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Measuring Perceptions of Workplace Safety: Development and Validation of the Work Safety Scale

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A 50-item instrument that assesses employees' perceptions of work safety, the Work Safety Scale (WSS), was constructed and validated using three independent samples. The results showed that the WSS measures five factorially distinct constructs: (a) job safety, (b) coworker safety, (c) supervisor safety, (d) management safety practices, and (e) satisfaction with the safety program. Each of these scales has a high degree of internal consistency across the three samples. Supervisor safety and management safety practices were the best predictors of job satisfaction. In addition, supporting previous research, supervisor safety and management safety practices were significantly correlated with reported accident rates. Coworker safety and supervisor safety were strongly linked to employee's compliance with safety behaviors. WSS subscales were logically related to job stress, psychological complaints, physical complaints, and sleep complaints. Implications of the results are discussed. © 1998 National Safety Council and Elsevier Science Ltd

Keywords: Work safety scale, job safety, coworker safety, supervisor safety, management safety practices, satisfaction with the safety program, safety climate

INTRODUCTION

In 1996, industrial accidents were responsible for an estimated cost of $121 billion, including administrative expenses, wage losses, and medical costs (National Safety Council [NSC], 1997). In addition, industrial accidents occurring in 1996 were responsible for an estimated loss of 80 million days in 1996 and will be responsible for an estimated loss of 60 million days in future years (NSC, 1997). Thus, industrial accidents are costly to both individual companies and the country as a whole. Reducing

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the rate of industrial accidents could conceivably save the nation billions of dollars annually.

Researchers have examined the role of perceptions of workplace safety in understanding the industrial accident process (Guastello & Guastello, 1988; Murphy, Sturdivant, & Gershon, 1993). In general, the results of these studies have shown that perceptions of workplace safety issues are related to accident-related variables, such as accident rates, anxiety, and employees' compliance with safety behaviors. The purpose of the present research is to develop and validate a scale of perceptions of workplace safety.

Perceptions of Workplace Safety and Industrial Accidents

Workers' perceptions of safety on the job are associated with variables related to industrial accident rates. Employees who perceive their jobs as safe tend to be involved in fewer accidents than employees who perceive their jobs as relatively more dangerous (Guastello & Guastello, 1988; Harrell, 1990; Smith et al., 1992). Employees who perceive their workplace as safe report lower levels of job-related anxiety and stress, and exposure to fewer environmental hazards (Guastello, 1992), variables that have been strongly linked to accident rates (Guastello, 1989, 1991).

Current Measures of Perceptions of Workplace Safety

The authors are aware of only four measures of perceptions of workplace safety: (a) the Occupational Hazards Survey (OHS) (Guastello & Guastello, 1988), (b) the Safety Climate Survey (SCS) (Zohar, 1980), (c) the Physical Demands and Dangers (PDD) (Sandman, 1992), and (d) the Perceptions of Workplace Hazards Scale (PWHS) Smith et al., 1992). These scales, however, have measurement-related problems. They either have poor psychometric integrity (i.e., reliability, validity) or do not comprehensively sample the content domain of work safety. For example, some of the 11 OHS scales possess low internal consistency estimates (.28, .30, .61). In addition, even though the SCS was designed to assess eight dimensions of perceptions of work safety, no studies have been done that report either internal consistency estimates of the subscales or indices of the degree of interrelationship among the eight subscales. In fact, a recent factor analysis of the SCS done by Brown and Holmes (1986) found evidence of only three factors rather than the original eight hypothesized by Zohar.

The PDD scale is a subscale of Sandman's Job Stress Index (JSI) (Sandman, 1992). The nine-item PDD scale has been found to have a reliability (internal consistency) estimate of .81, although nothing else is known about its psychometric properties. Item generation of the PWHS was guided by concerns identified by Smith, Cohen, Cohen, and Cleveland (1978) relating to organizations that have successful safety programs. This 10-item scale has a reported reliability estimate (internal consistency) of .71, which is not considered adequate by some standards (e.g., Nunnally, 1978).

PURPOSE

Although several existing measures of workplace safety exist, they suffer with respect to either their limited sampling of the work safety content domain or their psychometric integrity. The purpose of the present study was to develop an instrument that would (a) have adequate psychometric integrity—reliability and validity; (b) comprehensively assess important dimensions of perceptions of workplace safety; and (c) be easy to complete.

Structure and Content of the Work Safety Scale

To accomplish this, a series of proposed studies was designed to develop and validate an instrument of workplace safety, the Work Safety Scale (WSS). Based on the work safety literature regarding measures of perceptions of work safety (Guastello & Guastello, 1988; Sandman, 1992; Smith et al., 1992; Smith et al., 1987; Zohar, 1980) and studies and reviews dealing with different aspects of work safety (including quality of safety programs, predictors of safety compliance behaviors, and safety management; Brauer, 1990; Cleveland, Cohen, Smith, & Cohen, 1979; Dedobbeleer & German, 1987; Murphy et al., 1993; National Safety Council [NSC], 1967; Niskanen, 1994; Petersen, 1975, 1978), a five-facet measure of work safety was proposed for the current study. The five content domains to be assessed by the WSS were: (a) *global per-*

ception of job safety, (b) *coworker safety*, (c) *supervisor safety*, (d) *management safety practices*, and (e) *satisfaction with the safety program*. A five-facet approach to safety assessment was taken in the current study due to the evidence that the work safety rubric subsumes a number of different factors (Cleveland et al., 1979), including management's commitment toward safety, the quality of safety training, and the safety behaviors of both coworkers (Guastello, personal communication, August 27, 1992) and supervisors. The empirical findings suggesting that people can distinguish among only a few facets of work safety (Brown & Holmes, 1986; Zohar, 1980) may be due to the items in the current measures; the content domain sampled by these measures may limit the number of factors that are found in a factor analysis of these scales.

