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Using Community-based Organizations and Partnerships to Enhance Reach and Engagement of Small Construction Establishments

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Abstract

Small construction establishments--defined as those with fewer than 20 employees--experience a disproportionate share of fatal work injuries and increasing rates of non-fatal injuries. Reaching and engaging small establishments, and the vulnerable workers they employ, remain a challenge. To address this need, a community-based process targeting CPWR's Environmental Career Worker Training Program (ECWTP) was developed and tested in four U.S. metropolitan areas. At-risk individuals, including those working in small construction businesses, were surveyed regarding critical safety needs for construction workers in their communities. This process and related outcomes can be used to test and adapt evidence-based safety solutions developed by the CPWR Research to Practice Roundtable on Small Employers at Disproportionate Risk, as well as to expand the communication and collaboration among participating organizations, thereby enhancing research efforts in translational research.

Key Findings

- The process of using ECWTP community and organizational networks was not successful in reaching small construction businesses directly but was effective in reaching individuals from disadvantaged and underserved communities to assess their safety needs.
- At-risk workers responding to the survey indicated that safety is extremely important for construction workers in their communities and reported that safety training (88%), safety at the worksite (85%), and availability of safety equipment (82%) were the most important factors in supporting worksite safety.
- Respondents identified time pressure and emphasis on production (60%) and lack of training (54%) as the greatest challenges to safety that construction workers face in their communities.
- Eighty-six percent of those surveyed indicated interest in learning more about CPWR and the safety information and resources they provide, suggesting that CPWR can further use this process for targeting and disseminating evidence-based solutions directed at the safety needs of at-risk workers in these communities.

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Introduction

Small construction establishments, defined as those employing fewer than 20, experience a disproportionate share of fatal work injuries and increasing rates of non-fatal work injuries (CPWR, 2018). For example, in 2015, more than 50% of construction deaths occurred in small establishments, even though fewer than 40% of the wage and salary workforce were employed by these companies. Small construction establishments are also characterized as more isolated, employing greater numbers of at-risk workers, and lacking in formal health and safety programs often found in their larger counterparts (Wang et al., 2016). Health and safety researchers face significant challenges in not only reaching these small establishments, but also influencing their acceptance and adoption of evidence-based solutions (e.g., safer work practices, tools, equipment) that can improve worker safety.

CPWR's Research to Practice Roundtable on Small Employers and Disproportionate Risk (r2p Roundtable) was established to help address the safety and health needs of small employers and at-risk workers. The virtual r2p Roundtable provides a platform for information sharing and facilitates an on-going dialogue among researchers and industry professionals to advance use of research findings and related interventions by small contractors and their employees and thereby reduce occupational injuries, illnesses, and fatalities on construction sites (Betit et al., 2019).

In recent years, the r2pRoundtable convened to share study findings about various methods to recruit and engage small construction contractors (CPWR, 2019a). These discussions revealed that methods relying on established relationships such as construction management advisory boards and organizational networks led to more successful recruiting efforts (Marin & Al-Bayati, 2018; Olson, 2019). These findings are consistent with research on the effectiveness of using existing organizational and community-based networks for recruiting small residential construction contractors (Marin & Roelofs, 2018), engaging partners for a social marketing campaign through established community relationships (Macario et al., 2015), and pilot-testing opioid prevention training programs (Roelofs et al., 2021). Related research has demonstrated that over time, multi-stakeholder partnerships involving diverse members facilitate the dissemination of health and safety innovations and encourage collaborations to support their use (Chang et al., 2015). The reliance on partnerships, which can represent the local network of diverse organizations with established community relationships, engenders greater trust and increased access to small construction establishments and the workers they employ. Taken together, these results suggest that future engagement efforts for research on small construction establishments should incorporate the use of trusted relationships through local organizational and community-based networks.

The present study developed and tested a process that builds on established relationships to engage small construction establishments and workers at disproportionate risk in four US metropolitan areas. Funded by the National Institute of Environmental Health Sciences (NIEHS), the CPWR Environmental Career Worker Training Program (ECWTP) assists disadvantaged workers through health and safety and construction training, certifications, and securing construction jobs (NIEHS, 2015). In each area, the ECWTP has active advisory boards with representation from Building Trades Unions, community-based organizations, local businesses, state and local governments, and other relevant community partners to improve program outcomes (Sarpy, et al., 2020). The composition of the advisory boards and related partnerships varies based on the workforce needs of each community (Sarpy, 2019). Relationships among these key community leaders were used to engage the small contractors and at-risk workers targeted by the programs, which is a long-standing area of interest for the ECWTP and their partners. It is important to note that while small construction contractors are among the construction employers in ECWTP communities, they are not well represented as members on the ECWTP advisory boards.

The overarching goal of the study was to create an iterative multi-stakeholder approach that builds capacity for translation research targeted at small construction establishments thereby enhancing capacity of the r2p Roundtable. To achieve this goal, a systematic community-based process that relied upon trusted relationships among ECWTP advisory boards to facilitate identification of and outreach to small construction establishments

and the workers they employ was developed and implemented to gain a greater understanding of their specific safety practices and needs.

- Specific Aim 1: Establish a systematic community-based process, using CPWR ECWTP advisory board members and partnerships, to reach small construction employers and at-risk workers in four cities nationwide.
- Specific Aim 2: Assess safety needs and practices, including barriers and motivators (facilitators), to accelerate acceptance and adoption of safety practices among small construction businesses and the at-risk individuals they employ.
- Specific Aim 3: Inform research and practice partners regarding the effectiveness of a community-based process to reach and engage small construction companies and the individuals employed by these establishments.

