USE 2017

Understanding Small Enterprises: Proceedings from the 2017 Conference

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Understanding Small Enterprises: Proceedings from the 2017 Conference

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Lee Newman, Carol Brown, and Michelle Haan, Editors

DEPARTMENT OF HEALTH AND HUMAN SERVICES
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Foreword

The majority of the U.S. and global workforce works in firms with fewer than 250 employees, and these firms have a disproportionate share of all occupational injuries and illnesses. Consequently, there is a need for continued focus on small and medium-sized enterprises. The periodic conferences held under the auspices of the Understanding Small Enterprises (USE) collaboration serve to illustrate that focus. USE is a voluntary, international collaborative focused on addressing the occupational safety and health of workers in small enterprises.

The National Institute for Occupational Safety and Health (NIOSH) and the Center for Health, Work and Environment (CHWE) at the Colorado School of Public Health hosted the fourth international Understanding Small Enterprises (USE) Conference in Denver, Colorado, on October 25–27, 2017. This event represented a culmination of two decades of the NIOSH small business occupational safety and health research agenda and an opportunity to generate new ideas through collaboration with world experts, entrepreneurs, and small business leaders who are creating safe and healthy workplaces.

NIOSH, CHWE, and USE organized this conference because we know workers in small businesses are injured and killed on the job at a higher rate than workers in larger businesses. Over the years, NIOSH has expanded the research focus from identifying small businesses in high-risk sectors to understanding how community networks affect worker safety and health. Small businesses often have limited resources, and efforts must be adapted and solutions created that are accessible in these economic situations. Although these organizations are small, they can make a big impact on the well-being of the people they employ.

Small business leaders, researchers, safety and health professionals, and all those who share an interest in creating safe and healthy small workplaces are encouraged to continue the conversation to move worker well-being and sustainable business health from ideas to achievable reality.

John Howard, M.D.
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Introduction

Focus on Safety and Health in Small Businesses

Given the disproportionate burden of occupational injuries, illnesses, and fatalities experienced by small businesses in the United States and worldwide, small business occupational safety and health (OSH) is of increasing concern to the National Institute for Occupational Safety and Health (NIOSH). Although researchers in public health have addressed multiple OSH issues, the very large group of academics and researchers specializing in the area of OSH has not been very active in the area of small business OSH. The USE 2017 conference brought together experts in the area of small business OSH and researchers from public health to build connections and to move forward a research agenda for small business OSH.

This conference represents the leading thinkers in the small business OSH research community from around the world. The conference is relatively new, having convened three times since 2009, but it has already had a significant impact in moving the OSH community to focus on small businesses. The conference aims to enhance the work environment for people within small firms.

What do we mean by small?

A "small" business is defined in many ways. The U.S. Small Business Administration considers 99.7% of all U.S. firms to be small businesses, with fewer than 500 employees. If we narrow the distinction further, then just over one-third of the U.S. workforce is employed by businesses with fewer than 100 employees. For discussions of workplace safety and health and for research purposes, the NIOSH Small Business Assistance Program considers small businesses as those having fewer than 50 employees. NIOSH researchers have also found that other than number of employees, it is important to consider factors such as age of the business, structure of the ownership, and availability of resources for workplace safety and health.

We know that in many cases, businesses are starting smaller and staying smaller. Given that small businesses often lack safety and health professionals, the need is increasing for simple, inexpensive ways to ensure safe and healthful working conditions (e.g., Total Worker Health and safety apps for employers). Tools that work for small businesses—designed for convenience and ease of use—help everyone. Small business needs can drive safety solutions to cost less and to be more effective.

While NIOSH continues to lead a research agenda focused on small business safety and health needs, we recognize that no single organization can effectively reach the millions of small businesses that could benefit from assistance. That is why we have expanded our research agenda to include a specific focus on understanding the role of intermediaries. Intermediaries might be organizations already engaging small businesses in occupational safety and health assistance, looking for new ways to engage small firms, or already well-connected to a small business network. The range of intermediaries includes suppliers of goods and services (equipment/material suppliers, insurance companies, legal and financial advisors, health providers), membership organizations (trade associations, chambers of commerce), education organizations (community colleges,

vocational schools), and government agencies. Several of the presenters at the 2017 USE conference are making great advances in this line of research, both as investigators studying ways to improve OSH among small businesses and as intermediaries sharing their stories of success with helping small employers and their workforces.

USE is the premiere small business occupational safety and health conference and provides a forum where researchers and other national and world leaders in the study of worker health convene to discuss ways to prevent workplace illnesses and injuries among small business employees. It provides a forum for critical reviews, discussions, collaborations, and education on issues of occupational exposures and their human health effects.

The 2017 program was a stimulating mixture of talks, discussion sessions, posters, and mini-symposia with contributors from all over the world, with a forward-looking emphasis on addressing challenges for occupational epidemiology in the 21st century. Holding this world-renowned conference in the United States (for the first time) provided an excellent opportunity for U.S. researchers and small business stakeholders to participate with and engage in significant ways with their global peers.

USE Conference History

The different foci of the three previous Understanding Small Enterprises (USE) conferences reflect a progression in the study of managing safety in small and medium-sized enterprises (SMEs). The first Understanding Small Enterprises Conference (USE 2009) took place in October 2009 in Elsinore (Helsingør), Denmark. This initial conference focused on "understanding the issues (for practice)." The second conference (USE 2013) took place in February 2013 in Nelson, New Zealand, hosted by Massey University and AUT University. USE 2013 focused on "putting understanding into action." The 2013 conference also yielded two special journal issues, focused on small business OSH. These were the *Safety Science Special Issue: Managing Safety in Small and Medium Enterprises* (**https://www.sciencedirect.com/journal/safety-science/vol/71/part/PC**) and *International Journal of Small Enterprise Research Special Issue: Understanding Small Enterprises: Healthy Lives in Healthy Businesses* (**https://www.tandfonline.com/toc/rser20/21/2**). The third meeting, USE 2015: A Healthy Working Life in a Healthy Business, was held in October 2015 in Groningen, The Netherlands. The three main subthemes were healthy and safe working environments at SMEs, health organizations as small businesses, and SMEs in a networked society. The specific topics addressed at each of the previous conferences, as well as the 2017 conference, are available on the conference website, **www.useconference.com**.

USE 2017, Denver, USA

The overall aim of the most recent USE conference was to enhance both the work environment for people within small firms and the business performance of small firms. This opportunity significantly contributed to advancing the NIOSH Small Business Assistance Program strategic goal to reduce injuries and illnesses in smaller businesses by better understanding intermediary organizations (their structure, operations, and networks) and by better understanding the work environment of smaller enterprises. Several of the keynote presentations and other selected papers from the conference have been published in a dedicated issue of the *Annals of Work Exposures and Health* [2018;62(S1), doi: 10.1093/annweh/wxy061]. This issue includes topics ranging from

suggestions for an overall OSH communication research strategy for reaching small employers to specific presentations of research findings from implementation of worksite health interventions with small employers and investigating the facilitators and barriers to effective interventions with small employers. Additional papers from the conference are published in these proceedings.

The papers included in this volume follow the various topic areas of the conference sessions: impact of business size; occupational safety and health in small industrial settings; prevention in high-risk industries; tools, resources, and systems for small enterprises; health services for small enterprises; Total Worker Health in small enterprises; informal economy; vulnerable workers; and workplace health and safety in construction. The variety of the conference presentations and discussions is illustrated by the variety of topics included here, from eco-industrial park projects in Thailand to childcare centers in the United States. Small businesses and the research aimed at finding better ways to help them are diverse and span across the globe.

Acknowledgments

The convening of the Understanding Small Enterprises Conference in Denver, Colorado, was supported by the Small Business Assistance Program of the National Institute for Occupational Safety and Health (NIOSH) and its host, the Center for Health, Work & Environment at the Colorado School of Public Health. We greatly appreciate the many contributors to the conference planning and production. The core conference committee included Avery Artman, Carol Brown, Garrett Burnett, Thomas Cunningham, Michelle Haan, Brenda Jacklitsch, Lee Newman, Paul Schulte, and Liliana Tenney. Conference planning committee members included Lisa Brosseau, Chia-Chia Chang, Peter Hasle, Dennis Hudson, Heidi Hudson, Stephen Legg, Harm van Lieshout, Hans Jørgen Limborg, Bruce Lundegren, Kirsten Olsen, David Parker, Diane Rohlman, and Scott Schneider. The conference was sponsored by the American Society of Safety Professionals, Axion Health, Pinnacol Assurance, the Colorado Office of Economic Development & International Trade, Colorado State University, the International Commission on Occupational Health, and the International Social Security Association.

We also thank those who presented at the conference and all who engaged in the thoughtful discussions.

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Occupational Health and Safety Vulnerability in Canadian Small Enterprises

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Abstract

Objective: Occupational health and safety (OHS) vulnerability is often defined by demographic characteristics, such as young, new, or immigrant workers. We describe a novel conceptual approach to defining OHS vulnerability, on the basis of four characteristics of the enterprise: (1) workers' exposure to OHS hazards, combined with (2) the adequacy of OHS policies and practices, (3) workers' awareness of their rights and responsibilities, and (4) workers' perceptions of empowerment to participate in injury prevention. We estimate the extent to which differences in the risk of work injury among workers in small and large enterprises can be accounted for by differences in OHS vulnerability associated with workplace size.

Methods: We used a subset of respondents to a 27-item questionnaire administered to 1,835 working adults in the Canadian provinces of Ontario and British Columbia who worked in small (n = 505) or large (n = 525) enterprises. The survey instrument contained 9 items on OHS hazard exposure, 7 on organizational policies and practices, 6 on awareness, and 5 on empowerment. Survey respondents also self-reported the 12-month incidence of work injury requiring time off work and/or medical attention.

Results: Exposure to one or more of nine OHS hazards was reported by 49% of the overall sample. Inadequate organizational policies and procedures were reported by 42% of the sample, inadequate awareness of rights and responsibilities by 22%, and inadequate empowerment by 34%. Relative to workers in large enterprises (>500 employees), respondents in organizations with 5 to 19 employees reported a higher prevalence of hazard exposure, a higher incidence of work-related injury and illness, and a higher exposure to inadequate policies and procedures. Adjustment for these differences in the adequacy of workplace policies and procedures accounted for the higher work injury incidence observed among employees in small workplaces.

Conclusion: This study recruited respondents from a wide range of occupational categories, employment relationships, and workplace sizes. Applying an approach to measuring three distinct categories of OHS vulnerability has highlighted important areas of priority focus for strengthening worker health protection in small enterprises.

Introduction

Workplace injury and illness are responsible for a significant share of sickness and disability burdens in working-age populations. Among working-age adults, approximately 20% of traumatic injuries requiring medical care are caused by work exposures [Chambers et al. 2015]. The direct and indirect costs of fatal and non-fatal occupational injuries and illnesses in the United States are estimated to exceed $250 billion annually [Leigh 2011]. In the North American economy, small businesses with fewer than 100 workers employ approximately 50% of the total private-sector labor force and have well-described challenges in protecting the health of their workers [Breslin et al. 2010].

There is longstanding recognition that smaller enterprises face unique challenges in complying with regulatory standards concerning worker health protection. The unique characteristics of small enterprises include a limited knowledge of occupational health and safety (OHS) regulatory standards, generally weak or non-existent organizational policies and procedures concerning OHS practices, and a tendency to perceive the management of workplace health and safety risks to be the responsibility of individual employees [Breslin et al. 2010].

Here we apply a novel approach to measuring OHS vulnerability to describe differences between the smaller and largest employers in workplace characteristics that shape individual workers' risk of injury [Smith et al. 2015]. This approach contrasts with much previous research that has focused on demographic or occupational characteristics to identify vulnerability, such as young workers [Breslin and Smith 2005], new workers [Breslin and Smith 2006], workers in temporary employment [Quinlan 2001], recent immigrants [Premji and Smith 2013; Smith and Mustard 2010], and those in high-hazard industries [Dembe et al. 2004]. The approach we describe focuses on the role of workplace characteristics in determining the vulnerability of individual workers to the risk of injury or illness. The measurement method collects information reported by individual workers on four dimensions of OHS vulnerability: (1) exposure to workplace hazards; (2) workplace safety policies and procedures; (3) workers' awareness of health and safety-related rights and responsibilities; and (4) workers' empowerment to act to protect themselves and colleagues. The premise of this framework is that vulnerability arises from exposure to on-the-job hazards in conjunction with inadequate access to resources (policies and procedures, awareness, or empowerment) to mitigate the effects of these risks.

In previous work, we reported a higher incidence of injury requiring medical attention and/or days off work among employees who were exposed to workplace hazards and who reported poor access to protective policies and procedures, poor awareness of workplace rights and responsibilities, or low empowerment to act to make their workplace safer [Lay 2017]. Previous work has also shown higher hazard exposure and weaker protective policies and procedures among employees in smaller enterprises than in medium and large enterprises [Lay 2016]. The objective of this study was to determine the degree to which the elevated hazard exposure in smaller enterprises was associated with a higher risk of work injury and to estimate the extent to which a difference in injury risk could be accounted for by workplace differences in protective policies and procedures, awareness of workplace rights and responsibilities, and perceived empowerment to act to make the workplace safer.

Methods

Data for this study were collected through a cross-sectional survey in April and November 2015 from a sample of working adults (18 years or older) employed at least 15 hours a week at firms with five or more workers in British Columbia and Ontario, Canada. The majority of participants were recruited by a commercial survey provider from a panel of 90,000 Canadian households who had agreed to participate in surveys "from time to time." In this report, we compare worker respondents in the smallest enterprises (5–19 employees: n = 505) to worker respondents in the largest enterprises (greater than 500 employees: n = 525).

Outcome Measure: Workplace Injury or Illness

This report focuses on respondents' self-reported frequency of work-related injury or illness in the past 12 months. Participants were considered to have experienced a work-related physical injury if they responded "yes" to this question: "In the past 12 months, have you sustained a physical injury or illness due to your work?"

Exposure Measures: OHS Vulnerability

Exposure to OHS vulnerability was assessed with a 27-item questionnaire. A full account of the development of the tool can be found elsewhere [Smith et al. 2015]. Survey participants responded to statements related to four dimensions of OHS vulnerability: their self-reported exposure to workplace hazards, the existence of protective policies and procedures in the workplace, their awareness of workplace rights and responsibilities, and their sense of empowerment to protect themselves in the workplace. The questions used to measure each of these dimensions are listed in Table 1.

Workers were defined as vulnerable if they reported weekly exposure to one or more workplace hazards *and* they indicated inadequate access to at least one type of resource to mitigate the exposure risk (workplace policies and procedures, awareness, or empowerment). We defined three specific types of vulnerability: policy and procedure vulnerability (exposure to hazards and inadequate policies and procedures), awareness vulnerability (exposure to hazards and inadequate awareness), and empowerment vulnerability (exposure to hazards and inadequate empowerment).

Respondents were classified as having inadequate access to a specific mitigating resource (policies and procedures, awareness, or empowerment) when they disagreed or strongly disagreed with at least one of the related statements. The adequacy of policy and procedure resources was evaluated with statements such as "There is an active and effective health and safety committee and/or safety representative" and "Incidents and accidents are investigated quickly in order to improve workplace health and safety." Awareness was measured by statements about knowledge of worker rights and responsibilities in relation to health and safety, awareness of how to perform job tasks in a safe manner, and knowledge of how to contribute to safety and health in the workplace. Finally, empowerment was measured through five questions related to whether individuals feel free to voice concerns about health and safety issues and whether workers would act to correct an unsafe situation.

For each measure of OHS vulnerability (overall vulnerability, policy and procedure vulnerability, awareness vulnerability, and empowerment vulnerability), we classified

participants into four categories, according to those who were exposed to (1) no hazards and had adequate mitigation resources (considered the least vulnerable); (2) no workplace hazards but had inadequate access to mitigation resources; (3) workplace hazards and had adequate mitigation resources; and (4) workplace hazards and insufficient mitigation resources (considered the most vulnerable).

Covariates

Socio-demographic variables included in the multivariate analysis were gender (male or female), age (<35, 35–44, 45–54, or 55 years and older), and industry of employment (nine categories).

Analysis

Descriptive statistics contrasted the prevalence of hazard exposure and the 12-month prevalence of physical work injury between employees of small and large enterprises. These prevalence estimates were stratified by the adequacy of mitigation resources. Multivariate logistic regression models estimated the crude and adjusted risk of work injury among employees of small enterprises compared to large enterprises. Multivariate models adjusted for age, gender, industry, and the adequacy of policies and procedures, OHS awareness, and empowerment.

Results

Exposure to OHS hazards was reported by 49% of the analytic sub-sample. Self-reported hazard exposure was higher among workers in small enterprises (56.9%) versus large organizations (40.8%) (Table 2).

Inadequate organizational policies and procedures were reported by 42% of respondents, inadequate awareness of rights and responsibilities was reported by 22%, and inadequate empowerment was reported by 34% (Table 2). Relative to those in large enterprises (500 or more employees), respondents in organizations with 5 to 19 employees had a higher prevalence of vulnerability due to inadequate policies and procedures (33.7% versus 17.8%). Smaller differences were observed in the prevalence of inadequate awareness vulnerability and inadequate empowerment vulnerability between larger and smaller employers.

Relative to respondents in large enterprises, respondents in smaller enterprises reported a higher 12-month incidence of work-related physical injury (18.4% versus 12.7%) (Table 3). In both large and small enterprises, the risk of work injury was strongly graded by hazard exposure and the adequacy of mitigation measures. For example, among respondents reporting adequate OHS policies and procedures in their workplace and no hazard exposure, the 12-month incidence of injury requiring medical attention was 5.4% in small enterprises and 5.3% in large enterprises. In contrast, the 12-month incidence of injury requiring medical attention among respondents reporting exposure to hazards and inadequate workplace OHS policies and procedures was 31.2% in small enterprises and 31.1% in large enterprises.

In multivariate analysis, the crude relative risk of work injury among employees in small enterprises was 1.44 (95% confidence interval: 1.08–1.93) (Table 4). Adjustment for age, gender, and industry did not attenuate this risk. In a regression model additionally

adjusting for the adequacy of OHS policies and procedures, awareness, and empowerment, the relative risk observed for workers in small enterprises was no longer statistically significant, with the large majority of the relative risk accounted for by weaker OHS policies and procedures in small enterprises. Descriptive and analytic estimates were weighted to match the age, gender and provincial labour market distributions.

Discussion

The objective of this study was to estimate the extent to which differences in the risk of work injury among workers in small and large enterprises can be accounted for by differences in OHS vulnerability. Consistent with previous literature on OHS risk identification and control in relation to employer size, workers in small enterprises reported higher hazard exposure and weaker workplace OHS policies and procedures than did workers in larger enterprises. In multivariate analysis, the higher risk of work injury reported by workers in small enterprises was accounted for by differences in the adequacy of workplace OHS policies and procedures.

We acknowledge the following limitations to this study. The cross-sectional design cannot exclude the possibility of reverse causation, whereby a respondent who has experienced a workplace injury adopts a more critical assessment of one or more dimensions of workplace vulnerability. The study sample may also be affected by recall bias, in that those reporting recent injuries provide a more careful appraisal of workplace conditions than non-injured counterparts. Our study also had a relatively low response rate. Among the strengths of this study is its use of a large sample that includes respondents from a broad cross-section of occupations and industries. Additionally, whereas previous studies have examined the impact of workplace hazards and concepts of organizational climate on injury [Leitao and Greiner 2016; Smith et al. 2006], this is one of the first to formally test the influence of these factors on risk of injury relative to employer size.

This study recruited respondents from a wide range of occupational categories, employment relationships, and workplace sizes. Applying an approach to measuring three distinct categories of OHS vulnerability has highlighted important areas of priority focus for strengthening worker health protection in small enterprises.

Acknowledgments

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Table 1. Questions Used to Measure Four Dimensions of Occupational Health and Safety Vulnerability

Hazards: How often do you …
1. Have to manually lift, carry, or push items heavier than 20 kg at least ten times a day?
2. Have to do repetitive movements with your hands or wrists (packing, sorting, assembling, cleaning, pulling, pushing, typing) for at least three hours during the day?
3. Have to perform work tasks or use work methods that you are not familiar with?
4. Interact with hazardous substances such as chemicals, flammable liquids, and gases?
5. Have to work in a bent, twisted, or awkward posture?
6. Work at a height that is 2 meters or more above the ground or floor?
7. Work in noise levels that are so high that you have to raise your voice when talking to people less than one meter away?
8. Have you been bullied or harassed at work?
9. Have to stand for more than two hours in a row?
Policies and Procedures: At my workplace…
1. Everyone receives the necessary workplace health and safety training when starting a job, changing jobs, or using new techniques.
2. There is regular communication between employees and management about safety issues.
3. Systems are in place to identify, prevent, and deal with hazards at work.
4. Workplace health and safety are considered to be at least as important as production and quality.
5. There is an active and effective health and safety committee and/or health and safety representative.
6. Incidents and accidents are investigated quickly in order to improve workplace health and safety.
7. Communication about workplace health and safety procedures is done in a way I can understand.
Awareness: At my workplace…
1. I am clear about my rights and responsibilities in relation to workplace health and safety.
2. I am clear about my employer's rights and responsibilities in relation to workplace health and safety.
3. I know how to perform my job in a safe manner.
4. If I became aware of a health or safety hazard at my workplace, I know who (at my workplace) I would report it to.
5. I have the knowledge to assist in responding to any health and safety concerns at my workplace.
6. I know what the necessary precautions are that I should take while doing my job.
Empowerment: At my workplace…
1. I feel free to voice concerns or make suggestions about workplace health and safety at my job.
2. If I notice a workplace hazard, I would point it out to management.
3. I know that I can stop work if I think something is unsafe, and management will not give me a hard time.
4. If my work environment was unsafe I would not say anything and hope that the situation eventually improves. (*reverse scored)
5. I have enough time to complete my work tasks safety.

Table 2. Prevalence of Hazard Exposure and Adequacy of Mitigation Resources at Small vs Large Employers

Dimension	Small employers: 5–19 workers (*n* = 505)		Large employers: >500 workers (*n* = 520)		*P* value for test for difference (small vs large employers)
	Strata *n*	Column %	Strata *n*	Column %	
Policies/Procedures					
Adequate; no hazard	126	24.9	227	43.7	<0.001
Inadequate; no hazard	92	18.2	80	15.5	
Adequate; hazard	117	23.2	120	23.0	
Inadequate; hazard	170	33.7	93	17.8	
Awareness					
Adequate; no hazard	172	34.2	258	49.6	<0.001
Inadequate; no hazard	45	8.9	50	9.6	
Adequate; hazard	216	42.8	151	29.1	
Inadequate; hazard	72	14.1	61	11.7	
Empowerment					
Adequate; no hazard	168	33.4	233	44.9	<0.001
Inadequate; no hazard	49	9.7	74	14.3	
Adequate; hazard	169	33.5	105	20.1	
Inadequate; hazard	118	23.4	108	20.7	
Overall					
Adequate; no hazard	102	20.2	164	31.6	<0.001
Inadequate; no hazard	115	22.9	144	27.6	
Adequate; hazard	85	16.8	75	14.4	
Inadequate; hazard	203	40.2	137	26.4	

Table 3. Prevalence of Physical Injury, in Past 12 Months: Small vs Large Employers

Dimension	Small employers: 5–19 workers (*n* = 505)		Large employers: >500 workers (*n* = 520)		*P* value for test for difference (small vs large employers)
	Strata *n*	Column %	Strata *n*	Column %	
Policies/Procedures					
Adequate; no hazard	126	24.9	227	43.7	<0.001
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Inadequate; hazard	72	14.1	61	11.7	
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Inadequate; no hazard	115	22.9	144	27.6	
Adequate; hazard	85	16.8	75	14.4	
Inadequate; hazard	203	40.2	137	26.4	

Table 4. Crude and Adjusted Relative Risk of Being Physically Injured in the Last 12 Months: Small vs Large Employers

Size of Employer	Model 1		Model 2		Model 3 Adjusted for Policies and Procedures Vulnerability		Model 3 Adjusted for Awareness Vulnerability		Model 3 Adjusted for Empowerment Vulnerability		Model 3 Fully Adjusted	
	RR	95%CI	RR	95%CI	RR	95%CI	RR	95%CI	RR	95%CI	RR	95%CI
Small: 5–19 Employees	1.44	1.08, 1.93	1.39	1.04, 1.86	1.12	0.84, 1.48	1.37	1.02, 1.82	1.33	1.00, 1.75	1.22	0.92, 1.60
Large: 500+ Employees	ref.		ref.		ref.		ref.		ref.		ref.	

