INTRODUCTION

Intimate partner violence (IPV), also known as domestic violence, is defined as harm inflicted by one's past or current partner and may consist of physical, sexual, economic, or psychological abuse.[1] Globally, one in every three women who has ever been in a relationship has experienced IPV at some point in her life.[2] IPV is associated with many negative physical and mental health consequences for victims[3-5] who consequently consume more health care resources than non-victims.[6,7] IPV is a significant risk factor for intimate partner homicide with 38 percent of all female homicides committed by intimate partners.[2] Previous research has found that 45 percent of women who have been murdered by an intimate partner presented to health care providers (HCPs) within the two years preceding their death for the treatment of an injury sustained by IPV.[8]

IPV is a highly relevant topic within orthopaedic practice. Previous research has identified that musculoskeletal injuries are the second most common physical manifestation of IPV.[9] Additionally, a large prevalence study found that one in six women who present to fracture clinics have experienced IPV in the past year, and one in 50 women are presenting for an injury sustained directly from IPV.[10] Orthopaedic surgeons and other HCPs treating women in fracture clinics are therefore well positioned to identify and provide critical assistance to women experiencing IPV. However, HCPs often report feeling unprepared to ask female patients about IPV and to provide assistance upon disclosure.[11-13] Recent research suggests that these challenges can be overcome with educational programs within a clinical setting.[14] To address this need, we developed the EDUCATE program which is an IPV educational program for HCPs who see patients in the fracture clinic. The purpose of the program was to empower these HCPs with the knowledge and skills required to comfortably identify and assist women who have experienced IPV. In the current study, we assessed participants' readiness to manage IPV by determining changes in IPV-related knowledge, attitudes, beliefs, and self-reported behaviours (KABB) three months after program completion.

METHODS

Study Design and Participants

This pretest-posttest study was designed to evaluate the impact of the EDUCATE program on participants' IPV-related KABB. The study was reviewed and approved by the ethics committee at McMaster University and at each participating institution.

The EDUCATE program was implemented at six fracture clinics in Canada and one in the United States and all seven clinics enrolled participants in the study. Participants were orthopaedic surgeons, orthopaedic surgery residents or fellows, medical students, non-physician HCPs, clinical research personnel, and booking clerks who see patients in the fracture clinic and agreed to complete the EDUCATE program. All participants provided written informed consent.

Procedures

The EDUCATE program was delivered using a "train-the-trainer" model. In this model, one or more individuals from each participating fracture clinic (i.e. surgeons, surgical trainees, non-physician HCPs, or clinical research personnel) were identified to become local IPV champions. Local IPV champions received in-depth training about the EDUCATE program from the study team through an in-person champion training session held at a large annual meeting of a

prominent orthopaedic association. A small number of champions could not attend this meeting and received training over the phone. Local IPV champions were responsible for becoming program curriculum experts to implement the program at their local fracture clinics and were encouraged to tailor the training content to maximize applicability. Examples of tailoring include the inclusion of site–specific IPV policies, protocols, and procedures, the inclusion of information about local IPV resources, and discussion of local IPV case examples.

The EDUCATE program was implemented between October 24th, 2016 and June 28th, 2017 and consisted of three components (i.e. an introductory video (component one), three online modules (component two), and an in-person training session led by the local IPV champion(s) (component three)). Each component is described in detail in Table 1. All three components combined take approximately two to three hours to complete. Following completion of the program, bi-monthly training updates were distributed to participants. These updates highlighted timely topics related to IPV and provided additional information to supplement previous training materials.

Study recruitment took place between October 24th, 2016 and May 24th, 2017. Local investigators and research coordinators identified potential participants at each fracture clinic and invited them to participate in the study. Individuals who met all eligibility criteria and provided informed consent were included in the study. Data collection occurred at baseline (i.e. before completing the EDUCATE program) as well as immediately and three months after program completion. Participants completed the same questionnaire at baseline and both follow–up periods to assess IPV-related KABB. Additionally, participants completed a demographic questionnaire at baseline. All data collection was performed by local research personnel.