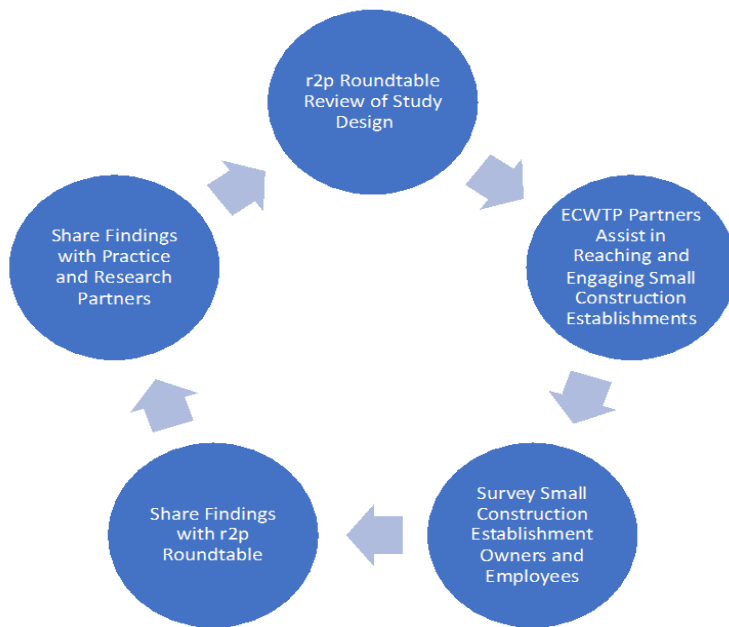
In meeting these aims, the study attempted to address the following objectives of the National Occupational Research Agenda for Construction: (1) Objective 9: Small Business; (2) Objective 8: Workers at Disproportionate Risk; and (3) Objective 13: Research to Practice (r2p).

Method

The approach used is grounded in participatory research (Davis & Ramirez-Andreotta, 2021) and emphasizes active involvement and collaboration among researchers and representatives from the community in which the interventions are targeted. The participatory approach is a hallmark of the ECWTP, which emphasizes advisory board members' and partners' input in ensuring the training meets the needs of the workplaces and communities in which program graduates are employed. The ECWTP advisory board has two types of committees: a Community Advisory Committee in each of the four metropolitan areas and an overall Environmental Justice Advisory Committee. (Each is described in more detail below.) Collectively, these committees represent a wide spectrum of organizations, providing diverse representation of the businesses and social system of each community. The ECWTP advisory board also engenders greater communication and collaboration among program partners and the broader communities in which program graduates typically work and reside.

The multi-stakeholder approach advanced by the present study was driven by this participatory closed-loop system (see Figure 1). As depicted below, each phase relies on input from major stakeholders to inform the next phase. The process began with meetings of the r2p Roundtable and the study team to review the project, including methods and design. The next phase met with the ECWTP partners to help reach and engage participants for the surveys and, following data collection and analysis, share preliminary results. Findings were then shared with the r2p Roundtable to inform on-going research efforts and disseminate to the broader scientific community and practice partners. The approach creates an iterative process that can be used to encourage collaboration among researchers and practice partners, incorporate needs of the community and small construction establishments, and identify and address barriers to acceptance and adoption of safety solutions in each community.

Figure 1. Multiple Stakeholder Approach for Community-based Process to Reach and Engage Small Construction Establishments



Review of Study with r2p Roundtable

The r2p Roundtable regularly convenes to share study findings regarding the usefulness of various methods to recruit and engage small construction contractors. As an initial step, the study was presented to the r2p Roundtable prior to collection of data. With support from CPWR’s Research to Practice Director, the study team met with the r2p Roundtable to formally present an overview of the study, including purpose, objectives, methodology, and potential synergy with r2p research efforts with small construction businesses and at-risk workers. The r2p Roundtable members served as subject matter experts and provided suggestions for improving study design and instrumentation. Individual meetings were conducted with Roundtable members who expressed interest in discussing the study in greater depth.

Two outcomes emerged from the r2p Roundtable discussions and individual meetings. First, based on suggestions from the members, minor modifications to the wording and format of the surveys were made (e.g., employee survey was revised from a short answer to checklist format; see Appendix A). In addition, r2p Roundtable members suggested three additional outreach meetings with colleagues. More specifically, the r2p Roundtable members facilitated meetings with representatives from OSHA state consultation services, who provided subject matter expert review of the study design and methodology. They also stated the process and outcomes in the study could provide complementary information to their program objectives.

Presentation and Discussion with ECWTP Environmental Justice Advisory Committee (EJAC)

The EJAC represents diverse regions of the country and areas of expertise. During the annual EJAC meeting, the principal investigator gave a formal presentation that provided an overview of the study (purpose, objectives, methodology) and highlighted the potential study benefits (enhancing workplace safety in their communities). A general discussion followed that included a review of the supporting documentation and surveys. Following the meeting, the study summary, survey instruments, and supporting documents were forwarded to EJAC members for in-depth review. In addition, individual meetings with members of the EJAC were held to provide guidance and support. Based on suggestions from EJAC members, the supporting documents used to recruit study participants were revised to better convey potential benefits (see Appendix B).

Presentations and Recruiting with ECWTP Community Advisory Committees (CAC)

The ECWTP has its own extensive network of partners representing government (including workforce investment boards), community-based organizations, faith-based organizations, labor unions, potential employers, transportation departments, and other organizations, which assist in core functions of the ECWTP. The ECWTP has separate CACs, comprised of approximately eight to ten representatives, in each of its four communities. Each CAC has regularly scheduled board meetings in which members discuss community needs and ECWTP progress. With the support of the ECWTP Program Coordinators, formal presentations and discussions of the study, including purpose, objectives, methodology, and potential benefits of enhancing workplace safety in their communities, were conducted with CACs in each community. As detailed below, the process used to conduct each meeting varied slightly across the four CACs.

Problems Encountered and Changes to Study Methods

The COVID-19 pandemic impacted the program activities of the ECWTP, including the regularly scheduled in-person meetings with CACs. To follow COVID-19 protocols and ensure safety, in-person meetings were transitioned to virtual format, which caused scheduling delays. A formal extension of the study timeline allowed additional time to meet with the CAC members and resulting referrals in each city.