Model 1: crude.
Model 2: adjusted for age, gender, and industry.
Model 3: further adjusted for Policies and Procedures vulnerability, Awareness vulnerability, and Empowerment vulnerability.
CI = confidence interval; RR = relative risk.

The Critical Success Factors for Eco-Industrial Park Projects in Thailand: A Case Study of Saha Group Industrial Park, Sriracha, Thailand

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Introduction

Large industrial parks have had a significant impact on communities and on people's health. Although industrialization brings wealth and development to a country's economy, it also brings many problems, and one of these is industrial pollution.

The current environmental problems in Thailand also have been created by the development of industry. To manipulate industrial pollution, however, industrial ecologists have introduced the concept of eco-industrial parks (EIPs) [Lowe et al. 1995]. EIPs are distinguished from industrial parks in their focus on ecological sustainability. Thai society has undergone significant changes and developments with important implications for issues of workplace health, and it is focusing on the significant health care needs of workers and their communities. Problems emerging from these considerations are the continuous restructuring and reorientation of occupational health services to meet the challenges created by the changing nature of working life and the environment [World Health Organization 2002].

Eco-industrial development in Thailand has been implemented by the Industrial Estate Authority of Thailand and Department of Industrial Works since its launch in 2000. Nevertheless, they have limited experience in evaluation of EIP initiatives. One major issue in the planning and development of EIPs in Thailand is that they are narrowly defined as companies "utilising each other's wastes or [exchanging] by-products." This approach is not practical for achieving the full benefits of an EIP developed according to a more systemic definition [Indigo Development ND].

Thailand needs to build capacity for using industrial waste. Illegal dumping is common, and illegal dumpsites are often not discovered until nearby soil and groundwater are found to be contaminated. Industrial waste disposal must be monitored, and policy compliance should be encouraged by improving accessibility to waste collection and treatment equipment. The private sector and local communities are potential partners for improving waste management across many waste streams, but such cooperation has not been emphasized by governmental policies. However, the country's responses to the need for cooperation show that overarching and wide-ranging issues affecting many waste streams must be addressed [Global Partnership on Waste Management ND].

This research explores the future development of EIP projects in Thailand by focusing on the critical success factors for implementation of the EIP concept in a potential industrial park. The researchers selected the Saha Group Industrial Park, in Sriracha, as the case study. Of the pilot projects launched by the Thailand Department of Industrial Works in 2012, Saha Group Industrial Park is one of seven potential industrial park zones that plan to develop into EIPs.

Methods

Our research focused on identifying the factors critical to the success of IEP projects in Thailand, on the basis of data from firms located in Saha Group Industrial Park, Sriracha. Data were collected mainly by field site investigations from May to September 2014 [Bunjongsiri 2017]. This article presents only selected results of the data collection, from occupational health and safety (OHS) personnel at factories there. The data collection tool was a survey questionnaire to gather information on OHS management at each factory. The survey was sent to the factories by the parent company. Out of 65 factories, 44 responded by having the safety officer or person in charge of OHS fill in the form. The indicators (questions) cover implementation of OHS management in any business and were pretested before the survey was conducted. The survey tool consisted of five parts:

Part 1: General data comprising factory and personnel data

Part 2: Health and safety data such as occupational health–supporting activities

Part 3: Knowledge of EIPs with regard to EIP regulations

Part 4: Opinions about EIP management with regard to EIP regulations (based on a Likert 5-point scale)

Part 5: Problems, obstacles, and suggestions for implementation of an EIP in the park.

To exemplify EIP management in companies operating in the case study area, secondary data were gathered to describe industrial park practices and operations. Then, factory officials were surveyed to evaluate critical success factors for EIP projects established in Thailand through industrial ecology methods.

In addition, observations and in-depth interviews with officials of industrial park businesses were used to identify the problems, barriers, and needs associated with the critical success of EIPs in Thailand, along with EIP regulation. The interviewed officials included one industrial park manager, two industrial park safety officers, three specialists, one local politician, and two officers of the Industrial Estate Authority of Thailand and Department of Industrial Works. The in-depth interview was used to gather specific data for identifying opportunities to improve OHS in the prototype EIP, from the point of view of professionals and decision makers.

Moreover, the workers from the industrial park factories were invited to participate in focus group discussions. Three groups of six to eight employees participated voluntarily. The participants came from each factory or enterprise group in the industrial park. The main issue of discussion was participation of industrial park workers in eco-industrial issues.

Therefore, we used mixed methods to gain complementary views about the same phenomenon. The methods were mainly qualitative, but quantitative methods complemented and enlarged the qualitative methods. This combination allowed a comprehensive collection and analysis of data. Furthermore, specific findings were explored through structured interviews, in-depth interviews, a questionnaire survey, and focus group discussions with different stakeholders in the factories, as well as through direct observation and relevant document review.

Results

Mainstreaming EIPs into the country's national strategy is vital for their success and continuity, similar to Thailand's circular economy. EIPs should be integrated into national development planning processes to link them to national plans, budgets, sector strategies, and local-level implementation within the wider stakeholder community. This would allow the government to use EIPs as one of the mechanisms to achieve economic growth and sustainable industrial development. Although there is a good indication that Thailand is moving toward industrial ecology, the conceptualization of EIPs still focuses strictly on only a few factors, such as by-product exchange and waste management, leaving out the other factors. Unfortunately, no action plan has followed the declaration to set up the conditions required to create EIPs in Thailand. The main findings and discussions of this research with regard to different levels are summarized next.

Industrial Park level

Following the industrial park's document review, in 2012, Saha Group Industrial Park began implementing the development-analysis guidelines issued in accordance with the Eco Industrial Town Project launched by the Department of Industrial Works. The first project, named "Green Factory," involved only 18 firms; participation was voluntary. The objective of this project was to enhance the environmental sustainability of Thai industry such that all concerned parties were involved [Sahapatana Inter-Holding Public Company Limited 2014]. Focus group discussions and brainstorming activities involving all stakeholders were conducted to analyze the project goals. An area-based working group was set up to implement the EIP plan within a 5-year period (2012–2017). Following the first stage in 2012, many activities were planned but delayed until government funding support came through.

Ideally, the industrial stakeholders will drive the entire process. Although an eco-center has been set up to serve as central management for the whole park, the eco-center's activities have not yet been as effective as expected. In addition, the level of participation has been low, with most firms and community members ignoring project activities. Full collaboration is needed from all involved in the area—its factories, communities, public organizations, and academic institutions—to monitor and support the move toward sustainable industrial ecology.

Government level

Although the government agencies, Industrial Estate Authority of Thailand and Department of Industrial Works, have worked since 2000 to carry out their important mission of developing EIPs, they have focused on environmental dimensions such as waste

exchange and water/wastewater management. Indeed, at present no EIPs in Thailand follow all the principles of industrial ecology. From the in-depth interviews, we derived data on the barriers and challenges in EIP implementation in the industrial park. These interview informants were from different organizational backgrounds, and their responses formed the themes and sub-themes listed in Table 1.

Table 1. Barriers and challenges for success in implementing EIP projects

Main Factors	Sub-factors
Policy and political challenges	• Unclear criteria/measures to guide implementation • Shortage of specialists in understanding EIPs • Lack of funding support • Previous narrow focus on waste management
Industrial park and personal challenges	• Weak cooperation between firms and the industrial park management • Need for guidance from government (policy) and experts (advice) • Lack of funding support • Firms ignoring the intention of the EIP
Community/local government agencies' challenges	• Weak cooperation between community and EIP management • Difficulty in determining leader in communities • Weak sense of responsibility among local government for running projects
Technical and knowledge challenges	• Limited dissemination of knowledge • Lack of technical services • Lack of support for training/education

Discussion

Most of the Thai factories focus mainly on manufacturing benefits rather than environmental improvements. Hence, the factory owners regard any environmental work as a burden to their business, not as a source of potential benefit. The success of EIPs depends heavily on support from the government and local administration as well as the local community. Coordination and working together with different sectors is a principle of the implementation of EIPs. Even with a strong desire to enhance environmental performance, the progress of EIPs in Thailand still has a long way to go. In addition, academic institutions have an important duty to assist the system by improving research-based knowledge and capacity building. Although many studies are done each year, few have an impact on national policy or lead to improvements in the country's EIPs.

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Occupational Health and Safety Practices in a Small Metal Mechanic Company in Piura, Peru

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Introduction

Participatory programs for occupational risk reduction, adapted to the particular reality of each enterprise, are becoming more important in small workplaces in developing countries such as Peru. The current legislation on occupational health and safety in Peru is more focused on occupational exposure in big companies, however.

In some small enterprises, workers have significant, high-risk occupational exposure. These companies provide services in mining, construction, and oil, work which increases the probability of accidents and diseases. Most of them are looking for suppliers aligned with their occupational health and safety systems.

Methods

This case report describes research in a small metal mechanic company where an occupational safety and health (OSH) system was implemented and improved during the past 3 years, with positive results.

The study was of the economic indicators of expenses and income of the small company, related to OSH activities such as conducting training programs, involving workers in safety inspections, performing medical examinations for workers, and performing internal audits to the system.

The study included analysis of the impact of the system on the frequency of accidents and illnesses in workers, on absenteeism, on labor inspections, on competitions organized by big companies seeking suppliers, and on other factors. The instrument used was a data collection sheet.

Results and Discussion

In 2014, the small metal mechanic company had 15 workers (2 administrative, 13 technical workers) and provided services to big companies in the agro-industrial, metallurgic, and civil construction sectors; some of them had high OSH standards and some not so high. Because of accidents leading to partial and temporary disability in their clients' work environments, the small company started to lose some contracts.

The small company hired an advisory team to implement the OSH system and training program for workers, involving employees and employers. The implementation

included elements such as Politics in OSH, Hazard Identification and Risk Assessment, Risk Maps, Preventive Activity Planning, and OSH Records and Statistics. The training program included monthly participatory sessions with workers, to identify and discuss risky conditions and behaviors. The most important risk factors were mechanical, locative, ergonomic, and chemical. Some of the working conditions that increased the probability of accidents and illness were machines in bad status with no maintenance program; inadequate storage and manipulation of chemical products; disorder in the company's facilities; and inadequate removal of chips and other waste.

During the first year of implementation, workers registered 14 accidents leading to temporary and partial disability and only 6 incidents (or, as they are called in Peru, "almost-accidents"). In relation to absenteeism due to job accidents, 360 man-hours were recorded. Because of these events, two of the small company's most important clients asked the company to homologate their OSH system.

During the second year, the advisory team worked on OSH system homologation and for the rest of the time provided OSH support, holding participatory activities with the employees and employers. The OSH plan of the small company for this second year included medical examinations for workers; scheduled and unplanned safety inspections; acquisition of better elements of personal protection; machine maintenance and removal of unused machines; management of solid and hazardous waste; accident reporting and causality investigation; and elaboration of safe working procedures. Also, the OSH training programs and conversations with workers about OSH occurrences were held more frequently (every 15 days).

During the second year of implementation of the OSH plan, workers registered 12 accidents leading to temporary and partial disability and 20 incidents (higher than the previous year); 5 of the accidents occurred in the small company's own work environment, and 7 occurred in a client's work environment. In relation to absenteeism related to job accidents, 280 man-hours (lower than the previous year) were recorded. At that time, their current clients were satisfied with the small company's OSH system change and asked it to renew the OSH system homologation.

For the third year of implementation, because of the improvements seen in the previous years' results, the small company hired the advisory team to work for the entire year on holding more frequent OSH activities each month and to prepare for any government labor inspections.

During the third year, other big companies with high OSH standards who had never hired the small company before started to ask for its services. Workers registered 11 accidents leading to temporary and partial disability and 30 incidents; both of these totals were better than in previous years. In relation to absenteeism due to job accidents, 230 man-hours (lower than in the previous year) were recorded. Also, some post-graduate course instructors at regional universities asked to visit the small company and assessed its OSH system, giving it very satisfactory results.

The investment in OSH (Table 1) during years 1, 2, and 3 was $44,800 USD, $48,280 USD, and $58,220 USD. The most important investment during the 3 years was in the advisory team services and OSH training programs for workers. Even with that investment, the income (annual sales) increased every year: $184,848 USD, $175,757 USD, and $188,650 USD in years 1, 2, and 3.

Table 1. Investment in OSH during the 3 study years

	Income ($US)	Investment in OSH ($US)					
Year	Annual sales	Advisory team	Elements of personal protection	Machine maintenance	Management of solid and hazardous waste	Training program in OSH	Medical examinations of workers
1	184,848	9,600	2,400	8,200	6,000	15,000	3,600
2	175,757	15,000	2,960	9,680	4,800	12,000	3,840
3	188,650	24,000	3,600	9,800	8,500	8,000	4,320
Total	549,255	48,600	8,960	27,680	19,300	35,000	11,760

Conclusion

The study findings suggest the following conclusions:

- It was a good investment to implement and improve the OSH system in this small metal mechanic company.
- It is necessary to implement studies for assessing the effect of OSH systems in other small enterprises in developing countries.

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Coordination Between Stakeholders to Improve Risk Prevention in Micro and Small Enterprises (MSEs): Case Studies in Transport and Construction Programs

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Introduction

Our aim is to describe the coordination between occupational safety and health (OSH) advisors and professional organizations, in order to develop good practices in risk prevention in micro and small enterprises (MSEs). We explore a major factor: the role of coordination of stakeholders in supporting the creation of prevention programs in MSEs.

The following factors have been identified as barriers to OSH in MSEs [EU-OSHA 2016].

- OSH is not a priority; the business market is of higher importance for the owner-manager, who has rather a reactive attitude toward occupational risks.
- There is a gap between MSEs and prevention stakeholders; few companies are visited by labor inspectors, few occupational health services are consulted for OSH advice, and support comes from private services.
- There is a lack of resources; enforcing OSH legislation is difficult because of a lack of time and internal skills.
- Few initiatives to prevent psycho-social risks are realized.

Our question is how to improve the capacity of owner-managers in MSEs to prevent occupational risks. The theoretical framework considers the following factors:

- OSH practices according to the sector and its specific risks
- The coordination of different stakeholders in a network
- The creation of programs that take into account the needs of the professional branch.

Methods

This study related to the French context is part of Work Package 3 (WP3) of the SESAME research, which is financed by the European Agency for Safety and Health at Work (EU-OSHA) and involves nine different European member states: United Kingdom, Belgium, Denmark, Italy, Germany, France, Estonia, Romania, and Sweden. During the 3 years of 2014–2017, this SESAME research aimed to improve OSH management in MSEs by providing evidence-based support, identifying good practices, and increasing knowledge about the determinants of these identified good practices. This study was

split into four work packages, focusing on different issues related to MSEs and risk prevention: a literature review (WP1); the existing good practices in OSH (WP2); the OSH program strategies and policies targeting MSEs in each country (WP3); and recommendations (WP4).

In France, in WP3, two networks were compared with regard to their different OSH intermediaries, which developed risk prevention actions in MSEs. Before choosing these two networks in road transport of goods and in construction, we made an inventory and selected among several programs with good practices (4). For each of them, we did collective interviews (2) with the leader of each national program and individual interviews with different stakeholders of the programs (4). We also obtained data about the targets (population, types of actions) and assessments of the programs.

In the construction sector, we completed 4 MSE interviews (including 1 owner-manager and 1 employee of each) and a short visit of the companies. This data collection was performed during WP2. For both the road transport and construction programs, we wrote two case studies (2), linked with the themes of the SESAME project, which will be part of more global analyses and a comparison between different countries (WP4).

We also held discussion groups during a dialogue workshop [Gustavsen and Engelstad 1986], bringing together different stakeholders of these programs. All identified stakeholders related to three defined sectors (road transport, construction, and restauration), which include a large number of MSEs, were invited to a 1-day workshop. OSH advisors and professional organizations had a strong interest in participating, but convincing worker and employer representatives and OSH regulators to participate was more difficult. The dialogue workshop was designed as a two-phased discussion. The first discussion centered on sector of activity and roles, practices, incentives, and obstacles in OSH preventive activities in MSEs. The second was between peers about strategies and needs in OSH activities in MSEs for each stakeholder group: regulatory organizations and various external non-institutional stakeholders (which we called intermediaries, like professional organizations, chambers of commerce and industry, and social partners).

In each group discussion of the dialogue workshop, notes were taken by a facilitator and a moderator, who then shortly discussed the insights in order to highlight the main relevant findings. At the plenary discussion, each moderator presented to all participants the findings from each discussion group, and the participants were allowed to comment on the summaries. Following the workshop day, each facilitator made a final document from the notes taken, which was verified and completed by the moderators. On the basis of these data, the researchers wrote a final summary about the entire dialogue workshop (minutes of discussions in the dialogue workshop). The partners of the French National Institute for Research and Safety (INRS) provided comments on this before using it for writing the final national report. The discussion groups, the plenary discussion, and the additional interviews were recorded.

Results

The French Government and the National Health Insurance Fund for Salaried Workers (CNAMTS) defined four priorities for OSH actions, and these priorities were deployed

in 13 programs (2014–2017). Among the latter, we chose two national programs with the aim of creating OSH tools related to the needs of MSEs, in both the road transport and construction sectors. The following programs were selected as examples because their actions were supporting companies in multiple ways and targeting several specific points related to the sector of activity. We also considered their innovative character, the possibility of obtaining evaluations and further details about them, the involvement of various prevention stakeholders, and their relevance to the effectiveness of the prevention system.

Example 1: Road Transport Sector Program

The road transport sector program is characterized by a combination of methods. These various methods aim to expand the ways to reach MSEs to improve prevention, such as with the following features.

- The Online interactive Risk Assessment tool (OiRA), an e-tool, allows for sectoral risk assessments for MSEs; this OiRA tool was adapted to the French road transport sector by the INRS.
- Two French Synergie toolkits (Synergie pédagogie and Synergie accueil) aimed at welcoming new workers in firms as well as learners in vocational training (during practices) also provide an introduction to OSH. The French Government, the INRS, the CNAMTS, and the Regional Health Insurance Funds (CARSATs), were involved in this preventive project.
- OPCA T&S[1] advisors undergo ongoing training on prevention.
- Financial aid is available for companies that purchase specific equipment, such as a truck trailer adapted to prevent falls from a height.
- The MavImplant tool provides advice for designing work environments for particular situations, such as loading/unloading docks.
- An awareness campaign educates owner-managers about specific risks and their legal obligations to face them.

This program required the coordination of various types of partners to reach the targeted companies: a training organization (OPCA T&S), national and regional OSH stakeholders (INRS, CNAMTS, CARSATs, and occupational health services), and equipment manufacturers.

An interesting point is that tools (OiRA and Synergie) were adapted to specific MSEs' needs in the road transport sector. They focused on specific risks related to their occupational activites and were easy to use, free, and accessible online.

Example 2: Construction Sector Program

The construction sector program is characterized by a central platform for distribution of easy-to-use tools and information, designed for employers who have little time and resources for OSH. This platform is the Institute for Research and Innovation in Health and Safety at Work (IRIS-ST), founded by two professional organizations (the Confederation of Crafts and Small Construction Companies [CAPEB] and the National Union of

[1]The *OPCA Transports & Services* is a public not-for-profit organization in the road transport sector that collects financial contributions from companies and organizes training.

Craftsmen of Public Works and Landscape [CNATP]) to reduce accidents and improve OSH conditions in construction.

The IRIS-ST collaborates with various prevention organizations: a professional organization specializing in prevention (the French Professional Agency for Risk Prevention in Building and Civil Engineering, or OPPBTP), two national prevention stakeholders (Social Security and INRS). Equipment manufacturers are also involved in the program.

The kind of support offered includes the following:

- Advice about equipment for safety at work
- Information about risk exposure by profession
- Tools to make a risk assessment and documents explaining legal obligations related to prevention
- Information about safety training, with an online survey that assists each company in identifying mandatory training
- Financial support for purchasing materials or equipment.

The main point is that all these actions were focused on the specific needs of the construction companies. The information, tools, training courses, and financial support were promoted by the professional organization. The tools for risk assessment and prevention were adapted to the target group and the working conditions in construction. The information on the website and the app (smartphone application) was simple, short, and effective, which is necessary considering that the work is mainly done at temporal workplaces with little time available for OSH. Finally, the information was free for companies.

Suggestions produced by stakeholders during the dialogue workshop

Road transport

Training must be further developed in several dimensions: initial, continuous, and specialized. The message about risk prevention should reach the priority targets, like companies with a high number of accidents at work (temporary workers included), and should convince owner-managers that risk prevention is a profitable investment (improving both performance and health in the company). Coordination between stakeholders must be improved (with harmonization of the agreements and more information about the actions made by each stakeholder). A risk prevention leader, attached to a unique prevention organization, could be appointed for creating links between several MSEs and this central OSH stakeholder.

Construction

Trainings for future owner-managers and workers must be improved, and a culture of risk prevention in the construction sector should be developed. Adaptation of tools according to the trades is relevant and should be continued. Better informing new MSEs on the roles and functions of the various stakeholders is suggested. There is a need to write into regional contracts for resources (CPOM) the distribution of concerted actions between the stakeholders. Construction companies that are rigorously engaged in improving risk prevention should be encouraged with award labels. Finally, the French codification of risks should be simplified (NAF, codes related to the French activities).

Discussion

In both sectors (construction and road transport), the networks of stakeholders and the various methods used in the programs allow the promotion of advice among MSEs, most of the time given by professional partners. This contribution of the intermediaries is a key factor to developing OSH practices in companies. When the MSE has a question about health and safety at work, it contacts the intermediaries for help or advice.

Cooperation between professional organizations and OSH advisors is necessary to develop a proactive OSH approach. Having a better network of different stakeholders can improve the efficiency of prevention in MSEs. However, this collective work among various stakeholders depends on sharing operative and common references about OSH and MSEs. One favorable comment from the dialogue workshop was that "it's the first time everyone is together around the same table." We must continue to promote meetings between stakeholders in order to coordinate their actions in MSEs.

Globally, the capacity of owner-managers to develop an OSH approach in their MSEs relies on their awareness of risks, their experience with implementing OSH measures, and the public policies (financial support to acquire equipment, obligation of risk assessment). Furthermore, the required written risk assessment determines the dynamics of MSEs in risk prevention. All stakeholders, both institutional and intermediary, agree that owner-managers often have difficulties in identifying the roles and functions of the stakeholders surrounding them. The diversity of support for prevention communications and the redundancy of multiple stakeholders' actions do not help simplify owner-managers' understanding of prevention devices, useful contacts, and adaptation of tools to their needs. The networks and programs we studied in both sectors (construction and road transport) show us that many stakeholders take several actions in OSH prevention according to their specific missions. However, these initiatives do not take into account collective strategies, such as for better coordination of actions with partnership agreements. These systems remain complex for MSEs. Networks between institutional stakeholders and intermediaries can answer the specific needs of MSEs, according to their professional branch, with tools appropriate for risk prevention. We need to be able to better identify, support, and pilot these networks.

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Reducing Exposure to Harmful Dust by Implementing a Culture of Prevention in the Demolition Sector

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Introduction

For the past 40 years we have had knowledge of what causes silicosis. We have also known what measures are necessary to prevent this serious occupational disease. Simultaneously, Denmark has developed a strategy for regulation of occupational health and safety (OHS), based on legislation, tripartite agreements, control and inspection, information, research, and occasionally economic incentives. Nevertheless, silicosis prevails as a major health risk. It seems that knowledge concerning silicosis has not been sufficiently translated to reach where it is needed in workplaces. One of the industries most affected is the demolition industry [Omland et al. 2014].

The aim of the project presented here was to assess how knowledge and prevention strategies can be transferred from regulation, research, and practice to the culture among workers on demolition sites.

The project integrated the following: health research that has documented the high risk of dust exposure in the demolition sector and high prevalence of chronic obstructive pulmonary disease [Mølgaard et al, 2013; Omland et al. 2014; NEPSI 2014; Bergdahl et al. 2004; Deurssen et al. 2014; Vestbo et al. 1990]; research on prevention culture, employee involvement, and strategies for reaching small and medium-size enterprises (SMEs) [Kines et al. 2013; Hasle et al. 2006; Hale and Hovden 1998]; and research on the importance of networks as a means of regulating OHS [Limborg and Grøn 2015; Ellenbecker 1996; Hopkins and Hale 2009].

The basic idea was to partner with the key agents in the sector (management and OHS professionals) to develop a tool that would enable the workplace/site manager to embed a prevention culture leading to reductions in dust exposure. The tool was based on the Safety Observer App (**http://www.arbejdsmiljoforskning.dk/da/projekter/safetyobserver**), a planning and auditing system, but was paired with training and a series of workshops to develop a prevention system for the industry. The research question was thus: Can the prevention culture in the demolition industry be improved by introducing the Safety Observer App in OHS programs?

