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If you've seen one construction worksite stretch and flex program … you've seen one construction worksite stretch and flex program

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ABSTRACT

Background: Work-related Musculoskeletal Disorders (WMSD) account for approximately one-third of all injuries in the U.S. construction industry. Many companies have implemented stretch and flex (s/f) programs to reduce WMSD despite a lack of evidence showing effectiveness. *Methods:* We conducted a mixed-methods study to understand (a) why employers continue devoting resources to s/f programs; (b) how programs vary; and (c) any actual or perceived benefits. *Results:* Nineteen safety and health professionals were interviewed and 133 more (13.3% response rate) completed an on-line survey. Fifty-six percent had implemented an s/f program with the primary goal of reducing WMSDs; though most did not review data to determine goal achievement. Program structure varied in terms of duration, frequency, and type of stretches. There was strong agreement about mandating attendance but not participation, due primarily to liability issues. Cost was a factor when deciding to implement a program but not for sustaining one. The majority had not implemented other ergonomic prevention activities, but many had started conducting daily safety huddles for task and safety planning. Those reporting a reduction in WMSDs agreed that it was not due to the s/f program alone and that other benefits included increased worker camaraderie, communication, and collaboration. *Conclusion:* Although there is little to no scientific evidence showing that they work as intended, construction companies continue to implement s/f programs with the goal of reducing WMSDs. Bringing work crews together for s/f activities has prompted employers to also begin conducting daily safety huddles. Although employers may not be able to link reduced WMDS to an s/f program, the ancillary benefits may warrant the time and resources. *Practical applications:* S/f programs should be only one component of a more comprehensive ergonomics prevention program. Conducting daily safety huddles at the same time also may enhance worker communication, camaraderie, collaboration and improve safety outcomes.

1. Introduction

Both the number and rate of construction work-related musculoskeletal disorders (WMSD) dropped between 2007 and 2010 (due in part to the economic downturn). Unfortunately, the 2010 rate was still 16% higher than the rate of 32.8 per 10,000 FTEs for all other industries combined (CPWR: The Center for Construction Research and Training, 2013). WMSDs (soft tissue and back strains and sprains) have always been and, for the foreseeable future, will continue to be an occupational hazard for construction workers. Fifteen to 20 years ago, in an effort to reduce the incidence and cost of WMSDs, construction firms began implementing jobsite stretch and flex (hereafter shortened to s/f) programs for their employees (Simonson & Iannello, 1994). Since then, academic reviews of studies evaluating such programs have concluded that while they may help increase muscle flexibility and joint range of motion, as well as decrease stiffness and joint and muscle discomfort, findings are less clear as to whether they achieve the desired outcome of reducing WMSDs and their associated costs (Choi & Woletz, 2010; daCosta & Vieira, 2008; Hess & Hecker, 2003). Recent research indicates that warming up prior to stretching and adding both strength and conditioning training may increase the value of the s/f activity (Choi & Woletz, 2010). They and others suggest that the diversity in findings may be due in part to methodological differences and shortcomings of the studies conducted to date. They recommend that well-designed prospective controlled studies using different program protocols are needed and that workers' age and other predisposing factors should be taken into account to definitively establish the relationship between s/f programs and reduced musculoskeletal injuries (Choi & Woletz, 2010; daCosta & Vieira, 2008; Hess & Hecker, 2003). Despite the lack of scientific data showing that s/f programs effectively reduce WMSDs, construction companies continue to devote valuable site management and craft employee time and resources to implementing s/f programs on some or all of their jobsites. The goals of the study reported here were to learn more about how s/f programs are structured and implemented, what are the associated costs and finally what are the perceived goals and benefits of implementation.

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2. Materials and methods

2.1. Study design

Because the study was exploratory, we used a sequential mixed-methods design (Creswell & Clark, 2007). We first conducted qualitative interviews and subsequently conducted a quantitative survey the design of which was informed by findings from the qualitative data. This study was reviewed and approved for exempt status by CPWR's Institutional Review Board.

2.2. Sample

The inclusion criteria for study phases was that the participant be a type of safety and health professional working for a construction company or related entity that currently has, has had in the past, or never had implemented an s/f program.

