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Translation research in occupational health and safety settings: Common ground and future directions

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1. Introduction

The research arm of the occupational safety and health (OSH) field has historically focused on the etiologic end of the research continuum rather than the workplace adoption and impact end. There has been a call to increase efforts to investigate factors that limit or enhance transfer, adoption, and sustained use of OSH risk information, interventions, and technology (collectively referred to as innovations); i.e. there has been a call for greater efforts in the far-reaching field of Translation Research for OSH (NAS, 2009). A central idea behind Translation Research for OSH is that as we improve our understanding of these limiting and enhancing factors at the individual worker, organizational, and societal level, we increase the likelihood that OSH research outputs lead to improvements in workers' safety, health, and wellbeing. Topic areas such as occupational hearing loss, lead toxicity, and occupational stress are only three examples of persistent OSH issues that would benefit from greater work on the adoption and impact end of the spectrum. In order to meaningfully decrease OSH injury, illness, and fatality rates related to these and other issues, it is imperative that innovations are not only developed, but widely adopted and sustained.

Across many fields of clinical medicine and public health research, the science of effective implementation of evidence-based interventions/programs lags behind the science related to developing the programs themselves (Fixsen et al., 2005). Such is the case in OSH as well, as there is some good evidence for OSH interventions' effectiveness (Ruotsalainen et al., 2006), but relatively few examples of how or if OSH innovations have been integrated into widespread practice. For example, according to Lucas et al. (2014), only 17% of fishing safety research had made it to the workplace adoption phase. Similar results were found in a study conducted by Tinc et al. (2018a). A 2009 National Academies of Science report stated "much remains to be learned about how to improve the likelihood that research translation

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efforts will positively impact worksites... [and]... continued contribution by NIOSH to research on improving the effectiveness of translation efforts will ensure consideration of the dynamics that characterize occupational safety and health" (NAS, 2009). Similar calls for greater emphasis on translation research for OSH can be found in several more recent NIOSH program reviews (NIOSH, 2018).

Several OSH researchers have recognized the specific need for improved research to encourage the adoption of relevant and effective occupational safety and health (OSH) innovations (Dugan & Punnett, 2017; Guerin et al., 2019; Lucas et al., 2014, Tinc et al., 2018a), and the National Institute for Occupational Safety and Health (NIOSH) has recognized these calls and responded with a Framework for Translation Research in OSH (Schulte et al., 2017). The increasing emphasis on Translation Research for OSH is much needed, and is already leading to meaningful impacts (Lucas et al., 2014; Sorensen et al., 2017). However, the OSH community has been somewhat late to embrace translation research activities compared to other fields, as those working in clinical medicine and public health have been spreading and scaling evidence-based innovations for many years. This lag can be both a challenge and an opportunity for OSH researchers, as frameworks developed for clinical medicine, then for public health in general, can now be adapted for use in OSH contexts, thus reducing the burden on OSH researchers to start from the beginning.

While there continues to be a need for establishing the evidence base for OSH interventions to address a myriad of hazards across multiple sectors, wider and more effective implementation of efficacious and effective OSH innovations is a critical next step (or perhaps leap). Despite its instructional value for developing research strategies to improve translation efforts for OSH contexts, the wealth of information derived from other disciplines can be both confusing and overwhelming to apply in this setting. This paper aims to open the discussion on and move forward in OSH translation research by: (1) disentangling terminology related to translation research, (2) examining pre-existing and related fields of research within clinical medicine and public health contexts, (3) considering the unique challenges to achieving success in translation within OSH settings, and (4) providing suggested next steps for the OSH research community.

2. Translation research components and terminology

In general, there is a lack of consensus on definitions and conceptions of constructs related to Translation Research for OSH, which draws from the fields of translational science and dissemination and implementation (D&I) science but more broadly incorporates earlier stages of research. As Powell and colleagues (2012) have observed:

> "Multiple terms are used for implementation processes (e.g., knowledge translation, diffusion, dissemination, translation) and strategies (e.g., methods, interventions, models) resulting in a literature that McKibbon et al. (2010) describe as a "tower of Babel." These variations in terminology and description inhibit scientific replication and meta-analyses (Michie et al., 2009) and reduce the value of the literature for stakeholders (e.g., researchers, administrators, etc.) who seek implementation guidance."