This multifaceted description of perceptions of workplace safety is supported by other organizational researchers who have developed measures that can reliably assess multiple attitudes within a given content domain. For example, there is considerable empirical evidence that measures of job satisfaction can reliably distinguish different facets of work attitudes (Smith et al., 1987). In addition, other researchers (Caplan, Cobb, French, Harrison, & Pinneau, 1975; Hayes, 1992) have developed measures of employees' perceptions of work social support across different sources of support (e.g., supervisor, coworkers, and spouse, friends and relatives).

STUDY 1

The purpose of Study 1 was to generate the items for the WSS and determine the psychometric properties of the WSS. Item generation was guided by review of the scientific literature related to industrial safety. This literature included research articles dealing directly with the measurement of perceptions of work safety and job attitudes (Guastello & Guastello, 1988; Sandman, 1992; Smith et al., 1992; Smith et al., 1987; Zohar, 1980) and studies and reviews dealing with different aspects of work safety, including quality of safety programs, predictors of safety compliance behaviors, and safety management (Brauer, 1990; Cleveland et al., 1979; Murphy, Sturdivant, & Gershon, 1993; NSC, 1967; Petersen, 1975, 1978). This review helped in the scale development process in two ways: (a) it identified the broad content areas of industrial safety to be measured, and (b) it generated specific items to clarify and define the broad content areas.

Methods

Subjects.

The respondents consisted of patients being seen at a medical consulting firm. Each of the patients was given an independent medical evaluation by a physician, and many of the patients were being examined for an industrial accident claim. In addition to a standard questionnaire patients completed for their medical evaluation (not used in the current study), patients were given the initial items of the WSS and other measures used for the current study. Responses to the WSS were anonymous.

Variables

Work Safety Scale (WSS).

A total of 20 to 29 declarative statements were generated for each of the five content domains of the WSS: (a) *job safety*, (b) *coworker safety*, (c) *supervisor safety*, (d) *management safety practices*, and (e) *satisfaction with the safety program*; total item pool equaled 124. These items were representative of statements typically found in safety evaluation programs (Petersen, 1978). Sample items of the WSS and instructions to complete the items are included in Table 1. Items for the WSS were written to reflect a diverse set of items, including items that reflected actual behaviors (e.g., *Keeps workers informed of safety rules*, and *Trains workers to be safe*) and items that focused more on general attitudes (e.g., *Committed to safety*, and *Ensures workers' safety*).

For each item, respondents were asked to indicate the extent to which they agreed that the item described its respective content domain. A five-point rating scale was used for each of the WSS items (1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree).

Accidents.

Three different accident indices were used in the current study. On the survey, each respondent indicated how many accidents he/she experienced in the last 12 months: (a) reported accidents (reported to the supervisor); (b) unre-

Table 1. Instructions for Completion and Sample Items from the Work Safety Scale

Scale	Items
Think about your job you indicated above. Do you agree or disagree that each of the following words or phrases describes your job?	
Job Safety (29 items)	Dangerous
	Safe
	Fear for health
	No time for safety
Think about the people you work with. Do you agree or disagree that each of the following words or phrases describes these people?	
Coworker Safety (22 items)	Careful
	Don't care about other's safety
	Follow safety rules
	Encourage others to be safe
Think about your immediate supervisor. Do you agree or disagree that each of the following words or phrases describes immediate supervisor?	
Supervisor Safety (22 items)	Promotes work safety
	Keeps workers informed of safety rules
	Enforces safety rules
	Involves workers in setting safety goals
Think about your management. Do you agree or disagree that each of the following words or phrases describes your management?	
Management Safety Practices (25 items)	Cares about safety of employees
	Sets up unsafe system
	Repairs damaged equipment quickly
	Doesn't care about safety prolems
Think about your safety program at work. Do you agree or disagree that each of the following words or phrases describes this safety program?	
Satisfaction with the Safety Program (26 items)	Worthwhile
	First-rate
	Doesn't apply to my workplace
	Too general

ported accidents (not reported to the supervisor); and (c) near accidents (something that could have caused an injury but did not). Researchers have shown that self-reported accident rates are related to accident rates obtained from personnel files (Smith et al., 1992). Due to the non-normality of the distributions (positively skewed) of the accident variables, the accident data were transformed using the square root transformation. This transformation made the distribution more normal compared to the untransformed data. Consequently, the transformed accident data were used in the remaining analyses.

Other variables.

Respondents were asked to indicate their job title. Job titles were coded using the Standard Occupational Classification Manual (U.S. Department of Commerce, 1980) by an undergraduate research assistant. Another research assistant independently coded 50 questionnaires. There was 77% agreement on the coding for job category. Thus, the coding of the initial rater was used to establish job categories. Jobs were divided into white- and blue-collar categories. Age and gender information were also collected.

