2), a qualitative study, explored the specific knowledge, skills, and attitudes needed for TWH practice. This study draws from the lived experiences of OSH professionals who implemented (or are attempting to implement) TWH practices. The data collected provides insights about specific competencies needed, as well as relevant barriers.

P2's Research Questions. This second study was also guided by two questions:

1. What specific competencies (i.e., knowledge, skills, attitudes/values) do professionals need to successfully implement key TWH practice approaches?
2. What barriers do OSH professionals identify, if any, for achieving specific TWH practice approaches?

The Third Paper

The third paper (P3) used a mixed methods approach to explore the feasibility of using IPE pedagogy to advance professionals' competency in TWH practice. This study assessed readiness, motivations, and barriers for interprofessional learning among OSH professionals using a survey and focus groups. This paper is intended to inform the design of future TWH education that uses IPE pedagogy to build competency in interdisciplinary collaborative practice. Knowledge generated from this dissertation study can be used by continuing education leaders to guide development of TWH competency measures and curricula.

P3's Research Questions. The last paper was guided by three research questions:

1. How favorable or unfavorable are OSH professionals' attitudes regarding interprofessional learning for *Total Worker Health*?
2. To what degree do OSH professionals express preferences for an interprofessional learning community with professionals from their own organization versus from other organizations?
3. How do OSH professionals view the motivators and barriers for participating in interprofessional continuing education for *Total Worker Health*?

Theoretical Frameworks

The theoretical frameworks of competency-based education and IPE shaped the research design and the data collection and analysis strategies for this study. The concept of interdisciplinary collaboration is also highly relevant for this study. These topics are introduced here to provide a conceptual introduction to the dissertation study.

Competency-Based Education

Competency-based education (CBE), also referred to as outcome-based education, is a performance approach to education that emphasizes the practical role of education for preparing learners to apply knowledge in the workplace (Gervais, 2016). Job tasks are broken down into their components, which can be taught sequentially to help learners gain expertise through a progression of learning (Gervais, 2016). CBE seeks to structure the acquisition of knowledge and skills sequentially, providing a progressive curriculum of learning that helps learners advance their skills from novice to career-ready. Learning is planned and evaluating against specified levels of performance that learners are expected to master across a curriculum (Gervais, 2016). The levels of performance are indicated with clearly defined statements that operationalize how professionals demonstrate their knowledge and skills (Calhoun et al., 2002; Westera, 2001).

CBE also involves the use of competency frameworks to specify domains of knowledge that are needed to perform in a professional role. Competency frameworks facilitate accountability of educational providers to adhere to a specified set of learning performance standards, which are often tied to profession-specific competency frameworks. Higher education accreditation, state-level K-12 curriculum standards, health professions licensure, and professional certification programs are all examples of accountability mechanisms that use CBE to ensure that educational programs properly prepare graduates to master specific performance standards. Accredited university public health training programs, a common academic home for OSH training, follow learning standards set by the Council on Education for Public Health (CEPH) for undergraduate

and graduate public health programs (Bennett & Walston, 2015; Calhoun et al., 2002; CEPH, 2021).

According to Bloom et al. (1956) and Krathwohl et al. (1964), the concept of competency includes three major domains, including cognitive (intellectual knowledge and skills, such as facts, procedures, principles, and theories), affective (attitudes, interests, values), and psychomotor (physical skills, doing things). This dissertation seeks to assess specific knowledge, skills, and attitudes that should be included in a TWH competency framework.

Interprofessional Education

Interprofessional education (IPE) refers to an educational pedagogy that engages participants from two or more disciplines to learn about, from, and with each other to collaborate in service of a shared goal (e.g., improved patient or worker health outcomes) (Gilbert et al., 2010). IPE education explicitly addresses skill building for interprofessional outcomes such as role awareness and valuing, communication, teamwork and collaboration, and interprofessional culture and identity building (Oandasan & Reeves, 2005; Rogers et al., 2017; Thistlethwaite et al., 2010). The concept of *interprofessional* is synonymous with *interdisciplinary,* meaning people from two or more different health professions working in an interdependent way toward a common purpose (Oandasan & Reeves, 2005). Role awareness involves understanding and valuing the role, responsibilities, and expertise areas of the other professionals. It also involves an understanding of role boundaries, philosophies of care, and the care system (e.g., in healthcare or in occupational systems of care) (Thistlethwaite et al., 2010). Interprofessional communication refers to communicating effectively and respectfully

with colleagues in other professions. It entails listening, conflict management and resolution, and respecting others' values. The teamwork competency entails having positive attitudes about collaborating with other professionals, collaborative decision making, assuming the roles of team leader/facilitator and team member, team dynamics and power relations. Interprofessional culture and values involve collegiality, appreciation of diversity, patient (or for OSH, worker) centeredness, reflexivity, and a commitment to interprofessional continuing education (Rogers et al., 2017). Reflexivity refers to the ability to reflect on and learn from interprofessional collaborations, identify learning needs of the interprofessional team, reflecting on one's role in the team and self-questioning of personal stereotypes (Thistlethwaite et al., 2010). Chapter IV (paper 3) explores OSH professional attitudes about IPE, which aspects of IPE goals are perceived as important for TWH practice, and other logistical and design factors that would be relevant for future TWH continuing education that uses an IPE approach.

Interdisciplinary Collaboration

Collaboration is the act of working jointly with others (Merriam-Webster, n.d.) for a common purpose (e.g., to address a problem or need). The term interdisciplinary collaboration specifically refers to the act of two or more people from different disciplinary backgrounds working jointly for a common purpose. To give examples relevant to TWH, interdisciplinary can mean OSH professionals working with non-OSH professionals (e.g., safety managers and human resources managers) or it can mean OSH professionals from different OSH disciplines (e.g., safety managers and occupational physicians) working together. Petri (2010) described three attributes of interdisciplinary collaboration: focusing on a problem using an interpersonal process; sharing equal

involvement and accountability among all disciplines; and the presence of shared goals to ensure that the disciplines are working together toward a common outcome (Petri, 2010). Petri's concept analysis therefore assumes equity and power-sharing as values underpinning interdisciplinary collaboration.

In the field of health professions education, the terms interdisciplinary, multi-disciplinary, and transdisciplinary are used to differentiate the nature of interaction between professionals (Oandasan & Reeves, 2005). The term interdisciplinary (where professionals work collaboratively and interdependently toward a shared goal) is distinguished from multi-disciplinary, in which professionals work independently in a coordinated way. Trans-disciplinary is sometimes used synonymously with inter-disciplinary, but some scholars use this term to indicate emergence of a shared practice in which roles are blurred and represent new roles that are outside of their traditional profession (Oandasan & Reeves, 2005). This study will explore OSH professional experiences with interdisciplinary collaboration for TWH to identify specific knowledge, skills, and attitudes needed.

Methodology

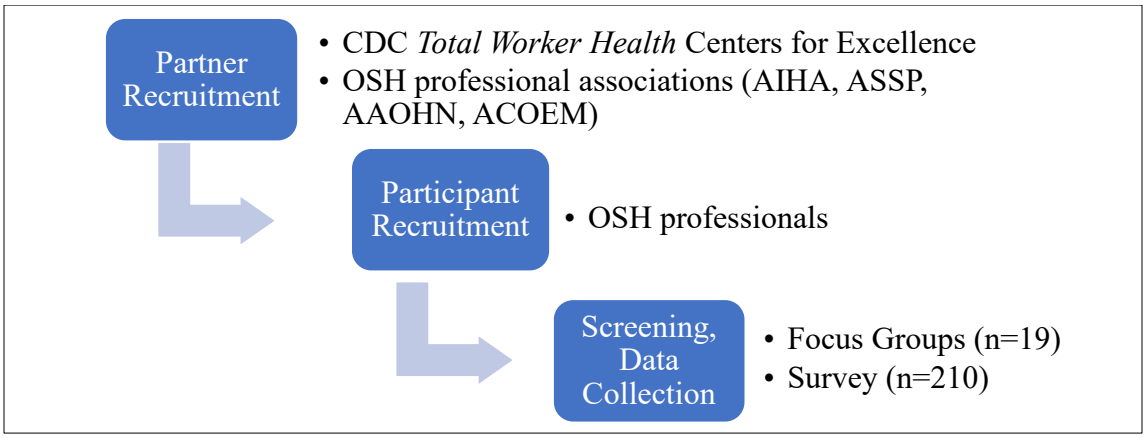
This dissertation study used mixed methods to assess multi-disciplinary occupational safety and health professionals' perceptions regarding skills needed for TWH practice approaches and the feasibility of IPE pedagogy when learning about TWH. The overall research approach used a descriptive, exploratory design. The data were collected over a five-month period from July 2022 to November 2022.

Participants

Participants recruited for this study included 210 professionals from the core OSH disciplines, including industrial hygienists, safety professionals (safety program directors and managers, injury prevention specialists, etc.), occupational health nurses, and occupational physicians (McAdams et al., 2011). Professionals responsible for workplace wellness programs were also recruited based on the relevance of health promotion fields for TWH. Convenience sampling was used, with the goal of recruiting a diverse mix of core OSH disciplines employed in a range of industrial settings. Recruitment was accomplished by partnering with key partner organizations to disseminate the study announcement their networks of OSH professionals (Figure 1). Key partner organizations included the federally funded, university based TWH Centers for Excellence, and OSH professional associations such as the American Industrial Hygiene Association (AIHA), American Society of Safety Professionals (ASSP), American Association of Occupational Health Nurses (AAOHN), and American College of Occupational and Environmental Medicine (ACOEM).

Figure 1

Recruitment Process



Data Sources

Two types of data sources were used for this study: surveys and focus groups.

Surveys

A 60-item anonymous online survey was administered to participants via the online survey tool Qualtrics. They were sent a website link to access the 60-item survey that took 10-12 minutes to complete. The instrument included questions related to TWH (17 items), occupational variables (16), educational preference variables (12 items), and IPE variables (15 items). If participants met focus group eligibility criteria, they were asked to provide whether they were interested in participating in a focus group (yes or no), as well as their name and email address for contact purposes. A total of 258 OSH professionals responded to the survey; of these, 210 participants were included in the survey analysis because they completed at least half of the survey. Those participants who scored themselves as having intermediate or higher TWH experience were invited to participate in the focus group portion of the study.

Focus Groups

A screened sub-sample of OSH professionals, who had practical experience implementing TWH in their or a client's place of employment, were recruited to participate in focus groups. Volunteers were scheduled to participate in one of five 90-minute structured focus groups held during October and November 2022. The focus groups were conducted online using video conferencing. Group size was limited to three to six people to optimize participant interactions in the virtual environment (Lobe et al., 2020; Nobrega et al., 2021). To the extent possible, focus groups were formed based on specific OSH disciplines (e.g., industrial hygiene, safety, occupational health nurses,

occupational physicians) to facilitate ease of discussion among members with similar job roles. A total of 41 OSH professionals volunteered to participate in a focus group, and from this group of professionals 19 attended a focus group. A structured script was used (Figure 2 and Table 3.1) along with visual question prompts shared on a screen to ensure consistency of questions between groups.

Figure 2

Focus Group Questions

Your TWH Role: How you see OSH vs. TWH Competencies	Competencies Needed for Specific TWH Practices	Interprofessional Education
• Please share your role in TWH, give 1 example of TWH in your organization? • How has TWH changed how you do your job? What competencies did you use that were different?	For each TWH practice (1-5): • What competencies are needed? • What barriers do you see?	• What would motivate you to participate in TWH IPE? • What barriers do you see to participate in TWH IPE? • What recommendations do you have for designing a quality TWH IPE experience?

Significance

This study adds to the literature on TWH education in several ways. First, this is the first study to report how OSH professionals see their level of skill for specific TWH practices to assess priority skills gaps for TWH education. The knowledge generated responds to calls from OSH scholars and practitioners to expand available OSH professional education that embeds TWH concepts (Laine et al., 2022; Newman et al., 2020; Schulte et al., 2019) by specifying the knowledge gaps that need to be prioritized for different groups of OSH professionals. Second, this study provides empirical

evidence to supplement the broader body of research needed to develop and validate a TWH competency framework. Factor analysis of a TWH skills scale used in this study provides empirical evidence supporting a two-factor TWH competency structure. The qualitative competency findings provide evidence for specific knowledge and skills areas that support the main competency domains. These findings build on prior work of TWH scholars and leaders (Newman et al., 2020) to advance this area of research. Development of a validated framework has practical significance for ensuring consistency of TWH implementation across different employer settings by professionals from different disciplinary traditions. Third, this study begins to fill a gap in literature regarding pedagogical approaches that appear to be feasible and effective for TWH education. The three papers together contribute novel evidence to answer the overarching question: *What do OSH professionals need to learn when adopting TWH practice approaches and to what extent can IPE pedagogical approaches help?* Findings can be used by curriculum leaders in higher education, professional associations, and other private and public sector education providers to support competency framework efforts and to make decisions about curriculum and course design to address TWH learning needs of OSH professionals.

Definition of Terms

The following terms are used throughout this dissertation:

Competencies. The term competency refers to specific knowledge, skills, and attitudes required to perform a task.

Interdisciplinary collaboration. Interdisciplinary collaboration refers to the act of two or more people from different disciplinary backgrounds working jointly for a common purpose.

Interprofessional education (IPE). IPE is an educational pedagogy that engages participants from two or more disciplines to learn about, from, and with each other to collaborate in service of a shared goal (e.g., improved worker health outcomes). IPE's explicit goals are to build interdisciplinary awareness and valuing, trust, communication, teamwork, and collaboration.

Occupational safety and health (OSH). OSH is an applied public health practice dedicated to protecting workers from injuries or illnesses that result from work tasks or the work environment. OSH professionals are the participants of focus for this study.

Safety, health, and well-being (SHW). SHW are the broad outcomes that are holistically addressed using TWH program approaches. Workplace programs often address these outcomes separately, whereas TWH approaches integrate these three domains when planning, delivering and evaluating programs and policies.

Total Worker Health (TWH). TWH is defined as programs, policies and practices that integrate protection from work-related safety and health hazards with promotion of injury and illness-prevention efforts to advance worker well-being. It is holistic, organizational strategy for improving worker SHW and organizational outcomes.

Conclusion

The three papers in this study collectively addressed the central question of *What do occupational safety and health professionals need to learn to build competency for TWH practice, and to what extent can IPE help?* By assessing the state of OSH

professionals' perceived gaps in TWH knowledge and skills, TWH educators can appropriately prioritize topics for TWH continuing education curricula. By assessing factors that predict TWH practice skill level, we can better understand how learning needs vary for diverse groups of OSH professionals so that education can be customized accordingly. By understanding the specific knowledge and skills needed for TWH practice, educators can more effectively design course content to help professionals develop those competencies, which will prepare them to transfer their knowledge to the workplace. TWH is an emerging professional practice that is still relatively new in the field of occupational safety and health. No research to date reports on the real-world experiences of professionals in the trenches as they implement TWH practices. This study shares insights from a broad sample of OSH professionals working in different industry sectors about practical skills need to achieve the specific TWH practice approaches. Finally, scarce literature is available about the use of IPE approaches with OSH professionals generally, and none specifically addressing TWH. Understanding how OSH professionals view the idea of IPE, and what benefits they perceive as meaningful and valuable, can support the design of effective TWH education that is well attended.

In summary, the results of the study can be used to prioritize learning objectives for TWH continuing professional education for diverse groups of OSH professionals; to add to the broader research base supporting the development and validation of a TWH competency framework; and to appropriately apply interprofessional teaching methods in TWH continuing education settings.

CHAPTER II

Total Worker Health Competency Among Occupational Safety and Health Professionals: A Survey Study to Guide Continuing Education

Professionals develop through training a specific set of practices, ethics, and behaviors, collectively referred to as standards or competencies (Smith & Roger, n.d.). Once professionals enter the workforce, continuing professional education provides a means of maintaining and expanding competencies over time. In many health-related fields, including occupational safety and health professions, continuing professional education is required for maintaining certification and licensure. Ongoing education can ensure that practice keeps pace with evolving needs for new competencies based on changes in economy, technology, and emergence of new professional subspecialties (Becker et al., 2013; Calhoun et al., 2002; Holmes & Scaffa, 2009).

Leaders in OSH research and education have been advocating for an expanded set of competencies that integrate personal health and wellbeing within the scope of OSH professional practice (Chari et al., 2018; Peckham et al., 2017; Schill, 2017; Schulte et al., 2019; Tamers et al., 2019). Since 2011, this expanded OSH practice paradigm, coined in 2011 by the phrase *Total Worker Health* (TWH) by the National Institute for Occupational Safety and Health (NIOSH) (Schill & Chosewood, 2013), calls for OSH professionals and employers to adopt an integrated, comprehensive strategy to safeguard workforce safety, health, and wellbeing (SHW). This evolution in OSH practice requires new kinds of competencies to expand the scope of risk assessment measures, to plan

multi-level interventions, and to collaborate across organizational units with program personnel who previously worked in separate organizational silos (Chari et al., 2018; Schulte et al., 2019; Tamers et al., 2019). Continuing professional education can help OSH professionals gain the knowledge and skills needed to adopt TWH practices. To develop effective curricula, providers of continuing education programs need to understand *what* skills need to be taught and *which* skills should be prioritized for different groups of learners. Education needs assessments are used for this purpose and this is the focus of this study.

The concept of TWH as a holistic strategy for advancing worker safety, health, and well-being has been gaining wide acceptance since the early 2000s among occupational safety and health (OSH) scholars and practitioners (Tamers et al., 2019). Occupational safety and health scholars have called for training and education to support implementation of TWH practices in the workplace (Newman et al., 2020; Peckham et al., 2017; Schulte et al., 2019; Tamers et al., 2019). Professionals in occupational safety and health (Scott et al., 2019) and occupational health nursing (Olszewski et al., 2021) have indicated they want TWH training and are open to implementing TWH practices. Examples of skills that OSH professionals need to learn include integration of health and well-being measures with workforce risk assessment activities; planning of multi-level interventions; and collaborating across organizational units instead of working in separate silos (Chari et al., 2018; Schulte et al., 2019; Tamers et al., 2019). Competencies for TWH practice extend beyond those developed during post-secondary OSH training and learning needs may vary by discipline and career stage.

Continuing professional education can help OSH professionals gain the knowledge and skills needed to adopt TWH practices. However, no studies have been published to describe specifically *what* skills need to be taught and *which* skills should be prioritized for different groups of learners. Although a preliminary inventory of TWH competencies has been proposed (Newman et al., 2020), the list of knowledge areas is broad and little to no empirical evidence is available to guide prioritization of topics when designing TWH continuing education programs for different groups. This article describes the results of a TWH education needs assessment to gauge perspectives of multi-disciplinary OSH professionals at different career stages regarding their skill level for specific TWH practice approaches. Results of this study can be used by TWH educators to design future TWH continuing professional education programs.

Literature Review

Description of *Total Worker Health* Practice Approaches

The concept of TWH was initiated in 2006 by National Institute for Occupational Safety and Health (NIOSH) as a federally funded "Work-Life" research initiative. The program supported several academic research groups to generate scientific evidence for implementation, barriers, and outcomes of holistic employer-based programs that applied the expanded OSH paradigm in real-world settings (CDC, 2020a). Starting in 2011, NIOSH coined the term, *Total Worker Health,* defining it as "policies, programs, and practices that integrate protection from work-related safety and health hazards with promotion of injury and illness-prevention efforts to advance worker well-being." (CDC, 2020b). Based on knowledge generated from TWH intervention OSH experts in government (Lee et al., 2016) and academia (McLellan et al., 2017; Punnett et al., 2020)

evidence-based guidelines have been published that describe essential elements of TWH program approaches. These guidelines are intended for use when implementing and evaluating TWH programs. Six essential elements (i.e., criteria, or indicators) of *Total Worker Health* practice have been described in the literature (Figure 2.1). Each element is described in detail below.

Figure 2.1

Six Elements of Total Worker Health Practice Approaches

TWH Practice 1: Leadership Commitment to Worker Safety, Health, and Wellbeing is Demonstrated at all Levels of the Organization

This criterion appears in several guidelines documents as an essential TWH program element (Lee et al., 2016; McLellan et al., 2017) and TWH organizational leadership has been studied (Schwatka et al., 2020, 2021) based on leaders' roles for setting organizational policy and strategy generally and prior evidence of effective occupational safety and health program management. However, some scholars (Punnett et al., 2020) have argued that leadership commitment is not a unique criterion for TWH programs but is foundational for any effective OSH program. Although it is true that

leadership support is essential for any successful organizational endeavor, the cross functional coordination needed to introduce a unified TWH organization strategy requires specific forms of upper management resources and supports. These supports may include authorizing cross unit planning and evaluation as well as establishing integrated information systems and reporting structures.

TWH Practice 2: Workforce Health and Safety Assessment Activities are Designed to Identify Both Work and Non-Work Hazards that Impact Employee Safety, Health, and Well-Being.

This criterion (which I refer to with a short-hand label of "integrated assessment") does not appear in government publications of TWH essential program elements (Lee et al., 2016) but has been emphasized by other TWH scholars as foundational for facilitating identification of the full range of work-related contributors to poor safety and health outcomes of workers (Chari et al., 2018; Punnett et al., 2020; Schulte et al., 2012, 2019). OSH professionals are trained to collect, analyze, and interpret data on work-related hazards, injuries, and illnesses. They are not trained to evaluate personal health conditions, mental wellbeing, and health behaviors that may be correlated with working conditions. Integrated assessment therefore represents an expanded skill set that OSH professionals would need to develop at a TWH practitioner.

TWH Practice 3: Confidentiality and Privacy of Workers is Ensured When Handling Workers' Health and Safety Personal Information

This TWH indicator has been emphasized by NIOSH in recognition of the risk to workers when considering personal health status and wellbeing concerns as part of an overall organizational TWH strategy (Lee et al., 2016). Ethical concerns of data privacy

and discrimination need to be taken seriously as organizations attempt to adopt a TWH strategy (Rogers & Schill, 2021). This TWH indicator is relevant especially in the context of TWH practice #3 above – integrated assessment activities. However, some TWH scholars argue that issues of worker privacy and confidentiality are not unique for TWH, but rather are an important consideration of quality and ethics for all health and safety activities sponsored by employers (Punnett et al., 2020).

TWH Practice 4: Interventions are Designed using an Integrated Approach to Simultaneously Prioritize Reduction or Elimination of Workplace Safety and Health Hazards while Promoting Health and Wellbeing of Workers

This emphasis on integrated (i.e., multi-faceted, multi-level, comprehensive) solutions to address poor health and safety outcomes is the signature concept of TWH approaches (Lee et al., 2016; CDC, 2020b; Punnett et al., 2020). By addressing employee health concerns holistically and attending to root causes in work and non-work domains, there is a much better likelihood of achieving better workforce health and safety outcomes (Schulte et al., 2012, 2019). Design of integrated interventions is not part of traditional OSH discipline training; OSH professionals need expanded knowledge and skills to perform this aspect of TWH practice. The ability to apply an integrated approach to designing interventions depends on holistic assessment of health and safety problems, which is captured in the next criterion.

TWH Practice 5: Worker Engagement is Promoted and Supported Throughout All Stages of Program or Intervention Design and Implementation

The rationale for this criterion for TWH programs is that too often safety and health promotion program management is compliance-driven and top down. By involving

employees at all levels (including and especially front-line workers) there is a better likelihood of identifying intervention targets that matter to workers and developing interventions that will be well accepted and impactful (Lee et al., 2016; Punnett et al., 2020). Additionally, worker participation contributes to greater job control, which itself, is health promoting and stress-reducing (Henning et al., 2009; Punnett et al., 2009).

TWH Practice 6: Program Systems Supporting Workforce Safety, Health and Wellbeing are Coordinated Across the Organization

An example of coordinating goals and activities between the occupational safety and the health promotion functions might be to use a common reporting structure and systematically analyze data across program domains to assess how health and safety risk factors interact with each other (Punnett et al., 2020). Another example is to bring together leaders and teams with overlapping or complementary responsibilities for planning and priority setting. For example, hold joint meetings of safety committees and occupational health staff, human resources, and wellness committees (Lee et al., 2016). Integrating and coordinating across traditionally siloed program functions has implications for OSH professional competencies and for organizational structures and resources needed to support planning, evaluation, knowledge management, communication among different actors within a multi-disciplinary system. The complexity of implementation implies time is needed both at the organizational level, the occupational sector level, and the industry levels to achieve widespread adoption of TWH as an innovation generally in occupational health practice.

Current Challenges for Creating TWH Curricula

Availability of *Total Worker Health* educational programs has expanded in recent years, including graduate (credit-based) and professional (non-credit) certificate programs and other courses (CDC, 2021). OSH professional associations also offer TWH continuing education to their members (AIHA, n.d.; ASSP, n.d.). Although availability of educational options has increased, TWH curricula are not grounded in a common validated competency framework built upon professional practice standards. In 2020, a proposed list of TWH "cross-cutting" competencies with associated knowledge/skill areas was published based on a stakeholder consensus panel (Newman et al., 2020). However, the competencies and their groupings have not been empirically validated. Additionally, the list of knowledge areas is extensive, making it unclear which to prioritize for OSH professionals seeking continuing professional education for TWH practice). Further validation efforts are needed to consolidate, organize, and operationalize a competency framework that can be used by educators for course design with different groups of OSH professionals. A validated TWH competency framework can help to ensure a common set of practice standards, consistent with the notion that professional practice is bound by a common set of values and behaviors.

In the absence of a validated TWH competency framework, current providers of TWH continuing education programs refer to published guidelines that define *Total Worker Health* program approaches (Lee et al., 2016; McLellan et al., 2017; Punnett et al., 2020). These guideline documents describe programmatic activities that can be evaluated in a workplace context, but do not specify specific knowledge and skills required to implement TWH practices. Additionally, little to no research has been

published describing TWH proficiency levels of different groups of OSH professionals. The lack of data on which knowledge gaps are greatest for specific TWH practice competencies makes it challenging to design curricula to meet the most pressing learning needs of specific OSH groups. Scott et al. (2019) and Olszewski et al. (2021) reported high interest in TWH education and in implementing TWH among occupational safety and health professionals and occupational health nurses, respectively. However, these studies did not measure proficiency/skill levels for specific TWH practice approaches among study participants. Knowledge about proficiency levels (even self-reported by participants) can help prioritize continuing education foci for different groups of professionals. The educational needs assessment survey planned for this study provides an opportunity to assess how OSH professionals see their strengths and weaknesses for implementing TWH practices and examine associations with certain occupational and organizational characteristics.

Educational Needs Assessment Approaches

The use of an education needs assessment study can help educators assess and prioritize learning needs when designing continuing professional education. If a validated TWH competency framework was available with description of a full scope of TWH competencies operationalized in written definitions, then measurement indicators could be developed to assess professionals' level of proficiency in relation to all competencies in the framework. When assessing level of proficiency, measurement indicators should cover a continuum of competence, to allow assessment of a progression through levels of mastery, ideally using a validated instrument (Drisko, 2014). When measuring competency, a best practice is to use multiple measures, assess all areas of knowledge,

skills, and values/attitudes of the profession (Drisko, 2014). Given that a validated TWH competency framework is not yet available, a TWH competency scale can be created to measure proficiency for specific TWH practices using descriptions of TWH practice approaches available in published literature (Lee et al., 2016; Punnett et al., 2020). To better understand the TWH educational needs of OSH professional groups, level of competence (i.e., skill, proficiency) can be measured at the group level using self-reported surveys (Drisko, 2014; Pilcher, 2016). This study used a needs assessment survey to assess level of TWH competence among a sample of multidisciplinary OSH professionals from all regions of the US. The survey assessed self-reported skill level for specific TWH practice approaches, as well as TWH experience and training history and other occupational characteristics that might be associated with TWH competence, such as discipline, level of OSH experience, career stage, and organizational characteristics. This study answers the following research questions:

1. How do OSH professionals rate their skill level (competence) in relation to specific TWH practice approaches?
2. What factors (e.g., occupational characteristics, organizational factors, TWH education and experience) are associated with level of TWH competence?

Methodology

This study used a descriptive and exploratory design to assess perceived level of competence for general and specific TWH practices; identify differences in competence between OSH subdisciplines (e.g., safety, industrial hygiene, occupational health medicine); and describe preferences for educational delivery methods (online synchronous, asynchronous, etc.) among a mixed sample of occupational safety and

health (OSH) professionals. An online structured survey was used to measure TWH competency variables, as well as job and organizational characteristics, to allow exploratory comparison of competency levels across disciplinary specialties, career stage, and workplace settings. The aim of the study was to identify learning priorities for future TWH continuing education for specific groups of OSH professionals.

Sampling and Recruitment

Participants included professionals from the core OSH disciplines, including industrial hygienists, safety professionals (safety program directors and managers, injury prevention specialists, etc.), occupational health nurses, and occupational physicians (McAdams et al., 2011). Professionals responsible for workplace wellness programs were also recruited based on the relevance of health promotion fields for TWH. Convenience sampling was used, with the goal of recruiting professionals employed in a range of industrial settings, and a combination of those delivering OSH services "in-house" for a single employer, as well as "externally" as consultants serving multiple organizations. Recruitment was accomplished by partnering with key OSH professional associations as well as with NIOSH-supported TWH Centers for Excellence, which could disseminate the study announcement to their networks of OSH professionals.

A standard study announcement with a link to the online survey was sent to key contacts at relevant OSH professional associations (Table 2.1) with a request to distribute the announcement to members. A similar announcement with distribution request was sent to ten TWH Centers for Excellence, which deliver TWH education and outreach to OSH professionals. Email invitations with the survey link were also sent directly to prior participants of TWH professional education courses delivered from the Center for

Promotion of Health in the New England Workplace, where the investigator was employed as outreach director. The survey link was also promoted at two professional meetings for OSH professionals (New England Industrial Hygiene Association Annual meeting, and the third International Symposium for TWH) in fall 2022. A $100 gift card drawing was offered as an incentive to participate. Partnering with familiar sponsors (such as trusted professional associations and TWH Centers for Excellence) and using a financial incentive are best practice strategies for enlisting internet survey responses (Fowler, 2014). Participant eligibility criteria included 1) current employment (minimum 20 hours/week), and 2) certification, training, education in a core OSH discipline (e.g., safety, industrial hygiene, occupational medicine, or occupational health nursing).

Table 2.1.

Study Recruitment Partners

Recruitment Partners	Affiliation
American Industrial Hygiene Association (AIHA)	New England and Connecticut River Valley sections
American Society of Safety Engineers (ASSP)	Greater Boston Chapter
American College of Occupational and Environmental Medicine (ACOEM)	
American Association Occupational Health Nurses (AAOHN)	Massachusetts (MAOHN)
Center for Promotion of Health in the New England Workplace	University of Massachusetts Lowell
Center for Work, Health, and Environment	Colorado University School of Public Health
Oregon Healthy Workforce Center	Oregon Health Sciences University
Center for Healthy Work	University of Illinois Chicago School of Public Health
Center for Healthy Work Design and Worker Well-being	University North Carolina Chapel Hill
Healthier Workforce Center	University of Iowa School of Public Health
California Labor Laboratory	University of California San Francisco

Center for Work, Health, Well-being	Harvard T.H. Chan School of Public Health
P.O.E. TWH Center in Mental Health	Johns Hopkins School of Public Health
Utah Center for Promotion of Work Equity	University of Utah

Participants

Participants included 210 OSH professionals representing professions of safety (31%), industrial hygiene (16%), occupational health nursing (12%), occupational physicians (11%), wellness/health promotion (6%) and academic researchers/educators (6%) and other mixed OSH related disciplines (18%) (Table 2.2). Two participants reported their profession as TWH. About two thirds (64%) described themselves as experienced OSH professionals; 32% were mid-career and 45% were advanced career stage. Roughly equal portions reported they delivered OSH services to single employers (49%) versus consulted to multiple employers (44%); 7% reported they were not OSH service providers, but instead served in "other" roles such as public health policy or administrative roles. Slightly over half (55%) of participants were employed by large organizations. Participants were employed in the US, from Northeast (31%), Western (31%), Midwest (16%), and Southern (18%) states.

Table 2.2

Participant Characteristics (n=210)

Variable	*n*	(%)
Job Role		
Safety, Environmental Health and Safety or Ergonomics	66	31.4
Industrial Hygiene	34	16.2
Occupational Health Nurse	25	11.9
Occupational Health Physician	23	10.9
Wellness	13	6.2
Researcher/educator	14	6.7

Other	21	10.0
Risk Management	4	1.9
Human Resources	3	1.4
Total Worker Health	2	1.0
Engineer	2	1.0
Student (not employed)	3	1.4
Career Stage		
Advance Career	95	45.2
Mid-Career	66	31.4
Early Career	47	22.4
No Response Provided	2	1.0
Occupational Safety and Health Experience		
A lot	86	41.0
A good deal	48	22.9
Moderate	41	19.5
Some	15	7.1
Very little	13	6.2
None at all	6	2.9
No Response Provided	1	0.4
Occupational Safety and Health Client		
Internal client (own employer)	101	48.1
External clients (consulting clients)	50	23.8
Both internal and external clients	41	19.5
Other (do not provide OSH Services)	15	7.1
No Response Provided	3	1.4
Employer Size		
More than 1000 employees	109	51.9
251-1000 employees	33	15.7
51-250 employees	17	8.1
1-50 employees	39	18.6
No Response Provided	12	5.7
U.S. Region*		
West	58	27.6
Midwest	30	14.3
South	34	16.2
Northeast	58	27.6
No Response Provided	30	14.3

*U.S. Census Bureau's (2021) classifications used.

Data Collection

An online 60-item structured survey (Appendix A) was administered online using Qualtrics survey software in two waves. The first wave was administered from July to Aug 2022 as part of a follow-up course evaluation of a TWH online continuing education course. A total of 156 multi-disciplinary OSH professionals (who completed the course 3-12 months earlier) received an invitation to the follow-up evaluation survey, and 59 of these professionals responded. The second wave was administered from September to November 2022 with OSH professionals recruited through email dissemination through partner organizations, as described above (total distribution of survey links is unknown). During the second wave, 199 people responded, and 151 of these participants were included based on completing at least 50% of question items. In total, 210 participants were included in the study. Participants read and confirmed informed consent and eligibility upon entry to the online survey welcome page. The University of Massachusetts Lowell Institutional Review Board reviewed this study and determined the activities as exempt from IRB oversight. However, human subjects procedures were followed, nonetheless.

Survey

The online, 60-item survey took 10-12 minutes to complete and included variables related to TWH (17 items), occupational characteristics (16), educational preference (12 items), interprofessional education (IPE) variables (15 items). TWH variables included: overall TWH knowledge, confidence and capability, and importance (4 items); TWH training history (1 item); TWH experience (1 item); level of skill for specific TWH practice approaches (11 items). Occupational variables included job role

and professional affiliation (3 items), OSH and career experience (2 items), organizational supports for interdisciplinary collaboration (8 items), state employed (1 item), and employer size (1 item). Other education needs assessment variables collected (but not reported on in this chapter) include preferences for education delivery methods (7 items), education topics (5 items), preferences for interprofessional learning community composition (2 items), readiness for interprofessional learning (12 items). The results related to interprofessional learning will be reported in Chapter IV. Three additional items were presented to participants if they met screening criteria to be invited to participate in a TWH focus group (Chapter III): interest in focus group participation, name, and email address to be contacted.

Overall TWH Knowledge, Confidence, Capability. Self-reported overall TWH competence was assessed with three questions, which rated overall level of knowledge about TWH approaches; confidence to discuss TWH with other professionals; and capability to implement TWH practices (Appendix A). For example, "Overall, how capable do you feel right now to implement a TWH approach?" Participants indicated their response using a 5-point scale ranging from 1 (not at all) to 5 (very).

TWH Practice Competency Scale. Self-reported level of competence for specific TWH practice approaches was measured with an 11-item scale that reflected the six previously published "essential elements" of TWH practice approaches (Lee et al., 2016; Punnett et al., 2020). Two items were used to measure each practice approach, except for "ensure confidentiality and privacy for workers practice," which used only one item. Question items used wording from the aforementioned documents (see Table 2.3) to operationalize the TWH practice approach with a specific behavioral indicator. Question

items were pretested with OSH and general public health professionals to assess face validity. Item wording was refined to reduce technical terms (e.g., use "worker characteristics" instead of "demographics"), length, and redundancy. Participants were asked to indicate their current skill level for each statement, using a 5-point response scale ranging from 1 (not skilled) to 5 (highly skilled).

Table 2.3

Total Worker Health Competency Scale Items

TWH Practice Approach	Scale Item	Item Source
1a. Leadership Commitment	Demonstrate leadership commitment to worker safety, health, well-being at all levels of the organization.	Lee et al. (2016)
1b. Leadership Commitment	Facilitate leadership commitment to worker safety, health and well-being.	De Novo (2022)
2a. Integrated Assessment	Use an integrated approach to assessment of work and non-work (e.g., home exposures, health conditions, health behaviors) risks.	Punnett et al. (2020)
2b. Integrated Assessment	Identify worker characteristics or working conditions in your organization associated with one or more health conditions.	NIOSH webinar evaluation tool
3. Maintain Confidentiality	Ensure confidentiality and privacy for workers when handling safety and health data.	Lee et al. (2016)
4a. Integrated Interventions	Design work to eliminate or reduce safety and health hazards and promote worker well-being**.**	Lee et al. (2016)
4b. Integrated Interventions	Develop workplace programs that integrate elements of safety/health protection with health promotion to advance worker wellbeing.	NIOSH webinar evaluation tool
5a. Worker Engagement	Promote and support worker engagement throughout program design and implementation.	Lee et al. (2016)
5b. Worker Engagement	Identify safety and health issues most important to front-line employees.	Lee et al. (2016)
6a. Systems Integration	Integrate relevant program systems (e.g., safety, occ health, HR, wellness) to advance worker wellbeing.	Lee et al. (2016)
6b. Systems Integration	Bring together leaders and teams with overlapping or complementary responsibilities for planning and priority setting (e.g., safety, occ health, HR, wellness.)	Lee et al. (2016)

TWH Experience and Education. Level of experience implementing TWH practices and prior TWH education were measured with a Guttman Scale item (DeVellis, 2012) created de novo for this study (Tables 2.4 and 2.5). Response items ranged from 1 (no prior experience or education) to 5 (expert level of experience or training).

