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Associations between transactional leadership and safety climate: moderating role of transformational leadership

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Article

Keywords: safety climate, transactional leadership, transformational leadership, employee well-being, moderating effects, Pakistani nurses

Posted Date: August 10th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10303555/v1

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Additional Declarations: No competing interests reported.

Abstract

Exploration of the safety climate among nurses during the COVID-19 pandemic has received little attention, but is of acute importance because of their potential effects on safety outcomes. The data used for the cross-sectional study are obtained from self-reported surveys, originally collected by the 314 Pakistani nurses during the COVID-19 pandemic. Two-factor structure has been found among transformational leadership (motivational leadership, inspirational leadership), transactional leadership (active leadership, contingent leadership), and safety climate (compliance with safety rules, occasional deviations), respectively. Analysis of variance indicates socioeconomic factors are related with transformational leadership, transactional leadership, employee well-being, and safety climate. Hierarchical linear regression identifies moderating mechanism of transformational leadership on the association between transactional leadership and employee well-being and between employee well-being and safety climate. These findings highlight the importance of employee well-being in the relationship between transactional leadership and safety behaviors among nurses.

Introduction

Safety climate (SC) is widely defined as “a collective construct derived from individuals’ shared perceptions of the various ways that safety is valued ” in the workplace (e.g., Griffin and Curcuruto, 2016). Safety climate has an impact on both patient and nurse injuries (Taylor, et al., 2012) and can directly increase nurses' intent to stay (Liang, et al., 2016). However, nurse perceptions of safety climate varies between hospitals as well as across wards within each hospital (Soh, et al., 2018). Nurse leaders play an important role in safety climate in hospitals (Ausserhofer, et al., 2012). Meanwhile, nurse managers are responsible for the nurse work environment which can contribute to improving nurses' perception of safety climate (Dutra & Guirardello, 2021).

Transactional leadership is the leadership that involves managing necessary transactions with and between employees on the basis of human relations model, closed-systems thinking, and the viewpoints of the workers (Swan, 2016). Studies validate that transformational leadership actually have stronger effects on employees than transactional leadership (MacKenzie, et al., 2001; Aboramadan and Kundi, 2020). An empirical study indicated that transformational leadership is underpinned by leader deontological ethical values, while transactional leadership is underpinned by leader utilitarianism (Groves and LaRocca, 2011). Transformational and transactional leadership are confirmed to lead to employees’ adoption of various achievement goals (Hamstra,et al., 2014).

The concept of transformational leadership was initially introduced by Burns (1978) and subsequently developed by Bass (1985). According to Bass (1985), transformational leadership comprises four dimensions of idealized influence, inspirational motivation, intellectual stimulation and individualized consideration. Ellen (2016) summarizes the concept that transformational leadership aims to inspire and motivate followers to achieve outcomes beyond expectations and help followers grow and develop by responding to their individual needs. Hence, nurses at work learn by observing their supervisors, whereupon, develop their well-being and enhance an important work outcome (safety climate).

This study contributes to nursing, leadership, and management theories by examining the content and characteristics of nursing job in the career context. First, This study contributes to the literature on motivation and career management by coordinating the multidisciplinary teamwork for future possible epidemiological crises. Nurses often are on the front line of the fight against contagious diseases, with an increased risk of contracting the viruses and becoming infected. The sudden situation produced by the diseasal pandemic would damage the operation of hospitals and forcefully change the working environment for nurses. The leadership styles could quickly restore procedure patterns and reduce professional burnout among the medical personnel. Second, understanding how leadership style relates to the human experiences during the COVID-19 pandemic can be used as a basis for understanding career choice for professional workers.In the situation of the COVID-19 pandemic, nurse managers facing additional pressures have the responsibility for the atmosphere at work to manage effectively the crisis prudently and nurturing supportive relationships to alleviate mental disorders of nurse colleagues and patients.At that time, nurse managers had to make extreme ethical decisions,allocate insufficient resources, deal effectively with emerging problems, and improve the quality of patient care. A final contribution of the study is to improve

the knowledge and competence of hospital management personnel, healthcare facilities, and safety climate. When nurse managers demonstrate courageous leadership in situations of uncertainty, they will contribute to the organization's effectiveness in crisis situations. Addressing self-efficacy and coping strategies is highly dependent on the past nurses' experiences caused by the pandemic crisis. Therefore, it seems reasonable to further explore this area and clarify the nurses' experiences during the coronavirus pandemic, which will allow more effective management in the future.

The structure of this study is complete and the topic is relevant to reality. The study explores the relationship between transformational leadership, transactional leadership, employee well-being, and safety climate among nurses during the COVID-19 pandemic, which is an important issue that has received little attention. The study provides a more detailed perspective on the development of nursing management theory and has practical guidance implications for the application of nursing management.

Literature review and hypotheses development

A large body of research reports that supporting /maintaining relationships between leaders and followers can improve safety culture. As to nursing job, emotional labour plays an important role in promoting safety climate and reducing workplace risk (Smith, et al., 2009). Moreover, psychosocial hazards can moderate the safety climate-performance relationship (Manapragada, et al., 2019). Nurse managers' inclusive leadership helps nurses to improve psychological safety and disclose nursing errors (Lee & Dahinten, 2021). Analogously, increased nurses' psychological capital and managerial support will enhance their in-role safety performance perceptions (Brunetto, et al., 2016).

The transactional leaders motivate and direct followers with rewards and punishment (Bass, 1985).The transformational leaders empower followers and respond to their needs (Burns,1978). Empowering nurses and supervisors could improve the overall patient safety culture (Amiri, et al., 2018). Nurse work environment is found to influence the association between safety climate perception and patient mortality (Olds, et al., 2017).Nurses who perceive decision authority and positive safety climate are less likely to miss nursing care (Labrague, 2021).

Combined with other leadership styles, TSL style has been confirmed to be useful to meet short-term goals, complete tasks, and maximise its effectiveness in healthcare settings (Richards, 2020). Through goal-setting, feedback, and reinforcement strategies, TSL style help team members maintain effective programs (Corrigan and Garman, 1999). For a structured 10-week exercise program, TSL style is able to explain unique variation in scheduling self-efficacy and barrier self-efficacy (Beauchamp, et al., 2007). The impact of TSL style on organizational-citizenship behavior between head nurse and staff nurses has been confirmed (Wang and Li, 2008), which varies across employee cultural-based individual differences (Nahum-Shani and Somech, 2011). Empirical studies in clinical practice indicate TSL style has positive relationship with residents' performance outcomes (Deng, et al., 2019) and moderates the relationship between employee-orientation culture and leader-member exchange (Deng, et al., 2020). TSL style exhibits supervisory coaching behavior and in turn mediates their relationships with job performance (Lee and Ding, 2020).