Results

Out of 5,551 patients seen during a six-month period, 787 patients completed the materials used in the current study for a response rate of 14%. Approximately 55% of the sample were male. The mean age was 41 years ($SD = 10.6$). At least 90% of the sample completed high school. Nearly 60% of the sample attended some college. Approximately 49% of the sample held blue collar jobs.

WSS items that had a high frequency of nonresponses were dropped from the remaining analysis. The high degree of nonresponse for some items may have indicated that the items were ambiguous or difficult to understand (e.g., *Perilous*).

For each of the a priori WSS subscales, corrected item-total correlations ranged from .33 to .78 (*job safety*), .49 to .78 (*coworker safety*), .62 to .85 (*supervisor safety*), .54 to .89 (*management safety practices*), and .31 to .81 (*satisfaction with the safety program*). Based on the high corrected item-total correlations, it seemed that almost all of the items within each of the subscales were good indicators of the same underlying construct. Consequently, the item selection process was guided by judgment for some of the WSS subscales. For the Coworker, Supervisor, and Management subscales, behavioral-type items were selected over items that were less behavioral. Behavioral items were selected because they allowed for more specific feedback and, consequently, provided a more viable means of increasing work safety. For the other two WSS subscales (*job safety*, and *satisfaction with the safety program*) that didn't have behavorial- type items, item selection was based on the mathematical properties of the items. Items with high corrected item-total correlations were retained for the final questionnaire.

As a result of this process, each WSS subscale contained 10 items and had high internal consistency estimates: .91 (*job safety*), .91 (*coworker safety*), .95 (*supervisor safety*), .95 (*management safety practices*), and .93 (*satisfaction with the safety program*).

A factor analysis of the entire set of 124 items was not conducted due to the small sample size relative to the item sample size. An exploratory principal-axis factors analysis (with oblique rotation) was conducted on the 50 retained items to determine the dimensionality of the WSS. A five-factor solution revealed a clean pattern of results. The factor pattern matrix (after rotation) is shown in Table 2. The first five factors accounted for 63% of the total variance. All items within their respective scales loaded on their primary factor. Although high cross-factor loadings between Supervisor and Management Safety were evident, none of the cross-factor loadings were higher than the primary loadings. The retained 50 WSS items are presented in the Appendix.

Next, the WSS subscale scores (calculated by summing items within their respective WSS subscales) were correlated with the other study variables. The correlation matrix is presented in Table 3. As seen in Table 3, the correlations among the WSS subscales ranged from .33 to .82.

All WSS subscales were negatively related to all of the self-reported accident variables. Stepwise regression analyses were conducted to determine the unique contribution of the WSS subscales in predicting accident rates (after first forcing age and gender into the equation). The results of the stepwise regression analyses are presented in Table 4. Only significant WSS predictors are reported. As seen in Table 4, the best predictors of accidents were *coworker safety*, *management safety*, *satisfaction with the safety program*, and *job safety*.

STUDY 2

The purpose of Study 2 was to cross-validate the findings of Study 1. The psychometric quality of the WSS subscales were evaluated in a new sample of respondents. Additional validity evidence will be provided in the current study. Researchers have found that perceptions of work safety are related to measures of job satisfaction and job stress (Guastello,1992). In addition, perceptions of work safety have been shown to be related to health-related variables (Guastello, 1992). Consequently, the current study included measures of job satisfaction, job stress, and measure of psychological, physical, and sleep complaints to determine if the the WSS was logically related to job-related attitudes as well as health-related variables.

The extent to which employees follow safety precautions has been shown to be related to employees' perceptions of management safety (Murphy et al., 1993). Specifically, using a hospital sample, Murphy et al. found that employees were more likely to follow recommended work practices if they perceived that management was committed to a safe work environment. The following study was designed to determine if other aspects of employees' perceptions of work safety were related to employees' compliance with recommended safe work practices.

Table 2. Factor Pattern Matrix (After Rotation) of the Work Safety Scale for Study 1

	Factor 1	Factor II	Factor III	Factor IV	Factor V	h^2
JOB 1		**.73280**				.53897
JOB 2		**.51464**				.32827
JOB 3		**.79316**				.62965
JOB 4		**.80426**				.65022
JOB 5		**.66362**				.47675
JOB 6		**.73106**				.54909
JOB 7		**.72450**				.58987
JOB 8		**.71052**				.53167
JOB 9		**.67389**				.46133
JOB 10		**.68392**				.47534
COWORKER 1				**.69173**		.53225
COWORKER 2				**.70757**		.52307
COWORKER 3				**.58932**		.36171
COWORKER 4				**.77263**		.61544
COWORKER 5				**.82077**		.68772
COWORKER 6				**.77257**		.62376
COWORKER 7				**.69357**		.56634
COWORKER 8				**.41491**		.23406
COWORKER 9				**.74460**		.58919
COWORKER 10				**.64744**		.44795
SUPERVISOR 1	.50980				**.76364**	.62218
SUPERVISOR 2					**.72749**	.58930
SUPERVISOR 3	.52043				**.82238**	.69966
SUPERVISOR 4	.57417				**.71865**	.58229
SUPERVISOR 5	.57243				**.83142**	.72261
SUPERVISOR 6	.52058				**.82601**	.69888
SUPERVISOR 7	.51254				**.82974**	.71035
SUPERVISOR 8	.54363				**.82534**	.71666
SUPERVISOR 9	.56124				**.83049**	.74713
SUPERVISOR 10	.60841				**.80980**	.73045
MANAGEMENT 1	**.69136**				.59514	.58341
MANAGEMENT 2	**.70923**				.60021	.59235
MANAGEMENT 3	**.79763**				.61711	.71592
MANAGEMENT 4	**.66972**				.57755	.53147
MANAGEMENT 5	**.76274**					.63148
MANAGEMENT 6	**.80587**				.54278	.74158
MANAGEMENT 7	**.83599**				.58746	.77329
MANAGEMENT 8	**.71063**					.56247
MANAGEMENT 9	**.69532**				.60716	.57920
MANAGEMENT 10	**.77897**				.60490	.69692
PROGRAM 1			**.80935**			.68995
PROGRAM 2			**.81204**			.70185
PROGRAM 3			**.84596**			.74064
PROGRAM 4	.50255		**.79533**			.68649
PROGRAM 5	.51409		**.74627**			.62725
PROGRAM 6			**.64776**			.46721
PROGRAM 7			**.60229**			.37530
PROGRAM 8			**.78402**			.65214
PROGRAM 9			**.52353**			.31162
PROGRAM 10			**.77381**			.62666
Eigenvalues	19.55	4.83	3.15	2.53	1.44	