2.2.1. Phase 1: qualitative

The primary goal of phase 1 was to gain an in-depth understanding of construction s/f programs. We examined CPWR: The Center for Construction Research and Training's database of construction industry stakeholders to identify a small convenience sample of individuals who we knew are well-respected opinion leaders in the field and with whom we already had a close working relationship. CPWR is a non-profit that has been conducting construction safety and health research and training for 25 years and is considered a leader in the field. The eight individuals we recruited represented employers, corporate safety and health directors, labor and employer association leaders, or safety and health consultants, all of whom either met our inclusion criteria or offered to help us identify others who might.

We sent an email to the potential interviewees explaining the study goals and invited them to be interviewed. We also implemented a snowball sampling strategy (Atkinson & Flint, 2001) whereby we asked them if they would be willing to reach out to their professional network to help us recruit additional potential interview participants. All agreed to do so. Three of the eight met the inclusion criteria and agreed to be interviewed. Each identified between 1 and 4 additional potential participants and introduced us and the study to them via email. We followed-up to determine eligibility. All met our criteria and were invited to participate; all agreed to do so. We discontinued recruiting interviewees once the sample contained at least one company representing each inclusion criteria and the analysis showed both response variation and saturation.

2.2.2. Phase 2: quantitative

The sample for phase 2 consisted of members of the American Society of Safety Engineers (ASSE) Construction Practice Group. These individuals manage, supervise, conduct research, and consult on safety, health, and the environment in the construction industry. They pay a $20 yearly fee to belong to the group over and above the $150 ASSE membership dues. We requested but were denied access to a comprehensive list of the approximately 1000 group members from which we could more deliberately select and recruit potential respondents. Rather, the ASSE Construction Practice Specialty Group Administrator sent an email to all members. In addition to describing the study's goals, providing assurance that the data would be aggregated and remain anonymous and stressing that participation was completely voluntary, the Administrator included the following text: "We have been asked to partner in a research study and as the Administrator I am asking for your help. We are going to be reaching out to you, our members, more as opportunities like this present themselves to provide us valuable insight concerning our industry. We are asking you to participate because we believe the information learned from this study will be valuable to our membership and to the broader construction industry." He also included a link to the online survey (via Survey Monkey) and gave them a two-week deadline to complete it. One reminder message was sent a week after the initial email went out.

2.3. Data collection

2.3.1. Interview

Those who met the inclusion criteria and volunteered to participate were sent an information sheet reminding them of the study goals, the interview process, and a copy of the semi-structured interview guide to review ahead of time and follow along during the interview (see Fig. 1). A 30–45 minute phone-interview was scheduled with the interviewer (LG). At the beginning of the call, questions were addressed and permission was requested to record the interview, which was agreed to by all participants.

2.3.2. Survey

The survey questions mirrored the interview questions except that they were closed-ended and included response options that we developed based on the interview findings. The high degree of overlap between interviewees' stated goals for and perceived benefits of the s/f program and the desire to create a survey of reasonable length led us to eliminate the question about goals and ask only about benefits in the survey.

2.4. Analysis

Recordings were transcribed verbatim, reviewed, and coded independently by the authors. They met to discuss codes, resolve disputes and create a codebook. Given the study goals, we determined that a sophisticated thematic analysis was not warranted. Rather, we calculated the frequency of codes. The most frequent responses were used to create relevant response options for the survey questions. We calculated frequencies from the survey data and then compared and contrasted them with interview descriptive statistics to identify similarities and

Demographics - Company name, Position/role in the company, Years working in construction industry

Does your company currently have a stretch and flex program for your employees? (Y/N)

YES

1. In your opinion, what are the primary goals of stretch and flex programs? Are there any secondary goals you can think of or have heard of? (Interview only)
2. Do you recall how you or your company first became aware of s/f programs?
3. Can you tell me about any other health and safety initiatives you started implementing at the same time you started the s/f program?
4. How long has the program been in place?
5. Could you please describe what participants do during the s/f activity?
6. Is the same program conducted on all of your jobsites? (If not, why not?)
7. Who typically conducts it?
8. When during the day is it conducted and approximately how long does it typically last?
9. Who gets to participate?
10. Is participation mandatory?
11. Are there incentives for participating?
12. How is the program coordinated with other contractors/subcontractors?
13. Can you describe the benefits that you perceive, or those you have actually seen since implementing the program?
14. Do you collect and use any outcome data to measure the programs' effectiveness such as overall injury rates, rates for specific injuries (like strain and sprains), or change in numbers of injuries?
15. Does your company include money in the budget for the s/f program? (On average how much do you think it costs the company for a typical project)?
16. What barriers/challenges did/do you face in terms of implementation? [Interview only]

NO

1. Has your company ever had a stretch and flex program for your employees?
   (YES) Can you describe it for me and then tell me why it is no longer being implemented?
   (NO) Can you share with me reasons why your company has decided to not implement an s/f program?