TFL style proves to be an effective way to engage and empower nurses and other members of the chronic pain team to enable them to achieve the project aims (Gousy and Green, 2015). The TFL style of First-line nurse managers has the strong direct effects on nurses' job satisfaction (Jankelová and Joniaková, 2021). Studies show TFL style is demonstrated as a positive contributor to safety climate (Merrill, 2015), promote medication safety in units (Lappalainen, et al., 2020), correlates with low levels of incivility (Kaiser, 2017), and leading to increased perceptions of organizational support (Spence Laschinger, et al., 2012). Staff nurses who perceives their nurse managers as demonstrating TFL style experience higher structural empowerment (Khan, et al., 2018). TFL leadership can improve patient safety outcomes (Labrague and Obeidat, 2021).

The aim of this study is to investigate whether there are effects of TSL on safety climate among nurses in COVID-19 pandemic. The safety climate of the health organization has a significant positive impact on the transactional and interpersonal psychological capital of nursing staff in the aged care industry at the outbreak of COVID-19 in China (Wang, et al., 2021). TFL style often is implemented with TSL style in mental health service organizations (Aarons, 2006), applied

psychology (Judge and Piccolo, 2004), and safety practices (Shi, 2021). Thinking about TFL style is a driver of safety climate, we guess TSL style also lead to safety behavior. As a result, we also predict that nurse leaders can improve safety climate through employee well-being. More specifically, we guess that TSL style, TFL style, employee well-being and safety climate have various dimensions after factor analyses. Simultaneously, TFL style can moderate the relationship between TSL style and employee well-being and the relationship between employee well-being and safety climate. Hypothetical diagram can be seen in Fig. 1. Thus, we have the following hypotheses:

Hypothesis 1

There is a significant relationship between transactional leadership style and employee well-being.

Hypothesis 2

Transformational leadership style moderates the relationship between transactional leadership style and employee well-being.

Hypothesis 3

There is a significant relationship between employee well-being and safety climate.

Hypothesis 4

Transformational leadership style moderates the relationship between employee well-being and safety climate.

Hypothesis 5

Transactional leadership style is related to safety climate through employee well-being.

Hypothesis 6

There is a significant relationship between transactional leadership style and safety climate.

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insert Fig. 1 about here

Methods

Data source

This study employs a publicly available cross-sectional survey data (Awais-E-Yazdan, et al., 2022). With convenience sampling, data is collected with the help of self-administered questionnaire from Services Hospital Lahore, Sir Ganga Ram Hospital Lahore, Government General Hospital Faisalabad, DHQ Hospital Chiniot, Municipal General Hospital Sargodha, DHQ Hospital Jhang, and DHQ Hospital Multan and Sulehri Children & General Hospital Sialkot in Punjab, Pakistan. The dataset includes the particulars of 314 nurse on safety climate during the COVID-19 pandemic. The dataset is collected specifically for industry purposes that organizations should implement workplace policies and procedures that influence safety behavior. The dataset is helpful to predict the attitude and behavior of employees at early stage of employment, focus on the hurdles which slow down the leadership practices and damage a safe work environment, and compare with other data in different geographic regions.

During the COVID-19 pandemic, it is reported that there is high prevalence of burnout, severe emotional exhaustion, severe depersonalization, and low personal accomplishment in Pakistani nurses (Andlib, et al., 2022). Empirically, abusive supervision may lead to subordinates' emotional exhaustion and job neglect among Pakistani Nurses (Malik, et al., 2022). Inadequate

knowledge of medication (Salman, et al., 2020) and acute kidney injury (Salman, et al., 2021) among Pakistani Nurses is reported. Still, there existed the prevalence of ethical violations in Pakistani nurses due to the absence of education curricula and clinical monitoring(Jafree, et al., 2015).

Transparency and Openness

The data adopted is from a publicly available cross-sectional survey dataset whose sampling plan, all manipulations, and all measures in the study adhered to the Journal of Applied Psychology methodological checklist. Analysis code and research materials are available if request. Data are not available due to their proprietary nature. Data were analyzed using SPSS version 25.0 and STATA version 17.0. The study design was not preregistered because the data were collected for an applied selection project.

Ethics Statement

The data adopted is from a publicly available cross-sectional survey dataset whose ethical approval is obtained from the institutional review board at Universiti Utara Malaysia. All methods are carried out in accordance with relevant guidelines and regulations. Written informed consent is obtained from all participants before they agreed to participate in the study. Participants are informed that they could leave the study at any time without penalty, and all personal information is kept confidential. Thus, it is not necessary to obtain ethical approval from the institutional review board at the author's institution.

Main variables

Control variables

The socioeconomic variables included in dataset are age, gender, and marital status. Marital status is comprised of unmarried (single, divorced, and widowed) and married status. Originally, age categories are under 25 years, 25 to 35 years, 36 to 45 years, 46 to 55 years, and above 56 years. Due to uneven distribution, the age group is recoded by three groups: under 25 years, 25 to 35 years, and above 36 years. Several studies indicate demographic factors including age (Herman, et al., 2017), gender (Apore and Asamoah, 2019), and marital status (Theucksuban, et al., 2022) may influence nursing leadership styles.

Main measures

Factors, items, and descriptions of the main scales can be seen in Table 1. Each scale's items are rated on a 5-point, Likert-type scale (1 = strongly disagree to 5 = strongly agree). Their Cronbach's alpha coefficients are .7830, .8507, .7632, and .7832, respectively. The values of average variance extracted (AVE) of transactional leadership, transformational leadership, employee well-being, and safety compliance are 0.552, 0.515, 0.655, and 0.514, respectively. Simultaneously, the values of composite reliability (CR) of transactional leadership, transformational leadership, employee well-being, and safety compliance are 0.860, 0.863, 0.850, and 0.863, respectively.

Table 1
Factors, items, and descriptions of the main scales.