Note: Primary factor loadings are in boldface. Cross-factor loadings equal to or greater than .50 are included.

Table 3. Intercorrelation Matrix of the Variables for Study 1

	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11
1. Job safety	31.94	9.17	(91)										
2. Coworker safety	35.18	7.64	47**	(91)									
3. Supervisor safety	33.16	9.42	33**	62**	(95)								
4. Management Safety practices	31.43	9.17	42**	63**	82**	(95)							
5. Satisfaction with the safety program	36.72	7.43	38**	57**	74**	80**	(93)						
6. Reported accidents	.82	.73	−26**	−31**	−22**	−24**	−16**	(−)					
7. Unreported accidents	.35	.78	−24**	−33**	−28**	−31**	−29**	48**	(−)				
8. Near accidents	.75	1.30	−34**	−32**	−32**	−35**	−32**	38**	52**	(−)			
9. Age	39.17	10.04	01	−08	07	09*	05	−19**	−13**	−09	(−)		
10. Gender	—	—	28**	02	01	−01	01	−03	00	−07	−05	(−)	
11. White collar	—	—	−35**	−07	02	−03	−12*	09*	−04	11*	02	−51**	(−)

Note: $N = 301$ to 710. Decimal points omitted. Reliability (internal consistency) estimates located in the diagonal. Accident variables represent the square root of the self-reported accidents. Gender (1 = Male; 2 = Female); White collar (1 = White collar; 2 = Blue collar).

* $p < .05$, ** $p < .01$.

Table 4. Hierarchical Regression Analyses Predicting Accidents Variables for Study 1

Criterion	Variable(s) entered[1]	Model ΔR^2	Model F	p
Reported accidents	STEP 1	.04	7.96	<.01
	Coworker safety	.09	40.06	<.01
	Job safety	.02	7.62	<.01
	All preceding variables	.14	16.52	<.01
Unreported accidents	STEP 1	.02	3.51	<.05
	Coworker safety	.10	44.62	<.01
	Program safety	.02	7.18	<.05
	All preceding variables	.14	15.12	<.01
Near accidents	STEP 1	.01	1.95	>.05
	Management safety	.12	40.25	<.01
	Job safety	.04	13.60	<.01
	All preceding variables	.17	15.05	<.01

[1]STEP 1 includes the following variables: age and gender.

Method

Subjects.

The method of data collection was the same method used in Study 1.

Variables

Work Safety Scale (WSS).

The 50-item WSS was used in the current study.

Sleep complaints.

A five-item measure of sleep complaints was used in the current study. This scale was used in an earlier study (Smith et al., 1992). The reliability (internal consistency) of this scale was .77. Higher scores indicated a greater degree of sleep complaints.

GHQ-12.

The General Health Questionnaire–12 (GHQ-12) (Goldberg, 1978) was used in the present study. The GHQ-12 is designed to detect minor psychiatric disorders. For each item, respondents are asked to indicate, on a scale from 1 (Less so than usual) to 4 (Much more than usual), the extent to which the item describes them. The GHQ-12 has been shown to have high internal consistency across various samples (α = .82 to .90). Also, the GHQ-12 has been shown to be positively related to work demand and negative affectivity, and negatively related to work support and direct coping (Parkes, 1990). Additionally, the GHQ-12 has been shown to differentiate employed and unemployed samples; unemployed respondents showed higher scores (poorer mental health) than employed respondents (Banks, Clegg, Jackson, Stafford, & Wall, 1980).

Scores for the GHQ-12 were calculated by summing the 12 items in the scale and then dividing this number by the number of items in the scale. Possible scores range from 1 to 4. Higher scores indicated poorer mental health. In the present study, the internal consistency estimate for the GHQ-12 was .88.

Physical complaints.

The 12-item Moos et al. (1986) scale was used to assess the degree of physical complaints experienced by the respondent. Respondents indicated if they did (1) or did not (0) experience each of the 12 symptoms in the previous 12 months. Scores for this Physical Complaints Scale were calculated by summing the 12 items in the scale. In the present study, the internal consistency estimate for the Physical Complaints Scale was .81.

