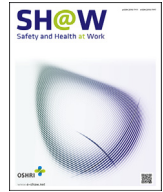




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Development and Validation of an Integrated Healthy Workplace Management Model in Taiwan

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ABSTRACT

Background: Impacts of exposure are generally monitored and recorded after injuries or illness occur. Yet, absence of conventional after-the-effect impacts (i.e., lagging indicators), tend to focus on physical health and injuries, and fail to inform if workers are not exposed to safety and health hazards. In contrast to lagging indicators, leading indicators are proactive, preventive, and predictive indexes that offer insights how effective safety and health. The present study is to validate an extended Voluntary Protection Programs (VPP) that consists of six leading indicators.

Methods: Questionnaires were distributed to 13 organizations (response rate = 93.1%, 1,439 responses) in Taiwan. Cronbach α , multiple linear regression and canonical correlation were used to test the reliability of the extended Voluntary Protection Programs (VPP) which consists of six leading indicators (safe climate, transformational leadership, organizational justice, organizational support, hazard prevention and control, and training). Criteria-related validation strategy was applied to examine relationships of six leading indicators with six criteria (perceived health, burnout, depression, job satisfaction, job performance, and life satisfaction).

Results: The results showed that the Cronbach's α of six leading indicators ranged from 0.87 to 0.92. The canonical correlation analysis indicated a positive correlation between the six leading indicators and criteria (1st canonical function: correlation = 0.647, square correlation = 0.419, $p < 0.001$).

Conclusions: The present study validates the extended VPP framework that focuses on promoting safety and physical and mental health. Results further provides applications of the extended VPP framework to promote workers' safety and health.

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1. Introduction

Exposures to safety and health hazards at work are well documented and researched. Impacts of exposure are generally monitored and recorded after injuries or illness occur. These after-the-effect outcomes (i.e., lagging indicators) focus on exposures that lead to death, days away from work, restricted work or transfer to another job, medical treatment beyond first aid, or loss of consciousness (e.g., US Occupational Safety and Health Administration [OSHA], 2001) [1]. Conventionally, these lagging indicators serve as performance index pertaining to occupational safety and health.

Although these indicators offer useful insights, they fall short of providing a complete picture how well organizations manage workplace safety and health. First, absence of after-the-effect outcomes does not necessarily mean employees are not exposed to safety and health hazards [2]. Second, these indicators tend to emphasize physical health more than mental health, even though mental health outcomes are as important as physical health outcomes, and their relationships are intertwined. For instance, stressful working conditions such as high workload tend to disrupt workers' immune systems as well as mental health such as anxiety [3].

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US OSHA [4], Singapore WSH Council [5], and Japan Industrial Safety & Health Association [6] have all proposed that leading indicators should be integrated with the organization's safety and health management processes. In contrast to lagging indicators, leading indicators are proactive, preventive, and predictive indexes that offer insights how effective safety and health management is.

As yet, there is no official leading indicators endorsed by government agencies such as OSHA. In addition, Walaski (2021) observes little or no consensus what leading indicators should be included in the safety and health management system [7]. She argued that OSH professionals likely lack of knowledge to create useful leading indicators, and some leading indicators don't indicate anything in substantive way that is associated with successful prevention.

Although there is no consensus about leading indicators, empirical research and recommendations from professional agencies offer insightful directions. The Voluntary Protection Programs (VPP) of the U.S. OSHA proposed a framework that safety and health management system should focus on hazard prevention and control, worksite analysis, training, worker involvement and management commitment [8]. In the remaining sections, we will expand the VPP framework with empirical findings to guide the present research.

Similar to VPP [8], the Singapore WSH Council [5] and the Japan Industrial Safety & Health Association [6] also suggested the importance of hazard prevention and control, which is referred to the systematic identification, assessment, elimination and control of safety and health hazards. Worksite analysis can be considered part of hazard prevention and control process because worksite analysis identifies and assesses hazards.