Fig. 1. Interview and survey questions.

differences across s/f programs in terms of logistics, perceived benefits, and implementation barriers. Given that both the interview and survey samples came from the same target population, we determined that it would be acceptable to report findings collectively when results were similar and report them independently when they differed. Once the quantitative descriptive analysis was complete, the co-authors independently reread the transcripts to identify and extract quotes they thought would best illustrate the most significant findings. They met to discuss their choices and agree on what would ultimately be presented in the paper.

3. Results

3.1. Participants

We conducted interviews with 20 safety and health professionals from 19 companies (one company had representatives from two business units — one with an s/f activity, the other without). One hundred and thirty-three construction safety and health professionals completed the online survey (13.3% response rate). While arguably low, it is not unusual to achieve such a response rate when conducting similar types of research in the construction industry (Black, Akintola, & Fitzgerald, 2000). Also, although there was potential for some overlap in survey and interview respondents as both may be ASSE construction practice group members, the data indicated there were none.

3.2. Demographics

The majority of our interview and survey respondents were construction safety directors or safety managers (see Table 1). Close to half reported working at large companies (self-defined by respondent). However, medium and small companies were well represented. Most worked for commercial general contracting or construction management companies, with the remaining distributed across a variety of other construction sectors. Thirty-two percent of the companies worked nationally or worldwide. The rest had offices in regions across the United States (Midwest (17%); Eastern Atlantic (11%); South/Southwest (17%); Pacific/Pacific Northwest (26%)). Interviewees reported working in construction an average of 14.5 years (range 1–31 years) (survey respondents were not asked about tenure).

Table 1
Interview and survey sample demographics.

Job title (n = 126[a] + 20[b] = 146[c])*	% (n)
Safety Director	40.0% (58)
Safety Manager	28.1% (41)
Safety Supervisor/Coordinator/Engineer/Specialist	9.6% (14)
VP Corporate Safety	5.5% (8)
Risk Manager	4.1% (6)
Project Manager	4.1% (6)
Consultant	4.1% (6)
Owner	2.7% (4)
Other	2.1% (3)
Company size (n = 129 + 20 = 149)	
Large	48.3% (72)
Medium	34.9% (52)
Small	16.8% (25)
Type of work (n = 133 + 20 = 153) (check all that apply)	
Commercial	58.2% (89)
Public Projects	36.6% (56)
Heavy Highway	24.2% (37)
Energy	12.4% (19)
Residential	12.4% (19)
Industrial	11.1% (17)
Consulting	3.9% (6)
Utilities	2.6% (4)
Civil	2.0% (3)
Other	2.6% (4)

[a] Number of survey respondents.
[b] Number of interview respondents.
[c] Total number of respondents.

3.3. Stretch and flex programs

Most respondents (56%) (survey n = 71; interview n = 15) said that their company had an s/f program and that it had been implemented between 2 and 5 years ago (survey 36.5%, n = 23) or 2–5 or 6–8 years ago (interview — each 33%, n = 5). Forty-eight survey respondents (36%) and four interviewees (20%) said that their company currently does not, or never has had a program. Not everyone provided a reason for not implementing a program, but the most prevalent ones mentioned are listed in Table 2. Only nine respondents (6%) had discontinued a program saying it was due to lack of obvious cost–benefit and limited evidence that the program reduced WMSDs.