Job stress and job satisfaction.

Job stress and job satisfaction were each assessed by a single-item measure. Respondents were asked to indicate, on a scale from 1 (The least stressful job imaginable) to 10 (The most stressful job imaginable), how much stress they experience on their job. Also, respondents were asked to indicate, on a scale from 1 (Very dissat-

Table 5. Items for the Compliance with Safety Behaviors Scale and Their Item-Total Correlations for Study 2

Items	Corrected Item-Total Correlations
1. Overlook safety procedures in order to get my job done more quickly	.41
2. Follow all safety procedures regardless of the situation I am in	.64
3. Handle all situations as if there is a possibility of having an accident	.59
4. Wear safety equipment required by practice	.59
5. Keep my work area clean	.60
6. Encourage coworkers to be safe	.65
7. Keep my work equipment in safe working condition	.63
8. Take shortcuts to safe working behaviors in order to get the job done faster	.37
9. Do not follow safety rules that I think are unnecessary	.24
10. Report safety problems to my supervisor when I see safety problems	.61
11. Correct safety problems to ensure accidents will not occur	.65

isfying) to 10 (Very satisfying), their level of satisfaction on their job.

Accidents.

Similar to Study 1, three different accident indices were used in the current study: (a) reported accidents (reported to your supervisor); (b) unreported accidents (not reported to your supervisor); and (c) near accidents (something that could have caused an injury but did not). As in Study 1, the accidents were recoded using the square root transformation to make the distribution more normal.

Compliance with safety behaviors.

Finally, an 11-item measure of compliance with safety behaviors (CSB) was developed for the present study. The items in the CSB were written to be general enough to apply to various occupations. Each CSB item reflected either a safe or unsafe work behavior. The CSB items and their corrected item-total correlations for the present study are presented in Table 5.

For each of the CSB items, respondents were asked to indicate how frequently they do the behavior on their current job using a scale from 1 (''Never'') to 5 (''Always''). After recoding, higher scores reflected greater compliance with safe work behaviors. CSB scores were calculated by averaging the responses.

Job categories.

Respondents were asked to indicate their job title. Job titles were coded using the Standard Occupational Classification Manual (U.S. Department of Commerce, 1980) by an undergraduate research assistant. Jobs were separated into white and blue collar jobs.

Results

Out of 8,464 patients seen during a four-month period, 879 patients completed the materials used in the current study for a response rate of 10%. These sample demographics were similar to the sample demographics in Study I. Approximately 56% of the sample were male. The mean age was 41 years (SD = 10.5). At least 90% of the sample completed high school. Nearly 60% of the sample attended some college. Approximately 49% of the sample held blue-collar jobs.

Data analyses.

The means, standard deviations, and intercorrelations among the study variables are presented in Table 6. The internal consistency estimates for each of the WSS subscales were high (all above .88). In addition, the intercorrelation among the WSS subscales were low relative to these internal consistency estimates, suggesting that the five WSS subscales measure five empirically distinct constructs. Similar to Study 1, the WSS subscales were negatively related to accident rates. Respondents reporting a safer work environment also reported experiencing fewer accidents than respondents reporting a less safe work environment.

Table 6. Intercorrelation Matrix of the Study Variables for Study 2

	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Job safety	32.89	9.34	(92)														
2. Coworker safety	35.97	7.84	45**	(89)													
3. Supervisor safety	33.12	10.31	28**	54**	(96)												
4. Management safety practices	32.53	9.87	41**	53**	82**	(95)											
5. Satisfaction with the safety program	36.27	8.10	29**	49**	63**	71**	(92)										
6. Reported accidents	.79	.72	−18**	−03	−04	−06	00	(−)									
7. Unreported accidents	.22	.61	−19**	−16**	−18**	−22**	−14**	26**	(−)								
8. Near accidents	.57	1.02	−35**	−24**	−24**	−30**	−15**	24**	44**	(−)							
9. Compliance with safety behaviors	4.22	0.67	17**	29**	36**	35**	29**	−05	−19**	−24**	(85)						
10. Physical complaints	2.99	2.83	−24**	−20**	−14**	−19**	−15**	−02	04	22	−09**	(81)					
11. GHQ-12	2.50	0.46	−21**	−20**	−24**	−25**	−19**	01	06	18**	−11**	39**	(83)				
12. Sleep complaints	2.37	0.60	−13**	−18**	−13**	−16**	−15**	−11*	−01	07	−05	54**	35**	(77)			
13. White collar	—	—	−38**	−11*	−00	−04	−03	01	−01	14**	−08*	−06	02	−03	(−)		
14. Job stress	6.31	2.11	−29**	−24**	−27**	−26**	−20**	07	06	15**	−12**	21**	18**	19**	−10**	(−)	
15. Job satisfaction	6.64	2.45	30**	25**	37**	41**	31**	−08	−08	−24**	26**	−22**	−22**	−18**	−01	−24**	(−)

Note: $N = 297$ to 826. Decimal points omitted. Reliability (internal consistency) estimates located in the diagonal. Accident variables represent the square root of the self-reported accidents. White collar (1 = White collar; 2 = Blue collar).

*$p < .05$.

