



Evaluation of changes in knowledge and attitude among youth after a one-hour introduction to workplace safety and health: *Safety Matters*

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ABSTRACT

Introduction: Young workers in the United States are injured at higher rates than adults, a trend that has persisted for more than two decades. Despite known risks, young people enter the workforce with little-or-no preparation for the hazards they may face. In 2016, the National Institute for Occupational Safety and Health and American Industrial Hygiene Association developed *Safety Matters*, a one-hour educational module to raise awareness of workplace safety and health among young people. **Method:** A pilot project was conducted to evaluate the effectiveness of *Safety Matters* to positively change workplace safety and health knowledge and attitude scores among a sample of 283 youth in Colorado. Train-the-trainer sessions prepared volunteer safety and health professionals to deliver *Safety Matters* with fidelity and to conduct the assessment immediately prior to and following the program. **Results:** After receiving *Safety Matters*, participants had statistically significant ($p < 0.001$) increased scores for both workplace safety and health knowledge (Cohen's $d = 1.12$; large effect size) and importance (attitude) (Cohen's $d = 0.51$; medium effect size). Although univariate analyses showed knowledge and attitude scores significantly increased for all demographic groups examined, there were statistically significant differences in knowledge scores by participant age ($p < 0.01$), ethnicity ($p < 0.05$), and race ($p < 0.001$) and statistically significant differences in attitude scores by participant race ($p < 0.001$). However, when race and ethnicity were both used as predictors in a regression model, only race continued to predict statistically significant ($p < 0.01$) changes in knowledge and attitude. **Conclusions:** This project introduces a promising, community-based model for a one-hour introduction to workplace safety and health on which future, job-specific safety training can be built. **Practical Applications:** Safety and health professionals can play a critical role in promoting the health and safety of young workers. Adapting health and safety programs to diverse youth populations may enhance program relevance and receptivity.

1. Introduction

Recent studies have shown that young workers (aged 15–24 years) in the United States experience higher rates of job-related injury when compared with adult workers (Government Accountability Office [GAO], 2018; Guerin, Reichard, et al., 2020). Data from the National Electronic Injury Surveillance System (NEISS-work; a U.S. nationally stratified, statistically weighted probability sample of emergency department (ED) treated injuries for 2012 to 2018) demonstrated the

annual rates of work-related ED-treated injuries to be 1.2 to 2.3 times higher for workers aged 15–24 years when compared with those for adults aged 25–44 years. Workers aged 18–19 years had the highest rate of ED-treated injuries (Guerin, Reichard, et al., 2020). Lack of job training and safety skills have been proposed as potential contributors to the disproportionate burden of young worker injury (Chin et al., 2010; Zierold & Anderson, 2006; Zierold et al., 2012). Results from focus groups and interviews with 42 currently employed teens aged 15–19 years indicated that workplace safety training for young workers is

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“non-existent or inappropriate and ineffective” (Zierold et al., 2012, p. 1294). More than 50% of the participating teens were employed in restaurant/food or retail (Zierold et al., 2012), the leading industries employing young workers (Bureau of Labor Statistics [BLS], 2023). Zierold (2012) also indicated that among teen workers, “improvement of safety training could have a large impact on preventing injury” (p. 1294). Researchers have reported that existing safety and health training may be inadequate for preparing young people to identify hazards and to advocate for safety, and that the lack of appropriate, high-quality safety training may contribute to high injury rates among these workers (Chin et al., 2010; Zierold & Anderson, 2006; Zierold et al., 2012).

In the year 2000, more than 50% of teens (aged 16–19 years) were engaged in summer employment (Desilver, 2022). This number dropped sharply to a low of 29.6% during the great recession of 2008 but has rebounded to 36.6%, with approximately 6 million U.S. teens having a paying job for at least part the 2021 summer (Desilver, 2022). Historically, as many as 80% of high school students have had a paying job at some time before graduating high school (BLS, 2005). Work, especially in moderation, has been shown to promote healthy youth development (Mortimer, 2010). Many jobs offer important occupation-specific skills and can also promote the development of soft skills such as dependability, reliability, and punctuality (Greene & Staff, 2012). In the past, research indicated that U.S. parents strongly approved of their teens working, with the benefits accrued being increased independence and self-esteem, greater responsibility, and better work habits and time management skills (Philips & Sandstrom, 1990). However, most young people enter the workforce with little-or-no preparation for the safety and health risks they may face at work. Key informant interviews conducted with a purposive sample of 34 school administrators, revealed that only a third of U.S. school districts had at least 75% of their students receiving any instruction on workplace safety and health, and 15% of the school districts provided no workplace safety and health instruction (Guerin, Okun, & Glennie, 2020).

