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RESEARCH ARTICLE

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A Mixed-Methods Study to Assess Readiness for Interprofessional Education on *Total Worker Health*® Practice

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Abstract: *Background:* Occupational safety and health (OSH) professionals increasingly need interdisciplinary collaborative practice competencies to respond to complex worker safety, health, and well-being risks. Effective collaboration with non-OSH-trained professionals (e.g., health promotion, human resources) is critical for planning integrated interventions that address work and non-work risks, consistent with a "*Total Worker Health*" (TWH) approach. Interprofessional education (IPE) pedagogy offers skill-building for interdisciplinary collaboration, but little attention has been given to IPE in OSH education and training literature. The goal of this study was to assess OSH professionals' perceptions about IPE to guide application in postgraduate TWH education. *Methods*: The mixed-methods study involved 210 U.S. professionals in safety (31%), industrial hygiene (16%), occupational nursing (12%) and medicine (11%), and related disciplines (30%). Participants completed a 12-item Readiness for Interprofessional Education Scale (RIPLS) adapted for TWH. Nineteen survey-takers also participated in virtual focus groups to share opinions about IPE benefits, barriers, and desirable course features. *Findings*: Occupational safety and health professionals reported high overall readiness for IPE (RIPLS, 4.45 ± 0.47), endorsing IPE for interdisciplinary skill-building. Salient IPE motivators were learning new perspectives from diverse disciplines and industries; gaining new subject expertise; developing common ground across disciplines; and learning TWH best practices. Participants recommended case studies to practice interdisciplinary problem-solving through group work. *Conclusions/Application to Practice*: Interprofessional education is a promising pedagogy for OSH continuing education to promote interdisciplinary collaboration skills needed for TWH practice in the workplace. Occupational safety and health educators need to build competency in IPE pedagogical theory and practice to ensure effective training design and evaluation.

Keywords: interprofessional education, Total Worker Health, continuing education, pedagogy

Background

Interdisciplinary collaborative practice has become a core competency for occupational safety and health (OSH) practice (Newman et al., 2020; Schulte et al., 2019). Whereas in past decades, OSH professionals focused primarily on physical, biological, and chemical workplace hazards, today's OSH professional is called upon to consider aspects of workers' 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, defined by the National Institute for Occupational Safety and Health (NIOSH) as "*Total Worker Health*" (Schill & Chosewood, 2013), has been adopted by increasing numbers of OSH professional organizations and employers (Tamers et al., 2019). One of the defining indicators of a *Total Worker Health* (TWH) approach is the coordination and integration of workplace safety, health, and well-being program systems in the workplace (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 OSH core disciplines (e.g., health promotion, psychology, and human resources). Thus, competency to develop positive and trusting relationships, communicate effectively, and work toward shared goals is critical for joint planning and delivery of workplace safety, health, and well-being programs. The shift to a broader interdisciplinary collaborative practice paradigm has implications for education and training for OSH professionals to develop a broader knowledge-based skill set.

Interprofessional Education

Interprofessional education (IPE), used widely in health professions education, is a pedagogy that specifically cultivates

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Applying Research to Occupational Health Practice

Occupational safety and health (OSH) professionals increasingly need interdisciplinary collaborative practice competencies to plan integrated interventions that address work and non-work risks, consistent with a "*Total Worker Health*" (TWH) approach. Interprofessional education (IPE) pedagogy offers interdisciplinary collaboration skill-building but has not been extensively explored in OSH education literature. This mixed-methods study assessed perceptions of mixed OSH professionals about IPE for postgraduate TWH education. Survey participants (n = 210) reported high readiness for interprofessional learning (RIPLS, 4.45 ± 0.47). Focus group participants (n = 19) identified IPE motivators: learning new perspectives from diverse disciplines; gaining subject knowledge; developing common ground across disciplines; and learning TWH best practices. Participants recommended case studies to practice interdisciplinary problem-solving through group work. Interprofessional education is a promising pedagogy for interdisciplinary collaboration needed for TWH practice in the workplace. Occupational safety and health educators need to build competency in IPE pedagogical theory and practice to ensure effective training design and evaluation.

interprofessional collaborative practice skills (Gilbert et al., 2010; IPEC, n.d.; Oandasan & Reeves, 2005). Interprofessional education involves participants from two or more disciplines to learn about, from, and with each other to improve quality of care/services (Gilbert et al., 2010). This pedagogy may offer a promising educational approach for OSH professionals as they learn to adopt TWH approaches in the workplace. TWH continuing education that uses IPE pedagogy would allow OSH professionals to learn side-by-side in an interdisciplinary context, offering opportunities to learn about and value perspectives and roles of other disciplines, to develop trust and respect, to develop a shared vocabulary and interdisciplinary identity, and to practice solving problems together (Bronstein, 2003; Khalili et al., 2013; Petri, 2010; Thistlethwaite & Moran, 2010).