Other researchers have noted the same lack of standardization and consensus around terminology, as well as how to best model and measure related phenomena (e.g., Dugan & Punnett, 2017). This lack of uniform understanding can likely be attributed to the varied and diverse origins from which these fields emerged (e.g., agriculture, education, marketing, communications, management) (Rabin et al, 2008). However, for a body of science to advance, there needs to be an explicit and common language. What cannot be defined cannot be operationalized and what is not operationalized cannot be measured. Nomenclature and scope are critical issues to find common understanding around so that OSH researchers and practitioners can move directly to application of existing innovations without extensive effort to rationalize a particular approach.

Table 1 highlights some key terminology and definitions to generate a productive discussion of Translation Research for OSH. In addition to these definitions, we encourage readers to review sources such as Brownson, Colditz, and Proctor's (2012) *Dissemination and Implementation in Health: Translating Science to Practice* textbook, which provides comprehensive definitions of a wider array of terminology than can reasonably be published here.

In developing Table 1, we've taken into account our collective understanding of the following. First, Translation Research for OSH can be conceived as "the application of scientific investigative approaches to study how the outputs of basic and applied research can be effectively translated into practice and having an impact (Schulte et al., 2017)." This field of research highlights all phases of research, including: problem identification; intervention development and testing; diffusion, dissemination, or implementation; and outcome evaluation (Schulte et al., 2017; Tinc, 2018a). The NIOSH Framework for Translation Research in OSH (Schulte et al., 2017) provides one conceptualization of this process. This framework builds on the NIH model (Zerhouni, 2003) and interpretation by Khoury et al. (2004) with its "T" phases, which follow the trajectory from scientific discovery (T0) to candidate health applications (T1) to evidence-based practice guidelines (T2) to health practice (T3) and finally to population health impacts (T4). In addition, the NIOSH Framework for Translation Research in OSH also incorporates aspects of the public health model of Ogilvie et al. (2009), Knowledge to Action (Graham et al., 2006; Wilson et al., 2011), Knowledge Transfer and Exchange (Lavis et al., 2003; Van Eerd et al., 2011), and the application of the NIH T0-T4 model by Lucas et al. (2014). The NIOSH Framework for Translation Research is characterized by moving findings to a larger scale and focuses on how best to make those transitions. Moving study findings and other knowledge products to a larger scale means finding ways to increase adoption, implementation, and sustained use of OSH innovations. For choosing the most appropriate terms to describe a particular research effort aimed at discovering new and better ways of moving OSH knowledge outputs to widespread adoption, there is no certain framework, theory, or model that is widely agreed upon; however, there have been calls to use existing terminology and resist development of new ones (Nilsen, 2015).

3. Related fields of research

Second, research within the various phases of the Framework for Translation Research in OSH (or other similar research process models) can be guided and defined by several fields of research, including intervention research, translational research/science (drawn from biomedical literature), and D&I science. Indeed, much of these growing fields may be different names for the same thing – likely stemming from different schools of research. Translation Research for OSH encapsulates the principles, values, and lessons learned from each of these disciplines which are considered distinct from one another, yet tend to overlap and can be applied in OSH settings. For example, translation research may be considered as more of an umbrella term (Rabin et al., 2008; Sussman et al., 2006) mainly because it includes the basic research and intervention development phases, which may or may not be included in widely-used, D&I frameworks that focus on the pre-adoption, adoption, and implementation and sustainment of an existing evidence-based intervention (Brown et al., 2017). Based on this argument, D&I research can be viewed as a component of translation research; however, this is not a universal understanding. Translation research and D&I research may be viewed instead as broadly overlapping, with each encompassing the study of a wide range of diffusion, dissemination, or implementation/de-implementation strategies. The work that comes before and contributes to this phase may also be included, so long as the end outcome is adoption, adaptation to fit the local context, fidelity, institutionalization, and maintenance by the target population, and thus, improved health outcomes. The NIOSH framework acknowledges that translation research activities related to an OSH intervention (such as feasibility testing) may be conducted even if there is not yet a clear evidence base for the intervention's effectiveness— a point of departure from D&I.

Much of the progress in these fields has come from clinical medicine, and several frameworks, models, and theories for advancing the fields have been developed (Chamberlain, Brown, & Saldana, 2011; Damschroder et al., 2009; Feldstein & Glasgow, 2008; Glasgow et al., 2001; Kilbourne et al., 2007; Nilsen, 2015; Rajan et al., 2012; Tabak et al., 2012; Trochim et al., 2011; Waltz et al., 2014). It also includes the concept of knowledge and relevant frameworks including knowledge transfer and exchange (KTE) and knowledge utilization processes, which are more commonly discussed outside of the US. Though there are nuanced differences between these various fields, they do overlap. The important point here is not to distinguish one set of knowledge as more appropriate than any other. Instead, as OSH researchers, we should take the opportunity to embrace the knowledge from diverse sources and apply it in our own settings.