To address this problem, the National Institute for Occupational Safety and Health (NIOSH) and the American Industrial Hygiene Association (AIHA) collaborated to develop *Safety Matters* (NIOSH & AIHA, 2016), a program to raise awareness about workplace safety and health and to provide young people with an understanding of the skills needed to become active participants in creating safe and healthy work environments. This one-hour interactive educational module also includes information on occupational safety and health (OSH) professions that help prevent harm to workers, the environment, and the public. *Safety Matters* is geared towards youth in Grades 7 through 12 but is also appropriate for young adults entering the workforce. This educational module includes a detailed, step-by-step instructor’s guide, PowerPoint presentation, and two short videos. *Safety Matters* is available free-of-charge on both the NIOSH and AIHA websites. The goal in developing *Safety Matters* was to create a simple-to-use educational module that provides an overview of essential workplace safety and health information that is portable to all jobs and industries, transferable across work environments, and compatible with existing work readiness frameworks.

The *Safety Matters* program is based on the *Youth@Work—Talking Safety* curriculum developed by NIOSH and its partners for use in schools throughout the United States (NIOSH, 2015). *Talking Safety* was designed to be delivered by teachers to middle- and high-school students in six, 45-minute lessons. The curriculum, built on the NIOSH eight core competencies (Okun et al., 2016), has been shown to significantly increase pretest–posttest scores for eighth grade students for measures of workplace safety knowledge, attitude, subjective norm, self-efficacy, and behavioral intention towards safety in the workplace (Guerin et al., 2019).

Often schools and other youth organizations are unable to commit to a multi-lesson, in-depth unit on workplace safety and health. *Safety Matters* was developed to provide young people with an introduction to

workplace safety and health that could be delivered in one hour. Volunteers could use the *Safety Matters* program to spread the message of workplace health and safety to youth-focused organizations and clubs, and to schools that offer little or no workplace safety and health training (Lacey, 2017). However, there is currently limited research demonstrating the effectiveness of one-hour, health promotion programs to increase knowledge or change health/safety-related attitudes.

Ke et al. (2015) reported students demonstrated positive changes in attitude and stigma reduction scores towards people with mental illness after one or two one-hour workshops. Campbell et al. (2013) reported that a one-hour workshop using adult learning principles was effective in increasing sexual harassment prevention knowledge scores among employees in three work settings in rural northeastern Missouri. Participants’ overall sexual harassment prevention knowledge scores significantly ($p < 0.05$) increased from before to after the workshop and were significantly ($p < 0.05$) higher after the workshop than those of a control group. Farokhi et al. (2018) found that both refugee patients and community members showed significant ($p < 0.001$) gains in oral literacy scores (33.5 and 22.2 percentage points, respectively) after a 15–20-minute presentation followed by a toothbrushing and flossing technique demonstration. Verbiest et al. (2014) observed significant differences between general practitioners in the Netherlands who participated in a low-intensity, one-hour training aimed at patient smoking cessation when compared to untrained general practitioners on the frequency in which they asked about smoking behavior (OR = 1.94, 95% CI = 1.45, 2.60) and advised smokers to quit (0.56 difference in mean number of smoking advice per day; 95% CI = 0.13, 0.98). The current pilot project was conducted to assess the effectiveness of the one-hour *Safety Matters* educational module to change workplace safety and health knowledge and attitude scores among youth in Colorado when delivered by volunteer OSH professionals (Smith & Guerin, 2019).

2. Methods

2.1. Training implementation

Two-hour train-the-trainer sessions were conducted with volunteer safety and health professionals to introduce the one-hour *Safety Matters* program, along with instructions on how to collect the pretest and posttest evaluation forms. To ensure fidelity of program delivery, the volunteer trainers were instructed to present the *Safety Matters* material as written. The train-the-trainer sessions also included tips on how to talk to youth and suggestions for how to engage with local schools and youth organizations.