Training is an efficient organizational strategy to prevent and control workplace hazards, which can directly and actively improve employees' safety, reduce injuries and accidents, as well as prevent occupational diseases and illness [9]. A meta-analysis further showed that employees who actively participate in training and acquire relevant knowledge and skills tend to report fewer workplace accidents, injuries and diseases [10].

Both worker involvement and management commitment are core components of safety climate, which contributes to workers' safety and health. Safety climate is the shared perception held by workers about aspects of their organizational environment pertaining to safety and health [11]. Management in an organization with a strong safety climate often commit to workers' safety and health policies and practices. Workers also involve in building healthy and safe work environment by providing feedback to and communicate freely with management about how to improve safety and health at work. Safety climate also set up priority of safety and health over other competing goals, such as production speed or sales [12]. Empirical research has consistently shown that successful safety and health management system is a result of a strong safety climate in which leaders and employees engage in safety practices and prioritize safety and health concerns over other competing priorities [5,8].

It has been postulated that leaders create climate [13]. Transformational leaders committing to promote safety and health inspire workers to engage safe and health practices, seek out workers' input for better ways to building a safe and health workplace. Through observing what leaders do and say, how policies, practices, and procedures are actually implemented and managed, and how resources and efforts are allocated to eliminate safety and health hazards, workers' shared perceptions about safety and health (i.e., safety climate) are formed [13].

Transformational leaders often go beyond rewarding and monitoring employees. They express a clear and positive vision for employees to achieve their goals, show respect and personal

concern for employees as individuals, inspire them to think creatively and innovatively and encourage them to voice their opinions and to think about problems in new ways, promote participation and cooperation between units within organizations, encourage them to strive for something beyond their individual goals to reach their full potential, and coach or mentor them to develop skills and to instill pride in themselves [14]. Empirical studies have provided support for the importance of transformational leadership in particular in establishing the safety climate in an organization, with meta-analyses estimating corrected correlations close to 0.5 to 0.6 [10,15].

The next two leading indicators, organizational justice and organizational support, also play vital roles in building and strengthening safety and health management system, although both indicators have not yet be integrated into the VPP framework. Organizational justice refers to employees' perception if they are treated fairly, or whether they are treated with respect and dignity. There are three different forms of organizational justice perceived by employees: distributive justice (perceived fairness regarding how rewards are allocated), procedural justice (perceived fairness regarding how the allocation process is developed and implemented), and interactional justice (perceived fairness regarding treatment and communication by management). Based on meta-analysis studies [16,17], employees who perceive fair treatment tend to be more satisfied with their jobs, experience lower levels of negative emotion, and engage in fewer counterproductive and withdrawal behaviors.

Finally, organizational support is considered a multi-faceted concept which includes perceived emotional support from the organization [18], perceived support from colleagues and supervisors [19], or flow of safety information from the organization [20]. Meta-analytic results have shown that supervisor support is positively associated with employees' well-being [21]. Katz-Navon found that an increased flow of safety information tends to lead to better safety performance [22].

In sum, the extended VPP framework consists of practical and evidence-based leading factors that promote healthy and safe workplaces. These leading indicators include hazard prevention and control (including worksite analysis), training, safety climate (including worker involvement, and management commitment), transformational leadership, organizational justice, and organizational support. The main aim of this study is to use criteria-related validation strategy to examine validity of the extended VPP framework applied in Taiwan. In specific, the present study investigates the relationships of the key leading factors with physical and mental health criteria (i.e., perceived health, burnout, and depression), as well as job related criteria (i.e., job satisfaction, and job performance). According to the literature reviewed previously [9–11,16,17,21,22], the leading indicators within the extended framework are expected to be positively related to perceive health, job satisfaction, and job performance, and negatively related to burnout and depression.