Table 2.4

Total Worker Health Experience Scale Items

TWH Experience	Scale Item
1 None	I have not yet attempted to implement a TWH approach
2 Beginner	I have started implementing TWH in my practice
3 Intermediate	I have been implementing TWH in my professional practice for some time
4 Advanced	I am working towards implementing all elements of TWH practice, including organizational structures to support integration of SHW systems
5 Expert	I have fully implemented all elements of TWH practice, including organizational structures to support integration of SHW systems.

Table 2.5

Total Worker Health Education Scale Items

TWH Prior Education	Scale Item
1 None	I have not participated in any TWH education
2 Beginner	I have attended one or more educational sessions (e.g., webinar, presentation, etc.) to learn TWH basic concepts
3 Intermediate	I have attended multiple hours (or courses) in TWH education to learn how to implement TWH approaches (e.g., in-depth e-learning course, full day course, ongoing professional learning community, etc.)
4 Advanced	I have completed (or am pursuing) a TWH certification program (multiple courses) to build comprehensive competencies TWH practice
5 Expert	I have completed advanced TWH training and have taught TWH practices to other professionals

Participant Occupational Characteristics. Six variables were collected to characterize the OSH professionals in this sample. Variables and response values are listed in Table 2.6.

Table 2.6

Participant Occupational Variables

Variable	Response Values
OSH Discipline	1=Safety (includes environmental health and safety, ergonomics, injury prevention); 2=Industrial Hygiene; 3=Engineer; 4=Occupational Health Nurse; 5=Occupational Physician; 6=Total Worker Health[a]; 7=Wellness; 8=Human Resources; 9=Risk Management; 10=Researcher/Educator; 11=Student (not employed); 12=Other Recoding: 1= Safety; 2=Industrial Hygiene; 3=Occupational Nurse; 4 = Occupational Physician; 5=All other codes
OSH Experience	0=None at all; 1=Very little; 2=Some; 3=Moderate; 4=A good amount; 5=A lot
OSH Clients	1=Serves single employer organization where participant is employed (internal OSH); 2=Serves employer clients other than current employer (external OSH); 3=Both (internal and external OSH services)
Employer Size	Survey Categories: 1 = Sole owner/operator; 2= 2 to 10 employees; 3=11 to 50 employees; 4=51 to 100 employees; 5=101 to 250 employees; 6=251 to 500 employees; 7=501 to 1000 employees; 8=More than 1000 employees Recoding: 1=1 to 50 employees; 2=51 to 250 employees; 3=251 to 1000 employees; 4=More than 1000 employees
Employer State	1-53, including all US states, plus District of Columbia, Puerto Rico, "Not in U.S."

Note. [a]TWH participants (n=2) were re-coded to categories 2 and 7 based on certification and job history.

Organizational Supports for Interdisciplinary Collaboration. Eight questions from a previously validated 20-item instrument (Moilanen et al., 2020) were used for the current study (See survey question 14 in Appendix A). The questions measure the degree

to which participants agree with statements affirming specific ways that interdisciplinary collaboration is supported in their immediate work unit or the organizational generally. The eight questions represented two of a total of five subscales. Four items measured leadership *in the work unit* for development of interdisciplinary collaboration (IDC) such as, "In my work unit, leaders of different disciplines make joint decisions." Four items measured supports for IDC in at the *organizational level*, such as, "In my organization (e.g., corporation, workplace), development of IDC between different units is supported." Participants respond using a 4-point scale (1 = Strongly Disagree, 4 = Strongly Agree). A mean score was computed using all 8 items in this scale to create a variable for organizational support for IDC. This variable was assessed because of the theorized centrality of collaboration across organizational units for TWH practice approaches. Two theories used in health behavior research implicate organization level variables for TWH practice competencies. The social ecological model states that behavior is influenced by the social context in which decisions are made (Stokols et al., 1996). The theory of planned behavior recognizes that behavior is a product of personal attitudes, perceived social norms, and perceived behavioral control (Ajzen, 1991; Glanz et al., 2015). Thus, perceptions about leader values and support for the interdisciplinary collaboration required for TWH may play a role in the degree to which OSH professionals attempt to implement TWH approaches, which would then facilitate learning and competency building.

Data Analysis

Survey data were exported from Qualtrics to Microsoft Excel for cleaning. The cleaned data were then imported to IBM's Statistical Package for Social Sciences (SPSS) for analysis.

Participant Demographics

Frequencies (number and percent) were computed for participant characteristics of OSH discipline, OSH experience, career stage, service setting (internal vs consultant), and employer size. Employer size was recoded to the categories of very small (1-50), small (51-250), medium (251 to 1000) and large (more than 1000). Employer state was recoded to describe representation of the sample across regions of the United States, using U.S. Census Bureau's (2021) region categories.

Overall TWH Competence, TWH Experience, and TWH Training History

Univariate statistics were generated to summarize means and response frequencies for overall TWH knowledge, confidence, and capability, as well as TWH experience and education. Spearman's rho evaluated the correlation between TWH experience and TWH education.

Competence for Specific TWH Practice Approaches

Means and response frequencies were computed for the 11 TWH practice skill items in Table 2.3. Cronbach's alpha test for internal scale consistency was performed to assess the scale reliability. Exploratory Factor Analysis was performed to assess factor structure of the scale.

Factors Associated with TWH Competency

One-way ANOVA was used to assess mean differences of TWH competency between OSH discipline groups. Multiple linear regression models were performed to assess associations of the following occupational and organizational characteristics with TWH competency: discipline (safety, hygiene, occupational nurses, occupational physicians), level of OSH experience, levels of TWH education and experience, organization size, and perceived leadership support for interdisciplinary collaboration.

Results

The results are organized in this section to answer two research questions: How competent are OSH professionals in relation to specific TWH practice approaches, and how does TWH competence vary, if at all, based on characteristics such as discipline, career stage, prior TWH education, and organizational setting? The results are organized in four parts. The first part presents participants' levels of TWH experience and TWH education, and results of a correlational analysis of these two variables. The second part presents frequency distributions of participants' self-reported responses regarding their overall TWH competency indicators (knowledge, confidence, capability), followed by a descriptive analysis of competency frequencies observed for specific TWH practice approaches. The third part describes the results of exploratory factor analysis (EFA) to assess latent constructs underlying the 11-item TWH skill scale. The fourth and final part presents the results of ANOVA and multiple regression analyses to explore the role of occupational and organizational factors that predict competency level for the dependent variables of TWH program leadership and TWH risk assessment and control skills, which were identified through EFA.

Prior *Total Worker Health* Experience and Education

Overall, mean scores for TWH education ($M = 2.14$, $SD = 0.99$) and experience ($M = 2.35$, $SD = 1.26$) were relatively low. A high number of participants reported very little prior TWH education. The distribution of education skewed right, with almost 70% reporting they completed either no prior TWH education (37%) or only beginner level TWH education (41%) to learn the basic concepts (Figure 2.2). About a fifth of participants (22%) had engaged in education focused on implementation of TWH practice approaches, and only 8% reported advance or expert level education. Contrary to TWH education, TWH experience was somewhat more evenly distributed. Although a little more than a third (36.7%) reported they had not yet tried to implement TWH practices, the distribution across beginner, intermediate and advanced experience levels was similar, ranging from 19-21% (Figure 2.3). Only 6 participants (3%) reported expert level experience.

Figure 2.2

Participant Level of Total Worker Health Education (n=203)

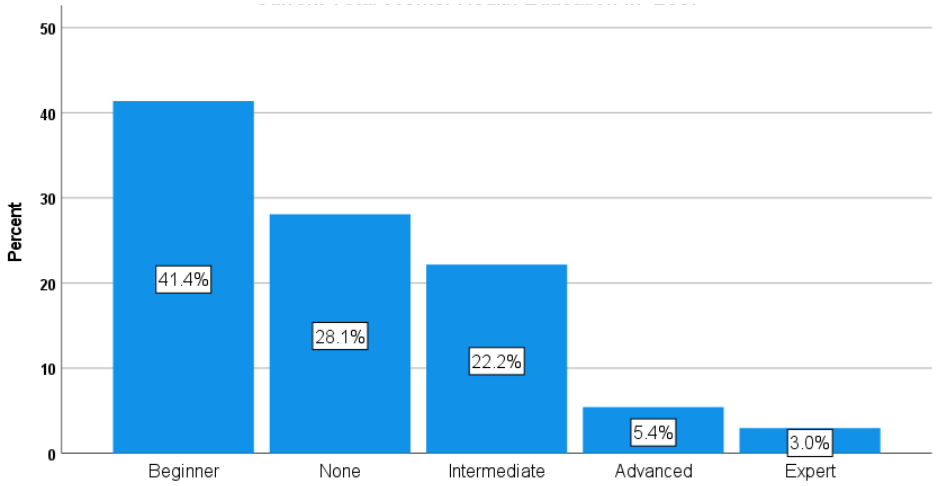
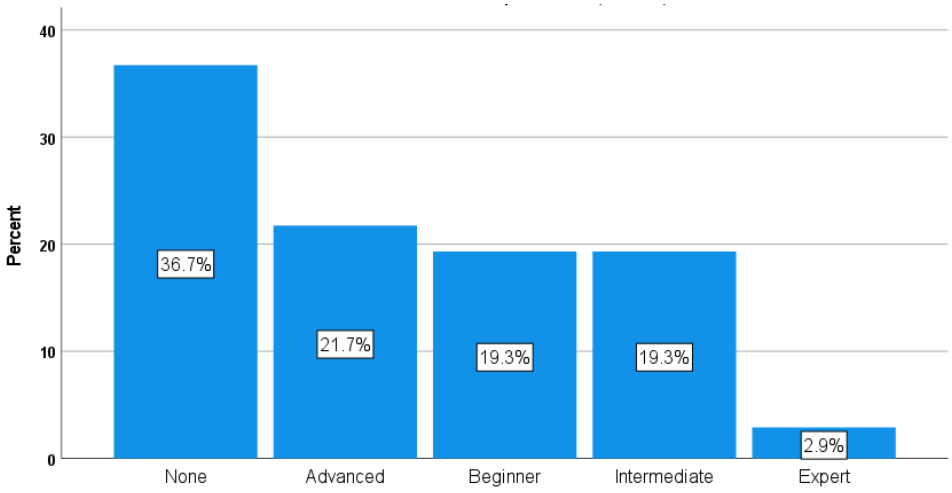


Figure 2.3

Participant Level of Total Worker Health Experience (n=207)

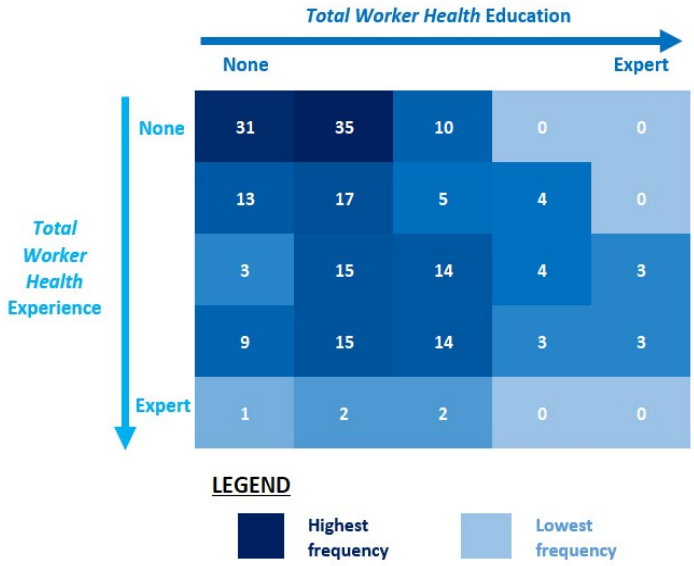


Relationships Between TWH Education and TWH Experience

Spearman's correlational analysis revealed a moderately positive association between the variables TWH education and TWH experience, r (201) = .34, $p < .01$ (Appendix B, Table B2). A heat map (Figure 2.4) shows that participants who report low TWH also report low TWH. However, 27 participants reported no or beginner TWH education but reported advanced or expert level TWH experience (see 4 lower left quadrant cells in Figure 2.4). Among those reporting "advanced" TWH experience (Figure 3, Row 4), the distribution of TWH education is overall positively (right) skewed.

Figure 2.4

TWH Experience vs. TWH Education Heat Map

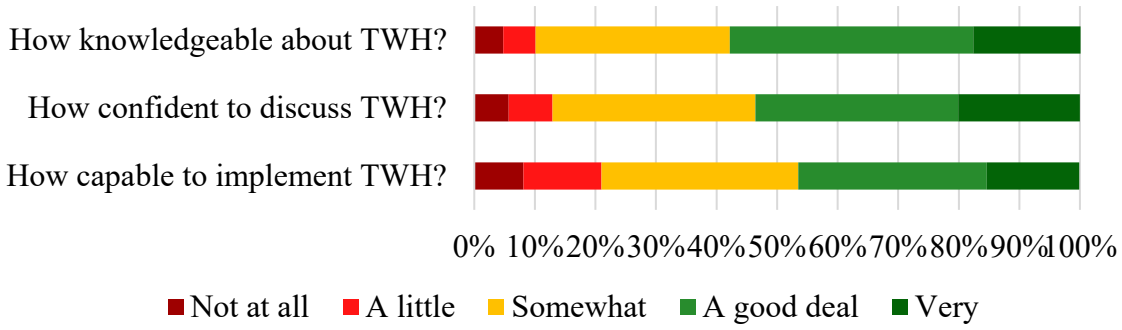


Overall *Total Worker Health* Knowledge, Confidence, and Capability

Slightly over half of participants reported high overall TWH knowledge (58%) and confidence (54%) (Figure 2.5). Professionals rated their capability to implement TWH slightly lower; only 46% said their capability was good or very good. Mean scores were TWH knowledge (M = 3.61, SD = 1.0), TWH confidence (M = 3.55, SD = 1.0) and TWH capability (M = 3.3, SD = 1.1) (Appendix B, Tables B3 and B4).

Figure 2.5

Overall Total Worker Health Knowledge, Confidence, and Capability among Occupational Safety and Health Professionals (n = 209)



Competency for Specific *Total Worker Health* Practice Skills

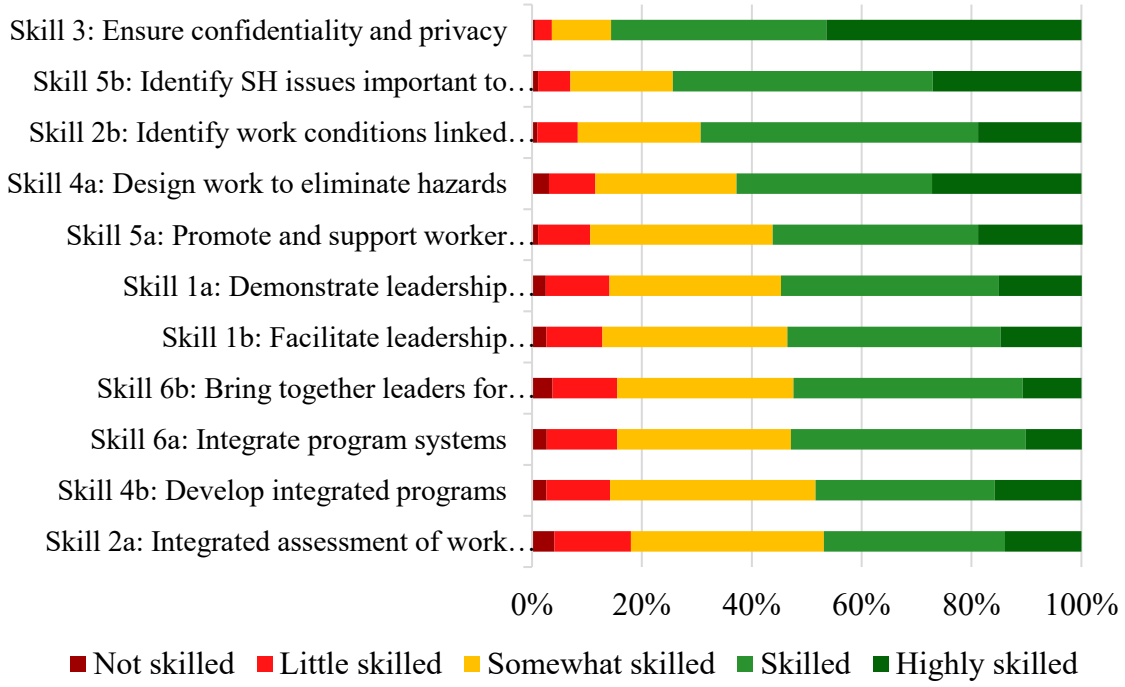
Mean scores for specific TWH practice skills ranged from a low of 3.42 (out of 5) for TWH Skill 2a (use an integrated approach to assessment of work and non-work risks) to a high of 4.29 for TWH Skill 3 (ensure confidentiality and privacy of workers) (Figure 2.6 and Appendix B, Tables B5, B6). Scores ranged from 1-5 for all TWH skill variables, except for TWH Skill 3, for which the minimum reported score was 2; 85% of participants rated themselves in the high or very high category for this skill. Overall, the items related to technical skills (i.e., TWH Practices 2,3, and 4 in Table 2.3) were ranked higher (i.e., higher skill) than related to TWH program management and leadership (TWH Practices 1, 5, and 6). One exception was Skill 2a, "Use an integrated approach to assessment of work and non-work risks," which was the lowest ranking skill with a mean of 3.42. The "Systems integration" practice Skills 6a and 6b were also low scoring variables, with means of 3.46 each. Just over half of participants reported themselves as "skilled or highly skilled" in the program management and leadership areas. Fewer than half of participants reported feeling skilled to "develop workplace programs that integrate elements of safety with health promotion to advance worker wellbeing."

Statistically significant differences in scores were observed within some, but not all TWH Skill skills pairs (Table 2.3). Pairs that were different included TWH Skills 2a (use integrated approach to assessment of work and non-work risks) (M = 3.42, SD = 1.00) and 2b (identify work conditions linked to health conditions) (M = 3.82, SD = .85); t(184) = 5.31, $p < .001$; Skill 5a (promote worker engagement throughout program design and implementation) (M = 3.66, SD = .93) and 5b (identify safety and health issues important to workers) (M = 3.96, SD = .87); t(184) = -4.44, $p < .001$; and Skill 4a (design

work to eliminate hazards) (M = 3.79, SD = 1.02) and 4b (developing integrated programs) (M =, 3.49, SD = .98); t(184) = 4.36, p < .001. TWH Skills 1a and 1b (Leadership commitment) and Skills 6a and 6b (Systems integration) had very little to no differences in mean scores (Figure 2.6 and Appendix B, Table B5).

Figure 2.6

Level of Competency for Specific Total Worker Health Practices (n=187 to 199 per row)



Assessment of TWH Practice Skills Scale Reliability and Factor Structure

Internal consistency (Cronbach's α) was performed on the 11item TWH competency scale. The 11-item scale had excellent reliability (α = 0.92); only slight changes in Cronbach's α (0.91 to 0.92) were estimated if any single item were to be removed (Appendix B, Table B7). Item correlations ranged from r = .256 to 0.777, p < .001. Lower correlation coefficients were observed for pairs involving TWH Practice 3

(ensure confidentiality) compared with other items in the matrix (e.g., r = .256 to .474 vs r = .361 to .777 for all other combinations) (Appendix B, Table B8).

Exploratory factor analysis (EFA) was performed on the 11-item TWH competency scale to assess the factor structure and to identify possible candidate items for removal. Maximum likelihood with an oblique rotation (Oblimin with Kaiser Normalization) was selected based on expected positive correlation between TWH practice skills (Costello & Osborne, 2005). KMO and Bartlett's tests confirmed that the dataset met criteria for factor analysis (Appendix B, Table B9). Factor analysis was performed on 198 rows of scale data after rows with missing data excluded listwise. The initial solution showed latent constructs with Eigenvalues greater than 1 that together, explained 65.3% of variance (Appendix B, Table B10). The first factor was comprised of 5 items in each factor plus one item (facilitate leadership commitment) that cross loaded on both factors (coefficients of 0.434 and .393, respectively). This item was removed from the scale initially, which produced cross loading of the "demonstrate leadership commitment" item across factors 1 and 2. The "facilitate leadership commitment" item was then added back into the model, and the "demonstrate leadership commitment" item was removed, and the factor analysis was repeated. This grouping produced a final 10-item, 2-factor scale that accounted for 66.0% of variance with no cross loaded items. Factor 1 (55.5% of variance) captured skills related to *Total Worker Health* program leadership, whereas Factor 2 (10.5% variance) captured technical skills related to hazard identification and control. Reliability of the factor 1 subscale (TWH program leadership) was high ($\alpha = 0.89$) as was factor 2 (TWH risk assessment and control) ($\alpha = 0.80$).

Table 2.7

Factor Analysis Results for the Total Worker Health Practice Skills Scale

Total Worker Health (TWH) Skill Scale Item	Factor loading	
	1 α = 0.89	2 α = 0.80
Factor 1: TWH Program Leadership Skills		
7. Develop programs that integrate safety/health protection and health promotion	**.884**	-.081
10. Integrate relevant program systems to advance worker well-being	**.870**	-.072
11. Bring together safety/HR/wellness/occ health leaders for planning/prioritizing	**.766**	.046
8. Promote worker engagement throughout program design and implementation.	**.743**	.018
3. Use integrated approach to assessment of work and non-work risks	**.556**	.232
2. Facilitate leadership commitment to worker S/H/W	**.551**	.224
Factor 2: TWH Risk Assessment and Control Skills		
4. Identify worker/work characteristics associated with health conditions	-.029	**.758**
9. Identify safety and health issues most important to front-line employees	.165	**.706**
5. Ensure worker confidentiality, privacy when handling S&H data	-.040	**.611**
6. Design work to eliminate or reduce S&H hazards and promote well-being	.291	**.493**

Note. N = 197. The extraction method was maximum likelihood with oblique (oblimin with Kaiser Normalization) rotation. Factor loadings greater than .30 are in bold.

Group Comparisons of *Total Worker Health* Competency by Discipline

Mean scores were computed for new variables of TWH sub-competency factor 1 (program leadership, 6 items) and factor 2 (risk assessment and control, 4 items). Mean skill score for the TWH program leadership domain (M = 3.51, SD = .77) was slightly lower than the mean score for the TWH risk assessment and control domain (M = 3.94,

SD = .72). Median and interquartile ranges for these variables were, respectively, were (*Mdn* = 3.50, IQR = 1.00, and 4.00, IQR = .75).

TWH Skills Factor 1 - Program Leadership

One-way ANOVA was conducted to assess whether there were differences in TWH Program Leadership Skills Factor 1 mean score based on OSH discipline. OSH discipline included five groups: safety (*M* = 3.55, *SD* = .70, *n* = 62), industrial hygiene (*M* = 3.66, *SD* = .75, *n* = 32), occupational nurse (*M* = 3.43, *SD* = .82, *n* = 23), occupational physician (*M* = 3.27, *SD* = .93, *n* = 22), and other (*M* = 3.33, *SD* = .93, *n* = 58). A detailed list of descriptive statistics and ANOVA test output for OSH discipline group level analysis of TWH Skill scores is provided in Appendix B, Tables B11 – B14. Levene's test confirmed the data met assumptions of homogeneity of variances, *F*(4, 192) = .960, *p*=.430. There was *no significant effect* of OSH discipline group on TWH Program Leadership Skills at p <.05 level [*F*(4,192) = 1.334, *p* = .259] for Safety, Industrial Hygiene, Occupational Health Nurses, Occupational Physician, and Other groups (Table 2.8).

Table 2.8

ANOVA Comparison of TWH Practice Skills (Factor 1) by OSH Discipline

	Sum of Squares	*df*	Mean Square	F	*p*
TWH Program Leadership					
Between Groups	3.600	4	.900	1.334	.259
Within Groups	129.505	192	.675		
Total	133.105	196			

TWH Skills Factor 2 - Risk Assessment and Control

Similarly, one-way ANOVA was conducted to assess differences in TWH Risk Assessment and Control skills mean score based on OSH discipline. OSH discipline included five groups: safety (M = 4.01, SD = .59, n = 62), industrial hygiene (M = 4.36, SD = .47, n = 32), occupational nurse (M = 4.02, SD = .72, n = 23), occupational physician (M = 3.89, SD = .80, n = 22), and other (M = 3.56, SD = .92, n = 59) (Appendix B, Table B11). Levene's test showed the OSH discipline group variances *violated ANOVA assumptions* of homogeneity of variances [$F(4, 193) = 2.603$, $p < .04$]. A Welch test (Robust Test of Equality of Means) showed *a significant effect* of OSH Discipline on TWH Risk Assessment and Control skills at the p<.05 level [$F(4, 71.03) = 7.60$, $p < .001$]. The effect size was estimated at 10.6% by computing omega squared from ANOVA statistics (Appendix B, Figure B1).

Table 2.9

Robust Tests of Equality of Means - TWH Practice Skills (Factor 2) by OSH Discipline

TWH Skill Factor 2	Statistic[a]	*df1*	*df2*	*p*
Welch	7.600	4	71.031	<.001
Brown-Forsythe	7.092	4	126.991	<.001

Note. a. Asymptotically F distributed.

A Games-Howell post hoc test was performed to assess the differences in mean score for TWH Risk Assessment and Control between OSH discipline groups (Table 2.10). This method was chosen based on the ability accommodate unequal sample sizes and its appropriateness when the assumption of homogeneity of variance is violated. All significant values are reported at $p < .05$. The Industrial Hygiene group scored higher than Safety group (score difference of .346, $p < .02$) and Other group (score difference .796, $p < .001$). Safety group also rated their TWH risk assessment and control skills

higher than Other (score difference of .450, $p = .02$). However, no effects were observed for occupational health nurses or occupational physicians. A Kruskal-Wallis Test was also performed, which produced similar results (Figure 2.7), confirming that scores for TWH Risk Assessment and Control skills for the industrial hygiene group were statistically significantly higher than the safety and other groups.

Table 2.10

OSH Discipline Group Differences for TWH Risk Assessment and Control – Games-Howell Post Hoc Test for Multiple Group Comparisons

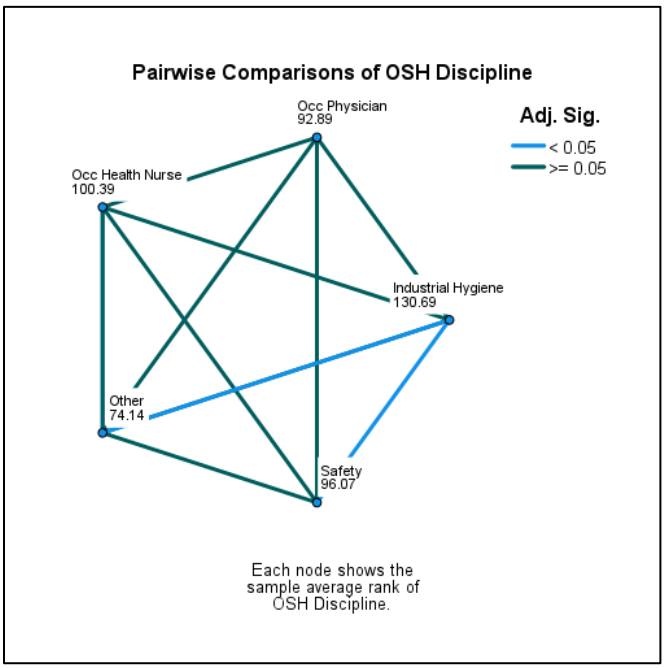
OSH Discipline (Referent - I)	OSH Discipline (Comparison - J)	Mean Difference[a] (I-J)	*SE*	*p*	95% Confidence Interval	
					Lower Bound	Upper Bound
Safety	Industrial Hygiene	-.346*	.112	.023	-.660	-.032
	Occ Health Nurse	-.008	.167	1.000	-.491	.474
	Occ Physician	.127	.186	.958	-.412	.666
	Other	.440*	.141	.016	.058	.842
Industrial Hygiene	Safety	.346*	.112	.023	.032	.656
	Occ Health Nurse	.338	.172	.303	-.156	.831
	Occ Physician	.473	.190	.118	-.075	1.021
	Other	.796*	.146	<.001	.389	1.203
Occ Health Nurse	Safety	.008	.167	1.000	-.474	.491
	Industrial Hygiene	-.338	.172	.303	-.831	.156
	Occ Physician	.135	.227	.975	-.510	.781
	Other	.458	.192	.135	-.084	1.001
Occ Physician	Safety	-.127	.186	.958	-.666	.412
	Industrial Hygiene	-.473	.190	.118	-1.021	.075
	Occ Health Nurse	-.135	.227	.975	-.781	.510
	Other	.323	.208	.535	-.269	.915
Other	Safety	-.450*	.141	.016	-.842	-.058

Industrial Hygiene	-.796*	.146	<.001	-1.203	-.389
Occ Health Nurse	-.458	.192	.135	-1.001	.084
Occ Physician	-.323	.208	.535	-.915	.269

Note. *The mean difference is significant at the 0.05 level.
Dependent Variable: TWH Risk Assessment and Control Mean Score

Figure 2.7

Pairwise Comparison of OSH Discipline Scores for TWH Risk Assessment Skill Factor



Correlates of TWH Competency Level

Regression analysis was performed to assess the influence of four occupational characteristics, TWH experience, and education on TWH practice competency. Three regression models were run to assess each independent variable using the regression equation below (Figure 2.8). Dependent variables for the three models were: Overall TWH competency (mean score TWH skills scale, 11 items), TWH Program Leadership

competency subscale (mean score TWH skill factor 1, 6 items), and TWH Risk Assessment and Control competency subscale (TWH skill factor 2, 4 items) (Table 2.7).

Figure 2.8

Regression Equation for Assessing Predictors of TWH Competency

$$Y = a + B_1*X_1 + B_2*X_2 + B_3*X_3\ B_4*X_4 + B_5*X_5 + B_6*X_6$$

1 = Level of OSH experience

2 = Level of TWH experience

3 = TWH training/education history

4 = OSH Discipline

5 = Organization size

6 = Perceived organizational support for interdisciplinary collaboration

Significant collective effects of independent variables were observed across all models. These variables together explained a significant proportion of variance (about a third) for overall TWH competency scores, $R^2 = .32$, $F(9, 162) = 8.36$, $p < .001$; TWH program leadership scores $R^2 = .33$, $F(9, 162) = 8.67$, $p < .001$; and TWH risk assessment and control competency, $R^2 = .28$, $F(9, 163) = 7.12$, $p < .001$. In Model 1 (all 11 items), three of the independent variables, OSH experience ($\beta1 = .41$, $p < .001$, 95%), TWH experience ($\beta2 = .22$, $p < .01$), and TWH training ($\beta3 = .16$, $p < .01$) significantly predicted TWH overall competency (Table 2.11). Similar results were observed for Model 2 (TWH program leadership competency). In Model 3, only OSH experience significantly predicted TWH risk assessment and control competency ($\beta1 = .40$, $p <. 001$). However, TWH education approached significance for TWH risk

assessment competency (β1 = .14, $p <$. 06). Across all three models, the independent variables OSH discipline, organization size, and organizational collaborative climate *had no significant effect* on TWH competency (Table 2.11).

Participants' level of OSH experience significantly predicted TWH competency scores in all three models and had twice the predictive power of either TWH education or TWH experience based on standardized beta values. Participants' predicted overall TWH competency is equal to 2.12 + .22 OSHExp + .20 TWHEduc + .09 TWHExp, where OSH experience is coded from 0 (none) to 6 (a lot); TWH experience is coded as none, beginner (concepts only), advanced (how to implement); and TWH experience is coded from 0 (no experience) to 5 (have implemented all elements of practice). Thus, for every unit increase in OSH experience, participant's TWH competency score increased by .22; for every unit increase in TWH education, TWH competency increased by .20; for every unit increase in TWH experience, TWH competency increased by .09, respectively, holding all other variables constant.

Diagnostic tests confirmed no violations of multicollinearity; variance inflation factor (VIF) values were between 1.0-2.2, which is well below the threshold of 10 for all regression models. Variance of regression standardized residuals was approximately normally distributed (Appendix B, Figures B2 and B3) and heteroscedasticity was not observed (Appendix B, Figure B4).

Table 2.11

Regression Coefficients: Predictors of TWH Competency

Variable	Model 1			Model 2			Model 3		
	B	β	*SE*	*B*	β	*SE*	*B*	β	*SE*
Constant	2.12***		.31	1.44***		.35	2.96***		.34
OSH Experience	.22***	.41	.04	.24***	.39	.05	.23***	.40	.04
TWH Experience	.09**	.16	.04	.12**	.19	.04	.04	.07	.04
TWH Training History	.20**	.22	.06	.24***	.24	.07	.13+	.14	.07
OSH Discipline[a]									
Safety Profession	.01	.08	.13	.12	.07	.15	-.17	-.11	.14
Occupational Nurse	-.14	-.06	.17	-.08	-.03	.19	-.19	-.08	.19
Occupational Physician	-.18	-.08	.17	-.11	-.05	.19	-.22	-.10	.18
Other OSH Profession	.04	.02	.15	.23	.13	.17	-.26	-.16	.16
Organization Size	.003	.01	.04	-.01	-.01	.05	.002	.004	.04
Organizational Support for Interdisciplinary Collaboration	.04	.03	.07	.11	.09	.08	-.04	-.03	.08
R^2	.32*			.33*			.28*		
Adjusted R^2	.28			.29			.24		

Note. N = 172, 172, 173 for models 1,2,3. We examined the role of OSH experience, *Total Worker Health* (TWH) experience, TWH training history, professional discipline, organization size, and organizational support for interdisciplinary collaboration (IDC) on level of TWH competency. Three regression models assessed impacts to mean score for overall TWH competency (Model 1, full 11-item scale), TWH Program Leadership (Model 2, sub-construct with 6 items) and TWH Risk Assessment and Control (Model 3, sub-construct with 4 items).

[a]OSH Discipline referent group is Industrial Hygiene. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$. $^{+}p < .06$.

Discussion

This study was designed to assess how OSH professionals perceive their level of skill (competency) for specific TWH practice approaches, and to identify characteristics associated with TWH competency. The vast majority of participants in this study reported being familiar with the TWH concept, but only half of participants scored their knowledge and confidence as strong. A substantial proportion of participants reported little or no prior TWH education, and yet some also reported intermediate or advanced experience with TWH implementation. It is possible that the weak/moderate correlation observed between TWH education and experience can be explained by misclassification. Participants may have rated their TWH experience inappropriately high if they lacked a clear understanding about what constitutes TWH practice. However, given that participants' scores for TWH experience outpaced their scores for TWH training, it is assumed that many professionals may be introducing TWH practices without a consistent conception of TWH practice and how to implement it in the workplace. The potential for inconsistent definition and implementation of TWH practices approaches is problematic for two reasons. The first problem is that OSH professionals who lack TWH foundational education will have difficulty communicating and justifying TWH approaches to organizational leaders and to other professionals with whom they need to collaborate. The second problem is that a lack of training may jeopardize the quality of TWH implementation, which could impede professionals' ability to achieve the full potential for program impact. For example, if professionals lack knowledge and skills to assess all dimensions of safety, health and well-being risks (e.g., including psychosocial stressors, personal health mental wellbeing outcomes), they cannot achieve the integrated approach

to risk assessment that TWH advocates. Thus, the low overall levels of TWH education observed in this study, point to the need for both introductory and advanced level TWH training for OSH professionals.

Performance of the TWH Competency Scale

A novel 11-item TWH competency scale was developed for this study based on specific TWH practice skills that have been described previously in the literature (Lee et al., 2016; Punnett et al., 2020). Internal reliability of this scale was very strong. The measurement of perceived skill for specific TWH practice approaches provided insights about how OSH professionals see their strengths and areas for development, which can guide content prioritization when developing continuing education programs. To the author's knowledge, this is the first study to report on perceived level competency for specific TWH practices among occupational safety and health professionals. Other studies of OSH professional educational needs reported high interest and readiness for TWH education (about 75% stated interest) (Olszewski et al., 2021; Scott et al., 2019), but these studies did not address specific learning needs in relation to *Total Worker Health* practices.

One item in the TWH Skill scale, TWH Practice Skill 3 item (maintain confidentiality and privacy for workers when handling safety and health data), was weakly correlated with all other scale items. This raised questions about the appropriateness of including this practice in the TWH skill scale. On the one hand, ensuring confidentiality and privacy is an OSH ethics practice standard for any professional working with health data and therefore this practice is not unique to TWH. However, using an integrated approach to risk assessment expands the breadth of data

OSH professionals may have been trained to work with and the cross-program collaboration advocated by TWH could introduce new data sharing practices across organizational units.

The ethical principles of autonomy, nonmaleficence, beneficence, and justice for workers have been discussed in the context of decision-making by OSH professionals when implementing TWH practices (Rogers & Schill, 2021). These principles are important as OSH and other professionals increasingly enter "uncharted territory" to share data for purposes that benefit both worker wellbeing and employer interests (Rogers & Schill, 2021, p. 2). Thus, holistic SHW risk assessment has implications for advanced level data handling competencies that may justify retaining the "ensure data confidentiality and privacy" skill item in the TWH competency scale.

Latent Constructs Underlying TWH Competency

Exploratory factor analysis of the scale revealed two latent constructs underlying TWH practice approaches: TWH program leadership skills and TWH risk assessment and control skills. The TWH program leadership construct included skills for facilitating leadership commitment to worker safety and well-being, engaging workers in safety and health improvements, and integrating program systems to support worker SHW. TWH technical skill areas included skills related to data privacy, risk assessment, and hazard control. The finding of a two-factor structure was unexpected because the development of the scale was organized around 5-6 distinct practice approaches as outlined in Table 2.3. Notably, some TWH skill pairs that were intended to reflect slightly different facets of the same TWH practice approach (e.g., skills 2a and 2b) ended up loading in different factors (per below discussion). This may indicate that the current skill scale statements

may not yet be specific enough to justify item-level. Despite the unexpected number of factors, the two-factor TWH competency finding represents the first empirical evidence available to support the formation of a hierarchical organizing structure for a TWH competency framework. These results contribute to the broader research base needed to formalize a TWH competency framework, as advocated by other scholars interested in TWH workforce education (Newman et al., 2020). Another practical application of the two-factor competency structure is to use the factor means as dependent variables when evaluating predictive factors or educational activities designed to advance TWH leadership and technical skills. Future research can build on the current study to expand and refine the scale statements to reflect specific practice performance measures that can be used in conjunction with TWH educational programs. The results of the study outlined in Chapter 3 of this dissertation may benefit that process.