The CAC meetings for the ECWTP in Boston and East Palo Alto, California, were held using virtual technology (Zoom). The programmatic delays and interruptions due to the pandemic also resulted in restructuring the original process for presenting and gathering information from the advisory committees. Newly developed materials helped Program Coordinators follow up with CAC members to encourage participation (i.e., an additional round of outreach and personal contact with the CAC members via emails and telephone calls). While increasing complexity and time needed, the revised process produced additional interactions to gain support and trust often required for referrals to small construction establishments.

As conditions surrounding the pandemic improved, training centers began returning to in-person meetings, allowing for site visits and in-person presentations. Changes in COVID-19 protocols allowed for site visits and face-to-face meetings for the two remaining cities, New Orleans and Flint, Michigan. The session with CAC members in Flint was also live streamed to enable participation for CAC members not able to attend in person. The different meeting formats allowed for comparison of the virtual and in-person formats.

Regardless of format, no small contractor referrals were provided by the ECWTP CACs in any of the four cities. While the outreach did not generate referrals to the small construction businesses, the in-person sessions in New Orleans and Flint and a meeting attended by the Principal Investigator with the Boston CAC in October allowed for additional follow-up regarding the barriers/challenges to accessing these owners. Specifically, informal discussions with individual CAC members gathered additional information about why the current study process did not identify and gain access to the small construction contractors.

These discussions identified several issues. Most often, the CAC members indicated that they did not have knowledge of or access to the small construction contractors. Other CAC members stated that they did not have names directly and further elaborated that they did not feel that the small construction businesses would be interested in providing information about their safety practices due to fear of being punished for any safety violations that may be identified. Others conveyed that they felt that the small businesses would be not amenable to sharing any information about their workers given the competition for workers. They stated that due to the current economic and COVID-19 concerns, these businesses were particularly careful about giving any information that might be used to draw workers away from their sites to their competitors. However, all CAC members consistently stated the need to provide greater safety solutions and resources to these small contractors and supported the study effort.

Survey Administration to ECWTP students and program graduates

While the community-based process was not successful in gaining access to the small construction businesses, it proved quite effective in gathering information from the current and graduated ECWTP students who are training for and/or working in construction. The students who come to the ECWTP are unemployed and underemployed workers from underserved communities and are representative of at-risk workers from vulnerable populations typically employed by the small construction companies in their communities. The ECWTP students attending the final 2021-2022 training cycle (March 2022 through June 2022) were surveyed using an anonymous online evaluation regarding current worker safety needs (Boston: n=12; East Palo Alto: n=10; Flint: n=5; New Orleans: n=5). The in-person visits to the New Orleans and Flint programs allowed for a similar survey administration to the graduated students who participated in the CPWR ECWTP 2021-2022 evaluation (Flint: n=4; New Orleans: n=4). It should be noted that the extension also allowed for administration of the online survey to the first 2022-2023 training cycle of the Boston ECWTP (n=10) in October 2022. In addition, graduated students were contacted directly by the Program Coordinators and provided the survey link in each of four communities from October 2022 to December 2022.

Results

The following section highlights the findings from the online survey of ECWTP students.

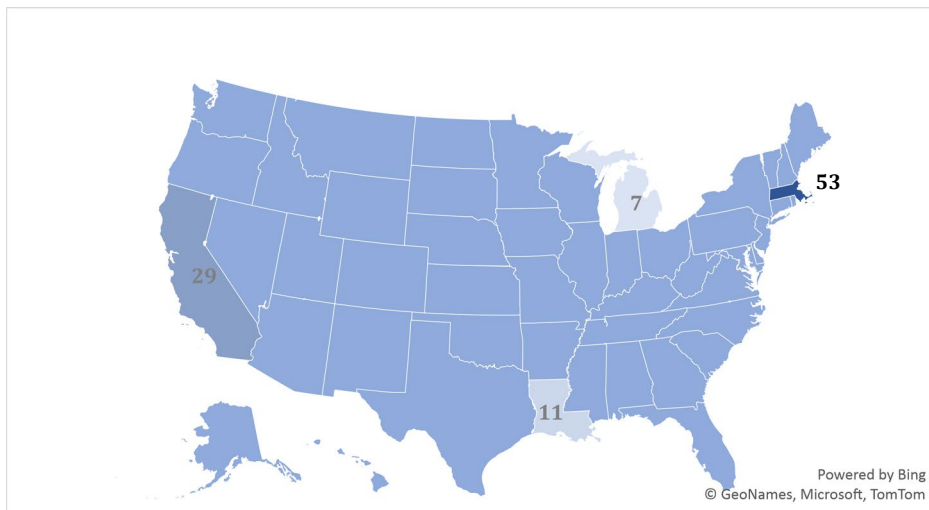
Participants

Seventy-two ECWTP students, both current and graduated, completed the online surveys. Because the evaluation process and related survey links were created to assure anonymity, response rates could not be calculated.

Location

As shown in Figure 2, respondents came from all four ECWTP communities, with the largest percentage of respondents working in construction in the greater Boston area. More specifically, ECWTP students from Flint (7%); New Orleans (11%); East Palo Alto (29%); and Boston (53%) completed the survey.