Although collaboration among OSH specialty disciplines is not a new concept, the collaboration between OSH and non-OSH trained professionals required to achieve integration of safety, health, and well-being programs and services (i.e., TWH approach) is a newer phenomenon. Providing OSH professionals with opportunities to learn about and practice TWH approaches together with professionals from non-OSH disciplines could facilitate adoption of TWH approaches in the workplace. However, very little literature addresses IPE for OSH professionals generally and for TWH specifically. Understanding how OSH professionals perceive how interprofessional learning aligns with their educational needs and values could help TWH educators make a judgment about whether this pedagogy, which can be labor intensive, would be well-accepted, feasible, and effective for TWH education. This article explores the feasibility of an IPE approach for TWH continuing education.

Review of Prior Literature

Prior studies have established that OSH professionals have high interest in learning about TWH (Laine et al., 2022; Olszewski et al., 2021; Scott et al., 2019). Olszewski et al. (2021) reported that occupational health nurses familiar with TWH concepts favor a TWH strategy, but see management commitment and resources (personnel, budget, time) as challenges to adoption. Attitudes about TWH interdisciplinary collaborative practice have not been assessed.

Interprofessional education pedagogy has been discussed extensively in health professions and social services education literature (Bronstein, 2003; Gilbert et al., 2010; Petri, 2010; Rogers et al., 2017). However, little attention has been given to IPE application in OSH education and training literature. Few studies are available that describe the use of IPE for OSH education generally, and none could be found on IPE for TWH education specifically. Two studies describe evaluations of interprofessional continuing education courses designed for working OSH professionals (Griggio et al., 2020; Rosen et al., 2011). These studies highlighted the value of interprofessional learning for promoting role understanding, relationship-building, and collaborative practice.

More available, but still limited, are studies about interdisciplinary competency-building in OSH higher education programs. McCullagh et al. (2022) described a feasibility study to integrate interprofessional competencies in a graduate-level occupational and environmental health course cross-posted for public health, engineering, and nursing. Several other studies have reported on introducing IPE approaches in public health curricula (Averill et al., 2020; Hoffman & Cowdery, 2022; Uden-Holman et al., 2015) to develop interdisciplinary practice skills as required by public health accreditation standards (Council on Education for Public Health, 2021). Introducing TWH concepts during higher education training may be ideal; however, many professionals enter the OSH field without a specialized OSH degree. Continuing education represents an important opportunity for OSH professionals from a range of disciplines to encounter and practice interdisciplinary collaborative practice skills.

Readiness for Interprofessional Learning

In continuing professional education, adult learners' goals and motivations determine their commitment to apply what they learn to the workplace (Gegenfurtner, 2011; Taylor & Hamdy, 2013). Measuring OSH professionals' beliefs about interprofessional learning can provide insights about their level

of motivation and readiness to participate. Interprofessional education 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). The Readiness for Interprofessional Learning Scale (RIPLS) is widely used for evaluation in health professions education (Parsell & Bligh, 1999); a Google Scholar search of literature involving the RIPLS questionnaire yielded 1,870 results (August 15, 2023). Reid et al. (2006) adapted and validated the RIPLS instrument for the continuing education context. The adapted instrument has 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 identified significant intergroup differences when tested with a sample of nurses, physicians, and allied health professionals (Reid et al., 2006).

Given the potential benefit IPE pedagogy for facilitating TWH education and adoption, research is needed to understand OSH professionals' attitudes and beliefs. Implementing TWH approaches in the workplace is complex. Many barriers can exist such as resource constraints, professional stereotypes, lack of a shared agenda across organizational units, and a lack of leadership mandate and supportive structures (Moilanen et al., 2020; Olszewski et al., 2021). IPE pedagogy can address some of these areas, but no research is available to inform the development, delivery, and evaluation of IPE models for TWH continuing education. Assessing OSH professionals' readiness for IPE, as well as their perspectives about motivations, barriers, and delivery options for IPE, would generate valuable knowledge to guide development of effective curricula. This study sought to address the following research questions:

Research Question 1: How favorable or unfavorable are OSH professionals' attitudes regarding the intended outcomes of interprofessional learning for TWH?
Research Question 2: To what degree do OSH professionals express preferences for an interprofessional learning community with professionals from their own organization versus from other organizations?
Research Question 3: What do OSH professionals view as the motivators and barriers for participating in interprofessional continuing education for TWH?