Examination of the two TWH competency sub-scales (factors 1 and 2) using regression analysis revealed that OSH professional characteristics had differential predictive value for TWH program leadership compared to TWH risk assessment skills. Level of OSH experience, TWH experience, and TWH education predicted TWH leadership skills, but only OSH experience predicted TWH technical risk assessment skills. These results suggest that TWH leadership skills may be more responsive (amenable to growth) to TWH training, whereas TWH risk assessment and control skills are more dependent on career maturity. However, it is possible that TWH training showed no statistical significance as a predictor because most training until recently has not provided advanced technical skills training for TWH. Advanced level TWH training (e.g., graduate level and professional TWH certificate programs) became available in

recent years. Only 8% of participants in this study said they participated in advanced level training. As more advanced level TWH risk assessment methods training become available, a statistically significant predictive association with TWH risk assessment competency would be expected. Despite a lack of statistical significance for TWH training as a predictor for TWH risk assessment skill, OSH professionals would benefit from advance level training on integrated risk assessment interventions approaches, as discussed below.

Role of Organizational Variables in TWH Competency

The organizational variables of size and leadership supports for interdisciplinary collaboration were theorized as possible predictors for TWH competency, but no effects were observed for either of these variables. Implementation success for new practice approaches and programs such as *Total Worker Health* is always subject to the organizational context (Guerin et al., 2021; Nilsen, 2015). The theory of planned behavior (Ajzen, 1991) and the social-ecological model (Stokols et al., 1996) have been used widely in health behavior research to explain and predict contextual influencers of health behavior. Both theories recognize the predictive role of social context in the program environment for facilitating or impeding new behaviors or practices. Perceptions of organizational support for collaborative interventions have been studied in healthcare organizations (Moilanen et al., 2020). Applying these theoretical viewpoints to TWH implementation, OSH professionals' perceptions about the level of leadership support for TWH practices (e.g., cross-program coordination, engaging workers in risk assessment and control activities, etc.) can influence their beliefs and expectations about how much control they have over the outcomes of their efforts. Their beliefs, in turn, influence the

effort they will apply when implementing the new TWH practices. Professionals who perceive high support for interdisciplinary collaboration may be more likely to have attempted cross-program coordination, and therefore may gain experience and competency in doing so. The lack of observed effects of this organizational variable in this study may be explained either by too small a sample size to detect an effect; or that the two subscales selected from the original instrument were not sensitive enough to measure an effect; or that leadership support for collaboration may not directly influence professional's real or perceived competencies for TWH practices. Correlational analysis confirmed a very weak association between leadership collaboration support and TWH competency, which suggests that other downstream variables might moderate or mediate any influence the organizational environment has on TWH competency.

Strengths and Limitations

The study sample represented a broad range of OSH disciplines from all regions of the US who delivered OSH services either in-house or as a consultant in varying-sized organizations. The breadth of OSH professionals represented in this study implies that we can be somewhat confident that the level of TWH skills observed in this study can be generalizable to other OSH professionals with similar occupational profiles and attitudes about the integrative, TWH approach to occupational safety and health practice. At the same time, the sample size was relatively small, and it is possible that different results (i.e., higher or lower TWH competence scores) may be observed with a larger sample. A larger sample may have enabled detecting statistically significant predictive effects of OSH discipline on TWH skills. In the current study, the effect of discipline was seen only in one-way ANOVA, but not in the regression models. It is also possible that a larger

sample may have revealed TWH skill effects based on perceived organizational supports for interdisciplinary collaboration. This variable was weakly but strongly statistically significantly correlated (.209, $p < .01$) with the TWH skill 11, "bring together safety/HR/occupational health leaders for planning and prioritizing). This correlation implies a possible contributing role of the organizational context for TWH program leadership that might be detectable with a larger sample size.

A limitation of this study is that the sampling strategy was non-random. We know that participants who volunteered already valued the *Total Worker Health* concept because nine out of ten participants agreed with the statement, "It is important to use TWH approaches in my professional practice." Consequently, the results of this study cannot be generalized to the general population of OSH professionals. It is assumed that the observed TWH skill levels in this study would *overestimate* those in the general OSH professional population because most participants had already made an effort to implement and develop TWH skills. However, given this study's purpose for determining learning needs among OSH professionals, the results probably could be generalizable to OSH professionals seeking TWH continuing professional education, as the study sample would reflect that population.

Another limitation is that the data were self-reported, and likely do not reflect actual skill level. Estimates of skill are probably overinflated because participants tend to overestimate their performance with self-reported measures (Drisko, 2014). Having more granular performance statements may help improve accuracy and precision of measurement. Having gradations of behavioral performance can help professionals and

educators identify specific skills to be taught, to build on professionals' existing knowledge.

Future Research

This study demonstrated the value of using a TWH competency scale to assess factors associated with TWH competency. Although the individual items and the two-factor structure helped to identify training needs in some detail, a more detailed scale could identify learning needs for specific sub-competencies within the two-factor structure. Future research could develop a more extensive, detailed TWH skills scale that captures a fuller range of practice sub-competencies. Such a study could explore and refine the factor structure to confirm or expand the main constructs and their sub-competencies. It is possible that a lengthier scale might identify additional latent constructs as was anticipated, but not observed, in this study. Scale development and validation can both formalize and validate a TWH competency framework and assess professional continuing education needs. Once a competency framework and measurement scale have been developed, follow-up education research can develop TWH education need assessment and evaluation instruments for use by providers of TWH continuing professional education.

Implications and Recommendations for Practice

Measuring perceived skill levels for specific TWH practice approaches provided insights useful for prioritizing content for continuing education programs. Recommendations for applying findings from this study are listed below.

Expand dissemination of and access to TWH Education. The low overall levels of TWH education observed in this study point to the need for greater dissemination of and

access to introductory TWH education for working OSH professionals. Myriad options are currently available now, although more educational courses may be needed to permeate the population of OSH professionals in the United States. Dissemination of programs is complicated by the fact that both safety and industrial hygiene professions have several career levels and entry pathways, not all of which require ongoing continuing education. Thus, effective dissemination will rely on partnering with multiple intermediary organizations to ensure wide access to low and no-cost introductory TWH education. Given the complexity of reaching diverse OSH professionals and practitioners in the workforce, learning about TWH concepts during undergraduate training in OSH majors, nursing, and public health programs can ensure that professionals who eventually enter the OSH field have had exposure to TWH and share a common conception of TWH practice approaches.

Target largest TWH skills gaps for TWH curricula.

In this sample, OSH professionals viewed themselves as having a greater skills gap in the TWH program leadership domain, indicating that the skills in this domain should be prioritized for continuing education. The largest specific gap in TWH leadership skills (with fewer than half of participants rating themselves as skilled) was the skills of developing programs that integrate elements of safety with health promotion. The need for leadership skills development identified in this study is consistent with prior research on OSH professional training needs (Scott et al., 2019). Among the technical skills, the skills of using integrated assessment methods to identify work and non-work risks ranked lowest among 11 skills measured. This low ranking implies that this practice

should be prioritized for skills development in advanced level TWH continuing professional education.

Few participants in this study reported they had participated in advanced level TWH education. This may be due to a low availability of course options. Results suggest specific skills needing attention for advanced training are: 1) developing programs that integrate elements of safety with health promotion, and 2) using integrated assessment methods to identify work and non-work risks. Additionally, advanced TWH training should include practical implementation strategies to support professionals as they attempt to transfer what they learn into real-world settings. Implementation strategies can help ensure that practices are consistent across employer settings, although adaptations are necessary and inevitable to meet local needs. Given the evidence that many professionals may be implementing TWH without prior TWH training, it is recommended advanced TWH education courses require prior TWH introductory education. This pre-requisite will ensure that all advanced learners have foundational knowledge about the scientific rationale supporting TWH principles and can define TWH practice approaches. Advanced level training can be delivered as specialized graduate certificate programs or non-credit, continuing professional education certificate programs or courses.

Match TWH education level to career stage. Mid and advanced career OSH professionals may be more appropriate than early career professionals to receive advanced level TWH training in competency domains of program leadership and integrative risk assessment and control. According to the regression results, level of OSH experience was the strongest predictor of TWH skill level (standardized beta was double

that of other predictor variables), whether in the program leadership domain or the risk assessment and control domain. OSH experience was the sole variable with statistically significant predictive value for the TWH risk assessment skills domain (regression Model 3 in Table 17). These results align with expectations that as OSH professionals advance in their career, their responsibilities grow, and they become more skilled and confident as leaders. Leadership skills facilitate access to and interactions with organizational leaders across organizational units. Expanded access to organizational leaders and units gives the opportunity to pursue coordination across programs and to build buy-in and commitment among organizational leadership to the TWH concept. Career maturation also brings mastery of technical skills, which should, in theory, facilitate learning and practice of integrated risk assessment and interventions consistent with TWH approaches for worker safety, health and wellbeing. Assuming prior completion of introductory TWH education, mid and advance career professionals can benefit from advanced level skills training to increase their content knowledge and measurement methods for risk domains such as job and organizational psychosocial stressors and mental wellbeing outcomes.

Customize TWH curricula by discipline. It is important to recognize the diversity of professionals involved in *Total Worker Health*; participants in this study sample alone reported at least 10 different OSH-related job titles. With increasing attention to TWH as an emerging, progressive approach to workplace safety and wellbeing, professionals from many disciplines, including those with *no prior training* in occupational safety and health (e.g., health educators, health promotion specialists, human resources) may increasingly seek TWH continuing education. This has implications for the design of TWH education to accommodate the diversity of knowledge and roles that participants bring to TWH

settings. Non-OSH professionals (or even safety technicians or safety shop floor "leads") who have little risk assessment training or experience will benefit from an overview of OSH risk assessment concepts and terminology, whereas trained OSH professionals will be ready for more advanced material. Customizing the TWH training to job roles will be essential. Conducting a more detailed needs assessment for specific groups (e.g., different disciplines and different career stages) is recommended to identify specific learning needs. Specific competency training needs are elaborated in greater detail in Chapter III. Structuring learning to simulate interprofessional interactions as they may take place in an employer setting would be especially beneficial, as will be discussed in Chapter IV.

Conclusion

This study set out to assess the views of diverse, multidisciplinary OSH professionals regarding their competency for specific TWH practices, and to identify factors associated with competency. To the author's knowledge, this is the first study to report on perceived level competency for specific TWH practices among occupational safety and health professionals. Overall, there remain substantial gaps in knowledge and participation in TWH education, and it is evident that many OSH professionals are implementing TWH practice approaches with little or no prior TWH training. A lack foundational grounding in TWH concepts could impede consistent implementation across different workplace settings as adoption of TWH expands. Broad access to introductory TWH education is needed both in higher education and in professional continuing education settings to help close the knowledge gap. Additionally, advance level training is needed for practicing OSH professionals to facilitate implementation of integrative risk assessment and hazard control approaches, and to build TWH program leadership skills.

A novel 11-item TWH competency scale was developed for this study, which had high internal consistency. Scale factor analysis revealed two latent constructs underlying TWH practice approaches: TWH program leadership skills and TWH risk assessment and control skills. OSH professionals scored their capabilities highest for technical skills related to risk assessment and hazard control, whereas they rated their abilities somewhat lower for skills related to overall program leadership and management. The two-factor TWH competency structure found in this study represents the first empirical evidence available to support the conceptual basis for a hierarchical organizing structure for a TWH competency framework. These results contribute to the broader research base needed to formalize a TWH competency framework, as advocated by other scholars interested in TWH workforce education (Newman et al., 2020).

This study explored possible predictors of self-reported TWH competency, and determined that career stage (i.e., level of OSH experience) was the strongest predictor of self-reported TWH competency; this variable was predictive of TWH leadership scores and was the only significant predictor identified for the TWH risk assessment/control domain. TWH education and, to a lesser extent, TWH experience were significant predictors for TWH leadership skills, but not for TWH risk assessment skills. These results suggest that TWH leadership skills may be more responsive (amenable to growth) to TWH training for OSH professionals of all career stages, whereas TWH risk assessment and control skills may be more suitable for mid or advance career professionals.

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CHAPTER III

Perspectives of Occupational Safety and Health Professionals on Competencies Needed for *Total Worker Health* Practice

The occupational safety and health (OSH) profession has been evolving over the past two decades in response to the changing nature of work, workforce demographic shifts, and structural shifts in work arrangements (e.g., contingent, temporary, contract) that have disrupted regulated workforce safety and health protections and placed a greater share of the American workforce in employment scenarios that are less secure and more unsafe (Peckham et al., 2017; Weil, 2014). OSH professionals comprise multiple disciplines such as occupational safety, ergonomics, industrial hygiene, occupational medicine, and occupational epidemiology, whose role is to identify and mitigate workplace hazards and to prevent and treat work-related injuries and illnesses (International Commission on Occupational Health [ICOH], 2014). Occupational safety and health scholars and professionals have advocated for an expanded occupational safety and health paradigm that can address a broader set of threats to workforce safety, health, and well-being (Chari et al., 2018; Peckham et al., 2017). This expanded approach, coined by the Centers for Disease Control in 2011 as "Total Worker Health," is defined by the National Institute for Occupational Safety and Health (NIOSH) as "policies, programs, and practices that integrate protection from work-related safety and health hazards with promotion of injury and illness-prevention efforts to advance worker

well-being" (CDC, 2020b). OSH experts in government (Lee et al., 2016) and academia (McLellan et al., 2017; Punnett et al., 2020) have published practical and scientific monographs that describe the essential elements of TWH practice approaches. These practice approaches were described in detail in Chapter 2. The expanded approach to OSH practice has implications for pre-professional training and continuing professional education. New kinds of curricula are needed to prepare OSH professionals in a broader set of competencies for which they have not yet been trained, based on emerging realities of modern working conditions and workforce demographics.

One of the challenges for delivering *Total Worker Health* (TWH) continuing education is the lack of a defined, validated competency framework to guide training curricula. Without this, continuing education developers lack a common set of performance standards that describe what OSH professionals must know, do, or value when demonstrating TWH practice. Newman et al. (2020) proposed a broad set of "cross-cutting" competencies for the emerging field of TWH using an expert review panel. However, these competencies have not been validated empirically and professional practice is evolving and emerging in the second decade following the introduction of the *Total Worker Health* concept by National Institutes for Occupational Safety and Health (NIOSH) (Tamers et al., 2019). As TWH intervention research evidence continues to accumulate, TWH practice also continues to emerge, setting up a dynamic and changing landscape for continuing professional education in this arena. Many TWH continuing education programs for OSH professionals are organized around defining and describing TWH practice approaches based on published guidelines for *Total Worker Health* program approaches (Lee et al., 2016; McLellan et al., 2017; Punnett et al., 2020). These

publications describe specific programmatic activities that can be evaluated in a workplace context, but do not specify knowledge and skills needed to implement those activities. As someone who has been directly involved in TWH research, evaluation and education for 16 years, I have used these guidelines and my experience interacting with OSH professionals around TWH implementation to decide how to plan and deliver TWH continuing education. Although I possess strong theoretical knowledge of TWH concepts and implementation, I do not have direct experience in the organizational context. Defining competencies from the lived experiences of professionals working in different occupational settings would be valuable to understand what exactly needs to be taught and how resources can be allocated efficiently for TWH continuing professional education. Understanding which competencies are required beyond OSH professionals' prior training, and whether learning needs vary by discipline and career stage would facilitate the design of training to meet specific needs.

This paper describes the perspectives of multidisciplinary OSH professionals, who have self-reported a moderate or advanced level of TWH experience, regarding the competencies needed to implement TWH practices in the workplace. This study addresses the following questions: Which competencies (knowledge, skills, attitudes/values) do OSH professionals feel are needed for *Total Worker Health*? Which specific competencies are needed for specific TWH practices? What barriers do OSH professionals identify for implementing TWH practice approaches? This paper is structured as follows: First, the literature is reviewed regarding the development and use of competency frameworks and prior work to develop *Total Worker Health* professional competencies. Second, the study methodology is described. Third, results are presented,

starting with participant and focus group characteristics, then presenting results of TWH competencies, followed by barriers to implementing TWH practices. For the competencies and the barriers results, the results are presented in descending level of specificity – first by competency (or barrier) category types, then a frequency analysis describing the most salient competency (or barrier) themes, and finally, a "matrix" analysis that explores how competencies (or barriers) clustered by each of five TWH practice approaches. The paper concludes with a discussion of results and implications for future TWH education and research to continue supporting development of a TWH competency framework.

Theoretical Framework

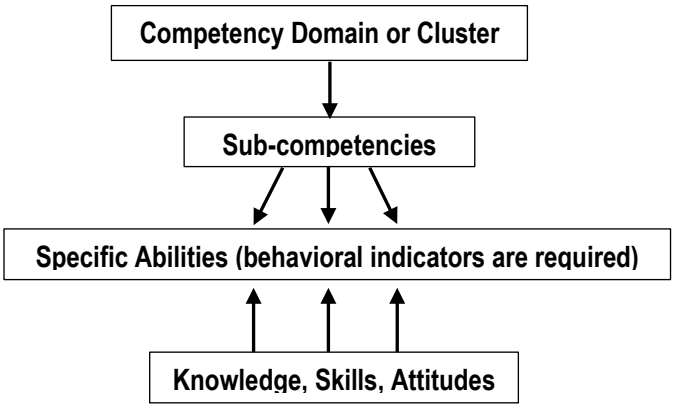
Professionals in the workforce have developed through training a specific set of practices, ethics, and behaviors, collectively referred to as standards or competencies (Smith & Roger, n.d.). Competencies provide a benchmarking standard for accountability to ensure individuals entering a profession have developed the requisite knowledge, skills, and attitudes needed to perform effectively in their job roles (Westera, 2001). In the health professions (including OSH professions), licensure or certification is required to ensure accountability to a high standard of practice that reflects performance standards specified in an established competency framework for the profession. Competency frameworks, which refer to a collection of competency domains, serve an essential role for guiding accreditation and curriculum standards in higher education and continuing professional education (Batt et al., 2020; Calhoun et al., 2002, 2008; Tanner , 2001). As professions evolve and change based on economic and social conditions, professional competency frameworks need to be updated and validated so that accrediting bodies and

educators can deliver education that prepares professionals for their job roles (Becker & Loy, 2004; Calhoun et al., 2002). Thus, competency frameworks are foundational to effective education delivery and evaluation.

A competency framework is the structure that defines the range of specific competencies needed to perform in a professional role. The framework provides clearly defined statements that operationalize how professionals demonstrate their knowledge and skills. The concepts involved in competencies address three major domains, including cognitive (intellectual knowledge and skills, such as facts, procedures, principles, and theories), affective (or attitudes, interests, values), and psychomotor (physical skills, doing things) (Bloom et al., 1956, 1964). Competencies often are comprised of sub-competencies (Figure 3.1) that can be observed and measured (Calhoun et al., 2002). For *Total Worker Health*, little or no empirical evidence is available to understand what competencies and sub-competencies (knowledge, skills, and attitudes) should be observed and measured. This study was designed to address this research gap.

Figure 3.1

Hierarchical Structure of Competency Frameworks



Note. This figure was adapted from Calhoun et al. (2002).

Literature Review

In the introductions to this dissertation (Chapter I) and in this paper, I described the evolution of the OSH professional to encompass new practice approaches that extend beyond OSH training curricula and established OSH competency frameworks. I also stated that a *Total Worker Health* competency framework was proposed but has not been validated. This study sought to generate evidence to support continued development of a TWH competency framework by utilizing practical knowledge from professionals with TWH experience. The goal was to understand what knowledge, skills, and attitudes are needed for TWH practice, and how do those competencies cluster within specific TWH practice approaches (Figure 3.2). This study explores five of the six TWH practice approaches in Figure 3.2. Competencies for the "ensure privacy" approach were not assessed in this study because this practice is standard for all health professionals, and not unique to *Total Worker Health*.

Figure 3.2

Six Elements of Total Worker Health Practice Approaches from Prior Literature

Note. There are some minor discrepancies in the number of defined TWH practice approaches. NIOSH describes five of the elements in this image (excepting "Assessment methods"). Other TWH scholars (Punnett et al., 2020) advocate a narrower list of four TWH practice indicators, which exclude the "Facilitate leader commitment" and "Ensure privacy" elements pictured here.

Prior Research to Define Total Worker Health Competencies

TWH practice involves broad-reaching knowledge domains applied to health risk assessment, organizational and individual level health interventions, worker engagement, and cross-functional (inter-disciplinary) coordination and collaboration (Punnett et al., 2020; Schulte et al., 2019). Collectively, these complex practice approaches call upon *inter-disciplinary* knowledge (from professions of occupational safety and health, environmental health, psychology, public health, health promotion) and *transdisciplinary* (or discipline-spanning) knowledge. In 2020, scholars and leaders in the OSH profession presented a proposed list of "cross-cutting core competencies" for TWH practice (Newman et al., 2020). The cross-cutting competencies were identified using an expert working group methodology, in which a diverse group of twenty-three experts from governmental agencies, academia, industry, and professional associations convened at a multi-day in-person roundtable conference in 2017 (Newman et al., 2020). The experts worked in small groups to produce consensus recommendations for grouping broad knowledge areas into key domains. Six competency domains were proposed (Figure 3.3) along with examples of broad knowledge requirements within each domain. These proposed competencies provided an initial categorized list of knowledge and skills proposed by experts to be essential for TWH practice. However, the "knowledge requirements" (figure 2, column 2) have not yet been operationalized as statements that describe performance standards, as would be needed to guide standardization of TWH curricula in higher education and continuing education settings. Thus, TWH educators do not yet have the tools needed to create effective learning activities and instruments for evaluating learning.

Figure 3.3

TWH Competencies and Knowledge Areas as Proposed by Newman et al. (2020)

Competency Domain	Knowledge Areas within the Domain
Subject Matter Expertise	- Technical and public health knowledge; occupational safety and health; health promotion; organization of work; business; and health services - Risk/Needs assessment, analysis and decision-making - Surveillance and research methods and analysis - Reading, interpretation, and practical application of research studies - Applied public health practices, approaches, and interventions
Partnership Building & Coordination	- Participatory collaborative, transdisciplinary, cross-functional teams and partnerships - Resource identification, workplace design, and organizational culture - Transdisciplinary, interdisciplinary, and integrated intervention teams and programs - Solution design that combines worksite safety, health promotion, and worksite wellness concepts - Measurement and evaluation tools
Communication & Dissemination	- Health safety and well-being literacy and behaviors - Health Communication strategies and teamwork - Evaluation of communication and marketing efforts
Advocacy & Engagement	- Ethics and worker representation - Diversity and cultural awareness - Social and community determinants of health - Training and education skills
Program Planning, Implementation, & Evaluation	- Public health programs and resources planning - Implement effective processes, practices/policy guidelines - Evaluation planning, methods, and resources
Leadership & Management	- Health systems and healthcare navigation strategic planning and leadership - Laws, standards, policy, and regulations - Multidisciplinary cross-functional teams

Note. Adapted from Newman et al. (2020).

Research is needed to continue development towards a formal TWH competency framework. Although the proposed competencies list in Figure 3.3 provides an initial inventory for educators to consider for TWH training curricula, research is needed to clarify professional practice performance standards and the associated knowledge and skills needed to achieve those standards. A hierarchical structure of primary competencies and sub-competencies that aligned with specific TWH practice approaches would be useful for curriculum design and evaluation. Newman et al. (2020) acknowledge possible overlap across domains in their inventory, and that levels of expertise within each domain still need to be defined. It is also possible that their list of knowledge requirements is incomplete (or incompletely defined). For example, Schulte et al. (2019) argue that with an expanded OSH paradigm, TWH practitioners need to have skills in systems thinking and "holistic analysis of worker health and wellbeing," which includes assessment of work-related and non-work-related health risks (p. 4955). These skills are not named specifically in the proposed competencies (Newman et al., 2020). A systematic process for identifying and validating competencies across many types of practice settings is vital for being able to communicate what OSH professionals need to know, do and value to work effectively as a TWH practitioner. On a practical level, without validation, poorly defined competencies can create inconsistent definitions and interpretations of TWH practice, with resulting poor ability to teach and evaluate performance against a common curriculum.

To advance the development and validation of a TWH competency framework, a systematic research effort is needed to illuminate all key competencies that are relevant across the breadth of TWH practice and clarify and rank the importance of those

competencies for specific practice approaches. Getting feedback from different OSH professionals across different practice settings will be important for broad utility. Prior research to develop and validate competency frameworks in fields of public health and health sciences has included a combination of methods such as literature review, consensus panels, Delphi method, group techniques, mapping exercises, and surveys and focus groups. These methods engage a wide audience of academic and professional stakeholders to review, refine, classify and prioritize professional practice competencies (Batt et al., 2020). Work to date to define TWH competencies is still in the early stages, with progress made in generating a pool of knowledge areas and organizing them into a preliminary set of domains. However, no further work has taken place to collect feedback from practitioner groups or curricular stakeholders to validate and expand upon prior work. New research activities could include mixed methods (interviews and/or focus groups, group techniques such as Delphi method) and surveys to assess practitioners' perceived priorities based upon their lived experiences in practice.

Developing competencies for emerging professional practice is challenging because the practice is evolving in real time, scholarly literature is slow to develop, and disseminating knowledge throughout professional communities can be fragmented and complex. There is scarce literature addressing methodology for competency definition in fields of emerging practice. Holmes and Scaffa (2009) used a Delphi approach to identify emerging practice competencies in leadership and entrepreneurship for occupational therapy (OT) practice. They recruited OTs working in "emergent" settings to gain their insights about essential abilities, qualities, skills, and knowledge for emerging leadership practice roles and how best to develop these competencies in future professionals.

Systematic data collection from professionals with real-world TWH experience is a gap in the TWH competency development work to date. Given the diversity of specialties within the OSH field, it would be useful to collect perspectives from a variety of OSH professionals with experience in TWH practice. Understanding how professionals view the TWH competencies and which aspects are new or different from their disciplinary training would be useful as experts grapple with the question of delineating TWH as a practice or a profession. This study aimed to contribute evidence needed for developing a TWH competency framework by assessing perspectives of OSH professionals who are actively implementing TWH practices. The research questions were:

1. What specific competencies (knowledge, skills, attitudes/values) do occupational safety and health professionals need to successfully implement *Total Worker Health* (TWH) practices in the workplace?
2. What specific competencies are important for specific TWH practice approaches?
3. What barriers do OSH professionals identify, if any, for implementing TWH practices?

Methodology

This study used a qualitative exploratory design involving structured focus groups to explore perspectives of OSH professionals regarding competencies needed (and barriers) to implement TWH practice approaches in the workplace. Participants targeted for this study included professionals from four core OSH disciplines, including industrial hygienists, safety professionals, occupational health nurses, and occupational physicians (McAdams et al., 2011); along with professionals responsible for workplace wellness programs. Convenience sampling was used, with the goal of recruiting professionals

employed in a range of industrial settings, and a combination of those delivering OSH services “in-house” (for a single employer) and “externally” as consultants serving multiple organizations. Professionals with experience in the TWH emerging practice context were targeted because they have valuable insights about the knowledge and skills required to perform the new ways of TWH practice. In this study, professionals were asked to identify specific competencies (i.e., knowledge, skills, and attitudes/values) and barriers relevant for five specific TWH practice approaches. Matrix queries were used to explore relationships of competencies or barriers with the specific TWH practices to gain insights relevant for future educational curricula.

Recruitment

Focus group volunteers were screened and identified for participation with a *Total Worker Health* education needs assessment survey (Appendix A). The survey items are described in Chapter I. A standard study announcement with a link to the online survey was sent to key contacts at selected OSH professional associations and to NIOSH *Total Worker Health* Centers for Excellence (see Table 2.1, Chapter II), which deliver TWH education and outreach to multidisciplinary OSH professionals. A $100 gift card drawing was offered as an incentive to participate. Survey eligibility criteria included 1) current employment (minimum 20 hours/week), and 2) certification, training, education in a core OSH discipline (safety, industrial hygiene, occupational medicine, or occupational health nursing). Survey participants were screened for focus group eligibility, which included the above criteria 1 and 2, plus following conditions: 3) delivers OSH services to employer organizations; 4) prior participation in at least one TWH training/education activity; and 5) history of active implementation of TWH practices over a period of time

(score of 3 or more on TWH experience variable, see Instruments section). All survey participants who met screening criteria for conditions 3-5 were asked if they would like to be contacted for inclusion in the focus group portion of the study. If they replied yes, then they were invited to participate in the focus group. A total of 210 OSH professionals responded to the survey; of the 41 participants to asked to be contacted for a focus group, 19 participated.

Focus group volunteers were contacted by email to schedule participation in a 90-minute session to take place virtually using Zoom conferencing software (Zoom Video Communications, Inc., n.d.). A gift card drawing, valued at $100, was offered as an incentive for each focus group session. Volunteers individually replied to the email invitation with their available dates; once groups were formed, participants were sent a confirmation email with calendar invitation. Group size was limited to 3-6 people to optimize participant interactions in the virtual environment (Lobe et al., 2020; Nobrega et al., 2021). To the extent possible, groups were formed based on specific OSH discipline (industrial hygiene, safety, occupational health nurses, occupational physicians) to facilitate ease of discussion among members with similar job roles. Where possible, group members were selected to ensure representation from diverse settings of practice.

Participants received written informed consent one week in advance of their session that explained their rights, the rationale and procedures for audio recording the focus group session, and how their privacy would be protected. Participants were also offered an opportunity for a brief Zoom practice session to familiarize them with the screen interface, including the controls for setting their screen name to a pseudonym to

protect privacy. This material was reviewed again at the start of the session before the discussion and recording began.

Data Collection

The TWH education needs assessment survey was administered online using Qualtrics survey software, (Qualtrics, 2022). The 60-item survey (Appendix A) included eight variables to describe focus group participants that were used in this study. These variables included prior TWH experience and TWH training (2 items) and occupational characteristics such as job role (2 items), OSH experience and career stage (2 items), and employer size and location (2 items). The University of Massachusetts Lowell Institutional Review Board (IRB) reviewed this study and determined the activities were exempt from IRB oversight. Even so, IRB human subjects guidelines were followed.

Virtual focus groups sessions were facilitated by the lead investigator, who has experience in online focus group facilitation (Nobrega et al., 2021) and has expertise TWH practices. A research assistant also attended and assisted with monitoring the chat window, providing time-keeping cues to the facilitator, entering question prompts in the chat window, and responding to technical or other needs during the focus group. The facilitator used a time agenda and structured script along with slides containing the question prompts (shared on screen) to ensure consistency of questions between groups.

The focus group questions included initial introductions, followed by three main topic segments, as shown in Table 3.1. Participants began by introducing their professional role in relation to TWH and describing an example of TWH practice. Next, the facilitator introduced the concept of professional competencies, along with subdomains of knowledge, skills, and attitudes/values (Chapter I); these definitions were

reviewed so that participants would be prompted to consider all domains in their responses. The main focus group questions began by asking participants to reflect and discuss generally whether and how, upon beginning to implement TWH practices, they began using competencies that were different from their OSH training. Next, participants were asked to reflect on and discuss 1) competencies needed and 2) barriers encountered (or anticipated), when implementing five specific TWH practices approaches. Responses related to competencies prompts were collected verbally and responses related to barriers were collected through the chat window. Some chat responses were also discussed verbally if the facilitator probed for clarification.

Table 3.1

Focus Group Questions

Section	Question prompts
1.Introductions	What is your current role in TWH? What is one example of TWH practice in your organization?
2.Differentiating TWH and OSH competencies	What competencies (knowledge, skills, attitudes) did you need to begin using? What was different about TWH from what you had been doing?
3.Competencies for specific TWH practices	What competencies (knowledge, skills, attitudes) did you need for this practice approach? What barriers did you encounter for this practice? Practice #1. Assessment methods identify work and non-work risks Practice #2. Design workplace interventions to eliminate hazards and promote well-being Practice #3. Safety, health, and wellbeing (SHW) systems are integrated Practice #4. Facilitate leadership commitment to SHW at all levels of the organization Practice #5. Workers are engaged in all phases of program design and implementation
4.Interprofessional education	Chat Prompts: What would be the most important benefits to you from a TWH interprofessional education experience?

	What recommendations do you have about course design that bout maximize value and meaning for interprofessional learning?
	What recommendations do you have about course design that bout maximize value and meaning for interprofessional learning?

The last segment of the focus group began by introducing the concept of interprofessional education (IPE), including the specific educational goals of building trust and teamwork, enhancing communication, and valuing of other disciplines. Participants were asked to respond to three question prompts (Table 3.1) by typing into the chat window. The IPE responses will be reported in Chapter IV.

Audio and chat text data were recorded and written transcripts were produced for all but one focus group session within the Zoom conferencing software (Zoom Video Communications, Inc., n.d.). Data from one unrecorded session were collected in written notes, then validated with participants. Audio, chat, and transcription data were exported from Zoom and saved on a university-secured network drive. Zoom transcription text was manually cleaned within one week of the recording to remove text indicating partial vocalizations and edit to correct misspellings and misattribution of speakers. Cleaned transcripts were imported to NVivo (QSR International, 2022) for coding and analysis.

Data Analysis

Competency Types and Themes

Competencies data were coded in three phases. In Phase 1, the transcript data from the five focus groups were coded by one researcher to assign the narrative from focus group sections 2 and 3 (Table 3.1, above) to nodes that reflected each *Total Worker Health* Practice approach. In phase 2, two researchers coded the data within each practice approach to one of three parent competency nodes that reflected Bloom's competency

domains – cognitive (i.e., knowledge), psychomotor (i.e., skills), and affective (i.e., attitudes) – using the definitions below in Table 3.2.

An inter-rater reliability kappa score of 0.65 was computed by using a coding comparison query procedure (QSR International, 2022) to evaluate initial coding agreement for all three competency domains. Although this initial score indicated acceptable (e.g., fair to good) agreement between coders, the two researcher coders discussed and reconciled discrepancies, after which a kappa score of 0.97 was achieved. A matrix analysis was performed in NVivo to assess the distribution of references for each competency type by TWH practice approach. The intent of the matrix analysis was to look qualitatively at the preponderance of competency types that professionals perceived to be important for the different TWH practices.

Table 3.2

Node Definitions for Competency Type Coding

Node Name	Definition
Knowledge	Statements about intellectual knowledge and cognitive skills needed to perform a TWH practice approach. Examples: Subject knowledge, facts, procedures, principles, and theories, computations, scientific or medical knowledge, regulations
Skills	Statements about psychomotor abilities to accomplish or demonstrate a TWH practice approach (i.e., "doing" skills). Examples: Professional behaviors, communication methods, performing data analysis, operating exposure assessment equipment.
Attitudes	Statements about participants' or others' beliefs, values, or interests in relation to worker SHW topics of discussion. Examples: Professionals' feelings towards workers, perceptions about the value that leaders place on worker wellbeing.

In Phase 3, data within each competency parent node (knowledge, skills, attitudes) were coded to specific competency-themed child nodes by one coder, using a combination of open coding and comparison with constructs from interdisciplinary collaborative practice frameworks (Bronstein, 2003; Petri, 2010). During the thematic coding process, theoretical memos (Gibbs, 2018) were written to explore emergent theories related to disciplinary, organizational, or other factors relevant for TWH competencies, interdisciplinary collaboration, and optimal design of TWH continuing education. The intent of thematic coding was to describe specific knowledge, skills, and attitudes that OSH professionals perceived to be important for each TWH practice approach. Interdisciplinary collaborative practice frameworks were relevant because TWH practice requires collaboration and knowledge sharing across disciplines (e.g., safety, health promotion, mental health) to accomplish an integrative programmatic approach to workplace SHW. Examples of constructs from interdisciplinary collaborative frameworks include relational (interpersonal) skills, communication, role clarity (Bronstein, 2003; Petri, 2010), professional identity attitudes (Hall, 2005; Khalili et al., 2013; Thomson et al., 2015), and organizational and leadership support factors (Bronstein, 2003; Moilanen et al., 2020; Petri, 2010; Suter et al., 2009). A second researcher reviewed the child node data to assess face validity of themes and reliability of data coded within the themes. Discrepant views were discussed and reconciled by the two researcher coders. See Appendix C (Table C1) for the node structure and definitions used for coding the transcript data.

After thematic coding was completed, exploratory queries were performed in NVivo to describe competency themes relevant for each TWH practice approach and to

assess which competencies, if any, professionals identified as cross-cutting for all TWH practice approaches. Matrix query results were generated based on both the number of data pieces coded (references) and the number of participants (number of cases) in relation to specific themes. Matrix analyses were performed to assess 1) the distribution of competency types (knowledge, skills, attitudes) for each TWH practice, and 2) the distribution of specific competency codes within each TWH practice. A matrix analysis was also performed to assess the prevalence of TWH competency themes that were discussed across the five focus groups.

Barriers to TWH Practices

Barriers from focus group section 3 (Table 3.1) were coded using the 3-phase procedure outlined above for competencies. In phase 2, the responses were coded by one researcher according to whether the source of perceived barriers was personal (from the OSH professional participant), organizational (from leaders or other program professionals in the workplace), or from workers (beneficiaries of TWH programs). Once again, theoretical memos (Gibbs, 2018) were written during the coding process to explore emergent themes and to document insights for analysis and interpretation of the eventual coded data. A single researcher then assigned data from parent barrier nodes (organizational, personal, worker) to specific barrier-themed child nodes based on themes that emerged from open coding and from theoretical memos. A second researcher reviewed the child node data to assess face validity of themes and reliability of data coded within the themes. Discrepant views were discussed and reconciled by the two coders. See Appendix C for the complete node structure and definitions used for coding the transcript data.

Participant Characteristics

Response frequencies (number and percent of sample) were computed in SPSS (IBM Corporation, 2021) for eight participants in terms of occupation (OSH discipline), career stage, TWH experience, OSH client type ("internal" provider vs consultant), and organizational size (see Table 3.3 for response values). The variable "state employed" was converted to U.S. region using Census categories (U.S. Census Bureau, 2021).