Figure 2. Percentage of ECWTP Students Participating According to Location

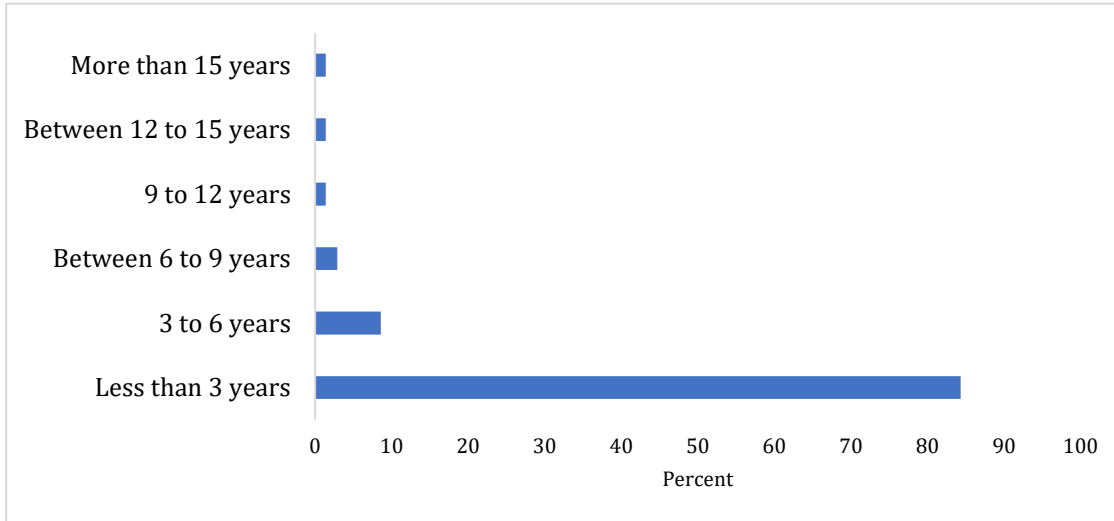


Note. N=72.

Years Worked in Construction

Respondents also provided information regarding their tenure working in construction (see Figure 3). The vast majority reported that they had worked in construction fewer than three years (84%). Several respondents had a slightly longer tenure of three to six years (9%), with a few indicating six to nine years (3%).

Figure 3. Years Worked in Construction Reported by Participants

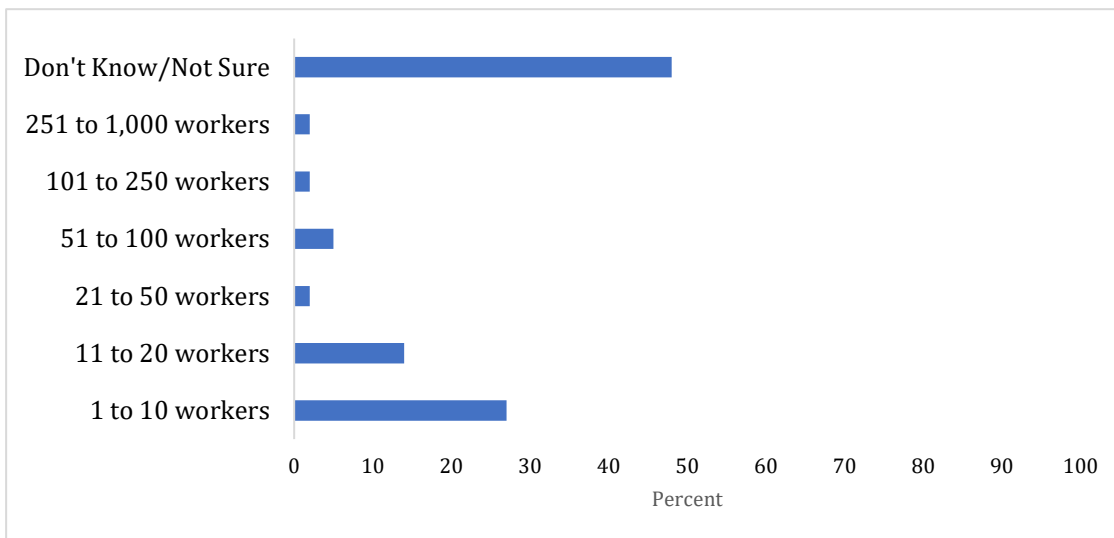


Note. N=70.

Number of Workers Employed on Site

Only a little more than half of the respondents (56%) provided information concerning number of workers employed on site. Of those responding, more than 40% reported that their construction company typically employed 20 or fewer workers on a job site (see Figure 4). More than a quarter of the respondents reported working with 10 or fewer workers (27%). It should be noted that nearly half of the respondents (48%) indicated that they were unsure of the numbers of workers employed at their worksites and did not provide an estimate.

Figure 4. Number of Workers on Site Reported by Participants

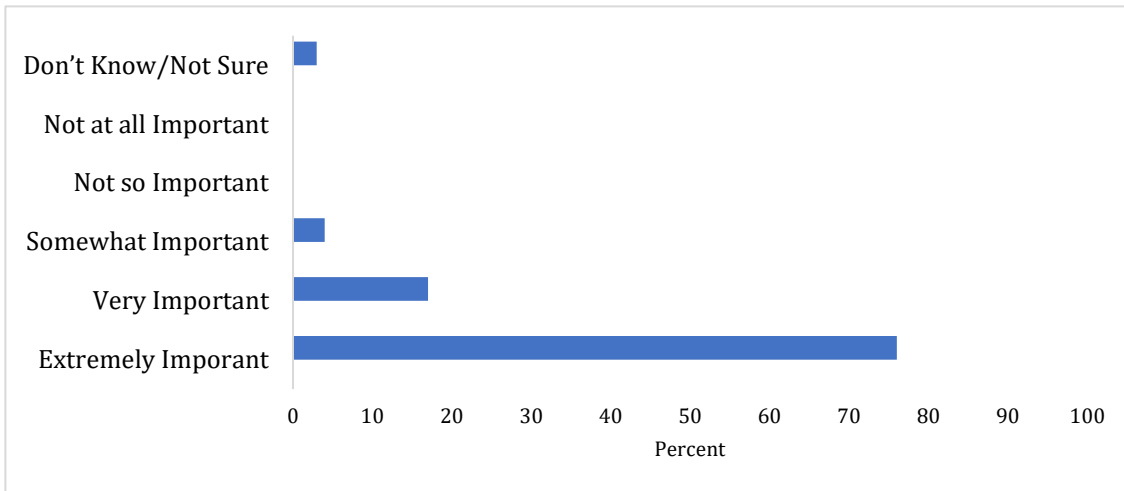


Note. N=41.