3.4. Program specifics

One quarter of interviewees said that participants were asked to perform 8–9 or 11–15 stretches (each 26.6%, n = 4), while a quarter of survey respondents said that 5–7 or 11–15 (each 25.7%, n = 9). A majority of survey respondents said that supervisors or foremen led the s/f activities (85.0%, n = 51) while most interviewees indicated that the leadership role is often shared with workers (66.7%, n = 10). Forty-six percent (n = 7) of interviewees and 34% (n = 20) of survey respondents said that programs were implemented similarly on all sites, while 38% (n = 22) of survey respondents said that the person in charge has some flexibility with both the content and process.

There was general agreement on program implementation in terms of the following: it was held in the morning at the beginning of the work shift (79.5%, n = 62), it typically lasted 6–10 min (60.3%, n = 47), attendance was mandated for both employees and subcontractors (92.1%, n = 70) but, due to potential liability, participation was not required (60.3%, n = 47), and incentives were not used to encourage participation (83.1%, n = 64). Respondents noted that although not mandatory, peer pressure typically resulted in a high participation rate for employees as well as subcontractors. The following quotes illustrate the qualitative findings about s/f program elements and logistics.

> "We've made it a safe work practice, it's not a mandatory thing every morning …it's strictly voluntary …It bothers me to say that we don't make it mandatory because of OSHA recordability. I truly think that we're missing something there but it's the world we live in… If our recordability rates get too high then we're pretty much unable to bid for work.".

> "…we provide incentives in the form of recognition [vs. material objects]. … Tradesmen are often overlooked for that. So we try and recognize folks for their work and we do it also with stretching."

> "…the contract language is you have to be present at the event but actual participation in the stretching is purely voluntary. … You

Table 2
Respondents' top mentioned/ranked reasons given for not implementing an s/f program.

	% (n)
Lack of financial benefit	20.0% (10)
It has never been discussed	15.4% (8)
Lack of employee and leadership buy-in/lack of interest	13.5% (7)
Creates a liability to company if someone gets injured during the s/f activity	6.0% (3)
Our workers don't have strains and sprains	6.0% (3)
Time is money	4.0% (2)
Union contract stipulations	4.0% (2)

know I think once they [subcontractors] see everybody else is doing it and they don't have a good reason not to do it, I think everybody more or less, seems to enjoy doing it."

The minority of respondents whose companies did mandate participation made comments such as the following:

"…it's become part of who we are and you have to do it. But we convince them in a way that says: 'You get to do this. You're on the payroll and you get to take care of your body so that you don't get hurt.'"

"Everybody participates from the project managers to any visitors, to the customer that might have 1 or 2 representatives. There is nobody that is fluffing off saying, 'To hell with it' because the stretching program that we do have is a mandatory program."

The majority (69%, n = 54) said that separate resources are not designated for the s/f program. While none were able to provide an exact dollar amount, saying that cost is subsumed within the safety budget or labor costs, qualitative data illustrated by the following quotes reflect the opinion that a good deal of money is spent on the s/f program and that they and their management believe the cost is worth it or they wouldn't be doing it.

"…we don't carry a dollar value in the bid for those activities because….We're creating the opportunity to set people up the right way before engaging in work activities. And why wouldn't you discuss what you're going to be doing, what equipment you're going to use, who is going to be engaged in what activity, what's going on in the area…?"

"We're convinced that if it helps one or two back muscle spasms on a project that money and time spent is worth it. Not only for the guy not being in pain but …the cost of somebody being off work for a week and seeing multiple doctors and all that, you've just exceeded the cost of having the stretching."

3.5. Goals and benefits

There was significant overlap between interviewees' stated goal for implementing the s/f program — "…These guys and ladies are not unlike athletes, if you watch any athlete…they're going to warm up and stretch their muscles. That's the primary goal; we're looking to prevent strains and sprains from the overexertion of tight muscles" — and the perceived benefits. Thus, as mentioned above, we asked only about benefits in the survey and will focus on findings pertaining to benefits here.

The top three most often mentioned (interview) or selected (survey) benefits of the s/f program pertained to reducing WMSDs, including workers warming up their muscles and joints and reducing the number and severity of soft tissue and musculoskeletal injuries (see Table 3). Surprisingly, less than 50% of respondents (survey — 48%, n = 29; interview — 47%, n = 7) said that their company looks at injury or claims data to measure s/f program success and goal attainment, while 36% (n = 22) of survey and 53% (n = 8) of interviewees said they do not. The qualitative data suggest however, that although they may not look at hard data, many believed that WMSDs had been reduced since starting the s/f program but added that they could not be sure it was due to that alone, as reflected in this quote: "I believe we're seeing a reduction in strains and sprains, however, I don't know if its 100% attributable to Stretch and Flex or if we're doing other things that's increasing the safety culture on the job."