Factors	Items	Descriptions
		Transactional leadership (TSL)
Active leadership	TSL1	Makes clear expectation
	TSL2	Will take action before problems are chronic
Contingent leadership	TSL3	Tells us standards to carry out work
	TSL4	Works out agreements with me
	TSL5	Monitors my performance and keeps track of mistake
		Transformational leadership (TFL)
Motivational leadership	TFL1	Listens to my concerns
	TFL2	Encourages me to perform
	TFL3	Increases my motivation
Inspirational leadership	TFL4	Encourages me to think more creatively
	TFL5	Sets challenging standards
	TFL6	Gets me to rethink never-questioned ideas
		Employee well-being (EWB)
Employee well-being	EWB1	How would you rate your quality of life?
	EWB2	How satisfied are you with yourself?
	EWB3	How satisfied are you with your capacity for work?
		Safety climate (SC)
Compliance with safety rules	SC1	I use all necessary safety equipments to do my job.
	SC2	I carry out my work in a safe manner.
	SC3	I follow correct safety rules and procedures while carrying out my job.
	SC4	I ensure the highest levels of safety when I carry out my job.
Occasional deviations	SC5	Occasionally due to Lack of Time, I deviate from correct and safe work procedure.
	SC6	Occasionally due to over familiarity with the job, I deviate from correct and safe work procedures.
	SC7	It is not always practical to follow all safety rules and procedures while doing.

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insert Table 1 about here

Statistical strategies

Common method variance

In this study, the variables were self-reported by the Pakistani nurses. To verify that the results are not influenced by common method variance (CMV), we follow the methods of Podsakoff, et al. (2003) and apply Harman's single-factor test. Principal component analysis is used to extract five principal component with eigenvalues larger than 1, of which the first component explained 35.632% of the variance of all items. Therefore, CMV is not severe in the measured items.

Instrumental variables regression

Single-equation instrumental-variables regression (Stata program: ivregress) has regressions for Models 1, 2, and 3 with estimations via two-stage least squares (2SLS).

The regressions for Model 1 have the following form:

$SC = \beta_0 + \beta_1 \times Age + \beta_2 \times Gender + \beta_3 \times Being\ married + \beta_4 \times TFLa + \beta_5 \times TFLb + u_1$

$EWB = \gamma_0 + \gamma_1 \times TSLa + \gamma_2 \times TSLb + u_2$

Here, SC is the dependent variable for the ith observation, EWB represents the endogenous regressor, age, gender, being married, TFLa, and TFLb represent the included exogenous regressors, and TSLa and TSLb represent the excluded exogenous regressors. u_1 and u_2 are zero-mean error terms, and the correlations between u_1 and the elements of u_2 are presumably nonzero.

The regressions for Model 2 have the following form:

$SC = \beta_0 + \beta_1 \times Age + \beta_2 \times Gender + \beta_3 \times Being\ married + \beta_5 \times TFLb + \beta_4 \times EWB + u_1$

$TFLa = \gamma_0 + \gamma_1 \times TSLa + \gamma_2 \times TSLb + u_2$

Here, SC is the dependent variable for the ith observation, TFLa represents the endogenous regressor, age, gender, being married, TFLb, and EWB represent the included exogenous regressors, and TSLa and TSLb represent the excluded exogenous regressors. u_1 and u_2 are zero-mean error terms, and the correlations between u_1 and the elements of u_2 are presumably nonzero.

The regressions for Model 3 have the following form:

$SC = \beta_0 + \beta_1 \times Age + \beta_2 \times Gender + \beta_3 \times Being\ married + \beta_4 \times TFLa + \beta_5 \times EWB + u_1$

$TFLb = \gamma_0 + \gamma_1 \times TSLa + \gamma_2 \times TSLb + u_2$

Here, SC is the dependent variable for the ith observation, TFLb represents the endogenous regressor, age, gender, being married, TFLa, and EWB represent the included exogenous regressors, and TSLa and TSLb represent the excluded exogenous regressors. u_1 and u_2 are zero-mean error terms, and the correlations between u_1 and the elements of u_2 are presumably nonzero.

The values of p (> 0.1) in the Durbin (score) chi-sq test and Wu-Hausman F test of endogeneity show that the hypothesis of exogenous regressor cannot be rejected. The values of p (< 0.05) in the Wald test indicates that the IV is not weak. The values of p (< 0.05) in the Sargan (score) chi2 tests and Basmann chi2 tests demonstrate that our models have no over-identifying restrictions. Consequently, the endogeneity issue is not serious in the hypothesized models.

Stepwise hierarchical regressions

Using stepwise hierarchical regressions was executed to determine the relative strength of the age, gender, marital status (in the first block), TSLa, TSLb, TFLa, TFLb (in the second block), TSLa×TFLa, TSLa×TFLb, TSLb×TFLa, TSLb×TFLb, and EWB (in the third block) on safety climate (SCa and SCb, respectively). Those predictor variables that are either not added to and/or not retained in the final model are excluded. The data are analyzed using SPSS 25.0. For the statistically significant interaction

effects with post-hoc tests, the two moderating lines are compared, which reflects the strength and direction of independent variables on dependant variables.

Moderated mediation analysis

Frazier et al. (2004) note that studying a moderator allows one to better understand the conditions in which a variable most strongly impacts an outcome variable. To verify the moderation and mediation effect, moderated mediation analysis was performed using SPSS Macro Process Model 58 (Hayes, 2017) as the most appropriate verification method for this study. With 5000 bootstrap samples, the 95% bias-corrected confidence interval in the bootstrapping method does not contain 0 which indicates the mediating effect is significant.

Results

Factor analyses

Regarding TSL style, PCA extracted 2 factors with an eigenvalue greater than one accounted for 74.167% of total variance. Each rotated factor is considered to be composed of subtests with loadings bigger than .50. KMO measure of sampling adequacy is .717, which indicates adequate sample size for the factor analysis. Bartlett's test of sphericity is significant (χ^2 = 491.506, df = 10, $p < .001$). Accordingly, factor 1 with 2 items (active leadership abbreviated by TSLa: TSL1, TSL2; Cronbach's alpha= .714; composite reliability=.885) and factor 2 with 3 items (contingent leadership abbreviated by TSLb: TSL3, TSL4, TSL5; Cronbach's alpha= .733; composite reliability=.871) are obtained in Table 2 (Left).

Table 2
Varimax rotated matrices from principal axis factor analyses of TSL, TFL, and SC.