Importance of Safety

Across locations, the respondents reported that **safety is extremely important to the average construction worker in their community** (Mean=4.71, SD=0.57); (see Figure 5). More specifically, 93% of those responding said safety was either Very or Extremely Important for the average construction worker in the ECWTP metropolitan area. Consistent with previous research, when assessing importance of safety, “average” construction worker was used as a referent to denote the typical construction worker in their community (Burke et al., 2002).

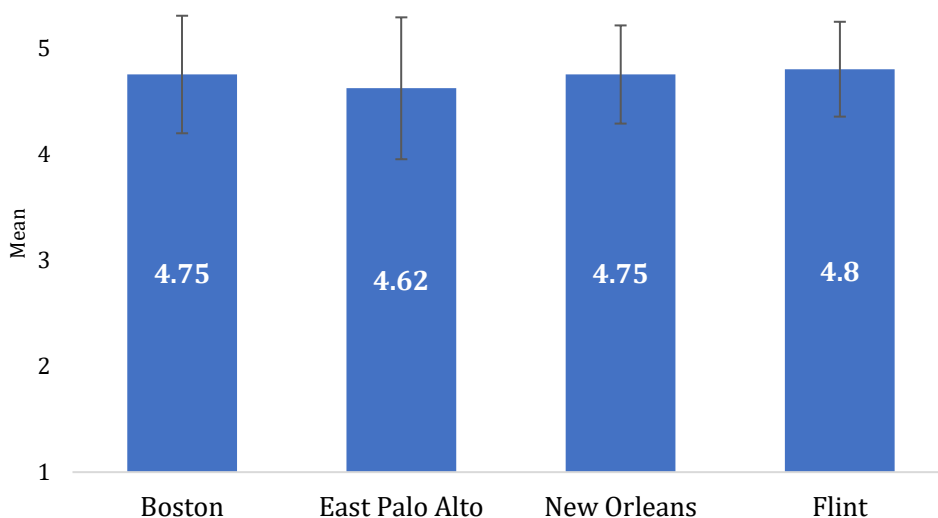
Figure 5. Percentage of Participants’ Ratings of Safety Importance for Average Worker in Construction



Note. N=71. Rating scale ranged from 1 ‘Not At All Important’ to 5 ‘Extremely Important.’

As depicted in Figure 6, these results are consistent across ECWTP locations. That is, while Flint provided the highest rating, **safety is recognized as extremely important for the average construction worker across all ECWTP communities.**

Figure 6. Mean Ratings of Safety Importance by Participants’ ECWTP Location



Note. N=70. Rating scale ranges from 1 ‘Not At All Important’ to 5 ‘Extremely Important.’ Vertical bars represent standard error of the mean.

To further examine these results, a one-way ANOVA was performed to determine if statistically significant differences existed between respondents' ratings of safety importance by ECWTP location (see Table 1). Results revealed there were no significant differences in mean ratings based on location of the ECWTP [$F(3, 66)=0.283$, $p=0.837$], suggesting shared perceptions of the high importance of safety to the average worker in construction nationwide.

Table 1. ANOVA of Safety Importance Ratings by Participants' ECWTP Location.

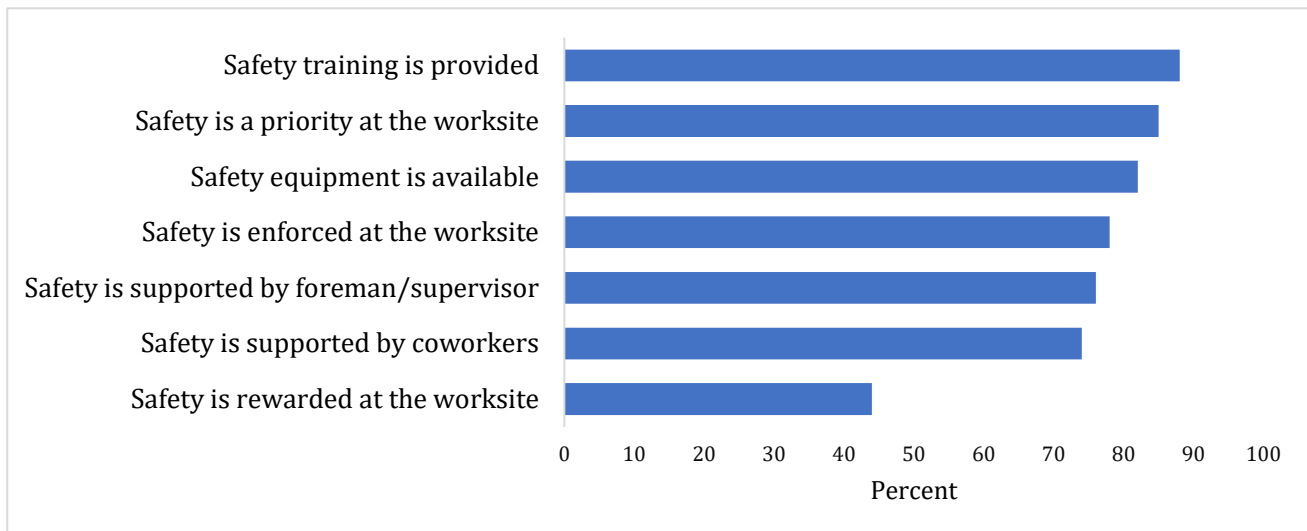
Respondent's ECWTP Location	N	Mean	SD	p-value
Boston	36	4.75	0.55	.837
East Palo Alto	21	4.62	0.66	
New Orleans	8	4.75	0.46	
Flint	5	4.80	0.44	

Note. Rating scale ranged from 1 'Not At All Important' to 5 'Extremely Important.'