Demolition Work

The Demolition Sector in Denmark consists mostly of SMEs and has within a decade changed from a hazardous, polluting, unregulated, "Wild West" sector to one with high standards of environmental protection. However, health hazards from dust exposure

containing silica are still prevalent and are not as well regulated in work practices as chemical risks are. This fact is a consequence of very strict regulation on handling of chemicals such as asbestos, paint containing lead, PVA, plastics, etc. The costs for sanitation of buildings before demolition are high, and the owner or the one who acquires the demolition task must pay these costs. This is basically the background for the economic growth of the demolition sector.

The demolition sector in Denmark has, following this development, been segregated into what the sector itself refers to as "the good guys and the bad guys." The "good guy" companies are organized in a section of the Danish Construction Association. These companies are the ones that benefit from regulation and have an interest in separating themselves form the other companies. The "bad guys" are foreign-owned companies hiring labor from Eastern Europe; from time to time they provide hired workers for the "good guys."

The demolition section in the Danish Construction Association consists of 15 companies, which have on average 25 to 200 employees. In the year 2000, this group of companies joined efforts in establishing an educational program, known as Skilled Demolisher. They received public funding for the training program and agreed that all would provide at least 2 to 3 workers for the course each year to sustain it [Limborg and Gron 2015].

There are several different tasks in demolition work:

- Sanitation (removal of toxic and environmentally unfriendly substances)
- Stripping
- Machine operation
- Manual ground labor.

Traditions for protection and prevention vary among the worker groups who complete these tasks. The sanitation workers and machine operators are in general well protected and have access to air-supply masks and other relevant protective equipment, as the costs can be transferred to customers. Because the stripping teams and the manual ground workers do not have the same opportunities, these groups were the focus of this project.

Methods

The research project was designed in partnership with the Sector and the Danish Construction Association, with the aim to develop a tool that enhances planning and auditing of a new prevention culture in relation to dust exposure. The tool was developed by integrating experiences and results from safety culture projects within safety research [Kines 2001; Kines et al. 2011]; research on health consequences of exposure to dust containing silica [Sauvé et al. 2013]; and inspiration from a similar tool developed for accident prevention by the Pete Kines group [Kines et al. 2010 and Kines et al. 2011].

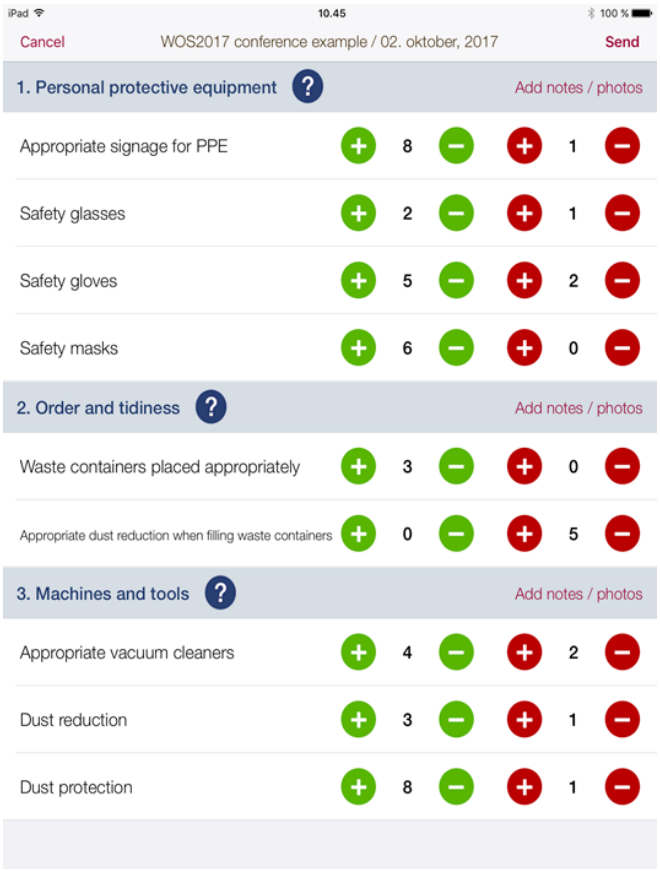
The tool was developed, tested, and evaluated in eight companies during 2016 and 2017; in three of the companies, two study cases were performed. The tool comprises a guide to developing a plan for a specific demolition job, with a focus on the dust-producing activities, equipment, etc., which are transferred to an audit tool developed as an application (app). The app can be used on various platforms such as IPad and Android phones. The

audit is performed by the local foreman/site manager and/or in-house OHS professionals. In the research project the results of the tool were evaluated. Results were assessed as changes in prevention strategies and workplace culture, documented through both a questionnaire answered by foremen and demolition workers and qualitative interviews performed with foremen and OHS professionals.

The results from the 11 cases were analyzed and used to develop a final version of the tool, consisting of four different elements:

- Instructions on how to develop a dust prevention plan and set up the app (which is specific for each single assignment). The plan is organized by factors that prove important to dust exposure: a) the physical layout of the site, b) the technology in use, c) the competence and training of the employees, d) the steps related to the specific tasks that will be done, and e) information related to availability and use of personal protective equipment available.
- Instructions on how to set up the app and how to use it, in a brief video-based training manual (to be found on YouTube). Using the app for safety rounds is meant as a task for the site manager. It is based only on observation and therefore takes little time.
- A guide for risk assessment of problems that are documented by the safety rounds; this is a job for the OHS professionals
- A general information section about dust and the health risks of silica exposure, to be used for training of all employees.

Figure 1. A picture of the app



Preliminary findings from the qualitative interviews have shown differences in motivation among the involved partners with regard to developing and using the tool.

- Managers find the tool relevant for reducing cost competition for OHS and to put the cost of health and safety on the customers.
- The OHS professionals see the tool as another instrument for them to develop their positions.
- The foremen and site managers find it an easy way to comply with regulation and provide necessary control.
- The most difficult task is to make sure all workers follow the safety plan. The fact that employees in many companies are Polish or Romanian and don't speak Danish adds to the complexity of enforcing safety plans.

Each employee assigned to the specific project where the tool was tested completed a questionnaire about dust prevention. The questionnaire was developed by the National Centre for the Working Environment of Denmark. It was translated into English, Polish, and Romanian and completed onsite before the tool was tested.

The results from the quantitative data reveal that the demolition workers are aware of possible health risks associated with exposure to dust, but nevertheless there are

severe barriers in their motivation to the use of dust prevention equipment. First, it is of course crucial that the right equipment is available, and second, that employees use it. They often find the equipment uncomfortable to use and find work tasks takes too long when wearing equipment.

Figure 2. The expected outcome, the gained outcome, and the obstacles to reaching it.

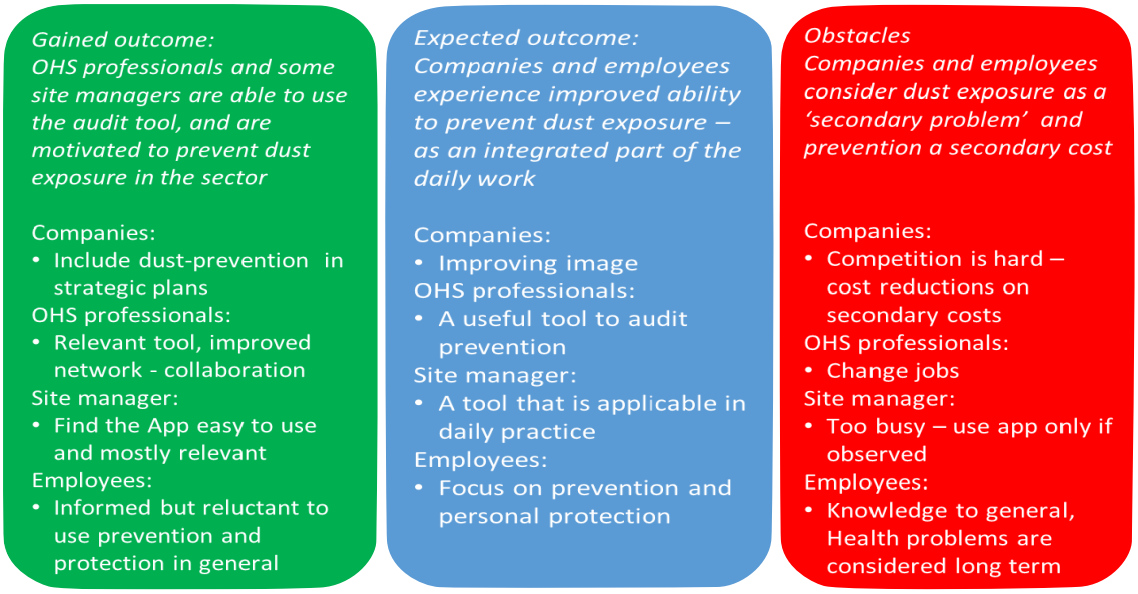


Figure 2 illustrates the expected outcome of the project and what proved possible to achieve, as well as barriers to full implementation that were uncovered through the evaluation. Management was formally interested in the prevention tool if they could transfer any costs for OHS to the customer; for this, the documentation given by the app was considered promising. However, cost competition is still hard, and OHS costs are often the first to be cut out in a tender. The group that benefitted the most were the OHS professionals. They found the tool very relevant, although an obstacle for this motivation was that the OHS professionals very often changed jobs and a new one had to be trained. The site managers found the tool very useful if they realized that it was an easy way to satisfy the management and OHS professionals. Finally, we learned that to encourage workers to maintain a safety culture, it is important to implement an ongoing flow of information and discussion about the health risks of silica dust. The diseases at risk are not likely to occur until the reach the age of above 50.

In the qualitative interviews, it was uncovered that the reluctance to use personal protective equipment was often linked to excessive heat while wearing the equipment but also vanity. We also found that tasks such as handling waste and cleaning old buildings create the highest levels of dust exposure, and employees are rarely using protective equipment during these tasks.

Discussion

The developed tool was found to be applicable in all 11 cases, and all the relevant stakeholders expressed motivation to use it. OHS professionals and site managers find

the tool easy to use and have adopted it for further projects. We have not documented changes in the level of dust, but the awareness of the risk and the means of prevention have increased among OHS professionals, site managers, and workers. However, there are several impediments to developing and maintaining a preventive practice in the sector as a whole:

- The relevant technical prevention equipment is not always available.
- Comfortable, effective dust masks are hard to find.
- There is a hierarchy in dust exposure; the most exposed are the least protected.
  - Sanitation workers (asbestos, PCB, etc.) are fully protected.
  - Machine operators are protected by cabin ventilation.
  - Manual site workers are exposed but often outdoors.
  - Demolishers are highly exposed at specific operations and tasks.
- Tasks such as handling waste, transporting waste, and cleaning old buildings cause the highest exposure but are considered less important.

Conclusion

For further development and application of the tool, it will be necessary to address the hierarchy of "intrinsic motivation" [Deci and Ryan 2012] among the different stakeholders, to create general interest in using and disseminating knowledge of the tool.

In summary:

- Companies/managers included dust prevention in strategic plans in order to utilize regulation to transfer costs to the customers.
- OHS professionals found that the Audit tool is very relevant and applicable, but the network collaboration with other OHS professionals provided added value to them.
- Site managers found the audit tool easy to use (smart phone or tablet use was not a problem) and an easy way to please the project manager, but their ability to provide relevant equipment at the relevant time was restricted.
- Employees proved to have general knowledge that dust is harmful, but little knowledge about health risks, effects of prevention, and long-term consequences.

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Examination of Corporate Social Responsibility and Sustainability Indicators in Small Brazilian Metallurgical Enterprises

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Introduction

Corporate Social Responsibility (CSR) has been the aim of wide discussion among enterprises, the academic community, and other stakeholders because of its importance to conscious, sustainable business management. Some questions to be answered by the studies on CSR and Sustainability Practices (SPs) are related to enterprises' size, business maturity level, effective level of practice formalization and implementation, and the people who benefit from the implemented practices. Despite significant studies, there is still a gap in knowledge related to monitoring and controlling CSR and SPs and their real impacts on society. To fill this gap, in 2014 the Institute Ethos developed Ethos Indicators for Sustainable and Responsible Businesses, a model which incorporates management practices with a simultaneous focus on CSR and SPs.

In this context, the main aim of this study was mapping CSR and SPs incorporated in the business management of four small enterprises (less than 100 employees). These enterprises are in the metallurgical segment of cutting and mechanical conformation of metals, in the region of São João da Boa Vista (SJBV), São Paulo State, Brazil. This study is classified as applied research, with a quantitative approach, through the application of an auto-declared questionnaire from the Ethos Indicators for Sustainable and Responsible Businesses model.

The results showed that the enterprises have proactive behavior for some Ethos indicators. They are in the initial maturity level of SP implementation, in compliance with the present legislation and the Ethos Institute's diagnosis report classification. The results also indicated that enterprise managers are interested in improving existing CSR and SPs, but the knowledge gap and insufficient human and economic resources prevent effective implementation of SPs.

Corporate Social Responsibility and Sustainable Development

The CSR strategic approach becomes more crucial day by day for enterprises' competitiveness [EuroCommerce 2011]. CSR demands commitment and dialogue between the enterprises and stakeholders. CSR permits the enterprises to anticipate their actions in functioning despite constant changes in society's needs and market fluctuations. The interaction with stakeholders provides solidity in enterprises' actions, improves risk management, and stimulates innovation by the sharing of experiences. Moreover, by

being socially responsible, enterprises can improve their reputations and inspire greater confidence from stakeholders [Pinheiro 2012]. CSR allows the enterprises to reduce costs and encourages the search for efficiency in use of resources (reductions in energy and water consumption; loss elimination and recuperation of valuable sub-products; increases in raw materials availability).

Therefore, enterprises who intend to participate in and contribute to sustainable development need to incorporate in their practices the concept of economic, social, and environmental equity. This means that CSR should be adopted by enterprises as a tool to achieve a sustainable development level in their businesses [Barbieri 2012].

The terms CSR and SD are frequently used indistinctively [Pinheiro 2012]. They are intrinsically related one to another, but they are distinct concepts. The concept of sustainable development was disseminated by The Brundtland Report, *Our Common Future*, in 1987 by the World Commission on Environment and Development–United Nations. It was characterized as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition considers simultaneously the social, environmental, and economic aspects of development. However, the core of CSR is organizations and the impact of their decisions that contribute to SD. From the fusion of social responsibility and sustainable development emerges the concept of sustainable enterprise, which represents a new way of business to satisfy the demands of new challenges imposed by society [Willard 2006].

The principles used to correlate these two concepts were based on the "triple bottom line (3Ps)" model: People, Planet, and Profit [Elkington 1997]. This model established that an enterprise should be evaluated according to social, economic, and environmental dimensions [Barbieri 2012]. Once CSR is supported by the 3Ps, a successful performance on the three dimensions is supposed to assure solid business sustainability [Marrewijk 2003].

The perspective of the 3Ps model is that enterprises could reach business equilibrium and simultaneously satisfy the social, economic, and environmental demands that emanate from stakeholders. However, according to Cambridge Leadership Development Ltd. [2013], "triple bottom line accounting and related frameworks fail to emphasize the foundations of sustainable prosperity in continuous and competitive entrepreneurship and innovation." It suggests that, to reach enterprise-related progress in individuals' lives and their communities, it is necessary to exhibit adaptive innovation and a successful implementation of new combinations related to all aspects of sustainable prosperity. It proposes that the "quadruple bottom line (4Ps)" model—People, Profit, Planet, and Progress—is capable of providing the basis for a more comprehensive framework for developing measures of sustainable prosperity.

Lawler [2012] affirms that organizations need to focus on quadruple, not triple, bottom line performance standards. He corroborates that it is necessary to perform well in financial, environment, and social terms, as well as treatment of employees. He adds that in the past, it was completely unrealistic to expect organizations to perform well in the 4Ps. Indeed, it was not practical to measure their performances, but times have changed. With the development of new metrics and computers with enormous data analytic capacity, it is easier to measure enterprises' performance in the 4Ps. "Of course, measuring quadruple bottom line performance is just the first step to getting organizations to perform in a sustainable way," Lawler [2012] notes.

In the structure of the Ethos Indicators for Sustainable and Responsible Business model, it is possible to identify all elements of the 4Ps model. Because the Ethos model was meant to support enterprises during the process of incorporating CSR and SPs in their businesses, the model was chosen for this study, which focused on small enterprises in the metallurgical segment of cutting and mechanical conformation of metals in the region of SJBV, São Paulo State, Brazil.

Methods

There are important organizations working worldwide to create CSR evaluation instruments, taking into account the present challenges faced by society [Pinto and Leitão 2006]. These organizations socialize knowledge on CSR. They support the control of CSR actions and maintain the quality of enterprises' social, environmental, economic, and progress performance. They provide instruments to ease enterprises' task of defining their values, beliefs, and policies, in addition to communicating their performances and management practices with transparency and commitment to stakeholders. Therefore, among these organizations, Institute Ethos was chosen for data compilation and analysis in this study. Its actions focus on multiple areas: Environmental, Human Rights, Integrity, Sustainable Management, Economy, and Support.

The "Ethos Indicators for Sustainable and Responsible Business" model was developed from a convergence of different initiatives, with an emphasis on ABNT 26000 Social Responsibility–2004 and the G4 guidelines for Sustainable Reports from the Global Reporting Initiative–GRI 2002 [Ethos 2014]. This model is subdivided into dimensions, themes, and sub-themes, inside a preformatted category named Essential. This category is composed of 24 indicators and brings relevant questions to enterprises with the perspective of different stakeholders. It represents the "minimal agenda" of CSR and SPs.

The Essential category questionnaire offers enterprises the possibility of self-evaluation in level of maturity. It means that, for each indicator, an enterprise can be self-evaluated in five different maturity levels:

- **1st:** Compliance with present legislation when applicable, and/or treats the theme superficially.
- **2nd:** Develops initiatives and implements current practices of CSR and sustainability.
- **3rd:** Adopts formalized policies and programs to promote its values.
- **4th:** Measures the benefits of its management and considers them to take actions and manage risks.
- **5th:** Passes by transformation and innovation processes to create values and promote updated practices.

This study was basic in that its intention was not to solve a specific problem related to the involved enterprises but instead to generate knowledge on CSR practices and the Ethos Indicators as an important tool for enterprises.

The method was defined as applied research with a quantitative approach and with exploratory and descriptive objectives. The sampling criteria were that enterprises were located in the region of SJBV (encompassing 16 cities); had no more than 100 employees;

were in the metallurgical segment of cutting and mechanical conformation of metals; and agreed to participate in the research. Only 7 enterprises met all the criteria and were formally invited to participate in the research; unfortunately, just 4 enterprises accepted the invitation, and the other 3 declined (they alleged a lack of access to information, due to organizational restructuring and shifting in business).

Quantitative data collection by means of a survey (self-evaluation questionnaire of Ethos Indicators for Sustainable and Responsible Business) occurred in November 2015. The questionnaires were filled out by the four enterprises with researcher supervision and then were sent to Institute Ethos, which was responsible for the data compilation.

The enterprise scores referring to general performance were calculated by Institute Ethos. The points were distributed for each indicator inside each sub-theme. The calculation process was executed according to an algorithm that involved three steps: pruning, distribution, and aggregation (explained at the Ethos site).

The Institute produced an exclusive diagnosis report for each enterprise, assuring full confidentiality and secrecy during this process. Only the researcher and Ethos workers involved in the compilation process had full access to all reports.

Institute Ethos did not create any performance index for CSR and SPs. Therefore, its work does not enable measuring or classifying enterprises in terms of CSR and SPs. However, the purpose was to provide a model for self-evaluation and reflection, learning, and motivation for developing with regard to identified issues. Therefore, with the aid from Institute Ethos, a conceptual index was developed for this study and future use: the Performance Index in CSR and Sustainability. It can be seen at the bottom of Charts 1, 2, and 3.

Results

This section presents the results obtained for the four enterprises that participated in this research, in comparison with the results (average and best scores) of 34 similar enterprises in the southeast region and metallurgical segment that participated in the 2015 cycle. They were distributed in four different categories: In depth – 17; Wide – 4; Essential – 5; and Basic – 8.

Charts 1, 2, and 3 compare the results of the four enterprises' individual performances with the average score of the five enterprises, in the Essential category. The results are also compared to the benchmark score, which was selected from the best results found in the Ethos database, cycle 2015, based on the 34 medium-sized southeast region enterprises in the metallurgical segment and different categories.

The results shown in Charts 1 and 2 indicate that only one indicator from the dimension Governance and Management, theme Organizational Governance, received a score of 4.4 (Satisfactory performance) in CSR and SPs. All the other indicators in Dimension or Dimension/Theme scored an Insufficient or Bad performance.

Chart 1: Enterprises' Scores by Dimensions X Average and Best Scores

DIVISION		ENTERPRISES				BENCHMARK SCORES	
INDICATOR	DIMENSION	1	2	3	4	Average Score	Best Score
01: Strategy for Sustainability; 02: Value proposition.	Vision and strategy	1.9	2.0	1.4	3.0	2.3	3.4
04: Behavior code; 05: Organizational governance; 07: Engagement of stakeholders; 09: Sustainability reports and integrated reports; 11: Fair competition; 12: Anti-corruption practices; 17: Supply management system; 18: Impact mapping of operation and risk management.	Governance and management	2.4	2.5	2.9	2.7	3.1	4.8
20: Business impact monitoring on human rights; 21: Child labor in the supply chain; 22: Forced labor; 23: Diversity and equity promotion; 24: Relations with employees; 25: Relations with unions; 29: Employee Health and safety; 30: Working conditions, quality of life and working time; 31: Relationship with consumer; 32: Impact arising from use of products/services; 34: Management of the enterprise's impacts in the community.	Social	1.7	2.0	1.7	2.5	2.5	4.7
37: Governance of actions related to climate change; 39: Environmental management system; 47: Reverse logistics.	Environmental	1.3	1.3	1.3	2.6	1.5	2.6
	Average	1.9	2.0	1.9	2.7	2.4	3.9
PERFORMANCE ON CSR	**Excellent**	**Good**	**Satisfactory**		**Insufficient**		**Bad**
	8.0≤Score≤10.0	**6.0≤Score≤7.9**	**4.0≤Score≤5.9**		**2.0≤Score≤3.9**		**0.0≤Score≤1.9**

Source: Adapted from Ethos Database, 2015.

Chart 2: Enterprises' Scores by Dimensions/Themes X Average and Best Scores

DIVISION		ENTERPRISES				BENCHMARK SCORES	
INDICATOR	DIMENSION/ THEME	1	2	3	4	Average Score	Best Score
01: Strategy for Sustainability; 02: Value proposition.	D1/Vision and strategy	1.9	2.0	1.4	3.0	2.3	3.4
04: Behavior code; 05: Organizational governance; 07: Engagement of stakeholders; 09: Sustainability reports and integrated reports;	D2/Organizational governance	3.1	2.3	4.4	2.2	3.2	4.4
11: Fair competition; 12: Anti-corruption practices; 17: Supply management system; 18: Impact mapping of operation and risk management.	D2/Operation and management practices	1.7	2.8	1.5	3.1	2.9	5.5
20: Business impact monitoring on human rights; 21: Child labor in the supply chain; 22: Forced labor; 23: Diversity and equity promotion.	D3/Human rights	1.4	1.6	1.8	2.8	2.2	3.3
24: Relations with employees; 25: Relations with unions; 29: Employee Health and safety; 30: Working conditions, quality of life and working time.	D3/Work practices	2.3	2.0	2.1	2.8	3.1	6.0
31: Relationship with consumer; 32: Impact arising from the use of the products or services;	D3/Questions related to costumers	1.6	2.8	1.4	2.8	2.9	5.8
34: Management of the enterprise's impacts in the community.	D3/Commitment with society and its development	1.5	1.5	1.5	1.5	2.0	3.8
37: Governance of actions related to climate change; 39: Environmental management system; 47: Reverse logistics.	D4/Environmental	1.3	1.3	1.3	2.6	1.5	2.6
	Average	1.9	2.0	1.9	2.6	2.5	4.4
PERFORMANCE ON CSR	**Excellent**	**Good**	**Satisfactory**	**Insufficient**		**Bad**	
	8.0≤Score≤10.0	**6.0≤Score≤7.9**	**4.0≤Score≤5.9**	**2.0≤Score≤3.9**		**0.0≤Score≤1.9**	
D1 – Strategy and Vision; D2 – Governance and Management; D3 – Social; D4 - Environmental							

Source: Adapted from Ethos Database, 2015.