**$p < .01$.

Table 7. Stepwise Regression Analyses Predicting Accidents and Compliance with Safety Behaviors for Study 2

Criterion	Variable(s) Entered[1]	Model ΔR^2	Model F	p
Reported accidents	STEP 1	.02	1.41	—
	Job safety	.04	2.81	<.01
	All preceding variables	.04	2.81	<.01
Unreported accidents	STEP 1	.01	0.86	—
	Management safety	.01	12.19	<.01
	Job safety	.02	5.50	<.05
	All preceding variables	.05	3.58	<.01
Near accidents	STEP 1	.09	7.99	<.01
	Job safety	.07	24.36	<.01
	Management safety	.02	5.77	<.05
	All preceding variables	.18	10.94	<.01
Compliance with safety behaviors	STEP 1	.08	10.59	<.01
	Supervisor safety	.08	45.16	<.01
	Coworker safety	.01	5.17	<.05
	All preceding variables	.17	16.23	<.01

[1]STEP 1 includes the following variables: age and gender, job satisfaction, and job stress.

The WSS subscales were related to the health-related measures. Specifically, the WSS subscales were negatively related to the General Health Questionnaire, Physical Complaints Questionnaire, and the Sleep Complaints Questionnaire. Respondents who reported having a safe work environment also reported fewer health-related complaints compared to respondents who reported having a less safe work environment. Additionally, all WSS subscales were significantly related to compliance with safety behaviors. Specifically, people who perceived their jobs as safe complied with safety behaviors at work more frequently than people who perceived their jobs as less safe.

Stepwise regression analyses (Table 7) were conducted to determine the unique contribution of the WSS subscales in predicting accident rates and compliance with safety behaviors (after partialling out the effects of age, gender, job stress, and job satisfaction). Only significant WSS predictors are reported in the table. The best predictors of accidents were *management safety* and *job safety*. The best predictor of compliance with safety behaviors was *supervisor safety* and *coworker safety*.

STUDY 3

The majority of the respondents completing surveys in the previous studies (Studies 1 and 2) were available due to their industrial accident claim. Thus, one purpose of Study 3 was to provide additional evidence of the reliability (internal consistency) and validity of the WSS using a sample of employees collected using a more traditional method of data collection.

Method

Subjects, materials, and procedures.

The current sample of employees consisted of 181 telephone line workers from a large telecommunications company. Participation in completing the WSS was voluntary and participants' identity remained anonymous.

Instruments.

A packet of materials, including the WSS, was administered to the sample of respondents. In addition, the materials included questions asking for occupational title, self-reported accidents, and self-reported near accidents. Actual accident data were not available for the current sample. To normalize the distributions, these accident variables were transformed using the square root transformation. Respondents were also asked to indicate their job tenure. In addition, respondents were asked to indicate how frequently they receive the formal company safety awareness training on a scale of (1) (''Never'') to 5 ''More than once a month''), and if they received the company safety orienta-

tion when they entered their current job (1 = Yes, 2 = No). Finally, the 11-item measure of compliance with safety behaviors (CSB) that was used in Study 2 was used in the present study.

Results

Out of a total of 498 employees who were administered the WSS as part of the company's safety awareness program, 181 returned completed surveys for a response rate of 36%. The sample consisted of 87% male. The median age of the sample was 40 years (SD = 7.1).

The descriptive statistics and the correlations among the study variables are presented in Table 8. The reliability estimates (Cronbach's alpha) for the WSS subscales were all above .87. The intercorrelations among the WSS subscales ranged from .33 to .76.

None of the WSS subscales were significantly related to reported accidents. This may have been due to the fact that the majority of employees (89%) did not report experiencing an accident in the last 12 months. All WSS subscales, except *coworker safety*, were negatively related to near accidents. Employees who reported having a safer work environment reported experiencing fewer near accidents in the last 12 months.

All WSS subscales were significantly related to CSB scores, the frequency of safety awareness training, and whether or not employees received a safety orientation when entering their new jobs. Specifically, employees who reported having a safer work environment reported they complied with safety behaviors more often and said they received safety awareness training more frequently compared to employees who reported having a less safe work environment. Also, employees who said they received a safety orientation when they entered their current job reported having a safer work environment compared to employees who reported not receiving a safety orientation.

Hierarchical regression analyses were conducted to determine the unique contribution of the WSS subscales in predicting the study variables (after first forcing age, gender, and job tenure into the equation). The results of the hierarchical analyses are presented in Table 9. Only significant WSS predictors are reported. As seen in Table 9, the best predictor of near accidents was *management safety*, while the best predictors of CSB scores were *management safety* and *coworker safety*.

GENERAL DISCUSSION

The present paper described a series of studies designed to establish a psychometrically sound measure of perceptions of work safety, the Work Safety Scale (WSS). The results of the studies suggest that the WSS reliably measures five facets of employees' perceptions of work safety: (a) *job safety*, (b) *coworker safety*, (c) *supervisor safety*, (d) *management safety practices*, and (e) *satisfaction with the safety program*. Furthermore, the studies provide good evidence of convergent and discriminant validity for the WSS.

A factor analysis of the WSS revealed an interpretable five-factor solution, each factor representing one of the five WSS subscales. Additionally, across three independent samples, the internal consistency estimates for each of the WSS subscales were high (above .87) and the correlations among the WSS subscales were relatively low, suggesting that the WSS measured five empirically distinct constructs. Thus, the limited number of factors measured in previous work safety questionnaires may not reflect the underlying dimensionality of work safety, but may be due to the inadequate sampling of the work safety content domain of these measures.