TSL			**TFL**			**SC**		
	Factor			**Factor**			**Factor**	
Item	TSLa	TSLb	Item	TFLa	TFLb	Item	SCa	SCb
TSL1	.888		TFL1	.877		SC1	.775	
TSL2	.842		TFL2	.741		SC2	.791	
TSL3		.699	TFL3	.773		SC3	.672	
TSL4		.858	TFL4		.858	SC4	.719	
TSL5		.837	TFL5		.850	SC5		.627
			TFL6		.889	SC6		.796
						SC7		.791
TSL: transactional leadership.								
TFL:transformational leadership.								
SC: safety climate.								
TSLa: active leadership.								
TSLb: contingent leadership.								
TFLa: motivational leadership.								
TFLb: inspirational leadership.								
SCa: compliance with safety rules.								
SCb: occasional deviations.								

Regarding TFL style, PCA extracts 2 factors with an eigenvalue greater than one which accounts for 78.369% of total variance. Each rotated factor is considered to be composed of subtests with loadings bigger than .50. KMO measure of sampling adequacy is .809, which indicates adequate sample size for the factor analysis. Bartlett's test of sphericity is statistically significant (χ^2 = 1008.464, df = 15, p < .001). Factor loading after the rotation of each item is shown in Table 1 (Left). Accordingly, factor 1 with 3 items (motivational leadership abbreviated by TFLa: TFL1, TFL2, TFL3; Cronbach's alpha= .809; composite reliability=.887) and factor 2 with 3 items (inspirational leadership abbreviated by TFLb: TFL4, TFL5, TFL6; Cronbach's alpha= .871; composite reliability=.922) are obtained in Table 2 (Middle).

Regarding safety climate, PCA extracts 2 factors with an eigenvalue greater than one which accounts for 63.453% of total variance. Each rotated factor is considered to be composed of subtests with loadings bigger than .50. KMO measure of sampling adequacy is .805, which indicates adequate sample size for the factor analysis. Bartlett's test of sphericity is statistically significant (χ^2 = 645.405, df = 21, p < .001). Factor loading after the rotation of each item is shown in Table 1. Accordingly, factor 1 with 4 items (compliance with safety rules abbreviated by SCa: SC1, SC2, SC3, and SC4 ; Cronbach's alpha= .784; composite reliability=.860), factor 2 with 3 items (occasional deviations abbreviated by SCb: SC5, SC6, and SC7; Cronbach's alpha= .668; composite reliability=.818) are obtained. Varimax rotated items loadings for factor analyses of safety climate can be seen in Table 2 (Right).

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insert Table 2 about here

Regarding employee well-being, PCA extracted 1 factor with an eigenvalue greater than one which accounts for 66.141% of total variance. Each rotated factor is considered to be composed of subtests with loadings bigger than .50. KMO measure of sampling adequacy is .661, which indicates adequate sample size for the factor analysis. Bartlett's test of sphericity is statistically significant (χ^2 = 363.822, df = 3, p < .001; Cronbach's alpha=.763; composite reliability=.867).

Descriptive analyses

The sample is predominantly married status (89.17%) and males (84.39%). Most participants (70.38%) are within the age group 25–35 years. Table 3 shows that there are statistically significant correlations among all the variables. Among them, correlation coefficients between SCb and TSLa (.559***), SCb and TSLb (.545***), TSLb and TFLa (.757***), SCa and TFLb (.503***), TFLa and TFLb (.512***) are higher than .500. Thus, both independent variable and moderator are related to the leadership types. All AVE square root values are higher than the correlation coefficients, which indicates an acceptable level of discriminant validity.

Table 3
Means, standard deviations, and correlations (n = 314).

1.SCa	**Means**	**SD**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	3.502	**1.020**	**.608**						
2.SCb	3.406	1.058	.431***	**.601**					
3.EWB	3.291	1.127	.459***	.145**	**.686**				
4.TSLa	3.198	1.166	.317***	.559***	.206***	**.740**			
5.TSLb	2.952	1.135	.377***	.545***	.193***	.448***	**.692**		
6.TFLa	2.811	1.242	.491***	.395***	.370***	.381***	.757***	**.725**	
7.TFLb	3.043	1.221	.503***	.434***	.429***	.385***	.337***	.512***	**.797**
Note: *, **, *** denote significance at 10%, 5%, and 1% levels, respectively. SD=Standard deviations. Diagonal values indicates the square root of average variance extracted (AVE).									
SCa: compliance with safety rules.									
SCb: occasional deviations.									
EWB: employee well-being.									
TSLa: active leadership.									
TSLb: contingent leadership.									
TFLa: motivational leadership.									
TFLb: inspirational leadership.									

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insert Table 3 about here

Outcomes of endogeneity test

From the results from IV regressions, as shown in Table 4, the coefficients for the effect of gender and TFLb on SCa are positive and significant. With respect to SCa, EWB in model 1, TFLa in model 2, TFLb in model 3 pass the test of endogeneity and show significant test statistic from the overidentification tests. But, they fail in the regressions on SCa. The test results suggest that EWB in model 1, TFLa in model 2, TFLb in model 3 may not be considered as endogenous when estimating SCa. EWB in model 1, TFLa in model 2, TFLb in model 3 may be considered as endogenous when estimating SCb. Thus, SCb can be isolated out of the endogenous system.

Table 4
Results from IV regressions predicting safety climate (N = 314).

	SCa			SCb		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Age	-0.047	-0.056	-0.061	0.258	0.025	0.038
	(0.090)	(0.083)	(0.087)	(0.213)	(0.104)	(0.142)
Gender	0.422***	0.416***	0.507***	0.014	0.158	0.629***
	(0.137)	(0.126)	(0.144)	(0.323)	(0.157)	(0.235)
Marital status	0.300	0.281*	0.337**	0.905	-0.209	-0.012
	(0.276)	(0.147)	(0.161)	(0.652)	(0.184)	(0.263)
EWB	0.185	0.214***	0.149**	-1.738**	-0.142**	-0.365***
	(0.334)	(0.047)	(0.073)	(0.790)	(0.058)	(0.120)
TFLa	0.211***	0.235***	0.109	0.515***	0.547***	-0.207
	(0.077)	(0.060)	(0.087)	(0.181)	(0.075)	(0.142)
TFLb	0.254**	0.230***	0.482**	0.788***	0.150**	1.299***
	(0.106)	(0.048)	(0.191)	(0.250)	(0.061)	(0.312)
Constant	0.999**	0.949***	0.637*	3.935***	1.883***	0.638
	(0.478)	(0.279)	(0.383)	(1.129)	(0.349)	(0.626)
First-stage regression summary statistics						
R-squared	0.2730	0.6679	0.3824	0.2730	0.6679	0.3824
Adjusted R-squared	0.2564	0.6603	0.3683	0.2564	0.6603	0.3683
Partial R-squared	0.0188	0.5186	0.0604	0.0188	0.5186	0.0604
Prob > F	0.0550	0.0000	0.0001	0.0550	0.0000	0.0001
Minimum eigenvalue statistic	2.92717	164.808	9.83775	2.92717	164.808	9.83775
Summary statistics						
R-squared	0.4040	0.4042	0.3520	.	0.1359	.
Wald chi2(6)	190.64	206.46	175.64	30.25	133.01	51.15
Prob>chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Root MSE	.78629	.78616	.81988	1.8589	.98194	1.3411
Tests of endogeneity						
Durbin (score) chi2(1)	.011644	.543777	1.80425	18.9417	53.7417	23.455
p	0.9141	0.4609	0.1792	0.0000	0.0000	0.0000
Wu-Hausman F(1,306)	.011348	.530842	1.76844	19.6441	63.187	24.7027
p	0.9152	0.4668	0.1846	0.0000	0.0000	0.0000
Test of overidentifification						
Note: *, **, *** denote significance at 10%, 5%, and 1% levels, respectively.						