We asked what other safety and health efforts had been initiated at or near the same time as the s/f program. We were particularly interested in knowing if other ergonomic interventions were implemented to help achieve the goal of reducing WMSDs. The data showed that only

Table 3
Respondents' top mentioned/ranked perceived benefits of s/f program.

Benefits (check top 7) (n = 62[a], 15[bc*])	Survey % (n)	Interview % (n)
Get workers' muscles, joints warmed up for the day	82.3% (51)	73.7% (11)
Reduce number and severity of work-related soft tissue injuries (e.g., sprains & strains)	75.8% (47)	86.7% (13)
Reduce number and severity of work-related musculoskeletal injuries (e.g., back)	64.5% (40)	86.7% (13)
Increase familiarity, communication, camaraderie and sense of teamwork regarding safety among supervisors, craft, and subs	61.3% (38)	60.0% (9)
Foreman is able to assess workers' physical status and assign work accordingly or send home	58.0% (36)	26.7% (4)
Improve safety climate on the job site	58.0% (36)	6.7% (1)[c]
Foreman is able to assess mental status and assign work accordingly or send home	37.0% (23)	6.7% (1)
Workers are more awake and ready to go, less fatigued during and at the end of the day	29.0% (18)	20.0% (3)
Show the workers the company cares	29.0% (18)	6.7% (1)
Treats workers like other professionals who have to warm up before work (e.g., athletes)	23.0% (14)	6.7% (1)
Opportunity for foreman to show leadership abilities	19.4% (11)	6.7% (1)

[a] Number of survey respondents.
[b] Number of interview respondents.
[c] Recall that response options were identified from interviews which is why each has at least n = 1.

22.2% (n = 16) mentioned implementing additional ergonomics-related initiatives, such as raising materials off the ground to reduce bending and lifting. Other initiatives included: daily walk-arounds/safety audits 33.3% (n = 24); encouraging employees to identify and report hazards 37.5% (n = 27), near-miss (good-catch) data collection system 30.6% (n = 22), and drug and alcohol screening program 27.8% (n = 20). A minority (15%; n = 11) said that no additional activities were started at the same time.

The initiative mentioned by a majority of respondents (69.4%; n = 50) was that they were conducting a 5–10 minute daily morning huddle/safety meeting for job hazard analysis/pre-task planning/plan of day either before, after, or during the s/f activity. There was consensus among interviewees that having a designated time before work to bring crews together provided an excellent opportunity to do much more than stretch. Indeed the 4th, 5th, and 6th benefits listed in Table 3 are likely facilitated by this added initiative and elucidated by the following quotes.

"So there's so much more than just, 'Hey everybody lets go out and stretch.', it is used as an opportunity to eyeball every one of your employees to determine their health and physical ability to do their job that day before they go and do it. Because if somebody is sick, somebody is under the influence, somebody is hurting; it becomes readily apparent. Now again the benefits of better flexibility and camaraderie, that's all, to me is just icing on the cake."

"So we stretch, we huddle, we talk about what we're going to do. It's like everybody gets their mind in the game. [It] builds a little bit of camaraderie. People of different trades or different companies feeling separate from each other and they're all working on the same job or project and a lot of time right in the same vicinity. So it's kind of a get to know you, know who everyone else is… You see more cooperation between contractors on a job site and even between the men themselves. They may work a job site for 6 months and never talk to most of the guys but if we're in that huddle in the morning they get a feeling of okay, 'I'm working with all these guys on the same job'. It's like you're part of a big group building a big project. I think it makes a difference. … So treating men with respect and dignity and recognizing their performance, it makes the job safer, it's more productive and it's the way we operate."

"You do your Stretch and Flex as a group, you talk about what activities are going to be happening that day, you talk about how people can get hurt and then you're going to talk about what we need to make sure nobody gets hurt whether it's proper PPE, whether it's going over the safety data sheet ….You're kind of killing two birds with one stone. If you want to do your 10 minute Stretch and Flex and then spend another 10 …it's still only 20 minutes."