Eight safety and health professionals who completed a train-the-trainer session went on to deliver the *Safety Matters* program and collect the pretest and posttest evaluations. These volunteer safety and health professionals provided the one-hour *Safety Matters* educational module to groups of high school-aged students recruited using convenience samples from seven youth organizations agreeing to participate in the *Safety Matters* program. Between January 26, 2019 and June 7, 2019, nine training sessions were held across Colorado with up to 60 youth participants per session. The *Safety Matters* program was delivered in auditorium or classroom settings, with seven of the sessions conducted by one instructor and two co-taught by two instructors. Instructors distributed and collected completed pretest and posttest evaluation forms immediately prior to and after the delivery of the *Safety Matters* program.

2.2. Measures

Pretest and posttest questionnaires consisting of 16 items were used to evaluate the *Safety Matters* program. The items were based on measures previously used by Guerin et al. (2016) to evaluate the *Talking Safety* curriculum. Workplace safety and health knowledge was assessed using a 6-item, multiple-choice measure of fact-based workplace safety

and health information contained within *Safety Matters* (e.g., a “hazard” is anything at work that can hurt you physically or mentally or that it is “illegal” for your employer to fire you for reporting a workplace hazard). Attitude towards workplace safety and health measured the perceived importance of performing five specific workplace safety skills, including “use what you know about how work injuries can be prevented,” “identify hazards,” “take steps to prevent injuries in the workplace,” “use your knowledge about workers’ rights for workplace safety,” and “report problems to people in charge when you feel unsafe” (1 = not important; 5 = extremely important; Cronbach’s $\alpha_{pre} = 0.84$ and Cronbach’s $\alpha_{post} = 0.92$). Five demographic items were also collected: sex (male or female), age in years (≤ 14 , 15, 16, 17, or ≥ 18), race (American Indian or Alaska Native; Asian; Black or African American; White; or other), ethnicity (Hispanic/Latino: yes or no), and whether the students had ever had a previous paying job (yes or no).

2.3. Participants

A total of 283 youth participated in the *Safety Matters* program during one of the nine sessions conducted, with 255 individuals completing both a pretest and a posttest (Table 1). Five of the nine sessions were conducted with the career and technical student organization, Future Business Leaders of America, contributing 62% of the participants completing a pretest and a posttest.

Demographic data for the 255 study participants completing both a pretest and posttest are presented in Table 2. Participants were predominantly White (74.9%), with 22.7% identifying as Hispanic/Latino. There were more female (57.4%) participants, with approximately a third of the participants being age ≤ 15 years (30.5%), a third being age 16–17 years (35.8%), and a third being age ≥ 18 years (33.7%).

2.4. Analyses

Paired *t*-test analyses were conducted to assess changes from the pretest to posttest for the overall sample and by the different demographic groups. Cohen’s *d* was used to measure effect size, with $d = 0.2$ be considered to be a small effect size, $d = 0.5$ to be a medium effect size, and $d = 0.8$ to be a large effect size (Cohen, 1988). Multiple regression analyses were conducted to assess changes from pretest to posttest for the overall sample while controlling for covariates. There was little missing data (1.7%) among those who had completed both a pretest and a posttest, therefore no data were imputed for the analyses. All analyses were conducted using SPSS Statistics version 25 (IBM

Table 1
Overview of the nine *Safety Matters* training sessions.

Session	Youth Organization	No. of Trainers	No. of Participants	Matched Pairs*
1	YMCA	1	56	55
2	Keystone Leadership Program	1	7	6
3	Future Business Leaders of America County Conference	1	20	18
4	Boys and Girls Club	2	22	17
5	Future Business Leaders of America State Conference	1	52	51
6	Future Business Leaders of America State Conference	1	59	50
7	Future Business Leaders of America State Conference	1	17	16
8	Future Business Leaders of America State Conference	2	26	24
9	Boys and Girls Club	1	24	18
Total			283	255

* Participants completing both a pretest and posttest.

Table 2
Demographic data for participants completing a pretest and posttest.

Category	Number	Percent
Sex (n = 244)		
Male	104	42.6
Female	140	57.4
Age (years; n = 246)		
≤ 14	27	11.0
15	48	19.5
16	44	17.9
17	44	17.9
≥ 18	83	33.7
Race (n = 243)		
White persons	182	74.9
Black or African American persons	10	4.1
American Indian or Alaska Native persons	6	2.5
Asian persons	12	4.9
Other persons	33	13.6
Hispanic/Latino persons (n = 242)		
Yes	55	22.7

Number of participants responding to each question provided in parentheses.

Corporation, 2017).