	SCa			SCb		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Sargan (score) chi2(1)	2.8475	2.31716	.973422	18.4147	35.9631	33.2901
p	0.0915	0.1280	0.3238	0.0000	0.0000	0.0000
Basmann chi2(1)	2.80034	2.27491	.951572	19.0635	39.5801	36.2893
p	0.0942	0.1315	0.3293	0.0000	0.0000	0.0000
Note: *, **, *** denote significance at 10%, 5%, and 1% levels, respectively.						

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insert Table 4 about here

Moderating analyses

Hypothesis 1

predicts there is a statistically significant relationship between TSL style and employee well-being. In Table 5, TSLa and TSLb do not significantly predict employee well-being. Thus, Hypothesis 1 is rejected. Hypothesis 2 predicted TFL style moderates the relationship between TSL style and employee well-being. Significant coefficients of TSLb×TFLa indicate that motivational leadership significantly moderate the relationship between contingent leadership and employee well-being (β = .153; *p*=.023). Thus, Hypothesis 2 is partially accepted. Hypothesis 3 predicts there is a statistically significant relationship between employee well-being and safety climate. The coefficient of employee well-being with SCa is statistically significant (β = .205, *p* < .001). Thus, Hypothesis 3 is partially accepted. Hypothesis 4 predicts TFL moderates the relationship between employee well-being and safety climate. A negative significant TFLb×EWB for SCa (β= − .303, *p* < .001) can be seen. Thus, Hypothesis 4 is partially accepted. Hypothesis 5 predicts TSL style is related to safety climate through employee well-being. The coefficients between TSLa and EWB, between TSLb and EWB, between EWB and SCa, between EWB and SCb are not zeros. Thus, Hypothesis 5 is completely accepted. Hypothesis 6 predicts there is a statistically significant relationship between TSL style and safety climate. Statistically significant relationships between TSLa and SCa (β = .080, *p* = .099), between TSLb and SCa (β = .147, *p* = .038), between TSLb and SCb (β = .325, *p* < .001), between TSLb and SCb (β = .414, *p* < .001) are found. Thus, Hypothesis 6 is completely accepted.

Table 5
Moderated hierarchical robust linear regression on safety climate.

	EWB			SCa			SCb		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Age	.114**	.063	.063	.067	− .025	.005	.104*	.034	.036
Gender	− .071	− .033	− .028	.123**	.148***	.138***	.088	.044	.051
Marital status	.183***	.200***	.197***	.116**	.088*	.107**	− .107*	− .073*	− .067
TSLa		.063	.057		.074	.080*		.330***	.325***
TSLb		− .191**	− .071		.028	.147**		.463***	.414***
TFLa		.342***	.322***		.209***	.115		− .219***	− .140*
TFLb		.287***	.228***		.273***	.213***		.277***	.204***
EWB					.244***	.205***		− .036	− .030
TFLb×EWB						− .303***			
TSLa×TFLb									− .193***
TSLb×TFLa			.153**						
R^2	.053	.273	.285	.030	.411	.487	.030	.481	.513
ΔR^2	.053	.220	.012	.030	.381	.077	.030	.451	.032
F	5.808***	23.133***	5.207**	3.150**	39.438***	45.364***	3.236**	52.951***	20.084***
Durbin-Watson	.726			1.259			1.311		

Note: *, **, *** denote significance at 10%, 5%, and 1% levels, respectively. TSLa: active leadership. TSLb: contingent leadership.TFLa: motivational leadership. TFLb: inspirational leadership. SCa: compliance with safety rules. SCb: occasional deviations. EWB: employee well-being. Regarding the regression on EWB, TSLa, TSLb,TFLa,TFLb, TSLa×TFLa, TSLa×TFLb, TSLb×TFLa, and TSLb×TFLb are excluded in the first model. TSLa×TFLa, TSLa×TFLb, TSLb×TFLa, and TSLb×TFLb are excluded in the second model. TSLa×TFLa, TSLa×TFLb,and TSLb×TFLb are excluded in the third model. Regarding the regression on SCa, TSLa, TSLb, TFLa, TFLb, EWB, TSLa×TFLa, TSLa×TFLb, TSLb×TFLa, TSLb×TFLb, TFLa×EWB, TFLb×EWB are excluded in the first model. TSLa×TFLa, TSLa×TFLb, TSLb×TFLa, TSLb×TFLb, TFLa×EWB, TFLb×EWB are excluded in the second model. TSLa×TFLa, TSLa×TFLb, TSLb×TFLa, TSLb×TFLb, and TFLa×EWB are excluded in the third model. Regarding the regression on SCb, TSLa, TSLb,TFLa,TFLb, EWB, TSLa×TFLa, TSLa×TFLb, TSLb×TFLa, TSLb×TFLb, TFLa×EWB, TFLb×EWB are excluded in the first model. TSLa×TFLa, TSLa×TFLb, TSLb×TFLa, TSLb×TFLb, TFLa×EWB, TFLb×EWB are excluded in the second model. TSLa×TFLa, TSLb×TFLa, TSLb×TFLb, TFLa×EWB, and TFLb×EWB are excluded in the third model.

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insert Table 5 about here

Regarding interaction effects with post-hoc tests, the significance of relationships TFLb×EWB on SCa can be plotted in Fig. 2. In this sense, TSLb, with high levels of TFLa, has a positive effect on EWB. The relationship between contingent leadership and employee well-being can be changed from negative direction to positive one by the increasing moderating effect of TFLa.