Table 3.3

Participant Characteristic Variables and Response Values

Variable	Response Values
OSH discipline)	1 = Safety (includes EHS, Ergonomics), 2 = Industrial Hygiene, 3 = Occ health nurse/physician, 4 = Wellness
OSH experience	0 = None at all; 1 = very little; 2 = some; 3 = moderate; 4 = good amount; 5 = A lot
Career stage	1= Early career; 2 = Mid-career; 3 = Advance career
Prior TWH experience[a]	3 = Intermediate. I have been implementing TWH in my practice for some time
	4 = Advanced. I am working towards implementing all elements of TWH practice, including organizational structures to support integration of SHW systems
	5 = Expert. I have fully implemented all elements of TWH practice, including organizational structures to support integration of SHW systems
Prior TWH education	1 = None. I have not participated in any TWH education
	2 = Beginner. I have attended one or more educational sessions (e.g., webinar, presentation, etc.) to learn TWH basic concepts
	3 = Intermediate. I have attended multiple hours (or courses) in TWH education to learn how to implement TWH approaches (e.g., in-depth e-learning course, full day course, ongoing professional learning community, etc.)

	4 = Advanced. I have completed/am pursuing a TWH certification program (multiple courses) to build comprehensive competencies TWH practice 5 = Expert. I have completed advanced TWH training and have taught TWH practices to other professionals.
OSH clients	1= Serves single employer organization where participant is employed (internal OSH); 2 = Serves employer clients other than current employer (external OSH); 3 = Both (internal and external OSH services)
Organization size	1 = 1 to 50 employees; 2 = 51 to 250 employees; 3 = 251 to 1000 employees; 4 = More than 1000 employees

Note. [a]Minimum score of 3 was required for focus group participation.

Results

The results are organized according to three parts: 1) participant and focus group characteristics, 2) competencies for *Total Worker Health* practice approaches, and 3) barriers to *Total Worker Health* practice approaches. The TWH competencies section presents two sub-sections. The first sub-section presents an overview of the competency types (knowledge, skills, attitudes) for each of five TWH practice approaches. The second subsection presents 20 competency themes, with analysis of cross-cutting and approach-specific themes. The final section presents OSH professional perspectives about barriers to TWH practices. Similar to the TWH competencies results, an overview of barrier type (organizational, personal, worker-related) by TWH practice approach is presented first, followed by an analysis of 17 barrier themes, and the extent to which specific themes cluster around specific TWH practice approaches or are relevant across multiple TWH practices.

Participant Characteristics

Participants were from all regions of the U.S., with nearly half from the Western U.S (Table 3.4). The sample represented all of the core OSH disciplines, including safety, industrial hygiene, occupational health nurses and physicians (one in this sample), plus three worksite wellness professionals. The majority (84%) identified themselves as advanced or mid-career stage. A little over one half (58%) of participants were employed by employers with more than 1000 employees and provided OSH services internal to those organizations. Slightly more than half (52%) provided OSH consulting services either exclusively, or in addition to serving their employer. About a quarter of participants (26%) were employed by firms with fewer than 50 employees; three of those five were in firms with 10 or fewer employees.

Table 3.4

Survey and Focus Group Participant Characteristics

Variable	Survey n	Survey (%)	Focus Group n	Focus Group (%)
Job Role	(n=210)		(n=19)	
Safety, Environmental Health and Safety or Ergonomics	66	31.4 %	5	26.3%
Industrial Hygiene	35	16.7 %	7	36.8%
Occupational Health Nurse	25	11.9%	3	15.8%
Occupational Health Physician	23	10.9%	1	5.2%
Wellness	14	6.7 %	3	15.8%
Researcher/educator	14	6.7 %	0	0
Other (Nurse, operations, risk management, HR, etc.)	21	15.7%	0	0
Career stage	(n=208)		(n=19)	
Advance career	95	45.5 %	9	47.4%
Midcareer	66	31.6 %	7	36.8%
Early career	47	22.5 %	3	15.8%

Occupational Safety and Health Client	(n=207)		(n=19)	
Internal client (own employer)	101	48.8 %	9	47.4%
External clients (consulting clients)	50	23.8 %	4	21.1%
Both internal and external clients	41	19.5 %	6	31.6%
Other (do not provide OSH Services)	15	7.1%	0	0
Employer size	(n=198)		(n=19)	
More than 1000 employees	109	55.1 %	11	57.9%
251-1000 employees	33	16.7 %	2	10.5%
51-250 employees	17	8.6 %	1	5.3%
1-50 employees	39	19.7 %	5	26.3%
US Region [a]	(n=185)		(n=19)	
West	58	31.4 %	9	47.4%
Midwest	30	16.2 %	4	1.1%)
South	34	18.4 %	3	15.8%
Northeast	58	31.4 %	3	15.8%

Note. [a] US Census Bureau classification used. [b]Minimum of intermediate was required to participate in a focus group.

Focus Group Size and Composition

Five focus group sessions were administered during fall 2022. Each session involved 3-6 participants per group from mixed OSH disciplines (safety, industrial hygiene, occupational health nurse/physician, and wellness professionals (Table 3.5).

Table 3.5

Focus Group Size and Participants by Session

Focus Group	Number of Participants	Discipline [a]
1	3	2 S, 1 IH
2	6	1 S, 4 IH, 1 W
3	3	1 S, 1 IH, 1 W
4	4	1 S, 2 OH, 1 W
5	3	1 IH, 2 OH

[a] S = Safety, IH = Industrial hygiene, OH = Occupational health nurse or physician, W = Wellness

Total Worker Health Level of Experience and Training

Focus group participants reported having either an intermediate or advanced level of TWH experience (Table 3.6). About half reported actively working towards

implementing all elements of TWH practice, including organizational structures to support programmatic integration of worker SHW systems. Notably, no participants classified themselves in the expert category, in which they achieved implementation of all TWH practice elements. Despite reporting intermediate or advanced levels of TWH experience, participants' self-reported level of TWH education was distributed broadly from no prior TWH training (3 participants) to expert (1 participant). Nine participants reported they had previously attended multiple training sessions to learn how to implement TWH practices. Two reported participating in a formal TWH certification program.

Table 3.6

Participant Total Worker Health Experience and Training

Variable	All Focus Groups n=19	
	n	(%)
Total Worker Health Experience[a]		
Intermediate	10	52.6%
Advanced	9	47.4%
Expert	0	0.0%
Total Worker Health Training		
No prior TWH education	3	15.8%
Beginner	4	21.1%
Intermediate	9	47.4%
Advanced	2	10.5%
Expert	1	5.3%

Note. [a] Minimum score of 3 (intermediate) was required for focus group eligibility.

Competencies for TWH Practice Approaches

The focus group data were coded by *type* of competency (i.e., knowledge, skill, or attitude), then were *thematically* coded. The distribution of competency types by TWH

practice approach is summarized in Table 3.7 and discussed in the next section, below. Twenty TWH competency themes were identified (see Table 3.8). Each theme comprises statements (references) from at least four participants, which appeared in a minimum of two (but often 4 or 5) focus groups (Appendix D). This degree of representation indicates that, for this study sample, the themes were consistently salient to professionals across different groups and were not idiosyncratic artifacts of specific discussions.

Competency Types

Across all TWH practice approaches (1-5) participants identified examples of all competency types (knowledge, skills, and attitudes) as relevant for TWH. Overall, knowledge and skills competency domains were discussed to a much greater degree than competencies in the attitudinal domain (Table 3.7). The relative importance of different competency types varied somewhat by the specific TWH practice approach. For example, knowledge-based competencies were somewhat more predominant for TWH practice approaches 1 and 2, comprising roughly half of their total references. These approaches (risk assessment and intervention design) require technical and content knowledge for development of instruments and interventions, as described in more detail in the "Specific Competencies" section below. By contrast, competencies in the skills domain (having to do with communications and interpersonal relations) seemed most important for TWH practices 3 (systems integration), 4 (leadership commitment), and 5 (worker engagement), reflecting the people-focused nature of these practices. Skills-based competencies were particularly important for TWH Practice 4, comprising 63% of references (67% cases) coded. Attitudinal competencies, mentioned least often for every

TWH practice (range 1-12 references), were most salient for TWH Practice 5 (12 references for worker engagement vs 1-7 references for TWH practices 1-4).

Table 3.7

Competency Types Identified for Total Worker Health Practice Approaches

Total Worker Health Practice Approach	Knowledge # References (# Cases)	Skills # References (# Cases)	Attitudes # References (# Cases)
1 - Assessment methods identify work and non-work risks	29 (14)	18 (12)	6 (5)
2 - Design workplace interventions to eliminate hazards and promote wellbeing	15 (9)	11 (9)	7 (5)
3 - SHW systems are integrated	12 (9)	16 (12)	1 (1)
4 - Facilitate leadership commitment to SHW at all levels of the organization	10 (6)	21 (16)	2 (2)
5 - Workers are engaged in all phases of program design and implementation	10 (8)	17 (12)	12 (9)
Total number of references	76	83	28

Table 3.8

Distribution of Competencies by TWH Practice Approach (n = 19 participants)

Competency Theme	Total References	Total Cases[b]	Practice 1 Assess Work & Non-work Risks # References (# Cases[a])	Practice 2 Intervention Integration # References (# Cases)	Practice 3 Systems Integration # References (# Cases)	Practice 4 Leadership Commitment # References (# Cases)	Practice 5 Worker Engagement # References (# Cases)
Knowledge							
1: Organization/business	18	14	2	0	8 (7)	8 (5)	0
2: Assessment instruments	19	11	19 (11)	0	0	0	0
3: Total Worker Health concepts	14	9	3	9 (4)	0	1	1
4: Occ. safety and health tenets	7	6	3	2	0	0	2 (1)
5: Workforce characteristics	8	6	2	2 (1)	0	0	4 (3)
6: Evidence-based interventions	8	5	0	4 (3)	4 (2)	0	0
7: Diversity, Equity, Inclusion	6	4	2 (1)	0	0	0	4 (3)
8: Other knowledge	4	4	2	1	0	0	1
Skills							
9: Communication - general	21	20	2	0	5	7 (6)	7
10: Communication - business case	15	12	1	0	2	12 (9)	0
11: Evaluation methods	18	12	10 (6)	3 (2)	3 (2)	0	2
12: Collaboration	10	9	3	2	4 (3)	0	1
13: Relational/interpersonal	9	9	2	1	1	0	5
14: Leading teams	8	7	0	3	2 (1)	1	2
15: Other skills (remote tools)	3	3	0	1	0	0	2
Attitudes							
16: Respect for worker knowledge	10	8	0	3 (2)	0	0	7 (6)
17: Flexibility	7	6	0	4 (3)	0	1	2
18: Concern for workers	6	5	5 (4)	0	0	0	1
19: Leader support for TWH	4	4	1	1	1	0	1
20: Other attitudes	3	3	0	0	0	1	2

Note. [a]Case count added if different from reference count. [b]Total cases may exceed 19 because participants may be counted more than once across TWH practice approaches.

Competencies Relevant for Multiple TWH Practice Approaches

Themes of communication, collaboration, team leadership, relational skills, and evaluation methods, and knowledge of *Total Worker Health* concepts were identified as relevant for the majority (at least four) TWH practices (Table 3.8). Participants discussed the importance of interpersonal (relational) skills for developing trusting relationships with other program leaders, but to a greater extent with workers. According to OSH professionals in this sample, trusting relationships are important for workers to feel secure sharing sources of safety and health concerns, and particularly non-work hazards that can't be observed in the workplace (Table 3.9).

Table 3.9

Quotes that Illustrate "Relational Skills" Competency Theme

Theme	Example quotes	Frequency *n*
Relational Skills	"I know a lot of the folks pretty well. They confide in me, and that helps with […] assessments." Safety Professional "In my experience the best health and safety professionals are [those with] boots on the ground, walking around talking to everybody and getting direct feedback. … just making sure that [professionals] have those interpersonal skills to speak to people face to face and not just through email and texting." Occupational Health Nurse "I think skills both in the regulatory arena and fundamentals of health and safety are critical but also soft skills to elicit personal responses and emotions that may help lead to specific questions. Particularly for non-work hazards that may not be observed." Industrial Hygienist	9

Communication. Participants in every focus group discussed communication related competencies more often than any other competency except for assessment and evaluation (Table 3.8 and Appendix D). A majority (14 of 19 participants) identified the

importance of *general communication* skills (listening to understand stakeholder needs and framing messages effectively to persuade stakeholders) and about half (10) identified *"business case" communication skills* (communicating about TWH in relation to organizational goals or "return on investment") which are important for gaining leadership support for TWH activities (Table 3.10). These skills were discussed most often as essential skills for TWH Practice 3 (systems integration), 4 (facilitating leadership commitment to worker safety and wellbeing) and 5 (engaging workers in safety and wellbeing efforts). The two communication themes together were most concentrated in TWH Practice 4 (facilitating leadership commitment) indicating the centrality of communication for gaining the support and involvement of diverse stakeholders across an organization at all levels to improve work processes and working conditions. Interdepartmental communication was recognized as important for creating program linkages and for effectively engaging workers.

Table 3.10

Quotes that Illustrate "Communication" Competency Theme

Theme	Example quotes	Frequency *n*
General communication skills	"Learning to speak the language of business leaders … I think that was the biggest learning curve. Understanding how to get to them, and once you got there, then they listen to everything you said." Occupational Health Nurse	21
Business case communication skills	"… it's [important] to explain it to leadership because if they're not on board with this, it's really hard to make it trickle down." Occupational Health Nurse "…learning how to listen first among different organizations and levels of the leadership. And that can really help you just tap into what's been working well for years." Injury Prevention Specialist	15

	"I definitely had to better understand how to conduct ROI assessments." Safety Professional
	"…for coordinating systems, we have monthly all hands meetings. It always starts with safety events and HR always talks, so... clearly communicating what groups are doing what things so you know who to talk to if you have questions." Safety Professional
	"You have to be able to communicate up and down, to be comfortable … relaying what you've heard … from the broader workplace to the leadership." Industrial Hygienist

Organizational Knowledge. Similar to the Communication theme, 14 of 19 participants across all focus groups identified organizational knowledge as a key TWH competency (Appendix D). This competency, closely related to communication, was identified as especially important for TWH Practice 3 (systems integration) and TWH Practice 4 (leadership commitment). Organizational knowledge includes knowing who the stakeholders are and their level of commitment to worker safety and health; what policies and programs are in place that are relevant to TWH and where they are situated in the organization; how work processes are organized throughout the organization; what beliefs and values are promoted in the organization; and what goals and metrics the organization (and program units) are used to measure performance (Table 3.11).

Table 3.11

Quotes that Illustrate "Organizational Knowledge" Competency Theme

Theme	Example quotes	Frequency *n*
Organization, business knowledge	"The most important thing for [systems integration] is being able to walk outside the silos and see how they all connect, and … communicate with them." Safety Professional	18

"Before you begin anything, you need to understand the resources your company does have. You need to understand the ins and outs of the [programs relevant for TWH]." Occupational Health Nurse
"I think it is important to understand how a business works, what benefits [programs] are there, how people are employed." Industrial Hygienist
"The knowledge certainly came with … professional experience and understanding the different culture and belief systems across our organization." Safety Professional
"By understanding what each organization [department] needs for their compliance goals, then we can see [how] we should be working together." Injury Prevention Specialist

Competencies Relevant for Specific TWH Practice Approaches

Assessment and evaluation themes dominated the discussions around TWH Practice 1 (assessment of work and non-work risks) (Table 3.8). Knowledge of assessment instruments was discussed in every focus group session (19 references from 11 participants: Appendix D). Participants stated that professionals intending to implement this TWH practice need to know *what variables* should be measured and *which instruments* they should use that are reliable and valid. Evaluation methods, although related to assessment instruments, referred to professionals' skills for collecting and analyzing a broad range of data in ways that were new to them. The following sections will discuss several sub-themes within these two themes.

Knowledge About TWH Risk Assessment Instruments. Several participants expressed that it is important to know "how to identify evidence-based surveys" and that it would be desirable to locate tools that are "standardized for use across industries and looked at over time." Some participants were skeptical whether a single tool could fit all

needs because OSH professionals are asked by their clients (organizational units or client companies) to collect and interpret various kinds of health and safety data. Having to respond to a diversity of requests from clients places more responsibility on OSH professionals to have a broad knowledge base of variables (e.g., safety indicators such as injuries, safety climate, pain, job stressors; and health indicators such as diagnosed conditions, health behaviors) and to know how to use the data collected.

Locating reliable, valid instruments was a competency discussed by professionals from multiple disciplinary backgrounds. For example, and occupational physician stated needing to know about "validated data collection tools with a dashboard to be able to see indicators in real time" and a wellness professional expressed the value of knowing about instruments that can be trusted and that are specifically tailored for TWH. He stated:

> I had previous leaders that wanted to do their own assessment [tool] … which led to me wonder if it was a valid assessment or not ... I appreciate when you have directed, validated assessments … for *Total Worker Health*.

Some participants reported using established tools from public health agencies or partnering with academic research centers to develop validated tools. The Worksite Health Scorecard (Roemer et al., 2022) was specifically mentioned by an occupational health nurse as a tool that is "easy to start with for companies" to help them take a "broad brush [scan of] the environment of a facility to see if they're looking at things from a *Total Worker Health* perspective." Another participant who advises small businesses on implementing TWH programs elaborated that OSH professionals not only need to know where to find validated instruments, but they also need to know when to use survey tools to measure employer versus employee-level variables. He stated:

> We have seen a need to explain the difference between an organizational survey (filled out by a few people at the workplace) and an individual (employee survey) and how and when to use both instruments and the value of the data collected in each one.

Although smaller businesses typically have fewer resources to employ personnel with dedicated expertise in safety and health risk assessment and control (Harris et al., 2014; Linnan et al., 2019; McCoy et al., 2014), knowledge and capacity for survey data collection may be limited even in larger organizations. Building knowledge about validated instruments and their application would be useful for OSH professionals serving organizations of any size.

Psychosocial Risk Assessment. A second sub-theme related to assessment instrument was acquiring competencies for assessment of *psychosocial work conditions* that affect, or are affected by, mental well-being. Psychosocial working conditions refer to psychological and social aspects of work such as job demands, job control, work organization, or social relations (e.g., social support, harassment, incivility, bullying) that can positively or negatively influence mental or physical health (Rugulies, 2019). Knowledge related to psychosocial work environment and implications for health seemed to be a work in progress for many participants in this study. Most participants discussed what they think professionals need to know for TWH assessment practices but have not yet mastered themselves. A senior level industrial hygienist contrasts OSH professionals' ease of measuring "traditional" safety hazards with a new need to measure "unseen" job stressors. He then goes on to express the need to be able to create reliable data collection instruments for this purpose, stating:

> We have the skills to measure traditional safety hazards, and now we're looking to measure both things seen and unseen. The unseen risk factors [stressors] are those things that can accumulate over time. We need competencies in creating reliable means to identify hazards that may not be related to the physical environment. That [competency] looks like the ability to create surveys, focus groups, and employee engagement campaigns to understand what the unseen risks and hazards are in the minds of employees.

Gaps in knowledge related to psychosocial work conditions and their measurement were evident for OSH professionals across disciplines. A wellness professional described past struggles with developing appropriate health survey questions. He struggled to understand how survey questions about co-worker support (e.g., in my workgroup, we have a sense of community) and organizational health culture (e.g., supporting employee wellness is among the top priorities in this organization) could produce "actionable" survey results. He stated, "The other thing with these assessment [questions] is ... is there something that we can change? Is ... it within our scope of being able to do something about it?" This wellness manager did not appear to grasp the relatedness of work climate (or possibly work environment generally) for health and/or did not see these areas amenable to intervention. Having a command of the evidence supporting correlations between psychosocial work experience and health status could strengthen professionals' ability to 1) justify measuring work variables alongside health variables and 2) develop multi-level, comprehensive hazard controls and health promotion.

Knowledge of measures to capture and prioritize risks in both the physical and psychosocial work environment domains allows for the possibility of designing

interventions that address work stressors as part of a broader TWH effort. Building knowledge of psychosocial work stressors and their causal role in SHW outcomes seems like a priority for TWH continuing professional education, particularly for professionals will little prior training in workplace safety and health.

Specific Challenges for Psychosocial Risk Assessment

Industrial hygienists discussed specific difficulties in relation to psychosocial risk assessment. One difficulty is a lack of familiarity with validated, reliable measures (e.g., attitudinal scales) of perceived psychosocial work environment conditions. Another challenge is trusting self-reported measures that cannot be directly and objectively observed in the workplace. A third challenge is uncertainty how to use psychosocial measures for controlling hazards when there are no regulated standards for these variables. In the following examples, three industrial hygienists express their struggles with these challenges. Fist, a university based industrial hygienist discusses the use of attitudinal data in workplace hazard assessment. She stated:

> I do think that you need evidence-based surveys, which can be difficult, because some of some of the client requests are … not easy to provide a quantitative result. So, things like attitudes, how people are feeling … you are basically taking someone else's word for how they are feeling. It's not something that you, as the assessor, can determine. So, I think that it's a lot of balancing, to do the *Total Worker Health* approach.

When probing to further explore this participant's meaning of the concept of 'balancing', she raised a concern about interpreting survey results for psychosocial variables, for which there are no regulated exposure limits or standards for hazard management as

recognized by the U.S. Occupational Safety and Health Administration (OSHA). She stated:

> So, we talk about evidence-based surveys, and you know, quantitative data. But there's also a lot of things that can't be quantitatively determined. They're much more qualitative, and [OSH professionals need to] … I guess, balance emotions of some of the clients, and how they perceive some of the hazards that may or may not have a standard attached to it. So, it may not be recognized by any regulatory agency or industry as being an occupational health hazard.

An industrial hygienist employed by a small (under 50 employees) risk consulting firm endorsed the need for training in qualitative methods, stating "Many IH professionals may not have been taught these kinds of elicitation skills." A third hygienist further expressed feeling challenged to "evaluate, interpret, and analyze" qualitative data especially because open ended questions can "yield a variety of responses." She further stated, "I had to develop more [skills] around presenting the scientific research to back up, like, that these types of [TWH] approaches are validated. Especially qualitative approaches, when you're talking to people who have very quantitative scientific backgrounds, explaining … [that] qualitative information is still data. It's still very valuable. … we need, as a field of industrial hygiene, to become a little bit more comfortable working with that."

Using a TWH approach to assessment necessitates consideration of attitudes and health and social conditions that cannot be directly observed. Many OSH professionals in this study expressed they feel unprepared to collect and use self-reported data related to psychosocial working conditions and mental health status. OSH professionals and

wellness professionals can benefit from specific training on psychosocial work conditions, how they are measured, their potential influence on health and safety outcomes, and intervention approaches for ameliorating excessive sustained job stress. Professionals can benefit from understanding how to collect, analyze, and use employee self-reported data prioritize and communicate the evidence for workplace improvement opportunities. Strengthening competencies in psychosocial assessment and intervention would be a valuable component of future TWH continuing professional education.

Skills in Evaluation Methods. Three sub-themes within evaluation methods that emerged were general ambivalence regarding the use of self-reported data, competencies in qualitative data collection and analysis, and the ability to collect and integrate a variety of variables across multiple sources and synthesize findings for intervention planning. Each sub-theme is discussed with illustrative quotes below.

Assessment of Hazards Outside the Workplace. Some participants, particularly industrial hygienists, expressed ambivalence about measurement strategies that do not involve direct observation. OSH professionals reflected on their proficiency with risk assessment methods that are formalized, use objective measures that they have control in the workplace (e.g., air quality sampling, OSHA lifting equation) and for which there is a standard for benchmarking. However, they are less prepared for measuring exposures outside of the workplace or collecting data on personal factors (conditions, environments, exposures) that affect overall safety and health outcomes. A university-based hygienist expressed they are less confident that they could be as thorough and precise when measuring non-work exposures or personal health risks because these things cannot be directly observed in the workplace setting by the OSH professional. She stated, "We have

a lot more control over being able to do a more … thorough assessment when it's a work-related exposure versus a non-work-related hazard."

Use of Qualitative Assessment Methods. Several OSH professionals, especially safety professionals and occupational health nurses, discussed their approach for qualitative assessment of health and safety risks in the non-work domain. One participant, a safety director who was trained in public health, discussed supplementing traditional safety assessments with individual interactions with workers to collect feedback. This participant described how she invited workers to talk about activities they enjoy outside the workplace, providing this example:

> There are generic questionnaires that we would utilize [for] different injury prevention specific items, like trying to reduce our material handling or soft tissue claims. So, from that standpoint, [also asking workers] 'what do you do outside of work or your hobbies? What kind of things do you do for fun? … different things like that. But also from an HR perspective, being very mindful of some of those questions that you may ask.

Similarly, an occupational health nurse described supplementing job safety analysis questionnaires, which are completed by employees after an injury, with open-ended dialogue. She asked workers questions to invite them to share insights about contextual factors, on and off the job, which might contribute to injuries. For example, asking "Are you happy with your job? Is there anything you would change?" The same nurse described using company health fairs as opportunities to assess workers' cumulative exposures (e.g., to noise) across work and home settings. She gave this example: "I had pictures - it was a game that they needed to guess – [saying to a worker, pointing] 'that

machine over there, we know it is 110 decibels. What is that equal to at home … a lawn mower, or the baby crying?' or something like that. Because if they don't make that connection to home, then whatever we're doing at work is only half the job. And that's been successful with the leaders as well."

Two industrial hygienists who endorsed qualitative methods as a key TWH assessment competency also expressed ambivalence about their own skills in this area. On hygienist shared, "qualitative information, it still is data. It's still very valuable, and we need, as a field of industrial hygiene, to become a little bit more comfortable working with that." The other hygienist noted a gap in prior training for collecting and assessing information about factors outside the workplace that could be relevant for occupational safety outcomes. She offered that "Some workers may want to be private about non-work hazards or non-work stressors and may not want to share these in the workplace. … Many IH professionals may not have been taught these kinds of elicitation skills." Qualitative evaluation methods may be a skills gap for hygienists and other more quantitatively trained OSH professionals.

Analyzing and Synthesizing Findings from Multiple Data Sources. Beyond data collection instruments and evaluation methods, the skill of analyzing and using data from disparate sources for prioritizing worker subgroups and intervention needs was described as an important TWH competency by several OSH professionals. An occupational health nurse from a very small (under 10 employees) consulting firm discussed the skills she uses when assisting business clients – merging and analyzing key variables form OSHA logs, workers compensation, and healthcare data to prioritize issues for intervention (Table 3.12). A senior industrial hygienist employed in a computing technology firm

framed these skills in terms of data analytics. This OSH professional, along with an occupational physician, endorsed data analytics as an essential TWH competency that supports an organizational TWH management strategy. These participants expressed that multi-layered data collection and sophisticated data analytics and are needed to gather, merge, and utilize a broad scope of workforce health and safety data across organizational units. Professionals perceived that data analytics, in tandem with a "dashboard to be able to see indicators in real time", would help organizations decide where to invest their resources for short- and long-term health and safety outcomes. Although enthusiastic about the potential value of integrated data systems, participants stated their organizations may not currently have the skill sets needed (Table 3.12).

Table 3.12

Quotes that Illustrate "Evaluation Methods" Competency Theme

Theme	Example quotes	Frequency *n*
Evaluation methods skills	**Breadth of data sources** "I look at the OSHA record keeping as well as the workers compensation data. I also will pull the medical spend to find out if they are having issues both work-related and non-work related, that are musculoskeletal in order." Occupational Health Nurse "We get a lot of raw data, but some practitioners are overwhelmed by the data and don't know how to pull out the key features. You ask the insurance company, and they give you everything. And you know, you can't analyze everything. It's not as meaningful as picking out exactly what you need." Occupational Health Nurse **Data analytics** "We are trying to expand our data collection and data analytics to assess and make correlations with a broader set of work environment/ working conditions that will allow us to evaluate short term and longer-term outcomes." Senior Industrial Hygienist	**18**

	"The ability to query, survey, and engage employees and employee groups on issues and opportunities related to work/outside of work stressors. As we have found, creating feedback mechanisms (surveys, etc.) that reliability identify clear TWH improvement opportunities *is not consistently a skill set* our Environmental Health and Safety practitioners possess. We are trying to determine if we need this skill within our practitioners or if we should hire the expertise." Senior Industrial Hygienist
	"The next skill evolution is to look at large data sets and seek correlation opportunities that we can't see with our current siloed approach. We think the skills are about creating data systems and analytics to make correlations with a broader set of work environment conditions that will allow us to evaluate short term and longer-term outcomes. We are trying to figure what competencies and standardized measures are needed. We don't know if we have the skills in house or if we need to hire the skills outside." Senior Industrial Hygienist

***Total Worker Health* Concepts.** Knowledge of TWH concepts emerged as a foundational cross-cutting competency, appearing in 14 references from 9 professionals across four focus groups (Table 3.8 and Appendix D). Participants described this competency as essential both for OSH professionals and for other organizational stakeholders, given the integrative nature of TWH approaches. To implement TWH approaches in the workplace, knowledge of the conceptual foundations is essential to think in a holistic, expanded way about safety and wellbeing – i.e., to apply a "whole person" approach to assessing and dealing with work-related exposures and outcomes. Some professionals stated the importance of having received training, either informally through mentoring or formally through an academic certificate program. Participants identified knowledge of TWH concepts as especially necessary for TWH practices 1 and 2 (i.e., holistic assessment and intervention design) (Table 3.8, Competency Theme 3). For example, several participants described their use of the NIOSH Hierarch of Controls

(HoC) framework (CDC, 2023), which emphasizes the concept of "prevention through design." An industrial hygienist illustrated the importance of understanding TWH principles by discussing the relevance of worker fatigue and stress when designing workstations, stating:

> I think of [TWH] as more of a formalized program that helps … broaden the way that I was trained to think about things. So maybe I didn't think enough about a person's mental health or state of mind when they come to work and how does that influence the way we think about workstation design, right? How do we design out the human error, if somebody is over-stressed or over tired?

The concept of design thinking appears to resonate with OSH professionals and could be a useful tool in teaching TWH approaches to interventions that simultaneously control hazards and promote well-being.

Participants also gave examples of the relevance of comprehending TWH concepts for TWH Practice 3 (systems integration), in which a shared understanding is needed by a broad range of stakeholders. As an example, an industrial hygienist discussed the need for stakeholders across the organization to operate with a TWH mindset that prioritizes safe working conditions as a foundation on which to build other prevention (health promotion) activities that enhance worker wellbeing. She stated, "Within this notion of *Total Worker Health*, [workers] need to feel secure and safe in a particular environment. Once that is established, then these other kinds of higher-level activities or needs can be addressed in a more effective way, and people will be more receptive to them." This statement endorses a TWH premise that organizations that begin with individual health promotion without attending to workforce basic safety will not be

able to engage the workforce effectively (Punnett et al., 2020). Therefore, establishing a shared knowledge base of TWH principles is essential for a successful organization-level TWH programmatic approach.

It was noteworthy that the Hierarchy of Controls (HoC) framework was not universally familiar to participants across all disciplines. This framework was shared on screen when posing the question prompt ("what competencies are needed for this practice?") to visualize the concept of TWH Practice 2 - design work to eliminate hazards and promote wellbeing. Participants trained in safety, industrial hygiene, and occupational health consistently recognized the HoC framework and verbalized how they had applied it to develop TWH interventions in the past. However, the recognition was inconsistent among wellness professionals and other professionals without prior formal OSH training. An ergonomist and exercise physiologist who managed health promotion programs explained that she used the HoC framework adapted for *Total Worker Health* "a lot of our health promotion [work] to demonstrate how programs, policies, interventions line up." However, in two different focus groups, at least three participants without formal OSH training (two wellness professionals and an injury prevention manager trained as an occupational therapist) did not seem to recognize this framework. One wellness professional, opted out of contributing a response at all, stating, "This doesn't apply to me. I don't think I have anything useful add." This remark could have meant that controlling workplace hazards or stressors was not within the span of her job role, or that the HoC framework was unfamiliar to her. However, the knowledge of work organization, job content, and basic awareness of hazard controls is foundational to be able to apply TWH principles. These knowledge areas are especially important to address

for professionals without OSH training, as is discussed in the next section about subject knowledge.

Another wellness professional, who did respond to the prompt, used the language of a public health prevention framework (i.e., primary, secondary, tertiary prevention) as the context for his response instead of the HoC model. Probing to surface this participant's conceptual understanding revealed a lack familiarity with the role of upstream work-related stressors in the development chronic diseases. Thus, knowledge of the HoC (and TWH adapted version) seems foundational to TWH practice and seems particularly important to teach non-OSH professionals in TWH professional educational programs. All professionals interested in TWH practice need to know the evidence about the role work organization and job stress for health and safety outcomes, and why these factors need to be considered for TWH Practice 2 (integrated interventions). Wellness professionals, who are especially focused on prevention of chronic disease, need to understand work related contributors to conditions and health behaviors that often are considered unrelated to work in order to appropriate operate in the TWH principles. It seems there is still work to do here showing the job stress/disease pathways.

A range of other subject areas were discussed by participants as relevant for TWH practices (Table 3.8, knowledge domain). Salient topics included principles of occupational safety and health (OSH), evidence based TWH interventions, knowledge of the workforce characteristics, and concepts in diversity, equity and inclusion (DEI).

OSH Knowledge. This was particularly important among participants who were not initially trained in OSH fields (e.g., wellness professionals, occupational therapists, exercise physiologists). These professionals said they needed to learn about the basic

tenets of safety, including legally mandated workplace safety standards and regulations; safety and health terminology; basic information about environmental health and safety management; and the workers compensation system (see quotes in Table 3.13). For participants employed by multi-national firms, understanding international workplace health and safety standards and regulations was also important to their ability to ensure compliance and appropriate scope of interventions.

Table 3.13

Quotes that Illustrate "OSH Knowledge" Competency Theme

Theme	Example quotes	Frequency *n*
	Occupational Safety and Health	
Occupational Safety & Health Knowledge	"For me, the biggest skill I needed to learn was some of the tenets of safety. For me, that was a skill that um I needed to bolster because most of my background in practice had been more in the human resources and general well-being domains." TWH/Wellness Professional	7
	"I always bring workers comp into it. So just making sure that [professionals] really understand how the workers compensation system works. What reserving practices are, why lost time injuries are such a problem, not just on an OSHA side, but on the workers comp side. And I find that traditional safety doesn't often, in my experience, look at things like workers Comp From the financial aspect of it other than just that it's OSHA recordable." Occupational Health Nurse	
	"… knowledge of OSHA standards and things like that, we don't traditionally have that in our roles. And so, we've kind of had to learn some of that along the way … because we're not from that traditional occupational health and safety side industrial hygiene side. So, learning the language of the professionals that you're working with to try and get these interventions" Exercise Physiologist/Ergonomist	
	"… there is ISO 45001 (safety management standards) … and there's a guide in there under program management about engaging the worker. So that's where I latched on to pull in the	

well-being piece, because now they've got ISO 45003 which is a whole psychosocial mental well-being focus." Injury Prevention Professional/Ergonomist
"One [competency] that comes to mind for designing work to eliminate hazards and promote health, especially for multinational clients … is understanding, interpreting and applying different international regulations. So, making sure you can design work to fit all these things and still be in compliance or go above and beyond." Safety Professional

Evidence-Based Interventions. When discussing competencies needed for TWH approach Practice 2 (design interventions to reduce hazards, enhance wellbeing) and 3 (systems integration), participants stated that knowledge of the supporting evidence for the TWH approach can be useful for gaining buy-in from stakeholder. The evidence can be in the form of case studies or in the form of scientific evidence (e.g., effectiveness study). Several participants talked about the competency of evaluating their activities to create internal evidence by measuring outcomes "in tangible ways that matter to our leadership" to justify continued support from leaders. An industrial hygienist shared:

> I think something that is valuable is if you have some data or research to back up that these … types of programs do work. The more examples and case studies this field can put together to create that platform that this is data driven, that these things work, then I think that gets more buy-in.

A safety professional shared, "[We] measure those outcomes specifically and in tangible ways that mattered to our leadership and decision makers … that was really important."

Workforce Knowledge. Participants discussed the importance of OSH professionals knowing demographic profiles and work profiles of the population they serve. Understanding the workforce population was viewed as essential for selecting

appropriate ways to communicate, assessing hazards, and tailoring improvements that are well-accepted by different groups of workers. A senior level industrial hygienist described the importance of learning about workers by talking to them, because “if you don't know how old they are, how long they've been on the job, what their expectations are, what they're doing, you're not going to pick up the outside things that are going to affect the job.” Another industrial hygienist explained that developing knowledge of the work processes and can build trust and enable better decision making, saying: “If you are going to assess and advise people of the hazards in the workplace, you really have to spend a little time in their workplace watching them work and watching the process. Make sure you understand what they're doing. If you’re successful the first few times, you get their confidence.” A related theme of diversity, equity, and inclusion was identified as relevant for ensuring equitable access and attention to employees who may otherwise be marginalized. Examples of often-marginalized worker groups that participants discussed include differently abled workers, workers with low literacy skills, non-English speakers, night shift or remote workers, and workers who are not as digitally connected as the majority of the workforce.

Attitudinal Competencies. Respect for worker knowledge and concern/care for workers were two key affective competencies that were especially relevant for TWH Practice 1 (assessment) and for TWH Practice 5 (worker engagement) (Table 3.8, 3.14). Respect for worker knowledge was the most important attitudinal competency, appearing in 10 coded references from six unique professionals across the groups (Appendix D). An industrial hygienist working in a state environmental health agency exemplified the “respect for worker’s knowledge” competency when coming up with workplace safety

improvements. She stated, "… treat your workers as if they know way more than you do about what they're doing, and respect what they say about it." She goes on to describe the need for professionals to put aside their perspective about what is "true" and what should be a "simple" solution in order to facilitate creation of solutions that make sense to the people doing the work. She emphasized privileging the lived experience of workers over "expert" knowledge, stating, "Even if it if it doesn't sound right, it's still what we what they believe. Check your assumptions about what's easy for somebody to do. Learn how to integrate, puzzle-solve, and make it easy for people to do it the right way." Other important attitudes endorsed by participants were concern for workers and flexibility. One participant, called it the "TLC factor - Just let the employee know that we care about you, tell me about what the job is entailing" (see Table 3.14). Being willing to be flexible in how OSH professionals respond to client organizations or worker groups when negotiating solutions was also expressed as important for TWH practice.