2. Materials and methods

2.1. Participants

Employees from 13 organizations (6 small or medium enterprises and 7 large enterprises) across service, construction, and manufacturing industries in Taiwan were recruited to participate in this study through purposive sampling. After acquiring the consent of the enterprises, each participating employee received a package that consisted of a questionnaire, a consent form, and a return envelope. Written informed consent was obtained from all participants, and all responses were anonymous. A total of 1,439

completed questionnaires were received between October to December 2016, with a response rate of 93.1%.

This study's protocols were reviewed and approved by the Institutional Review Board at Taiwan Fu-Jen Catholic University (FJU-IRB No: C104116) before the process began.

2.2. Measures

The questionnaire consisted of participant background information, measures of leading indicators, and criteria measures, which are described below.

2.2.1. Background information

Background questions asked about gender (male/female), age (20–29, 30–39, 40–49, 50–59, 60 and above), education level (high school or below, college/university, postgraduate), marital status (single, married, or separated/divorce), industry type (manufacturing, construction, or service), job position (department manager, general staff), seniority (within 1 year, 1–5 years, 5–10 years, 10–15 years, 15–20 years, over 20 years), working days per week (below 5 days, 5 days, 5 and half days, over 6 days), working hours (7 hours or below, 8 hours, 9 hours, over 10 hours), and whether they did shiftwork (yes vs. no).

2.2.2. Leading indicators

Measures of the leading indicators included hazard prevention and control, training, safety climate, transformational leadership, organizational justice, organizational support.

2.2.3. Hazard prevention and control

Hazard prevention and control was measured with four items modified from the Voluntary Protection Programs (VPP): Policies and Procedures Manual [9]. The scale assessed routine monitoring of causes of health and safety hazards, sources of exposure to such hazards, control of physical and psychological health and safety hazards (e.g., source elimination or quarantine, work procedure improvement, and the provision of personal protective equipment).

2.2.4. Training

Four items were developed to assess training availability. These items were developed based on the Voluntary Protection Programs (VPP): Policies and Procedures Manual [9]. Respondents were asked whether a company provided sufficient, skill-based training programs to enhance employees' health competence and workplace safety prevention skills.

2.2.5. Safety climate

The measure, modified from Zohar and Luria [23], consisted of 8 items regarding the commitment of the enterprise to employees' physical and psychological health and safety, enterprise prioritization of employees' physical and psychological health and safety, and listening carefully to employees' suggestions about improving workplace safety and health.

2.2.6. Transformational leadership

Modified from Carless, Wearing, and Mann's [24] scale, the transformational leadership scale consisted of 3 items regarding staff development, innovative thinking, and charismatic leadership.

2.3. Organizational justice

Modified from Colquitt [25] and Moorman [26], the 4-item organizational justice measure assessed fairness of procedure in implementing health and safety welfare, and fairness of rewarding for effort.

Table 1

Baseline characteristics among research population ($n = 1,439$)

Variables	Number	%
Gender		
Male	987	68.6
Female	433	30.1
Missing	19	1.3
Age		
20–29	261	18.1
30–39	523	36.3
40–49	425	29.5
50–59	152	10.6
60 and above	63	4.3
Missing	15	1.0
Education level		
High school or below	302	21.0
Colleges/university	829	57.7
Post-graduate	296	20.6
Missing	12	0.8
Marriage		
Single	489	34.0
Married	870	60.5
Separated/divorce	44	3.0
Missing	36	2.5
Industry		
Manufacturing	783	54.4
Construction	200	13.9
Service	456	31.7
Job seniority		
Within 1 y	139	9.7
1–5 y	377	26.2
5–10 y	235	16.3
10–15 y	274	19.0
15–20 y	224	15.6
Over 20 y	178	12.4
Missing	12	0.80
Position		
Department manager	195	13.6
General staff	1229	85.4
Missing	15	1.0
Shifts		
Yes	209	14.5
No	1203	83.6
Missing	27	1.9
Work days per week		
Below 5 d	37	2.6
5 d	1014	70.5
5 and half days	140	9.7
Over 6 d	157	10.9
Missing	91	6.3
Average working hour		
7 h or below	40	2.8
8 h	892	62.0
9 h	287	19.9
Over 10 h	208	14.4
Missing	12	0.8

2.3.1. Organizational support

Based on McMillan [19] and Ladd & Henry [20], a 4-item scale was developed in the present study. It assessed to what extent a company provided sufficient health and safety information, and how a company encouraged teamwork and support for promoting safety and health.