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insert Fig. 2 about here

Regarding interaction effects with post-hoc tests, the significance of relationships TFLb×EWB on SCa can be plotted in Fig. 3. Concerning high levels of TFLb, EWB has a minimizing effect on SCa. Here, the line labeled “Low TFLb” for the first interaction has a steeper gradient if contrasted with “High TFLb”, which indicates that when employee well-being is higher, the positive relationship between TFLb and EWB is weaker.

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insert Fig. 3 about here

Similarly, the significance of relationships TSLa×TFLb on SCb can be plotted in Fig. 4. In this sense, TSLa, with high levels of TFLb, has a positive effect on SCb. Here, the slope of the line labeled “High TFLb” is smaller than that with “Low TFLb”, which indicates that when compliance with safety rules is higher, the positive relationship between TSLa and TFLb is becoming weaker.

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insert Fig. 4 about here

Outcomes of moderated mediation analysis

The results of 5000 times of bootstrapping to verify the significance of the direct effect of TSL on SC at is the 95% confidence level is [.2720, .4657] shown in Table 6. Since the bootstrap confidence interval does contain “0”, the path (TSL→EWB→SC) is considered to have no statistically significant indirect effect. Thus, the mediating role of EWB is not established. Regarding the regression outcomes, TSL, TFL, and and TSL×TFL had no statistically significant relationships with EWB as the bootstrap confidence intervals at the 95% confidence level do include “0”. Simultaneously, TSL, EWB, TFL, and EWB×TFL had statistically significant relationships with SC as the bootstrap confidence intervals at the 95% confidence level do not include “0” .

Table 6
Total, direct, and indirect effects for the model (N = 314).

Model 1: Outcome variable=employee well-being				
	coeff	**se**	**LLCI**	**ULCI**
constant	2.5052	.5690	1.3856	3.6248
TSL	− .2752	.1862	− .6417	.0912
TFL	.3696	.2328	− .0885	.8276
TSL×TFL	.0566	.0660	− .0734	.1865
R^2	.2199			
ΔR^2: TSL×TFL	.0018			
Model 2: Outcome variable=safety climate				
	coeff	se	LLCI	ULCI
constant	.3985	.2924	− .1769	.9739
TSL	.3689	.0492	.2720	.4657
EWB	.4006	.0871	.2292	.5719
TFL	.5858	.1011	.3868	.7848
EWB×TFL	− .1076	.0300	− .1665	− .0487
R^2	.4969			
ΔR^2: EWB×TFL	.0210			
Conditional effects of the focal predictor at values of the moderator(s)				
TFL	Effect	se	LLCI	ULCI
1.6667	.2212	.0463	.1302	.3123
3.0000	.0777	.0371	.0048	.1507
4.1667	− .0478	.0576	− .1612	.0656
Direct and indirect effects of transactional leadership on safety climate				
Direct effect of transactional leadership on safety climate				
	Effect	se	LLCI	ULCI
	.3689	.0492	.2720	.4657
Conditional indirect effects of transactional leadership on safety climate:				
Indirect effect: TSL→EWB→SC				
TFL	Effect	BootSE	BootLLCI	BootULCI
1.6667	− .0400	.0244	− .0839	.0142
3.0000	− .0082	.0085	− .0277	.0061
4.1667	.0019	.0085	− .0166	.0191

insert Table 6 about here

Discussions

There are statistically significant moderate correlations between occasional deviations and active leadership, between occasional deviations and contingent leadership, between contingent leadership and motivational leadership, between compliance with safety rules and inspirational leadership, between motivational leadership and inspirational leadership. Analysis of variance shows there are statistically significant interaction of socioeconomic factors with transactional leadership style, transformational leadership style, and safety climate. Analyses from hierarchical regression show active leadership and contingent leadership do not significantly predict employee well-being. Motivational leadership significantly moderate the relationship between contingent leadership and employee well-being. There is a statistically significant relationship between employee well-being and compliance with safety rules. Inspirational leadership moderates the relationship between employee well-being and safety climate. Transactional leadership style is related to safety climate through employee well-being. There is a statistically significant relationship between transactional leadership style and safety climate. Meanwhile, the mediating role of employee well-being between transactional leadership and safety climate is not established. The findings in this study can be used to compare with related studies in other geographic regions.

The findings of statistical outcomes do not support Hypothesis 1, which is against some prior results of social exchange theory. Social exchange theory is confirmed to be used to develop employee engagement (Saks and Rotman, 2006) which subsequently contributes to employee wellbeing (Hamilton Skurak, et al., 2021).

Congruent with other studies, sociodemographic factors have significant associations with subjective well-beings. For example, a study has identified socioeconomic differences in leadership styles among nurse managers in a regional Australian context (Moon, et al., 2019).

A two-factor structure of transactional leadership style, transformational leadership style, and safety climate are identified in this sample. The factors defined in this study are in line with the relevant studies. For example, nurses' occasional deviation from guidelines often causes medication-related errors (Karttunen, et al., 2020). With respect to inspirational leadership, emotional intelligence plays an important role in nurse manager transformational leadership effectiveness (Spano-Szekely, et al., 2016). But, the factorial structures are not consistent with the general knowledge. For instance, a meta-analysis indicates 3 dimensions (idealized influence-inspirational motivation/charisma, intellectual stimulation, and individualized consideration) of transformational leadership style and 3 dimensions (contingent reward, management by exception-active, and passive leadership) of transactional leadership style (Bono and Judge, 2004). This is because factor structures and dimensions originated from various scales and items.

Statistically significant correlations among factors of the main scales are in line with some prior studies. For example, an early study confirms the relationship of transformational leadership style → psychological empowerment → job satisfaction (Larrabee, et al., 2003). Another study demonstrates agreement on the frequency of transactional leadership behaviors between nurse managers and staff nurses (Kleinman, 2004). Transformational leadership and transactional leadership styles of nurse managers are positively related to staff nurse overall job satisfaction (Bormann and Abrahamson, 2014). Consequently, the empirical outcomes from Pakistani healthcare workers are similar to other countries.

There are several possible explanations for these moderator findings. First, motivational leadership may play a role in contingent leadership. Modifying head nurse messages is confirmed to improve safety climate in healthcare organizations (Zohar, et al., 2017).Research indicates that positive and relational leadership styles can improve nurses' job satisfaction, organizational commitment, and retention while concurrently reducing emotional exhaustion and burnout (Hall, et al., 2022).A systematic review shows nurse leaders' leadership styles affect nurses' work-related well-being which is mainly assessed in terms of burnout (Niinihuhta and Häggman-Laitila, 2022).