Outcomes

We used the Physician Readiness to Manage IPV Survey (PREMIS) to assess changes in IPV-related KABB.[15] The PREMIS is a self-administered questionnaire and consists of ten validated subscales which are scored individually and include: (1) perceived preparation to manage IPV, (2) perceived knowledge of important IPV issues, (3) actual knowledge, (4) preparation, (5) legal requirements, (6) workplace issues, (7) self-efficacy, (8) alcohol/drugs, (9) victim understanding, and (10) practice issues.[15,16] The actual knowledge subscale generates scores ranging from zero to 38, the practice issues subscale generates scores ranging from zero to 58, and all other subscales generate scores ranging from one to seven. We determined *a priori* that our primary outcome would be the change in score on the actual knowledge subscale of the PREMIS questionnaire from baseline to three months post-training. Additionally, we determined *a priori* that changes in score for all other subscales of the PREMIS questionnaire between baseline and three months, and changes in score for all subscales of the PREMIS questionnaire between baseline and immediate post-training, would be exploratory outcomes.

Statistical Analysis

Our sample size was based on the minimal clinically important difference (MCID) for the actual knowledge subscale of the PREMIS. As no previous research has been conducted to determine the MCID, we defined the MCID as one half of the subscales' standard deviation. Previous research has reported standard deviations (SDs) ranging from 5.00 to 5.18.[15,17] We used a conservative estimate of 2.5 for the MCID and eight for the SD of change. Using these

assumptions and an alpha of 0.05 and a beta of 0.10, we require a sample size of 110 participants to be adequately powered to detect changes. This sample size was inflated to 138 participants to account for an anticipated loss-to-follow-up rate of 20 percent[18] and rounded to a required sample size of 140 participants for convenience.

To analyze the impact of the EDUCATE program on participants' IPV-related KABB, we first scored each questionnaire as per the algorithm published by the questionnaire developer.[15] Our primary analysis was conducted using multiple linear regression analysis with change in score on the actual knowledge subscale entered into the model as the dependent variable. Additionally, we included pre-training PREMIS score, age, gender, health care profession, and previous IPV training as independent variables in the model. We entered pre-training PREMIS score and age into the model as continuous variables and all other independent variables as dichotomous or categorical variables (i.e. gender (male vs. female), profession (orthopaedic surgeon vs. student, resident, or fellow vs. non-physician HCP vs. research personnel/administrative staff), and previous IPV training (some vs. none)). We entered all variables into the model simultaneously and included all participants with both a baseline and three-month post-training PREMIS. We presented results using a mean difference from baseline to three months after training, 95% Confidence Interval (CI), and p-value. We repeated this analysis for all exploratory outcomes. Additionally, we conducted an *a priori* sensitivity analysis to report results obtained from a paired *t*-test analysis for the primary outcome as well as for all exploratory outcomes. We present mean scores for each subscale for the baseline, immediate post-training, and three-month post training PREMIS. All tests were two tailed and used an alpha level of 0.05. We used SAS software, version 9.4 to conduct all statistical analyses.

As no previous research has been conducted to determine the MCID for the PREMIS, we defined the MCID as one half of the subscales' baseline standard deviation as reported in our sample.[19] We compared the mean difference for each subscale to the corresponding MCID to determine whether any statistically significant changes were also clinically important.

RESULTS

We enrolled 140 participants into the study. Participants included 70 surgical trainees (50.0%), 32 non-physician HCPs (22.9%), 28 orthopaedic surgeons (20.0%), and ten research or administrative staff (7.1%). Of the 140 enrolled participants, we achieved three-month follow-up for 121 (86.4%, Figure 1). The mean age of participants was 35.7. Typical participants were Caucasian males who were surgical trainees. Approximately half of all participants had received some previous IPV training. Participant characteristics are summarized in Table 2.

The standard deviations for each subscale of the baseline PREMIS and the corresponding MCIDs are shown in Table 3.

Participants' scores on the primary study endpoint, change in actual knowledge subscale of the PREMIS questionnaire between baseline and three months post-training, significantly improved (Table 4). This change was both statistically significant and clinically important. There were no statistically significant differences in the magnitude of improvements experienced by different groups of HCPs (p=0.24). During this time period, participants' scores also significantly improved on seven out of the nine additional subscales of the PREMIS questionnaire (i.e.

perceived preparation, perceived knowledge, opinion subscales, preparation, legal requirements, workplace issues, self-efficacy, and practice issues). These changes were both statistically significant and clinically important. No statistically significant differences were seen for the alcohol/drugs and victim understanding subscales between baseline and three-months post-training. Our sensitivity analyses using paired *t*-tests showed similar results (Table 4).