2.3.2. Criteria measures

Criteria measures consisted of physical and psychological health outcomes (perceived health, burnout, and depression), job satisfaction, life satisfaction and job performance. Among health outcome measures, one item each regarding perceived health, burnout, and depression was adapted from Fisher, Matthews, and Gibbons [27]. Job satisfaction and life satisfaction were measured by one item, also developed by Fisher, Matthews, and Gibbons [27]. Finally, employees were asked to report on their job performance over the last six months, on a scale developed by Kessler et al. [28] ranging from 0 to 10.

Table 2
Descriptive statistics of six healthy workplace management dimensions as the correspondent items

Variables	<i>n</i>	Mean	S.D.	Item-total correlation	Cronbach's α
A. Hazard prevention and control					0.89
1 The company will actively understand or investigate the causes of physical and mental health hazards of employees on a regular basis.	1,419	3.97	1.28	0.89	
2 The company will take any strategy to solve the problem of the physical and mental health hazards of employees.	1,419	4.22	1.17	0.91	
3 The company will actively investigate the causes of employee safety hazards on a regular basis.	1,419	4.46	1.09	0.88	
4 The company will take any strategy to solve the problem for employees' work safety hazards.	1,419	4.74	0.91	0.81	
B. Training					0.92
1 The company has provided sufficient health education and training program.	1,428	4.46	1.14	0.90	
2 The company providing skilled-based health education strategies is adequate to enhance personal health competence.	1,428	4.36	1.13	0.92	
3 The company has provided sufficient safety education program.	1,428	4.76	0.93	0.87	
4 The company providing workplace safety education strategies is sufficient to enhance personal preventing workplace hazards skills.	1,428	4.66	0.98	0.89	
C. Safe climate					0.88
1 The company is willing to commit itself to investing resources to prevent employees from accidental injuries caused by work.	1,424	4.98	0.92	0.77	
2 The company is willing to commit itself to investing resources to improve the health of employees.	1,424	4.83	1.04	0.80	
3 The company will take the maintenance of employees' physical and mental health as the first priority.	1,424	4.71	1.09	0.81	
4 In my company, to get work done, one must ignore employees' physical and mental health aspects.	1,424	3.82	1.38	0.68	
5 The company will take the maintenance of employees' safety as the priority	1,424	4.93	0.93	0.80	
6 The company, to get work done, one must ignore employees' safety aspects.	1,424	4.28	1.31	0.69	
7 Employees put forward ideas for improving physical and mental health, the company will adopt	1,424	4.41	1.02	0.78	
8 Employees put forward ideas for improving work safety, the company will adopt	1,424	4.63	0.95	0.74	
D. Transformational leadership					0.89
1 Company supervisors treat employees as independent individuals, encouraging and supporting their development	1,413	4.13	1.13	0.89	
2 Company supervisors encourage employees to think in new ways	1,413	4.33	1.12	0.92	
3 Company supervisors respect employees, let employees rush to confidence, and motivate employees to become better	1,413	4.15	1.21	0.92	
E. Organizational justice					0.89
1 The company considers employee responsibilities to allocate the fair health and safety benefits	1,430	4.40	1.11	0.90	
2 The company considers the performance of employees and gives the fair physical and mental health and safety benefits.	1,430	4.21	1.20	0.86	
3 The company has been free of supervisor's bias in the process of developing physical and mental health and safety benefits.	1,430	4.11	1.25	0.86	
4 The company has consistent standards for maintaining the fairness of employees' health and safety benefits.	1,430	4.53	1.05	0.86	
E. Organizational support					0.87
1 The company regularly provides physical and mental health information to disseminate.	1,422	4.61	1.06	0.87	
2 The company regularly provides safety protection information to disseminate.	1,422	4.72	0.96	0.83	
3 The company encourages teamwork among colleagues in the same department (unit) to enhance co-workers support.	1,422	4.49	1.13	0.88	
4 The company has promoted teamwork between departments to enhance co-workers support between departments.	1,422	4.26	1.14	0.83	