This study contributes to transformational leadership style theory by examining the moderating effect on relationship between employee well-being and safety climate in the nurse management. Theoretically, transformational leaders influence components of follower motivation through affective and cognitive processes (Ilies, et al., 2006). In practice, transformational leadership is considered to be best suited to the dynamic and changing health care system in Saudi Arabia nursing workforce (Al-Yami, et al., 2018). But, another study reports a different result. With respect to leadership styles and outcomes in nursing homes, a multicenter cross-sectional analysis indicates that passive-avoidant leadership styles are excessively present in contrast to transformational leadership styles in nursing homes (Poels, et al., 2020).

Moderating effect of motivational leadership can be explained by some statistical findings. For example, motivational leadership strategy is documented successfully applied to professional development (Woelfel, 2008). A review summarizes motivational leadership possibly matches the career success of contract workers (Jooste, et al., 2016). Comapred with extrinsic motivational factors, intrinsic motivational factors are more important to transform an organization (Rajiah and Bhargava, 2016). Accompamied by perceived environmental uncertainty and work discipline, a study describes the significant impact of moderated motivational leadership on employee performance(Machmud, 2020).

The role of inspirational leadership in this study can be explained by some empirical results. In truth, managerial effects of inspirational leadership depend on some specific conditions. Though amplifying effect of shared identity (Molenberghs, et al., 2017), inspirational leadership can generate enthusiasm and energy within the business and help the managers to get the best out of their teams (Dawson, 2005). With catalyst action of emotionally intelligent capabilities (Chopra and Kanji, 2010), inspirational leadership emerges as a significant predictor of organizational trust and commitment in highly dispersed contexts (Joshi, et al., 2009). Considering moderating effect of professional salience and mediating effect of follower positive mood, inspirational leadership styles may foster innovation in multidisciplinary healthcare teams (Mitchell and Boyle, 2019). Coupled with innovative communication, a leader’s inspirational behavior is confirmed to be a significant predictor of engagement and commitment in socially sustainable organizations (Toseef, et al., 2022). Thus, inspirational leadership is confirmed to be vital in entrepreneurial experience of angels (Murnieks, et al., 2016).

Some factors including proactive personality (Crant and Bateman, 2000) and leader resilience (Shelton, et al., 2022) are reported to influence leadership style in other studies but not in this study. A study with data from 389 frontline banking employees working in Italian and Spanish banks highlights the importance of follower characteristics in the effectiveness of inspirational leadership (Salas-Vallina, et al., 2020). A narrative review indicates leadership behaviors that best matches nursing home care depend on the specific context (Zonneveld, et al., 2021).

A cross-sectional correlational study in Iran concludes combination of transformational and transactional leadership can reduce nurse's job stress and intention to leave and improve job satisfaction and quality of nursing services (Pishgooie, et al., 2019). Change in nursing service is confirmed to depend on change in transformational and transactional leadership at all levels of the health organization (Dickson and Smith, 2013). A medium-sized hospital in Sweden exposed to a high degree of transactional and transformational leadership at the same time does not show a high degree of organizational effectiveness (Prenkert and Ehnfors, 1997). But, another study supports that transformational and transactional contingent reward leaderships associated with organizational culture are essential for maintaining organizational effectiveness within a nursing unit (Casida and Pinto-Zipp, 2008).Transactional and transformational factors can be assessed by The Multifactor Leadership Questionnaire in a sample of registered nurses working in acute care hospitals in Canada (Boamah and Tremblay, 2019).

The empirical outcomes of transactional style can be explained by some studies. The nurses under a transactional leadership style are confirmed to be more likely to select an nursing home administrator as a career path (Peerman, 2021). A systematic review indicates relational leadership styles can promote positive nursing workforce outcomes and related organizational outcomes (Cummings, et al., 2018). Neglecting job satisfaction, retention, work environment factors and individual productivity within healthcare settings, sole focus on task completion is insufficient to achieve optimum outcomes from the nursing workforce within healthcare settings. A case study indicates a transactional style that may cause nurses to leave the system, while transformational leadership has a positive affect on team building (Thyer, 2003). These findings highlight the

importance of transactional leadership in the relationship between employee well-being and safety behaviors among the nurses.

The role of contingent leadership in this study can be explained by some research results. Theoretically, there is the contingent relationship between leadership roles and the evolving organizational contexts (Egglestonl and Bhagat, 1993). A study indicates effective leadership behaviour is contingent on organizational activities, cultural context, the source of leader influence and the leader–follower relationship (Furu, 2012). Rather, the interaction effects between leadership styles and hierarchical levels are observed for perceived nursing unit effectiveness in some nursing departments (Stordeur, et al., 2000). Specifically, an investigation indicates relatively specific situational contingencies moderates the relationship between leadership and team effectiveness (Yun, et al., 2005).

Practical implications

In terms of practical implications, the results of this study suggest that transactional leadership instead of transformational leadership play a role in nursing management. Existing studies demonstrate that transformational leadership plays a more important role than transactional leadership in nursing management. The findings of this study indicates transactional leadership could be utilized to design employee well-being interventions addressing safety climate. An organizational study suggests that positive work engagement and work conditions contribute to enhanced safety climate and can reduce nurse injuries (Mark, et al., 2007). In addition, organizational design targeted at specific patient groups, like patients in the intensive care unit, would be useful during the COVID-19 pandemic. Hospitals must screen nurses frequently for the presence of significant unsafety climate and poor employee well-being and offer supportive leadership to preserve efficient medial management.

To increase staff nurses' safety climate, we suggest that contingent leadership styles and employee well-being could be improved among the nurse managers. The nurse managers should consider their leadership style from the point of view of employee well-being. Nurse managers must address contingent leadership that affect employee well-being because this has an impact on safety climate.

Limitations

There are some limitations to this study. First, a cross-sectional nature with a small sample size can not exhibit causal relationship between transactional leadership style and safety climate. Specially, findings from convenience sampling are of little use statistically to be generalized to the wider research population. Second, the findings in this study are possibly not worth being generalized because healthcare systems and their operations vary across countries. Especially, males dominate the sample. Third, without occupational variables like working years and hospital department, only three socioeconomic factors with categorical values are included in this study. Consequently, some comparative analyses can not be performed. Lastly, the starting and ending time of 3 months for data collection is not reported. Thus, health needs shock from the COVID-19 worldwide pandemic can not be considered in this study.

