Creating a Climate for Ergonomic Changes in the Construction Industry

Laura Boatman, BA,[1] Debra Chaplan, BA,[1] Suzanne Teran, MPH,[2] and Laura S. Welch, MD[3]*

Background *Ergonomic solutions that have gained acceptance in other industries are often considered not applicable to a construction work environment, even though the industry is characterized by high physical work demands.*
Methods *We conducted 50 key informant interviews with 23 contractor representatives and 27 union staff, plus 4 focus groups with a total of 48 workers.*
Results *Many workers hold the belief that WMSDs are inevitable as part of the job, and did not consistently believe that changing the nature of the work could prevent that injury or pain. The interviewees reported limited availability and accessibility of tested and effective tools that both reduce physical demand and also get the job done efficiently and effectively. Yet for each major obstacle to implementation of ergonomics in the industry identified, the construction professionals we interviewed offered a variety of solutions.*
Conclusions *Contractors, unions, and workers need to work together to find actions that work within the parameters of the current economic environment.* Am. J. Ind. Med.

KEY WORDS: construction; ergonomics; qualitative; focus group; intervention; musculoskeletal disorder; MSD

INTRODUCTION

Construction is one of the largest industries in the United States, with 11.1 million workers [CPWR The Center for Construction Research and Training, 2013]. The physically demanding nature of the work in construction includes manual material handling, awkward and static postures, vibration, and a harsh outdoor environment, and strains and sprains are the most common type of work-related injury in construction. [Schneider, 2001; CPWR The Center for Construction Research and Training, 2013] Cross-sectional studies reveal a high prevalence of chronic musculoskeletal symptoms and musculoskeletal disorders among construction workers. [Hunting et al., 1994; Silverstein et al., 2002; Holmstrom and Engholm, 2003; Merlino et al., 2003; Goldsheyder et al., 2004; Spector et al., 2011]. A national US survey found that when occupations were ranked by their physical demands construction occupations were consistently at the top of the list for kneeling/crawling/stooping/crouching, for climbing, and for twisting and bending [Tak and Calvert, 2011]. The economic and social costs are also significant; construction workers are less likely to return to work after a musculoskeletal injury than workers in other occupations [Rossignol et al., 1988; Oleinick et al., 1996; McIntosh et al., 2000; Turner et al., 2000], and are more likely to retire with a disability [Brenner and Ahern, 2000; Arndt et al., 2005].

Ergonomic solutions that have gained acceptance in other industries are often considered "not applicable" to a construction work environment. Among 32 Midwestern construction firms ranging in size from 6 to 3,000 workers, well more than 90% of the companies had a written safety

[1]State Building and Construction Trades Council of California, California
[2]Coordinator of Public Programs, Labor Occupational Health Project, University of California at Berkeley, California
[3]CPWR: Center for Construction Research and Training, Medical Director, CPWR, Silver Spring, Maryland
*Correspondence to: Laura S. Welch, MD, CPWR: Center for Construction Research and Training, Medical Director, CPWR, 8484 Georgia Ave, Silver Spring, MD 20910. E-mail: lwelch@cpwr.com

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program and only a third had an ergonomic program [Choi, 2012]. Management and employees at all levels of the industry say that construction work is just hard and there is simply no way to avoid wear and tear on workers' bodies. Existing research provides invaluable information on kinds of tools used, the repetitive actions, the body positions, how jobs are planned and implemented, and the introduction of tools, processes, and technologies that can mitigate strain and sprain-type hazards. There is little research on the actions or specific messages that can move the industry to change ergonomic practices, equipment, and policies. This study was designed to assess current attitudes and perceptions among contractors, unions, and workers about ergonomics, barriers and motivators for changing the physical demands of the work, and what kinds of messages could be used in the industry to promote programs to prevent these injuries.

Prevention of injury and illness among construction workers required dissemination, adoption, and implementation of effective interventions, or research to practice (r2p) [National Academy of Sciences National Research Council, 2008; Gillen, 2010]. Regulation would require employers to make changes, but knowledge, attitudes, and work practices can evolve significantly even without regulation. In a 2005 study on the implementation of interventions in the construction industry [van der Molen et al., 2006], the authors identify seven levels of changing behavior with respect to intervention measures: being aware of the intervention, understanding it, wanting it, intending to buy/lease it, ability to use it, using it, and continuing to use it. The authors conclude that on every level, an obstacle can arise that would cause an actor not to proceed in the change process.