The most part of the average score calculated for the five similar enterprises from the same Essential category is situated in the Insufficient scale. The analysis of the Best Score in Charts 1 and 2 shows some scores from 4.4 to 5.8, indicating Satisfactory performance; only one score of 6.0, indicating Good performance; and the remaining scores of Insufficient, in terms of performance in CSR and SPs. Four scores of Good performances were identified in Chart 3 in different subthemes. No scores of Excellent performance are seen in Charts 1 to 3.

In general, the results ratify the supposition of initial maturity level of the enterprises that were the object of this study. Moreover, the results indicate that all the companies participating in this research and even the ones used as benchmarks have much work to do and are far from achieving the status of Excellent in CSR and SPs, with regard to most of the Ethos Indicators.

Chart 3: Enterprises' Scores by Subthemes X Average and Best Scores

DIVISION		ENTERPRISES				BENCHMARK SCORES	
INDICATOR	SUB-THEME	1	2	3	4	Average Score	Best Score
01: Strategy for Sustainability; 02: Value proposition.	Vision and strategy	1.9	1.4	1.4	3.0	2.3	3.4
04: Behavior code; 05: Organizational governance; 07: Engagement of stakeholders;	Governance and behavior	2.0	3.4	3.4	2.9	3.6	6.7
09: Sustainability reports and integrated reports.	Accountability	4.2	1.5	5.4	1.5	3.6	6.7
11: Fair competition.	Legal competition	2.2	1.5	1.5	4.0	4.0	8.8
12: Anti-corruption practices.	Anti-corruption practices	1.6	3.2	1.2	1.6	2.1	3.2
17: Supply management system.18: Impact mapping of operation and risk management.	Management systems	1.5	1.9	1.9	3.7	2.6	4.4
20: Business impact monitoring on human rights; 21: Child labor in the supply chain; 22: Forced labor.	Human rights risk situations	1.5	1.6	1.6	1.5	1.7	3.0
23: Diversity and equity promotion.	Affirmative actions	1.3	2.1	2.1	4.2	2.6	4.2
24: Relations with employees; 25: Relations with unions.	Work relations	2.9	1.4	1.4	2.7	3.2	7.4
29: Employee Health and safety; 30: Working conditions, quality of life and working time.	Health and safety at work and quality of life	1.6	2.9	2.9	2.9	2.9	4.6
31: Relationship with consumer; 32: Impact arising from the use of the products or services.	Respect to consumers	1.6	1.4	1.4	2.8	2.9	5.8
34: Management of the enterprise's impacts in the community.	Community impact management and development	1.5	1.5	1.5	1.5	2.0	3.8
37: Governance of actions related to climate change.	Climate changes	1.0	1.0	1.0	2.8	1.3	2.8
39: Environmental management system.	Management and monitoring of impacts on ecosystem services and biodiversity	1.7	1.7	1.7	3.4	2.0	3.4
47: Reverse logistics.	Impacts of consumption	1.2	1.2	1.2	1.7	1.3	1.7
	Average	1.8	1.9	2.0	2.7	2.5	4.2
PERFORMANCE ON CSR	**Excellent** 8.0≤Score≤10.0	**Good** 6.0≤Score≤7.9	**Satisfactory** 4.0≤Score≤5.9		**Insufficient** 2.0≤Score≤3.9	**Bad** 0.0≤Score≤1.9	

Source: Adapted from Ethos Database, 2015.

Discussion

The main aim of this study was mapping CSR and SPs of four enterprises in the metallurgical segment of cutting and mechanical conformation of metals, in the region of SJBV, and comparing the results with those in the Ethos database. The research results permit us to conclude that the proposed objective was achieved successfully.

The enterprises' poor performance results, described in Charts 1 to 3, can be explained by (1) unfamiliarity with and difficulties in understanding and implementing CSR and SPs to meet the Ethos Indicators; (2) the need to realign the Mission, Vision, Values, and Objectives to include new CSR and SP perspectives; (3) the gap in using Ethos Indicators

to support the improvement of existing SPs and to implement new ones (which would demand commitment, dedication, and minimal financial support); (4) the absence of alternatives to improve CSR and SP performance as gradual implementation of ISO 14,000, ISO 18,000, and ISO 26,000 (at least in a self-applied way); and (5) insufficient human and economic resources, affecting the effective implementation of CSR and SPs.

In view of the results, this study brings to the enterprises, Institute Ethos, and the academic community the following contributions. (1) The four participating enterprises have proactive behavior for some Ethos indicators. (2) They are in the initial maturity level of SP implementation, basically in compliance with the present legislation, according to the Ethos Institute's diagnosis report classification. (3) They still have a long way to go in the search for excellence in CSR and SPs, according to the Ethos Indicators. (4) Despite the efforts of Institute Ethos in launching a model for micro and small enterprises, it was clear that the participating enterprises in this study had serious difficulties in understanding and implementing practices in compliance with Ethos Indicators, whether at the level of dimension, theme, or sub-theme. (5) Because the Ethos model is still complex for micro and small enterprises, Institute Ethos should consider stratifying this model by industrial and commercial activity branches, once they have established different specificities; this could help micro and small enterprises better understand and implement CSR and SPs. (6) The Ethos model has made undeniable contributions to enterprises, but dissemination of this model to micro and small enterprises in SJBV and other regions must be intensified to promote excellence in CSR and SPs. (7) A scoring scale should be proposed to evaluate enterprises' performance in CSR and SPs. (8) An update with information on the Ethos Indicators for Sustainable and Responsible Business model would be helpful for application to metallurgical enterprises in cutting and mechanical conformation of metals. (9) Future in-depth research on CSR and SPs, including micro and small enterprises in different sectors of activity and using different models, such as GRI, is suggested.

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Vocational Colleges: Unique Opportunities to Enhance Safety and Health in Small Businesses—Findings from the Technical Education Curricula for Health and Safety (TECHS) Study

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Background

Collision repair and machine and metal manufacturing are industries with a large percentage of small businesses [U.S. Census Bureau 2017], whose owners face unique challenges in implementing health and safety regulatory requirements. Workers in these trades experience injuries and illnesses at rates above average for many types of incidents [U.S. Department of Labor 2017] and are unlikely to receive safety and health training on the job [Brosseau et al. 2014]. Numerous studies have examined the effectiveness of health and safety interventions with business owners [Bejan et al. 2015], and researchers in those studies have recommended finding ways to involve workers in making safety and health decisions in the workplace. Previous research has found that 72% of collision repair shop technicians and 47% of machinists working in manufacturing companies attended some classes or graduated from vocational college programs in their trade [Parker at al. 2014, 2017].

In 2013, more than 1.5 million sub-baccalaureate occupational educational credentials were awarded in the United States. Of these, nearly 200,000 were in manufacturing, construction, repair, and transportation [IES-NCES n.d.]. As early as 1995, the National Institute for Occupational Safety and Health (NIOSH) engaged in activities to increase knowledge in occupational safety and health among vocational college students and instructors and supported efforts to develop health and safety curricula for young workers. However, a decade later, Schulte et al. [2005] concluded that "little quantitative information exists on (1) the extent of OSH training provided within these programs and (2) the effectiveness of the program for reducing occupational injuries and illnesses." We propose that graduates of vocational college programs who have a good understanding of safety and health hazards in their trade and are knowledgeable about the available solutions may be able to assist business owners with improving workplace safety and health.

The Technical Education Curricula for Health and Safety (TECHS) study is a NIOSH-funded educational intervention being conducted in partnership with two vocational colleges in Minnesota. The goal of this study is to evaluate the impact of comprehensive trade-specific safety and health curricula delivered systematically throughout a

2-year program on students' health and safety knowledge, skills, attitudes, and work practices at graduation and one year afterward. An extensive baseline evaluation and student assessments were conducted prior to designing and implementing the new curricula.

This report presents (1) a summary of the educational practices and materials used to teach safety and health to auto body collision technology (ABCT) and machine tool technology (MTT) students and (2) the results of a student safety and health survey administered in May 2015.

Methods and Materials

Instructors teaching in the ABCT and MTT programs were invited to participate in discussion groups and one-on-one interviews and to complete surveys on the materials and methods used to teach and assess their students' health and safety knowledge.

Students enrolled in ABCT and MTT programs were asked to complete an anonymous survey 1 to 2 weeks prior to the end of the 2014–2015 academic year. The surveys contained questions on important safety and health issues jointly identified by the participating instructors and study staff with expertise in industrial hygiene and occupational medicine. ABCT students answered 21 questions on isocyanates, respirators, solvents and acids, fire and electrical safety, and eye and hearing protection. MTT students answered 20 questions on machine guarding, lockout/tagout, materials handling, and eye and hearing protection. No student-specific identifiers were collected.

All study materials and methods were approved by the institutional review board of Park Nicollet Institute.

Results

Instructors

Six ABCT and seven MTT instructors participated in all baseline activities. The ABCT instructors have been working in the industry for an average of 32 years (standard deviation [SD] = 9 years; range = 21–42 years), have been teaching for an average of 21 years (SD = 12 years; range = 2–35 years), and have been in their jobs at the college for an average of 18 years (SD = 13 years; range = 2–35 years). The MTT instructors have been working in the industry for an average of 27 years (SD = 10 years; range = 10–35 years), have been teaching for an average of 14 years (SD = 10 years; range = 2–26 years), and have been in their jobs at the college for an average of 11 years (SD = 9 years; range = 2–22 years).

Key findings

- Fifty percent of the ABCT instructors and 17% of the MTT instructors reported not having adequate time to cover information on health and safety in class.
- Instructors lack trade-specific health and safety training and have few opportunities to receive it from knowledgeable sources.
- Students receive most of their health and safety information as assigned reading from books, handouts, and trade group–designed education materials (CDs).

- All video clips reviewed were outdated and not trade-relevant.
- Some handouts contained incomplete and (at times) misleading information.
- Instructors placed a lot of emphasis on rules related to personal protective equipment, especially the use of safety glasses in the shop.
- "Teaching moments" often occur when instructors notice unsafe acts in the shop. Students that are not present miss these training opportunities.
- Instructors report teaching safety primarily during the first year of each program.
- Instructors described many of the safety issues as "plain common sense."
- No comprehensive health and safety assessment instruments were identified.

Our work indicates that the means and methods of teaching and assessing health and safety knowledge, skills, attitudes, and work practices in the ABCT and MTT programs studied are inadequate.

Students

Fifty-one ABCT students from College A and 25 from College B completed surveys. Students completing 2 years of instruction (Y2) in College A had survey scores that ranged from 57% to 91% (mean = 76%; SD = 10%). Students in College B had scores ranging from 57% to 91% (mean = 72%; SD = 10%). Survey scores of students that completed 1 year of instruction (Y1) were 29% to 90% (mean = 66%; SD = 13%) in College A and 67% to 91% (mean = 81%; SD = 7%) in college B.

The number of years of instruction made a significant difference in the survey scores within each college ($p = 0.02$). However, the difference was not always in the expected direction. At the end of the first year of instruction, students attending College B correctly answered significantly more questions than students attending College A ($p < 0.0001$) (Table 1).

Table 1. ABCT student survey scores

	College A, Y2 (n = 12)		College A, Y1 (n = 39)		College B, Y2 (n = 11)		College B, Y1 (n = 14)	
Survey section	Mean (%)	SD (%)	Mean (%)	SD (%)	Mean (%)	SD (%)	Mean (%)	SD (%)
Overall	76[a]	10	66[a,c]	13	72[b]	10	81[b,c]	7
Isocyanates	72	26	71	21	71	21	81	21
Respirators	63	23	66	24	56	17	75	26
Fire and Electrical Safety	81[d]	10	69	19	88[d]	6	86	7
Eye and Hearing Protection	81[e]	22	65	26	58[e]	22	67	23
Solvents and Acids	82	25	79	25	75	27	88	22

[a-e] Significantly different; $p < 0.05$.

The following are examples of knowledge gaps among graduating ABCT students:

- 78% do not know that a tight-fitting respirator fits well only if the user shaved the same day;
- 57% were unaware that bonding clamps are not effective if placed on painted metal surfaces;
- 48% do not know that safety glasses are marked with Z87 on the lens or temple;
- 48% do not know that removing tape and sanding recently applied clear coat can expose them to uncured isocyanates;
- 30% do not know that isocyanates induce asthma and that the main routes of exposure are inhalation and skin contact.

Seventy-eight MTT students from College A and 51 from College B completed surveys. There were no significant differences between the scores of students attending college for 1 year versus 2 years. The graduating class (Y2) of College B had significantly higher survey scores (mean = 81%; SD = 10%) than the graduating class of College A (mean = 67%; SD = 14%; p = 0.0001) (Table 2).

Table 2. MTT student survey scores

	College A, Y2 (n = 24)		College A, Y1 (n = 54)		College B, Y2 (n = 29)		College B, Y1 (n = 23)	
Survey section	Mean (%)	SD (%)	Mean (%)	SD (%)	Mean (%)	SD (%)	Mean (%)	SD (%)
Overall	67[a]	14	74	14	81[a]	10	75	15
Machine Guarding	51[b]	19	61	20	69[b]	17	65	21
Eye and Hearing Protection	66[c]	21	68	22	84[c]	18	68	22
Lockout/Tagout	84	19	82	17	83	20	75	21
Materials Handling	74[d]	21	86	14	90[d]	13	89	13

[a-d] Significantly different; $p < 0.05$.

The following are examples of knowledge gaps among graduating MTT students:

- 68% do not know that a pressure mat is not an acceptable way to guard the point of operation;
- 40% do not know that safety glasses are marked with Z87 on the lens or temple;
- 38% do not know that noise-induced hearing loss does not depend on whether the exposure occurs at work or at home;
- 30% do not understand the purpose of outage protection;
- 30% do not know that coolants can cause skin rashes and lung problems.

Graduating class survey scores were not significantly influenced by previous employment in the trade or by employment in the trade during the academic year 2014–2015 (data not shown).

Conclusions and Next Steps

TECHS study baseline activities show that the current materials and methods used to teach and assess student health and safety knowledge in the collision repair and machine tool technology trades are inadequate. As a result, students are graduating with incomplete knowledge of important safety and health issues that are likely to influence their work-related adverse health outcomes.

The TECHS study staff, in collaboration with lead instructors from the two participating ABCT and MTT programs, has designed comprehensive safety and health curricula. Implementation of the new curricula at the participating colleges began with the 2015–2016 academic year. The ABCT curriculum contains modules on isocyanates, solvents, acids and bases, dust and fumes, hearing protection, eye protection, respirators, fire safety, and electrical safety. The MTT curriculum contains modules on machine guarding, lockout/tagout awareness, hearing protection, eye protection, and materials handling.

All the materials and activities follow the principles of student-centered active-learning instruction. Each training module is composed of classroom instruction, lab activities, homework, and a quiz. Student success is measured by an end-of-the-year survey that assesses safety and health-related knowledge, skills, attitudes, and work practices. To date, instructor feedback has been positive. Faculty recommendations will be used to update the TECHS curricula prior to dissemination.

The TECHS study is an example of how creating formal collaboration opportunities between educational systems and the health and safety professional community can benefit students, instructors, and the local business community.

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Assessment of Psychosocial Policies in Small and Medium-Sized Enterprises

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Introduction

A well elaborated occupational safety and health (OSH) policy is crucial, yet small and medium-scaled enterprises (SMEs) often fail to implement a good prevention program. Online risk-assessment tools such as BRIE (Better Risk Inventarisation and Evaluation) have been developed to guide occupational health nurses during company visits. BRIE provides a list of important sector-specific OSH issues (such as psychosocial issues); advice regarding good practices; legal information and preventive actions; and an evaluation of sector-specific occupational risks.

Methods

BRIE risk assessments were performed in a convenience sample of SMEs during the period 2013–2014. A selection of psychosocial factors (N = 7) was assessed and scored with yes or no. For example,

1. Has a psychosocial risk analysis been performed?
2. Has the company formalized a resolution regarding unacceptable behavior in the workplace?
3. Is there a policy addressing undesirable behavior?

Only the SMEs for which all psychosocial factors were assessed and scored were included for analysis. Frequencies were calculated.

Results

Data were available from 8,100 SMEs (response = 35%). About 93% of the companies had not yet performed a psychosocial risk analysis. A resolution and policy regarding unacceptable behavior were available in 41.5% and 32% of the SMEs. In 39.5% of the SMEs, employees know who the confidential counsellor is. In 18.5% of the SMEs there was no register for unacceptable behavior, and in 49% there was no policy on alcohol and drugs.

Discussion

BRIE risk assessments reveal that in a significant number of SMEs, there are no assessments or policies regarding psychological risks or unacceptable behavior. SMEs therefore need additional support and information. A well-instructed prevention expert, such as an OSH nurse, can use a BRIE assessment as a first step to assess company policies.

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Use of IDEWE's General Prevention System (iGPS) to Implement and Manage Occupational Safety, Health, and Well-Being in Small Enterprises

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Introduction

Serious accidents are most prevalent in small and medium-sized enterprises (SMEs), most likely because of their poor performance in using risk assessment and risk management systems. Despite of all their efforts, SMEs often do not possess the knowledge required to secure occupational safety, health, and well-being (OSH). How can we guide SMEs in risk management and subsequent development of preventive measures?

Methods

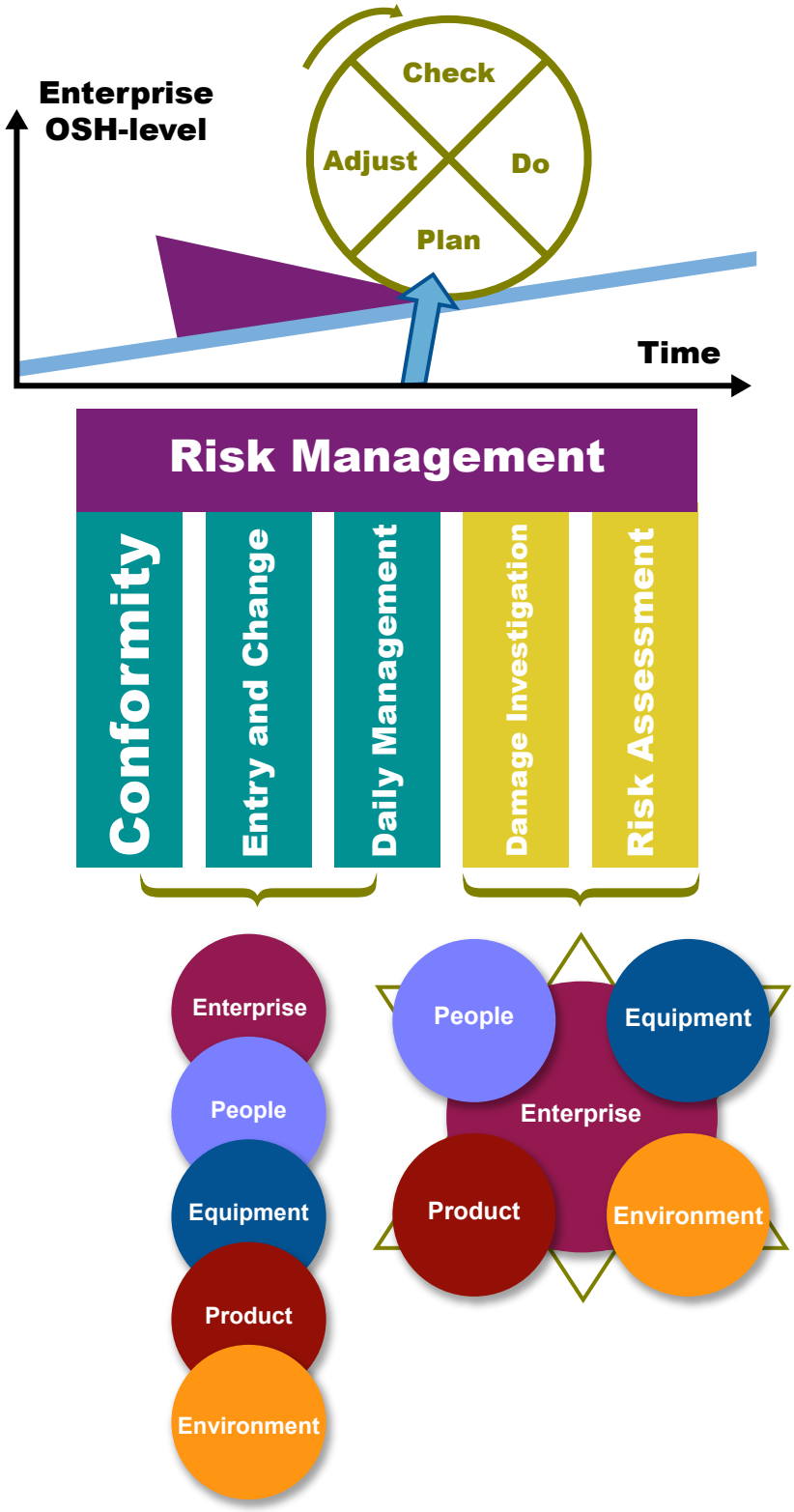
As the largest Belgian external service for prevention and protection at work, IDEWE (originally the Interdisciplinaire Dienst voor het Welzijn, or Interdisciplinary Service for Well-being) provides services to 35,000 enterprises and their 600,000 employees. To lead SMEs toward OSH, IDEWE developed a document management tool, named GPS: IDEWE's General Prevention System.

The GPS strategy translates into a cohesive modular structure (seven modules) that allows organization and execution of the OSH tasks and assignments in an SME. Well-being at work is applied and integrated into the GPS system, supplemented with other aspects of OSH (Environment, Energy Efficiency, Construction Safety, Food Safety, Playground Safety, etc.).

The features of GPS are threefold:

1. GPS is a strategy to implement risk reduction within the framework of occupational risk and health in a medium enterprise. It steers the company's dynamic risk management system.
2. GPS is a structure that includes the different fields involved in safety and health (safety at work, occupational medicine, ergonomics, occupational hygiene, psychosocial aspects of work) and handles them interdisciplinarily.
3. GPS facilitates a pragmatic and coherent system to optimize the internal safety tasks and culture.

Figure 1. General Prevention System—Management of OSH (Illustration created by the authors, Sommen and Van de Plas, 2017)



Training and One-on-One Support

For the purpose of this small article, we focused on the use of GPS in SMEs during the period 2011–2016.

IDEWE trained 1,903 new users in a 6-day practical course to implement GPS in their SMEs; 1,031 of these users followed up on an annual basis (via a reunion day) to keep track of new developments and changing legislation. Since 2014, 53 new users received GPS training in a 2-day course for very small enterprises (fewer than 20 employees).

Furthermore, 1,052 prevention experts in SMEs receive one-on-one support from IDEWE to implement GPS and carry out customized preventive measures. The support is given via a contractual consultancy base (a team of 120 prevention specialists), in visits to the enterprise ranging from 6 to 144 half-day visits a year. During a visit, the enterprise's prevention expert works with the IDEWE prevention specialist to implement risk reduction within the interdisciplinary framework of occupational risk and health.

Results

Feedback from these users supplemented GPS as a pragmatic, coherent risk management tool in which all relevant documents can easily be found. The GPS strategy translates into a cohesive modular structure that allows organization and execution of OSH tasks and assignments. Model documents are provided, along with a section for managing enterprise-specific reports. By using GPS, enterprises can comply with Belgian OSH law.

Conclusion

On the basis of these results, IDEWE decided to digitalize the document management tool and make it an online platform: iGPS. Extra benefits for users will be automatic backup, securing the latest versions of all their documents, and easy access from any workstation, including tablets and phones. The system can notify the user when new (model) documents are posted.

Since 2016, more than 3,000 users have logged onto the platform (my.idewe.be), implementing the document management system and using the template documents. Hence, iGPS has grown to be a practical tool for use by prevention workers to guide SMEs in their OSH policy.

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Working Successfully with Small Business Owners: Results and Lessons from the Collision Auto Repair Safety Study (CARSS)

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Introduction

In the United States approximately 220,000 people work in 33,648 collision repair establishments, of which only 3,421 have more than 20 employees. The majority of establishments (18,471 shops) have fewer than 4 employees [U.S. Census Bureau 2015]. Collision repair business owners face unique challenges in implementing health and safety regulatory requirements. They often are unaware of safety laws and seek information from easily accessible sources such as equipment or materials suppliers. However, these sources often lack training and have financial interests that may play a role in the type and amount of information provided to business owners. In addition, owners may be reluctant to develop and enforce safety rules or to regard the identification and control of risks as a priority, and they may have limited resources to hire professional safety consultants [Parker et al. 2012].