Most Important Factors in Supporting Worker Safety

The respondents reported the most important factors that support their safety (see Figure 7). Specifically, respondents identified all factors deemed as critical to supporting their safety in performing construction work. **Safety training** (88%) was most often identified, followed closely by **safety being a priority** at the worksite (85%) and the **availability of safety equipment** (82%). **Enforcing safety** (78%) as well as **direct support** by foreman/supervisors (76%) and fellow workers (74%) also were often recognized as critical. It should be noted that these factors characterize positive safety climates, which research has shown promote enhanced safety for workers at construction sites.

Figure 7. Percentage of Most Important Safety Factors Keeping Workers Safe in Performing Construction Work in Their Communities Reported by Participants



Note. N=70. Respondents could indicate more than one response.

Greatest Challenges to Worker Safety

Respondents also identified all challenges to safety that construction workers face in their communities. As shown in Figure 8, the most often cited challenge to safety was **time pressure and emphasis on production** (60%) at the worksite. More than half of the respondents reported that **lack of safety training** (54%) was a challenge to safety for construction workers in their community. Respondents also cited **lack of support by coworkers** (28%) and **supervisors** (25%), **safety not being recognized as a priority** (25%), **lack of available equipment** (18%) and **difficulty in enforcement** (18%) impeded their safety. Interestingly, a small but meaningful percentage of respondents indicated the belief that “**construction is dangerous and nothing can be done to change that**” as the greatest challenge facing workers in their community.

Figure 8. Percentage of Challenges to Safety Reported

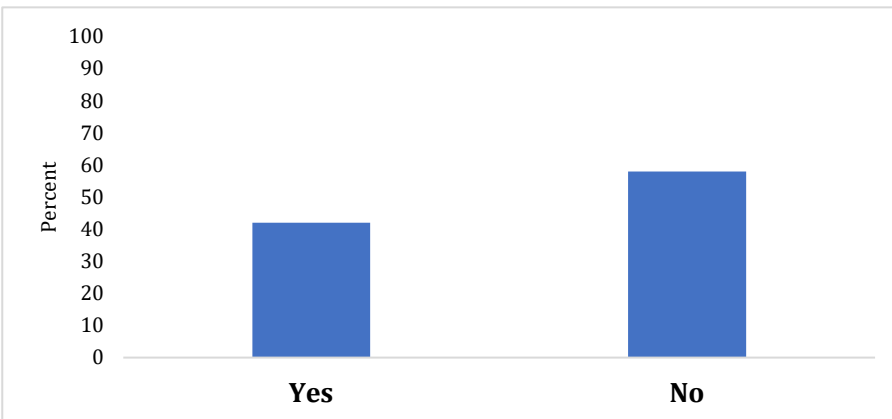


Note. N=70. Respondents could indicate more than one response.

Familiarity with CPWR

In addressing these challenges, respondents were asked to indicate their level of familiarity with CPWR. This question is particularly important given the current support that CPWR provides to the ECWTP (e.g., worker health and safety trainings) and assesses students’ awareness of the available information and resources. As depicted in Figure 9, the **majority of respondents indicated that they were not familiar with CPWR** (58%).

Figure 9. Percentage of Participants Familiar with CPWR

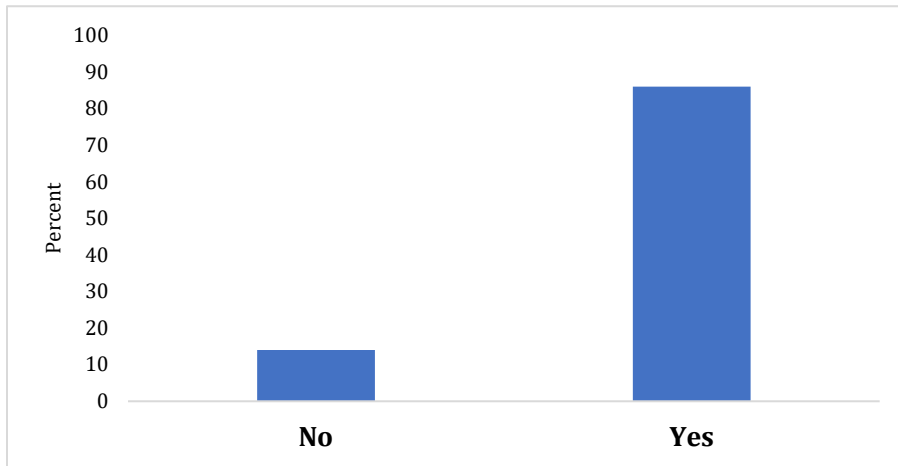


Note. N=71.

Interest in Learning More about CPWR

Overwhelmingly, the respondents indicated that they were interested in learning more about safety information and resources that CPWR provides (86%) (see Figure 10). It should be noted that this percentage includes those who already are familiar with the CPWR (i.e., respondents indicating familiarity with CPWR as shown in Figure 9). These results suggest an opportunity to share CPWR resources to enhance safety for both workers who have knowledge of existing CPWR information and resources as well as those who are unfamiliar with that material.

Figure 10. Percentage of Participants Indicating Interest in Learning More about CPWR



Note. N=71.

Additional Comments and Suggestions

The findings from the descriptive and comparative analyses provide evidence of the worker safety needs of the ECWTP students in their communities. To gain a more thorough understanding of why these results occurred, qualitative data were gathered.

Respondents were asked to comment about safety in construction businesses in their communities. Several themes emerged from the responses, and categories and comments are presented in Table 2 in order of frequency.