3.6. Challenges/barriers

As mentioned earlier, we had to make some strategic decisions related to the length of the survey and chose to not include questions about challenges faced when implementing s/f programs. Interviewee responses to this question fell into three overarching categories: workers/supervisors, management, and program logistics. Almost all said that workers and supervisors resisted initially because the s/f program required them to go outside their normal routine and comfort zone and that they feel shy and silly stretching in front of each other: "it's like high-school gym class." This challenge is particularly true for the older guys. Another challenge related to the older guys is the aging workforce. They also mentioned that individuals who focus mainly on production, including some workers, may blame safety officers for coming up with another gimmick that will negatively affect productivity. The following quotes are illustrative of these challenges.

"Yeah it's not that separate silly exercise thing that we do. It's part of starting the day and guys in the safety huddle, they talk about safety everybody gets serious, we're getting ready to go to work type of thing. It ties it all together."

"There's a significant demographic that we're working against, a demographic that has particular risk factors. That said, we've seen a small reduction in our soft tissue injuries but I would offer that it's probably a significant reduction because rather than an increase in soft tissue injuries that those aforementioned risk factors and exposures would lead you to anticipate we've actually seen a small reduction. A small reduction along with stemming the tide against those other factors in my view is a significant reduction."

A lack of demonstrated management support and encouragement can be a barrier because it leads to lack of time and resources devoted to the s/f activity and can create the perception that "it's [just] an employee thing" rather than a company-wide activity designed to improve worksite safety and health and safety climate/culture.

"…So we realized that to be successful you really have to have that management buy-in, you really have to have that climate of safety that people thought that this was part of a proactive and an effective means to reduce injuries overall… That's the visual buy-in to participate and then they know that that program is something that they're participating in so there's more acceptance of it…"

On the other hand, a few interviewees did tell us their programs had expanded beyond those working in the field to administrative staff and others, which they said demonstrated a high level of commitment by the employer.

Finally, in terms of program logistics, many interviewees mentioned that jobsites with workers in disparate locations can make s/f implementation efforts challenging. They also commented on how critical it was that s/f leaders be knowledgeable (those who add non-approved stretches that could cause or exacerbate an injury), reliable, and committed. If this recommendation is ignored, interest will likely wane and the effort will fail.

"You have to keep it short and sweet. For attention and the guys want to get to work, unfortunately. I shouldn't say unfortunately because that's what they're there for. But most of the guys really want to get to work."

"Well-meaning leaders start adding routines that actually have potential of causing or at least exacerbating an existing injury (still recordable). It is not a barrier, it is just a guard rail to the program."

4. Discussion

The main study goal was to understand how and why construction companies continue to implement s/f programs despite a lack of clear evidence showing that they effectively reduce WMSDs and save companies money (Choi & Woletz, 2010; daCosta & Vieira, 2008; Hess & Hecker, 2003). A majority of our respondents said that their companies conduct s/f programs and have been doing so for a number of years. Although there were similarities across many program elements, variations were considerable, as articulated in the following interviewee quote: "I've participated in a number of different stretching activities conducted by other companies and it's amazing the differences. There appears to be no standard set of stretches. Every company has pretty much done what [company name] has done and that is to forge its own way and design stretches around preventing those injuries they've seen." Given the plethora of possible stretching techniques and recommendations, this finding isn't surprising. Also, the highly variable nature of the construction industry in terms of jobsite locations and characteristics, workforce compositions, building materials and processes, particularly when compared to a manufacturing site where stretching programs were first initiated, likely contribute to the divergences. The title of this article — *When you've seen one construction s/f program…you've seen one construction s/f program* — is an attempt to reflect these findings.

Experts have determined that tailoring s/f programs is not problematic unless it results in reduced effectiveness, or worse, causes injury. They provide guidelines that should be followed including: (a) Program content (warm-up first, use static or proprioceptive neuromuscular facilitation stretching — PNF, stretching techniques to enhance both active and passive range of motion); (b) types of stretches to include (tailored to job duties); (c) duration of the stretch (hold the stretch for 15–30 seconds, do 3–4 repetitions per stretch); and (d) the frequency with which the s/f program should be conducted (at least 3 times/week); among others (IOMA's Safety Director's Report's, 2003). The s/f programs described by our respondents suggest that companies were, for the most part, following these guidelines.