In collision repair shops, the technicians encounter a wide variety of physical and chemical hazards during vehicle repair, assembly, and painting. Exposure to several of these hazards (such as isocyanates and noise) can have serious and permanent consequences. Whittaker and Reeb-Whitaker [2009] showed that work-related compensable asthma claims in Washington state were nine times higher for collision painting technicians compared with workers in other industries, and Bejan et al. [2011] documented noise exposure levels above 50% dose (85 dBA 8-hr time-weighted average).

The Collision Auto Repair Safety Study (CARSS), conducted between 2007 and 2014, was designed to assist business owners located within 50 miles of the Minneapolis–St. Paul metropolitan area with understanding and improving safety and health conditions in their shops. Brosseau et al. [2014] describes in detail the intervention mapping process followed to identify intervention targets, change objectives, strategies for motivating workplace improvements, and outcome measures, as well as the shop assessment form used in this study.

The study had two phases: an *active phase* and a *passive phase*. During the active phase of CARSS, a health and safety assessment was conducted at baseline, and business owners were assisted with creating and implementing a Shop Improvement Plan. In consultation with study staff, owners assigned a deadline to each item listed in the Shop Improvement Plan. Technical assistance provided included quarterly reminders

and newsletters, safety training, respirator fit testing, and medical evaluation for respirator users. A study website was created and hosted health and safety information, including checklists, training, and sample safety programs. One year post-enrollment, all shops participated in another health and safety assessment, referred to as the Year 1 assessment. The outcomes of this phase of the study were described in detail by Parker et al. [2015]. The *passive phase* of CARSS is the focus here.

Methods

For one year after the completion of the *active phase* of the study, business owners received up to three reminder postcards on the following topics:

1. Safety checklists available on the study website: electrical safety, jacks, and jack stands; ladders; slings, ropes, and chains; and welding safety
2. Content of study website and available assistance
3. Due dates of annually required training.

Business owners were not contacted directly by the study staff. However, all their assistance requests were answered. After one year of participation in the *passive phase* of CARSS, all owners were contacted via telephone and invited to participate in a health and safety assessment—referred to here as the Year 2 assessment. The assessment used the same 92-item survey used for baseline and Year 1 assessments. The results were communicated to owners in a written report.

Data analysis included computation of means and standard deviations of business assessment scores and percentage of businesses in which each assessment item was present. Year 1 and Year 2 assessment scores were compared with the sign and Cochran-Mantel-Haenszel tests, and all data analyses controlled for the "shop" variable.

Results

Forty-nine shops received baseline assessments, and 33 were visited for both the Year 1 and Year 2 assessments. There were no differences in demographics, scores at baseline, or Year 1 scores between the 33 participating shops and the 12 shops that did not participate in the Year 2 assessment. At baseline, these 33 shops had 40% to 81% of assessment items present (mean = 55%; SD = 10%). At Year 1, the shops had 60% to 81% of assessment items present (mean = 73%; SD = 11%). At Year 2, the shops had 63% to 89% of assessment items present (mean = 73%; SD = 9.5%). All improvements from baseline to Year 1 and from baseline to Year 2 were statistically significant ($p < 0.05$).

Fifty-three items were assigned to one of the following safety topics: facility and equipment safety (33 items), written safety documentation and records (13 items), and personal protective equipment (7 items). These items were examined in detail, and the only significant change between Year 1 and Year 2 was in the area of personal protective equipment (Table 1).

Table 1. Business safety score at baseline, Year 1, and Year 2, by safety topic

	Baseline		Year 1		Year 2	
	Mean	SD	Mean	SD	Mean	SD
	% Items Present					
Overall	55	10	73[a]	11	73[b]	10
Facility and equipment safety	72	10	78[a]	10	79[b]	9
Written safety documentation and records	14	20	60[a]	28	56[b]	24
Personal protective equipment	72	20	83[a]	14	89[b,c]	12

[a]Significantly different from baseline ($p < 0.05$)
[b]Significantly different from baseline ($p < 0.05$)
[c]Significantly different from year 1 ($p < 0.05$)

Facility and equipment safety

No statistically significant change in the percentage of items present was observed between Year 1 and Year 2 (78% vs. 79%). An item-by-item examination indicated that some improvements continued to occur in the second year of the study (16 items). However, there was a decline in the number of businesses that had explosion-proof lights in the paint booth, easily accessible emergency exits, a suitable eye wash station, correctly grounded flammable liquids containers, and properly stored oxygen cylinders.

Written safety documentation and records

Overall, the business safety score declined slightly from Year 1 to Year 2 (60% vs. 56%; $p = 0.26$) At Year 2 significantly fewer shops had up-to-date Right-to-Know and respirator training than in Year 1. Similarly, 30% fewer shops had conducted annual respirator fit testing (73% vs. 42%; $p = 0.02$). There was a non-significant decrease in the percentage of shops in which respirator users had medical certification (76% vs. 73%).

Personal protective equipment

Overall, business safety improved significantly between Year 1 and Year 2 (83% vs. 89%; p = 0.006). There was no change in the percentage of shops (82%) that provided body technicians with appropriate gloves (other than disposable, medical-grade latex gloves). The percentage of shops that required employees to use hearing protection when operating compressed-air tools increased from 64% to 88% (p = 0.01). A non-significant increase (52% to 61%) occurred in the percentage of shops that required the use of safety glasses during operations such as grinding, working under cars, or cleaning items with compressed air.

Analysis by number of reminder postcards

Of the 33 businesses, 2 did not receive any reminder postcards, 3 received one, 9 received two, and the remaining 19 received three. At Year 2, there were no statistically significant differences in overall business safety scores between the shops that received two or fewer postcards and shops that received three postcards. There was no difference in the likelihood of requesting assistance, based on the number of reminders sent, and there was no association between the date of the service request and the date of receiving a reminder postcard.

For a detailed analysis of the Year 2 assessment results, including the role of the Shop Improvement Plan after in-person follow-up activities ceased, please refer to Bejan et al. [2015].

Discussion

Results indicate that most business owners were able to implement and maintain health and safety improvements during both phases of the CARSS. However, once the study staff–initiated activities ceased, improvements were more likely to continue if the deficiencies to be corrected had been included in a formal Shop Improvement Plan. The reminder cards did not appear to provide sufficient incentives for owners to continue implementation of the recommended health and safety improvements.

Conclusion

Keys to the success of this intervention were establishing a partnership with the local business association; conducting preliminary activities to gain insight into shop owners' and workers' knowledge and attitudes towards safety; building relationships with owners, employees, and regulatory authorities; and being creative in designing and offering incentives throughout the study. It was important to owners that the researcher was affiliated with a non-regulatory organization (a research institute) and had strong support of the local business association. Positive owner attitudes towards CARSS participation were fostered by researchers' ability to inspire trust; their good understanding of the technical aspects of the industry; their ability and willingness to assist with issues not related to the study (such as air permits, neighbors' complaints, and OSHA inspection findings); and their ability to maintain confidentiality.

The collision repair industry has seasonal variations in workload, and during the study some businesses changed locations. Therefore, it was essential that we adopted flexible timelines to accommodate the demands facing business owners. We also created incentives and opportunities for celebrating owners' and workers' achievement of milestones, such as the implementation of 50% or 100% of the recommendations selected. Last but not least, it was important to remain connected to the business community, share the results of the study, and make all members aware of the study opportunities for free health and safety assistance. Bejan and Skan [2013] offer an example of such outreach efforts.

We recommend that, in addition to working closely with business owners and creating tools that are straightforward and easy to use, researchers should incorporate activities in future interventions that increase workers' awareness of safety and health hazards in their workplace and offer opportunities for their direct involvement in creating change.

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Occupational Health Nurse as an Alternative Resource in a Small-Scale Enterprise in Japan

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Introduction

The Economic Census for Business Frame by the Ministry of Economy, Trade, and Industry in Japan showed that in 2014, 59.8% of all employees work for small-scale enterprises (SSEs) with fewer than 50 employees. The Industrial Safety and Health Law in Japan stipulates that enterprises with 50 or more employees must establish a health committee, appoint an occupational physician (OP), and select health officers from among their employees. Moreover, large-scale enterprises with 1,000 or more employees must appoint a full-time OP. However, SSEs do not need to appoint an OP, and occupational health (OH) activities such as health guidance and workplace inspections are usually not enforced in SSEs.

To improve this situation, the Ministry of Health, Labour, and Welfare in Japan established Regional Occupational Health Centers (ROHCs). ROHCs are the national OH providers for enterprises with fewer than 50 employees. There are about 350 ROHCs in Japan. Their services, which are free, include health guidance for employees based on the results of their health examinations and advice for work environment improvements through worksite visits. However, because of budget shortages at the ROHCs and time shortages among registered OPs, the utilization rate by enterprises has been quite low for many years. Therefore, employees' OH is generally poorer in SSEs than in middle-scale and large-scale enterprises in Japan.

Kyoto Industrial Health Association is an OH service provider in Kyoto, Japan. It provides general health examinations as well services such as these: examinations at mobile units for employees with specific concerns of exposure to hazardous materials such as chemicals; examination of work environments for hazardous materials at enterprises; health guidance for employees; occupational health instructions by OPs in enterprises; mental health services for employees; and outpatient clinics for patients with work-related diseases. OH service providers like Kyoto Industrial Health Association have been trying to offer various services for SSEs in Japan, such as periodic health examinations, work-environment evaluations, guidance for healthy lifestyles, and clinical services. However, these trials have not achieved satisfactory outcomes yet.

For example, Japan's Ministry of Health, Labour, and Welfare reported that OH activities related to general health examination—such as consulting with physicians regarding the examination results of each employee and health guidance based on the examination results obtained from OH nurses—were lower in SSEs than in large-scale and medium-scale enterprises in 2010 (Table 1).

Table 1. Situation of general health examination related OH activities in each enterprise size

No. of employees	OH activities related to general health examination (%)		
	Implimentation of health examination	Consulting physicians	Health guidance
>1000	100.0	93.4	94.3
500-999	99.5	84.1	81.3
300-499	99.5	76.1	71
100-299	99.0	72.1	61.8
50-99	98.9	58.8	48.1
30-49	95.7	37.7	39.8
<29	84.5	35.6	34

Hiring an OH nurse is not considered to be a duty of employers in Japan. However, employers in large-scale and middle-scale enterprises often hire OH nurses. These employers have expectations from OH nurses in the areas of management of work-related diseases, health guidance after health examination, and health promotion. Experienced OH nurses are not only skillful in their basic domain but also are able to manage work and work environments like OPs, and the salary of OH nurses is generally lower than that of OPs.

To improve OH services in SSEs, an OH service organization in Japan recently started placing OH nurses in these enterprises.

Methods

In 2012, the employer of Enterprise A, with 36 employees, requested basic OH support from Kyoto Industrial Health Association. Then one OH nurse began providing basic OH service monthly for this enterprise. The OH nurse provided health guidance to employees and conducted workplace inspections. She also made recommendations to the employer regarding improvements in the work environment, based on the results of a health questionnaire survey and observations through workplace inspection.

In our multidisciplinary OH team for an SSE, one OH nurse takes initiative for this team. As mentioned above, experienced OH nurses are not only skillful in their basic domain but also are able to manage work environments, mental health problems, and other matters. If a difficult problem emerges which the OH nurse cannot solve by herself, then the professional in each OH domain such as the OPs, work environment evaluation experts, and clinical psychologists will support her to solve the problem.

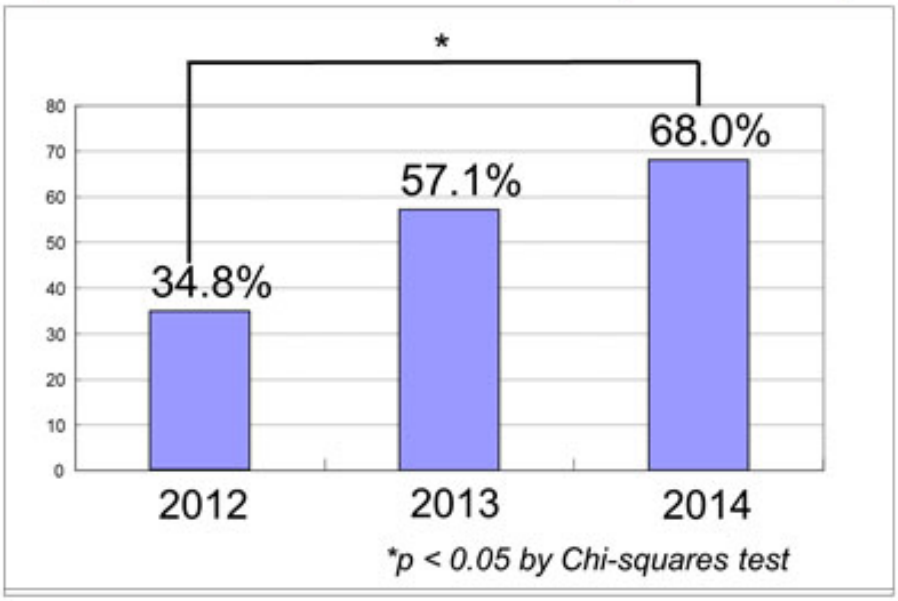
Results

At this enterprise, the OH nurse elucidated from the health questionnaire results that the rating was low for the questionnaire item “full recovery after sleep.” When providing health guidance to the employees, she also acquired the information that most employees usually stay late at work, until 8 or 9 p.m. Therefore, the OH nurse provided health guidance on proper sleep habits for all employees and informed the employer

that this sleep problem was related to overtime work. Through the information obtained from the OH nurse, the employer realized that the overtime working conditions for some employees was problematic. He decided to hire several part-time workers.

After the OH nurse provided health guidance on sleep habits for all employees and informed the employer about their health condition, responses to the questionnaire item "full recovery after sleep" improved significantly, along with the reduction in overtime work, from 2012 to 2014 (Figure 1). These results suggest that activities by OH nurses can improve employees' health conditions in SSEs.

Figure 1. Change in responses to the questionnaire item "full recovery after sleep"



In this enterprise, upon deliberation with the OH nurse, the employer decided to recruit additional workers to reduce overtime work. Then the sleep habits of the employees improved. Hasle and Limborg have reported that the employer in SSEs is the key person in OH activities [Hasle and Limborg 2006]. OH professionals in SSEs may have better opportunities to inform and educate the employer through direct conversations with him or her than those in middle-scale or large-scale enterprises [Moriguchi et al. 2010].

When a photo was taken to show the effect of the workplace inspection by the OH nurse at the OH committee in the enterprise after the improvement, the employer of this enterprise accepted the request of our OH nurse and volunteered to demonstrate poor conditions in working with computers (straight arm, no arm rest, and working without a sun shade) in the photo. This episode could be a symbol of the good communication between the employer and the OH nurse in this enterprise.

For clarity, several OH nurse activities in other SSEs were introduced. In one enterprise, OH improved with monthly visits by the OH nurse. For example, voluntary health

consultations requested by the employees increased from 0 in 2016 to 4 in 2017. Moreover, physicians were consulted sooner than previously regarding the health examination results of each employee. In 2016, the health officer in this enterprise performed this legal task with our OH nurse just before the next year's health examination. However, in 2017, he performed this task within 4 months after the health examination. The OH nurse explained to the health officer that asking for an OP's opinion on employees' work restrictions, based on their health examination results, is always a legal obligation of enterprises. Therefore, his attitude changed.

In another enterprise, based on the advice of the OH nurse, the employer arranged an OP consultation with an employee after sick leave due to a mental health condition. Because the return-to-work recommendation for an employee in Japan can be provided only by an OP, as per the Industrial Safety and Health Law in Japan, the employer had to arrange an OP consultation in this case.

Our reported findings have several limitations. OH nurse activities were implemented only in a few SSEs. Most OH nurse activities were implemented in subsidiary enterprises of large-scale enterprises. Effects of OH nurse activities in a wide range of OH levels in SSEs are unclear. Further investigations of OH nurse activities in many SSEs should be considered.

Discussion

These results suggest that the activities of OH nurses can improve employees' health conditions in SSEs. The communication between employers and OH professionals is important for the development of successful OH activities.

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Applying Fundamentals of *Total Worker Health®* Approaches: Essential Elements for Advancing Worker Safety, Health, and Well-being

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Introduction

In 2016, the National Institute for Occupational Safety and Health (NIOSH) published *Fundamentals of Total Worker Health® Approaches: Essential Elements for Advancing Worker Safety, Health, and Well-being*. This workbook serves as a practical starting point for employers, workers, labor representatives, and other professionals interested in implementing workplace safety and health programs that align with the *Total Worker Health (TWH)* approach. TWH strategies explore opportunities to both protect workers and advance their health and well-being by improving the conditions of their work, primarily through workplace policies, programs, and practices.

Because TWH approaches are adaptable to a wide range of workplaces, organizations, and industries, these strategies are of particular interest to small- and medium-sized businesses, many of which frequently face challenges related to staffing, resources, and time. Workers' contributions and skills are often considered the centerpiece or greatest asset of many small firms. Therefore, integrated concepts that call for worker participation in all aspects of program design and encourage customization of interventions for greatest health impact are well suited to smaller firms. With TWH's uniquely organizational and integrated approach, rather than one that is only individually focused, TWH strategies provide small enterprises with an expanded opportunity to protect and promote the health of their workers.

The goals of this paper are to (1) familiarize employers with the fundamentals workbook content and layout; (2) provide examples of policies, programs, and practices that incorporate the five defining elements of TWH; and (3) provide guidance on how to utilize featured tools and resources to assist with planning and implementation efforts.

Methods

What is the Fundamentals Workbook?

Fundamentals of Total Worker Health® Approaches, developed with peer and stakeholder input from small and medium-sized businesses, focuses on five defining elements of TWH. Offering a user-friendly entry point, this workbook can provide a baseline "snapshot" of where your organization is on the path to TWH; identify initial steps

to improve your workforce safety, health, and well-being in alignment with the TWH approach; and help you measure progress as you implement interventions relevant to your organization.

Five Defining Elements of TWH

The five defining elements of TWH are guiding principles that provide practical direction for organizations seeking to develop policies, programs, and practices that contribute to worker safety, health, and well-being. Infused within each defining element are tips for success, examples to illustrate TWH in action, and relevant resources. Below we briefly highlight each defining element.

Defining Element 1: Demonstrate leadership commitment to worker safety and health at all levels of the organization. Commitment to worker safety and health throughout all levels of an organization, as reflected in words and actions, is critical [Sorensen et al. 2012]. Organizational leaders should acknowledge and communicate widely the value of workforce safety and health as a core function and prioritize worker safety and health on the same level as quality of services and products.

Defining Element 2: Design work to eliminate or reduce safety and health hazards and promote worker well-being. A TWH-aligned health approach prioritizes a hazard-free work environment for all workers. Its prevention approach is consistent with traditional occupational safety and health prevention principles of the NIOSH Hierarchy of Controls, as applied to TWH (Figure 1).

Defining Element 3: Promote and support worker engagement throughout program design and implementation. Ensure that workers involved in daily operations as well as supervisory staff are engaged in identifying safety and health issues, contributing to program design, and participating in all aspects of program implementation and evaluation.

Defining Element 4: Ensure confidentiality and privacy of workers. Note that workplace policies that discriminate against or penalize workers for their individual health conditions or create disincentives for improving health are inconsistent with the TWH approach.

Defining Element 5: Integrate relevant systems to advance worker well-being. TWH emphasizes the role of organizations in shaping worker safety and health outcomes. Organization must recognize that a multilevel perspective on policy, environmental, organizational, and social concerns may be best for tackling complex challenges to worker safety, health, and well-being [Best 2011].

As organizations use the defining elements to plan TWH interventions and programmatic content, it may be useful to explore a conceptual model based on a familiar tool from traditional occupational safety and health, the Hierarchy of Controls.

The Hierarchy of Controls Applied to Total Worker Health

Developed specifically to help increase understanding of TWH policies, programs, and practices, the Hierarchy of Controls Applied to NIOSH TWH illustrates the prioritization of efforts to advance worker safety, health, and well-being. Like the traditional Hierarchy of Controls, strategies are presented in

descending order of anticipated effectiveness, as suggested by the cascading arrows. The Hierarchy of Controls Applied to NIOSH TWH expands the traditional hierarchy from occupational safety and health to include controls and strategies that more broadly advance worker well-being. To apply this model, those implementing a TWH approach begin by eliminating workplace conditions that cause or contribute to worker illness and injury or otherwise negatively impact well-being. These include factors related to supervision throughout the management chain. The second is replacing unsafe, unhealthy working conditions or practices with safer, health-enhancing policies, programs, and management practices that improve the culture of safety and health in the workplace. The third step, redesigning the work environment for safety, health, and well-being, includes removing impediments to well-being, enhancing employer-sponsored benefits, and providing flexible work schedules. Providing safety and health education and resources to enhance knowledge for all workers is the final step before encouraging personal change for improvements to health, safety, and well-being. This encouragement includes assisting workers with individual risks and challenges and providing support for making healthier choices.

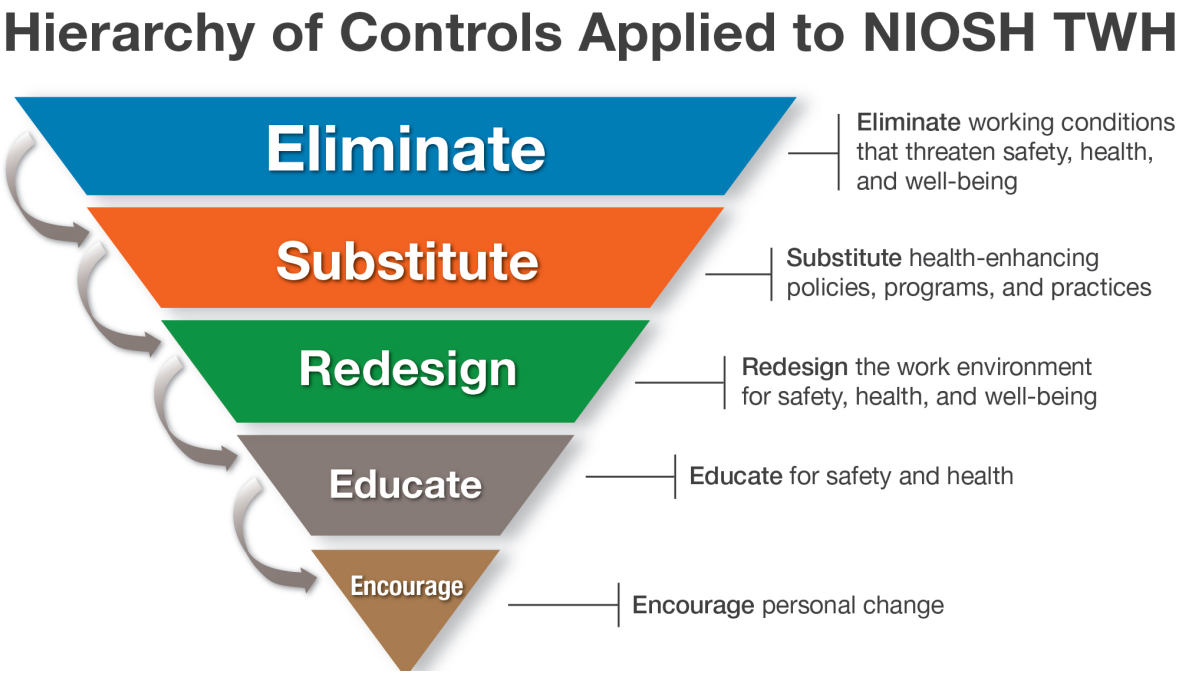

Figure 1: Hierarchy of Controls Applied to NIOSH Total Worker Health®

Self-Assessment and Action Plan

Defining element of TWH	Where we are now/What we do well	Where we want to be/ What must be improved
Demonstrate leadership commitment to worker safety and health at all levels of the organization		
Design work to eliminate or reduce safety and health hazards and promote worker well-being		
Promote and support worker engagement throughout program design and implementation		
Ensure confidentiality and privacy of workers		
Integrate relevant systems to advance worker well-being		

Worksheet 1: Self-Assessment

Defining element of TWH	Needs identified	Who should we include?	What obstacles might we encounter?	What are some solutions to those obstacles? What resources outside the workplace could we pull in to help?	What steps must we take to make this happen?

Worksheet 2: Action Plan

The workbook includes two worksheets to frame and evaluate work design through the lens of *Total Worker Health*. The first (Worksheet 1) is a self-assessment that allows readers to consider how existing programs, policies, and practices could be adjusted or expanded to more effectively address TWH in an organization. The second (Worksheet 2), an action plan, provides guidance, through pointed questions and the defining elements, for next steps toward implementing a TWH approach.