Social marketing is the "application of commercial marketing technologies to the analysis, planning, execution, and evaluation of programs designed to influence voluntary behavior of target audiences in order to improve their personal welfare and that of society" [Andreason, 2004]. Social marketing aims to go beyond individual behavior change, and to affect the larger environment by creating a culture that facilitates preventive health behaviors [Kaggwa et al., 2008]. There is evidence that social marketing campaigns lead to an increase in the use or adoption of health behaviors, and that mass media interventions are effective in influencing behaviors and practices [Mustard and Bielecky, 2007]. Kreuter [Kreuter and Bernhardt, 2009] points out the need for marketing and distribution systems for public health interventions of all kinds.

Social marketing uses a strong formative research approach, working at the initial stage of intervention development to assess beliefs, perceptions, behaviors, the environmental structures, and other factors that may inform intervention development and enhance intervention effectiveness [Mustard and Bielecky, 2007]. This study was designed to undertake that formative research needed for a social marketing campaign around ergonomics in construction.

METHODS

We conducted 50 individual key informant interviews, taking an average of 45 min, with 23 contractor representatives and 27 union staff and 4 focus groups of 90 min each with a total of 48 workers. The State Building and Construction Trade Council of California invited participants through an established network of affiliate unions, signatory contractors, and joint labor/management apprenticeship programs using letters, presentations about the project at safety meetings, local building trades council meetings and trainings. In addition, we conducted personal, one-on-one recruitment.

Each group was asked questions addressing:

- Understanding of ergonomics;
- Attitudes relative to impact of WMSD;
- Strategies currently used on the job to address WMSD;
- Work role and approach to ergonomic solutions on the job;
- Obstacles to addressing WMSD hazards and attitudes about ergonomics and ways to overcome those obstacles;
- Messaging: what resonates for construction professionals about ergonomics and WMSD.

We established a working definition of "ergonomics" so that all interviewers used the same framework. We used "ergonomic injuries" to describe a group of injuries that include repetitive motion injuries, back problems, sprains and strains, and injuries like carpal tunnel syndrome (CTS), tendinitis, and rotator cuff tears. We used "ergonomic hazards" to refer to the work conditions and tasks in construction that may result in these types of injuries. However during the interviews, we did not give participants a definition of "ergonomics."

Each interview was scripted for consistency and tape-recorded with the permission of the interviewee for accuracy. Each participant's identity was kept strictly confidential, no individual names or company names are used in any references, and no responses are tied to any individual respondent. No participant declined to be recorded or declined to answer any questions. The study was approved by the IRB of the Center for Construction Research and Training.

We created a matrix/database of interview responses from transcripts, then reviewed interview notes and searched the database for key words and phrases. The interviewer developed themes with input/review from two co-investigators. We categorized responses into themes,

and determined the relative strength of each theme by counting responses for each theme [Seidel, 1995; Anonymous, 2012].

RESULTS

Survey results are presented in the following themes: knowledge and awareness of the term "ergonomics," actions taken by contactors to control hazards, how workers assess the risk of WMSDs, which solutions work and which don't, barriers to applying ergonomic principles and ideas for overcoming those barriers, changes in safety culture, and motivators/messages for change.

Demographics

We surveyed a combined total of 98 individuals, the majority of whom represented unionized companies and workers. The union and contractor representatives were very experienced, averaging 29 and 19 years working in the trades, respectively. Almost half were between 46 and 55 years old, consistent with the average age of construction workers generally. Table I presents more details on the participants.

The majority of contractor representatives held positions as safety managers. They reported they had considerable authority for training, enforcing policy, handling worker complaints, safety policy and regulatory compliance, work practices/procedures and selection of tools/equipment. The majority of union representatives reported having considerable control over training and regulatory compliance, with slightly less power over job site conditions and safety policy.

Knowledge and Awareness

Reaction to the term "ergonomics"

Contractors and union representatives demonstrated a high level of recognition of the term "ergonomics," making reference to body mechanics, types of tool modifications and injuries that could result. In contrast, 40% of the workers did not know what the term meant.

Importance of ergonomic risk and WMSDs

When asked about specific types of injuries or health conditions, the issue of greatest concern to union representatives and contractors was back and joint pain, followed by fatigue and shoulder problems (Table II). Workers in focus groups also responded that they were very concerned about these types of injuries and by far, the interviewees believed that they see more ergonomic injuries than other injuries (Table III).

When we asked whether ergonomic injuries are given as much attention as other injuries, contractors and union representatives had opposite opinions (Table IV). One general contractor summed up the majority contractor viewpoint when he said, "Because it's not an acute thing. . .not as obvious as seeing blood, or a very distinct injury that someone will see, it's just under the radar for a lot of companies out there."