Although infrequent, several translation research/science and D&I models have been applied in OSH settings. For example, Schulte et al. (2017) and Tinc et al. (2018a) recently published modified versions of the NIH T0-T4 models, which are intended specifically for use among occupational safety and health researchers. Tinc et al. (2018a) and Storm et al. (2016) have also published studies applying the Consolidated Framework for Implementation Research and RE-AIM (both from the field of D&I research) to agricultural settings.

4. Challenges of the OSH context

One critical question is why has the field of OSH taken longer to focus on dissemination and implementation science? The OSH context is different in many ways from the fields where much of the translational research and D&I bodies of literature originated (e.g. clinical medicine). Although many work-related injuries and fatalities can be prevented by adopting evidence-based solutions, this outcome may require different approaches to dissemination and implementation than clinical solutions. For example, just as patient adherence to physician recommendations is a consistent challenge in clinical medicine, in OSH research and practice settings it can be difficult to get employer and/or employee buy-in for OSH innovations that are often disseminated by OSH practitioners (Pinder et al., 2016). Identifying ways to overcome these types of challenges is a central tenet of translation research across most fields. However, the answers to those research questions will likely lead to different guidance in how to influence decision-making, and at what level (individual, group/team, organization, industry, and government/regulatory). While the NIH T0-T4 model and many other frameworks, models, and theories developed for translation efforts that provide guidance for innovations supported by the structure and processes of the healthcare system acknowledge the complexity of real-world contexts, challenges to the uptake of innovations may be amplified in the OSH field (Tinc, 2018b).

There are several practical issues which can make conducting translation research in the workplace challenging. Most workplaces are considered small businesses—approximately 90% of all U.S. firms have 20 or fewer employees (Cunningham, Sinclair, & Schulte, 2014)—and these workplaces have traditionally been seen as “hard to reach” by researchers across multiple disciplines (Curran & Blackburn, 2001). Because of the small size of many workplaces, other practical challenges of conducting OSH research (which also apply to translation research studies) include the ability to collect representative samples of data and generalize findings to a broader population (Curran & Blackburn, 2001; Lewis et al., 2007). Factors such as cost of implementation of new innovations, as well cultural and political dimensions can strongly influence decisions to adopt OSH interventions (Goldenhar & Schulte, 1994), and can shift over relatively short time-spans. Contextual factors reflecting real-world, ever-changing priorities and working environments that hinder and facilitate the effective adoption, implementation (with high fidelity) and sustainment of OSH innovations, are necessary to consider at all stages of the translation research process, including during efforts to spread and scale innovations.

Another challenge to conducting translation research in OSH settings is that D&I science utilizes several classic psychological behavior change theories (including Social Cognitive Theory (Bandura, 1986), the Theory of Planned Behavior (Ajzen, 1991), etc.), as these theories are useful to understanding the user/adopter characteristics and behaviors that affect implementation outcomes (Nilsen, 2015). However, the OSH context is unique compared to clinical contexts, and many public health contexts, in that change efforts which focus on individual behavior change at the worker level are often criticized for potentially blaming the worker (e.g., Ringen et al., 2018). While worker buy-in is critical to successful D&I activities, change efforts in OSH contexts need to focus primarily on behavior change at the management, ownership, and organizational levels. Theories concerning organizational

culture, climate, and leadership are therefore relevant for explaining organizational influences on innovation adoption. Within OSH contexts, there is a robust literature specifically related to safety culture and climate (e.g, Zohar, 1980; Zohar & Tenne-Gazit, 2008). Safety climate is mainly used as a measure of effectiveness for safety interventions, or as a leading indicator of safety performance; however, this body of literature could be drawn upon to better understand success or failure in increasing adoption, implementation, and maintenance of OSH innovations.