Application of TWH Approaches

Implementing a TWH approach is an ongoing effort in which workers' safety, health, and well-being are top priorities. In many settings, TWH is a constellation of interventions,

policy changes, and practices that create a robust culture of safety, worker protection, and greater health opportunity. TWH programs are voluntary and participatory, giving workers a voice in the conditions of their work and a say in workplace offerings. Putting TWH into action often starts with an organizational focus, looking at the challenges to keeping workers safe and healthy. Changes to policy, the built environment, and programs follow. Enduring, system-wide levers for better health take priority over programs promoting individual behavior change.

The application of TWH practices, policies, and programs emphasizes organizational approaches, including paid family and sick leave, paid medical benefits, equitable wages, safe staffing levels, and voluntary overtime; attention to work-life integration; recognition of work factors as potential causes of chronic conditions; and prevention of discrimination, harassment, and violence. Additional examples of TWH application are interpersonal-level interventions (such as health-enhancing work organization and healthier supervisory practices, respect, fair performance appraisals, and advancement opportunities) and individual-level interventions (such as programs to help workers manage their health challenges, worker participation in workplace problem solving, and voluntary participation in confidential occupational health services).

On our **Promising Practices webpage**, the NIOSH Office for TWH highlights real-life examples of organizations that are moving toward such an approach. In addition, scientists both within the Institute and at the NIOSH-funded Centers of Excellence for TWH are leading a number of research-to-practice initiatives. The following example demonstrates strategies targeting small and medium-sized employers.

Healthy Environments in Workplaces and Communities

The Nebraska Safety Council (NeSC) is a TWH Affiliate and not-for-profit 501(c)(3) organization, with over 600 member organizations in various industries, including manufacturing, state and local governments, and construction. NeSC offers trainings, educational materials, and interactive consultations for its members in addition to integrated resources through the WorkWell division organizations to help employees achieve optimal well-being. In 2014, The University of Iowa Healthier Workforce Center for Excellence, a NIOSH TWH-funded Center, awarded NeSC a community pilot grant. NeSC then offered hands-on resources to participating small businesses in the community via the pilot grant program. It focused on implementation of TWH interventions at three small Nebraska businesses in the cities of Lincoln and Beatrice, based on previous interactions with leadership and their interest in TWH solutions. NeSC created customized solutions such as providing interactive training and consultations, assisting with policy development and communication, offering training modules, and providing practical support. Each of the businesses was already meeting state and federal guidelines for workplace safety but sought assistance from NeSC to expand safety beyond regulatory requirements with a TWH approach.

The Nebraska Safety Council/WorkWell experiences emphasize the importance of interaction between leadership and workers in establishing TWH programs, policies, and practices in small businesses. NeSC focuses on what each business is already doing to keep its workers safe, healthy, and well. This allows critical next steps to build upon the foundation present at the business. By meeting the businesses "where they were" with safety, health, and well-being, NeSC developed infrastructure and allowed workers to lead changes, enabling the businesses to create sustainable impact [NIOSH 2015].

NIOSH Centers of Excellence for *Total Worker Health*

NIOSH funds six Centers of Excellence (Centers) to conduct research on the concepts of TWH. These Centers are partnering with those in their regions to better champion worker safety and health. The scientists at the Centers, along with their partners in government, business, labor, and the community, are essential in moving research into practice. The Centers use multidisciplinary research projects, including intervention-focused research, outreach and education, and evaluation activities, to improve our understanding of which solutions work. The scientists at the Centers, along with their partners in government, business, labor, and community, are conduits for the research-to-practice effort that holds promise for having a positive impact on the health and productivity of American workers.

Conclusion

With the 2016 publication of the workbook F*undamentals of Total Worker Health® Approaches: Essential Elements for Advancing Worker Safety, Health, and Well-being*, NIOSH prioritized a hazard-free work environment for all workers. The workbook applies a modern prevention approach—consistent with traditional occupational safety and health prevention principles—that recognizes that job-related factors can have an important impact on the well-being of workers, their families, and their communities. Although it is still a developing field and more research is needed, the TWH approach holds promise for small and medium-sized enterprises. Its flexibility, adaptability, and participatory approach make it ideally suited for any organization looking to begin or continue developing a worker safety and health program.

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Total Worker Health in Childcare Centers: Preliminary Results from a Community-based Model

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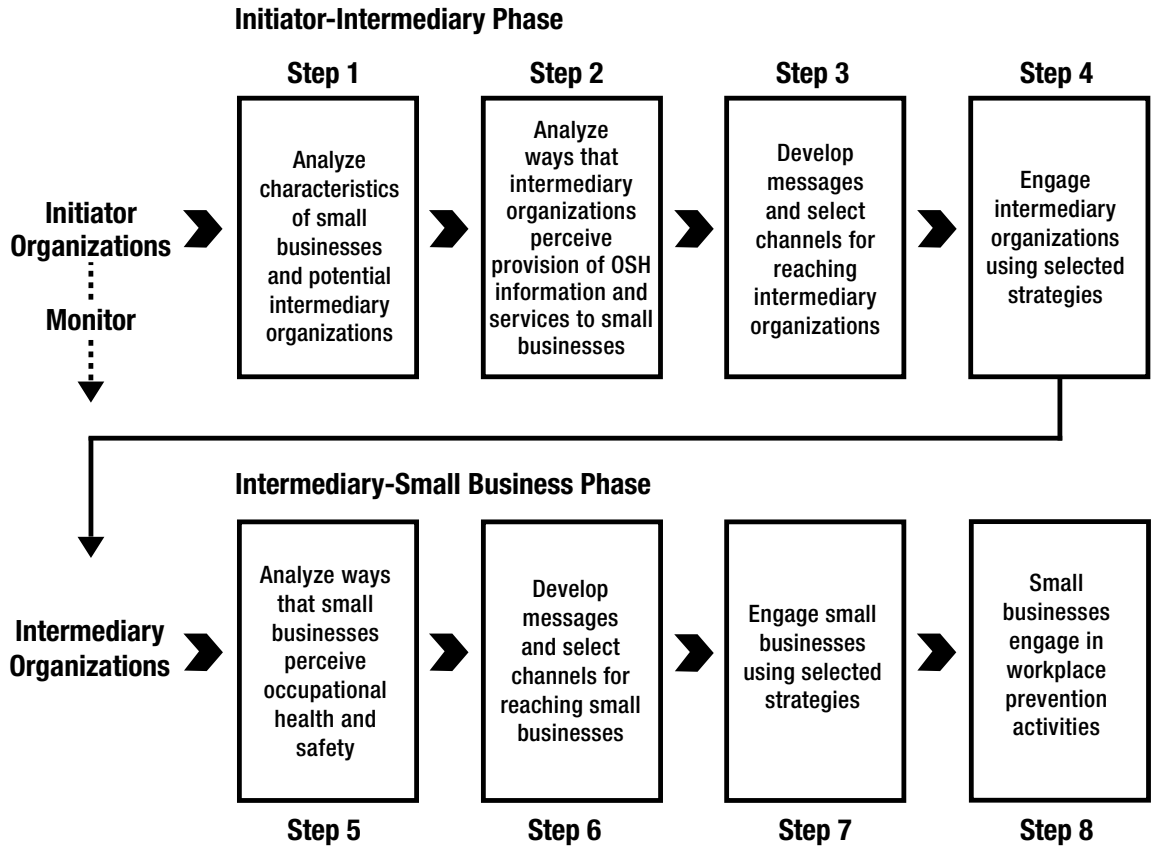
Background

Small businesses deliver fewer workplace health promotion and occupational safety and health activities than larger businesses [Linnan et al. 2008; Sims 2008]. In addition, small businesses tend to need more external assistance with integrated safety and employee health programs such as Total Worker Health [Newman et al, 2015], and they endure a higher burden of occupational injuries and illnesses [Mendeloff et al. 2006]. Business size has also been shown to be one of the best predictors of a small business's involvement with workplace health promotion and safety activities [Linnan et al. 2008; Sinclair and Cunningham 2014]. Many factors, such as these, affect small businesses' lack of motivation to engage in prevention: lack of resources, isolation, low probability of inspection, and inaccurate perceptions of illness and injury rates [De Kok 2005; Hasle and Limborg 2006; Lentz and Wenzl 2006; Parker et al. 2007; Sinclair and Cunningham 2014].

For this study, the Total Worker Health concept and suggested programming were introduced to small businesses. *Total Worker Health (TWH®)* is defined 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" [NIOSH 2017]. Considerations in designing the study included the need for multiple levels of intervention to support employee health and wellness promotion efforts, including support from the community [Faghri et al. 2010; Baker et al. 1996; DeJoy and Southern 1993]. Working with a local business network in a small geographic area was also suggested as a successful approach [O'Donnell 2012]. Identifying local businesses already familiar to our partners was ideal. Developing a strong business case for TWH that included financial costs and benefits, personal effort required, time commitment, compatibility with existing systems, and expected outcomes would also be essential for participants to remain open to the concept and potentially gain insight into successful future adoption [Rogers 2003; Maddux 1999].

The Intermediary–Small Business Diffusion Model was used as the basis for structuring and designing this study (Figure 1). The model was previously published by the NIOSH Small Business Assistance Program, and its utility has since been demonstrated in other studies [Cunningham and Sinclair, 2015; Bruening et al. 2015; Sinclair et al. 2013]. The model consists of two stages, an initiator–intermediary stage and an intermediary–small business stage, which provide a framework for identifying who small businesses use for information, how to reach out to those intermediaries, and how to work with those intermediaries to then reach out to and engage small businesses. This model is ideal for learning about both small businesses and intermediaries, as stages may overlap at multiple points.

Figure 1. The intermediary–small business diffusion model



The overarching, larger study targeted two communities (Northern Kentucky and Greater Cincinnati). Each set of community partners, or intermediaries, selected slightly different approaches for identifying small businesses as participants. Cincinnati-based partners wanted a geographic approach, whereas Northern Kentucky–based partners preferred a sector-based approach (such as childcare centers). Intermediary community partners included health departments, business health services, and safety consultants. Health departments were ideal partners because of their interest in new channels to deliver health objectives, experience in data collection, and interest in health outcome changes. Business health services were ideal partners because they already offered employee health services to businesses, were interested in market research, and understood the importance of both prevention and return-to-work activities. Safety consultants were ideal partners because of their knowledge related to workplace safety and regulations and their ability to discuss options to decrease risk of injury and illness.

The goals of this study were (1) to understand perceptions of the cost and benefits of TWH approaches among small business owners/operators and employees; (2) to understand perceptions of TWH among community organizations that serve small businesses; and (3) to explore methods for encouraging use of TWH approaches by small businesses, particularly childcare centers.

Methods

Participating childcare centers were eligible if they had fewer than 50 employees or more than five employees. Initial outreach efforts via phone calls and interview data collection were conducted by the health department.

Study steps included (1) baseline interviews with the owner or manager, (2) individual business consultations and provided services, and (3) exit interviews with the owner or manager. Baseline interviews gathered initial perceptions about the TWH concept and determined what the childcare center may be doing or may be interested in doing for employee health and occupational safety and health. During the business consultations, consultants met with childcare centers and provided resources as requested. For childcare centers, the services included a TWH Training Day delivered on a Saturday by the partnered intermediaries (for example, an ergonomist presented on lifting, stress management techniques, and vaccinations). Exit interview questions were similar to those in the baseline interviews but also sought to elicit descriptions of changes in perceptions.

All interviews were recorded and transcribed. The transcribed interviews were analyzed by an inductive approach with thematic coding and a subsequent iterative process for further clarification of themes [Braun 2006; Gale et al. 2013]. During familiarization, or phase 1, the research team independently reviewed the transcripts and then together reached consensus on important themes and ideas. The team developed a codebook to guide data analysis. In phase 2 (generating initial codes), the research team systematically coded interesting features, direct quotations, and patterns across the entire data set, reviewing differences in coding until consensus was reached. During phase 3 (searching for themes), the data were reviewed, gathered into relevant groups, and collated into potential themes. During phase 4 (reviewing themes), the team used the constant comparison method to examine and refine the themes by comparing and contrasting information within each interview and across all the interviews and focus groups [Boeije 2002; Corbin and Strauss 2014]. In phase 5 (defining and naming themes), the team conducted ongoing analysis to refine each theme and further condense the themes into a cohesive narrative.

Results

Eight participants completed baseline interviews and participated in business consultations, but only five completed exit interviews. Participants were characterized as being the owners of the childcare center and reported good overall health. Childcare centers were characterized as having good work climates, good staff, and positive working relationships. The age of employees ranged from young adult college students to senior citizens. Most childcare centers did not provide health insurance, and paid holidays and sick leave varied by facility. Some of the biggest challenges these childcare centers faced—in general and in relationship to the study—for implementing a TWH program were money and time. There was concern about the cost of employee health initiatives, as some facilities were consistently on the brink of closing because of finances. There was also a lot of concern about finding or making time for additional employee-focused programming.

Overall, exit interview responses demonstrated that childcare center providers reflected increased attention and recognition of safety issues through more conversations and awareness that what's good for the children is good for the employees and the center as a whole. Participants described one-time trainings/activities related to safety, such as lifting children or safety in the classroom (Table 1). No respondents described new programming or formal, structured activities related specifically to safety.

Table 1. Changes made and lessons learned about safety

Themes	Example Quotes
Increased attention and recognition of safety issues, especially personal safety	"All of our safety rules and things like that are there for the children, but I think this brought to their attention that they're there to protect themselves as well."
	"Definitely opened eyes and put some more focus on certain things that were brought to our attention that we kind of knew in the back of our head."
	"We had a lot of conversations—individual conversations with people."
	Recognized that what's good for kids is good for all of us and the whole center.
One-time safety-related training/activity	"We did have training on how to lift children."
	"The fire department is going to be coming in and walking through to assess some of the safety things here at the center."
	"We've talked about safety in the classroom at our teacher meetings."

In addition, childcare center providers showed an increased awareness of and attention to factors that influence employee health. They described small, informal changes they had made to promote employee health and wellness (such as healthy foods at meetings) or one-time trainings and activities that were designed to promote employee health. Some respondents described changes being made by individual employees to improve their health that were not related to the workplace, such as starting gardens (Table 2). No respondents described new programming or formal, structured activities related to total worker health.

Table 2. Changes made and lessons learned about employee health

Themes	Example Quotes
Small, informal activities to support employee health	"We started eating healthy at our staff meetings and I started bringing in healthy foods instead of getting, you know, cheese coneys and chips and stuff."
	"We did have a garden this year."
	"We usually try to do like a potluck every once in a while. We started trying to do, like, the healthier—bring in your healthiest dish."
Small, informal activities to boost morale/reduce stress	"As kind of like a team-building activity, we took the staff out to dinner (to a restaurant) just to kind of reward them…you know, kind of build relationships."
	"I kind of had like a teacher meeting where we all came in and it was quiet and I had the lights off and had relaxing music and we had healthy foods that we partaked [sic] in, and I had everybody put their biggest problem on a piece of paper and then we crumpled it up, put it in a bowl, and then put it outside and said 'Let's just not think about those. Do you want to just talk about, you know…think of how we can relax.'"
Increased attention to and recognition of health and wellness issues	"We do a lot of water, stay away from a lot of pop and stuff like that."
	"I feel more that people are calling and saying 'I need help,' 'I can't,' you know, where normally I think they were afraid to call. You know, because they felt like they couldn't do their job, but I think now they're—my phone rings a little bit more now."
One-time training/activity	"Ergonomics training"
	"They came in to check BMI."
	"Chiropractor came in."
	"(Company) did a training for us on stress management."
Reports of individual staff changes	"There's a couple of them that have—are working on quitting smoking."
	"There's a couple of them that are working on losing weight."
	"She exercises, she also uses the steps for stuff like that and her eating habits have changed."
	"I'm cooking more, using more fresh fruits and vegetables."

Childcare center providers were split on the opinion of TWH (that is, integrated safety and wellness activities) being a good idea. Many of the providers felt that safety should continue to be separated so that, as one participant said, "important things don't get jumbled up." However, participants did express that the following activities would be desirable: cost-effective employee health programs (such as exercise programs, gym memberships, walking clubs, and pedometer challenges), health programs for both employees and clients (that is, parents), lifting safety, and free and useful safety training.

Conclusion

The study findings presented on childcare centers are a piece of a larger study examining two communities and a larger variety of small businesses. Although the childcare centers presented here were somewhat open to the idea of a TWH program for their employees, there were restrictions to potential future adoption, such as cost and time availability. Despite these restrictions, these childcare centers did find certain potential future activities related to TWH to be desirable. As each childcare center was somewhat unique, it is likely important to not design a one-size-fits-all TWH program. Instead, a successful TWH program should be flexible and tailored to the needs and desires of the owners and employees. In addition, it is important for the TWH program to give the childcare center a sense of ownership and for a couple program champions to be identified in order to increase the likelihood of success.

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Correlation between Weekly Exercise Duration & Light Duty and Lost Time: A Cross-Sectional Analysis of an Occupational Working Population

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Introduction

The United States Office of Disease Prevention and Health Promotion guidelines suggest 150 minutes per week of moderate activity [American College of Sports Medicine 2013]. Physical inactivity doubles the risk of developing cardiovascular disease, type 2 diabetes, and obesity [Wen et al. 2011]. These diseases can cost hundreds of billions of dollars in loss of productivity nationally [Stewart et al. 2003]. We performed a cross-sectional analysis to determine the association of different durations of leisure-time physical activity (PA) and the prevalence of light work and lost time in an industrial working population.

Methods

This was a cross-sectional study analyzing baseline data from a large prospective cohort study. Workers were enrolled from 27 different employers having 30 different production facility types located in Texas, Wisconsin, Utah, and Illinois. At baseline enrollments, workers completed a laptop-administered questionnaire. Data quantified included demographics, PA (such as baseball, walking, skiing, tennis, and yoga), and light duty/lost time (LD/LT) prevalence.

Moderate activity was defined as any activity between 3 and 5.9 Metabolic Equivalent of Tasks (METs), and vigorous activity as an energy expenditure greater than or equal to an MET value of 6. Workers were split into groups according to minutes per week of PA: 1–60, 61–150, 151–315, and 316+. We performed multivariate logistic regression analyses to assess correlations between exercise duration and LD/LT.

Results

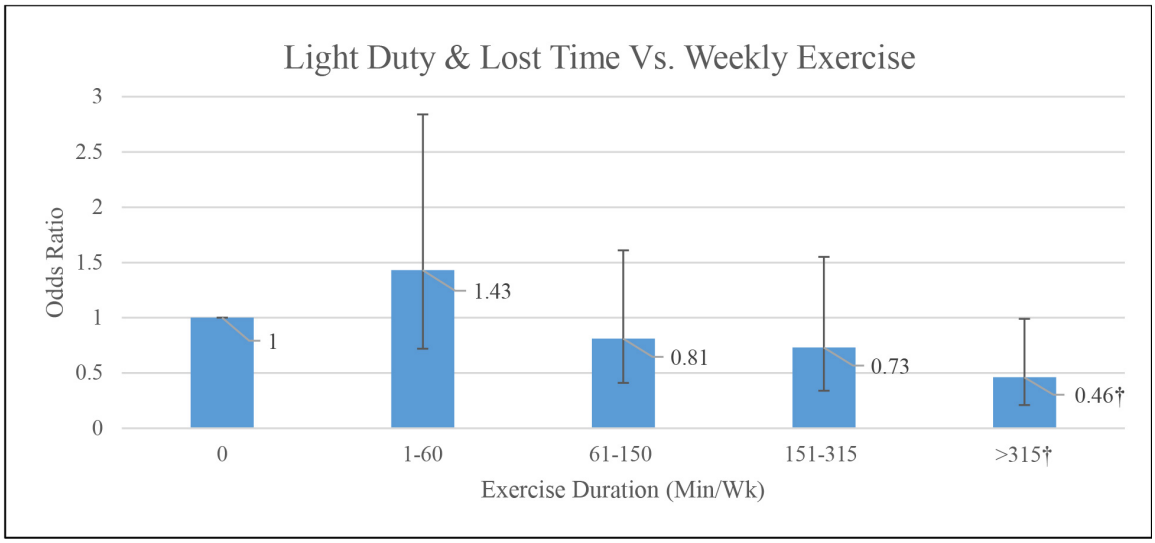
We included 827 workers in our analysis. The majority of workers were male (63.8%) with a mean age of 38.8 (±12.1) years. The median amount of PA performed was 82.5 minutes per week, with 25.9% (n = 214) indicating they did not participate in any PA. Workers who exercised 1–60 and 61–150 minutes per week were 1.3 ($p = 0.20$) and 1.1 ($p = 0.97$) times more likely to be prescribed LD/LT, respectively. Workers who exercised 151–315 and 316+ minutes per week had a 0.7 ($p = 0.42$) and 0.4 ($p < 0.05$)

chance of being prescribed LD/LT, respectively (figure 1). A test for trend showed a significant negative correlation between LD/LT and increased level of exercise ($p < 0.05$).

Discussion

This cross-sectional analysis shows a positive correlation between worker productivity and weekly PA durations (Figure 1). These results may be used to implement a worker exercise program in order to increase the productivity and well-being of workers. A longitudinal study on exercise intervention in the workplace could be useful to confirm this relationship.

Figure 1. Correlation between weekly exercise and light duty/lost time.



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Assessment of the Relevance and Impact of Promoting Marketable Skills for the Informal Sector in Addis Ababa, Ethiopia

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Abstract

Concern World Wide Ethiopia (CWWE) received a grant from the European Union (EU) to implement a Promoting Marketable Skills training program for the informal sector in selected woredas (city administrative districts) of Addis Ababa. Six woredas from three sub-cities were selected to assess the performance of the project, using the evaluation criteria of relevance and impact. Surveys, key informant interviews, and focus group discussions were conducted to gather primary data, and reports of the project were utilized for desk review. The study indicated that the project was relevant in addressing the identified needs of the target group. Over 60% of the participants responded that the project was relevant to their interests, previous experiences, and the demands of the labor market, and 86% indicated that the skills acquired through the training were relevant to the job market. The results of the study revealed that the impact of the training was very positive: over 91% of participants indicated that their competence had improved, over 61% indicated that their life had been changed, 55% indicated that they were employed or managed their own business, and 76% indicated a significant difference in income (which ranged from 500 to 2,000 birr per month).

Key Words: informal sector, marketable skills, relevance, impact, CWWE, EU, survey, key informant interviews, focus group discussions

Introduction

Employment problems recently have become a central global concern, and nearly all governments and development partners are fully engaged in finding lasting solutions. In the past, development planning efforts were concentrated on the growth of a modern industrial sector that would serve the domestic market, facilitate absorption of redundant or surplus workers in the urban economy, and create rapid economic growth and development. However, the anticipated ability of the modern industrial sector to absorb migrants was never achieved.

Although various conceptualizations of the informal sector have been debated since the early 1970s [Bangasser 2009; Hart 197], today it encompasses about 500 million workers around the world [ILO 2013, 2014]. The informal sector's capacity for

employment generation in the economy has been recognized by scholars, policymakers, and lately governments in developing countries. The informal sector therefore represents an important part of the economy and certainly of the labor market in most developing countries. It plays a major role in employment creation, productivity, and income generation. It is widely believed that employment generation in the informal sector is necessary for the survival of countries that lack social safety nets and for absorption of growing numbers of unemployed members of the labor force. Empirical enquiries have confirmed the vastness, resilience, and dynamism of the informal sector [Akande and Akerele 2008].

Ethiopia is one of the emerging economies, similar to other countries in developing regions such as sub-Saharan Africa. Though the country has had double-digit economic growth over the last decade, Ethiopia is still one of the poorest countries in sub-Saharan African, with a total estimated population of 87,952, 000 [CSA 2014]. According to the Central Statistical Agency [CSA 2014], urban unemployment has decreased to 17.5%, from 26% in 2008. However, unemployment (especially among youths) in Ethiopia has become a major development issue. A significant portion of the urban workforce works without pay for a family business; more than 40% are self-employed in the informal economy, most of which live on the edge of poverty. In addition, 75% of the workforce is concentrated in low-skill employment sectors such as commerce, services, and elementary occupations. As an intervention to those issues, the Ethiopian government has crafted an integrated plan and has been implementing it with two growth and transformation plans and previous integrated development plans.

In line with this, the 2008 Technical and Vocational Education and Training (TVET) strategy aimed to provide more opportunities to a wider range of different target groups in Ethiopia. The TVET system addresses not only school dropouts but also people without formal education, including illiterate or least educated people; farmers and their families; unemployed people who need initial education and training or retraining to support their reintegration into the labor market; people with disabilities; and people from marginalized ethnic groups and other groups.