3. Results

3.1. Paired *t*-Tests

After receiving the one-hour *Safety Matters* educational module, study participants overall had statistically significant ($p < 0.001$) increases in their scores for both workplace safety and health knowledge, a change from 62% to 85.3% correct (Cohen’s $d = 1.12$; large effect size), and importance of workplace safety and health (attitude), an increase from 4.48 to 4.77 on a 5 point scale (Cohen’s $d = 0.51$; medium effect size) (Table 3). Significant increases in workplace safety and health knowledge scores were found, showing a consistent pattern of large effect size changes, regardless of sex, age, race, ethnicity, or previous employment status. The exception was those participants aged ≤ 14 years whose increase in knowledge scores had a medium effect size. Significant increases in attitude scores for importance of workplace safety and health were also found regardless of sex, age, race, ethnicity, or previous employment status; however, effect sizes were medium to small (Table 3).

3.2. Multiple regression

Multiple regression analyses revealed that knowledge scores increased significantly ($p < 0.05$) from pretest to posttest with increasing participant age and that participants identifying as White, as compared to all other races combined, demonstrated significantly ($p < 0.01$) greater increases in both knowledge and attitude scores (Table 4). Although improvements in knowledge and attitude scores were observed regardless of race (See Table 3), multiple regression analyses revealed that those identifying as White had greater increases in knowledge and attitude scores from pretest to posttest. In this sample, race and ethnicity were statistically significantly correlated with one another ($r = 0.401$, $p < 0.001$), representing overlapping groups. Therefore, while ethnicity alone predicted changes in knowledge and attitude scores, when race and ethnicity were both included as predictors in the model, only race continued to predict statistically significant changes in knowledge and attitude scores and was used in the final regression models.

4. Discussion

The youth who participated in the *Safety Matters* program demonstrated significant increases in workplace safety and health knowledge and attitude scores across all age, sex, race, ethnicity, and previous work

Table 3
Paired *t*-Test Results Analyzing Changes in Knowledge and Attitude Scores Following Participation in the *Safety Matters* Program.

	Knowledge				Attitude			
	Pretest Score (%)	Posttest Score (%)	<i>p</i> -value	Effect Size*	Pretest Score**	Posttest Score**	<i>p</i> -value	Effect Size*
Overall	62.0	85.3	<0.001	1.12	4.48	4.77	<0.001	0.51
Sex								
Male	62.4	83.6	<0.001	1.10	4.43	4.72	<0.001	0.49
Female	61.9	86.5	<0.001	1.75	4.54	4.81	<0.001	0.52
Age								
≤14 years	52.8	66.1	<0.01	0.66	4.33	4.63	<0.05	0.48
15–16 years	65.2	89.1	<0.001	1.29	4.33	4.71	<0.001	0.56
17 years	60.8	85.9	<0.001	1.30	4.49	4.82	<0.001	0.65
≥18 years	62.4	87.5	<0.001	1.13	4.68	4.87	<0.001	0.41
Race								
White persons	63.6	87.9	<0.001	1.20	4.51	4.82	<0.001	0.58
Other persons	58.6	77.7	<0.001	0.91	4.39	4.57	<0.05	0.29
Hispanic/Latino								
Yes	61.0	80.8	<0.001	0.94	4.45	4.69	<0.01	0.40
No	62.7	87.2	<0.001	1.22	4.50	4.81	<0.001	0.55
Ever Employed								
Yes	62.7	86.2	<0.001	1.13	4.51	4.79	<0.001	0.49
No	60.7	82.3	<0.001	1.12	4.37	4.72	<0.001	0.57

* Cohen’s *d*. (Cohen, 1988).

^b **Attitude toward workplace safety and health measured on a 5 point scale from 1 = not important to 5 = extremely important.

Table 4
Multiple Regression Models for Factors Associated with Changes in Knowledge and Attitude Scores from Participation in the *Safety Matters* Program.

Covariates	Knowledge			Attitude		
	<i>b</i>	<i>S.E.</i>	<i>p</i> -value	<i>b</i>	<i>S.E.</i>	<i>p</i> -value
Age in years	0.145	0.009	<0.05	0.026	0.025	–
All other races combined*	–0.164	0.061	<0.01	–0.178	0.071	<0.01
No previous work experience**	–0.011	0.009	–	–0.033	0.077	–

* Reference category is White persons.