We asked if workers report these injuries when they become aware of them, and if not, why not. Nearly twice as many union representatives felt that workers did not report injuries than did contractor representatives. They cited a variety of reasons, including machismo and trying to show they are tough; fear of losing their jobs if their bosses know that they're hurting and may potentially slow production; and missing paychecks if they took time off. All groups cited the current economy as having a dampening effect on injury reporting, by creating an atmosphere where workers fear jeopardizing their employment.

Actions Taken to Control Risk of WMSD

We asked if contractors employ programs on job sites to prevent ergonomic injuries, and if the union reps have seen such programs. This open-ended question yielded a large variety of responses (see Table V). The top three actions used to address WMSD reported by both contractors and unions were the same: changes in tools and equipment, training and education, and stretch and flex programs.

Tools and Equipment

Several times, interviewees mentioned that they thought tools had greatly improved in recent years, with the availability of lighter weight and more balanced power tools, hand tools with handles available in different sizes, with padding, and with a better fit; vibration dampening on tools; shock absorbing seats in heavy equipment; rebar-tying gun and other tool extensions to reduce bending; power tools that replace manual work; overhead drilling equipment; and mechanical lifts and carts for easier material handling.

Training and Education

Both contractors and unions are implementing training programs to raise awareness; however, the predominant topic cited is proper lifting techniques and back injury prevention. Some union representatives felt that bigger contracting companies are more likely to have ergonomics training than smaller companies. Generally, the tone was positive about training as a solution for WMSD.

TABLE I. Characteristics of Participants

Contractor reps	Union reps	Workers
Total Surveyed = 23	Total Surveyed = 27	Total Surveyed = 48 (all union)
Union = 20, Non-union = 3	Male = 26 Female = 1	Male = 34 Female = 14
Male = 18 Female = 5		
Job Titles:	Job Titles:	
Safety Manager/Director = 11	Business Agent/Business Rep = 11	
Safety Liaison = 1	Apprenticeship Coordinator or Instructor = 9	
Vice President-Safety = 1	Business Manager = 1	
Field Superintendent/Safety Coordinator = 4	Field Rep = 1	
Purchasing/Shop Manager = 1	Foreman = 1	
Operations Administrator = 1	Journeyman = 1	
General Superintendent = 1	Organizer = 1	
Foreman = 1	Dual Business Rep & Apprenticeship Coordinator = 2	
Risk Manager = 1		
Safety Engineer = 1		
Type of contractor:	**Trades represented: 16**	**Trades represented: 10**
General = 7	Boilermakers	Bricklayers/Masons
Roofing/Waterproofing = 1	Bricklayers and Allied Crafts	Carpenters
Heavy construction,	Cement Masons	Electricians
underground utility, heavy	Drywall Finishers (Painters)	Gas/Electrical Service
road work = 4	Electrical Workers	Iron Workers
Electrical = 3	Floor Coverers (Painters)	Plasterers (Cement Masons)
Mechanical-HVAC = 4	Glaziers (Painters)	Plaster Tenders (Laborers)
Insulation = 2	Heat & Frost Insulators	Roofers & Waterproofers
Rebar/Reinforcing steel = 1	Iron Workers	Sheet Metal Workers
Specialty (Iron Workers,	Plaster Tenders (Laborers)	Tile Setters
Carpenters, Laborers, Roofers) = 1	Plasterers (Cement Masons)	
	Plumbers/Pipefitters/HVAC	
	Roofers & Waterproofers	
	Sheet Metal Workers	
	Steamfitters	
	Teamsters	

Stretch and Flex Programs

Twenty-three out of 50 contractor and union interviewees noted using daily stretching exercise programs on-the-job. Most are described as 10–30 min stretching sessions lead by a foreman or designated worker at the beginning of each day, using a series of predetermined exercises designed to warm-up the body and prepare workers for a strenuous day of work.

Personal Protective Equipment

Mention of PPE was limited to padding for knees, elbows, and working on the ground; wrist braces; anti-vibration gloves; and work boots to protect/support ankles.

We asked contractors and union representatives to rank which type of solutions they are most likely to implement or advocate: purchasing/using redesigned tools, equipment or material; developing a written ergonomics policy; or providing worker training on ergonomics. Contractors and union representatives agreed on their top 2 choices, (a) provide training and (b) purchase/use new tools and equipment. Union representatives were quick to point out however, that cost is a major factor for the workers when purchasing tools that may affect their ability or desire to buy redesigned or specialty tools. Throughout the survey, many interviewees commented that basic tools of the trade had not changed much over the last 100 years.