Respondents described specific examples about the importance of **safety knowledge and safety training** particularly for apprentices. The competing priorities of **emphasizing productivity versus safety** was also highlighted, with one respondent pointing out that “safety should be more important, because working in a safe area we can be more productive.” The **general importance of safety** for construction workers was also identified as a critical issue, with several respondents acknowledging **the important role that ECWTP** plays in their communities. Examples of issues with **safety communication** with safety representatives, foremen, and coworkers were also offered. Finally, the **lack of safety enforcement** was raised by one respondent who noted that “it shouldn't take an accident” for enforcement to happen.

Table 2. Additional Comments Regarding Safety in Construction in ECWTP Communities

Safety Knowledge/Safety Training
It is crazy how now when I walk around and see work sites. I notice more and more safety violations.
I've worked on a Suffolk Construction job from December-July my entire crew never did their safety orientation.
I have experience in the trades and have done some of these trainings 2x over and its good information. But novice apprentices definitely need to be drilled this information specially with real life events that can drive home the info and realize it.
A lot of construction workers walk off the streets to work and know nothing about safety training and what could happen on a site.
I am very new to the trade with no experience, when I do get accepted into the union I would hope that the union I'm with would help me and not feel annoyed because I am a 'newbie'.
Prioritizing Safety over Production
Safety practices are verbalized to employees but getting the job done is often more important than safety requirements
Safety should be more important, because working in a safe area we can be more productive.
I think most non-union companies try to be safe but they are most concerned about finishing the job faster rather than focusing on safety
Most things are production driven which puts safety on the back burner
Importance of Safety in Construction
Safety First
Safety in construction is so important. I want to make sure that anyone working in construction is safe.
Safety is very important at any job.
Importance of CPWR ECWTP
You are great for teaching us about safety.
I love JOBTRAIN period amazing organization.
Currently, attending the pre-apprenticeship program.
Safety Communication
I spoke to the Suffolk safety guy and his response was tell your foreman. Even though I had previously done so. I felt like that wasn't a professional response as that is his job.
I think as trades workers we need to be able to have conversations with each other and work together to be safe.
Safety Enforcement
The foreman didn't enforce it.
OSHA rules and regulations need to be followed by everyone in the construction field, from apprentices', to journeymen, foreman, and even site managers or supervisors. Once an individual steps foot onto a worksite, all safety and OSHA precautions, rules and regulations have to be followed without hesitation. In addition, OSHA inspectors need to make more frequent visits to work sites to help enforce safety. I understand there are supposed to be safety representatives at every work site, but that may not be enough. I also understand that OSHA inspectors are very minimal in numbers and staffing but it shouldn't take an accident to happen for an inspector to show up.

Summary of Findings and Implications for Future Research

A systematic process was developed and pilot-tested in four U.S. metropolitan areas to determine the effectiveness of ECWTP community and organizational networks in reaching small construction businesses and the at-risk individuals they employ. Pilot-testing of the process revealed that using connections of the ECWTP advisory committees was not successful in reaching small construction businesses directly. While the advisory committees had deep connections to their communities, they did not extend to small construction establishments directly. Those reporting more indirect ties to these establishments further cited current business environment and challenges to the labor market brought on by the pandemic as barriers that inhibited their ability to reach these smaller businesses.

However, this process was effective in reaching at-risk individuals in underserved communities to assess their safety needs because the ECWTP has direct access to current and graduated students. Respondents to a survey of graduated and current ECWTP students in the four communities found that they were generally new to the field of construction (3 years or less), most often worked on sites with fewer than 20 workers, and were representative of the targeted, at-risk worker subpopulation. The respondents reported, on average, that safety is “Extremely Important” to construction workers in their community. Respondents cited critical factors that support safety for construction work, including (in order of frequency): (1) safety training is provided; (2) safety is a priority; (3) safety equipment is provided; (4) safety is enforced; and (5) safety is supported by foreman, supervisors, coworkers.

They also identified critical safety challenges construction workers face in their communities, including (in order of frequency): (1) time pressure and emphasis on production over safety; (2) lack of safety training; (3) lack of support by coworkers and supervisors; (4) lack of equipment; (5) difficulty in enforcement; and (6) the attitude that construction is dangerous and nothing can be done to change that.

Qualitative comments echoed these findings. Respondents described specific examples depicting the importance of: (1) safety knowledge and training; (2) competing priorities of safety and production; (3) issues with safety communication with supervisors and coworkers; (4) lack of safety enforcement; and (5) general importance of safety for construction workers. Importantly, they stated ECWTP plays a critical role for worker training and safety in their communities.

Respondents also described their familiarity with and interest in accessing safety information. While fewer than half of the respondents were familiar with CPWR, the overwhelming majority wanted to learn more about the safety resources that CPWR provides. Upcoming discussions at the EJAC annual meeting will focus on identifying ways in which the CPWR and the products and services it provides can be better promoted by the programs. Further, because many of the respondents indicated that they work on sites with 20 or fewer employees, the ECWTP students themselves (both current and graduated) also may be a source for identifying small construction establishments in underserved communities and provide a direct conduit to the vulnerable workers who would benefit the most from these resources.

Findings suggesting benefit of strengthening the relationship between ECWTP graduates and the CPWR is consistent with other ECWTP research projects concerning careers in construction (Sarpy & Surtees, 2023), particularly those promoting diversity, equity, and inclusion (DEI). Results of an ECWTP study revealed that women ECWTP graduates who recently attended the North American Building Trades Union’s “Tradeswomen Build Nation” conference expressed interest in continued and enhanced connections with ECWTP and CPWR. Along with providing information about the growing needs for women with careers in construction, the graduates stated that they were the “Power Tools of the ECWTP” and suggested that they would like to serve in a greater role in fostering ties between ECWTP, CPWR, and other program graduates, including their male counterparts, to support careers in construction. Given the relative emphasis on DEI initiatives in the construction industry (Bilginsoy et al., 2022), these results present an opportunity in advancing DEI workforce development efforts, particularly those focused on promoting safety and retention of at-risk workers in construction in underserved communities.