The two program characteristics agreed upon by the largest majority of respondents pertained to mandating attendance but not participation and also not using incentives to increase participation. Potential liability was the reason given most often for not mandating participation even though only one person reported a worker being hurt during the s/f program requiring the company to log it as a recordable injury. No studies could be found that have examined the degree to which mandating the s/f program would result in more recordable injuries. Our data suggest however that not mandating it has little negative impact on worker and even sub-contractor participation rates.

The one interviewee reporting that their s/f program had been discontinued said it was due primarily to employees claiming incentives via an on-line tracking program without having actually participated in the s/f program (also the owner did not think the program was worth the cost). Incentive programs are not viewed favorably by Occupational Safety and Health Administration (OSHA) and the broader occupational safety and health community. The primary concern is that they may encourage workers to either underreport or not report injuries (Michaels, 2014). However, in the health promotion community, incentive programs have been shown to increase participation in health behavior change programs (Farooqui, Tan, Bilger, & Finkelstein, 2014; Gingerich, Anderson, & Koland, 2012; Task Force on Community

Preventive Services, 2010). While s/f programs may appear to be more closely affiliated with health promotion activities (e.g., physical activity), the fact that they are being conducted on worksites with the primary goal of reducing WMSDs puts them more in line with health protection programs. There is a recent effort to combine health promotion and health protection into or what The National Institute for Occupational Safety and Health (NIOSHO is calling Total Worker Health (http://www.cdc.gov/niosh/twh/). Regardless, our data suggest that most companies that implement s/f programs do not use traditional incentives to encourage participation. Rather, most encourage participation by telling their workers that participating in the s/f activity is itself an incentive because it is something they "get" to do (versus have to do) to become healthier and they are also being paid to do it!

The other issue that our respondents agreed on was that their s/f programs were expensive primarily due to the time spent not working. While none were able to share an exact dollar amount, saying it is typically incorporated into labor costs, the majority still believed that the cost was worth it in terms of benefits received. This finding contradicts a common perception that cost is *the* primary driver affecting a construction company's decision to adopt a new technology or process, a finding others have also found with respect to adopting construction-focused ergonomic innovations (Kramer et al., 2010). On the other hand, we also heard from a minority of respondents that either they or their employer was not convinced that the cost was worth it: "I'm not sure if it warrants the cost of doing the program, the headache with the subcontractors and all of that. I'm not sure if it's a great trade off or not."

Reducing WMSDs and soft tissue injuries were the primary reasons given for implementing an s/f program. This matches the benefits advertised by providers when they started promoting s/f programs to construction companies starting in the 1990s. Surprisingly, only a handful of respondents said that they reviewed or monitored outcome or claims data to determine if their stated goals were being met. Even those who reported having seen a reduction in WMSDs believed it was not due to the s/f program alone, but that other initiatives implemented at or near the same time likely contributed to any positive results, as reflected in this quote, "For anybody to make the correlation that you have less musculoskeletal injuries as a relationship to a Stretch and Flex program, I'm not sure that you're going to find any data that will support that …" Ergonomic researchers and practitioners alike strongly recommend that an s/f program should be only one component of a more comprehensive effort to limit ergonomic stresses and reduce WMSDs (Hess & Hecker, 2003; Lowe, 2007; Schneider & O'Reilly, 2015). Other important elements include raising materials off the ground to reduce bending and twisting motions, providing workers with ergonomically designed tools, and providing ergonomic education on material handling and carrying out work tasks. These recommendations may be even more germane today than they were 10 years ago given the aging construction workforce (Choi, 2009). The small number of respondents reporting that their companies had implemented such initiatives suggests to us that employers continue to focus on worker behavior rather than environmental changes.