Methods

Mixed methods were used to address the research questions for this descriptive study. A survey was administered with 210 multidisciplinary OSH professionals to measure attitudes regarding the value of IPE for improving teamwork and collaboration skills that are needed for TWH 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 and potential barriers to participation.

Recruitment

Convenience sampling was used to recruit 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) and other disciplines relevant for TWH practice (e.g., health promotion, human resources). Regional associations for professionals in occupational safety, industrial hygiene, occupational health nursing, and occupational medicine, as well as university-based TWH Centers for Excellence (National Institute for Occupational Safety and Health [NIOSH], n.d.) sent a standard study announcement with link to the online survey to their networks. Survey eligibility criteria included minimum age of 18 years and current employment (minimum 20 hours/week) as an OSH professional. Survey participants were screened for focus group eligibility, which required intermediate or higher experience with implementing TWH practices. Eligible focus group volunteers were contacted by email if they agreed to be contacted for the focus group portion of the study. A gift card drawing was offered as an incentive for survey participation and each focus group session. The study protocol was approved by the University of Massachusetts Lowell Institutional Review Board (IRB#: 22-103).

Data Collection

The data were collected over a 5-month period from July to November 2022. All participants completed the online survey; participants who reported intermediate or higher TWH experience on a screening question were invited to participate in the focus groups. A total of 258 OSH professionals responded to the survey; of these, 210 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.

Survey

Participants were sent a link to access the online survey in Qualtrics (Qualtrics, 2020). The instrument included questions related to readiness for IPE (13 items), IPE peer community preferences (two items), and occupational variables (16 items). The questions were contained in a larger survey focused on TWH competencies and educational needs.

Readiness for Interprofessional Education Scale

Readiness for IPE was measured with the 12-item Teamwork and Collaboration sub-scale of the Readiness for Interprofessional Education Scale (RIPLS) (Parsell & Bligh, 1999; Reid et al., 2006). The RIPLS items (Table 1) were adapted for OSH professionals in a TWH context and pretested with five professionals in occupational safety, nursing, and hygiene. Pre-testers evaluated the adapted items (RIPLS-TWH) by scoring each on a 5-point scale (1 = *not at all*, 5 = *very*) for two criteria: clarity of meaning and appropriateness for OSH and

Table 1. Readiness for Interprofessional Learning Scale (RIPLS), Adapted for Total Worker Health

Please indicate your level of agreement with the statements below related to interprofessional learning. (Note: "TWH" means Total Worker Health)
Shared learning . . .
1. . . . will help me to think positively about working with professionals outside of my discipline when working on TWH solutions.
2. . . . will help to clarify the nature of problems related to safety, health, and well-being.
3. . . . will help me to communicate better with workers and other professionals.
4. . . . during continuing education would help workplace safety and health professionals become better team workers.
5. . . . with other professionals will increase my ability to understand problems related to employee safety, health, and well-being
6. . . . 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.

Note. **Participants indicated their level of agreement using a 5-point Likert-type scale: 1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, 5 = *strongly agree*.**

TWH context. Pre-testers' mean score was 4.4 for each criterion; the Cronbach's alpha for the Teamwork and Collaboration subscale was highly reliable ($\alpha = .93$) in the study sample.

Participants were also asked whether they agreed with the statement, "I have participated in interprofessional education in the past." This statement was included in the survey to benchmark prior IPE history because prior IPE experiences (especially if positive) have been observed to predict interdisciplinary collaborative competency (Petri, 2010).

Interprofessional Peer Learning Community Preferences

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: (a) learn together with interdisciplinary professionals from different organizations, and (b) learn together with interdisciplinary professionals from my organization.

Participant Occupational Characteristics

Five variables were collected to characterize the OSH professionals. Variables included OSH discipline (e.g., occupational health nurse or physician, safety professional, industrial hygienist), client type (serves external clients, internal clients, or both), OSH experience (none to a lot), employer size, and employer region.