These results also have implications for the community-based process developed in the current study. First, although using connections of the ECWTP advisory committees did not provide direct entrée to the small construction businesses, the ECWTP students themselves served as conduits for gaining information and insight, as many respondents indicated that they work on sites with 20 or fewer employees. Therefore, future studies could examine the use of social networks and trusted ties among the ECWTP students in increasing awareness and adoption of evidence-based safety solutions targeting at-risk workers. Social network analyses could be conducted to explore the relationships and connectivity among ECWTP students to obtain a greater understanding of the characteristics of the most influential connections in supporting communication and dissemination efforts of

safety-related information (Sarpy & Stachowski, 2020; CPWR 2019b). This analysis could also examine the extent of outreach to those employed in small construction establishments. Related, tailored strategies for disseminating this information, such as safety nudges derived from behavioral economics, can combat critical safety challenges and related managerial decisions (e.g., prioritizing productivity over safety) (Sarpy, et al., 2022). Because these techniques are simple and cost-effective, they are a useful enhancement for resource constrained organizations in underserved communities such as those associated with the ECWTP.

A final consideration for future use of this study's process can be found in recent research on use of occupational safety training to assist in addressing the impact of climate change and accomplishing sustainability development goals (Burke, Sarpy, & Valenzuela, 2023). Working populations are often overlooked in the research studying the impact of climate change on human health, and as such, workers are aptly described as "the climate canaries in the coalmine" (Roelofs & Wegman, 2014; Levy & Roelofs, 2019). In response, frameworks have been advanced that describe several priority areas for enhancing worker health and safety in response to emerging climate challenges (e.g., greater understanding of impacts of exposure to extreme temperatures); (Schulte & Chun, 2009; Schulte, et al., 2016). Critical training needs of at-risk worker populations from low-income and disproportionately impacted communities are a priority area. Occupational health and safety trainings are a primary prevention strategy to address their emerging needs (Kiefer et al., 2017). Recently, an assessment of existing occupational health and safety trainings with respect to these emerging climate-related occupational hazards was conducted to identify critical training needs for at-risk workers, including those in construction (NIEHS, 2022). The process established by the current study offers a novel approach for systematically examining the training needs of this vulnerable worker population and tailoring effective community-based initiatives for addressing these needs. It should also be noted that the NIEHS ECWTP consortium is comprised of five other NIEHS grantees (Western Regions Universities Consortium; OAI, Inc.; Sustainable Workplace Alliance; Deep South Center for Environmental Justice/Texas Southern University; New Jersey/New York Hazardous Waste Materials Training Center) that also serve at-risk workers in underserved communities. There are potential research collaborations among these groups to use the process developed and refined in the current study to address these emerging worker health and safety training needs in other communities nationwide.

List of presentations/publications

Completed Presentations

The Justice40 Initiative is a whole-of-government effort to ensure that at least 40 percent of overall benefits from federal investments in climate and clean energy flow to disadvantaged, low-income, marginalized communities of color. The National Institute of Environmental Health Science (NIEHS) ECWTP was among the initial set of Justice40 pilot programs that emphasize training and workforce development. This study's Principal Investigator and the Director of the CPWR ECWTP coordinated with the Director of the NIEHS Worker Training Program to develop a panel presentation focusing on the Justice40 Initiative at the 2022 American Public Health Association annual conference (Sarpy, Beard, et al., 2022). This session featured the Boston ECWTP and was attended by approximately 150 occupational health and safety professionals. It highlighted the benefits ECWTP offers workers and underserved communities and cited the present study as part of the community-based process in developing and evaluating the programs. Dr. Sarpy is collaborating with Dr. Mitchell Rosen from Rutgers University and Sharon Beard of NIEHS in writing a manuscript for submission to a peer-reviewed journal that highlights this presentation.

Planned Presentations

Dr. Sarpy, Dr. Stachowski, and Steve Surtees are preparing a submission, which will describe the community-based process in addressing the needs of at-risk workers in construction, to the Occupational Health and Safety division of the 2023 American Public Health Association annual conference "Creating the Healthiest Nation: Overcoming Social and Ethical Challenges."

Dr. Sarpy, Mary Vogel (Program Coordinator, Boston ECWTP) and Steve Surtees are preparing a submission, which will present the findings of the present study as part of a larger presentation discussing enhancing retention of women in the trades (Town Hall Meeting), to the 2023 National Brownfields Training conference.

Dissemination plan

As previously described, the multi-stakeholder approach advanced by the present study was driven by a participatory closed-loop system (see Figure 1) to create synergy among practice and research partners, with each phase of the process relying on participation and input from major stakeholders to inform the next. The dissemination plan follows this approach in sharing the study findings.

An overview of the study findings was presented to the ECWTP Program Coordinators at their annual meeting in January 2023. Each program can use the findings to assist on-going efforts to identify and improve resources to ensure safety for construction workers in these underserved communities. An online presentation of study findings to the ECWTP Environmental Justice Advisory Committee meeting took place February 2023. Together with information gathered from the ECWTP Program Coordinators, this discussion further gathered information to identify relevant CPWR resources to support program graduates in their construction career path.

The preliminary findings of the surveys and recommendations from discussions with ECWTP partners then will be presented to the r2p Roundtable. Further, based on these findings, recommendations toward social network analysis and safety nudges that can be used to enhance acceptance and adoption of the workplace safety interventions will be shared. This iterative process will create a closed-looped feedback system that initially used the r2p Roundtable input to enhance the effectiveness of the outreach activities of the study as well as help to inform the research aim on Behavioral Economics of the r2p Roundtable in the later stages of the process. Further, the r2p Roundtable will help disseminate information about the industry guidelines used in the process and the study findings nationwide. As previously described, the findings will also be submitted for presentation at professional conferences. In this way, this iterative process can be used to encourage collaboration among researchers and practice partners to address at-risk workers' safety needs in underserved communities.

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