Participants' scores on all ten subscales of the PREMIS questionnaire significantly improved between baseline and immediately following training (Table 5). These changes were both statistically significant and clinically important for eight subscales (i.e. perceived preparation, perceived knowledge, opinion subscales, preparation, legal requirements, workplace issues, self-efficacy, and practice issues), and only statistically significant for the alcohol/drugs and victim understanding subscales. Our sensitivity analyses using paired *t*-tests showed similar results (Table 5).

INTERPRETATION

Our educational program led to statistically significant and clinically important improvements in participants IPV–related KABB, both immediately and three months after program completion. This effect was found in both our regression and paired *t*-tests analyses. This suggests that orthopaedic surgeons, surgical trainees, non-physician HCPs, and staff who see patients in the fracture clinic are better prepared to manage IPV within the fracture clinic after completing the educational program.

Our study is the largest and most comprehensive evaluation of an IPV educational program specifically designed for delivery in a fracture clinic setting. Despite the high prevalence of IPV in female patient populations with orthopaedic injuries, only one previous study, conducted by members of the study team as preliminary work for the current study, has assessed effectiveness of an IPV educational program in an orthopaedic setting.[18] Similar to our findings, this study reported that the educational intervention significantly improved participants' knowledge immediately following completion of the course (mean difference in scores from baseline to immediately after course: 16%, 95% CI: 7% to 25%, p=0.01), and that these improvements were retained three months later (mean difference in scores from baseline to three months after course: 11%, 95% CI 1% to 19%, p=0.018).[18] However, this study was limited by the small sample size (n=33), the restriction of the population to surgical trainees from one centre, and the lack of a validated outcome measurement tool. Our study attempts to build upon this previous work by sampling participants from seven different fracture clinics, ensuring a sufficient sample size to achieve adequate study power, expanding the population to include any individual who sees patients in the fracture clinic, and using a validated survey to measure study outcomes.

While our study is one of the first to assess the impact of an IPV educational program within an orthopaedic setting, numerous other studies have examined this question in other health care disciplines such as family medicine, emergency medicine, and internal medicine.[20,21] A recently published scoping review of the literature evaluating IPV educational programs for HCPs reported that 55 percent of the 65 included studies reported positive program effectiveness,[14] suggesting that well-executed programs have good potential to improve HCPs' IPV-related KABB and IPV victims' care. Our program was designed based on this literature and we incorporated characteristics frequently found in programs demonstrating positive results such as

the inclusion of an online training component, program delivery by an IPV educator or physician, the inclusion of patient resources, and training that is provided over more than five sessions lasting no more than five hours in total.[14]

Despite the strengths of our study, it has some important limitations. Firstly, our study used a non-experimental pretest-posttest design which produces a lower quality of evidence than randomized controlled trials (RCTs) due to the biases that can result when participants are not randomly assigned to intervention and control groups. However, pretest-posttest study designs are the most common study design used to assess IPV educational programs in health care settings.[14] These designs are beneficial as they avoid bias that could result from contamination if an unexposed cohort was used as the comparator and they allow all participants to gain rapid access to training. Secondly, our study did not assess program compliance with the introductory video or online module components of the training. Thirdly, while our study achieved an 86 percent follow-up rate, we were unable to obtain primary outcome data for 14 percent (n=19) of participants. However, our follow-up rate was consistent with, or in most cases better than, follow-up rates reported in the literature.[14] Finally, our study did not assess the impact of the educational program on patients' experiences in the fracture clinic. While our study showed participants' IPV-related KABB improved following training, it is unknown whether these positive changes translated into improved patient care and experiences. Future research should investigate the impact of IPV educational programs on patients' experiences and perceptions of the fracture clinic.

Our results suggest that an IPV educational program developed specifically for delivery in a fracture clinic setting improves IPV–related KABB in orthopaedic surgeons, surgical trainees, non–physician HCPs, and research and administrative staff. We recommend that fracture clinics provide ongoing IPV education to all staff who see patients to better help the one billion women worldwide who have experienced IPV.[2] To support this recommendation, we have partnered with the Canadian Orthopaedic Association (which represents approximately 80% of the orthopaedic surgeons in Canada) to make the EDUCATE program available to fracture clinics across Canada as of June 2018.

ACKNOWLEDGMENTS

The study was funded by research grants from the Canadian Institutes of Health Research (KAL – 147545) and the Hamilton Academic Health Sciences Organization. MB was also funded, in part, by a Canada Research Chair in musculoskeletal trauma, which is unrelated to the present study (McMaster University, Hamilton, ON, Canada).