Table 3.14

Quotes that Illustrate TWH Attitudinal Competency Themes

Theme	Example quotes	Frequency *n*
Respect for Worker Knowledge	"I learned a long time ago to respect worker knowledge. So, treat your workers as if they know way more than you do about what they're doing, and respect what they say about it. Also, check your assumptions about what's easy for somebody to do." - Industrial Hygienist "Workers do the job day in and day out, and they know it better than anybody. So, you want to include them." - Safety Professional	10
Flexibility	"What I perceive to be one of the competencies is needed to do workplace interventions to eliminate hazards and promote health and well-being um is to have, like kind of a creative mind and kind of a solutions approach. Because one solution	7

	might not work for all locations that you may have. And so, application of the hierarchy of controls and getting their buy in can be kind of difficult. So, I just think that flexibility in attitude as well as technical knowledge and reasoning for getting stakeholder buy-in … are things that are needed to do this approach." - Industrial Hygienist "Flexibility was on my list of skills and attitudes necessary [for TWH Practice 2]. The example in the health promotion space is … diabetes prevention. The business wants to talk to us about handling people at work that have diabetes rather than preventing another group from having it. So [needing] flexibility to be able to have those types of conversations." - TWH/Wellness Professional "Learn how to integrate, puzzle, solve, and make it easy for people to do it the right way. If you can find a way to integrate into something they would normally do then they will do it anyway, and you won't be asking them to get out of their [routine] of how they usually do things." - Industrial Hygienist	
Concern for Workers	"I think that that just continues to go back to approaching individuals with care and compassion, and just [stating] 'Hey, I just I care about your well-being. You know, I don't necessarily care what you're doing outside of work. I just want to make sure that when you come to work, you're safe and that … I can send you home no worse for wear." - Safety Professional "I called it the "TLC" factor (tender, loving care). Just let the employee know that we care about you, tell me about what the job is entailing." - Injury Prevention/Ergonomist	6

Summary of TWH Competencies Findings

Overall, communication-related skills (general communication effectiveness and abilities to persuade stakeholders by communicating the value of TWH for meeting business goals), were by far emphasized most heavily by OSH professionals for a range of TWH practices, most notably TWH practices 3 (systems integration), 4 (facilitating

leadership commitment to safety and wellbeing), and 5 (encouraging worker engagement). As such, they can be considered "cross-cutting" skills. Other competencies related to communication that were identified as important included knowledge of the organization (culture, stakeholders, business operation); collaboration (ability to work together to solve problems); and relational skills (ability to establish trusting relationships). Collectively, these communication/relational competencies were believed by OSH professionals to be essential for working effectively with organizational stakeholders at different levels of the organization to achieve implementation of *Total Worker Health* practices. Technical and knowledge-based competencies were seen by OSH professionals as especially relevant for TWH practices 1 and 2, which focus on measurement of risks and design of interventions based on empirical and scientific evidence.

The most salient technical knowledge-based competencies identified by OSH professionals include knowledge of measures, instruments, and data collection and analysis methods to use when using integrative approaches for assessment of work and non-work risks. Psychosocial work environment assessment was a specific need area. Knowledge of *Total Worker Health* concepts was recognized as foundational for both of OSH professionals and for other organizational stakeholders to be able to successfully enable professionals to approach safety and health problems and solutions from a "whole person" perspective. For professionals working in the OSH field without prior formal training in occupational safety and health, knowledge of OSH principles was identified as important pre-requisite knowledge for conceptualizing and applying TWH practice approaches. Knowledge of the workforce demographic and job profiles, as well as respect

for worker knowledge, were also deemed essential to enable professionals to be successful with TWH assessment, intervention, and worker engagement activities.

Barriers to TWH Practice Approaches

OSH professionals were invited to share opinions about barriers to *Total Worker Health* practices that they have encountered or are likely to encounter. Surfacing perceived barriers can provide insights into real-world limitations that should be acknowledged and potentially addressed in the context of TWH educational activities. As discussed in Methods, responses related to barriers were primarily collected via the Zoom chat window but were sometimes elaborated upon if the facilitator invited verbal clarification. Responses were coded first by barrier type – factors related to the organization, OSH professionals themselves ("personal") or workers – and then according to themes within each type. Table 3.15 summarizes the distribution of all references coded by type of barrier (organization, personal, or worker) for each TWH practice approach. Counts of references for each theme (overall and by TWH practice approach) are presented in Table 3.16, with illustrative quotes presented in Table 3.17.

Organizational barriers (e.g., factors related to organizational culture, attitudes of leaders, organizational resources) were by far the dominant barrier type for every TWH practice approach, comprising 70% of total references coded. Personal barriers related to OSH professionals themselves and worker-related barriers, together, comprised a much smaller share (17% and 13% respectively) of total references coded. Participants generated roughly equal numbers of barriers reference counts across specific *TWH practice approaches* except for TWH Practice 5 (worker engagement), which had slightly higher reference counts (about 30 references compared with 20-23 references) (Table

3.15). This pattern may indicate that OSH professionals generally perceive worker engagement as more difficult to implement compared with other TWH practice approaches, possibly due to issues of cost and time, both for workers and for OSH professionals.

Table 3.15

Barrier Types Identified for Specific Total Worker Health Practice Approaches

Total Worker Health Practice Approach	Organizational Barriers (# References)	Personal Barriers (# References)	Worker Barriers (# References)
1 - Assessment methods identify work and non-work risks	12	5	4
2 - Design workplace interventions to eliminate hazards and promote wellbeing	18	3	0
3 - SHW are integrated	15	2	3
4 - Facilitate leadership commitment to worker safety and wellbeing at all levels of the organization	16	6	0
5 - Workers are engaged in all phases of program design and implementation	19	4	8
Total Number of References	81	20	15

The most salient organizational barriers were obstacles related to organizational culture (19 references), cost and time concerns (18 references), competing organizational priorities (10 references), concerns about leadership buy-in (9), and lack of access to leaders (8) and organizational TWH knowledge (8) (Table 3.16). Other perceived organizational barriers were leaders' resistance to change, silos (i.e., organizational units that work in isolation of each other), and poor communication. Although data were coded according to discrete coding definitions (see Appendix C) the themes are interrelated. For example, cost, time, and competing priorities are barriers probably share a common,

underlying relationship to organizational goals. Similarly, lack of access to leaders may also signal the strength or proximity of safety and health for organizational goals. Participants identified knowledge gaps as a primary theme cluster within the *personal barriers* category. Several participants described challenges with prioritization of health/safety issues in relation to facilitating leadership commitment to TWH. *Worker barriers* primarily related to perceptions that workers may be too overworked to engage deeply in TWH activities and that their health privacy concerns may impede holistic assessment of work and non-work risk factors.

Table 3.16

Perceived Barriers to Total Worker Health Practices

Barrier Theme	Total References	Practice 1 Assessment of Work/Non-work # References (# cases[a])	Practice 2 Intervention Integration # References (# cases)	Practice 3 Systems Integration # References (# cases)	Practice 4 Leadership Commitment # References (# cases)	Practice 5 Worker Engagement # References (# cases)
Organizational						
1: Culture	19	3 (2)	5 (4)	1	1	9 (8)
2: Competing priorities	10	1	0	5 (4)	3	1
3: Cost	10	0	4	1	3	2
4: Leadership buy-in	9	4	2	2	1	0
5: Lack of access	8	0	0	0	7 (6)	1
6: Time	8	1	2	2	0	3
7: Lack of knowledge – among organizational and program leaders	8	3 (2)	3	2	0	0
8: Resistance to change	7	1	3	0	3	0
9: Silos	6	0	1	5 (3)	0	0
10: Poor communication	4	1	1	2	0	0
11: Other org barrier	7	0	2	0	2 (1)	3 (2)
Personal						
12: Lack of knowledge – among OSH professionals	11	5	3	2	0	1
13: Prioritization	5	0	0	0	4 (3)	1
14: Other personal barrier	2	0	1	0	1	0
Worker-related						
15: Privacy concerns about health information	8	3	0	3 (2)	0	2 (1)
16: Workload	5	1	0	0	0	4
17: Mistrust of organization	4	1	0	0	0	3

Note. [a]Case count added if different from reference count.

Table 3.17

Quotes that Illustrate Total Worker Health Competency Barriers

Theme	Example quote	Frequency *n*
Culture	*Top-Down Culture* "When an organization comes up with a plan, they don't want it interrupted by any other facts that would change what's gonna happen. The organization always wants control." Industrial Hygienist *Trust (Lack of) Culture* "I think it comes back to just that culture of trust … If you're going to be asking people to talk about, 'What needs to change?' if you don't have that culture of trust, then people aren't going to be truthful and honest about how they're feeling … fearful that they could be retaliated against." Ergonomist "I you don't have the trust and engagement, then you're not going to get the response or the outcome from employees." Industrial Hygienist *Compliance-Oriented Culture* "I think, when it's [about things] non-related to work functions, employees are on their own to make sure they get enough sleep at night and take care of themselves. That's outside of work and we don't talk about outside of work things." Wellness Professional *Competitive Culture* "Groups or people thinking you want to take control of their area." Wellness Professional	19
Competing Priorities	"As someone who reported to security, and now reports to the VP of HR in the same organization, … definitely sort of the culture and mindset there, for what my specific supervisor also thinks is important from a competing priority standpoint." Safety Professional "Prioritizing based on need/finance/willingness of people to collaborate and current need of the business (e.g., pandemic mode versus business as usual)" – Occupational Health Nurse	10

Cost	"I work at a nonprofit organization, so our budget is pretty set. Resources, whether it's time or funds, is a significant barrier that we face." Safety Professional	10
Time	"Resources … how are we going to pay for this? ROI is great long term, but how is it going to benefit me right this minute? How can I justify that expenditure right now?" Safety Professional "One significant barrier I've seen for using the assessment tools is the time it takes employees to complete those kinds of things, and to gauge what those needs are." Safety Professional "Everyone is busy with their traditional work. It's hard to ask someone to join yet another committee or team to implement a new program or policy." Ergonomist, Exercise Physiologist	8
Lack of Access to Leadership	"Being able to get in the room to educate leaders about the TWH overall principles and approaches is critical for success. I recently had a meeting with leadership to discuss employee on-boarding and having occupational medicine in the discussion was a big deal. If you can't communicate, then you can't influence." Occupational Physician	8
Lack of Knowledge …among Organizational Leaders	[*participant referring to cross-unit stakeholder push-back*] "They said, 'Why are you asking [survey questions] about outside of work? That's [employees'] business -- we only talk about work related things.' or, on the other hand, they asked, 'Why are you asking [survey questions] about work? Just stick with wellness.'" Wellness Professional	8
…among Professionals	"Not having staff available for [TWH] implementation -- you need people do the work." Occupational Physician "Not having staff with the needed skill sets…" Senior Industrial Hygienist "Getting evidence-based information and explaining "*the why*" to leaders. Injury Prevention Specialist	11
Silos	"We have challenges where occupational medicine systems don't necessarily talk to our industrial hygiene systems and assessments. And so how do we	7

	bring those together? The systems piece is a challenge for us, once you start getting outside of EHS. … We all have the same goal, but we're still a little bit siloed." Industrial Hygienist "The term that comes to my mind is **ownership.** One thing that we've been talking about late lately is everyone should own safety. I think if we can create ownership outside of EHS -- with engineering, with operations -- that's when we get their buy-in [for] really owning the EHS risk reduction and incorporating it into our design projects." Safety Professional "I think [participant] talked about ownership, right? And so, that ownership can fall under different departments, and they don't always talk to each other." Safety Professional "Leadership needs to set an expectation for TWH as a management strategy. We are siloed and there's no structure for people to come together to collaborate on the integrated approach. We have to pursue TWH as an organizational management strategy." Occupational Physician	
Worker-Related Barriers	"Some workers may want to be private about non-work hazards or non-work stressors and may not want to share these in the workplace." Industrial Hygienist "I definitely think there's some barriers [to assessing non-work hazards] … Especially as you get some of those individuals who are like, 'What I do at home is really none of your business.' And they're not wrong necessarily." Safety professional Chat response: "Mistrust/Hidden Agendas" Industrial Hygienist "The workers, they're focused on getting their job done, and so adding to their workload… you have to figure out how to justify it and make it worth their while, in the short term. I mean, in the long term, clearly there is a benefit but really emphasizing why it's helpful <u>now</u>." Safety Professional	17

Organizational Barrier Themes

Organizational barriers comprised the most numerous themes. Each theme is described in the narrative below, with data references to provide the number of times it was discussed (Table 3.16) and illustrative quotes (Table 3.17).

Organizational Culture. Themes related to organizational culture were the top-most discussed barrier to TWH practices. Key sub-themes in this category were top-down vs employee engagement culture, culture of trust, compliance-oriented culture (vs culture of care/wellbeing), and competitive culture (see Table 3.16). Top-down culture (i.e., absence of worker engagement culture) was discussed in every focus group (9 total references) as a barrier especially relevant for TWH Practice 5 (worker engagement), but also as a barrier to TWH Practice 1 (assessment of work and non-work risks). Organizational trust was also identified as highly relevant for TWH Practice 1 (assessment), as workers need to feel safe sharing personal information about health and work-related problems. Compliance – focused culture vs well-being culture was identified as an obstacle to TWH Practice 2 (integrated interventions or designing work for safety and wellbeing together). Participants expressed that organizations that value safety compliance and "disregard the wellbeing" component will not incentivize an integrated approach to workplace improvements. One participant identified competitive culture as a TWH barrier (i.e., works against program/systems integration (TWH Practice 3) if different programs or departments are not willing to collaborate on health and safety initiatives.

Competing Priorities. Participants in four focus groups also cited barriers related to competing priorities. They cited departmental priorities competing (not aligned), short

term and longer term financial and health goals, as well as broader organizational priorities that might take precedent over investments in worker well-being.

Cost. About half the participants stated that cost was a barrier relevant to all TWH practices except for Practice 1 (assessment methods identify work and non-work risks). Costs constraints were mentioned mainly in terms of funds available (or not) for interventions, but also in relation to the constant need to justify spending in the context of return on investment (ROI).

Time Constraints. Professionals listed time as a barrier across all TWH practice approaches, with the exception of Practice 4 (facilitating leadership commitment) (Table 3.16). Generally, professionals perceived more time required for TWH approaches than for traditional approaches to workplace safety and health promotion. The reasons were based on time for coordination of worker involvement in risk assessment and solution building, or time required to involve a wider scope of professionals across organizational units in TWH activities.

Leadership Buy-in. Professionals pointed to lack of leader buy-in as an obstacle to TWH practices, although few participants elaborated on the responses sent through the chat window. The largest number of references (4) was clustered in TWH Practice 1 (assessment), presumably because assessment across disciplinary/content domains would imply involvement in using the assessment results. The concept of leadership buy-in was closely related to "competing priorities" subtheme (i.e., deciding how worker wellbeing is considered relative to broader organizational priorities). However, this theme seemed to be viewed distinctly by participants as a requirement to enable professionals to successfully use specific TWH practices. For example, an ergonomist expressed that

leader buy-in was especially important for TWH Practice 3 (systems integration), stating, "Lack of leadership support is a large barrier for integration."

Lack of Access to Leaders. A distal relationship between OSH professionals and organizational leaders was described in all but one focus group as an impediment to their ability to facilitate leadership commitment to TWH (Practice 4). Organizational distance itself may be an important predictor of leader support for TWH. "Not getting the ear of leadership," as stated by an occupational physician, prevents OSH professionals from any progress to advance TWH concepts in the workplace. An occupational physician shared:

> Being able to get in the room to educate leaders about TWH principles and approaches is critical for success. I recently had a meeting with leadership to discuss employee on-boarding and having Occupational Medicine in the discussion was a big deal. If you can't communicate, then you cannot influence.

Lack of Knowledge Among Organizational Leaders. Two aspects of knowledge were reported as organizational barriers. The first was a lack of understanding about TWH concepts on the part of organizational or program leaders, which can make it difficult to implement TWH approaches when other stakeholders need to be involved. For example, OSH professionals who attempt to collaborate across organizational units for coordinated assessment or intervention activities may have difficulty if stakeholders in other units lack awareness of the rationale for a coordinated approach. The knowledge-related organizational barrier was lack of personnel who possess TWH skills sets to implement TWH practices. (See quotes in Table 3.17, Lack of Knowledge)

A wellness professional described an example of a conflict that can arise from a lack of shared knowledge and commitment to TWH approaches in his organization. This

professional had been challenged by stakeholders in other units who were concerned about the appropriateness of a broad scope of survey items for an upcoming assessment. The concerns were about inclusion of questions that assessed lifestyle behaviors outside of work (off the job) and questions that elicited feedback about work stressor or the workplace climate. The participant stated that stakeholders asked, "Why are you asking about [behaviors] outside of work – that's their (employees') business; we only talk about work related things" and "Why are you asking about work, just stick with wellness." These statements exemplify a lack of awareness among his collaborators about the holistic nature of the TWH concept. In this kind of scenario, OSH professionals need to be able to communicate the rationale for using a broad-based approach to assessment and intervention planning. This still requires a solid knowledge base of evidence supporting TWH concepts (as discussed in the Competencies section) and especially the causal relationship between unsafe and/or unhealthy working conditions and poor health conditions and behaviors.

Resistance to Change. Six professionals across three focus groups responded that resistance to change is a barrier to implementing TWH practices. A safety professional pointed to the difficulty of getting upper leaders from her non-profit organization (many from an older generation) to be receptive to new ways of managing workplace safety.

> We are a science-based organization, but we also have a lot of old-school traditional folks in [our] field. So, the barrier there is shifting that mindset … at the top for those for those specific decision makers that really can hold up a program implementation in a specific department.

Another safety professional employed in a government agency expresses how some managers saw a shift to a more participatory, worker-engaged culture as a threat to their authority, stating the following:

> *Total Worker Health* … is kind of a new concept, and [organization] is doing a lot of changes like moving from a 'command and control' type structure and to people being more involved in what we're doing. … A lot of managers are threatened by the idea [of greater worker participation]. They're concerned that someone is trying to take their control away.

These statements highlight the importance of communication and interpersonal skills of OSH professionals for navigating resistant mindsets that can work against new ways of approaching workplace safety and health.

Silos. Professionals in two focus groups discussed programmatic silos as a barrier especially relevant for TWH Practice 3, safety, health, wellbeing systems coordination. Some professionals spoke about silos as a challenge with complexity and getting people to work together as part of a "big broad program" (as one industrial hygienist called it). She said, "From a program standpoint, I think it's a big broad program, right? So, I think we have systems in place that are doing different aspects of the program, and I think the challenge and the benefit of all this *Total Worker Health* approach is bringing them together, and I can't say that we're there yet." Other professionals pointed to the general problem of responsibility for safety and health being siloed within an environmental health and safety (EHS) unit, and not having shared accountability across the organization. An occupational physician employed by a large healthcare organization attributed the problem siloes as a lack of organizational commitment. This participant

stated that organizational leaders needed to set an expectation for *Total Worker Health* a management strategy in order to create the structures needed to coordinate safety and health functions.

Poor Communication. Lack of communication (e.g., decentralized communication, poor communication) was mentioned by four participants in two focus groups in relation to TWH practices 1 (assessment), 2 (interventions), and 3 (systems integration). Communication problems likely are more acute in organizations where silos are reinforced, and professionals are expected to work within the scope of their own organizational units.

Personal Barrier Themes

Participants identified two key personal qualities that impede implementation of TWH practices. These include knowledge gaps and the challenge of prioritizing issue areas in the context of the expansive TWH approach. These are described below.

Lack of Knowledge Among OSH Professionals. Participants described a range of challenges related to knowledge gaps that they perceived as obstacles to implementing TWH practices (Tables 3.16, 3.17). Each theme appeared in at least two focus groups (Appendix D); the dominant theme, lack of knowledge, clustered most heavily in TWH practices 1 and 2.

TWH Assessment (Practice 1) Knowledge Gaps. Participants described multiple knowledge gaps that they perceived to serve as barriers to using in TWH Assessment approaches. These gaps were discussed in detail in the Competencies section above. They include knowing which survey instruments to use (organization vs employee level); measures and methods for assessing psychosocial variables, (non-work) personal health

and environmental risk factors; collecting, analyzing, interpreting qualitative data (e.g., survey open response questions); and communicating the value of assessments to worker and leaders.

TWH Intervention Design (Practice 2) Knowledge Gaps. As discussed in the Competencies section, participants cited a lack of prior training on "realistic and practical methods or approaches" for designing integrated TWH interventions (i.e., using a "prevention through design" approach); a lack of prior training or certification in occupational health and safety (i.e., professionals trained in health science,); and having a command of evidence to communicate "the business case" to justify resources for TWH.

Prioritization. Three different participants in two groups responded that *prioritization* can be a challenge for OSH professionals working to implement TWH practices. For example, prioritizing a single focus to communicate to leadership becomes a challenge when the scope of focus become broader (i.e., when holistically considering safety, health, well-being dimensions together). An industrial hygienist at a large, multi-national conglomerate company describes the difficulty of narrowing their focus to communicate clearly with leaders. Similarly, another industrial hygienist spoke about the potential of becoming overwhelmed with choices and needing to be practical when figuring out how to engage workers in TWH activities. She stated:

> For us, one of the barriers … is prioritization -- determining and emphasizing what the priorities are. Otherwise, you start to have … an ocean [of possibilities], it's just unfocused. What are we asking [leaders] to commit to? Because this is a broad big field.

Other personal-level barriers OSH professionals described included fear of "rocking the boat" when trying to facilitate leadership commitment; difficulty "getting the right people to the table;" and lack of authority to implement TWH programs or interventions.

Worker-related Barrier Themes

Although this barrier type was discussed least often (only 17 total references coded to this category), participants in four of the five focus groups stated that workers' concerns about health information privacy as a key potential (or actual) barrier for TWH practice #1 (assessment of work and non-work risks) (Table 3.16). Professionals talked about workers either having a personal philosophy that personal health is an issue that should not be the concern of employers, or about worker mistrust (and perhaps hidden agendas) relative to the organization seeking personal information. Another worker-related barrier, particularly relevant to TWH practice #5 was time for workers to be involved in intervention design and implementation (Table 3.16).

Summary of Perceived Barriers to TWH Practices

In this study, the most salient barriers to TWH practices for OSH professionals were organizational culture concerns; competing organizational priorities that divert time and funding resources from TWH activities; lack of leadership awareness and commitment to TWH concepts; and lack of TWH knowledge among OSH professionals. On balance, OSH professionals perceived organizational barriers to be a much greater obstacle to adoption of TWH practices, compared to personal factors or barriers related to workers attitudes. Obviously, barriers related to OSH professional knowledge gaps are the most straight-forward to address with continuing professional education in TWH. However, understanding OSH perspectives on organizational barriers, which may be

outside of their direct control, can be useful for creating realistic problem-solving scenarios in continuing education contexts. Understanding how the perceived barriers can impede specific TWH practices, educators can facilitate learning activities that recognize real-world conditions and gives professionals an opportunity for advanced skills development. Implications for future TWH education are addressed in the Discussion section.

Discussion

This study explored the lived experiences of OSH professionals attempting to implement TWH practices with the goal of identifying specific competencies needed (knowledge, skills, attitudes/values) and barriers to adopting TWH practices. Professionals recruited for this study reported having at least a moderate amount of experience with, but not mastery of, TWH practice approaches. In cases where participants had not yet achieved a particular practice approach, they offered perspectives on competencies they needed to acquire and perceived barriers. Study findings first will be discussed in relation to prior work to describe TWH practice competencies, and then in relation to the use of findings to guide future *Total Worker Health* continuing professional education and also, for continued research to develop a formal TWH competency framework.

Comparison of Findings to Prior Work

The competencies identified for TWH practice in this study overlapped with and augmented TWH competencies proposed by Newman et al. (2020), but there were some areas of difference. The competencies identified as cross cutting for most TWH practices were the relational leadership skills of communication and collaboration. OSH

professionals identified these skills as essential for navigating the organizational implementation context for *Total Worker Health* Practices and for getting "buy-in" from leaders and other stakeholders in their organizations. This study revealed in greater detail the specific communication skills of listening to understand diverse stakeholder perspectives, framing messages to match the needs of diverse audiences, and communicating "the business case" for TWH approaches to leaders to obtain support and resources. OSH professionals in this sample expressed that their success relied on their ability to present evidence, justify interventions selected, and estimate return on investment to compete with other organizational priorities.

The subject matter knowledge areas identified in this study reflected some, but not all, of the topics listed within the sub-competency of "technical and public health knowledge" that is listed in Newman et al.'s (2020) proposed TWH competencies (p. e386?). For example, knowledge of health services was not discussed by participants. Occupational safety and health (OSH) concepts were identified by professionals not previously trained in OSH topics as important for TWH practices. Some participants stated that filling this knowledge gap was a motivating factor to participate in a *Total Worker Health* advanced certificate program. Organizational (or business) knowledge in this study was defined by participants to knowing their organization's business goals, organizational culture and values, key stakeholders, and how they view safety and health, as well as work and operational processes across the organization. These insights from OSH professionals extend Newman et al.'s (2020) framing of business knowledge as general "business strategies and management principles."

Findings from OSH professionals revealed insights about specific technical knowledge and skills needed for holistic assessment of worker safety, health, and well-being risks. Participants identified risk assessment competency needs such as skills in using surveys and qualitative methodology, and identifying instruments to assess psychosocial and organizational stressors, as well as non-work environmental or personal health risk factors, either in physical or mental/behavioral domains. Participants described needing skills in data analysis to integrate variables across work and non-work dimensions for decision making and development of solutions. Some advanced career participants emphasized the utility of "data analytics" for generating statistical evidence to support decision making about TWH interventions and for supporting an organizational, TWH management strategy. However, these participants also acknowledged that data analytics skills are outside of core OSH skills. Development of analytics tools may represent a research and development effort to be pursued by professionals with specialized statistical skills in in epidemiology, biostatistics, or public health informatics.

An important subject knowledge topic identified in this study (but not by Newman et al. (2020) was knowledge of *Total Worker Health* principles. Knowledge of OSH concepts underpin the TWH principle of focusing first on health protection (i.e., ensuring work that is safe) before adding health promotion (i.e., preventive activities to enhance wellbeing and lifestyle health behaviors). This "safety first" approach for prioritizing controls of hazards is embedded in TWH Practice 2, which emphasizes interventions that design work to eliminate or reduce hazards. Interestingly, the Newman et al. (2020) did not include *Total Worker Health* subject knowledge specifically in its list

of proposed knowledge areas. However, professionals in this study suggested that knowledge of TWH concepts -- understanding the rationale and the evidence for an integrative, holistic approach to managing SHW– was important not only for practitioners, but also was important for organizational leaders. A shared understanding of the TWH concept, and shared perspectives on meeting mutual goals across programs, was seen as a facilitating factor for adopting TWH practices.

Implications for TWH Continuing Professional Education

This study has numerous implications for designing TWH education programs to meet the of OSH professionals with diverse job roles and levels of TWH expertise.

Tailoring TWH Curricula for Targeted TWH Practices

One purpose of this study was to generate knowledge that can be used to guide future education to enable OSH professionals to adopt *Total Worker Health* practices. The results can also be useful for OSH professionals for selecting continuing education and training courses. The competency themes generated from this study provide evidence that different competencies are needed for different aspects of *Total Worker Health* practice. Educators developing TWH training and education can refer to Table 3.8 as a guide for prioritizing learning objectives for specific TWH practice approaches. For example, courses designed to advance skills for TWH Practice 3 (systems integration) and TWH Practice 4 (facilitate leadership commitment to TWH) can draw from the competency themes listed in Table 3.8 to plan learning objectives focused on communication skills, making a business case, presenting TWH evidence, and understanding the organizational culture and stakeholders. Courses designed to advance skills in TWH assessment methods and measures can use Tables 8 and 11 as a guide to

set learning objectives and develop learning activities to develop OSH professionals' competencies with selecting appropriate instruments and measures, expanding data collection and analysis skills. Although the matrix analysis of competency themes in Table 3.8 should not be prescriptive, it can provide clues to the relative importance of different competencies for specific TWH practices, which competencies are needed across practices, and possibly, the nature of the instructional approaches that should be selected to advance knowledge, skills, or attitudes of learners.

Prioritizing Work Organization and Psychosocial Work Environment Knowledge

Psychosocial workplace stressors and the related topic of work organization are two content areas that should be prioritized for TWH continuing professional education programs. Understanding these topics, and the concepts within each, provides the necessary frameworks for assessing and communicating root causes underlying stress. The ability to describe a range of causal contributors allows the creation of more complete, and therefore more effective, interventions. Although the concept of organization of work was not explored specifically, this concept is directly linked with psychosocial work hazards, which study participants did identify as "unseen" risks and/or hazards for which there is "no recognized standard." Professionals who want to use TWH approaches need to understand and communicate about features of work processes and job content with production leaders when recommending improvements in work design. Work organization refers to how work is done, by whom, how fast and for how long. The control of work and division of labor set the physical and psychosocial conditions of work, which are predictive of safety outcomes (injuries, illnesses, lost time, etc.) and health outcomes (chronic diseases, depression/anxiety, etc.). Understanding these causal

relationships enables OSH professionals to recommend effective work interventions that can prevent poor safety and health outcomes.

Although OSH academic training programs introduce future professionals to concepts of organizational of work, many OSH professionals have not been introduced to this concept because only a quarter of professionals enter the field with an OSH degree (National Safety Council, 2022). Employer-based wellness roles also have diverse career entry points. Between 60-70% of employers have at least one dedicated person (Linnan et al., 2019) and an estimated 80% of wellness managers are bachelor's degree or less (Zippia, 2020). Even with graduate preparation in health promotion, health sciences, or public health, many workplace health promotion professionals do not encounter concepts of organization of work (or occupational health generally) as a required curriculum standard (CEPH, 2021). Therefore, the majority of professionals attempting to implement *Total Worker Health* practices need an introduction to the concepts of work organization and psychosocial stressors, making these topics good candidates for future curriculum standards in *Total Worker Health* continuing education.

Competency on the measurement and management of psychosocial stressors and wellbeing outcomes was a key gap identified in this study. Results of this study suggest the need for TWH education to prioritize learning for validated tools for measurement of psychosocial stressors and mental wellbeing outcomes, along with guidelines for interpretations and examples of interventions that aim to reduce or control stressors, consistent TWH intervention approaches. Other OSH scholars have also advocated to prioritize this topic for TWH education (Schulte et al., 2019); a recent scoping review of instruments could provide a useful reference for OSH professionals and for TWH

educators to build knowledge on integrated assessment and intervention approaches for workplace mental well-being (Nebbs et al., 2023). Some OSH professionals expressed ambivalence about measuring or managing hazards for which there are no regulations or standards. OSH professionals are trained to help an organization ensure compliance with safety standards. In the United States, there are no regulations governing psychological or emotional job hazards. Nor are there standards for compensable work-attributable stress-related illnesses through workers compensation insurance. Workplace safety and health professionals who measure worker perceptions about job stressors (e.g., working very hard, fast, without decision authority, etc.), organizational climate (fairness, flexibility, support, respect, etc.), and mental well-being outcomes, would reasonably seek threshold standards to interpret results and make decisions about interventions needs. Although no such standards are published for U.S. employers, the World Health Organization (World Health Organization, 2022) and countries such as Canada (Mental Health Commission of Canada, n.d.) and England (Health and Safety Executive, n.d.) do have published employer management standards and intervention guidelines for workplace stress and mental health. The U.S. Surgeon General Report on Mental Wellbeing in the Workplace (Department of Health and Human Services, n.d.) also contains useful guidance and resources about evidence-based interventions. Examples of employer management standards for stress and mental wellbeing could be incorporated in TWH continuing education for OSH professionals. With this information OSH professionals could be better equipped to recommend and justify workplace improvements in the psychosocial domain, which would complement OSH professionals' existing skills sets for *Total Worker Health* practices.

Preparing Professionals to Address Barriers to TWH Implementation

The knowledge generated in this study about TWH practice barriers can be used by educators when developing learning activities and materials for TWH continuing education. Educators who are aware of the barriers that OSH professionals experience, especially organizational barriers that are outside of their direct control (e.g., culture, competing organizational priorities), can incorporate these obstacles into realistic problem-solving learning scenarios, consistent with adult learning and continuing education best practices (Garg & Mulloy, 2018; Taylor & Hamdy, 2013). Specifically, educator can refer to Table 3.16 for cues on the relative importance of specific kinds of barriers for specific TWH practices. As an example, when developing education on TWH assessment practices, the barriers listed in Table 3.16 suggest that learning activities should incorporate attention to educating and persuading leaders on the rationale for holistic assessment and intervention planning. Acknowledging practice barriers in educational settings can help OSH professionals build confidence and avoid pitfalls when transferring TWH practice knowledge to the workplace. Designing learning activities that target specific skills while reflecting real-world conditions can provide professionals with opportunities for advanced TWH skills development.

Meeting Multi-disciplinary TWH Training Needs

An ongoing challenge for designing TWH continuing education curricula is the diversity of professionals and knowledge domains relevant for *Total Worker Health* practice. As TWH continuing education and higher education offerings continue to expand, greater clarity is needed about appropriate curriculum standards and educational materials for professionals (or professionals in training) with different disciplinary

backgrounds. One issue that arose in this study was inconsistent recognition of the NIOSH Hierarchy of Controls framework among non-OSH professionals. Tailoring educational materials with frameworks familiar to health education, health promotion, and public health such as the social ecological model (Stokols et al., 1996) or prevention pyramid) could help bridge the conceptual understanding for principle of focusing first on environment and policies before individual behavior, which is conveyed through the HoC framework.

This study contributed insights that address a challenge raised by other OSH scholars about the potential for TWH training to overburden OSH professionals. Schulte et al. (2019) have recognized the challenge of helping OSH professionals acquire the necessary knowledge and skills, inter-professionalism, and application of systems thinking required for an expanded OSH paradigm (i.e., TWH) without "overburdening the curriculum." These scholars suggest that TWH training for OSH professionals could adopt one of two strategies: 1) train OSH professionals to possess full range of disciplinary knowledge and skills relevant to be able to recognize the contribution of work and non-work risks and how to intervene proactively (i.e., become an TWH "super" professional), or 2) train OSH professionals to know when and how to collaborate interprofessionally for same (Schulte et al., 2019). Evidence from this study seems to suggest something in between – that OSH and wellness professionals feel a need to expand their knowledge outside their own disciplinary training, but also feel collaboration across disciplinary boundaries is necessary for practical and political reasons. Continued research to formalize a *Total Worker Health* competency framework

can help guide development of curriculum standards for professionals of different disciplines, and for inter-disciplinary TWH education.

Implications for Development of a TWH Competency Framework

Perspectives gathered from occupational safety and health professionals in this study can be used as part of the longer-term research effort to develop and validate a *Total Worker Health* competency framework. The competency clusters proposed by Newman et al. (2020) were generated using a guided group process with nationally recognized TWH subject experts in government, academia, industry, but few mid-level practitioners from "everyday" work settings. This study provides practice-based evidence from real-world settings, which can deepen our understanding about the specific competencies needed for specific TWH practices.

The findings from this study are relevant when considering TWH competency domains and sub-domains, as well as specific knowledge and skill areas within the sub-domains. The matrix analyses of competency themes revealed that support clustering of knowledge and skill types across and within TWH practice approaches. This clustering helps with education planning, but also may be evidence of competency domains and sub-domains. For example, skills such as communication, collaboration, organizational knowledge, clustered across organization-level programmatic TWH practices (facilitating leadership commitment, integration of program systems). These practices together are consistent with the latent construct "TWH Program Leadership" identified in Chapter 2. Similarly clustering of competencies related to measurement instruments, evaluation methods, psychosocial stressors, and mental health clustered in TWH practices of integrated risk assessment and integrated intervention approach. These findings support

the notion of a competency domain of Risk Assessment and Control, a construct identified in Chapter 2. Thus, the clustering patterns also an inform the knowledge and skill areas within each competency sub-domain.

The evidence from this study suggests a TWH competency framework that includes specialized and cross-cutting competencies. Cross-cutting competencies can be viewed as essential knowledge and skills needed for TWH program leadership, without regard to prior disciplinary training. Examples of cross cutting competencies could include communication, interprofessional collaboration, evaluation, *Total Worker Health* ("systems") thinking, professionalism, ethics, and DEI. Specialized competencies can be viewed as the content knowledge and skills of core disciplines relevant for *Total Worker Health* (occupational medicine, occupational safety and health/industrial hygiene, health promotion, public health, and occupational health psychology). Competency frameworks with specialized and cross-cutting competency structures have been used in public health graduate programs (Calhoun et al., 2008) and in occupational health and safety (Keshmiri & Mehrparvar, 2021; Olson et al., 2005). Keshmiri and Mehrparvar (2021) developed a specialized/cross-cutting competency framework specific to interprofessional occupational health teams, which could be adapted for the *Total Worker Health* professional context. Their results outlined three domains of specialized competencies, including prevention (hazard assessment and control), occupational health assessments (job analysis, clinical examination), and occupational disease management) and three domains of general competencies (interprofessional collaboration, education and evidence-based practice, and professionalism). Given the diversity of professionals

implicated in TWH practice (discussed below) and the interdisciplinary nature of TWH practice, a model with specialized and cross-cutting competencies seems fitting.

Future Research

Adoption of TWH practices by OSH professionals has expanded in recent years (Tamers et al., 2019). This expansion offers an opportunity to continue learning from a growing number of professionals with practical TWH experience. Continued research is needed to gain insights about TWH practice in larger vs smaller organizations, and among professionals from different disciplinary backgrounds. This knowledge can help educators customize education to meet the needs a wide range of professionals working in different settings.

The TWH practice approaches investigated in this study represented a composite list of practices described in prior literature, specifically, the NIOSH TWH Fundamentals (Lee et al., 2016) and indicators of integrated TWH programs (Punnett et al., 2020). One "TWH essential element" promoted by NIOSH – ensuring confidentiality and privacy when handling worker health information -- was not investigated in this study because it was considered an ethical best practice for all occupational and other health professionals. It was not considered a practice approach unique to *Total Worker Health.* However, concerns about health privacy were raised by participants in relation to skills needed to avoid impinging on worker privacy (e.g., don't ask too questions that are too personal) or in relation to concerns about worker receptivity to TWH (lack of worker trust in the employer). Future studies could explore and define specific competencies relevant to these issues in the context of TWH practice.