TABLE II. Contractor and Union Concern About WRMDs

Contractor ranking (n = 23)

	High→Low								
Level of concern	**5 (%)**	**4.5 (%)**	**4 (%)**	**3.5 (%)**	**3 (%)**	**2.5 (%)**	**2 (%)**	**1.5 (%)**	**1 (%)**
Shoulder problems	39	—	22	—	35	—	4	—	—
Sprains	43	4	35	4%	13	—	—	—	—
Back/joint pain	52	4	22	—	17	—	4	—	—
Tendonitis	22	4	30	—	30	—	13	—	—
Carpal tunnel syndrome	17	—	30	—	17	—	30	—	4
Fatigue/overexertion	39	—	35	—	22	—	4	—	—

Union rep ranking (n = 27)

	High→Low								
Level of concern	**5 (%)**	**4–5 (%)**	**4 (%)**	**3–4 (%)**	**3 (%)**	**2.5 (%)**	**2 (%)**	**1.5 (%)**	**1 (%)**
Shoulder problems	52	—	19	7	19	—	4	—	—
Sprains	22	—	19	—	30	—	15	—	4
Back/joint pain	78	4	15	—	4	—	—	—	—
Tendonitis	34	—	30	4	19	—	4	4	—
Carpal tunnel Syndrome	37	—	34	—	11	4	11	—	4
Fatigue/overexertion	56	—	7	—	26	4	7	—	—

Q. From your perspective as a construction employer/union rep, on a scale of 1 to 5, where 1 = no concern and 5 = very concerned, how concerned are you about the following worker injuries and health issues?

How Do Workers Respond to WMSD?

We asked both union representatives and the worker focus groups what they believe workers are doing to protect themselves from WMSDs. The picture painted by the workers is very different from management. Workers tend to believe that WMSDs are acceptable as part of the job and that avoiding injuries is a personal responsibility. They're also skeptical that their employers are committed to making the workplace safer.

Union representatives' responses to ergonomic hazards included exercising and conditioning, getting better tools and adapting tools to make them easier to use, wearing braces and pads, self-medicating with Motrin or Advil, attempting to rotate tasks or switch hands, and getting educated and talking with others to learn "tricks of the trade."

TABLE III. Importance of WMSDs to Contractors and Union Representatives

Contractor responses		**Union responses**	
More	12	More	20
Less	9	Less	5
Same	2	Same	2

Q. Do you see more or less of these injuries/issues occurring as compared to injuries from other hazards (such as falls, electrocutions, operating machinery, etc.)?

Workers reported similar strategies: trying to use lighter power tools, adapting tools, stretching, staying hydrated, getting enough rest, slowing down and thinking ahead, asking for help; thinking of how to do things "better, safer, faster"; planning out the work and "thinking smart," knowing your limits.

When asked what actions workers have seen contractors take to prevent these injuries, all of the focus groups talked about safety meetings (held daily, weekly, monthly, every 3 months); and safety information stuffed in paychecks—but there were varying opinions on how useful this information is. There was some cynicism among workers about preventing WMSD coupled with an acceptance of pain as part of their job. A significant number of participants said they would prefer to work through the pain rather than report it to their employer either because of fear of losing their job or being perceived negatively by their peers. This verifies what union representatives said when asked if workers would report injuries. The workers were not confident that employers would take action to resolve safety problems or control risk. No worker reported going to the union for help in these situations.

The workers we interviewed often indicated they take a high level of personal responsibility for what happens to them at work. A roofing apprentice said it this way, "Blame the foreman if you don't have the right tools, but if you got hurt just for doing something, blame yourself." When asked

TABLE IV. Contractors and Union Representatives Assessment Of Attention Paid To WMSDs

	Contractor Question: Do you think ergonomic injuries are given as much attention as other injuries?	Union Question: Does your union give the same attention to ergonomic injuries as to other injuries?
Yes	6	15
No	15	9
Yes in own company but not in construction generally	2	1

who is responsible for preventing injuries, five out of eight roofers answered that "it's your responsibility" and also the employers' responsibility.

What "Solutions" Work and Do Not Work Well to Prevent Injuries?

We asked both union and contractor representatives what has worked or not worked in addressing ergonomic hazards. Examples from each of the categories used earlier (tool/equipment innovation, stretch and flex programs, training, job rotation, personal protective equipment, and job hazard analysis) all made the list. What was mentioned more consistently than others was raising awareness of what can happen due to repetitive motion.