2.4. Data analysis

Statistical analysis was performed using SAS Version 9.4(SAS Inc., Cary, NC). The underlying characteristics of the overall sample

distribution and the distribution in each individual industry were analyzed. Firstly, categorical or continuous variables were described through absolute frequency (%) or mean (SD) respectively. Secondly, Cronbach's α was used to assess the internal

Table 3
Correlations between healthy workplace management dimensions and criteria

Criterion	Indicators	β-value	p-value	95% CI	
				Lower	Upper
Perceived health					
	A. Hazard prevention and control	0.04	0.001	0.02	0.06
	B. Training	0.02	0.09	-0.003	0.05
	C. Safety climate	0.02	<0.001	0.01	0.04
	D. Transformational leadership	0.01	0.51	-0.02	0.04
	E. Organizational justice	0.01	0.38	-0.01	0.03
	F. Organizational support	-0.003	0.86	-0.03	0.03
	R	0.41			
	R ²	0.17			
Burnout					
	A. Hazard prevention and control	-0.05	0.001	-0.08	-0.02
	B. Training	-0.004	0.78	-0.03	0.03
	C. Safety climate	-0.05	<0.001	-0.06	-0.03
	D. Transformational leadership	-0.06	0.002	-0.09	-0.02
	E. Organizational justice	-0.02	0.13	-0.05	0.01
	F. Organizational support	0.05	0.01	0.02	0.09
	R	0.45			
	R ²	0.21			
Depression					
	A. Hazard prevention and control	-0.05	0.002	-0.08	-0.02
	B. Training	0.01	0.50	-0.02	0.04
	C. Safety climate	-0.05	0.01	-0.08	-0.02
	D. Transformational leadership	-0.05	0.01	-0.08	-0.02
	E. Organizational justice	-0.004	0.81	-0.03	0.03
	F. Organizational support	0.03	0.06	-0.001	0.07
	R	0.42			
	R ²	0.18			
Job satisfaction					
	A. Hazard prevention and control	0.07	<0.001	0.05	0.09
	B. Training	0.03	0.01	0.01	0.05
	C. Safety climate	0.02	0.003	0.01	0.03
	D. Transformational leadership	0.06	<0.001	0.04	0.09
	E. Organizational justice	0.01	0.27	-0.01	0.03
	F. Organizational support	-0.01	0.52	-0.03	0.02
	R	0.63			
	R ²	0.39			
Job performance					
	A. Hazard prevention and control	0.07	0.002	0.03	0.11
	B. Training	0.01	0.53	-0.03	0.05
	C. Safety climate	0.03	0.01	0.01	0.05
	D. Transformational leadership	0.03	0.26	-0.02	0.08
	E. Organizational justice	-0.04	0.04	-0.08	-0.001
	F. Organizational support	0.04	0.12	-0.01	0.09
	R	0.35			
	R ²	0.12			
Life satisfaction					
	A. Hazard prevention and control	0.04	<0.001	0.02	0.06
	B. Training	0.02	0.10	-0.003	0.04
	C. Safety climate	0.02	<0.001	0.01	0.04
	D. Transformational leadership	0.04	0.004	0.01	0.07
	E. Organizational justice	0.01	0.38	-0.01	0.03
	F. Organizational support	0.01	0.36	-0.01	0.04
	R	0.56			
	R ²	0.31			