Future research on *Total Worker Health* competencies can help to discern whether TWH represents a new profession or is better conceptualized as a specialized skills set that can be developed by any professional with responsibility for worker safety, health, and well-being. *Total Worker Health* is relevant for a broad range of occupations, including occupational health and safety professionals (occupational health nurses and physicians, industrial hygienists, safety and environmental health managers, industrial engineers, occupational health psychologists) and professionals in worksite health promotion, organizational/industrial psychology, employee assistance, and human resources. Cross-walking or mapping TWH competencies with those of the above-named groups would identify which TWH knowledge, skills, and attitudes are unique versus shared among various professions. Understanding the commonalities and differences across disciplines could generate useful information for prioritizing learning goals both for pre-professional and continuing professional education settings for different disciplinary groups. This process could also surface candidate language from existing validated competencies (e.g., inter-professional collaboration) that could be adapted for use in a TWH competency framework. Possible methods for a cross-walking research approach could involve stakeholder group techniques (as reported by Calhoun et al., 2008), document review (as in Woodhouse et al., 2010), or both (as in Olson et al., 2005). This is a relevant area of study as governmental and academic experts have taken steps to form a specialized *Total Worker Health* professional society (Colorado School of Public Health, 2022). Assessment of uniqueness and overlap between TWH competencies and those of other professionals would be useful as experts grapple with the question of delineating TWH as a practice or a profession.

More research is needed to define and validate a TWH competency framework so that standards of practice can be set, and educational learning objectives and evaluation tools can be created to measure learning and practice performance. It may be beneficial to align the competency clusters with the TWH practice approaches. Structuring inquiry around the specific TWH practice approaches seemed to generate discussion easily in this study. The process to define and validate a TWH competency framework can benefit from approaches used in other fields. These approaches include extracting knowledge from literature, generating a body of practice-based knowledge from professionals in real-world settings, and applying broad consensus building processes such as expert advisory panels and Delphi methods (Batt et al., 2020; Strudsholm & Vollman, 2021). These processes will take time. However, as more professionals and professionals-in-training graduate from TWH academic and professional education programs, there will be more opportunities to engage a range of experienced stakeholders in these processes. The results of this study suggest that it will be important to involve faculty in both higher education and continuing professional education to help identify appropriate levels of TWH practice performance for OSH professionals along a continuum from novice to advance career.

Study Strengths and Limitations

A strength of this study is that data were gathered from a broad sample of OSH professionals representing diverse disciplinary backgrounds, industry sectors, career stages, and geographic locations across the United States. The sample included a broad array of professionals from the primary core OSH disciplines (safety, industrial hygiene, occupational health practitioners) plus worksite wellness practitioners. Some participants

delivered services to a single employer (internal clients), and some were consultants who served multiple organizational clients. Most participants were mid and advanced career professionals who likely had a sufficient level of decision authority in their job roles to adopt at least some TWH practices from which they could share their experiences. The breadth of representation is a strength of this study because it allowed the data to be drawn from professionals with diverse perspectives based on their diverse roles and practice settings. Another strength of this study is the structured data collection protocol, which used the same script and slide set to pose questions consistently across all focus groups. The use of slides on a shared screen to present question prompts and standardized talking points ensured that all participants considered and responded to the same questions. A third strength is the consistency of evidence across focus groups. Most themes were generated based on data from at least two, but often 4-5 focus groups (Appendix D). This consistency signals that, for this study sample, the themes were consistently salient to professionals across different groups and were not idiosyncratic artifacts of specific discussions.

This study has several limitations to acknowledge. Although the study sample was diverse, the total number of participants was limited. The experiences of the professionals in this sample may not be generalizable to the range of experiences of all professionals actively working to adopt TWH principles in the workplace. However, the consistency of the themes across focus groups indicates that the data has approached saturation across different professionals. Another limitation was the lack of time available within the focus groups to explore all responses in-depth. The 90-minute duration required assigning time limits to each discussion segments to accomplish the research goals. Time constraints

prevented frequent follow-up probes to elicit more details about contextual processes and relationships that more completely explain TWH experiences. Given the importance of organizational context for any implementation effort, much more could have been learned if the focus group duration was extended to two hours or if the study used an interview data collection format. Interpretation of the TWH practice barriers data was limited by the textual responses that were supplied through the chat window; those data were mostly collected through the chat window as a time-saving measure. Although designating certain topics (e.g., barriers) for chat response collection allowed a breadth of information to be collected, it precluded a more thorough investigation of these topics. Consequently, it's possible that the limited words from the chat responses could have contributed to misclassification. A threat to validity was the lack of a second coder for thematic analysis within the knowledge, skills, and attitude competency codes. It is possible that the positionality of the coder could have biased the understanding of the meaning of participants' statements. However, the data were discussed in depth by two coders during the first phase of coding by competency type (knowledge, skills, attitudes), with rigorous assessment of interrater reliability and follow up reconciliation. These conversations between coders provided ample opportunities to develop shared understanding of response meanings, which was then carried into thematic analysis. A second coder was used to validate subsets of data within the theme codes.

And finally, even though participants were screened during recruitment to ensure sufficient TWH experience to speak knowledgeably about TWH competencies, it is possible that some participants did not have the in-depth of experience to allow identification of all relevant competencies. For example, no participants in this study

expressed that they had successfully achieved TWH Practice 3, systems integration. Also, two participants reported having no previous TWH education, which raises questions about their conceptual grounding in TWH principles. Thus, the insights gained from this study should not be considered an exhaustive investigation of TWH competencies. Future studies could explore each TWH practice in greater detail, with participants who have been screened using rigorous criteria that can be (at least somewhat) objectively assessed.

Conclusion

This study explored the lived experiences of occupational health professionals in relation to competencies and barriers to perform *Total Worker Health* practice approaches. Knowledge-based technical competencies were most salient for the practice approaches related to integrative risk assessment and intervention design. Leadership skills-oriented competencies such as communication and collaboration were important for every TWH practice approach but were especially important for practice approaches related to overall organizational program strategy, such as coordination of program systems and facilitating leadership commitment to TWH. Professionals identified organizational obstacles of culture and competing priorities as the most important barriers to TWH practices. The insights from this study contribute to the broader knowledge base that is accumulating to inform the development of a TWH competency framework. The results can also guide the design of advanced TWH training activities that support implementation of specific TWH practice approaches. Given the emerging status of *Total Worker Health* professional practice, future studies should continue monitoring practice-based experience of professionals to augment our understanding of specific skill professionals need when implementing TWH practice approaches.

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CHAPTER IV

Attitudes of Occupational Safety and Health Professionals Towards Interprofessional Education for *Total Worker Health*

The occupational safety and health profession has been evolving over the past two decades in response to the changing nature of work, workforce demographic shifts, and structural shifts in work arrangements (e.g., contingent, temporary, contract) that have fissured employment protections, both legal and health and safety (Peckham et al., 2017; Weil, 2014). The occupational safety and health (OSH) professional community has recognized the need to broaden its scope to incorporate attention to aspects of personal health status, health conditions, and mental well-being (Chari et al., 2018; Peckham et al., 2017; Schulte et al., 2019). This expanded OSH approach, called "*Total Worker Health*®" has been increasingly adopted by OSH professional organizations and employers since the start of its promulgation in 2011 by the National Institute for Occupational Safety and Health (NIOSH) (Tamers et al., 2019). The expansion of *Total Worker Health* (TWH) acceptance has implications for the design and delivery of effective continuing professional education to help OSH professionals expand their knowledge base and improve skills for working collaboratively and inter-professionally with new kinds of professionals for joint planning and delivery of workplace-based programs that promote worker safety, health, and well-being.

One of the defining indicators of a TWH approach is the coordination and integration of workplace safety, health, and well-being program systems (Lee et al., 2016; McLellan et al., 2017; Punnett et al., 2020). This cross-functional integration requires OSH professionals to work in new ways with professionals outside of traditional occupational safety and health core disciplines (e.g., with wellbeing professionals, industrial psychologists, and human resources professionals). For many organizations, health and safety programs are often managed in production or regulatory compliance units, whereas human resources units manage programs and policies related to wellness, work-life, and health insurance benefits. An apt metaphor may be that a *Total Worker Health* strategy asks OSH and other professionals to depart from "swimming in one's own lane" and start "swimming with others in an open sea." Collaboration among professionals with diverse educational backgrounds, job roles, and subject expertise can be challenging unless specific efforts are made to develop interprofessional practices, shared goals, and vocabulary. Cross-functional coordination of programs and policies is a complex behavior that requires interprofessional relational competencies, in concert with supportive organizational structures and management systems (Bronstein, 2003; Moilanen et al., 2020; Petri, 2010). Given that TWH emphasizes programmatic "integration," interdisciplinary collaborative practice can be considered a core TWH competency. Accordingly, interprofessional education (IPE) may be an appropriate pedagogy for building skills in this TWH practice competency.

IPE, used widely in health professions pre-licensure education, is a pedagogy that specifically cultivates interprofessional collaborative practice skills (Gilbert et al., 2010; IPEC, n.d.; Oandasan & Reeves, 2005). This kind of pedagogy may offer a promising

educational approach for training OSH professionals' side-by-side with prospective collaborators from other disciplines in the workplace (e.g., human resources and wellness professionals). Shared learning with workplace collaborators (or other similar to potential collaborators) can provided a facilitated practice experience to learn about and value other perspectives, to develop a shared vocabulary and interdisciplinary identity, and to practice solving a problem together (Bronstein, 2003; Khalili et al., 2013; Petri, 2010; Thistlethwaite et al., 2010). The objective of article was to understand the feasibility of this approach for TWH continuing education.

Theoretical Framework

This study focuses on concepts related to IPE and interdisciplinary collaboration. IPE engages participants from two or more disciplines to learn about, from, and with each other to facilitate interdisciplinary collaboration and (in the case of health-related professions) to improve quality of care/services and health outcomes of patients (Gilbert et al., 2010). IPE education activities explicitly build skills in interprofessional role awareness and valuing (needed for teamwork), effective communication, mutual respect, and trust (Khalili et al., 2013; Oandasan & Reeves, 2005; Thistlethwaite et al., 2010). Other IPE researchers also specify learning goals of interprofessional culture and identity building as important (Khalili et al., 2013) for counteracting stereotyping that can form as students are socialized into the culture of their profession (Hall, 2005). In this paper, the concept of *interprofessional* is synonymous with *interdisciplinary,* meaning people from two or more different health professions working in an interdependent way toward a common purpose (Oandasan & Reeves, 2005).

Core Concepts and Competencies of Interdisciplinary Collaboration

A core concept that IPE seeks to strengthen is interdisciplinary collaboration, defined as the act of working jointly with others for a common purpose (Merriam-Webster, n.d.). Collaboration can be distinguished from coordination or cooperation by the degree of interaction between participants and the extent of change (e.g., in one's own thinking) that is required in the process of creating a solution or product. The term interdisciplinary collaboration specifically refers to the involvement people from two or more disciplinary backgrounds working together. In the field of health professions education (including occupational health), the terms *interdisciplinary, multi-disciplinary, and transdisciplinary* are used to differentiate the nature of interaction between professionals (Oandasan & Reeves, 2005). Giving examples relevant to TWH, interdisciplinary can mean two different professions (e.g., safety managers vs human resources managers) or it can mean different OSH (e.g., safety managers vs industrial hygienists vs occupational physicians) working together. The term *interdisciplinary* (where professionals work collaboratively and interdependently toward a shared goal) is distinguished from *multi-disciplinary*, in which professionals work independently in a coordinated way. *Trans-disciplinary* is sometimes used synonymously with inter-disciplinary, but some scholars use this term to indicate emergence of a shared practice in which roles are blurred and represent new roles that are outside of their traditional profession (Oandasan & Reeves, 2005).

Interdisciplinary collaboration (sometimes called interprofessional collaborative practice) is a skill set that is discussed widely in the health professions and social services education literature (Bronstein, 2003; Gilbert et al., 2010; Petri, 2010; Rogers et al.,

2017) but is less often discussed in literature about education for OSH professions. In healthcare, interprofessional teams have become a standard of healthcare practice based on evidence of better patient and organizational outcomes, as well as job satisfaction (Petri, 2010; Reeves et al., 2013). The interdisciplinary collaboration concepts discussed in healthcare and social service literature can be applied to *Total Worker Health* practice approaches. To collaborate effectively across program and disciplinary boundaries, OSH professionals must understand and value the roles of professionals outside of their discipline and be willing to work interdependently.

Given the purpose of IPE for developing interprofessional skills, this may be a promising way for OSH professionals to learn about and practice TWH approaches with professionals they might collaborate with in the workplace. However, very little literature addresses IPE for OSH professionals generally, and for *Total Worker Health* specifically. This study sought to explore how OSH professionals perceive interprofessional learning and how this approach aligns with their educational needs and values. These insights could help educators make a judgement about whether this pedagogy, which can be labor intensive, could be well-accepted, feasible, and effective for TWH education. In the next section, I summarize the available literature on the use of IPE in OSH field, and instruments used to evaluate readiness for IPE.

Literature Review

Although IPE literature is vast in healthcare and social work fields, few studies are available that describe the use of IPE with OSH professionals. No studies have been found on the use of IPE to develop competencies for TWH practice. Two studies describe evaluations of courses designed for interprofessional learning involving *working* OSH

professionals. One study based in the Northeast U.S. (Rosen et al., 2011) defined "interdisciplinary" as between professional specialists *within* OSH disciplines. This study described a 5-day experiential continuing education program that engaged multi-disciplinary OSH professionals in 5-day tours of diverse workplaces. The curriculum fostered interdisciplinary learning about job hazard exposure assessment, mitigation, and clinical treatment. Participants reported the interprofessional interactions were the most important facet of the experience because they increased their understanding of professional roles, stimulated new relationships, and increased valuing and willingness to work with professionals from other disciplines. OSH professionals recognized the importance of interdisciplinary collaboration for addressing complex workplace safety and health problems. In another study based in Brazil, a community-based experiential program involved public health and clinical healthcare personnel in learning together about work station design, and how to refer to occupational clinicians appropriately (Griggio et al., 2020).

More available, but still limited, are studies about interdisciplinary competency-building for OSH professionals in training in university-based settings. McCullagh et al. (2022) reported a feasibility study to integrate interprofessional competencies in a graduate-level occupational and environmental health course cross-posted for public health, engineering, and nursing students. The goal was to understand how to apply IPE in the context of a public health curriculum to increase students' understanding of occupational safety and health issues. Several other studies have similarly reported on introducing IPE approaches in public health curricula (Averill et al., 2020; Hoffman & Cowdery, 2020; Uden-Holman et al., 2015) in line with new accreditation standards that

identify interprofessional practice as a foundational competency domain for public health graduate programs (CEPH, 2021). The increasing attention to interdisciplinary collaboration competencies in public health curricula presents an opportunity for OSH professionals in training to develop interdisciplinary values, which they can take into their professional roles in the workplace. Introducing *Total Worker Health* concepts at this stage in OSH professional education may be ideal to exemplify interdisciplinary approaches to workplace SHW.

Readiness for Interprofessional Learning

Learners' learning goals and motivations determine successful educational outcomes and transfer/application of learning to the workplace. Therefore, attitudes about educational topics, including interprofessional learning, can therefore influence participation effort and learning outcomes. IPE scholars have developed tools to measure readiness for IPE either as formative assessment or for pre-post evaluation of IPE learning experiences (Norris et al., 2015; Parsell & Bligh, 1999; Reid et al., 2006). Although several instruments are available to measure the quality of interdisciplinary collaboration (Bronstein, 2002; Orchard et al., 2012; Van Dijk-de Vries et al., 2016), the learning readiness instruments are specifically designed to measure attitudes related to IPE learning outcomes. The Readiness for Interprofessional Learning Scale (RIPLS) is widely used in health professions education (Parsell & Bligh, 1999); a Google Scholar search of the RIPLS questionnaire yielded 1,790 results. The original RIPLS instrument contained 19 items with three subscales tied to intended IPE outcomes: Teamwork and Collaboration, Professional Identity (i.e., attitudes about working with people from other disciplines), and Professional Roles (i.e., how the participant sees their roles in relation to

others). Mahler et al. (2015), IPE researchers, point to problems they observed from the accumulated publications reporting on RIPLS results: mostly the weak loadings of the Professional Roles subscale items and inconsistencies in the constructs for which they question the overall construct validity. However, Reid et al. (2006) adapted and validated the RIPLS instrument for the continuing education context. The adapted instrument contains 23 items, with subscales of Teamwork and Collaboration, Patient Centeredness (i.e., shared commitment to patient outcomes), and Sense of Professional Identity. The validation study for this instrument showed reasonably strong loadings for each subscale (the Professional Identity subscale was weakest with loadings from .42 to .58), and the instrument was able to identify significant inter-group differences when tested with a sample of nurses, physicians, and allied health professionals (Reid et al., 2006). Although this instrument was developed for use with clinical health professionals, the questions could be adapted for use with occupational safety and health professionals.

Given the potential value of IPE for strengthening competencies for *Total Worker Health* practice, measuring readiness for interprofessional using the Reid et al. (2006) RIPLS instrument could give insights about the level of enthusiasm for an TWH interprofessional learning experience. Working cross functionally is complex; many barriers can exist such as time constraints, stereotypes, lack of shared agenda, lack of leadership mandate and supportive structures. Because TWH is an emerging OSH practice, there is little to no literature describing cross-functional coordination for TWH implementation. This gap points to an important role for continuing professional education to develop TWH interprofessional competency. No research has been reported to develop, deliver, and evaluate interprofessional continuing education models for *Total*

Worker Health. Assessing OSH professionals' readiness for IPE, and their perspectives about motivations, barriers, and delivery options for IPE would generate valuable knowledge to help educators create an effective program that would be feasible and attractive for OSH and other professionals. Although the IPE approach seems conceptually promising, research is needed to guide course design to create TWH interprofessional learning that is feasible, meaningful, and effective. This study therefore, seeks to address the following research questions:

1. How favorable or unfavorable are OSH professionals' attitudes regarding interprofessional learning for *Total Worker Health*?
2. To what degree do OSH professionals express preferences for an interprofessional learning community with professionals from their own organization versus from other organizations?
3. What do OSH professionals view as the motivators and barriers for participating in interprofessional continuing education for *Total Worker Health*?

Methodology

Mixed methods were used to address the research questions for this descriptive study. A survey was administered with 210 multidisciplinary occupational safety and health professionals to measure attitudes regarding the value of IPE for improving teamwork and collaboration skills that are needed for *Total Worker Health* practice. Focus groups were administered with a subset of 19 survey participants to assess perspectives about the benefits of IPE that would motivate OSH professionals to participate; potential barriers to participation were also assessed.

Recruitment

Participants recruited for this study (described in Chapter I) included professionals from the core OSH disciplines, including industrial hygienists, safety professionals (safety program directors and managers, injury prevention specialists, etc.), occupational health nurses, and occupational physicians (McAdams et al., 2011). Professionals responsible for workplace wellness programs were also recruited based on the relevance of health promotion fields for *Total Worker Health*. Convenience sampling was used to recruiting a diverse mix of core OSH disciplines employed in a range of industrial settings. Recruitment was accomplished by partnering with key partner organizations to disseminate the study announcement in their OSH professional networks. Key partner organizations included the federally funded, university-based *Total Worker Health* Centers for Excellence, and OSH professional associations such as the American Industrial Hygiene Association (AIHA), American Society of Safety Professionals (ASSP), American Association of Occupational Health Nurses, and American College of Occupational and Environmental Medicine.

A standard study announcement with a link to the survey was sent to key contacts at recruitment partner organizations; a $100 gift card drawing was offered as an incentive to participate. Participant eligibility criteria included: 1) current employment (minimum 20 hours/week); and 2) certification, training, and/or education in a core OSH discipline (safety, industrial hygiene, occupational medicine, or occupational health nursing). Survey participants were screened for focus group eligibility, which included the above criteria 1 and 2, plus the following conditions: 3) delivers OSH services to employer organizations; 4) prior participation in at least one TWH training/education activity; and

5) history of active implementation of TWH practices (score of 3 or more on TWH experience variable, see Instruments section). All survey participants who met eligibility criteria for conditions 3-5 were asked if they would like to be contacted for participation in the focus group portion of the study. A gift card drawing, valued at $100, was offered as an incentive for each focus group session.

Participants

Survey participants included 210 OSH professionals representing professions of safety (31%), industrial hygiene (16%), occupational health nursing (12%), occupational physicians (11%), wellness/health promotion (7%), academic researchers/educators (7%) and other mixed OSH related disciplines (16%) (Table 4.1). The focus group participants were drawn from the survey sample. The focus group sample had slightly more industrial hygienists (37% vs 31%) and wellness professionals (16% vs 7%) compared to the broader survey sample. About two-thirds of survey (64%) and focus group (63%) participants described themselves as experienced OSH professionals. The focus group sample had less TWH experience than the larger survey sample. Roughly equal portions of survey (49%) and focus group (47%) participants reported they delivered OSH services to single employers versus reporting they provided any consulting services. In the survey sample, 7% reported they were not OSH service providers, but instead served in “other” roles such as public health policy or administrative roles. Slightly over half of the survey (55%) and focus group (58%) participants were employed by large organizations. Survey participants were employed in the US, from Northeast (31%), Western (31%), Midwest (16%) and Southern (18%) states. The focus group sample had

more professionals employed from the Western region (and less from the Northeast) than the survey sample, but distributions were similar in other regional categories.

Table 4.1

Survey and Focus Group Participant Characteristics

Variable	Survey n	Survey (%)	Focus Group n	Focus Group (%)
Job Role	(n=210)		(n=19)	
Safety, Environmental Health and Safety or Ergonomics	66	31.4 %	5	26.3%
Industrial Hygiene	35	16.7 %	7	36.8%
Occupational Health Nurse	25	11.9%	3	15.8%
Occupational Health Physician	23	10.9%	1	5.2%
Wellness	14	6.7 %	3	15.8%
Researcher/educator	14	6.7 %	0	0
Other (Nurse, operations, risk management, etc.)	21	15.7%	0	0
Career stage	(n=208)		(n=19)	
Advance career	95	45.5 %	9	47.4%
Midcareer	66	31.6 %	7	36.8%
Early career	47	22.5 %	3	15.8%
Occupational Safety and Health Client	(n=207)		(n=19)	
Internal client (own employer)	101	48.8 %	9	47.4%
External clients (consulting clients)	50	23.8 %	4	21.1%
Both internal and external clients	41	19.5 %	6	31.6%
Other (do not provide OSH Services)	15	7.1%	0	0
Employer size	(n=198)		(n=19)	
More than 1000 employees	109	55.1 %	11	57.9%
251-1000 employees	33	16.7 %	2	10.5%
51-250 employees	17	8.6 %	1	5.3%
1-50 employees	39	19.7 %	5	26.3%
US Region [a]	(n=180)		(n=19)	
West	58	32.2 %	9	47.4%
Midwest	30	16.7 %	4	21.0%
South	34	18.9 %	3	15.8%
Northeast	58	32.2 %	3	15.8%

Note. [a] U.S. Census Bureau's (2021) classifications used. [b]Minimum of intermediate was required to participate in a focus group.

Data Collection

The data were collected over a five-month period from July 2022 to November 2022. All participants completed the online survey; those scoring intermediate or higher TWH experience were invited to participate in the focus group portion of the study. If they answered yes, then they were asked to provide their name and email address for scheduling purposes. A total of 258 OSH professionals responded to the survey; of these, 210 participants were included in the survey analysis because they completed at least half of the survey. A total of 41 OSH professionals volunteered to participate in a focus group; of these, 19 attended a focus group.

Instruments

Survey

Participants were sent a link to access the online, 60-item survey in Qualtrics (*Qualtrics*, 2020). The survey took 10-12 minutes to complete. The instrument included questions related to *Total Worker Health* (17 items), occupational variables (16), educational preference variables (12 items), IPE variables (15 items). This study reports only on the IPE variables and selected occupational variables.

Readiness for Interprofessional Education Scale. Readiness for IPE was measured with a previously validated instrument, Readiness for IPE Scale (Parsell & Bligh, 1999; Reid et al., 2006). The full scale is 23 items that are organized in three subscales: Teamwork and Collaboration, Sense of Professional Identity, and Patient Centeredness (Reid et al., 2006). For brevity, this study used only the 12 items that comprise the Teamwork and Collaboration subscale. This subscale was selected based high relevance for the collaborative practice needed for *Total Worker Health*. Examples of RIPLS questions, adapted for *Total Worker Health* as described below) were, “Shared

learning with other professionals will help me to communicate better with workers and other professionals" and "Shared learning will help me to think positively about professionals outside of my discipline when working on TWH solutions." Participants responded on a Likert 5-point scale (1=strongly disagree to 5=strongly agree). A mean score was computed using all 12 items to create a variable for readiness for IPE.

The previously validated RIPLS instrument (Reid et al., 2006), originally developed and validated with healthcare professionals, was adapted for this study by replacing healthcare terminology with wording appropriate to occupational safety and health professionals working in employer settings to deliver *Total Worker Health.* Adapted items for the adapted "RIPLS-TWH" scale were pre-tested with a small sample of OSH professionals in occupational safety, occupational nursing, and industrial hygiene. Pre-testers evaluated the modified questions using an evaluation tool that scored each item on a scale of 1-5 (1 = not at all, 5 = very) for two criteria: clarity of meaning and appropriateness for OSH and TWH context. Reviewers' pre-tests mean score was 4.39 for each criterion of clarity and OSH appropriateness. Item modifications and reviewer scores are provided in Appendix E, Table E1.

Interprofessional Peer Learning Community Preference. Interprofessional peer learning community preferences were assessed by asking participants, "If a *Total Worker Health* IPE experience was available to you, how likely would you be to participate in the following types of peer learning communities?" Participants responded using a 5-point scale (1 = very unlikely to 5 = very likely) to these two questions: 1) Learn together with inter-disciplinary professionals from <u>different organizations</u>, and 2) Learn together with inter-disciplinary professionals from <u>my organization</u>.

Participant Occupational Characteristics. Six variables were collected to characterize the OSH professionals in this sample. Variables and response values are listed in Table 4.2.

Table 4.2

Participant Occupational Variables

Variable	Response Values
OSH discipline	1=Safety (includes environmental health and safety, ergonomics, injury prevention); 2=Industrial Hygiene; 3=Engineer; 4=Occupational Health Nurse; 5=Occupational Physician; 6=Total Worker Health; 7=Wellness; 8=Human Resources; 9=Risk Management; 10=Researcher/Educator; 11=Student (not employed); 12=Other Recoding[a]: 1= Safety; 2=Industrial Hygiene; 3=Occupational Nurse; 4 = Occupational Physician; 5=All other codes
OSH experience	0=None at all; 1=Very little; 2=Some; 3=Moderate; 4=A good amount; 5=A lot
TWH experience	1=None. Have not yet tried to implement a TWH approach; 2=Beginner. Have started implementing TWH in my practice; 3=Intermediate. Have been implementing TWH for some time; 4=Advanced. Working towards implementing all elements of TWH practice, including organizational structures to support integration of safety, health, and well-being systems; 5=Expert. Have fully implemented all elements of TWH practice.
OSH clients	1=Serves single employer organization where participant is employed (internal OSH) 2=Serves employer clients other than current employer (external OSH) 3=Both (internal and external OSH services)
Employer size	**Survey categories:** 1 = Sole owner/operator; 2= 2 to 10 employees; 3=11 to 50 employees; 4=51 to 100 employees; 5=101 to 250 employees; 6=251 to 500 employees; 7=501 to 1000 employees; 8=More than 1000 employees **Recoding:** 1=1 to 50 employees; 2=51 to 250 employees; 3=251 to 1000 employees; 4=More than 1000 employees
Employer state	1-53, including all US states, plus District of Columbia, Puerto Rico, "Not in U.S."

Note. [a]TWH participants (n=2) were re-coded to categories 2 and 7 based on certification and job history.

Focus Group

Participants recruited for focus groups were OSH professionals who had practical experience implementing TWH in their or a client's place of employment. Volunteers were assigned to one of five focus groups held during October and November 2022. Group size was limited to 3-6 people to optimize participant interactions in the virtual environment (Lobe et al., 2020; Nobrega et al., 2021). To the extent possible, groups were formed based on specific OSH discipline (industrial hygiene, safety, occupational health nurses, occupational physicians) to facilitate ease of discussion among members with similar job roles. A structured script was used (Table 3.1 and Figure 4.1) along with visual question prompts shared on screen to ensure consistency of questions between groups. This study reports only on the focus group questions related to IPE. For these questions, participants were invited to submit their responses by typing into the chat window. If clarification was needed, the researcher facilitator invited verbal elaboration of the response.

Figure 4.1

Focus Group Questions

Your TWH Role: How you see OSH vs. TWH Competencies	Competencies Needed for Specific TWH Practices	Interprofessional Education
• Please share your role in TWH, give 1 example of TWH in your organization? • How has TWH changed how you do your job? What competencies did you use that were different?	For each TWH practice (1-5): • What competencies are needed? • What barriers do you see?	• What would motivate you to participate in TWH IPE? • What barriers do you see to participate in TWH IPE? • What recommendations do you have for designing a quality TWH IPE experience?

Data Analysis

Survey data were exported from Qualtrics to Microsoft Excel (Microsoft Corporation, n.d.) for cleaning. The cleaned data were then imported to SPSS (IBM Corporation, 2021) for analysis. Descriptive statistics (*M, SD*) were computed and reported for individual RIPLS-TWH items and for the RIPLS-TWH scale. Scale internal consistency was assessed, and ANOVA was performed to test group differences in RIPLS-TWH based on OSH discipline. Frequencies for the two IPE peer learning community preference items were computed.

Focus group audio and chat text data were recorded and written transcripts were produced for all but one focus group session within the Zoom conferencing software (Zoom Video Communications, Inc., n.d.). Data from one unrecorded session were collected in written notes, then validated with participants. Audio, chat, and transcription data were exported from Zoom and saved on a university-secured network drive. Zoom transcription text was manually cleaned within one week of the recording to remove text indicating partial vocalizations and edit to correct misspellings and misattribution of speakers. Cleaned transcripts were imported to NVivo (QSR International, 2022) for coding and analysis.

Focus group data were coded by a single researcher in two phases. During phase 1, the data were coded using an a priori node structure that mirrored the three question prompts used in the focus group script: IPE motivators, IPE barriers, and IPE recommendations. During phase 2, the data within each node were coded thematically into child nodes, using a combination of open coding and comparison with constructs from interprofessional collaborative practice frameworks (Bronstein, 2003; Petri, 2010).

The intent of thematic coding was to identify the most common motivators, barriers, and recommendations that could be used practically by educators when designing future IPE-inspired TWH continuing education. Examples of constructs from interdisciplinary collaborative frameworks include relational (interpersonal) skills, communication, role clarity (Bronstein, 2003; Petri, 2010), professional identity attitudes (Hall, 2005; Khalili et al., 2013; Thomson et al., 2015), and organizational and leadership support factors (Bronstein, 2003; Moilanen et al., 2020; Petri, 2010; Suter et al., 2009). A second researcher reviewed the child node data to assess face validity of themes and reliability of data coded within the themes. Discrepant views were discussed and reconciled by the two researcher coders.

Results

The results are organized in this section in three parts to align with three key research questions: How do OSH professionals rate their readiness for interprofessional learning for *Total Worker Health*? Do OSH professionals express a preference for learning with interdisciplinary professionals from within their own organization or from other organizations? How do OSH professionals view the motivators and barriers for participating in interprofessional TWH education?

Readiness for Interprofessional Education

Item Statistics

The item level responses for Readiness for Interprofessional Learning in *Total Worker Health* (RIPLS-TWH) were high across all items (Table 4.3), indicating that participants mostly or always agreed that interprofessional learning could facilitate positive outcomes for TWH teamwork and collaboration for *Total Worker Health*. Nearly

three quarters (72%) of participants reported they agreed with the statement, “I have participated in interprofessional education in the past.” This statement was not part of the RIPLS scale. However, it was included in the survey to benchmark prior IPE history and because prior IPE experiences (especially if positive) predict interdisciplinary collaborative competency (Petri, 2010).

Table 4.3

Item Descriptive Statistics: Readiness for Interprofessional Learning in Total Worker Health

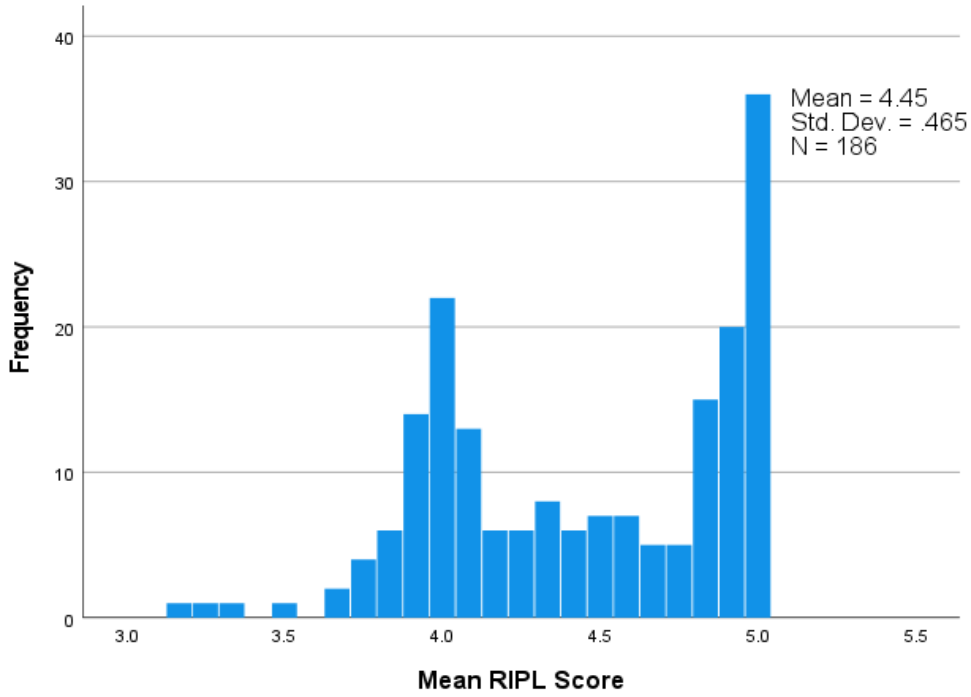
	N	Range	*M*	*SD*	Skewness	
					Statistic	*SE*
RIPLS_1- think positively other disciplines	185	3	4.43	.568	-.540	.179
RIPLS_2 - clarify nature of problems	185	2	4.49	.523	-.198	.179
RIPLS_3 - communicate better	186	3	4.46	.589	-.715	.178
RIPLS_4 - better team workers	186	3	4.44	.596	-.832	.178
RIPLS_5 - better understand problems	183	3	4.50	.637	-1.282	.180
RIPLS_6 - understand my limitations	183	3	4.38	.643	-.806	.180
RIPLS_7 - more effective TWH team	183	4	4.45	.652	-1.390	.180
RIPLS_8 - improve relationships in workplace	183	3	4.36	.687	-.698	.180
RIPLS_9 - comm skills should be learned with other disciplines	183	3	4.30	.749	-.702	.180
RIPLS_10 - welcome small group projects with other disciplines	183	4	4.38	.692	-1.178	.180
RIPLS_11 - team working skills are essential to learn	183	3	4.57	.606	-1.262	.180
RIPLS_12 - trust and respect is needed for group learning	183	2	4.63	.528	-.984	.180
Valid N (listwise)	183					

Scale Statistics

The RIPLS-TWH scale mean score was high (M =4.45, SD = .47); skewness was -.310; negative (left) skewness is evident in Figure 4.2. Shapiro-Wilk and Kolmogorov-Smirnov tests of normality confirmed the data were not normally distributed ($p < .001$), which is also evident from visual inspection of Figure 4.2.

Figure 4.2

Histogram Showing Non-Normal Distribution of RIPLS Mean Score Data (n = 186)



A Shapiro-Wilk test of normality was performed to evaluate normality of the data for each RIPLS item. The results showed that the distribution data for RIPLS items 1-12 data was not normal ($W_{RIPLS1\text{-}12} = .644\text{-}.786, p < .001$) Based on this result, a non-parametric test was used to summarize the data. RIPLS-TWH median score was 4.5, with interquartile range of 0.92. A test of internal consistency (Cronbach's α) was performed on the 12 items comprising the Readiness for TWH Interprofessional Learning Scale. The 12-item scale was highly reliable (α = .93). Item statistics supported retaining all items

for analysis, as the estimated reliability varied only slightly (α ranged from .925 to .93) when estimated for removal of any specific item.

Assessment of Group Differences in RIPLS-TWH

One-way ANOVA was conducted to assess whether there were differences in RIPLS mean score values based on OSH discipline. OSH discipline included five groups: safety (M = 4.35, SD = .48, n = 58), industrial hygiene (M = 4,56, SD = .41, n = 31), occupational nurse (M = 4.50, SD = .47, n = 26), occupational physician (M = 4.41, SD = .50, n = 21), and other (M = 4.49, SD = .46, n = 50). Levene's test confirmed the data met assumptions of homogeneity of variances, $F(4, 181) = .700$, p=.593. There were *no significant differences* in RIPLS-TWH scores among OSH discipline groups [$F(4,181) = 1.400$, $p = .236$].

Interprofessional Peer Learning Community Preference

Three quarters of participants expressed they would be likely to participate in an interprofessional learning community, whether with interdisciplinary peers from organizations other than their own, or from within their organizations (Table 4.4).

Table 4.4

Response Frequencies: Interprofessional Peer Community Preferences (n=183)

	Frequency	
Variable	*n*	%
Learn together with inter-disciplinary professionals from different organizations.	*M*	*SD*
	4.25	.79
Very likely (5)	77	36.7 %
Somewhat likely (4)	81	38.6 %
Neither likely nor unlikely (3)	19	9.0 %
Somewhat unlikely (2)	5	2.4 %
Very unlikely (1)	1	.5%
Learn together with inter-disciplinary professionals from my organization.	*M*	*SD*

	4.35	.74
Very likely (5)	86	41.0%
Somewhat likely (4)	81	38.6 %
Neither likely nor unlikely (3)	11	5.2 %
Somewhat unlikely (2)	4	1.9 %
Very unlikely (1)	1	.5%

Similar to the RIPLS-TWH scores, peer learning community scores were also clustered on the upper two response options. A Kolmogorov-Smirnov Normal Test for non-parametric data confirmed the data do not follow normality either for the "different organizations" variable $D(183) = 0.25$, $p < .001$ or the "my organization" variable $D(183) = .28$, $p < .001$. A Wilcoxon Signed-Rank Test was performed to compare the scores for the two peer learning types (different organizations vs my organization). The mean score for "interdisciplinary peers from my organization" ($M = 4.25$, $SD = .79$) was not statistically significantly different from the mean score for "interdisciplinary peers from other organizations" ($M = 4.35$, $SD = .74$), $W(183) = 1.85$, $p = .064$.