TABLE V. Contractors and Union Representatives Assessment of Actions to Prevent WMSDs

Contractor responses (23 surveyed)	Union responses (27 surveyed)
Change in Tools and Equipment (12)	Change in Tools and Equipment (18)
Stretch and Flex Programs (11)	Training and Education (15)
Training and Education (10)	Stretch and Flex Programs (12)
Job Rotation (8)	Policy for Lifting (5)
Job Organization and Pre-Planning (8)	Personal Protective Equipment (4)
Personal Protective Equipment (5)	Job Hazard Analysis / Safety Task Analysis (3)
Job Hazard Analysis / Safety Task Analysis (4)	Job Rotation (2)
	Alter Work Practices (2)

What programs or activities do you employ on construction job sites to address ergonomic injury prevention? (Contractors) or as a union rep what programs or activities have you seen on construction job sites or through your union that address ergonomic injury prevention (union)?

Union representatives identified back belts as the number one piece of equipment that did not work. Many respondents saw them as potentially more of a problem than a benefit as they can lead to a false sense of protection. Some other responses were:

- *Tools and equipment:* New tools are not built to withstand the abuse they get on the job so they break down.
- Some *safety rules conflict* with ergonomics (e.g., mandatory fall protection harnesses worn at all times with lanyard dragging behind).

When we asked contractors to tell us what solutions did not work for them, they expressed similar concerns about back belts and tool quality/durability. They mentioned that they had tried some ergonomic solutions, but implementation led to other problems. Contactors reported worker resistance to ergonomic programs like stretch and flex and productivity programs, which they attributed to "old school mentalities" and resistance to change.

Challenges to Applying Ergonomics to Construction and Suggestions for Overcoming Them

We asked contractors and union reps what were the obstacles to reducing ergonomic hazards in construction (Table VI). Among workers, the pace of production and staffing levels were mentioned in each focus group as major obstacles. Workers were also concerned about losing their jobs, being replaced, peer pressure, foremen who don't understand or don't buy-in to ergonomics, unwillingness of older workers to change habits, tight budgets, lack of training by employers, and lack of co-ordination on job sites. Very few thought that a lack of solutions was an issue.

Challenges from Business and Financial Concerns

It was repeated throughout the interviews that production is driving the industry. One mechanical contractor

TABLE VI. Contractors and Union Representatives Assessment of Challenges to Applying Ergonomics to Construction

	Contractors (23)	Union Reps (27)
Attitudes	10	8
Knowledge/awareness	7	5
Business / financial	5	11
Availability of solutions	1	3

What do you think are the obstacles that stand in the way of addressing ergonomic hazards in construction?

summed it up this way, ". . .it's not a company thing, it's an industry-wide cultural thing that's out there—of course it's production. . .that has taken the lead and the other two [safety and quality] have fallen behind... It used to be the safest company got weighted, meaning they would take us. But it's not that way anymore; [project owners] will take anybody that is less than us on big projects."

About 40% of the union representatives also identified production and financial issues as the number one obstacle to preventing ergonomic injuries. In every focus group, workers expressed concern about pace of work and accelerated schedules, and the dampening effect that a focus on production has on their ability to "work smarter not harder" even if they receive training on ergonomics and preventing WMSD.

When asked how to overcome these obstacles, contractors identified the need for a positive return on investment that showed they could increase production by preventing WMSDs and, therefore, having workers at full capacity. Several felt that workers compensation insurance companies were key to pushing best practices, and insurers could provide data about the relationship between the cost of coverage and these injuries. Union representatives were also concerned with return on investment questions, wanting proof that working "ergonomically" would help productivity and reduce injuries and workers' compensation claims. Workers too understood that making the economic case would likely motivate contractors to implement ergonomic solutions.

Attitudes and Perceptions as Barriers, and Ideas of how to overcome the obstacles

All groups surveyed identified attitudes that affect the way WMSD and repetitive strain injuries are approached in construction; 43% of contractors believed that personal attitudes and the work culture create resistance to making positive change toward accepting ergonomics and preventing injuries. Resistance to change among workers and contractors was cited repeatedly among all groups. Apprentices saw an attitude of "that's the way it's always been done" among older workers who preserve a trade tradition and will not take the chance of doing something differently. Union representatives saw it as inertia—how, at various levels of the industry, people don't want to add more to what they have to do already. Others cited the learning curve required to adopt something new.

Many respondents expressed a belief that the work is just difficult by its nature and they cannot envision how it could change. As one plumber/pipefitter rep said, "Our whole world is about wearing ourselves out to get the building built." Workers expressed the fear of losing their jobs or being replaced if they appear weak or unable to do the work.