As noted, the 'occupational' element of OSH implies the need for some understanding of organizational contexts, specifically those that limit (or enhance) OSH performance and adoption of OSH innovations. Certain organizational factors (such as workforce demographics and business size, as discussed previously) are important to consider, as they are associated with disproportionate OSH burden (Cunningham et al., 2018; NIOSH, ASSE, 2015). Consideration of these contextual factors leads to modification of established models to include a specific focus on intermediaries (organizations that deliver goods or services to small businesses), as both a critical mechanism to achieve knowledge transfer, as well as a much-needed subject of research (Hasle, Kines, & Anderson, 2009; Sinclair, Cunningham, & Schulte, 2013).

As previously stated, the individual characteristics of program implementers are also important to take into account when promoting the successful uptake of research and innovations (Damschroder et al., 2009; Greenhalgh et al., 2004; Michie et al., 2005). An example from the OSH field relates to a recent study in one of the largest U.S. school districts exploring outcomes related to the implementation of a foundational curriculum in workplace safety and health in eighth grade science classrooms (Guerin et al., 2019). Analyses that considered years teaching—an individual, teacher-level characteristic—as a moderator of implementation fidelity (i.e. adherence to the program as designed) did not suggest any significant relationships among the student outcome variables (which included OSH knowledge, subjective norm, self-efficacy, and behavioral intention to enact workplace safety skills learned through the program). Thus, implementation fidelity made a consistent contribution to students' success on intervention outcomes regardless of the teacher's experience level (Guerin et al., 2019).

Discussions of who the target of implementation efforts should be also warrant discussion of trust levels between various parties, including workers, firm owners and managers, and researchers and practitioners (which often includes members of government agencies). While, from a research perspective, little can be done to address trust issues within the workplace, it is important to consider these potential problems as evidence-based practices are disseminated. Similarly, including members of the target population (both workers and those at the managerial/ownership level) can increase trust and help to identify issues before they hinder implementation efforts. This can be done by incorporating principles described in approaches such as Community Based Participatory Research (Holkup, Tripp-Reimer, & Salois, 2004; Israel et al., 2001), Social Marketing (Andreasen, 2006; Grier & Bryant, 2005; Lee & Kotler, 2011), and Action Research (Neill, 1998). Such examples can be found throughout OSH intervention development efforts. In particular, social marketing efforts to increase the adoption of safety technologies such as rollover protection for farm tractors

(Sorensen et al., 2011) and personal floatation devices for commercial fishermen (NIOSH, 2014) have been successful in increasing workplace adoption at local and regional levels, with continued efforts to reach broader populations Social marketing strategies are developed in conjunction with target populations in order to first identify and understand the barriers that populations face in engaging in health behaviors. Then, social marketing incorporates four marketing principles (product selection, acceptable pricing, promotion, and product placement) to reduce those barriers and include appropriate and targeted motivational components (e.g. promotion and cost reduction), thus creating an environment in which engaging in health behaviors is less difficult. In increasing the use of rollover protection for farm tractors, social marketing components include providing sourcing assistance for rollover protection (to reduce the barrier of time constraints), targeted messages (to highlight personal risk), and financial assistance (to reduce the burden of cost) (Sorensen et al, 2006; 2011). A 2011 study demonstrated that combining these components resulted in a higher number of New York farmers initiating retrofit processes than any of the individual intervention components. Since then, this approach has been replicated in six additional states with similar results (Tinc et al., 2016). Recently, efforts to implement this program nationally have further highlighted the importance of the intervention design on implementation (Tinc et al., 2019).

Finally, another challenge the OSH context presents relates to conducing T4/Evaluation research. There are limited examples of true impact evaluations in OSH research (e.g., Lucas et al., 2014; Myers, 2018).

Impact evaluations are used to determine whether a causal relationship exists between an intervention and the outcomes of interests. However, these associations are exceedingly difficult to assess in real-world, practice settings (Downes, Novicki & Howard, 2018; Gertler, Martinez, Premand, Rawlings & Vermeersch, 2011). Thus, government agencies and other organizations are employing innovative, evaluation methods to capture and characterize possible relationships between research activities and specified outcomes. One such example is the use by NIOSH of contribution analysis (Mayne 2001, 2011; Downes, Novicki & Howard, 2018) to evaluate the impact of its research programs. Many other participatory evaluation methods are gaining visibility across public health disciplines (Lobo, Petrich, & Burns, 2014) and should be explored for their utility to assess the impact of OSH research.

5. Future directions in OSH translation research

As a community, OSH researchers have struggled to carry through research to a point in which communities at large are benefitting from them – a severe ethical and practical challenge. As Sogolow et al. (2007) explain:

> “This situation is equivalent to developing a life-saving medication but not telling physicians or patients that it is available, not packaging the product for public use, not having skilled pharmacists to dispense the medication, and not providing guidance about the management of its effects.”