Motivators, Barriers, and Recommendations for TWH IPE

Motivators, barriers, and recommendations for TWH interprofessional learning are summarized below from the five focus group sessions. Most responses were collected through the chat window, except for a few verbal responses that were collected when elaboration was needed.

Motivators for IPE Participation

Having an opportunity to learn about new perspectives was, by far, the most important anticipated benefit for using IPE pedagogy during TWH training. This idea was mentioned by 10 of 19 participants across all the focus groups. Participants expressed their desire to learn from professionals who are different from them (different disciplines or working in different industries) to learn how others view problems and

solutions. For example, one participant stated they would like to engage in discussions with an interdisciplinary group around a specific intervention, and "understand how each discipline would approach the problem [or] solution." Another participant stated that seeing a different perspective helps them "see my own environment" in a new way. Others pointed to the value of learning about the "barriers to success" and "key performance metrics" relevant to professionals outside of their discipline. Gaining new perspectives through IPE was also seen as means to expand subject knowledge; mental health and occupational health psychology were topics mentioned by one participant, an industrial hygienist.

Participants named other anticipated benefits for IPE, such as learning about TWH best practices (4 references) (e.g., seeing "how TWH is applied and the challenges in different industries") and developing common ground when it comes to TWH approaches and terminology (3 references). One participant mentioned relationship building as a key benefit that could be achieved by learning alongside professionals from other disciplines.

Barriers to IPE Participation

Participants were asked what barriers they perceive to participating in an interprofessional continuing education experience. Time (10 references) was most often mentioned, followed by cost considerations (4 references), and the possibility that professionals might not see IPE as relevant for their job roles (2 references). Other barriers raised were a lack of a TWH formal certification (1 reference) and the concern that professionals from different disciplines might be "speaking different languages;" the latter was presented as a possible barrier to learning success but not to participation itself.

Recommendations for Effective IPE Course Design

Participants recommended specific course design features that would create a high-quality IPE learning experience for *Total Worker Health*. The use of case studies topped the list as valuable tools for facilitating knowledge acquisition around TWH implementation and around interdisciplinary collaboration, comprising 11 of 25 total references focused on recommendations. The content of the case study should be selected and developed carefully to provide enough specificity for learning but "not so specific that it alienates certain industries." Some participants stated that case studies can help them learn how TWH is applied in different industries and for seeing "concrete examples of successful approaches." A safety professional recounted her experience attending a prior TWH interprofessional training, stating that hearing "small snippets of case examples and challenges" about TWH from other professionals with different backgrounds in different settings helped to build her knowledge of how TWH principles can be applied. Discussion during case study learning activities was recognized as a critical facilitator of interprofessional learning. Participants perceived that discussing problems with diverse professionals facilitates their understanding about the expertise that each member brings to problem-solving. For example, a wellness professional stated that when professionals from different backgrounds discuss a case study, individuals can take turns sharing how they approach the problem, then "bring them [the approaches] together into practice." This participant highlighted how the discussion process itself reveals "how we work together."

Another important course design recommendation was clear and specific learning objectives (8 references from 5 participants). Participants stated that future TWH

interprofessional education should have learning objectives that are "very targeted and specific" instead of a general overview course. IPE courses should offer a "concrete skill" and the learning objectives need to be "relevant for employers" (i.e., clearly state how the knowledge gained will benefit the organization). In addition, the course should provide a "clear reason for why the groups involved are there" – that is, how the knowledge will be relevant for different disciplines based on their TWH role. One of the reasons given for the importance of specificity was that OSH professionals cannot "waste time."

Participants from two groups recommended that IPE opportunities be offered online (virtually) so that distance would not hinder participation. One participant emphasized the importance of allowing "plenty of breakout sessions for discussion." and suggested that efforts be made to include professionals representing a broad range of disciplines. Availability of continuing education units/points was also mentioned as a recommendation; this concern was raised by nurses and industrial hygiene participants.

Discussion

This study was motivated by the desire to assess the desirability and readiness for interprofessional learning as a pedagogical approach for *Total Worker Health* continuing professional education. I sought to learn how favorably or unfavorably OSH professionals viewed learning with professionals from other disciplines (OSH related or not), how they feel about attending education with intra-organizational or inter-organizational participants, what factors would motivate or deter them from participating, and what recommendations they have for course design features that would satisfy interprofessional TWH learning needs. Overall, the findings show that OSH professionals view the concept of interprofessional learning highly favorably, attitudes did not vary

based on OSH discipline, and participants seemed equally open to learning with interdisciplinary groups from their own or other organizations.

The Readiness for Interprofessional Learning Scale adapted for this study had high internal consistency. Unlike Reid et al. (2006), no disciplinary differences were observed in the RIPLS-TWH Teamwork and Collaboration subscale score. Differences were not necessarily expected, since OSH professionals share a common code of ethics and shared similar knowledge (ICOH, 2014). However, results in this sample may differ from other OSH professionals who are not as interested or involved in *Total Worker Health* because interdisciplinary collaboration is embedded as a core value for TWH practice. The complete 23-item RIPLS-TWH instrument with three subscales might be useful for evaluation of future TWH interprofessional continuing education programs. Future research should evaluate the face and construct validity of the entire TWH-adapted RIPLS instrument (23 items; Appendix E) with a larger sample of OSH and non-OSH professionals. This would permit looking at the utility of the three constructs (teamwork and collaboration, sense of professional identity, and worker centeredness) for *Total Worker Health* and interprofessional differences in IPE readiness, similar to the protocol used by Reid et al. (2006). Alternatively, other instruments could be considered, such as the 27-item Interprofessional Attitudes Scale, which uses some of the RIPLS constructs and others (Norris et al., 2015).

Learning about and valuing discipline-specific knowledge is a key IPE learning outcome (Petri, 2010; Reeves et al., 2013). Participants identified these learning goals (referring to discipline-specific knowledge as “different perspectives”) as key motivating factors for participating in TWH interprofessional education. One industrial hygienist

volunteered to elaborate on her written chat response to the question of IPE motivators to describe the benefits she gets from talking with diverse professionals about *Total Worker Health*. She stated that in her role, "I rarely talk to people that are working with wellness programs. … So, this kind of interdisciplinary [discussion] is really helpful for me to see things from someone else's viewpoint." Her eagerness to speak up to share this view illustrated her enthusiasm for talking with others in the interdisciplinary focus group.

Participants highlighted the value of using case studies when designing future TWH interprofessional education. Case studies offer a tool for diverse professionals to interact around a specific scenario to solve a specific problem (Allen et al., 2011; Ramsay & Sorrell, 2006). Several participants described how the problem-based approach would enable them to learn how others viewed problems and how OSH professionals could collaborate across disciplinary boundaries. To achieve IPE goals, problem-based learning activities must be structured specifically to elicit discussion between all participants and to prompt reflection to process the information shared across disciplinary boundaries (Stentoft, 2017). Through discussion, professionals learn about the expertise and lenses of all the group members, and how other members' expertise can be brought together (i.e., integrated) to solve problems comprehensively. This approach is well suited for practicing interdisciplinary solution-building for complex workplace safety and well-being problems that can be addressed with a *Total Worker Health* approach. Thus, case studies can be a key tool to help OSH and other professionals practice the skills they need to learn to adopt TWH practices. In theory, practicing these skills successfully in a facilitated continuing education setting can build confidence for transferring them into the workplace independently.

Limitations and Strengths

A limitation of this study is the use of convenience sampling. A random sampling strategy may have produced different results, possibly resulting in lower scores if the kinds of OSH professionals who did not respond have less interest in TWH. Survey responses indicated that slightly over 90% of participants agreed with the statement, "It is important to use TWH approaches in my professional practice." Consequently, the results of this study cannot be generalized to the general population of OSH professionals. It is assumed that the study's observed readiness for interprofessional learning *overestimates* the readiness level of the general OSH professional population because participants in this study already value the concept of integration and interdisciplinary approaches. However, given that the intent of this study was to apply findings to OSH professionals seeking TWH continuing education, it is likely that the results would be generalizable to OSH professionals seeking TWH continuing professional education.

Another limitation is that the most focus group participants were mid and advanced career professionals. However, no obvious patterns differentiated responses of the early-career participants from the mid- and advanced-career participants. Therefore, it is unlikely that having more early-career OSH professionals in the sample would have produced different responses. Finally, the data collection method of collecting responses via the chat window in a compressed amount of time during the focus group may have limited the number of responses that participants contributed. It is possible that more responses (and more detail) would have been shared if participants had been given more time to express themselves verbally. However, this possibility may not be a significant limitation because many participants demonstrated they preferred chat responses to

verbal responses during earlier segments of the focus group. When invited to respond verbally, some participants offered text responses through the chat window instead.

One of the strengths of this study is that both the survey and focus group samples include OSH professionals from all US regions, from all core OSH disciplines (plus others relevant for TWH), who deliver OSH services in different ways (i.e., in-house vs. consultants) in varying sized organizations. The breadth of OSH professionals represented in this study implies that we can be somewhat confident that the readiness for interprofessional learning observed in this study can be generalizable to other OSH professionals with similar occupational profiles and involvement with *Total Worker Health* practice. Another strength is that the focus group participants were a subset of the survey participants and shared similar characteristics. Thus, the focus group data elaborated on what was learned in the survey to offer deeper insights about participants' views on TWH competencies and interprofessional education pedagogy.

Implications for Future Research and Practice

The findings of this study strongly support the use of interprofessional education pedagogy when designing TWH continuing education for OSH professionals. Questions remain as to whether and how IPE can best be applied for learners at different levels of OSH training. IPE has been used successfully in higher education training of health professionals, and more recently, with graduate OSH and public health training programs (McCullagh et al., 2022). TWH content could be introduced in existing IPE courses in higher education settings. Future research could evaluate faculty receptivity and opportunities to embed TWH content as part of graduate IPE courses in various programs (e.g., public health, health sciences, OHS, psychology, business). Future research could

also evaluate how to effectively use of IPE approaches in beginner- and advanced-level TWH continuing education. OSH professionals in this sample emphasize that, for advanced level TWH education, it is important to plan IPE learning objectives that are clear and specific. Professionals stated that, given their competing time demands, they will choose to participate in continuing education that offers a chance to develop a specific skill that they can use. Future research can be directed at identifying candidate TWH case study topics with broad appeal and utility for OSH professionals, and evaluation of case study learning activities for different groups (e.g., beginner and advanced-level TWH learning) working in different industry settings.

Conclusion

Occupational health practice is transitioning to a more expansive practice paradigm called, *Total Worker Health.* Continuing professional education in TWH is needed by OSH professionals, but evidence is lacking for effective pedagogies for this emerging practice arena. This study begins to fill a knowledge gap to understand how OSH professionals view interprofessional education and what features would help enable effective course design. Providers of TWH continuing education can use findings from this study to guide curriculum development and delivery.

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CHAPTER V: CONCLUSION

This dissertation was motivated by the need to understand what competencies should be addressed in TWH training curricula and whether interprofessional education (IPE) pedagogy would align well with OSH professionals' learning needs. Three papers, together, addressed these questions. The research questions for each paper are listed in

Table 5.1

Research Questions for Each Paper

Paper	Research Questions
Paper 1 presented in Chapter II	1.1 How do OSH professionals perceive their level of skill in relation to specific TWH practice approaches?
	1.2 What occupational and organizational characteristics (e.g., OSH discipline, career stage, OSH experience, prior TWH education, climate for interdisciplinary collaboration) are associated with TWH skill level?
Paper 2 presented in Chapter III	2.1 What specific competencies (knowledge, skills, attitudes/values) do professionals need to successfully implement key TWH practice approaches?
	2.2 What barriers do OSH professionals identify, if any, for achieving specific TWH practice approaches?
Paper 3 presented in Chapter IV	3.1 How favorable or unfavorable are OSH professionals' attitudes regarding interprofessional learning for *Total Worker Health*?
	3.2 How do OSH professionals view the motivators and barriers for participating in interprofessional continuing education for **Total Worker Health**?

The First Paper

In the first paper, "*Total Worker Health* Competency Among Multidisciplinary Occupational Safety and Health Professionals: A Survey Study to Guide Continuing

Education", I assessed OSH professionals' appraisal of their skill level for specific TWH practices. I also explored whether and how occupational and organizational factors influence TWH skill level. Understanding where the skill gaps are greatest and how skills vary for different groups can help educators prioritize learning objectives for future TWH educational curricula.

I found that substantial gaps in TWH knowledge and participation in TWH education still remain. It is evident that many OSH professionals are implementing TWH practice approaches with little or no prior TWH training. Based on analysis of a novel 11-item TWH competency scale developed for this study, two latent constructs -- TWH program leadership skills and TWH risk assessment and control skills – appear to underlie TWH competence. OSH professionals scored their capabilities highest for technical skills related to risk assessment and hazard control, whereas they rated their abilities somewhat lower for skills related to overall program leadership and management. The two-factor TWH competency structure found in this study represents the first empirical evidence supporting a hierarchical organizing structure for a TWH competency framework.

In this paper, I also explored possible correlates of self-reported TWH competency. Career stage (i.e., level of OSH experience) was the strongest predictor of self-reported competency for TWH practice and was positively associated with both TWH leadership scores and TWH risk assessment and control scores. TWH education and, to a lesser extent, TWH experience were also significantly associated with TWH leadership skills but were not associated with TWH risk assessment skills. These results suggest that TWH leadership skills may be more responsive to TWH training for OSH

professionals of all career stages, whereas TWH risk assessment and control skills may be more suitable for mid or advance career professionals. Neither organization size, nor perceived organizational support for interdisciplinary collaboration, were statistically associated with self-reported TWH competency in this study.

The Second Paper

In the second paper "Perspectives of Occupational Safety and Health Professionals on Competencies Needed for *Total Worker Health* Practice," I explored specific competencies (i.e., knowledge, skills, attitudes) and barriers for five specific TWH practices that have been discussed in literature. This study drew from OSH professionals' real-world experiences with implementing TWH practices. Competencies discussed most frequently were communication skills (general and business specific); knowledge of OSH and TWH concepts, knowledge of appropriate risk assessment instruments and methods (especially for psychosocial risk exposures and mental health outcomes); knowledge of evidence supporting interventions that use a TWH approach, and knowledge of the organizational context (i.e., business priorities and key stakeholders) where OSH services are delivered. These specific knowledge and skill areas could be the focus of targeted education and training.

The findings of the second paper suggest tailored training content is needed for different TWH practice approaches. Some competencies (e.g., communication and collaboration) were cross cutting because they were important across multiple TWH practices, while other competencies clustered within specific TWH practice approaches (e.g., assessment instruments). Skills-oriented competencies, important for practices related to the TWH program leadership domain (i.e., coordination of safety, health,

wellbeing systems; facilitating leadership commitment to TWH), included communicating effectively with diverse audiences, communicating with leaders using business language, collaboration, and knowledge of the organizational context. Knowledge-oriented competencies (e.g., subject knowledge or technical skills), important for the practices related to the TWH risk assessment and control domain (i.e., integrated risk assessment, integrated interventions), included knowledge of risk assessment instruments and measures, evaluation methods (using surveys and qualitative method, integrating and synthesizing results across instruments), evidence-based interventions, workforce demographics, and subject/theoretical knowledge about TWH and OSH principles. Attitudinal competencies were least-often discussed; they appeared with greatest frequency in the TWH practices of (in descending order) worker engagement, integrated interventions, and integrated risk assessment. Respect for worker knowledge was the most salient attitudinal competency, followed by concern for workers. Findings from this paper can provide insights on specific learning objectives for different TWH practice approaches.

The second paper also provided insights about organizational, personal, and worker related obstacles that OSH professionals perceived for implementing TWH practices. Organizational barriers were by far, the most numerous and intractable. Examples of organizational barriers were culture (e.g., lack of trust, top-down, compliance oriented), competing priorities, cost/time, and lack of TWH knowledge and buy-in from organizational leaders. Personal barriers most often were related to lack of TWH knowledge, consistent with the low TWH education levels reported in the first

paper. Worker related barriers were the least numerous, and primarily were related to real or perceived concerns about workers' privacy and lack of trust.

The Third Paper

In the third paper "Attitudes of Occupational Safety and Health Professionals Towards Interprofessional Education for *Total Worker Health*," I examined OSH professionals' perceptions of the use of interprofessional education (IPE) approaches for TWH continuing education. Understanding OSH professionals' overall attitudes about IPE and what learning outcomes are most valued can help educators design effective curricula.

Through survey responses, participants strongly endorsed interprofessional education for building teamwork and collaboration skills. Through focus group responses, participants expressed their top valued IPE outcome was the opportunity to learn different perspectives when interacting with others from different backgrounds. This motivating factor endorses of one of the explicit goals of interprofessional education, which is to gain an understanding and respect for the expertise of other professionals within a team environment. Other valued IPE outcomes expressed by OSH professionals were learning about TWH best practices in other workplace settings and "developing common ground" for a shared TWH vocabulary and ways of working together. In this paper, participants identified time as the primary concern for participation. They also recommended specific qualities they would like to see in an IPE continuing education course. The use of case studies was the top recommendation for interprofessional learning. Participants saw two benefits for using case studies: learning how TWH is applied in different workplaces and learning how professionals from

different disciplines can collaborate. Finally, some focus group participants and a high proportion of survey participants endorsed online and virtual learning for removing distance and time barriers to participation. Some participants emphasized the value of small group discussion time to maximize opportunities for interdisciplinary interactions.

Implications for Practice

Collectively, the findings from this dissertation have numerous implications for design and delivery of TWH continuing education for OSH professionals. I share reflections on implications for TWH education access, delivery, curriculum content, and considerations for meeting the needs of a complex, multi-disciplinary field in the sections that follows.

Increasing Availability and Access to TWH Education

The low overall levels of TWH education reported by OSH professionals in this study point to the need for greater access to introductory and advanced level TWH education for working OSH professionals. Dissemination of education programs should not rely only on academic and professional associations because a variety of formal and informal pathways into the OSH field exist. Partnering with providers of OSH technical training and with labor organizations can help ensure wide access to low and no-cost introductory TWH education. Introducing TWH concepts during undergraduate training in OSH majors, nursing, and public health programs can help ensure that future OSH professionals share a common understanding of TWH approaches.

Given the evidence that many professionals may be implementing TWH without prior TWH training, more strategies are needed to ensure that professionals can access a progressive course of TWH education that first introduces the foundational concepts and

rationale, and then provides skills training that develops the specific competencies needed for the five TWH practice elements: integrated assessment, integrated interventions, coordination of organizational safety, health and well-being systems, facilitation of leader commitment to TWH, and engagement of workers. It is recommended that advanced TWH education courses require prior completion of TWH introductory education. This pre-requisite will ensure that all advanced learners have foundational knowledge about the scientific rationale supporting TWH principles and can define TWH practice approaches.

Prioritizing Content for TWH Curricula

A central purpose of this study was to generate knowledge that can be used to guide the design of TWH continuing professional education curricula. Based on the survey and focus group findings, it is evident that TWH education should address specific knowledge, skills, and attitudes within two main competency domains: TWH program leadership and TWH risk assessment and control skills. Educators can use the findings from the first and second papers to guide decisions about how to structure their course or curricula to address specific key competencies within each domain. Advanced level training in TWH program leadership and TWH risk assessment is recommended for mid-career and advanced career professionals to build knowledge and skills needed for program implementation. Additionally, advanced TWH training should include practical implementation strategies to support professionals as they attempt to transfer what they have learned into real world settings. Findings suggest that advanced TWH training content should include business communication; organizational and leadership behavior; the role of work organization and workplace psychosocial hazards on physical and mental

health outcomes; psychosocial risk assessment measures and methods; and evidence-based interventions that use a TWH approach. Advanced level training can be delivered as specialized graduate certificate programs or non-credit, continuing professional education certificate programs or individual courses.

Optimizing TWH Education Delivery

This study confirmed that interprofessional learning is a pedagogical approach that fits well with OSH professionals' educational values. Designing learning experiences that engage an interdisciplinary community to learn together about TWH practices has high potential for supporting the adoption of such practices. Not only can professionals learn the content, but they also learn how the content is perceived through different disciplinary lenses, and how to work together based on their job roles. Deciding how to offer interprofessional learning, especially if done online, will require careful consideration. Several participants stated that time is a potential barrier for educational participation. This constraint has implications for the course duration, scope, and process. Although learning engagement over a longer duration can allow deeper interaction and learning, time and flexibility must be considered for course design so that participation is feasible. Formative assessment with target audiences may be useful for selecting topics and the parameters for course involvement. Many examples of online interprofessional education learning for personnel in healthcare and social services are available (MacNeill et al., 2014; McCabe et al., 2021; McLoughlin et al., 2018; Reeves et al., 2017), but very few examples are accessible for OSH professionals, whether online or in person (Bottrup, 2005; Griggio et al., 2020). Some programs were offered as online, instructor-led, and some as professional learning communities (sometimes called communities of practice),

in which a cohort meets repeatedly (McLoughlin et al., 2018; Reeves et al., 2017). Prior studies highlight the importance of structuring the learning activities to facilitate effective interactions and support skills development; sharpening the facilitative skills of the instructor has also be shown to be critical for achieving IPE learning outcomes (Barbour et al., 2018; Hanna et al., 2013; McLoughlin et al., 2018). These prior studies and others could be models from which to develop and evaluate future virtual TWH interprofessional education for OSH professionals.

Tailoring Total Worker Health Curricula for Non-OSH Professionals

The diversity of professionals involved in TWH practice has implications for tailoring training content based on participants' prior knowledge. With increasing attention to TWH as an emerging, progressive approach to workplace safety and wellbeing, professionals with *no prior training* in occupational safety and health (e.g., health educators, health promotion specialists, human resources) may increasingly seek TWH continuing education. Customizing the TWH training to job roles will be essential. Non-OSH professionals need to be oriented to the basic concepts and terminology of occupational safety and health, including the NIOSH Hierarchy of Controls framework for mitigating hazards (CDC, 2023). Participants in this study attested to the importance of these topics as foundational knowledge. Basic training in these areas would help ensure effective communication and collaboration between OSH and non-OSH professionals. Starting with a shared mental model of the notion that TWH focuses first on remedying issues within the workplace before addressing individual behaviors can set the tone for effective collaboration when applying TWH thinking for problem solving. Non-OSH specialists (or even safety technicians or safety shop floor "leads") who have

little risk assessment training will benefit from learning OSH risk assessment concepts and terminology, whereas trained OSH professionals (in particular those with advanced risk assessment knowledge) will be ready for more advanced material. Applying a competency-based education approach for TWH can help learners at different levels of TWH skill advance along the continuum of novice to advanced. To the extent possible, TWH curricula should be tailored to different levels of complexity based on job role and prior TWH training history.

Recommendations for Future Research

This study demonstrated the value of using an 11-item TWH competency scale to assess factors associated with TWH competency. This scale was developed with input from a small number of OSH professionals and would benefit from further testing and development. Future research could develop a more extensive, detailed TWH skills scale that captures a fuller range of practice sub-competencies. Such a study could explore and refine the factor structure to confirm or expand the main constructs and their sub-competencies. It is possible that a lengthier scale might identify additional latent constructs, as was anticipated but not observed, in the current study. Scale development and validation can serve both to formalize and validate a TWH competency framework and to assess professional continuing education needs. Once a competency framework and measurement scale have been developed, future educational researchers can develop TWH education needs assessments and evaluation instruments for use by educators.

The TWH competencies identified in this study represent specific knowledge, skills, and attitudes needed for TWH practice. However, the study did not evaluate whether the competencies identified were unique to TWH or if they overlap with

competencies already developed during university-based or technical professional practice preparation. Future research should assess how the competencies identified in this study compare with competency frameworks from specific disciplines in OSH and other fields. Which competencies, if any, are shared and which do not overlap? Understanding the uniqueness of the competencies can 1) help identify the feasibility of incorporating TWH competencies into existing curricula, and 2) help discern whether TWH represents a new profession or is better conceptualized as specialized skills that can be developed by any professional with responsibility for worker safety, health, and well-being. TWH is relevant for a broad range of occupations, including occupational health and safety professionals (occupational health nurses and physicians, industrial hygienists, safety and environmental health managers, industrial engineers, occupational health psychologists) and professionals in worksite health promotion, organizational/industrial psychology, employee assistance, and human resources. Cross-walking or mapping TWH competencies with those of the above-named groups would identify which TWH knowledge, skills, and attitudes are unique versus shared among various professions. This process also might identify validated competency domains disciplines (e.g., interprofessional collaboration) from other disciplines that could be adapted for use in a TWH competency framework. Possible methods for this research could involve stakeholder group techniques (Calhoun et al., 2002), document review (Woodhouse et al., 2010), or both (Olson et al., 2005). This area of study is relevant as governmental and academic experts have taken steps to form a specialized TWH professional society (Society for *Total Worker Health*, n.d.).

Evidence that a good number of professionals are implementing TWH without prior TWH education raises concerns about fidelity to TWH principles in different settings. More research is needed to define and validate a TWH competency framework so that standards of practice can be set, and educational learning objectives and evaluation tools can be created to measure learning and practice performance. The process to define and validate a TWH competency framework can benefit from approaches used in other fields. These approaches include extracting knowledge from literature, generating a body of practice-based knowledge from professionals in real-world settings, and applying broad consensus building processes such as expert advisory panels and Delphi methods (Batt et al., 2020; Strudsholm & Vollman, 2021).
These processes will take time. However, as more professionals participate in TWH academic and professional education programs, the available study population will also expand, creating more opportunities to engage a range of experienced stakeholders in competency validation activities. The results of this study suggest that it will be important to involve faculty in both higher education and continuing professional education to help identify appropriate levels of TWH practice performance along a continuum from novice to expert.

The findings of this study strongly support the use of an IPE framework for delivering TWH continuing education. Participants' statements explicitly aligned with the learning outcomes targeted by this framework. Questions remain as to whether and how IPE can best be applied for learners at different levels of OSH training. IPE has been used successfully in higher education training of health professionals, and more recently, with graduate OSH and public health training programs (McCullagh et al., 2022). TWH

content could be introduced in existing IPE courses that take place in higher education settings. Future research could evaluate faculty receptivity and opportunities to embed TWH content as part of graduate IPE courses in various programs (e.g., public health, health sciences, OHS, psychology, business). Research could also evaluate how to tailor problem-based learning through case studies to deliver IPE effectively for beginner and advanced level TWH continuing education settings.

Conclusion

Occupational health practice is transitioning to an expanded, integrative practice paradigm called, *Total Worker Health.* This paradigm directs prevention efforts simultaneously to work and non-work contributors of poor health and work outcomes. Continuing professional education in TWH is needed by OSH professionals, but TWH competencies have not yet been validated and use of IPE has been reported for TWH continuing education. This study begins to fill a current knowledge gap by understanding how OSH professionals appraise their current level of competency in TWH practices, what specific knowledge skills and attitudes need to be learned, and whether interprofessional education aligns with OSH professionals' educational values and needs for TWH learning. Findings from this study can be used by providers of TWH education to guide curriculum development and to advance a TWH competency framework. The latter is urgent for ensuring consistent TWH practice across industrial settings.

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APPENDICES

APPENDIX A

Total Worker Health Education Needs Assessment Survey for Occupational Safety and Health Professionals

Welcome to the *Total Worker Health*® Education Needs Assessment Survey.

We are asking you to complete a brief, anonymous survey that will take10-15 minutes to complete. The survey purpose is to learn what specific knowledge and skills are needed by occupational safety and health (OSH) professionals related to *Total Worker Health* (TWH), and how you prefer to participate in continuing education. You will also be asked to provide some demographic information.

During the survey, you may be invited to participate in a focus group to discuss TWH competencies in greater detail. If you agree, we will ask you to enter your contact details to receive a scheduling email.

If you complete the survey by October 31st, you will have an opportunity to participate in a drawing to win a $100 Amazon gift card. To participate, select "Yes, I would like to be entered to win" as your response to the last question of this survey. If you elect to participate in a focus group, you will be offered an additional incentive.

This survey is an activity of the Center for Promotion of Health in the New England Workplace, a NIOSH *Total Worker Health* (TWH) Center for Excellence. Survey results will be used to guide development of new TWH continuing professional education for Occupational Safety and Health professionals. The survey is part of a dissertation study, “Perspectives of Occupational Safety and Health Professionals on *Total Worker Health* Competencies and Interprofessional Education.”

Informed consent information

- No personal information will be collected in this survey.
- There are no anticipated risks to you from participating, other than the time you spend completing the survey.
- You are free to skip any questions you do not want to answer.
- You may withdraw your participation at any time.
- There are no direct benefits to you from participating, beyond the opportunity to enter a gift card drawing.
- Your responses will help to design future education courses for OSH professionals on the topic of *Total Worker Health*

If you have any questions, please contact the lead investigator, Suzanne Nobrega, M.S. (Suzanne_Nobrega@uml.edu) or Associate Professor, Jill Lohmeier, Ph.D., (Jill_Lohmeier@uml.edu), who is supervising this study. If you have any questions about your rights as a participant, concerns, or complaints, contact the UMass Lowell IRB at

IRB@uml.edu or at 978-934-4134. You may print a copy of this consent page for your records.

Thank you in advance – we appreciate you sharing your time and insights! To proceed with the survey, please click on "Agree" below to indicate that:

• You have read and understand the above information
• You voluntarily agree to participate in the research
• You are 18 years of age or older
• You are employed at least 20 hours per week as an occupational health and/or safety professional

A few quick questions about your profession.

Occupational Information

Q1 What is your profession?

Safety professional (e.g., safety consultant, health and safety, environmental health and safety, ergonomist)
Industrial hygienist
Engineer (safety engineer, industrial engineer, etc.)
Occupational health or employee health nurse
Occupational physician
Total Worker Health
Wellness professional (health promotion, wellness manager, etc.)
Human resources professional
Risk management/loss control
Researcher/Educator (academic, government, etc)
Student (not employed as an OSH professional)
Other (please specify)

Q2 How do you provide OSH services?

Internally - for my employer (1), Externally - for client organizations (2), Both (3), Other (4)

Q3 Please indicate if you are a member (local chapter or national) of the professional associations below (select all that apply)

American Society of Safety Professionals (ASSP)
American Industrial Hygiene Association (AIHA)
Human Factors and Ergonomics Society (HFES)
American Association of Occupational Health Nurses (AAOHN)
American College of Occupational and Environmental Medicine (ACOEM)
Worksite Wellness Council of Massachusetts (WWCMA)
Northeast Human Resources Association (NEHRA)
Society for Human Resource Management (SHRM)
Other (please specify)

Q4 Please rate your current level of OSH experience:

None at all (1), Very little (2), Some (3), Moderate (4), A lot (5)

Q5 What stage do you identify yourself at in your current profession?

Early Career (1), Mid-Career (2), Advanced Career (3)

Q6 Please estimate the number of employees in the organization where you are employed.

I am the only employee (or sole owner/operator)

2 to 10 employees
11 to 50 employees
51 to 100 employees
101 to 250 employees
251 to 500 employees
501 to 1000 employees
More than 1000 employees

Q7 In which state is your employer located?

▼ Alabama (1) ... I do not reside in the United States (53)

The following questions will ask your opinions about using *Total Worker Health* approaches in your job as an Occupational Safety and Health (OSH) professional.

> *Total Worker Health* is defined as policies, programs and practices that integrate protection from work-related safety and health hazards with injury and illness-prevention efforts to advance worker well-being.

Please indicate your level of agreement with the following statements.

5-point scale: 1=Strongly disagree, 2=Disagree, 3=Neither disagree nor agree, 4=Agree, 5=Strongly agree

Q8 It is important to use *Total Worker Health* approaches in my professional practice.

Q9 Please rate your overall knowledge, confidence, and ability to practice a *Total Worker Health* approach. Scale 1-5: 1 = Not at all, 5 = Very

a. How knowledgeable are you about the TWH approach?
b. How confident would you feel to discuss the TWH approach with another professional?
c. Overall, how capable do you feel right now to use a TWH approach?

Q10 Please select the option below that best describes your current level of *Total Worker Health* experience:

5-point scale: 1=None, 2=Beginner, 3=Intermediate, 4=Advanced, 5=Expert

1 = Have not yet attempted to implement a TWH approach

2 = Have started implementing TWH in my practice

3 = Have been implementing TWH and learning/refining over time

4 = Have fully implemented most elements of TWH in my practice

5 = Have fully implemented all elements of TWH practice, including organizational structures to support full integration of safety, health, and wellbeing systems.

PARTICIPANTS WHO SELECT SCORE OF 3 OR GREATER RECEIVE THIS QUESTION:

Based on your experience, you are eligible to participate in a focus group study to assess specific skills needed to implement TWH practices. Would you like to be contacted to participate in a focus group (using Zoom) in early fall to discuss your experience implementing a TWH approach?

- Yes, please contact me with more information.
- No, I do not wish to participate.

(If yes) Please write your name so we can contact you about the focus group.

(If yes) Please write the email address we should use to contact you about the focus group.

(If yes) Please rewrite your email address to confirm

RESUME SURVEY FROM HERE

Q11 Please selection the option below that best describes your current level of TWH training.

5-point scale: 1=None, 2=Beginner, 3=Intermediate, 4=Advanced, 5=Expert

1 = I have not participated in any TWH education

2 = I have attended one or more educational sessions (e.g., webinar, presentation, etc.) to learn TWH basic concepts

3 = I have attended multiple hours (or courses) in TWH education to learn how to implement TWH approaches (e.g., in-depth e-learning course, full day course, ongoing professional learning community, etc.)

4 = I have completed (or am pursuing) a TWH certification program (multiple courses) to build comprehensive competencies TWH practice

5 = I have completed advanced TWH training and have taught TWH practices to other professionals.

Q12 Please indicate your **current skill level** in each of the following competencies related to *Total Worker Health* approaches.

Likert Scale 1-5: 1 = Not skilled, 2 = Little Skill, 3 = Somewhat skilled, 4 = Skilled, 5 = Highly Skilled

1. Demonstrate leadership commitment to worker safety and health at all levels of the organization.

2. Facilitate leadership commitment to worker safety, health, and well-being

3. Use integrated approach to assessment of work and non-work risks. (E.g., work risks = ergonomic hazards, job stressors; non-work risks = health conditions, health behaviors)

4. Ensure confidentiality and privacy for workers when handling safety and health data

5. Identify worker characteristics or working conditions in your organizations that are associated with one or more health conditions.

6. Design work to eliminate or reduce safety and health hazards and promote worker well-being

(e.g., Use the Hierarchy of Controls adapted for TWH to prioritize elimination of workplace hazards over individual level safety practices)

7. Develop workplace programs that integrate elements of safety/health protection with health promotion to promote worker wellbeing

8. Promote and support worker engagement throughout program design and implementation

9. Identify safety and health issues most important to front-line employees

10. Integrate relevant program systems (by assessing relationships across relevant policies and programs) to advance worker wellbeing

11. Bring together leaders and teams with overlapping or complementary responsibilities for planning and priority setting (e.g., safety, occ health, HR, wellness)

Q13 Interprofessional learning is when professionals from two or more disciplines participate in education together for "shared learning.

Please indicate your level of agreement with the statements below related to interprofessional learning. (Note: "TWH" means *Total Worker Health*)

Likert 1–5 scale: 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree

1. Shared learning will help me to think positively about working with professionals outside of my discipline when working on TWH solutions.

2. Shared learning will help to clarify the nature of problems related to safety, health, and well-being.

3. Shared learning will help me to communicate better with workers and other professionals.

4. Shared learning during continuing education would help workplace safety and health professionals become better team workers.

5. Shared learning with other professionals will increase my ability to understand problems related to employee safety, health, and wellbeing

6. Shared learning will help me to understand my own limitations.

7. Learning with other professionals will help me become a more effective member of a *Total Worker Health* team.

8. Learning with professionals from other disciplines during continuing education would improve relationships in my workplace.

9. Communication skills should be learned with professionals from other disciplines.

10. I would welcome the opportunity to work on small-group projects with professionals outside of my discipline.

11. Team-working skills are essential for all workplace health and safety professionals to learn.

12. For small group learning to work, professionals need to trust and respect each other.

13. I have participated in interprofessional education in the past. (not part of RIPLS scale)

Q14 Organizational support needed for interdisciplinary collaboration

Interdisciplinary collaboration refers to professionals from two or more different disciplines working together toward a common purpose.

Please indicate your level of agreement with the statements below related to interdisciplinary collaboration.
Likert 1–4 scale: 1 = Strongly disagree, 2 = Disagree, 3 = Agree, 4 = Strongly agree

In my work unit. . .
. . .development of IC is a core aim
. . .leaders of different disciplines make joint decisions
. . .leaders of different disciplines have shared education
. . .leaders allocate resources for the development of IC
In my organization (e.g., corporation, workplace, firm). . .
. . .development of IC is a core aim
. . .databases support realization of IC between work units
. . .development of IC between different units is supported
. . .resources are allocated for development of IC

Q15 Please indicate your likelihood of participating in future *Total Worker Health* offerings using the following continuing educational methods / formats:

Scale 1-5: Extremely unlikely (1), Somewhat unlikely (2), Neither likely nor unlikely (3), Somewhat likely (4), Extremely likely (5)

Items:

1. In-person workshop at a conference
2. In-person workshop in New England
3. Blended courses (combines online and in-person learning)
4. Webinars (1-hour) delivered using video conferencing
5. Virtual learning community that meets repeatedly using video conferencing
6. Online, instructor-led courses (learners access content using a computer, plus they meet using videoconferencing with instructors and other learners)
7. Online, on-demand courses (learners access content using a computer at their own pace, no meetings with instructors or other learners)

Q16 Interprofessional education provides an opportunity for professionals from <u>different disciplines</u> to jointly participate in an educational experience to learn how to work toward a common purpose.

If a *Total Worker Health* **interprofessional education** experience were available to you, how likely would you be to participate in the following **types of peer learning communities**?

Scale 1-5: Very unlikely (1), Somewhat unlikely (2), Neither likely nor unlikely (3), Somewhat likely (4) Very likely (5)

Items:

1. Learn together with inter-disciplinary professionals from <u>different organizations</u>.
2. Learn together with inter-disciplinary professionals from <u>my organization</u>.