** Reference category is having previous work experience.

experience groups. Overall, among all program participants, the one-hour *Safety Matters* program demonstrated a large effect size increase for workplace safety and health knowledge and a medium effect size increase for attitude toward workplace safety and health. Although limited published studies demonstrate the effectiveness of one-hour, health-related trainings for youth (Ke et al., 2015), the results of the current study provide support for a one-hour workplace safety and health educational module designed for youth to significantly increase workplace safety and health knowledge and attitude scores. Similar increases in knowledge scores following a short one-hour workplace safety and health training was reported by Ceballos et al. (2020), where a 14% gain in knowledge scores was observed following a one-hour pilot training program designed to prevent workers from taking home workplace contaminants.

The *Safety Matters* program demonstrated larger effect size increases for youth older than age 14 years, indicating that students in high school, who are often just entering the workforce, may benefit most from this educational module. Our pilot study also found that participants identifying as White, as compared to all other races, demonstrated significantly greater increases in both knowledge and attitude scores. According to Flynn et al. (2018), culture for OSH can be thought of “as a system of shared beliefs and behaviors that affects how workers from different ethnic and social groups perceive, understand, adapt to and address safety concerns at work” (pp. 28–29). There is evidence that supports the need to design culturally tailored and adapted health and safety programs to enhance relevance for ethnically, racially, socio-economically, and geographically diverse populations (Bridge et al., 2008; Garner et al., 2014; Ringwalt & Bliss, 2006; Rodriguez et al., 2011). Kreuter et al. (2003) and O’Connor et al. (2014) offer strategies to better integrate culture into OSH intervention approaches and training materials to ensure they are culturally appropriate. The

tailoring of occupational safety and health materials for youth should also account for the industrial sectors where most youth work and include relevant and relatable examples. These examples may need to vary by geographic region, especially where agricultural jobs are more common and where young people commonly work on family farms (Kraybill et al., 2012; Lee et al., 2017). *Safety Matters* is currently being updated with consideration to its relevance for diverse populations to better enable all young workers to obtain the maximum benefit from the program. Although train-the-trainer sessions were conducted for this study to ensure fidelity of content delivery and the collection of the pretest and posttest assessments, no instructor training is required because *Safety Matters* includes detailed instructions for delivery of the content. The current study demonstrated that youth with previous work experience had similar gains in workplace safety and health knowledge and changes in attitude toward workplace safety as those without previous work experiences, possibly supporting the lack of foundational workplace safety and health information being provided to young workers while on the job. These findings may highlight the benefit of providing foundational workplace safety and health information to all youth regardless of their previous work experience. This idea is supported by qualitative research from Zierold et al. (2012), who found that teenagers (*N* = 42) participating in focus groups who reported receiving safety training at work had actually been given instructions on how to perform their job, rather than how to stay safe at work.

There are several limitations of the current research. First, the convenience sample used and the cross-sectional design limits the generalizability of results and the ability to make causal inferences. Second, the study design did not allow for assessment of the retention of workplace safety and health information over time since the identity of the youth were not obtained. Future research should explore differences across a larger and more representative sample of youth in the intended

age range and should follow them longitudinally to assess knowledge retention, sustained changes in attitudes, and changes in behavior that contribute to workplace safety and health.

5. Conclusions

Safety Matters introduces a promising, community-based model through which volunteers can provide a one-hour introduction to workplace safety and health to youth who may otherwise never receive training on this important topic. This educational module, complete with instructor's guide, PowerPoint presentation, and two short videos, also provides young people with information on workplace safety and health careers and provides a basis upon which future, job-specific safety training can be built. Finally, adapting health and safety programs to diverse youth populations may be needed to enhance relevance and receptivity.

5.1. Practical applications

Safety Matters, a one-hour introduction to workplace safety and health, may be an effective way to reach young people with an introduction to workplace safety and health before they enter the workforce. It is important that workplace safety and health programs for youth be tailored to enhance program relevance and receptivity among diverse populations. Safety and health professional organizations and their members can play a critical role in promoting the health and safety of young workers in their communities.

CRedit authorship contribution statement

Andrea Okun: Conceptualization, Methodology, Data curation, Writing – original draft. **Rebecca Guerin:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Roberta Smith:** Conceptualization, Funding acquisition, Project administration, Data curation, Writing – review & editing. **Devin Baker:** Data curation, Writing – review & editing. **Michelle DiMeo-Ediger:** Methodology, Formal analysis, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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