The prevalence of poverty in Ethiopia, as reflected in population data, is determined on the basis of a poverty line that stratifies by the per capita income or consumption below which an individual is considered to be poor. The proportion of people in Ethiopia categorized as absolutely poor (those whose total consumption expenditure was less than US $124.28 per year) was 44% during 1999–2000 [MOFED 2002]. Moreover, an estimated 37% in urban areas and 45% in rural areas were categorized as poor [MOFED 2002]. The most vulnerable segments of the Ethiopian population are (1) the rural land-less, (2) small holders, (3) victims of drought due to shortage of rainfall, (4) female-headed households, (5) the urban unemployed (in particular) and urban poor (in general), and (6) street children [Asmamawu 2004].

In recognition of these facts, Concern World Wide Ethiopia has initiated and implemented a program known as Promoting Marketable Skills in the Informal Sector in Addis Ababa. Thus, it is legitimate to question how the project has changed the livelihoods of its beneficiaries. The objective of this assessment study was to evaluate the relevance and impact of the program in the intervention area.

Methods

The evaluation, conducted from February to June 2016 in all targeted woredas of Addis Ababa, involved the following methods.

- **Beneficiary survey.** The beneficiaries for the study were selected by simple random sampling from within the sampling frame. To generate quantitative data, a structured survey questionnaire was developed and administered to 281 beneficiaries by trained enumerators.
- **Key informant interviews.** Potential key informants who had sufficient information about the project were conveniently selected and interviewed.
- **Focus group discussions.** Focus group discussions were also conducted in the targeted woredas.
- Desk review and on-site observations. Desk reviews and field visit observations were also part of the data collection.
- **Data analysis.** The quantitative data were analyzed via SPSS version 20. Text data, secondary data, and findings of focus group discussions/key informant interviews were managed and analyzed via content analysis for key themes.

Evaluation Criteria and Evaluation Questions

Criteria for final evaluation of the project were adopted from the standard evaluation criteria developed by the Development Assistance Committee [DAC 1991]: relevance, effectiveness, efficiency, impact, and sustainability. The current study focused on relevance and impact, with special attention given to questions related to those two criteria.

Relevance

Relevance was considered to be the extent to which the objectives stated in the project application actually corresponded with identified problems or real needs. Evaluators asked these questions:

- To what extent are the objectives of the program still valid and relevant in relation to the priority and focus of the targeted area?
- Are the activities and outputs of the program consistent with the overall goal and the attainment of its objectives?
- Are the activities and outputs of the program consistent with the intended impacts and effects?

Impact

Impact was considered to be changes in human development and well-being brought about by development initiatives, either directly or indirectly and intended or unintended. Evaluators asked these questions:

- What has happened to the life of those targeted as a result of the program or project?
- What real difference has the activity made to the beneficiaries?
- How many people have been affected?

Results

Demographic Characteristics of Respondents

The survey study had 281 participants (99 male and 182 female). With regard to educational level, over 66% had completed grade 9 to 12 (40%, grade 10 to 12). Approximately 36% of the study participants were married, 57% were single, and the rest were divorced or widowed. Table 1 depicts the demographic characteristics of the study participants.

Table 1. Demographic characteristics of the 281 study participants

Category		Number of Participants	Percentage
Sex	Male	99	35.23%
	Female	182	64.77%
Marital status	Married	90	36%
	Single	160	57%
	Divorced or widowed	21	7%
Level of education	Cannot read and write	12	4.28
	Can read and write	5	1.78
	Grade 5 to 8	77	27.40
	Grade 9 to 12	187	66.55

Relevance of the Project

The relevance of the Promoting Marketable Skills in the Informal Sector project has received critical attention in many parts of the world [NCEUS 2009]. In this study, evidence for understanding the relevance of the project was collected from various sources: desk reviews, key informant interviews, focus group discussions, on-site observation of project areas, and beneficiary surveys.

Relevance and Complementariness to the Country's Sector Policy and Strategy

The project objective was to contribute toward the first Millennium Development Goals (MDG1) by increasing employability, productivity, and income. As indicated by the 2008 TVET strategy documents, integrated development plans, the two growth and transformation plans, and key government officials and experts who participated in the key informant interviews, the Promoting Marketable Skills project aligns with and complements the policies, strategic focuses, and priorities of Ethiopia.

Relevance in Addressing the Identified Needs of the Target Groups

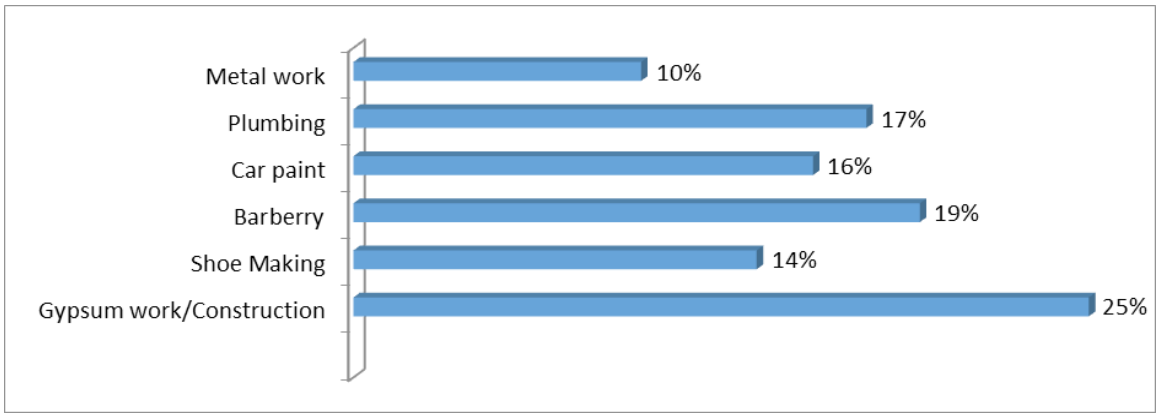
Focus group discussion participants pointed out that the identified skills strongly aligned with their interests and previous experiences. Because the trainings were relevant to the needs of the targeted groups, some focus group discussion participants indicated that they have started their own businesses, and others reported being employed in organizations. The survey data supported the focus group findings. The majority of participants (57%) reported that they chose skill areas on the basis of their experience (12.5%) or market demand for the skills (46.80%). These data agree with the findings of a similar study conducted in Ethiopia [Elias 2015].

Relevance of the Acquired Skills to the Labor Market

Targeted beneficiaries who participated in the focus group discussions in the three sub-cities also noted that the identified potential marketable skills were relevant to labor market demands. However, in some cases such as auto painting and leather work, they said, it was not easy to either own a business or be employed because workers need greater skills and experience than informal TVET trainees like them generally have. Participants in the key informant interviews also believed that the six selected marketable skills were in high demand in the labor market. Of the more than 30 marketable skills proposed, the six were selected on the basis of a market survey in the study areas.

Among beneficiaries interviewed about how they chose a training program (Figure 1), nearly 47% mentioned the high demand for such skills in the market. Indeed, market demand was the driving factor for the selection of skill areas. The highest enrollment of study participants was for training in the construction sector, at 66% (gypsum work, 25%; plumbing, 17%; shoemaking, 14%; and mental work, 10%); the remaining enrollments were in service sectors such as Barberry (19%) and auto painting (16%). These findings of the survey align well with those of the 2013 National Labor Force Survey of the CSA. According to that survey, in major cities of the country, the Minor Industrial Division of construction work (including plumbing and other construction installation activities, as well as metal and finishing work) accounted for the majority of the labor force, especially the informal sector workers. Therefore, it appears that the training program scheme was duly responsive to the job market demands in Ethiopia.

Figure 1. Beneficiaries' training enrollment rates, as proxy indicators of labor demand area



Impact

Table 2 indicates the monthly income of the beneficiaries, ranging from 500 to 2,000 birr or more. Nearly 76% of the participants pointed out that their monthly income tremendously increased after the training. The average income per month is around 1,250 birr (equivalent to US $56.82, on the basis of US $1 = 22 birr). The daily income is around US $1.89, which surpasses the poverty line of US $1.25 a day. Thus, this project helped reduce abject urban poverty. In addition, study participants indicated that as a result of the training, their competence improved (over 91% of participants), their life has changed (over 61%), or they are employed or manage their own business (55%).

Table 2. Employability of the surveyed beneficiaries

Monthly income category, in Ethiopian birr	Number of employed beneficiaries (N = 213)	Remark
Up to 500	36	The amount of monthly income from employment after receiving the skill-development training
500–1000	49	
1000–1500	52	
1500–2000	46	
Above 2000	30	

Discussion

The project was found to be very relevant to the National (Ethiopian) TVET Strategy of 2008. The project was relevant in addressing the identified needs of the target group. Its implementation in the three sub-cities of Addis Ababa helped to achieve the first MDG by improving productivity as well as boosting household income of the target beneficiaries. It also aligned with the first growth and transformation plan of the country and the MDG by empowering women in their economic status, where 70% of target beneficiaries were female. Through this project, the beneficiaries' monthly income increased (range, 500 to 2000 birr), as indicated in focus group discussions, key informant interviews, and surveys. The project has helped reduce urban poverty by improving productivity and the employability of the target groups. For key stakeholders, it was relevant in successfully equipping beneficiaries with the six most appropriate skills for engagement in the labor market.

Conclusions

According to GTP II (Ethiopia's growth and transformation plan draft document), the major strategic directions for the social welfare and labor sectors are (1) expanding social security services to ensure that they are beneficial to women, youths, people with disabilities, and the elderly and (2) expanding employment and labor market information services to ensure citizens are benefitted. Despite progress, employment generation and poverty eradication still remain at the top of the development agenda. Ethiopia therefore remains committed to sustaining an inclusive, pro-poor development strategy over the coming years to meet these challenges. Micro and small enterprises will be expanded as part of a plan to focus on manufacturing industries to increase their productivity and competitiveness. Therefore, scaling up of the project in Addis Ababa as well as in other regions of Ethiopia is critical, especially in alignment with the GTP II and the United Nations Sustainable Development Goals to empower women, people with special needs, and youths.

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Overlapping Vulnerabilities and Immigrant Safety Training in Small Construction Firms

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Introduction

In 2015, the American Society of Safety Engineers (ASSE) and the National Institute for Occupational Safety and Health (NIOSH) published the report *Overlapping Vulnerabilities: The Occupational Health and Safety of Young Immigrant Workers in Small Construction Firms* [NIOSH, ASSE 2015]. This report focused on three populations that research indicates are at increased risk for adverse work-related health outcomes—Hispanic immigrants (individuals born in Latin America who currently live in the United States), employees of small businesses (firms with fewer than 20 employees), and young workers (<25 years old)—with a specific focus on implications for the construction industry.

The report began with an examination of demographic trends and occupational risk factors for each vulnerable group. Vulnerability does not exist in a vacuum; vulnerable workers are often members of two or more at-risk groups. These overlapping vulnerabilities create a unique risk environment for workers. Using the example of young Hispanic immigrants working in small businesses, we presented a conceptual model for understanding how the vulnerabilities interact for workers who are members of all three groups. These vulnerable groups were chosen because they often overlap; about 40% of the 1.5 million Hispanic immigrants working in construction are with firms that have fewer than 10 employees, and about 50% of all young Hispanic immigrants working in construction are with very small businesses [U.S. Census Bureau 2014].

The report by NIOSH and ASSE concluded with a call to business leaders, researchers, and policy makers to consider the efforts needed to address and reduce the occupational health disparities experienced by vulnerable workers. Following the report, ASSE conducted a survey with construction business representatives and shared the results with NIOSH researchers. NIOSH researchers analyzed the data to further explore the training experiences of foreign-born workers in the construction industry and to identify needs for further research and interventions to protect workers experiencing overlapping vulnerabilities. The full results of the survey have been published in the journal *Safety Science* [Cunningham et al. 2018].

Methods

The survey explored how workplace safety and health training differs between smaller construction businesses (fewer than 50 employees) and larger ones (50 or

more employees) that employ foreign-born workers, as well as between companies in which less than 25% versus 25% or more of the workforce is foreign-born. The survey consisted of 34 items and was based on a comprehensive review of the professional and academic literature. It was cognitively tested with potential respondents to ensure the items were understandable. Revisions were made to the instrument on the basis of the results of this testing. To establish content validity, the survey was reviewed by eight occupational safety and health experts. Their suggested revisions were incorporated into the final survey instrument.

The survey was administered online by ASSE, who recruited respondents via email using a snowball-sampling method. Following the initial recruitment email, the survey was available for a period of 4 weeks. To increase the number of small residential construction business respondents, another recruitment email was sent to 19 residential construction business representatives following an initial review of the survey responses.

Statistical analyses of the survey data used the IBM SPSS, version 23.0. Descriptive statistics were analyzed for all response categories. Pearson's chi-square tests of association were computed for categorical variables ($\alpha = 0.05$) to analyze response differences on survey items between small and large businesses and companies with fewer or more foreign-born workers. The survey contained several questions for which respondents could provide more than one answer. To allow significance analyses for these items, each response option was made into a separate variable. Participants were coded as either answering (selecting that option) or not answering. To reduce type I and type II errors, multiple comparisons were corrected by means of the Benjamini-Hochberg method ($Q = 0.10$) [Benjamini and Hochberg 1995; McDonald 2014].

Results

The results of the data analysis examining differences between small and large businesses are published elsewhere [Cunningham et al. 2018], and selected results are presented here. There were 50 responses representing small businesses and 215 responses representing large businesses. The results show that, among businesses represented in the sample, there are deficits in the amount, frequency, and format of workplace safety and health training provided to foreign-born workers in smaller construction firms versus larger firms. Smaller companies provided significantly less initial safety training ($p = 0.012$) and ongoing safety training ($p = 0.042$). Smaller companies were less likely to employ a supervisor who speaks the same language as foreign-born workers ($p < 0.001$) and significantly less likely to have training in a different language for foreign-born workers ($p = 0.002$). The lower overall access to training for foreign-born workers in smaller firms is consistent with findings in other studies (for example, [Dodge Data & Analytics 2016]) and may be due to multiple factors such as a lack of resources and lack of capacity for occupational safety and health implementation in smaller firms. Table 1 highlights some of the results of the two sets of analyses presented here.

Among the companies responding, in 158 less than 25% of the workforce was foreign-born ("fewer foreign-born workers") and in 83, 25% or more of the workforce was foreign-born ("more foreign-born workers"). The foreign-born worker groups varied little in the amount of training received, with no significant differences in the amount of either initial or ongoing safety training. However, there were some language-related

advantages for foreign-born workers in companies with more foreign-born workers. These companies were more likely to employ a supervisor who speaks the same language as foreign-born workers ($p < 0.001$), to present training in the workers' primary language ($p = 0.003$), and to deliver safety communications in the workers' primary language ($p = 0.013$). These advantages may be due to the fact that companies in this sample with more foreign-born workers also tended to be larger companies, which would likely have more resources to devote to training foreign-born workers. Foreign-born workers at smaller companies experience both the language and cultural barriers of being foreign-born as well as the training barriers common in small businesses, such as a lack of time, resources, and personnel.

Table 1. Characteristics of safety training among construction firms

	Business Size			Foreign-Born Workers		
Characteristics	**Small (%)**	**Large (%)**	***p* value**	**Fewer (%)**	**More (%)**	***p* value**
Employ supervisor/foreman/lead person who speaks the same language as foreign-born workers						
Yes	37.5	68.9	<.001*	54.9	78.0	<.001*
Type of safety training foreign-born workers receive†						
Pre-work safety orientation	50.0	84.2	<.001*§	71.5	89.2	.002*§
Job-specific training	52.0	83.7	<.001*§	69.9	92.8	<.001*§
Ongoing training	52.0	86.0	<.001*§	72.8	90.4	.002*§
OSHA 10-hour training	26.0	51.2	.001*§	42.4	50.6	.224
Required training due to federal/state requirements	40.0	73.0	<.001*§	60.1	74.7	.024*§
Training required by a collective bargaining agreement	6.0	29.8	<.001*§	20.9	30.1	.111
Hours per month that foreign-born workers receive ongoing safety training						
0–2	61.8	42.9	.042*	50.0	40.3	.114
3+	38.2	57.1		50.0	59.7	
Method of delivering training to foreign-born workers†						
Text-based print material	40.0	66.0	.001*§	55.7	69.9	.032*§
Hands-on training	56.0	80.5	<.001*§	69.0	88.0	.001*§
Classroom lectures and demonstrations	52.0	81.9	<.001*§	71.5	84.3	.027*§

(Continued)

Table 1 (Continued). Characteristics of safety training among construction firms

Characteristics	Business Size			Foreign-Born Workers		
	Small (%)	Large (%)	*p* value	Fewer (%)	More (%)	*p* value
Online training modules including webinars	22.0	32.6	.144	32.3	25.3	.261
Picture-based print material	32.0	47.4	.019*§	40.5	55.4	.027*§
Recorded video	30.0	48.4	.019*§	43.7	48.2	.503
Recorded audio	18.0	16.3	.768	17.1	14.5	.598
Informal talks	42.0	65.6	.002*§	57.0	71.1	.032*§
How the training offered to foreign-born workers differs from that of native workers†						
Language	26.0	49.8	.002*§	34.2	66.3	<.001*§
Literacy level	10.0	16.3	.264	12.7	21.7	.068
Frequency	4.0	5.1	1.000‡	4.4	6.0	.756‡
Delivery method	18.0	24.7	.317	20.3	32.5	.035*
Content	0.0	6.0	.137‡	3.8	7.2	.349‡
No difference	38.0	44.7	.393	45.6	37.3	.220
Frequency of communications with foreign-born workers about safety-related issues						
Daily	51.3	69.3	.029*	61.6	76.8	.020*
Not daily	48.7	30.7		38.4	23.2	

*Statistically significant at α = 0.05.
†Multiple response questions; only the percentage of those who responded is reported.
‡Fisher's exact test (not significant).
§Significant by the Benjamini-Hochberg procedure; Q = 0.10.

Conclusion

The survey results suggest that a targeted training approach is needed for foreign-born workers, particularly those working for small construction businesses. Foreign-born workers in smaller businesses experience significant communication barriers that can impact the effectiveness of training. These data suggest foreign-born workers, regardless of how many there are or the size of the company, are not receiving adequate levels of safety training. These results provide evidence to support the claims made in the *Overlapping Vulnerabilities* report, demonstrating that foreign-born workers in small construction businesses experience increased occupational safety training barriers.

The partnership between NIOSH and ASSE is continuing with efforts to create a pilot training program that focuses on foreign-born construction workers and their employers. The training program will address the overlap of business size, nativity, age, and work arrangement. This program has two goals: (1) to increase the likelihood that safe practices will be used to prevent falls on sites operated by small construction businesses and (2) to increase workers' self-efficacy related to occupational safety and health. Initial phases of the program are in development and include interviewing small construction business owners to understand the barriers they experience providing training to foreign-born workers and to get their feedback on existing training materials that may be included in a training package.

The training program will deliver both technical and soft skills. The technical skills will focus on two common areas of work for small construction firms (roofing and residential construction), with an emphasis on fall protection. Soft skills give workers the ability to address safety concerns with one another and with their supervisor when they encounter potentially dangerous situations at work. Vulnerable workers often face additional barriers to speaking up if there is a problem. For example, foreign-born workers may not know their rights in the United States, and they may have a difficult language barrier with their supervisor. Soft skills training would help workers develop strategies on how to address such issues. It also could help employers understand the barriers their workers face and how to develop open communication with their workers.

Although the exact format of the training is under development, the training program is expected to be participatory and include more visual elements to overcome language and literacy barriers. Although Spanish training materials are available, they are often direct translations from English that do not consider workers' comprehension of the material. Because many foreign-born workers have limited formal education, which results in low literacy and a lack of learning skills [Arcury et al. 2010], translations can be worthless. Training materials are also rarely simultaneously tailored to multiple vulnerable groups. Therefore, it is obvious that specific interventions are needed to address the deficits in occupational safety and health training received by foreign-born workers in small construction firms, and these interventions must acknowledge their unique barriers to workplace safety and health.

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Improved Safety Tools for Small Enterprises through Lean Start-up and Design Thinking

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Background

Work in the construction industry is consistently among the most hazardous in the United States in terms of injuries, illnesses, and fatalities [BLS 2016]. Although the definition of "small" is fluid, in 2007 roughly 80% of construction payroll establishments had fewer than 10 employees [CPWR 2013]. These smaller enterprises "suffer a disproportionate share of fatal work injuries" within the construction industry [CPWR 2013]. Several traits of small businesses that have been identified as contributors to this disparity should influence the design of any product or service meant to improve health and safety outcomes for small construction businesses. These include

1. isolation from broader industry networks [Champoux and Brun 2003; Hasle and Limborg 2006];
2. lack of dedicated safety resources [Champoux and Brun 2003; Hasleet al. 2012];
3. lack of a safety culture [Cunningham and Sinclair 2015];
4. owners playing an outsized role in the survival of the company [Hasle and Limborg 2006; Hasle et al. 2012]; and
5. lack of awareness of the level of risk [Hasle et al. 2010].

Here we describe the efforts of the Research to Practice Team at the National Institute for Occupational Safety and Health (NIOSH) to supply small construction businesses with information to improve worker health and safety outcomes. Because the goal was to create a tool that would provide some measure of assistance that might otherwise be shared via a safety consultant, we entitled the project as the Virtual Safety Consultant.

Initial project plan

The original conception for the Virtual Safety Consultant involved recasting existing NIOSH publications in a simpler, shorter format to make the documents more usable by small business owners. The project scope was narrowed to include only publications that were relevant to the construction industry, specifically residential construction. The project was organized into five major phases:

1. inventory all existing NIOSH publications for construction content;
2. organize the content by profession and task;
3. summarize the content, rewrite it in plain language, and provide illustrations when valuable;

4. design these newly produced modules for the web; and
5. use the web-based modules to feed a mobile app.

This plan did not include any analysis of customer demand. As the project began, it was uncertain which elements of NIOSH construction content should be synthesized. What information would there be demand for? This marked a pivot from the initial project plan toward incorporating principles from lean start-up, design thinking, and agile methods.

Lean start-up, design thinking, and agile methods

Although the details and histories of lean start-up, design thinking, and agile methods differ, these business concepts have several traits in common. Each forces the user to understand customer or audience needs and motivations. Each requires users to articulate and then challenge assumptions in an iterative manner. Each functions by testing scaled versions of a product. And each of the approaches encourages users to test the riskiest assumptions first and to fail quickly. Whereas they are useful for different stages in a product's lifecycle, these practices all create value for the end customer.

Lean Start-up

Lean start-up was born out of the highly successful Toyota manufacturing process, and the term was first coined in 2008 by entrepreneur Eric Ries. Lean start-up values rapid development and the creation of what is termed a "minimum viable product" (MVP)—in essence, the simplest version of a product, based on a minimum set of features necessary for customers to take the product seriously. The MVP is built around the designer's perceptions of what the end customers will value. These assumptions are tested by early users, and their responses are measured. Evidence-based decisions can then be incorporated into the next iteration of the product. More features are added to the MVP as test data prove that the product accurately addresses user demand. If the core assumptions are wrong, a project pivot is necessary. The pivot is a structured course correction designed to test "a new fundamental hypothesis about the product, strategy, and engine of growth" [Ries 2011].

Design Thinking

Whereas lean start-up emphasizes getting an MVP to market as quickly as possible, design thinking takes a step back, placing more emphasis on learning about customer needs before any product development occurs. An audience is identified and assumptions about that audience are articulated. "Customer discovery" interviews test the validity of the assumptions. Each time an assumption is proven true, it is refined to probe a deeper level of customer need. When assumptions are disproven, they enable a pivot toward a new line of customer discovery. The information accrued through the customer discovery process informs the development of the MVP, which is then iteratively tested with customers [Osterwalder and Pigneur 2010; Martin 2009].

Agile Method

The agile method is used mainly in software development. It is thought to bring more adaption to a changing environment, allowing a quick response to change through iteration. Being unable to forecast everything, an agile process starts with a vision of the project's endpoint but accepts that the path to that endpoint will be in constant flux

[Sims and Johnson 2012]. This approach is guided by the "Agile Manifesto," which emphasizes people over processes and tools, prototypes over documentation, responding to change over following a plan, and customer collaboration over rigid contracts [Pressman 2014].

Applying These Methods to the Virtual Safety Consultant

After deciding to incorporate facets of design thinking, lean start-up, and agile methods in the Virtual Safety Consultant, we took the first step, which was to articulate project assumptions:

1. Small construction businesses care about safety.
2. The universe of NIOSH research covers enough to be valuable.
3. A hazard-recommendation approach works.
4. Small construction businesses want a tool.
5. Digital is the right medium.