Q17 Would you like to be entered in the drawing to win a $100 Amazon gift card?

o Yes, I would like to be entered to win (1)
o No, I prefer not to participate in the drawing (2)

APPENDIX B

Descriptive Statistics and Test Results for Selected Survey Variables

Table B1

Response Frequencies: TWH Education and Experience

Variable and Response Values	*M (SD)* or *n*	%
Total Worker Health Education (n=203)	2.14 (.99)	
1 = None. I have not participated in any TWH education.	57	28.1 %
2 = Beginner. I have attended one or more educational sessions (e.g., webinar, presentation, etc.) to learn TWH basic concepts.	84	41.4 %
3 = Intermediate. I have attended multiple hours (or courses) in TWH education to learn how to implement TWH approaches (e.g., in-depth e-learning course, full day course, ongoing professional learning community, etc.).	45	22.2 %
4 = Advanced. I have completed (or am pursuing) a TWH certification program (multiple courses) to build comprehensive competencies TWH practice.	11	5.4%
5 = Expert. I have completed advanced TWH training and have taught TWH practices to other professionals.	6	3.0%
Total Worker Health Experience (n=207)	2.35 (1.26)	
1 = None. I have not yet tried to implement a TWH approach.	76	36.7 %
2 = Beginner. I have started implementing TWH in my practice.	40	19.3 %
3 = Intermediate. I have been implementing TWH in my professional practice for some time.	40	19.3 %
4 = Advanced. I am working towards implementing all elements of TWH practice, including organizational structures to support integration of safety, health, and wellbeing systems.	45	21.7 %
5 = Expert. I have fully implemented all elements of TWH practice, including organizational structures to support integration of safety, health, and wellbeing systems.	6	2.9 %

Table B2

Spearman's Ranked Correlation Test for Total Worker Health (TWH) Education and TWH Experience

			Current level of TWH experience	Current TWH training history
Spearman's rho	Current level of TWH experience	Correlation Coefficient	1.000	.336**
		Sig. (2-tailed)	.	<.001
		N	207	203
	Current TWH training history	Correlation Coefficient	.336**	1.000
		Sig. (2-tailed)	<.001	.
		N	203	203

**. Correlation is significant at the 0.01 level (2-tailed).

Table B3

Descriptive Statistics: Overall Total Worker Health Knowledge, Confidence, Capability

Variable	*n*	*M*	*SD*	Median	Minimum	Maximum
TWH Knowledge	209	3.61	0.99	4.00	1.00	5.00
TWH Confidence	209	3.55	1.07	4.00	1.00	5.00
TWH Capability	209	3.33	1.13	3.00	1.00	5.00

Table B4

Response Frequencies: Overall TWH Competence - Knowledge, Confidence, Capability

Variable	*M (SD)* or *n*	%
Total Worker Health Importance (n=210)	4.4 (0.8)	
Strongly agree (5)	105	50.0 %
Agree (4)	87	41.4 %
Neither agree nor disagree (3)	12	5.7 %
Disagree (2)	1	0.5 %
Strongly disagree (1)	5	2.4 %
Total Worker Health Knowledge (n=209)	3.6 (1.0)	
Very (5)	37	17.7 %
Good amount (4)	84	40.2 %
Somewhat (3)	67	32.1 %

A little (2)	11	5.3 %
Not at all (1)	10	4.8 %
Total Worker Health Confidence (n=209)	3.6 (1.0)	
Very (5)	42	20.1 %
Good amount (4)	70	33.5 %
Somewhat (3)	70	33.5 %
A little (2)	15	7.2 %
Not at all (1)	12	5.7 %
Total Worker Health Capability (n=209)	3.3 (1.1)	
Very (5)	32	15.3%
Good amount (4)	65	31.1 %
Somewhat (3)	68	32.5 %
A little (2)	27	12.9 %
Not at all (1)	17	8.1 %

Table B5

Descriptive Statistics: Specific Total Worker Health Practice Skills

Variable	*n*	*M*	*SD*	Median	Minimum	Maximum
SKILL_1 Demonstrate leadership commitment to SHW*	184	3.60	0.93	4.00	1.00	5.00
SKILL_2 Facilitate leadership commitment to SHW	184	3.59	0.91	4.00	1.00	5.00
SKILL_3 Integrated approach to assess work and non-work risks	184	3.42	1.00	3.00	1.00	5.00
SKILL_4 Ensure confidentiality and privacy	184	4.29	0.78	4.00	2.00	5.00
SKILL_5 Identify work conditions linked to health	184	3.82	0.85	4.00	1.00	5.00
SKILL_6 Design work to eliminate hazards	184	3.79	1.02	4.00	1.00	5.00
SKILL_7 Develop integrated programs	184	3.49	0.98	3.00	1.00	5.00
SKILL_8 Promote and support worker engagement	184	3.66	0.93	4.00	1.00	5.00
SKILL_9 Identify SHW issues important to workers	184	3.96	0.87	4.00	1.00	5.00

SKILL_10 Integrate program systems	184	3.46	0.92	4.00	1.00	5.00
SKILL_11 Bring together teams and leaders for planning and priorities	184	3.46	0.95	4.00	1.00	5.00

*SHW = Safety, health, and well-being

Table B6

Response Frequencies: Specific TWH Practice Skills (n=210)

Variable	*M (SD)* or *n*	%
Skill 1: Demonstrate leadership commitment to worker safety and health at all levels of the organization (n=199)	3.5 (1.0)	
Highly skilled (5)	30	15.1 %
Skilled (4)	79	39.7 %
Somewhat skilled (3)	62	31.2 %
Little skilled (2)	23	11.6 %
Not skilled (1)	5	2.5%
Skill 2: Facilitate leadership commitment to worker safety, health and well-being (n=196)	3.5 (1.0)	
Highly skilled (5)	29	14.8 %
Skilled (4)	76	38.8 %
Somewhat skilled (3)	66	33.7 %
Little skilled (2)	20	10.2 %
Not skilled (1)	5	2.6 %
Skill 3: Use an integrated approach to assessment of work and non-work (e.g., at home exposures, health conditions, health behaviors) risks (n=194)	3.4 (1.0)	
Highly skilled (5)	27	13.9 %
Skilled (4)	64	33.0 %
Somewhat skilled (3)	68	35.1 %
Little skilled (2)	27	13.9 %
Not skilled (1)	8	4.1 %
Skill 4: Ensure confidentiality and privacy for workers when handling safety and health data (n=194)	4.3 (0.8)	
Highly skilled (5)	90	46.4 %
Skilled (4)	76	39.2 %
Somewhat skilled (3)	21	10.8 %
Little skilled (2)	6	3.1 %
Not skilled (1)	1	0.5 %
Skill 5: Identify worker characteristics or working conditions in your organization that are associated with one or more health conditions (n=192)	3.8 (0.9)	
Highly skilled (5)	36	18.8 %
Skilled (4)	97	50.5 %
Somewhat skilled (3)	43	22.4 %

Little skilled (2)	14	7.3 %
Not skilled (1)	2	1.0 %
Skill 6: Design work to eliminate or reduce safety and health hazards and promote worker well-being (n=191)	3.8 (1.0)	
Highly skilled (5)	52	27.2 %
Skilled (4)	68	35.6 %
Somewhat skilled (3)	49	25.7 %
Little skilled (2)	16	8.4 %
Not skilled (1)	6	3.1 %
Skill 7: Develop workplace programs that integrate elements of safety/health protection with health promotion to advance worker wellbeing (n=190)	3.5 (1.0)	
Highly skilled (5)	30	15.8 %
Skilled (4)	62	32.6 %
Somewhat skilled (3)	71	37.4 %
Little skilled (2)	22	11.6 %
Not skilled (1)	5	2.6 %
Skill 8: Promote and support worker engagement throughout program design and implementation (n=190)	3.6 (0.9)	
Highly skilled (5)	36	19.0 %
Skilled (4)	71	37.4 %
Somewhat skilled (3)	63	33.2 %
Little skilled (2)	18	9.5 %
Not skilled (1)	2	1.1 %
Skill 9: Identify safety and health issues most important to front-line employees (n=188)	3.9 (0.9)	
Highly skilled (5)	51	27.1 %
Skilled (4)	89	47.3 %
Somewhat skilled (3)	35	18.6 %
Little skilled (2)	11	5.9 %
Not skilled (1)	2	1.1 %
Skill 10: Integrate relevant program systems (e.g., safety, occ health, HR, wellness) to advance worker wellbeing (n=187)	3.4 (0.9)	
Highly skilled (5)	19	10.2 %
Skilled (4)	80	42.8 %
Somewhat skilled (3)	59	31.6 %
Little skilled (2)	24	12.8 %
Not skilled (1)	5	2.7 %
Skill 11: Bring together leaders and teams with overlapping or complementary responsibilities for planning and priority setting (e.g., safety, occ health, HR, wellness) (n=187)	3.4 (1.0)	
Highly skilled (5)	20	10.7 %
Skilled (4)	78	41.7 %
Somewhat skilled (3)	60	32.1 %
Little skilled (2)	22	11.8 %
Not skilled (1)	7	3.7 %

Table B7

Results of Cronbach's Alpha Test for Internal Consistency of Total Worker Health Skill Scale

	Cronbach's Alpha	Cronbach's Alpha if Item Deleted
Overall Scale (11 items)	0.920	
Item 1 Demonstrate leadership commitment to worker S&H		.910
Item 2 Facilitate leadership commitment to worker S/H/W		.910
Item 3 Use integrated approach to assessment of work and non-work risks		.911
Item 4 Ensure worker confidentiality, privacy when handling S&H data		.921
Item 5 Identify worker/work characteristics associated with health conditions		.917
Item 6 Design work to eliminate or reduce S&H hazards and promote well-being		.913
Item 7 Develop programs that integrate safety/health protection and health promotion		.910
Item 8 Promote worker engagement in all phases of program design/implementation.		.912
Item 9 Identify safety and health issues most important to front-line employees		.910
Item 10 Integrate relevant program systems to advance worker well-being		.911
Item 11 Bring together safety, HR, wellness, occ health leaders for planning/prioritizing		.910

Table B8

Intercorrelations among the Total Worker Health Practice Skills Scale Items

Correlation Matrix[a]

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Sig. (1-tailed)
Item 1 Demonstrate leadership commitment to worker S&H	1.000	.777	.553	.390	.419	.570	.502	.552	.589	.508	.527	<.001
Item 2 Facilitate leadership commitment to worker S/H/W		1.000	.550	.313	.419	.487	.535	.617	.574	.543	.587	.000
Item 3 Use integrated approach to assessment of work and non-work risks			1.000	.430	.412	.505	.568	.518	.560	.639	.542	.000
Item 4 Ensure worker confidentiality, privacy when handling S&H data				1.000	.440	.360	.256	.323	.474	.313	.321	.000
Item 5 Identify worker/work characteristics associated with health conditions					1.000	.551	.431	.384	.598	.361	.410	.000
Item 6 Design work to eliminate or reduce S&H hazards and promote well-being						1.000	.571	.486	.591	.445	.525	.000
Item 7 Develop programs that integrate safety/health protection and health promotion							1.000	.648	.481	.685	.655	.000
Item 8 Promote worker engagement throughout program design and implementation.								1.000	.484	.582	.593	.000

Item 9 Identify safety and health issues most important to front-line employees									1.000	.544	.554	.000
Item 10 Integrate relevant program systems to advance worker well-being										1.000	.667	.000
Item 11 Bring together safety/HR/wellness/occ health leaders for planning/prioritizing											1.000	<.001

[a]Determinant = .001

Table B9

KMO and Bartlett's Test Results

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.912
Bartlett's Test of Sphericity	Approx. Chi-Square	1180.8 92
	df	55
	Sig.	<.001

Table B10

Results of Factor Analysis for Total Worker Health Skill Scale (11-items)

Total Variance Explained

	Initial Eigenvalues			Rotation Sums of Squared Loadings[a]
Factor	Total	% of Variance	Cumulative %	Total
1	6.131	55.735	55.735	5.197
2	1.047	9.519	65.254	4.750
3	.715	6.500	71.754	
4	.678	6.164	77.918	
5	.496	4.506	82.423	
6	.454	4.123	86.547	
7	.408	3.713	90.260	
8	.338	3.070	93.330	
9	.302	2.749	96.079	
10	.240	2.186	98.265	
11	.191	1.735	100.000	

Note. N = 198. The extraction method was maximum likelihood with an oblique (oblimum with Kaiser normalization) rotation.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

Table B11

Total Worker Health Skill Scores – OSH Discipline Group Means Descriptives

	n	*M*	*SD*	*SE*	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
TWH Skill Factor 1								
Safety	62	3.546	.703	.089	3.367	3.724	1.83	5.00
Industrial Hygiene	32	3.662	.746	.132	3.393	3.930	1.83	5.00
Occ Health Nurse	23	3.431	.818	.171	3.077	3.785	2.17	5.00
Occ Physician	22	3.265	.925	.197	2.855	3.675	1.17	5.00
Other	58	3.329	.931	.122	3.084	3.574	1.00	5.00
Total	197	3.456	.824	.059	3.340	3.572	1.00	5.00
TWH Skill Factor 2								
Safety	62	4.013	.588	.075	3.864	4.163	2.75	5.00
Industrial Hygiene	32	4.359	.475	.084	4.188	4.531	3.50	5.00
Occ Health Nurse	23	4.022	.719	.150	3.711	4.333	2.00	5.00
Occ Physician	22	3.886	.797	.170	3.533	4.240	1.75	5.00
Other	59	3.564	.920	.120	3.324	3.803	1.00	5.00
Total	198	3.922	.768	.055	3.815	4.030	1.00	5.00

Table B12

Total Worker Health Skill Scores – Levene Test for Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
TWH Skill Factor1	Based on Mean	.960	4	192	.430
	Based on Median	.928	4	192	.449
	Based on Median and with adjusted df	.928	4	182.097	.449
	Based on trimmed mean	.967	4	192	.427
TWH Skill Factor 2	Based on Mean	2.603	4	193	.037
	Based on Median	2.663	4	193	.034
	Based on Median and with adjusted df	2.663	4	155.841	.035
	Based on trimmed mean	2.576	4	193	.039

Table B13

Total Worker Health Skill Factor 1 Scores (TWH Program Leadership) – ANOVA

TWH Skill Factor1	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.600	4	.900	1.334	.259
Within Groups	129.505	192	.675		
Total	133.105	196			

Table B14

OSH Discipline Group Comparisons for TWH Skill Factor 1 Scores (Risk Assessment and Control) – Analysis of Variance (ANOVA)

TWH Skill Factor 2	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	**14.477**	**4**	**3.619**	**6.860**	**<.001**
Within Groups	**101.830**	**193**	**.528**		
Total	**116.307**	**197**			

Figure B1

Equation for Computation of Effect Size for Occupational Safety and Health Discipline on Total Worker Health Risk Assessment and Control Skills (TWH Factor 2), following one-way ANOVA

$$\omega^2 = SS_B - (df_B)MS_W/SS_T + MS_W$$

$$\omega^2 = [14.48 - (4)0.528]/116.31 + 0.528$$

$$\omega^2 = 12.34/116.84$$

$$\omega^2 = .1056$$

Interpretation: 10.56% of variance explained by OSH occupation

Table B15

Regression Coefficients: Predictors of TWH Competency Comparing Models With (Model 1) and Without (Model 2) Organizational Supports for Interdisciplinary Collaboration Variable

Variable	Model 1			Model 2		
	B	β	*SE*	*B*	β	*SE*
Overall TWH Competency	N = 184			N = 172		
Constant	2.24***		.23	2.12***		
OSH Experience	.23***	.42	.04	.22***	.41	.04
TWH Experience	.09**	.17	.04	.09**	.16	.04
TWH Training History	.18**	.20	.06	.20**	.22	.06
OSH Discipline[a]						
Safety Professional	.03	.02	.13	.01	.01	.13
Occupational Nurse	-.115	.17	-.05	-.14	-.06	.17
Occupational Physician	-.18	.161	-.09	-.17	-.08	.17
Other OSH Profession	.063	.04	.14	.04	.02	.15
Org Support for Interdisc. Collab.				.04	.03	.07
R^2	.31*			.32*		
Adjusted R^2	.28			.28		
TWH Program Leadership Competency	N=183			N = 172		
Constant	1.73***		.26	1.42***		.33
OSH Experience	.24***	.39	.04	.24***	.39	.05
TWH Experience	.13***	.21	.04	.12**	.19	.04
TWH Training History	.22**	.22	.07	.24***	.24	.07
OSH Discipline[a]						

Safety Profession	.14	.09	.14	.12	.07	.15
Occupational Nurse	-.06	-.02	.19	-.08	-.03	.19
Occupational Physician	-.11	-.05	.18	-.12	-.05	.19
Other OSH Profession	.28	.16	.16	.23	.13	.16
Org Support for Interdisc. Collaboration				.11	.09	.08
R^2	.30*			.33*		
Adjusted R^2	.28			.29		
TWH Risk Assessment and Control Competency	N = 188			N = 173		
Constant	2.91***		.24	2.97***		.32
OSH Experience	.23***	.42	.04	.23***	.40	.04
TWH Experience	.04	.07	.04	.04	.07	.04
TWH Training History	.12	.13	.07	.13	.14	.07
OSH Discipline[a]						
Safety Profession	-.19	-.13	.14	-.17	-.11	.14
Occupational Nurse	-.23	-.10	.17	-.19	-.08	.19
Occupational Physician	-.25	-.11	.17	-.22	-.10	.18
Other OSH Profession	-.27	-.17	.15	-.26	-.16	.16
Org Support for Interdisc. Collaboration				-.04	-.03	.08
R^2	.29*			.28*		
Adjusted R^2	.26			.25		

Note. We examined the role of OSH experience, *Total Worker Health* (TWH) experience, TWH training history, professional discipline, and organizational support for interdisciplinary collaboration (IDC) on level of TWH competency. The multiple regression models assessed impacts to mean score for 1) overall TWH (11-items) competency, and for two sub-constructs of 2) TWH Program Leadership competency and

3) TWH Risk Assessment and Control competency. In Model 1, we entered all variables except for IDC. In Model 2, we added the variable organizational support for IDC to the regression analysis, which was not significant and did not impact predictors for any TWH competence scores tested.
[a]OSH Discipline referent group is Industrial Hygiene.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Figure B2

Plot Showing Normal Distribution of Regression Model 1 (Overall TWH Competency Standardized Residuals

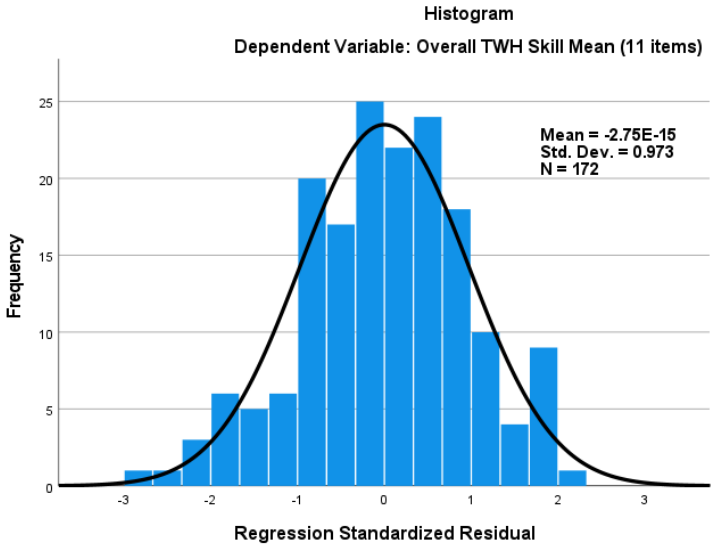

Figure B3
Normal P-P Plot of Regression (Model 1) Showing Normal Distribution of Standardized Residuals (Observed vs Predicted)

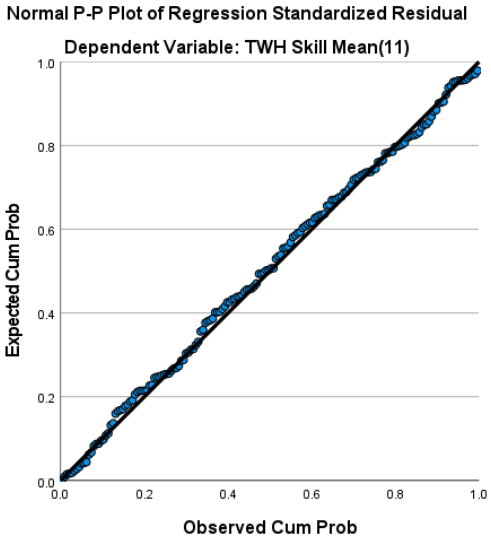

Figure B4

Scatterplot Showing Rectangular (Non-heteroscedastic) Distribution of Regression Model 1 Standardized Predicted Value Versus Residuals

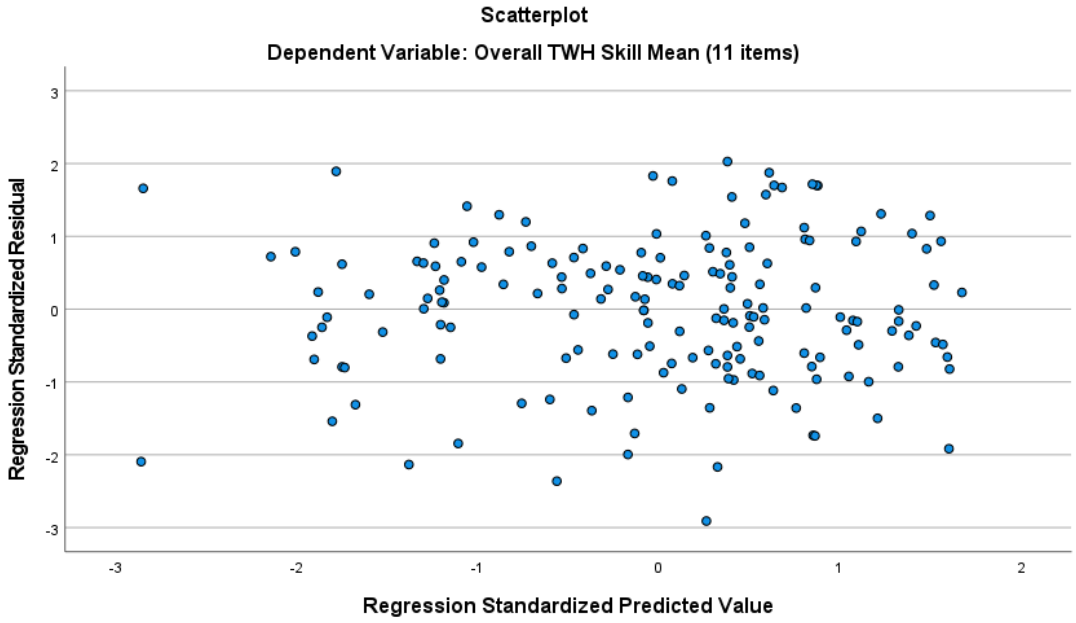

Table B16

Means, Standard Deviations, and Wilcoxon Ranked-Sum Analyses for Intra vs Inter Organizational Interprofessional Learning Community Preferences (N=183)

Measure	Learn with professionals from my organization		Learn with professionals from other organizations		*F*(183) Unstandardized	*F*(183) Standardized
	M	*SD*	*M*	*SD*		
Likely to participate	4.35	.74	4.25	.79	1497.00	1.850*

Note. $p = .064$, Standard error of unstandardized F statistic = 156.50

APPENDIX C

Codebook for Qualitative Analyses

Table C1

Codebook for Qualitative Analyses

Code Name	Code Description
Knowledge Competencies	Statements about intellectual knowledge and cognitive skills they need to perform a TWH practice approach. Examples are subject knowledge, facts, procedures, principles, and theories, computations, scientific or medical knowledge, regulations
Assessment instruments	Knowing what to measure, how to locate instruments or tools for integrated assessment/measurement for TWH
DEI	Diversity, equity, inclusion issues related to assessment, interventions
Evidence - Interventions	Knowledge about evidence-based interventions, or evidence supporting interventions
Organizational knowledge	Knowledge of organizational values, culture, policies, programs, work operations, stakeholders
OSH knowledge	OSH terminology, compliance, workplace hazards prevention and control, work-related disease, injury, etc.
TWH concepts	Knowledge of principles and approaches of TWH; holistic approach that includes work/non-work domains; use of hazard control approach (e.g., primary prevention, prevention through design)
Workforce	Characteristics of the workforce (e.g., demographics, work schedules, job content)
Other Knowledge	Other knowledge topics that did not fit other categories
Skills Competencies	Statements about psychomotor abilities to accomplish or demonstrate a TWH practice approach (i.e., "doing" skills). Examples are professional behaviors, communication, operating equipment to measure exposures.
Collaboration	Ability to work together with diverse people to solve problems
Communication (business case)	Ability to make a business case argument to encourage leaders to support TWH; calculate return on investment; communicate ROI
Communication (general)	Ability to effectively conveying information to diverse audiences; receiving and understanding information from diverse people; establishing effective organizational communication systems
Evaluation methods	Ability to collect, analyze, synthesize, and use data from broad domains (safety, health, wellbeing; work and non-work domains) to prioritize issues, develop solutions

Leading teams	Ability to convene people to work together to solve problems
Relational skills	Ability to develop rapport and trusting relationships
Other skills	Statements about other skills needed for TWH practice that did not fit the other child nodes
Attitudinal Competencies	Statements about attitudes, interests, values – how participants or others feel towards things
Concern for workers	A feeling about caring about worker wellbeing
Flexibility	Willingness to adapt approaches to thinking or communicating based on stakeholder needs
Leader support for TWH	Attitudes leaders need to display for TWH practices to be successfully adopted.
Respecting worker knowledge	Believing in the importance and value of workers' knowledge and perspectives
Other attitudes	Statements that did not fit other categories
Barriers	Reasons that could stand in the way of implementing TWH practices
Organizational	Organizational factors such as culture, structures, resources, or leader behaviors that could get in the way of implementing TWH practices
Competing priorities	Organizational priorities other than safety, health, wellbeing that might take precedent for leader attention or resource allocation
Cost	Funding constraints (real or perceived)
Culture	Accepted norms of behaviors and beliefs about what is valued in the organization
Lack of access	Inability to or difficulty with accessing leaders to gain support for TWH
Lack of knowledge	Lack of understanding on the part of organizational or program leaders regarding TWH principles
Leadership buy-in	Lack of leader commitment to TWH principles or practices
Other organizational barrier	Statements about organization-related barriers that don't fit any of the other child nodes
Poor communication	Insufficient structures, procedures, skills to support information dissemination and exchange
Resistance to change	Attitudes of leaders or other stakeholders to avoid changing the way things are done
Silos	Program management approach that does not encourage cross-functional or interdepartmental collaboration. Program managers "stay in their lane" by interacting with narrow scope of influence.
Time	Statements about time constraints due to involvement of multiple people - e.g., needing to coordinate with workers. Not just professionals' time.

Personal	Characteristics or behaviors of OSH professionals that could be an obstacle to implementing TWH practices
Lack of knowledge	Insufficient awareness, knowledge, training for the TWH practice
Prioritization	Difficulties with selecting priorities for OSH or TWH
Other personal barrier	Statements about personal or professional factors that do not fit with other nodes
Worker-related	Characteristics or behaviors of workers that could be an obstacle to implementing TWH practices.
Mistrust	Worker perceptions that participation would bring negative consequence. Lack of trust in organizational intent.
Privacy	Concerns about sharing personal information or belief that employer should not have access to personal information
Workload	Barriers related to workload and time constraints of workers
Interprofessional Education (IPE)	Any text that appeared in the focus group segment on interprofessional education
IPE Barriers	Reasons professionals give for possible obstacles to participating in TWH interprofessional learning
Cost	Statements that refer to financial cost of an IPE experience
Lack of interest	Perceptions that learning objectives are not relevant or not important to their job
Time constraints	Not having time to participate
Course features	Features of course content that could get in the way of participation
IPE motivators	Most important benefits or reasons that would motivate participation in IPE continuing education
Best practices	Statements about learning how TWH is done in other settings; case examples
Developing common ground	Statements about developing shared purpose, consensus, agreement
New perspectives	Statements about learning how other people view a problem or solution
Other IPE motivators	Statements that do not fit within the other IPE motivator child nodes
IPE Recommendations	Course design features that would add meaning and value for participants
Case studies	Statements pointing to the use of case studies; highlight different kinds of challenges to overcome; facilitate interdisicplinary interactions and problem solving; demonstrate or learn best practices or success stories.

Clear objectives	Statements about learning something specific, not just general knowledge; learning objectives are clearly outlined.
Other IPE recommendations	Statements that do not fit with other IPE recommendation child nodes
Total Worker Health (TWH) Practices	Any text that appeared in the focus group segments on TWH practices
TWH Practice 1 (Integrated Assessment)	Statements about TWH practice 1 - Assessment methods identify work & non-work hazards
TWH Practice 2 (Integrated Interventions)	Statements about TWH practice 2 - Design work to reduce hazards and promote health/well-being
TWH Practice 3 (Coordination of program systems)	Statements about TWH practice 3 - Safety, health, well-being systems are integrated
TWH Practice 4 (Facilitating leadership commitment)	Statements about TWH practice 4 - Facilitate leadership commitment to safety and health at all levels of the organization
TWH Practice 5 (Worker engagement)	Statements about TWH practice 5 - Workers engaged in all phases of program design and implementation

APPENDIX D

Competency and Barrier Cases by Focus Group

Table D1

Distribution of Competencies (# cases) by Focus Group

Competency themes	Focus Group 1 (# cases)	Focus Group 2 (# cases)	Focus Group 3 (# cases)	Focus Group 4 (# cases)	Focus Group 5 (# cases)
Knowledge					
1: Organizational/business	2	2	3	2	1
2: Assessment instruments	1	4	1	2	3
3: Total Worker Health concepts	3	1	0	4	1
4: Occupational safety and health tenets	1	1	2	2	0
5: Workforce characteristics	1	2	1	0	1
6: Evidence-based interventions	0	2	1	0	2
7: Diversity, Equity, Inclusion	0	1	2	0	0
8: Other knowledge	1	1	1	0	0
Skills					
9: Communication - general	3	3	3	2	3
10: Communication - business case	2	3	2	1	2
11: Evaluation methods	2	2	0	2	1
12: Collaboration	2	1	2	2	0
13: Relational/interpersonal	1	4	0	3	0
14: Leading teams	1	0	0	4	0
15: Other skills	1	2	0	0	0
Attitudes					
16: Respect for worker knowledge	3	0	2	1	0
17: Flexibility	0	2	1	1	0
18: Concern for workers	2	1	1	1	0
19: Leader support for TWH	1	0	0	1	2
20: Other attitudes	0	0	1	1	0

Table D2

Distribution of Barriers (# cases) by Focus Group

Competency themes	Focus Group 1 (# cases)	Focus Group 2 (# cases)	Focus Group 3 (# cases)	Focus Group 4 (# cases)	Focus Group 5 (# cases)
Organizational					
1: Culture	1	2	2	4	1
2: Competing priorities	2	4	1	1	0
3: Cost	2	2	2	0	1
4: Leadership buy-in	1	1	2	3	0
5: Lack of access	0	2	1	2	1
6: Time	1	1	2	3	0
7: Lack of knowledge – among leaders, stakeholders	0	2	0	2	2
8: Resistance to change	1	4	0	1	0
9: Silos	2	1	0	0	1
10: Poor communication	0	2	1	0	0
11: Other org barrier	0	1	2	1	0
Personal					
12: Lack of knowledge – among OSH professionals	0	4	1	2	1
13: Prioritization	3	0	0	0	1
14: Other personal barrier	0	0	1	1	0
Worker					
15: Privacy concerns about health information	2	1	2	0	0
16: Workload	1	0	2	1	0
17: Mistrust of organization	0	0	2	2	0

APPENDIX E

RIPLS Scale Adaptation

Table E1

Original and Modified Question Items: Readiness to Interprofessional Learning Scale

Original Item Wording with Factor Loading	Modified Wording for the TWH survey (Blue text = wording changes)	Mean pre-test scores[a, b]	
		Meaning is Clear	Appropriate for OSH and TWH context
[c]Subscale 1: Teamwork and Collaboration Sub-Scale		**4.39**	**4.39**
RIPLS_1 Shared learning will help me to think positively about other health care professionals (0.72)	Shared learning will help me to think positively about working with professionals outside of my discipline when working on TWH solutions.	3.33	3.33
RIPLS_2 Shared learning helps to **clarify the nature** of patient problems 0.66	Shared learning will help to clarify the nature of problems related to safety, health, and well-being.	4.33	4.67
RIPLS_3 Shared learning with other health care professionals will help me to communicate better with patients and other professionals 0.64	Shared learning with other professionals will help me to communicate better with workers and organizational leaders *FINAL* Shared learning will help me to communicate better with workers and other professionals. *PRELIMINARY*	4.67	4.67
RIPLS_4 Shared learning before qualification would help health care professionals become better team workers 0.63	Shared learning before degree completion would help worksite health care professionals become better team workers *FINAL*	3.67	3.67

	Shared learning during continuing education would help workplace safety and health professionals become better team workers		
RIPLS_5 Shared learning with other health care professionals will increase my ability to **understand** clinical problems 0.63	Shared learning with other professionals will increase my ability to understand problems related to employee safety, health, and wellbeing	5.00	5.00
RIPLS_6 Shared learning will help me **understand** my own limitations 0.63	Shared learning will help me understand my own limitations	4.00	4.33
RIPLS_7 Learning with other health care professionals will help me be a more effective member of a health care team 0.62	Learning with other professionals will help me become a more effective member of a *Total Worker Health* team	4.67	4.67
RIPLS_8 Learning with health care students from other disciplines before qualification would **improve relationships** after qualification 0.59	*FINAL* Learning with professionals from other disciplines during continuing education would improve relationships in my workplace	4.33	4.33
RIPLS_9 Communication skills should be learned with other health care professionals 0.57	Communication skills should be learned with professionals from other disciplines	4.67	4.00
RIPLS_10 I would welcome the opportunity to work on small-group projects with other health care professionals 0.46	I would welcome the opportunity to work on small-group projects with professionals outside of my discipline	4.67	4.67

RIPLS_11 Team-working skills are essential for all health care professionals to learn 0.43	Team-working skills are essential for all workplace safety and health professionals to learn	4.67	4.67
RIPLS_12 For small group learning to work, health care professionals need to trust and respect each other 0.42	For small group learning to work, professionals need to trust and respect each other	4.67	4.67
Patient centeredness	**[d]Subscale 2: Worker centeredness**	**4.61**	**4.56**
5 Patients ultimately benefit if health care professionals work together to solve patient problems 0.41	Workers would ultimately benefit if professionals worked together to solve problems related to employee safety, health, and wellbeing	4.67	4.67
26 Establishing trust with my patients is important to me 0.80	Establishing trust with workers is important to me	4.67	4.67
29 In my profession one needs skills in interacting and co-operating with patients 0.70	In my profession one needs skills in interacting and co-operating with workers	4.67	4.67
28 Thinking about the patient as a person is important in getting treatment right 0.70	Thinking about workers as people is important in getting interventions right	4.33	4.67
25 I like to understand the patient's side of the problem 0.70	I like to understand the worker's side of the problem	4.67	4.67
27 I try to communicate compassion to my patients 0.67	I try to communicate compassion to workers	4.67	4.00
[d]Subscale 3: Sense of Professional Identity		**4.00**	**4.20**
17 The function of nurses and therapists	The function of occupational safety and health professionals	4.33	4.67

is mainly to provide support for doctors 0.58	is mainly to prevent recordable injuries and illnesses		
16 Clinical problem-solving skills should only be learned with professionals from my own discipline 0.58	*Total Worker Health* problem-solving skills can only be learned with professionals from my own discipline	4.00	4.67
20 I have to acquire much more knowledge and skills than other health care professionals 0.47	I have to acquire much more knowledge and skills than other professionals involved in *Total Worker Health* activities	3.33	4.00
19 I would feel uncomfortable if another health care professional knew more about a topic than I did 0.43	I would feel uncomfortable if another workplace health professional knew more about a topic than I did	4.00	3.00
18 There is little overlap between my role and that of other health care professionals 0.42	There is little overlap between my role and that of other workplace health professionals	4.33	4.67

Note. The source of the instrument used in this study was Reid, R., Bruce, D., Allstaff, K., & McLernon, D. (2006). Validating the Readiness for Interprofessional Learning Scale (RIPLS) in the postgraduate context: are health care professionals ready for IPL? *Medical Education*, 40(5), 415–422. Reid et al. (2009) updated an earlier version of this instrument (developed by Parsell and Bligh in 1999 for higher education IPE) with terms appropriate for post graduate professionals. Reid et al. (2009) extended the Parsell and Bligh (1999) instrument from 19 to 23 items. In the post-graduate adapted version the structure of the final validated survey included three factors (as shown in table sub-scales) explaining 44.3% of the variance in the data. The overall internal consistency of the scale was .76; Cronbach alphas for each scale were .88 for Teamwork and collaboration, .86 for Patient-centeredness, and .69 for Sense of professional Identity.

[a]Item response scale was 1 = not at all, 2 = a little, 3 = moderately, 4 = mostly, 5 = very
[b]Mean scores were computed from three reviewers with expertise in occupational health nursing, industrial hygiene, and occupational safety.
[c]Subscale was used in study
[d]Subscale was *not* used in study

BIOGRAPHICAL SKETCH OF THE AUTHOR

Suzanne Nobrega is employed as Outreach Director for the Center for Promotion of Health in the New England Workplace, a NIOSH Center of Excellence for *Total Worker Health*® at the University of Massachusetts Lowell. In this role, she oversees *Total Worker Health* (TWH) continuing professional education and research translation activities aimed at promoting adoption of TWH concepts in the workplace. Having joined the Center at its inception in 2006, she was a lead developer of the Center's Healthy Workplace Participatory Program, which has been recognized internationally for innovation in occupational health psychology practice.

Prior to coming to UMass Lowell, Nobrega was health communications consultant with the Harvard School of Public Health Prevention Research Center on Nutrition and Physical Activity in Boston, Massachusetts. There she developed school-based and afterschool childcare nutrition and physical activity policies and curricula. Earlier in her career, she worked for thirteen years as an educator and director of prenatal, preconception health promotion programs with the March of Dimes Defects Foundation in White Plains, New York, and in Westboro, Massachusetts.

Nobrega earned a Bachelor of Science degree in Nutritional Science, with minor in Biology from the University of Delaware. She earned a Master of Science in Human Nutrition from Cornell University, with concentration in Maternal and Child Health and minor in Health Communications. Prior to enrolling in the Research and Evaluation in Education doctoral program, she completed graduate coursework in Work Environment at the University of Massachusetts Lowell.