Focus Groups

Volunteers were assigned to one of five focus groups held between October and November 2022. 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, 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 and visual question prompts were used to ensure consistency of questions between groups. The IPE questions comprised the final 15 minutes of a 90-minute focus group that explored TWH professional competencies and interprofessional continuing education (IPE). For the IPE segment, participants were first introduced to the concept of IPE and its relevance for TWH practice, and then were asked three questions: (a) What would motivate you to participate in an IPE course to learn about TWH? (b) What barriers, if any, do you see to participate in IPE? and (c) What recommendations do you have for designing a quality TWH IPE experience? Participants were invited to submit their responses by typing into the chat window. If needed, the researcher invited verbal elaboration of the response.

Data Analysis

Data were analyzed using SPSS version 28.0 (IBM Corporation, 2021). Descriptive statistics were reported for

individual RIPLS-TWH items and for the overall scale. Analysis of variance (ANOVA) was performed to test group differences in RIPLS-TWH scores based on OSH discipline. Frequencies were computed for the two IPE peer learning community preference items. A Wilcoxon signed-rank test was performed to compare the scores for the two peer learning types (participants from different organizations vs. my organization).

Focus group audio and chat text were recorded and automatically transcribed by Zoom (Zoom Video Communications, Inc., n.d.). Transcripts were then cleaned by one researcher and imported to NVivo (QSR International, 2022) for analysis.

Focus group data were coded by one researcher in two phases. First, the data were coded using a priori categories that mirrored the three question prompts: IPE motivators, barriers, and recommendations. Second, the data were coded thematically within each category. Coding entailed open coding and comparison with interprofessional collaborative practice constructs such as relational 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 coding results to assess face validity of themes. Discrepancies were discussed and reconciled by the two researchers.

Results

Survey participants included 210 OSH professionals representing 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 2). The focus group sample had slightly more industrial hygienists (37% vs. 31%) and wellness professionals (16% vs. 7%) compared with the broader survey sample. About two thirds of survey (77%) and focus group (84%) participants described themselves as mid- or advanced-career OSH professionals. For both groups, slightly less than half provided "in-house" OSH services (vs. consulting) and slightly more than half were employed by large organizations. Survey participants were employed in the United States, from Northeast (31%), Western (31%), Midwest (16%), and Southern (18%) states. Nearly half the focus group samples were from the Western region (47%).

Readiness for Interprofessional Education

The RIPLS-TWH scale mean score was high (M =4.45, SD = 0.47), indicating high endorsement of IPE learning for fostering collaboration and teamwork. The item-level responses were high across all items. Nearly three quarters (72%) reported they agreed with the statement, "I have participated in interprofessional education in the past."

Assessment of Group Differences in RIPLS-TWH

One-way ANOVA revealed no significant differences in RIPLS-TWH scores among OSH discipline groups, $F(4,181) = 1.400$, $p = .236$: safety (4.35 ± 0.48, n = 58), industrial hygiene (4,56 ± 0.41, n = 31), occupational nurse (4.50 ± 0.47, n = 26), occupational physician (4.41 ± 0.50, n = 21), and others (4.49 ± 0.46, n = 50).

Interprofessional Peer Learning Community Preference

The majority (over 75%) reported they would likely participate in an interprofessional learning experience. No significant difference was observed in mean scores for learning with "peers from my organization" (M = 4.35, SD = 0.74) versus learning with "peers from other organizations" (M = 4.25, SD = 0.79), $W(183) = 1.85$, $p = .064$.

Motivators, Barriers, and Recommendations for TWH IPE

Motivators, barriers, and recommendations for TWH interprofessional learning are summarized below and in Table 3. Overall, the focus group results highlighted the high value placed on interdisciplinary collaboration and teamwork, which was consistent with the high RIPLS-TWH scores from the survey. This sentiment was expressed succinctly by one occupational health nurse, who stated, "Let's learn together!" Several concepts from the RIPLS-TWH questionnaire were specifically mentioned by focus group participants as strengths of IPE, such as helping to understand problems better, improving relationships, and working on small group projects. As with the survey responses, the focus group responses did not seem to vary qualitatively by discipline. Responses in each of the themed areas were reflected across disciplinary boundaries.