Iterative design

The first three assumptions were tested by presenting reviewers with different types of content on the same topic in an effort to build a minimum viable product. Unlike a full, accurate, approved tool, an MVP is something that can be tested and takes little effort to create. To keep the MVP minimal, we focused it on only five common residential construction topics: painting, framing, insulation, excavation, and electrical work. Within each topic, several modules presented content in four different ways: how-to instructions; hazard identification plus recommendations; regulations; and incident reports. In the building of these modules, the limitations of the second assumption became quickly evident. Therefore, the modules included regulations from the U.S. Occupational Safety and Health Administration (OSHA), incident reports from NIOSH's fatality investigation program, hazard identification from NIOSH publications, and how-to instructions from across the internet.

For example, the painting section contained modules on OSHA regulations for removing lead paint; a story of a painter who was electrocuted; information about the hazards of sandblasting and how to avoid them; and instructions on how to paint high walls and ceilings, courtesy of Home Depot. Each of the five topics included about 30 modules, resulting in 150 short modules in total.

Three participants who represented the target audience (a carpenter who worked in a small shop, a full-service maintenance operator for an apartment complex, and a proprietor of a handyman company) reviewed the MVP via individual, permissions-protected websites using Blogger, a free-web management tool from Google. For 6 consecutive weeks, the reviewers were assigned a series of modules to review and participated in weekly qualitative phone interviews. Web analytics and interview notes were collected and analyzed, and reviewer feedback was incorporated into the following weeks' modules, informing the iterative development of the MVP.

Lessons learned

All three of the professional reviewers were drawn in by the incident reports. Each report described the timeline and setting of a real workplace fatality and recommendations on how to protect against a future incident of a similar nature. The reviewers

strongly identified with the subjects in each of the scenarios, some even sharing personal stories of similar situations they had encountered. During one iterative development cycle, the recommendations were removed and the web page was modified to prompt reviewers to answer what should have been done to avoid the fatality. Reviewers were deeply engaged even with this minor level of interactivity.

None of the reviewers had any interest in reading regulations, even in a simplified form. They also responded positively to how-to videos that demonstrated a process or best practice. Long video length or low production quality didn't dissuade viewership, as long as the person in the video seemed competent. The reviewers also liked seeing lists of tools and supplies that could be used for job planning and checklists that could help keep a job on track.

The weekly feedback and iterations made to the MVP demonstrated that the customers were not looking specifically for a safety and health tool. They desired content that would help them do their jobs better, more quickly, and less expensively, and if it improved their safety and health, then that was a nice bonus.

Customer discovery

This experiment with the Virtual Safety Consultant MVP left the project team with new questions and a new hypothesis to test more broadly: *Small business owners and managers will use our tool to do their jobs better, but also more safely*.

This hypothesis was founded on several assumptions, which needed to be tested. The first three assumptions were

1. Small construction businesses seek out information on how to do their work better and more efficiently.
2. Safety is not a top priority for small construction businesses.
3. Small construction business owners are not safety experts.

To test these assumptions, we conducted customer discovery interviews in person and over the phone. Specifically, interviews were targeted to residential construction business owners and managers with 20 or fewer employees and other stakeholders in this ecosystem. In total, 24 interviews were conducted: 13 with small business owners or managers, 5 with contractors or laborers, and 6 with industry intermediaries (researchers, chambers of commerce, or small business administration).

Lessons learned

Through these interviews, it became apparent that the target audience members do indeed seek out information about their work, and almost universally they start by searching the internet. In their peer networks, they value input from suppliers, manufacturers, and colleagues with whom they have worked.

It was expected that cash flow would be the top business priority for the audience. This assumption was wrong; most interviewees mentioned meeting customer needs as their top business priority. Several also described workforce maintenance ("finding warm and sober bodies") as being a primary stressor. Universally, they cared about safety. However, as it was assumed, safety was not the top priority.

The last assumption (lack of safety expertise) was only partially true. Interviewees took pride in their experience and considered safety knowledge to be a part of what made them a pro. Many knew the greatest hazards they faced in a given task. However, the interviews did not probe about in-depth safety expertise or knowledge outside of their area of expertise. Some interviewees spoke about barriers they face to engaging in safety practices.

Conclusion

This project started as an attempt to build a tool—a Virtual Safety Consultant—to supply small construction businesses with information to improve their health and safety outcomes. As this project began, however, customer demands and preferences were not fully understood. This lead to a pivot to incorporate lean start-up, design thinking, and agile methods. Participant reviews and customer discovery interviews were conducted with the target audience. This feedback challenged project assumptions and enabled us to iteratively build upon the minimal viable product. Involving small construction business owners while designing the Virtual Safety Consultant makes it more likely to be usable for them.

This project is not complete. The project team will continue to apply these methods and insights to revamp and retest the minimal viable product, in an effort to move closer to designing a tool that small construction businesses will actually want to use.

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Aging Workforce Issues in Small Businesses: Preliminary Findings

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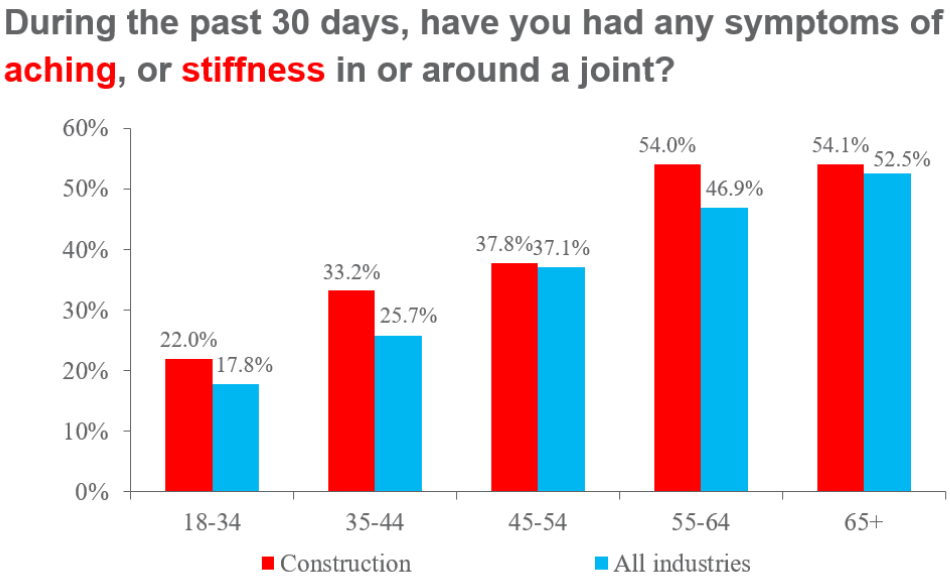
Background

Among construction workers, workplace musculoskeletal disorders (WMSDs) are a significant portion of non-fatal injuries and a major cause of functional impairments [LeMasters et al. 2006], disability [Brenner and Ahern 2000], and lost productivity [Meerding et al. 2005]. Construction workers tend to experience higher rates of WMSDs (such as pain, aches, and joint stiffness) than do workers in other industries [Dong et al. 2016]. These rates also increase among older workers (see Figure 1). Between 1985 and 2015, the average age of construction workers in the United States increased by 6.5 years, with the average age being 42.5 in 2015. That is higher than the increase in average age of workers in all other industries, which was 4.9 years (42.2 average age in 2015) [Dong et al. 2016].

Figure 1. Rates of Musculoskeletal Injury Across Age Groups in Construction and All Industries



Source: 2015 National Health Interview Survey. Calculations by The CPWR Data Center.

Small businesses make up about 80% of all construction enterprises but often do not have adequate access to resources on worker safety [CPWR 2013]. For example, small contractors (1–9 employees) lag behind large contractors (500+ employees) in

indicators of safety culture [CPWR 2016]. Whereas 90% of large firms have safety goals and objectives included in their overall mission, only 37% of small enterprises do. Also, 74% of large construction contractors include safety and health agenda items in their regular meetings, compared to 25% of small companies. Whereas 80% of large contractors require 10-hour OSHA training, only 53% of small businesses have this requirement.

Addressing the aging workforce requires an evidence-based theoretical framework. One is *work ability*, which is workers' capacities to continue working in their jobs given reasonable working conditions and adequate resources [Ilmarinen 1999; Silverstein 2008]. There are four ways employers can meet the needs of their aging workers. First, they can make changes or improvements to the *work environment*, which includes physical or environmental conditions that can improve or impede worker safety and health [Silverstein 2008]. Second, employers can adapt and make improvements to the *Organization of work*, which refers to such things as work schedules, job designs, relationships with supervisors and co-workers, and decisions related to work organization [Silverstein 2008]. Third, Organizations might also offer programs that benefit *individual worker health*, such as information about healthy diet or training to improve skills. According to Ilmarinen [1999] and Silverstein [2008], companies can take individual measures to protect workers as well as promote their health and improve their skill sets. Finally, *social support* refers to making community-based support services available or protecting workers from age-based discrimination [Silverstein 2008].

Creating resources and guidance that are inclusive of the needs of small businesses requires an understanding of the issues of work ability and the needs of aging workers that resonate with small business owners. The findings in this report address issues identified by small business owners that suggest ways to generate and disseminate resources for small businesses. The findings have implications for ways to benefit aging construction workers, as well as workers in other sectors.

Methods

Respondents

The researchers conducted a focus group of nine small-business owners, who employ fewer than 20 workers in physically demanding and not physically demanding jobs. Two of the nine participants own construction firms. Other industries and occupational groups represented were warehousing, firefighters, clerical settings, and light retail companies.

Data Collection

The purpose of the focus group interview was to collect verbatim responses from the small business owners for qualitative analysis (described below). A facilitator, who was a member of a research firm external to NIOSH, conducted the focus group session. She posed series of questions (generated by the researchers) to the respondents to gather their experiences, perspectives, and knowledge about the aging workforce. The session was conducted at the office of the research firm and lasted about 90 minutes. The session was audio-recorded and the recorded responses were later transcribed into a script format.

The NIOSH researchers developed the focus group questions with the facilitator's input in advance of the session. The questions touched on the perceived health and safety needs of aging workers; generational differences and/or tensions that might affect safety and health outcomes; currently used and needed guidance that address safety and health issues at work; current safety and health practices they implement at work; and barriers and challenges that prevent them from addressing the safety and health needs of aging workers.

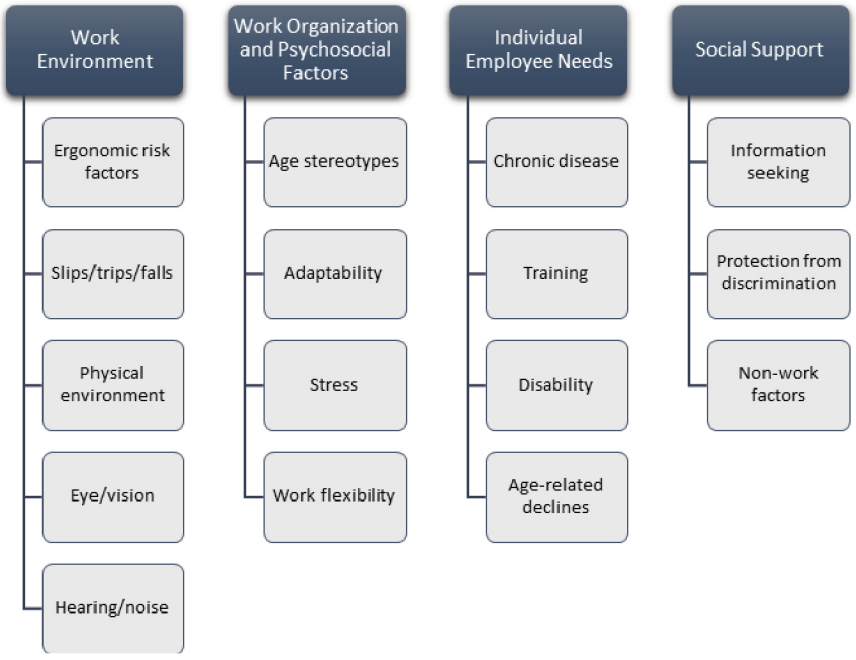
Data Analysis

The researchers obtained a verbatim transcript of the focus group session and coded the responses inductively, using the NVivo 11 software package. Thematic analysis was used to code responses into one or more of four primary themes representing the components of the work ability model: (a) work environment, (b) work organization and psychosocial factors, (c) individual employee needs, and (d) social support. The authors implemented intercoder agreement (ICA) by independently coding one-fourth of the original transcript. The ICA revealed an average of 60% agreement across the four primary themes. Once the researchers resolved the coding discrepancies, they coded the remaining responses by separating statements that reflected distinct thoughts about one of the four primary themes. Multiple thoughts that repeated a more specific aspect of that primary theme were coded into emergent sub-themes. Coding continued until the analysis reached saturation [Fusch and Ness 2015].

Results

Each of the four primary themes represents an approach to meeting the work ability needs of aging workers. Each primary theme contains sub-themes that reflect more specific aspects. Figure 2 illustrates the final coding of the themes and sub-themes according to the work ability framework.

Figure 2. Approaches to Meeting the Work Ability Needs of Aging Workers



Work Environment

The sub-themes emerging within *Work Environment* were ergonomic risk factors (proper movement during tasks; interaction between equipment and the people who use them), slips/trips/falls (caused by poor surfaces or other physical hazards), physical environment (physical aspects that help or hinder safety; building issues), eye/vision (threats to eye health or efforts to safeguard the eyes), and hearing/noise (hearing loss or damage, not because of age-related decline). When talking about older workers, one small business owner commented that a physical threat was ". . . slips and falls. Yeah, going down physically; going down." The physical environment was viewed as especially impactful on older workers. Another participant commented:

> *From our perspective—small businesses operating in the older building, right?—there's a lot of risk with this. There's, you know, from lead potential from even the build-up of dust to, you know, some animals and all that good stuff, and this is in downtown.*

These and other comments suggest that small business owners view adjustments to the work environment important, especially to accommodate age-related changes, such as strength and endurance, balance, and vision or hearing declines.

Work Organization and Psychosocial Factors

Within *Work Organization and Psychosocial Factors*, the sub-themes were age stereotypes (views of traits or characteristics attributed to an age group; perceived or actual differences among age groups), adaptability (ability to adjust to changing conditions or demands), stress (response to an excessive demand or threat at work), and work flexibility (work schedules or arrangements that help workers maintain a work/life balance and improve productivity and efficiency). Some participants seemed to perceive that older workers are hesitant to learn new ways of doing things:

> *Some work that we do . . . with municipalities, etc., with older or more-seasoned workers is that when a particular safety measure or policy is put in place, as simple as putting on a hardhat, that the folks who have been in that space for 25/30/40 years, they don't see any reason for that at all.*

When discussing how workers' needs changed, one owner described what might encourage older workers to be more adaptable:

> *I would say they look for more of a, a more well defined job description with some parameters. You know, where there's a lot of physical activity, you better make sure that you've got the up-to-date and necessary equipment to assist them to help them do their job.*

Another comment linked adaptability with stress: "Our greatest risk is accumulated stress because we're not moving around a lot and we're dealing with tight schedules and having to be creative instantly and pull a rabbit out of your hat all the time." In general, older workers were perceived as less adaptable, and this limited adaptability could be seen as a source of stress for older workers.

Individual Employee Needs

The theme of I*ndividual Employee Needs* included chronic disease (persistent health conditions that become more severe with age), training (enabling employees to improve their skills and organizational knowledge), disability (physical, cognitive, sensory, or other impairment that is not attributed to the job), and age-related declines (physical or cognitive losses due to age, not working conditions). Many small business owners appeared to express concern about their employees' chronic conditions. One comment suggested a personal interest in how employees were handling their conditions:

> *We have a number of folks who have terminal illnesses and you know they have to take medication and things of that nature, and I guess I don't ask them if they are okay because I see them and I know they are medicating for their own safety.*

Another concern was the need for training but its perceived lack of effectiveness with older workers:

> *We've done training and that's around awareness, but the individuals have to actually practice what they learn to change the behavior toward more safe and safety behavior. And that's a challenge where we think, you know, you can teach [an] old dog new tricks but some of the old dogs say, you know, in the last 60/65/70 years, I'm good.*

In general, the owners appeared to recognize that employees have various individual needs that could be addressed through company-wide efforts, such as healthcare and wellness programs, appropriate design of training, and age-specific approaches to training. However, there appeared to be challenges to bringing the training or programs to the workers.

Social Support

Social support implies that many aspects of daily living outside of work (related to family or employment laws, for instance) can affect the way a company can manage an aging workforce and meet employees' work ability needs. Many of the comments emerging in the social support discussion touched on economics, or how limited resources were a major barrier to providing for workers' economic needs. One owner said this:

> *I often find in the retail sector you often get minimum wage workers who work in that industry for a long period of time . . . And so, having a solid 401(k), sick leave, vacation time, and the like, and so extending those opportunities to part-time workers to the extent that it makes sense, and often small businesses can't afford to do that.*

Such economic issues were coded under social support because owners' comments suggested that there were economic forces external to their company that forced them to cut certain benefits. To combat the lack of resources, many owners talked about looking to their industry peers for information or just for a source of comparison:

In a strategic sense meaning, what I try and do is compare our claim's data on property and casualty and our workers compensation to peers in the industry. Are we higher, lower, average? And if I know I'm higher or I know I'm average, I have some room for improvement. Things that are working if I'm below benchmark are probably pretty good, but the data is not easy to obtain.

Discussion and Conclusion

The factors affecting work ability (work environment, work organization, individual employee needs, and social support) suggest useful avenues for the development of effective tools and integrated approaches that may lead to safe and healthy workplaces not only for older workers but for workers of all ages. The initial results of the needs assessment point to the necessity of guidance that focuses on work demands (such as modification of work tasks), work organization (such as flexible schedules), workers' health and function (such as wellness programs), and workers' and managers' professional skills (such as training on new technologies and training on age stereotypes). Success in developing useful and relevant guidance in these areas requires further understanding of the needs of specific sub-sectors (such as construction) and their workers.

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Conference Agenda

Tuesday, October 24, 2017

6:00–8:00 pm	Welcome Reception

Wednesday, October 25, 2017

Time	Session	Presenter
8:00–8:30am	Registration and Coffee	
8:30–10:00am	Worker Well-Being and Sustainable Business Health Plenary	
	Welcome Address	Paul Schulte Mizralm Cordero Thomas Cunningham Lee Newman
	Keynotes	Gloria Sorensen Peter Hasle
10:00–11:15am	Poster Session	
11:15am–12:00pm	Lunch	
12:00–1:45pm	Research to Practice Plenary	
	Keynote	John Boudreau
	Panel Discussion	Anca Bejan Garrett Burnett Heidi Hudson Tony LaMontagne David Parker
1:45–2:00pm	Break	
2:00–400pm	Concurrent Workshops	
	Improving Safety in Small Enterprises	David Parker Daniele Champoux Paul Schulte Kazutaka Kogi
	The Informal Economy	Jaime Butler-Dawson Lyndsay Krisher Yesuneh Gizaw Shamusideen Kadiri Josefina Flores Morales

Time	Session	Presenter
	Tools, Resources, and Systems for Small Enterprises	Ilonka Sommen Marc Malenfer Filip Pelgrims Natalie Schwatka
	Total Worker Health® in Small Enterprises	Ann-Beth Antonsson Diane Rohlman Liliana Tenney Brenda Jacklitsch
	Vulnerable workers	Stephanie Sayler Noah Seixas Michael Flynn Kevin Walters
	Workers and Their Families	Vicki Shabo Kelsie Daigle Shalyn Stevens Michelle Haan
4:00-4:15pm	Break	
4:15–5:45pm	Concurrent Workshops	
	Ergonomics in Small Enterprises	Sheryl Ulin Caitlin DeClercq Colleen Brents
	Impact of Business Size	Ann Marie Dale Tommaso Tempesti Cameron Mustard
	Meaningful Work	Adelyn Shimizu Ethan Merk Joshua Scott
	Support Networks	Albert Tien Helena Palmgren Marc Malenfer
	The Role of Public Health in Small Enterprises	Deborah Hoefler Cheri Prochazka Mitzi Schindler Jennifer Tellis Katie Haas Cheri Miller

Time	Session	Presenter
	USE Conference in Review: What Have We Learned and Achieved Since Then	Ann-Beth Antonsson Lisa Brosseau Thomas Cunningham Peter Hasle Hans Jorgen Limborg David Parker Diane Rohlman Paul Schulte Noah Seixas

Thursday, October 26, 2017

Time	Session	Presenter
8:00–8:30am	Registration and Coffee	
8:30–10:00am	Small Business Perspective Plenary I	
	Keynote	Knut Ringen
	Panel Discussion	Bill Brazile Tom Coohill Thomas Cunningham Joshua Vigil
10:00–10:15am	Break	
10:15am–12:15pm	Concurrent Workshops	
	Health and Safety Management Systems	Willie Avelar Brandon Dickinson Todd Mall Keith Minor Georg Nix Bill Brazile Patty Jeffries Jason Santistevan Kevin Suber Eric Tyrell

Time	Session	Presenter
	Health Services for Small Enterprises	Kuck Hyeun Woo Jiro Moriguchi Kristina Rajala Anca Bejan
	Prevention in High Risk Industries	Hans Jorgen Limborg Sandrine Caroly Deborah Gaudin Yumi Sano Paulo Pereira
	Occupational Safety & Health in Small Industrial Settings	Kultilda Bunjongsiri Norvil Antonio Mera Chu Alexis Rydell David Parker
	Wellness Programs in Small Enterprises	Cristina Banks Isabelle Thibau Laurie Cluff Natalie Schwatka Claire Brockbank Kim Jinnett Lee Newman Rachel Kramer
	Workplace Health and Safety in Construction	Garrett Burnett Gino Fazio Thomas Cuningham Bermang Ortiz Juliann Scholl Eileen Betit
12:30–1:30pm	Lunch	
1:30–3:45pm	Small Business Perspective Plenary II	
	Keynote	David Weil
	Panel Discussion	Josh Kreul Kyle Littman Emily Prisco Diane Rohlman
3:45–4:30pm	Awards Presentation	

Friday, October 27, 2017

Time	Session	Presenter
7:30–8:00am	Registration and Breakfast	
8:00–10:00am	The Future: Where Do We Go from Here Plenary	
	Keynote	Luz Stella Marin
	Panel Discussion	Kelly Holmes Meridith Marshall Liliana Tenney Kimberly Watkinson
10:00–10:15am	Break	
10:15–11:15am	Integrated Approaches Plenary	
	Keynotes	Lisa Brosseau Tony LaMontagne
11:15am–12:00pm	Closing Remarks	Greg Baxter John Howard Lee Newman

Poster Presentations

October 25, 10:00 – 11:15am

1. A Mixed-Methods Analysis of Logging Injuries in Montana and Idaho
   John Rosecrance (presenting on behalf of Elise Lagerstrom)
   Colorado State University
2. Applying Fundamentals of Total Worker Health Approaches: Essential Elements for Advancing Worker Safety, Health, and Well-Being
   Sarah Mitchell
   Office for Total Worker Health, National Institute for Occupational Safety and Health (NIOSH)
3. Correlation between Weekly Exercise Duration and Light Duty and Lost Time: A Cross-Sectional Analysis of an Occupational Working Population
   Skyler Walker
   Rocky Mountain Center for Occupational and Environmental Health, University of Utah School of Medicine
4. Health-Related Predictors of Workers' Compensation Claims
   Erin Shore
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5. Occupational Physical Activity in Active and Sedentary Work
   Janalee Thompson
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6. Opioid Use: Case-Control Analyses of Workers' Compensation Data
   Ulrike Ott
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7. Overlapping Vulnerabilities of Immigrant Safety Training in Small Construction Firms
   Brenna Keller
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8. Safety Visits to Small Private Day Care for Babies and Toddlers
   Hilde De Raeve
   Group IDEWE, External Service for Prevention and Protection at Work
9. Sleep Habits and Frequency of Excessive Daytime Sleepiness in Shift-Work Security Agents from an Agency in Piura-Peru
   Norvil Antonio Mera Chu
   Universidad de Piura
10. Social Media Influence: Messaging and Marketing Total Worker Health to Engage Small Businesses and their Millennials
    Kaylee Rivera
    Center for Health, Work & Environment, Colorado School of Public Health

11. The Role of Leadership as a Success Factor in the Establishment of Preventive Culture in SMEs in the Food Industry

    Constanze Nordbrock
    Berufsgenossenschaft Nahrungsmittel und Gastgewebe

12. Total Worker Health: Overcoming the Barrier of Perceived Cost for a Small Business' Small Budget

    Tonia Smith
    City of Cincinnati Health Department

13. Vocational Colleges – Unique Opportunities to Enhance Safety and Health in Small Businesses. The Technical Education Curricula for Health and Safety (TECHS) Study

    Anca Bejan
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