It is time that researchers and practitioners work together to increase the impact of OSH innovations that have already been developed and undergone efficacy and effectiveness trials. With advances in translation science in other disciplines, OSH researchers have the advantage of building on what has already been learned and applying this knowledge to new fields. To become acquainted with these fields, journals including *Implementation Science, BMC Journal of Translational Medicine, Clinical and Translational Science,* and *Translational Research* may be important starting points for understanding the principles of moving toward wider adoption and use of OSH innovations. Similarly, process models such as Knowledge to Action, Knowledge Transfer and Exchange, and T0-T4 (and recent revisions); and implementation frameworks and theories such as REACH, RE-AIM, the Consolidated Framework for Implementation Research, and Theoretical Domains Framework may provide added guidance for how to maneuver in these later stages of the translation research cycle. While there can be significant benefit from applying the existing knowledge regarding research/knowledge translation from other fields, the need to test and evaluate potential guidance for OSH settings persists.

There is a critical need for more investment in latter stages/phases of Translation Research for OSH. While many of the resources described above focus particularly on the later stages of the research continuum, it is relevant and important to plan for translation activities at the earliest stages of innovation development, and to continually assess threats to adoption and maintenance over time. Researchers, health communicators, and practitioners should embed translation research questions into existing activities, and not just ask how many we reached or who adopted; but move forward to ask questions such as “how can we communicate knowledge more effectively?” “why do diffusion, dissemination, and implementation strategies work, or not?”, “how and why are evidenced-based, OSH interventions adopted, implemented, and maintained?”, “what are the individual, group, organizational, etc. characteristics that affect the successful uptake of OSH interventions?” and “how does translation research have a direct and relevant impact on OSH policies, practices and programs in real world workplaces/settings?”, Greater investment in latter phases of translation research should also include investment in developing the evidence base for OSH interventions, as variable levels of evidence may also inhibit trialability and adoption decisions. Barriers to adoption, innovation fit within the target setting and context, logistical challenges, and resource allocation may be among the many factors that can be monitored and addressed from the beginning to allow for greater adoption, implementation, and sustainment of OSH innovations.

In many cases, the barriers presented may be related to knowledge or resource gaps, which could be addressed through collaboration with diverse partners, particularly those outside of the OSH research community. Based on multiple sources of guidance outlined above, the importance of stakeholder and intermediary engagement cannot be overstated. Also, working with members of the D&I and translation research fields can help improve implementation strategies and evaluations, while partnering with manufacturing organizations from early on may help limit the barriers faced in implementing engineering solutions (Fiske & Earle-Richardson, 2013). Already the benefits of such partnerships have been highlighted in the agriculture (Tinc et al., 2018b), construction (CPWR, 2014), and

fishing sectors (Teske & Victoroff, 2017), as wider implementation of OSH best practices has begun.

In reframing our thoughts about what implementation and translation are, it becomes evident that there are many commonalities across disciplines, and that the skills needed to conduct research in this area are often the same as those required for innovation development, particularly for those who are familiar with evaluation processes. A critical component of progress is clearly describing what research is being conducted, where it fits in a continuum leading to impact, and what the outcomes (both intervention and translation) are. Toward this aim, dissemination and implementation science approaches should be embedded into early stages of OSH research development, so that translation research is not misunderstood as an add-on activity. To meet its long-term goal of reducing work-related injuries and fatalities, the OSH research community will need to work to identify ways to improve the adoption, adaptation, delivery, and maintenance of promising/effective interventions in the workplace. Consistency in how translation, dissemination, and implementation science terms are used will greatly enhance this conversation. With more work to spread OSH innovations, as a research community, we can begin understanding important translation questions (what works in what settings, under what conditions, and why), and how this knowledge can be generalized and applied to other areas of OSH and public health research. In the end, this progress will allow for greater impact on OSH outcomes and a healthier workforce.