When asked about how to remove this barrier, union representatives and contractors acknowledged that the macho attitude of construction workers must be addressed. According to one electricians' union representative, those attitudes are slowly breaking down. "Younger workers seem more willing to learn how to do this work any way we want to guide them—they're easy to convince to be a safer workforce." For that reason, several suggested that training be focused on the younger workers.

As for convincing management to care about the workers in the field, one union representative said, "All we can do is speak to them. The only way to learn on their own is if they get fines for being unsafe."

Lack of Knowledge and Understanding

Contractors cited a lack of understanding as the second most important obstacle to reducing ergonomic hazards, and it was 3rd for union representatives. Workers also mentioned a lack of education among older workers about ergonomics. The issues that were expressed by contractors were hazard recognition; lack of education at all levels; not realizing long-term effects and costs associated with WMSD; not understanding how ergonomics can help work practices and benefit employees; and lack of awareness of ergonomics as a "health and life span issue."

Overall the concern was that there is not an awareness of the connection between the hazards and injuries, often because they are cumulative and not taken seriously until a worker is unable to perform their job. Workers do not realize how the repetitive work they perform might injure them; they are not aware of the consequences to their life and career. Even though there was evident concern about injury and pain, there was a lack of understanding about the bigger picture of ergonomics. A contractor indicated that ergonomics has "never been analyzed" or included in Job Hazard Analyses possibly because they have very few claims resulting from these hazards (as opposed to falls). However, we found through our survey that most of the 50 contractors and union representatives interviewed thought WMSD were happening more frequently than injuries from other hazards.

When asked how to address these barriers, all groups had many ideas about who should be trained, and suggested methods and materials for training. Some suggested getting both contractors and unions to team-teach, to show that they are on the same page and that they care for the workers.

Availability of Ergonomic Tools and Other Solutions

A small group of contractor and union representatives raised concern about a lack of available solutions. In

addition, some tool changes intended to improve ergonomics were not worker friendly. For example, power tools that were made safer proved to be more cumbersome and frustrating so that the worker could not get the job done as quickly or efficiently. One union roofer rep pointed out that hand tools, such as utility knives and hammers that have been redesigned to be more "ergonomic," are often too expensive for apprentices.

When asked for ideas of how to overcome these obstacles, a few contractors noted that new ergonomic equipment is coming out that's more user-friendly on the body. Union representatives talked about the need to make ergonomic tools affordable for workers since most workers purchase their own hand tools. One cost-free recommendation was to ensure that a worker has easy access to the tools needed for the job. "If you have everything you need right where you're working, you don't have to search for anything; you're more likely to get your job done quickly and safely."

Is the Ergonomics Culture Changing for Construction?

We did not have a direct survey question asking what has changed over time regarding ergonomics in construction but we found that contractor and union rep responses were peppered with signs of change. In their replies to other questions, we counted 32 comments expressing the opinion that positive change has taken place in addressing WMSDs. The majority of comments refer to changes noticed over the last 10–15 years. They reported that an increased focus on awareness and training has led to a shift in behavior, that improvements in tools and how materials are packaged are helping change work processes, that an influx of younger workers is slowly creating a shift away from "tough guy" attitudes, and that contractors and unions are increasingly encouraging workers to report all injuries, immediate and cumulative.

Interviewees noticed ways that new tools/equipment and material packaging are helping contractors and workers to get away from "old school ideas" and look at new processes and techniques. Some specific things mentioned were power tools, cushioned handles, gloves, rolling carts, and rolling tool boxes. One mechanical contractor noted that workers are now using personal protective equipment such as knee pads, when they would not have "in the old days."

Some contractor and union representatives thought that reporting of injuries had improved because a bigger focus was being put on WMSDs and they are being taken more seriously than they were 20 years ago. This was attributed to better education and company policies that require reporting of all work-related injuries.

Motivation and Triggers

Since contractors have primary responsibility for implementing solutions on the job, we asked them an additional question about motivation, asking for their top three considerations when making decisions about adopting solutions to prevent ergonomic injuries. The following answers were included most often:

#1: How will it impact production and will it prevent injuries
#2: Cost
#3: Availability and usability (does it work?)

Specific responses included the benefit of it, ease of use/implementation, replicability from job-to-job, potential return on investment and productivity, feasibility, turnaround time, and making sure it would not be a hindrance or make anything worse. It is clear that when thinking about ergonomic solutions, safety managers are most concerned with practicality, financial prudence, efficacy, predictability, and overall benefit.