Note: adjusted for gender, age, education level, marriage, industry, job seniority, position, shifts, work days per week, and average working hour.

consistency among the dimensions. A Cronbach's α value of >0.8 indicates satisfactory internal consistency. Thirdly, the Pearson correlation coefficient method was used to investigate the item total correlation. Fourthly, multiple linear regression was used to assess the independent effects of the leading indicators on each criterion after controlling for covariates including gender, age, education level, marriage, industry, job seniority, position, shifts, work days per week, and average working hour. Finally, canonical correlation analysis was used to identify and measure the associations among two sets of variables: leading indicators and criteria. This approach best explains the variability both between and within sets via orthogonal linear combinations of the variables in each set. A p -value of less than 0.05 was considered statistically significant.

Table 4
The results of canonical correlation analysis

Criterion	Structural coefficients	Leading indicators	Structural coefficients
Perceived health	-0.613	Hazard prevention and control	-0.935
Burnout	0.662	Training	-0.874
Depression	0.610	Safe climate	-0.868
Job satisfaction	-0.947	Transformational leadership	-0.862
Job performance	-0.501	Organizational justice	-0.847
Life satisfaction	-0.825	Organizational support	-0.866
Variance explained	0.503	Variance explained	0.767

$\rho = 0.647, \rho^2 = 0.419, p < 0.001.$

3. Results

Of the 1,439 participants enrolled in this study, 68.6% ($n = 987$) were male, and 54.4% ($n = 784$) were younger than 40 years. 57.7% ($n = 829$) had a college or university education, and 60.5% ($n = 870$) were married. In addition, 52.2% ($n = 751$) participants had a total service time less than 10 years, 85.4% ($n = 1229$) were general staff, 14.5% ($n = 209$) did shift work, 70.5% ($n = 1014$) worked 5 days per week, 62.0% ($n = 892$) worked 8 hours a day on average, and 54.4% ($n = 783$) were in the manufacturing industry (see Table 1).

Reliability is gauged by the Cronbach's α as shown in Table 2. The Cronbach's α of hazard prevention and control, training, safe climate, transformational leadership, organizational justice and organizational support are 0.89, 0.92, 0.88, 0.89, 0.89, and 0.87, respectively. The ranges of item total correlation of hazard prevention and control, training, safe climate, transformational leadership, organizational justice and organizational support are 0.81–0.91, 0.87–0.92, 0.68–0.81, 0.89–0.92, 0.86–0.90 and 0.83–0.88, respectively.

Table 3 provides the linear regression analysis results of the relationship between six leading indicators and six criteria after adjustment for confounding factors. R^2 of six leading indicators to perceived health, burnout, depression, job satisfaction, job performance, and life satisfaction were estimated at 0.17, 0.21, 0.18, 0.39, 0.12, and 0.31, respectively. Both safety climate and hazard prevention and control are positively associated with perceived health ($\beta = 0.02, 95\% \text{ CI: } 0.01\text{--}0.04$; $\beta = 0.04, 95\% \text{ CI: } 0.02\text{--}0.06$), job satisfaction ($\beta = 0.02, 95\% \text{ CI: } 0.01\text{--}0.03$; $\beta = 0.07, 95\% \text{ CI: } 0.05\text{--}0.09$), job performance ($\beta = 0.03, 95\% \text{ CI: } 0.01\text{--}0.05$; $\beta = 0.07, 95\% \text{ CI: } 0.03\text{--}0.11$) and life satisfaction ($\beta = 0.02, 95\% \text{ CI: } 0.01\text{--}0.04$; $\beta = 0.04, 95\% \text{ CI: } 0.02\text{--}0.06$), but negatively associated with burnout ($\beta = -0.05, 95\% \text{ CI: } -0.06 \text{ to } -0.03$; $\beta = -0.05, 95\% \text{ CI: } -0.08 \text{ to } -0.02$) and depression ($\beta = -0.05, 95\% \text{ CI: } -0.08 \text{ to } -0.02$; $\beta = -0.05, 95\% \text{ CI: } -0.08 \text{ to } -0.02$). Transformational leadership is positively related to job satisfaction ($\beta = 0.06, 95\% \text{ CI: } 0.04\text{--}0.09$) and life satisfaction ($\beta = 0.04, 95\% \text{ CI: } 0.01\text{--}0.07$), but negatively related to burnout ($\beta = -0.06, 95\% \text{ CI: } -0.09 \text{ to } -0.02$) and depression ($\beta = -0.05, 95\% \text{ CI: } -0.08 \text{ to } -0.02$). Training ($\beta = 0.03, 95\% \text{ CI: } 0.01\text{--}0.05$) is positively related to job satisfaction. In addition, organizational justice ($\beta = -0.04, 95\% \text{ CI: } -0.08 \text{ to } -0.001$) is negatively associated with job performance. Organizational support ($\beta = 0.05, 95\% \text{ CI: } 0.02\text{--}0.09$) is positively related to burnout.