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FIGURE LEGEND

Figure 1: Study participant flowchart

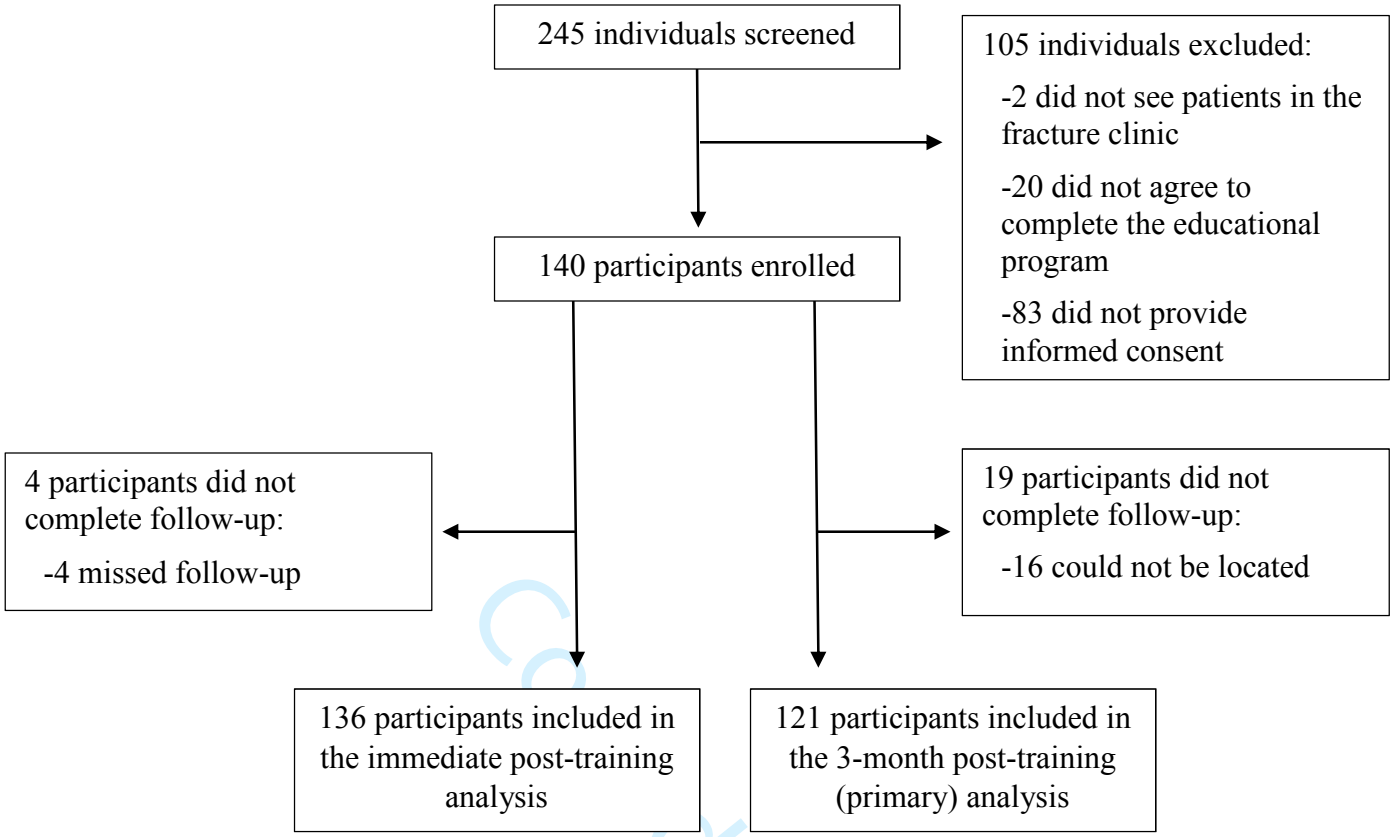

Table 1: EDUCATE Program Content

Component	Summary of Session Content
1	*Content:* A video presentation speaking about the importance of orthopaedic surgeons and other HCPs becoming involved in IPV identification and assistance. The video also introduced the IPV education program. *Purpose:* • To obtain buy-in from the orthopaedic community and convince them of the importance of investing time and resources in the IPV education program. • To inform trainees about what they could expect to receive from the IPV education program
2	*Content:* Three interactive online modules that are part of the series entitled "Responding to Domestic Violence in Clinical Settings" available through dveducation.ca.[24] The modules focus on conveying background knowledge (e.g. definitions, prevalence, dynamics of abusive relationships, barriers to leaving an abusive relationship, etc.), as well as clinical skills pertaining to IPV identification and assistance. This training was designed to help trainees achieve competency in identifying and providing assistance to women who have experienced IPV. *Purpose:* • To provide trainees with core IPV knowledge such as definitions, prevalence, effects of IPV, supportive and non-judgmental communication, etc. • To demonstrate appropriate ways of asking women about IPV experiences. • To provide interactive opportunities for trainees to select from a variety of statements asking women about IPV and to receive feedback on the appropriateness of these statements. • To demonstrate appropriate ways of providing support and assistance to women experiencing IPV. • To provide interactive opportunities for trainees to select from a variety of statements providing support and assistance to women experiencing IPV and to receive feedback on the appropriateness of these statements.

Component	Summary of Session Content
3	*Content:* The local IPV champion(s) delivered an in-person presentation using PowerPoint slide that included a lecture explaining how to ask women about IPV in the fracture clinic and provide assistance to women experiencing IPV. This presentation included two videos demonstrating IPV identification and assistance within a health care setting, as well as four case-based scenarios. Champions were provided with mock cases, but were encouraged to discuss real life cases from their practice, if possible. Trainees were given a chance to role play and discuss how they would respond to these cases in their practice. The presentation concluded with a discussion of local IPV policies, protocols, and procedures and community resources. Trainees