Generally workers expressed that they simply want to preserve their ability to work, earn a living, and have a full career. They definitely take note of the way older workers are suffering from the pain of repetitive strain injuries and expressed that they do not want to end up that way.

Messaging

The final data we collected from each survey group involved opinions about what messaging would resonate for contractors, unions, and workers. What message would serve to move workers away from the "tough guy" image that may be putting them at risk for injury? Is there an approach that would appeal to the needs of contractors' practical realities?

We began by asking for feedback on the word "ergonomics" itself. Only three of 27 union representatives felt comfortable using the term "ergonomics," while contractors (seven of 23) were somewhat more comfortable with the term. Five contractor representatives and six union representatives actually thought the term would have negative associations for employers and workers. Our interviewees had many suggestions for better terms to use in place of ergonomics. The most popular among union representatives was repetitive motion injuries (12/27 respondents); contractors suggested strains and sprains, soft tissue, repetitive motion and cumulative trauma injuries. Most respondents from both groups believed talking about better techniques, tools and planning as well as treating repetitive motion hazards as another safety issue would help to make ergonomics resonate more for construction.

TABLE VII. Identified Themes for Social Marketing

Rank	Contractors (23)	Union Representatives (27)	Workers (43)
1	It will help workers be more productive (11)	For my family (22)	For my family (26)
2	It saves money (10)	I cannot afford to get injured (20)	I cannot afford to get injured (24)
3	It is the right thing to do (9)	For my health (12)	For my health (23)
4	For good health (8) I will be more competitive (8) It is worked for others like me (8)	It's the right thing to do (11)	It will help me be more productive (19)
5	It's easy to do (7)	For the workers health (9)	It is the right thing to do (11)
6	For the workers health (6)	It will help me be more productive (7)	It will help me do a better job (10)
7	It will help workers do a better job (5)	It will help me do a better job (5) It is easy to do (5) It saves money (5) It is worked at other job sites like mine (5)	It is easy to do (6)
8	It is the law (3) I cannot afford injuries (3)	It's my right (4)	It is my right (4) It saves money (4)
9			It's worked at other job sites like mine (1)

Next, we looked at sample messages with each group. The results are summarized in Table VII ordered by the number of times they were chosen. Interviewees were not asked to rank their choices, just to pick which phrase(s) they thought would resonate most within their group. The message chosen by 48% of contractors related to production and the second most chosen (43%) related to money. Among contractors the message that garnered the most negative comments was "it's the law."

For union representatives and workers the top three choices were the same for both groups and related to more personal issues like family, the cost of being injured, and one's own health, with 81% of union representatives and 60% of workers surveyed choosing the phrase "for my family" most often.

For 44% of workers, the message about being more productive also resonated. Among union representatives, 41% liked "it's the right thing to do" and 33% chose "for the workers' health." Interestingly, union representatives and workers agreed with contractors in placing a message about mandatory compliance at the bottom of their lists.

DISCUSSION

We initiated this study project with the vision that it would lay the foundation for a social marketing effort to reduce WMSDs in the construction industry. Our specific goal was to assess current knowledge, perceptions, and attitudes held by the different players in the construction industry—the potential target audiences for future social marketing approaches—toward voluntarily implementing ergonomic solutions.

Some clear themes emerged:

- "Ergonomics" has many different meanings within the industry.
- The construction industry has been changing over time, and that awareness of ergonomic hazards and solutions exists and has been increasing, particularly over the last 10–15 years. For each major obstacle to implementation of ergonomics in the industry identified, the construction professionals we interviewed offered a variety of solutions.
- Workers care deeply about the impact WMSDs have on their lives and their ability to continue working.
- Many workers hold the belief that WMSDs are somewhat inevitable or acceptable as part of the job.
- Although workers know that the physical demands of work cause injury and pain, there is no consistent belief that changing the nature of the work could prevent that injury or pain.
- The fear of losing their jobs or being laid off also motivates workers to keep quiet and work through pain. This perception is pervasive among all groups of workers and is echoed by union representatives.
- Most workers believe that avoiding injuries is a personal responsibility, while some think it is a combined responsibility with the employer.
- Construction is driven by production; some interviewees see production as a much higher priority than safety. Neither workers nor contractors are interested in using new tools and techniques that might hamper their productivity.
- An important obstacle is the limited availability and accessibility of tested and effective tools, equipment and processes, ones that both reduce physical demand and also get the job done efficiently and effectively.