Motivators for IPE Participation

Learning new perspectives from other professionals 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 represent different disciplines or different industries to learn how others view problems and solutions. For example, a worksite wellness professional 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, a safety professional, stated that seeing a different perspective helps them "see my own environment" in a new way. An industrial hygienist elaborated a similar point, stating, "I rarely talk to people that are working with wellness programs. This interdisciplinary [focus group discussion] is really helpful for me to see things from someone else's viewpoint." These participants and others

Table 2. Survey and Focus Group Participant Characteristics

Variable	Survey *N* = 210	Survey (%)	Focus group *N* = 19	Focus group (%)
Job role				
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				
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				
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				
More than 1,000 employees	109	55.1	11	57.9
251–1,000 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
U.S. Region[a]				
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. OSH = occupational safety and health.
[a]U.S. Census Bureau's (2021) classifications used.

expressed valuing hearing perspectives of professionals whose role and training were different from their own. They spoke of differences as a learning opportunity.

Participants named other anticipated benefits for IPE, such as learning about TWH best practices. For example, participants stated they could see "how TWH is applied and the challenges

Table 3. Summary of Themes (and Numbers of Participants) for Motivators, Barriers, and Course Design Recommendations for Interprofessional Continuing Education on Total Worker Health

Motivators (# *participants*)	Barriers (# participants)	Course design recommendations (# *participants*)
Learn new perspectives (11) • See problems and solutions in new ways • Expand subject expertise from new disciplines	Time (9) Cost (4) Relevance (2)	Use TWH case studies (8) • Practice interdisciplinary collaboration • Apply TWH concepts • Learn about different professions
Learn TWH best practices (4) • Hear examples from different industries • Develop common ground and terminology • Practice building relationships		Develop clear learning objectives (5) • Describe organizational benefits • List specific skills
Develop common ground (3) • TWH roles for each discipline • Gain a common understanding of terms		

Note. TWH = Total Worker Health.

in different industries" and develop "common ground" when it comes to TWH approaches and terminology. Others pointed to the value of learning about the "barriers to success" and "key performance metrics" relevant to professionals outside of their discipline. Interacting with people from different disciplinary backgrounds was also seen as helpful for expanding subject knowledge (e.g., mental health and occupational health psychology). Finally, relationship-building was mentioned as another key skill 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 was mentioned most often, followed by cost considerations, and the possibility that professionals might not see IPE as relevant for their job roles. Other barriers raised were a lack of a TWH formal certification 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 TWH continuing education. The use of case studies topped the list as valuable tools for facilitating knowledge acquisition around TWH implementation and around interdisciplinary collaboration. 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. Time for 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 [the approaches] together into practice. This participant highlighted how the discussion process demonstrates "how we work together."

Another important course design recommendation was clear and specific learning objectives. Participants stated that future TWH interprofessional education should have learning objectives that are "very targeted and specific" instead of a general overview course. The professionals in this study stated that they prioritize education that promises specific skill-building because they have so little time and many competing demands. Interprofessional education courses should offer a "concrete skill" and the learning objectives need to be "relevant for employers" (i.e., how the knowledge will benefit an organization). In addition, IPE courses should make explicit how the knowledge will be relevant for different disciplinary roles in TWH practice.

Some participants recommended that IPE opportunities be offered online (virtually) so that distance would not hinder

participation. One participant emphasized the importance of breakout rooms in virtual training to allow time for small group discussion. Participants also recommended that IPE courses include professionals from a broad range of disciplines. Availability of continuing education units/points was also identified as an important feature.

Discussion

This study was motivated by the desire to assess OSH professionals' readiness for interprofessional learning as a pedagogical approach for TWH education. Overall, the findings show that OSH professionals endorse the concept of interprofessional learning and were equally open to learning with interdisciplinary groups from their own or other organizations. We observed no discipline-based differences in RIPLS-TWH scores, unlike Reid et al. (2006), who observed differences between nurses, physicians, and social workers. The consistency of IPE attitudes across OSH disciplines is not surprising, given that all OSH disciplines share a common code of ethics and subject knowledge (International Commission on Occupational Health, 2014).

The RIPLS-TWH questionnaire may be useful for evaluating future TWH interprofessional continuing education curricula. Future research should evaluate the face and content validity of a full 23-item RIPLS-TWH questionnaire with a larger sample. This would permit assessment of all three RIPLS constructs for OSH and other professionals, similar to the protocol used by Reid et al. (2006). Assessing the relevance of the professional identity and client (worker) centeredness constructs for OSH professionals would be especially beneficial. Other similar published instruments could be considered for evaluating IPE learning for OSH professionals, such as the 27-item Interprofessional Attitudes Scale, which includes some RIPLS constructs (Norris et al., 2015).