were then provided with an opportunity to ask questions and have a group discussion about the training content. Purpose: • To consolidate learning from the video and online training and provide trainees with an opportunity to ask questions about any previous aspects of training that were not clear. • To provide training about how to identify, and provide assistance for, IPV. • To provide trainees with an opportunity to practice asking about, and providing assistance with, IPV. • To ensure trainees are knowledgeable about all resources included in the toolkit and key local resources. • To consolidate learning through interactive discussion and opportunities to ask questions.
Ongoing:	*Content:* Local IPV champions received bi-monthly training updates from the Methods Centre. Local IPV champions were responsible for distributing these updates to trainees (e.g. through presentations at rounds, training meetings, and email).

Table 2: Participant characteristics

	Total (N=140)
Demographics	
Age (years), mean (SD)	35.7 (10.2) (n=139)
Gender, n (%)	
Male	96 /140 (68.6)
Female	44/140 (31.4)
Race/ethnicity, n (%)	
White/Caucasian	107/140 (76.4)
South Asian	16/140 (11.4)
East Asian	11/140 (7.9)
Middle Eastern	3/140 (2.1)
Black (African/Caribbean)	1/140 (0.7)
Other	2/140 (1.4)
Professional Characteristics	
Profession, n (%)	
Orthopaedic surgery resident	62/140 (44.3)
Orthopaedic surgeon	28/140 (20.0)
Orthopaedic technician	11/140 (7.9)
Nurse	10/140 (7.1)
Research personnel	9/140 (6.4)
Orthopaedic surgery fellow	6/140 (4.3)
Physiotherapist	5/140 (3.6)
Physician/surgical assistant	5/140 (3.6)
Medical student	2/140 (1.4)
Occupational therapist	1/140 (0.7)
Booking clerk	1/140 (0.7)
Previous IPV Training	
Hours of Previous IPV training, n (%)	
0	67/139 (48.2)
1 to 5	65/139 (46.8)
6 to 15	7/139 (5.0)
Type of Previous IPV training, n (%)	
Attended a lecture/talk	64/72 (88.9)
Watched a video	25/72 (34.7)
Completed online training	9/72 (12.5)
Attended skills-based training workshop	7/72 (9.7)
Other	3/72 (4.2)
Setting of Previous IPV training	
Medical or professional school	33/72 (23.6)
Residency/placement/internship	20/72 (14.3)
Workplace	18/72 (12.9)
Professional education	12/72 (8.6)
Self-learning	3/72
Volunteer position	2/72
Research	1/72

SD = standard deviation; IPV = intimate partner violence

Table 3: Standard deviations and minimal clinically important differences (MCID) for PREMIS subscales

	Baseline Mean (SD) N=139	**MCID**
Actual Knowledge	4.83	2.42
Perceived Preparation	1.10	0.55
Perceived Knowledge	1.09	0.55
Practice Issues	6.11	3.06
Opinion Subscales		
Preparation	1.17	0.59
Legal Requirements	1.54	0.77
Workplace issues	0.90	0.45
Self-Efficacy	0.44	0.22
Alcohol/drugs	0.55	0.28
Victim Understanding	0.69	0.35