Table 4 and Fig. 1 present the results of canonical correlation analysis. The first criterion canonical variate is characterized by perceived health ($r = -0.613$), burnout ($r = 0.662$), depression

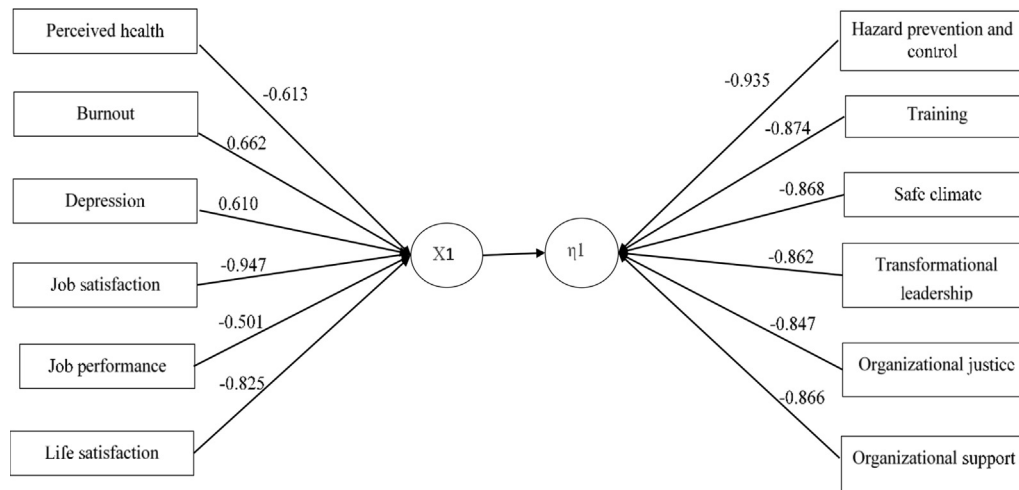


Fig. 1. Canonical correlation analysis for healthy workplace management dimensions and criteria.

($r = 0.610$), job satisfaction ($r = -0.947$), job performance ($r = -0.50$), and life satisfaction ($r = -0.825$). High levels of hazard prevention and control, training, safety climate, transformational leadership, organizational justice, and organizational support seem to be good predictors for the criteria, as all have expected correlations with the first criterion canonical variate. In addition, the canonical correlation analysis indicated a positive correlation between the six leading indicators and criteria (1st canonical function: correlation $\rho = 0.647$, square correlation $\rho^2 = 0.419$, $p < 0.001$).

4. Discussion

Results of the present study show positive relationships between the six leading indicators and six outcome criteria. These findings suggest that the six leading factors proposed in the extended VPP framework be integrated with the organization's safety and health management system to reduce psychosocial risks at work.

Among these indicators, hazard prevention and control explains the most variance in perceived health, burnout, depression, job satisfaction, and job performance, and life satisfaction that the evidence clearly suggests the benefit for employers to conduct worksite analysis to mitigate or control work hazards inherent in each particular environment.