Supporting previous research on perceptions of work safety, WSS subscales were correlated with accident rates (Guastello and Guastello, 1988; Smith et al., 1992), physical, psychological (Guastello, 1992), and sleep complaints (Lavie, Kremerman, & Wiel, 1982). Employees who said they worked in a safer environment reported experiencing fewer accidents and reported fewer health complaints than employees who said they had a less safe work environment.

It is important to note that the *management safety practices* and *supervisor safety* subscales were among the best predictors of accidents, job satisfaction, and compliance with safety behaviors. This is in line with previous research supporting the importance of management safety in predicting accident-related variables (Murphy et al., 1993; Zohar, 1980). Thus, improving the safety record of a company (e.g., increasing employees' compliance with safety behaviors, decrease accident rate) should include attention to management's role in safety (Murphy et al.).

Table 8. Intercorrelation Matrix of the Variables for Study 3

	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Job safety	28.57	7.09	(88)												
2. Coworker safety	37.94	6.27	33**	(88)											
3. Supervisor safety	37.20	8.14	35**	44**	(96)										
4. Management Safety practices	35.72	6.75	51**	44**	76**	(89)									
5. Satisfaction with the safety program	38.18	5.82	35**	39**	54**	68**	(89)								
6. Reported accidents	0.13	0.39	−11	−04	−00	−04	−00	(−)							
7. Near accidents	0.80	1.83	−35**	−11	−31**	−40**	−41**	13	(−)						
8. Frequency of safety awareness training	3.94	0.74	−12	11	34**	38**	35**	−07	−21**	(−)					
9. Age	1.21	0.41	−19*	−23**	−27**	−33**	−31**	03	33**	−21**	(−)				
10. Compliance with safety behaviors	4.21	0.49	27**	32**	38**	36**	29**	−11	−30**	14	−17*	(79)			
11. Job tenure	8.40	8.58	−02	01	−02	02	−02	−05	−03	12	−21**	−12	(−)		
12. Gender	—	—	08	19*	13	10	−10	−12	−06	−08	−03	08	02	(−)	
13. Age	40.23	7.10	15	−01	08	10	03	00	00	08	−07	03	09	−10	(−)

Note: $N = 156$ to 177. Decimal points omitted. Reliability (internal consistency) estimates located in the diagonal. Accident variables represent the square root of the self-reported accidents. For safety orientation, 1 = Received; 2 = Did not receive. Gender (1 = Male; 2 = Female).
*$p < .05$.
**$p < .01$.

TABLE 9. Hierarchical Regression Analyses Predicting Accidents and CSB Scores for Study 3

Criterion	Variable(s) Entered[1]	Model ΔR^2	Model F	p
Reported accidents	STEP 1	.02	0.82	—
Near accidents	STEP 1	.00	0.21	—
	Program safety	.18	29.66	$<.01$
	Job safety	.04	7.52	$<.01$
	All preceding variables	.23	7.88	$<.01$
Compliance with safety behaviors	STEP 1	.03	1.27	—
	Supervisor safety	.13	21.18	$<.01$
	Coworker safety	.02	4.17	$<.05$
	All preceding variables	.19	6.21	$<.01$

[1]STEP 1 includes the following variables: age, gender, and job tenure.

The content of the items in three of the WSS subscales (Coworker, Supervisor, and Management) reflect behaviors of each of the respective sources. Consequently, the specificity of these items may allow organizations to determine why employees' perceptions of work safety may be poor and can provide a means to improve work safety perceptions.

Models of the industrial accident process have included such variables as a person's social environment, employee behaviors at work, and personality variables (Hansen, 1988, 1989; Heinrich, 1959), each contributing, directly or indirectly, to accidents. Perhaps the role of a person's social work environment should be included in these models. The use of the WSS to measure employees' social work environment could provide insight regarding the determinants and consequences of industrial accidents.

Limitations and Future Research

The sample of respondents of Studies 1 and 2 may not be representative of the population of workers to which we would like to generalize. Unlike previous samples used in industrial accident research, the majority of the respondents completing surveys were available due to their industrial accident claim. Thus, the characteristics of the current sample may have biased the study's findings. Consequently, the psychometric characteristics of the WSS items may be questionable.

The biased sample may have affected responses in two ways: (a) average responses for each item may have been changed, and (b) the interrelationships among the items may have been affected. For example, the GHQ-12 scores (mean = 2.50, $SD = .46$, $N = 831$) for the Study 2 sample were significantly higher (e.g., more complaints) than GHQ-12 (mean = 2.29, $SD = .43$, $N = 150$) scores using a sample of full-time employed workers (Hayes, 1992), ($t(735) = 150.00$, $p < .01$); however, although the difference was statistically significant, the difference was still relatively small.

The intercorrelations among the scale items influence the internal consistency of the scale. The internal consistency estimate of the GHQ-12, as with the other standard measures (physical complaints, sleep complaints) used in the current study, are within the range of internal consistency estimates found in previous research using these scales. Thus, the pattern of correlations among the items may not have been substantially affected by the sample. Consequently, the process of determining the psychometric characteristics of the WSS items may not have been adversely affected by the current sample. The results of Study 3 showed that the internal consistency estimates of the WSS were similar to internal consistency estimates found in Studies 1 and 2. Additionally, in Study 3, the pattern of correlations of the WSS with other study variables were similar to that of Studies 1 and 2.