SD = standard deviation; MCID = minimal clinically important difference

Table 4: Change in PREMIS subscales between baseline and 3 months post-training

PREMIS Subscales	Baseline Mean (SD)	3-Months Mean (SD)	Regression Analysis (N=121)		Paired *t*-Test Analysis (N=121)	
			Mean Difference (95% CI)	p-value	Mean Difference (95% CI)	p-value
Actual Knowledge	26.60 (4.79)	29.04 (3.89)	2.44 (1.79, 3.09)	<0.0001	2.44 (1.54, 3.33)	<0.0001
Perceived Preparation	2.63 (1.06)	4.59 (1.12)	1.96 (1.79, 2.13)	<0.0001	1.96 (1.75, 2.17)	<0.0001
Perceived Knowledge	2.71 (1.08)	4.77 (1.05)	2.05 (1.88, 2.23)	<0.0001	2.05 (1.84, 2.27)	<0.0001
Practice Issues	5.73 (6.27)	11.83 (7.74)	6.10 (4.98, 7.23)	<0.0001	6.10 (4.91, 7.30)	<0.0001
Opinion Subscales						
Preparation	3.68 (1.20)	4.74 (0.97)	1.06 (0.89, 1.22)	<0.0001	1.06 (0.81, 1.30)	<0.0001
Legal Requirements	3.41 (1.51)	4.91 (1.12)	1.50 (1.30, 1.70)	<0.0001	1.50 (1.21, 1.80)	<0.0001
Workplace issues	3.00 (0.92)	4.11 (0.88)	1.11 (0.97, 1.26)	<0.0001	1.11 (0.93, 1.30)	<0.0001
Self-Efficacy	3.56 (0.45)	4.09 (0.57)	0.54 (0.45, 0.63)	<0.0001	0.54 (0.43, 064)	<0.0001
Alcohol/drugs	4.26 (0.56)	4.28 (0.46)	003 (-0.05, 0.11)	0.50	0.03 (-0.09, 0.15)	0.65
Victim Understanding	4.95 (0.70)	4.95 (0.78)	0.002 (-0.11, 0.11)	0.98	0.002 (-0.13, 0.13)	0.98

SD = standard deviation; CI = confidence interval

Table 5: Change in PREMIS subscales between baseline and immediate post-training

PREMIS Subscales	Baseline Mean (SD)	Immediately Post-training Mean (SD)	Regression Analysis (N=136)		Paired *t*-Test Analysis (N=136)	
			Mean Difference (95% CI)	p-value	Mean Difference (95% CI)	p-value
Actual Knowledge	26.71 (4.88)	30.06 (3.95)	3.35 (2.77, 3.94)	<0.0001	3.35 (2.57, 4.13)	<0.0001
Perceived Preparation	2.69 (1.10)	4.74 (1.14)	2.06 (1.88, 2.23)	<0.0001	2.06 (1.85, 2.27)	<0.0001
Perceived Knowledge	2.76 (1.10)	4.89 (1.01)	2.14 (1.98, 2.30)	<0.0001	2.14 (1.93, 2.35)	<0.0001
Practice Issues	5.53 (5.96)	9.62 (5.91)	4.08 (3.35, 4.82)	<0.0001	4.08 (3.29, 4.88)	<0.0001
Opinion Subscales						
Preparation	3.70 (1.17)	4.75 (0.94)	1.04 (0.89, 1.20)	<0.0001	1.04 (0.82, 1.27)	<0.0001
Legal Requirements	3.44 (1.55)	5.10 (1.17)	1.66 (1.47, 1.85)	<0.0001	1.66 (1.38, 1.94)	<0.0001
Workplace issues	3.04 (0.90)	4.12 (0.82)	1.08 (0.96, 1.20)	<0.0001	1.08 (0.94, 1.23)	<0.0001
Self-Efficacy	3.56 (0.45)	4.12 (0.49)	0.56 (0.49, 0.63)	<0.0001	0.56 (0.48, 0.64)	<0.0001
Alcohol/drugs	4.24 (0.55)	4.44 (0.58)	0.20 (0.10, 0.30)	<0.0001	0.20 (0.08, 0.32)	0.0012
Victim Understanding	4.94 (0.69)	5.08 (0.77)	0.15 (0.04, 0.25)	0.0056	0.15 (0.03, 0.26)	0.0125

SD = standard deviation; CI = confidence interval