The views of participants in this study endorsed the importance of learning about and valuing roles of other professionals, a key IPE learning outcome (Petri, 2010; Reeves et al., 2013). However, the concept of professional identity, emphasized in prior IPE studies, was not raised in the focus group sessions. In health professions IPE literature, stereotype attitudes formed during training (e.g., for nurses, physicians, social workers) can interfere with interprofessional collaboration (Hall, 2005; Khalili et al., 2013; Thomson et al., 2015). The absence of this theme in the focus group data may indicate that professional identity is less of a concern for OSH professionals.

Participants recommended using case studies as a learning tool when designing future TWH interprofessional education. Case studies offer an opportunity for diverse professionals to interact around a specific scenario for realistic problem-solving, consistent with adult learning and continuing education best practices (Allen et al., 2011; Garg & Mulloy, 2018; Taylor & Hamdy, 2013). To achieve IPE goals, problem-based learning activities must be structured specifically to elicit discussion between all participants and to prompt reflection on the information shared across disciplinary boundaries (Stentoft, 2017). Through reflective discussion, professionals can learn about the expertise of all group members, which can be integrated to solve problems. This approach is well suited for the integrated solution-building needed for a TWH approach. Practicing these skills in a facilitated continuing education setting can build professionals' confidence for transferring them into the workplace independently. However, to teach effectively, OSH educators need to develop competency in IPE pedagogical theory and practice. This has implications for the IPE training needs of OSH professional educators to facilitate IPE adoption in higher education and continuing education settings.

Questions remain as to whether and how IPE can best be applied for postgraduate TWH education for learners with varying degrees of OSH knowledge, given the diverse set of professionals involved in TWH. Examples of online interprofessional education learning have been reported for healthcare and social service professionals (MacNeill et al., 2014; McCabe et al., 2021; McLoughlin et al., 2018; Reeves et al., 2017), but fewer examples have been described for OSH professionals. Future research could develop and evaluate TWH IPE curricula to prepare multidisciplinary professionals to collaborate effectively across disciplinary boundaries in the workplace.

Limitations and Strengths

A limitation of this study is the use of convenience sampling for the survey, which could have overestimated readiness scores of the general OSH population. Another limitation is the potential sampling bias of focus group participants, the majority of whom were mid- and advanced-career professionals. However, we did not identify any obvious differences in the focus group responses between the early-career and mid- or advanced-career participants. Finally, collecting focus group responses via the chat window in a compressed amount of time may have limited the number of responses contributed. It is possible that more responses (and more details) would have been shared if participants had been given more time to express themselves verbally. However, this may not be a significant limitation because many participants demonstrated they preferred chat responses to verbal responses during earlier segments of the focus group.

A strength of this study is the mixed-methods design, which allowed triangulation between the qualitative and the quantitative findings. Because the focus group participants were a subset of the survey participants and shared similar characteristics, they were able to elaborate on the survey findings to offer deeper insights about interprofessional education readiness. Another strength was the diversity of the survey and focus group sample. Study participants represented all U.S. regions and all core OSH disciplines plus others relevant to TWH. The sample included professionals from

different organizational sizes and sectors who delivered OSH services both "in-house" for their own employer and as consultants. The breadth of OSH professionals in this study provides an understanding of IPE readiness across different occupational profiles.

Applications to Professional Practice

Occupational safety and health (OSH) practice is transitioning to a more expansive, integrated practice paradigm that requires interdisciplinary collaborative practice skills. Educational innovations are needed to develop these skills. Interprofessional education offers a promising approach for developing interdisciplinary collaborative practice skills and can be used in both higher education and continuing professional education settings. Findings from this study suggest that OSH professionals would be motivated to participate in IPE-focused curricula and view case studies as useful practice opportunities for addressing real-world OSH problems using an integrated, TWH practice approach.

Educators who design curricula for OSH professionals can use the findings from this study to justify IPE pedagogy and to design curricula with IPE learning objectives such as learning about and valuing different perspectives; developing shared vocabulary and shared goals; and effective communication. Educators new to IPE can develop their own competency by engaging with an expert in their home institution or with one of the established IPE professional associations and teaching centers (CIHC, IEC). More research is needed to generate effective evidence-based IPE curricula that meet the real-world challenges of OSH professionals as the nature of work and the workplace continue to evolve.

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Conflict of interest

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Ethical Approval

This study was approved by the University of Massachusetts Lowell Institutional Review Board on July 14, 2022 (IRB#: 22-103).

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