These themes are consistent with research conducted elsewhere in the construction industry. Kramer [Kramer et al., 2009,2010] found that a lack of awareness of the significance of WMSDs in the industry and a lack of

confidence to manage WMSDs were barriers to adoption of interventions to reduce them. Village [Village and Ostry, 2010] found that construction workers who believed change could reduce MSDs, and those who thought that MSDs were caused by work and not by personal factors, were more likely to implement changes at work. Among employers, those who had advanced further along a series of behavioral stages were more likely to institute interventions to improved ergonomics [van der Molen et al., 2006]; these stages began with an awareness of the risk of MSDs, followed by an understanding of the intervention, then the willingness to buy it and the ability to use it. These findings are consistent with earlier work on intervention effectiveness [Rogers, 1995].

Ergonomic solutions exist and are already helping the construction industry protect workers and reduce injuries [Entzel et al., 2007, 2013; Kramer et al., 2010; Hess et al., 2010], and there is great potential for more widespread application. However, the barriers to implementing more solutions, while not insurmountable, will require the participation and cooperation of all levels of the industry, contractors, unions, and workers [Carlan et al., 2012]. If the principles of ergonomics are integrated into all phases of construction (bidding, engineering, pre-planning, purchasing, materials handling, job site management, training of supervisors and workers) we can take the burden off of workers, mitigate hazards and reduce, WMSDs.

Stretch and flex programs have not been shown to be effective in reducing WMSDs [Hess and Hecker, 2003; da Costa and Vieira, 2008], yet they are widely used, and both workers and contractors rated them as successful. Future research should explore this dichotomy.

Safety culture is a term currently used to refer to a combination of attitudes and policies, but there is no agreement on a definition. In a recent symposium participants from the construction industry developed a consensus definition: “Deeply held but often unspoken safety-related beliefs, attitudes, and values that interact with an organization’s systems, practices, people, and leadership to establish norms about how things are done in the organization” [CPWR, 2014]. Our research suggests that these beliefs, attitudes, and values are changing, and a social marketing campaign may be able to build on those trends.

A successful strategy for a social marketing campaign for ergonomics in construction must address the diversity of the industry, with different materials developed for large and small employers and for specific crafts [Weinstein et al., 2007; Carlan et al., 2012]. Rather than focusing on a single message, there need to be several that hone in on what is most important to each segment of the target audience. The campaign would need to develop specific components for construction managers, union staff and workers, and focus around specific themes, such introduction of new tools.

Based on our findings in this study, we recommend a campaign that has these components:

1. **Document cause/effect relationships.** Information that lays out the relationship between specific types of solutions and positive end results, presented clearly and concisely, is necessary so that contractor representatives and unions can justify investing resources in WMSD prevention programs.
2. **Standardize terminology, without using the term “ergonomics.”** Developing a standard, consistent terminology that contractors, unions and workers can all relate to would be very helpful for doing training and outreach.
3. **Develop separate campaigns for contractors and workers.** For contractors, messages would speak to increasing productivity and saving money. For workers and unions, the message would be more personal, addressing how staying healthy and working “smarter not harder” benefits not only them, but their families.
4. **Develop contractor success stories.** A positive way to promote different types of control strategies for ergonomics is to use peer-to-peer messages. Researching which strategies have been most effective in reducing WMSDs and developing testimonials that feature stories from contractors themselves would be a credible way to encourage other contractors to take action.
5. **Directly address the resistance to change.** This is a tradition-bound industry, so change needs to be framed in a way that builds a transition from the “old ways” rather than overturning them.
6. **Include explicit framing.** Any campaign needs to frame prevention of WMSDs in a way that speaks to workers' strengths, skills and productivity, and that overcomes the view it is a weakness to take actions to prevent injury.

Contractors, unions, and workers need to work together to find actions that work within the parameters of the current economic environment. To change worker attitudes, we need to provide them specific examples of how their lives will be impacted by cumulative injuries and tie the tools they use and the tasks they perform directly to those injuries. We can create a picture of what their life will be like in the future if they don’t take care of themselves in the present. For unions, we can develop information to make representatives more aware of the benefits ergonomic solutions offer for both business health and to protect their members and keep them productive. We can make sure apprenticeship programs have information on ergonomic training materials. Contractors need research and hard data to show that ergonomic programs actually reduce injuries without having a negative impact on production. They need

to see how it pays them in the long run to protect their skilled workforce.

Creating a culture for making ergonomic change will require the skills and ingenuity of the people who are on the construction front lines dealing with day-to-day, real-world issues. Ultimately, they are the problem solvers, the planners, the people responsible for making worksites safer, and the people who are getting injured. The insights they shared with us are invaluable in understanding the needs and conditions that inform a social marketing approach. They are our best hope for making ergonomics a success story for construction.

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