The initiative mentioned most often was a daily huddle or safety meeting conducted in the morning before, during, or after the s/f. Studies have shown that employees think that daily stretching with their coworkers builds a stronger team (Drennen, Ramsey, & Richey, 2006) and we believe that combining the s/f with a daily huddle explains why a large percent of our respondents ranked highly the benefits of improved communication, collaboration, camaraderie, a greater sense of teamwork within and across crews, and improved safety climate. Daily huddles that incorporate discussions about relevant safety matters (versus traditional weekly toolbox talks that may or may not be relevant to the daily work being conducted) are considered mission-critical to high-risk companies that are working to become High Reliability Organizations (HROs) (Goldenhar, Brady, Sutcliffe, & Muething, 2013; Helmreich, Merrit, & Wilhelm, 1999). The role of the huddle's leader (in construction this would be the supervisor or foreman) is to create a sense of teamwork by engaging workers and subcontractors in a dialog about the day's planned work, the potential safety hazards that exist or may arise, and procedures for mitigating them before adverse incidents occur. Indeed, daily huddles that successfully create a sense of teamwork have been shown to improve safety climate (Guldenmund, 2000; Hale, 2000), safety performance and safety related outcomes (Mitropoulos & Memarien, 2012).

Another benefit of the s/f that respondents ranked highly was having the opportunity to assess crew members' physical status commenting that during the 10–15-minute activity the leader can watch how well each worker performs the stretch and can compare to their ability to do it the day(s) before. If a worker is having trouble, the supervisor has time to intervene and reassign the worker to a less risky task or even send him/her home (or to the doctor) to recover. The respondents also mentioned that the time set aside for the s/f (and huddle) gives workers some time to physically and mentally transition from thinking about whatever is going on at home, etc., to focusing on the work tasks that they will be doing that day which, they said has great potential to reduce injuries and improve jobsite safety.

While respondents reported benefits of an s/f activity, they also articulated some challenges. Most notably, they said that some workers and subcontractors do not want to spend time stretching and just want to get to work. This type of resistance appears to be addressed primarily by ignoring it, mandating attendance, and letting peers take care of the rest as reflected here, "We've made it a safe work practice, it's not a mandatory thing every morning …it's strictly voluntary …most of the guys feel peer pressure. They don't want to be the only guy saying: 'I don't want to bend over. I don't want to do that.'" The other logistical challenge is the typical decentralized nature of a construction jobsite where some workers may be assigned to locations a fair distance away from where the s/f takes place. While not ideal, respondents told us that when this can't be overcome, supervisors or co-workers are relied upon to ensure that they conduct their own s/f sessions using recommended stretches.

4.1. Limitations

There are some limitations to our study. The sample was composed of 48% large companies, although there was some variation. Typically, larger and medium-sized companies have the resources to employ safety and health professionals who would implement activities such as an s/f program. Also, respondents from such companies also are more likely to have time to participate in an interview or complete a survey. We plan to disseminate the key findings from this study to smaller contractors and follow up with some of them to collect their opinions of the findings.

Another limitation is the low survey response rate, though it is not atypical for research conducted in the construction industry. We think, however, that respondent distribution across company types and sizes, the high degree of correspondence between the interview and survey findings from non-overlapping samples, and the percentage of respondents whose companies did and didn't have an s/f program, provides additional confidence in the lack of potential selection bias.

5. Conclusion

WMSDs account for approximately one-third of all injuries in the U.S. construction industry (CPWR: The Center for Construction Research and Training, 2013). Our findings suggest that construction companies continue to implement S/F programs with the goal of reducing WMSDs, albeit with little to no scientific evidence showing that they work as intended. Even participants who reported seeing a reduction in WMSDs said that it was likely not due to the s/f programs alone but did say that stretching may reduce the severity of such injuries, particularly for older workers. The aging workforce should also be an important

motivator for companies to add ergonomically focused system and process changes to the more worker behavior-focused s/f programs.

5.1. Practical applications

While reducing WMSDs may be the primary reason for conducting jobsite s/f programs, there are other benefits as well. Bringing work crews together for the s/f activity at the beginning of the day has prompted employers to also begin conducting daily safety huddles which can lead to improved worker communication, coordination, camaraderie, and team building. Even if employers do not see a reduction in WMSDs or can't specifically attribute a reduction solely to their s/f program, the ancillary benefits may be enough to warrant the investment of time and resources, as long as they are properly designed and conducted. Well-designed prospective studies are needed to assess the degree to which s/f programs plus other ergonomic and non-ergonomic initiatives can improve jobsite safety climate, communication, camaraderie, collaboration, as well as reduce WMSDs.

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