Safety climate is the shared perceptions of organizational members regarding how safety policies, procedures and practices are implemented [29]. Evidence-based studies have also indicated that there are relationships between perceived workplace safety climate and worker health behaviors, worker outcomes, and employer outcomes [30]. Integrated strategies to improve an organization's overall safety climate may positively influence employee physical and mental health, as well as job satisfaction, job performance, and life satisfaction.

We also found transformational leadership was significantly related to burnout, depression, and job satisfaction. This result echoed the important role of transformational leadership in establishing safe and health work environments [31]. Transformational leadership is frequently related to higher levels of employee satisfaction, job performance, work engagement, and employees' willingness to put in extra effort to reach a targeted goal [32]. By establishing transformational relationships with subordinates, transformational leaders obtain the trust of their employees and meet their needs by providing the necessary information, support, and resources required to carry out their work in a meaningful way [31].

The present study showed the association between organizational justice and job performance. Organizational justice is defined as "the rules and social norms governing how outcomes (e.g., rewards and punishments) should be distributed, the procedures used for making such distribution decisions (as well as other types of decisions), and how people are treated interpersonally [33]." There is a mutually beneficial relationship between an organization and its employees when employees feel that they are not being treated fairly by the organization. If the relationship is imbalanced, employees may reduce or withdraw their participation in this relationship [34].

Burnout has become one of the major concerns in organizations, especially when employees frequently interact with the public [35]. Previous studies have shown that lack of adequate resources likely contribute to stress and burnout [36]. Efforts to improve personal, interpersonal, and organizational resources such as worker involvement, management commitment, fair treatment, or organizational support may increase work engagement and buffer the impact of employees' stress and burnout [37].

Past research has shown a positive relationship between positive training experiences and job satisfaction. Specifically, initial training, ongoing supervision, and continuing education accounted for 24% of the variance in job satisfaction [38]. This result in conjunction with the present result point out that organizations could benefit from improving training programs delivery and implementations.

A surprising finding from this study was a positive relationship between burnout and organizational support ($\beta = 0.05$, $p = 0.01$) and a negative relationship between job performance and organizational justice ($\beta = -0.04$, $p = 0.03$). In the univariate analysis, the Pearson's correlation coefficients between burnout and organizational support and between job performance and organizational justice were 0.314 ($p < 0.01$) and 0.241 ($p < 0.01$), respectively. This disparity indicates the appearance of suppressor effects. There are two possible reasons why the suppressor effects occurred. First, intercorrelation among the leading indicators may have confounded the results. Second, the suppressor effects may reveal that those with lower scores of leading indicators may have a higher risk of developing burnout and depression. This possible explanation implicated the need to design interventions by tailoring to the special staff subgroups.

4.1. Limitations

Three limitations should be considered when interpreting results of this study. First, cross-sectional design utilized in this study could not provide definitive conclusion about the causal

relationships between the leading indicators and the criteria. Future studies with longitudinal design are needed to assess long-term effects (e.g. prevalence of accidents or occupational diseases) of the leading indicators within the extended VPP framework. Second, the present study was conducted in the service, construction, and manufacturing industries. Results may not be generalizable because other industries may not have similar characteristics. Results of the present study should be replicated in other industries. Finally, participants of the present studies are invited from selected organizations. Therefore, the present findings should not be extrapolated to other organizations or industries in Taiwan.

5. Conclusion

The present study provides an initial investigation of the extended VPP framework, which consists of six leading indicators focusing on physical and mental health, in addition to safety. As shown in Table 4, strong magnitude of structured coefficients of the leading indicators (ranging from 0.77 to 0.94 in absolute values) not only provide validity evidence of six leading indicators, but also support future applications of the extended VPP framework to manage and improve workers safety and health.

Authorship

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Declaration of competing interest

All authors declare that there are no conflicts of interest.

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