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Disclaimer:

The findings and conclusions in this paper are those of the author(s) and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

7. Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

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Paul A. Schulte, Ph.D., is the Director of the Division of Science Integration, and Co-Manager of the Nanotechnology Research Center, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention. Dr. Schulte has 40 years experience in conducting research and developing guidance on occupational cancer, nanomaterials, risk communication, workplace well-being, and genetics. He also has examined the convergence of occupational safety and health and green chemistry and sustainability. Dr. Schulte has developed various frameworks for addressing the aging workforce, burden of occupational disease and injury, translation research, synthetic biology and occupational risk. He is the coeditor of the textbook entitled, “Molecular Epidemiology: Principles and Practices.” He has served as guest editor of the Journal of Occupational Medicine and the American Journal of Industrial Medicine and was on the initial editorial board of Cancer Epidemiology, Biomarkers and Prevention. He currently is on the International Advisory Board of the Annals of Occupational Hygiene.

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Table 1

Select, relevant terminology in Translation Research for OSH.

Term	Definitions
Innovation	A new idea, practice, or object (Rabin et al., 2008; Rogers, 2003). In OSH settings, this can include engineering controls, safety programs, educational interventions, policies, and guidelines, behavior change campaigns, etc.
Evidence	Scientifically developed information that "concerns facts (actual or attested) intended for use in support of a conclusion" (Lomas, 1993). Traditionally, evidence stemming from quantitative, objective sources are given the highest priority; however, other sources of evidence (e.g. qualitative and case studies) are equally as important, depending on the research questions and focus of investigation.
Knowledge	A wider category, which includes evidence. Knowledge may include scientific and non-scientific information (e.g. practitioner experience) that can be used to further develop and spread innovations.
Adoption	A person or organization's decision to commit to and begin using an evidence-based innovation (Rabin et al., 2008; Sussman et al., 2006). Adoption can be a result of broad diffusion, dissemination, or implementation efforts and involves site-specific implementation of innovations.
Diffusion	The passive spread of innovations to new populations. Diffusion requires few resources, but may be more difficult to track or measure. (Greenhalgh et al., 2004; Lomas, 1993; MacLean, 1996; Rabin et al., 2008; Rogers, 2003)
Dissemination	The active spread of innovations and knowledge to target audiences to encourage the decision to adopt. (Greenhalgh et al., 2004; Lomas, 1993; MacLean, 1996; Rabin et al., 2008).
Implementation	The set of activities designed to put into practice an activity or program of known dimensions (Fixsen et al., 2005; Rabin et al., 2008). This is done by increasing the skillful, consistent, and committed use of innovations by target populations (Klein & Sorra, 1996). This is the most resource-intensive method of spreading innovations, but may also provide the most detailed understanding of why innovations succeed or fail in various settings (Lomas, 1993; MacLean, 1996).
Translation Research/ Translational Science	A field of biomedical and health research that deals with ensuring that new treatments and research knowledge actually reach the patients or populations for whom they are intended and are implemented correctly. The production of a new drug, an end point for "bench-to-bedside" translational research, is only the starting point for this second area of research (Woolf, 2008). Type I translation research uses discoveries generated through laboratory and/or preclinical research to develop and test treatment and prevention approaches. In other words, type I clinical research moves science from "the bench" (fundamental research, methods development) to the patients' "bedside" (efficacy research). Type II translation research focuses on the enhancement of widespread use of efficacious interventions by the target audience. This type of research includes effectiveness research, diffusion research, dissemination research, and implementation research and also referred to as "bedside to (clinical) practice" translation (Rabin et al., 2008; Sussman et al., 2006).
Translation Research for OSH	A field of research that deals with "the application of scientific investigative approaches to study how the outputs of basic and applied research can be effectively translated into practice and have an impact (Schulte et al. 2017), and "...comprehensive applied research that strives to translate the available knowledge and make it useful (Narayan et al. 2000). Includes concepts from Dissemination and Implementation Science as well as Translation Research/Translational Science.
Dissemination and Implementation (D&I) Science	A field of research that deals with "the systematic study of how a specific set of activities and designated strategies are used to successfully integrate an evidence-based public health intervention within specific settings" (Bauer, Damschroder, Hagedorn, Smith, & Kilbourne, 2015).
Knowledge Transfer and Exchange	"Knowledge transfer and exchange (KTE) is a process of makingrelevant research information available and accessible for use in practice or policy. Integrated KTE, where knowledge users are engaged in the research process, is considered to better facilitate uptake and use" (Van Eerd & Saunders, 2017).
Knowledge Translation	"A dynamic and iterative process that includes synthesis, dissemination, exchange, and ethically sound application of knowledge." (CIHR,2000)
Research to practice (r2p)	"An approach focused on the use, adoption, and adaptation of NIOSH knowledge, interventions, and technologies within the workplace." (NIOSH, 2013).