Another limitation of the current series of studies is their sole reliance on the use of self-report instruments. Thus, the correlations between the accident variables and the WSS subscales may be due to common method variance. Previous studies, however, have found that self-reported accident rates were related to objective

accident rates obtained from employees' personnel files (Smith et al., 1992). In any event, future studies should use objective accident indices to provide additional evidence of construct validity of the WSS.

Although the exploratory factor analysis of the WSS revealed five factors, there was considerable overlap between the *supervisor safety* and *management safety practices* items in the factor pattern matrix. Furthermore, the pattern of correlations of these two WSS subscales with other variables was similar. The correlation between these two scales, however, was still low relative to each scale's reliability, suggesting that the two WSS subscales measure distinct, but overlapping, constructs. Future studies could examine organizational factors (flat–fewer layers of management vs. tall–many layers of management) that may affect the overlap of these two WSS subscales. Changes in the referent of the WSS instructions for the *management safety practices* subscale (from *management* to *senior management*) might result in a lower correlation between the *supervisor safety* and *management safety* scales.

The results of the exploratory factor analysis suggest that employees' perceptions of work safety, as measured by the WSS, are multidimensional. In the future, researchers could apply confirmatory factor analysis on the WSS to test various measurement models.

CONCLUSIONS

This article presents the research supporting the validity of a measure of employees' perceptions of work safety, the WSS. The preliminary evidence suggests that the WSS reliably assesses five facets of employees' perceptions of work safety.

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APPENDIX

Work Safety Scale

Think about your current job. Using the scale below, please answer the following questions on the following pages.

Please write the job title here: _____

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

I. Job Safety

Think about your job you indicated above. Do you agree or disagree that each of the following words or phrases describes your job? Circle one answer for each statement using the scale at the top of the page.

1. Dangerous	1	2	3	4	5	6. Could get hurt easily	1	2	3	4	5
2. Safe	1	2	3	4	5	7. Unsafe	1	2	3	4	5
3. Hazardous	1	2	3	4	5	8. Fear for health	1	2	3	4	5
4. Risky	1	2	3	4	5	9. Chance of death	1	2	3	4	5
5. Unhealthy	1	2	3	4	5	10. Scary	1	2	3	4	5

II. Coworker Safety

Think about the people you work with. Do you agree or disagree that each of the following words or phrases describes these people? Circle one answer for each statement using the scale at the top of the page.

1. Ignore safety rules	1	2	3	4	5	6. Encourage others to be safe	1	2	3	4	5
2. Don't care about other's safety	1	2	3	4	5	7. Take chances with safety	1	2	3	4	5
3. Pay attention to safety rules	1	2	3	4	5	8. Keep work area clean	1	2	3	4	5
4. Follow safety rules	1	2	3	4	5	9. Safety-oriented	1	2	3	4	5
5. Look out for others' safety	1	2	3	4	5	10. Don't pay attention	1	2	3	4	5

III. Supervisor Safety

Think about your immediate supervisor. Do you agree or disagree that each of the following words or phrases describes your immediate supervisor? Circle one answer for each statement using the scale at the top of the page.

1. Praises safe work behaviors	1	2	3	4	5	6. Discusses safety issues with others	1	2	3	4	5
2. Encourages safe behaviors	1	2	3	4	5	7. Updates safety rules	1	2	3	4	5
3. Keeps workers informed of safety rules	1	2	3	4	5	8. Trains workers to be safe	1	2	3	4	5
4. Rewards safe behaviors	1	2	3	4	5	9. Enforces safety rules	1	2	3	4	5
5. Involves workers in setting safety goals	1	2	3	4	5	10. Acts on safety suggestions	1	2	3	4	5

IV. Management Safety Practices

Think about your management. Do you agree or disagree that each of the following words or phrases describes your management? Circle one answer for each statement using the scale at the top of the page.

1. Provides enough safety training programs	1	2	3	4	5	6. Provides safe working conditions	1	2	3	4	5
2. Conducts frequent safety inspections	1	2	3	4	5	7. Responds quickly to safety concerns	1	2	3	4	5
3. Investigates safety problems quickly	1	2	3	4	5	8. Helps maintain clean work area	1	2	3	4	5
4. Rewards safe workers	1	2	3	4	5	9. Provides safety information	1	2	3	4	5
5. Provides safe equipment	1	2	3	4	5	10. Keeps workers informed of hazards	1	2	3	4	5

Does you company have a formal safety program (policies)? (circle answer) Yes No Don't know
If you answered ''Yes,'' please answer the following questions about the safety program (policies).

V. Safety Program (Policies)

Think about your safety program at work. Do you agree or disagree that each of the following words or phrases describes this safety program? Circle one answer for each statement using the scale at the top of the page.

1. Worthwhile	1	2	3	4	5	6. Unclear	1	2	3	4	5
2. Helps prevent accidents	1	2	3	4	5	7. Important	1	2	3	4	5
3. Useful	1	2	3	4	5	8. Effective in reducing injuries	1	2	3	4	5
4. Good	1	2	3	4	5	9. Doesn't apply to my workplace	1	2	3	4	5
5. First-rate	1	2	3	4	5	10. Does not work	1	2	3	4	5

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