Further research is needed to find possible explanations for the association between nurse-patient interaction and occupational psychology in this field. To enhance the reliability of research results in future studies, it is suggested to adopt multiple sources of data, including multiple subjects, to reduce errors caused by a single source of data.

Conclusions

The results of this study suggest that inspirational leadership is one of important driving factors of safety climate among nurses during the COVID-19 pandemic. Motivational leadership moderates the relationships between contingent leadership and employee well-being and between compliance with safety rules and employee well-being. Employee well-being mediates the relationship between transactional leadership style and safety climate.

Abbreviations

TSL
transactional leadership
TFL
transformational leadership
SC
safety climate
EWB
employee well-being
TFLa
motivational leadership
TFLb
inspirational leadership
TSLa
active leadership
TSLb
contingent leadership
SCa
compliance with safety rules
SCb
occasional deviations

Declarations

Data Availability

Definitions of variables, coding schemes, data collection procedures, statistical scripts, code, and supporting documentation are described in the literature (Awais-E-Yazdan et al., 2022). The raw data and questionnaires are accessible via Mendeley Data (https://data.mendeley.com/datasets/wt2dbjcgc8/draft?a=703cfd69-8e84-47f1-884f-8df3e61a0774) or the Appendix. Supplementary materials are available at: https://www.sciencedirect.com/science/article/pii/S2352340922000439.The processed data are available for sharing and upload.

Ethical approval

The data utilized in this study were derived from a publicly available survey dataset. All procedures were conducted in accordance with relevant guidelines and regulations. Written informed consent was obtained from all participants prior to their involvement in the study. Participants were informed of their right to withdraw at any time without penalty, and all personal information was kept confidential. This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Xuchang University (No.2024001). Consequently, separate approval was not sought from other institutions, as data collection was centralized and had already been approved by the primary institution.

Author Contribution

MG designed the study, conceived the statistical analysis, and completed the original version. HYG searched literature, performed Tables and Figures, displayed the statistical outcomes, and participation in the discussion section under the tutorship of BXH. BXH redesigned, reorganized, rewritten, read, polished, revised, and approved the final manuscript. All authors read and approved the final manuscript.

Acknowledgement

The authors of this paper would like to acknowledge the very helpful comments of the reviewers on the original submission.

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Figures

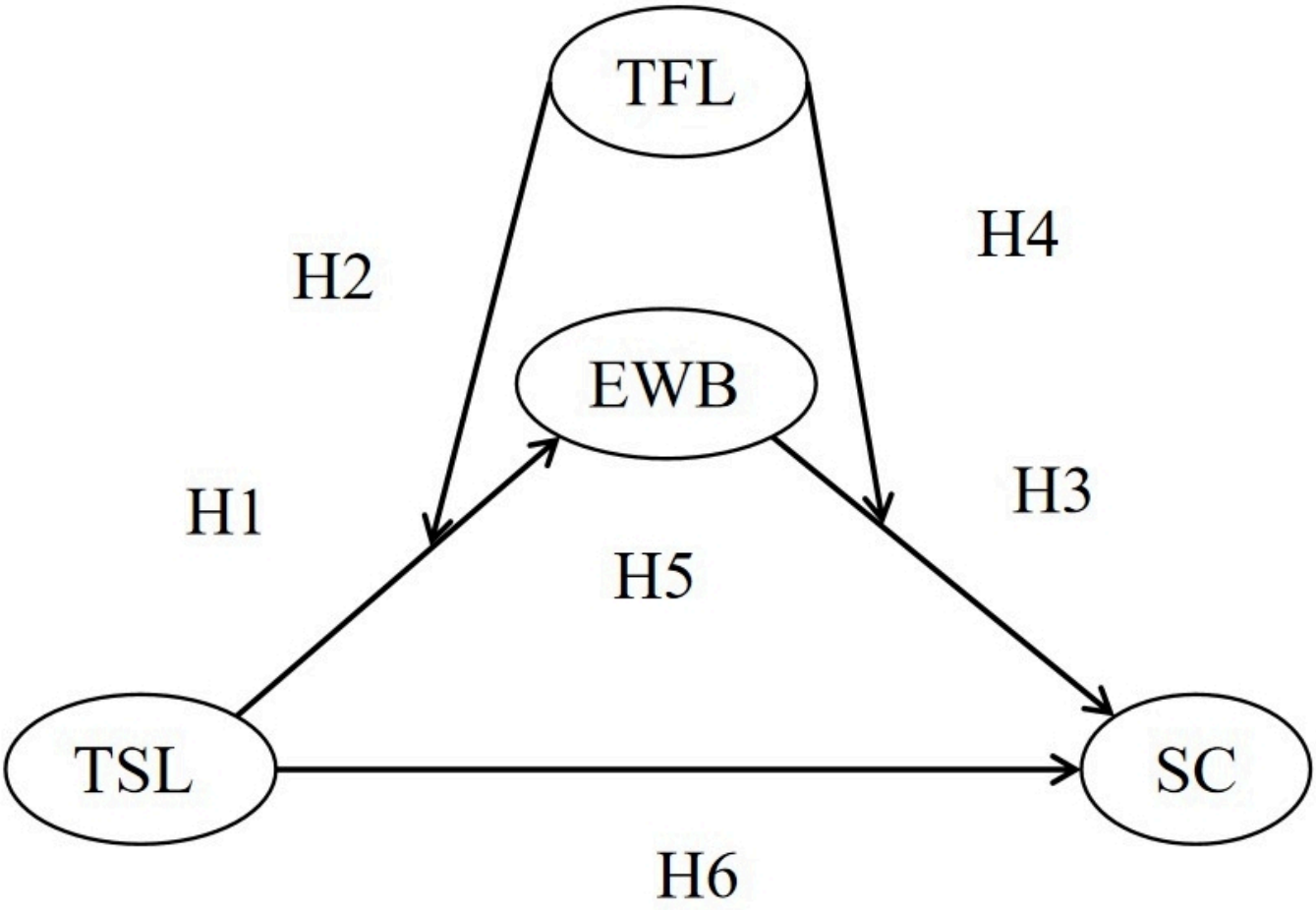


Figure 1

Hypothetical diagram.

TSL: transactional leadership.

EWB: employee well-being.

TFL: transformational leadership.

SC: safety climate.

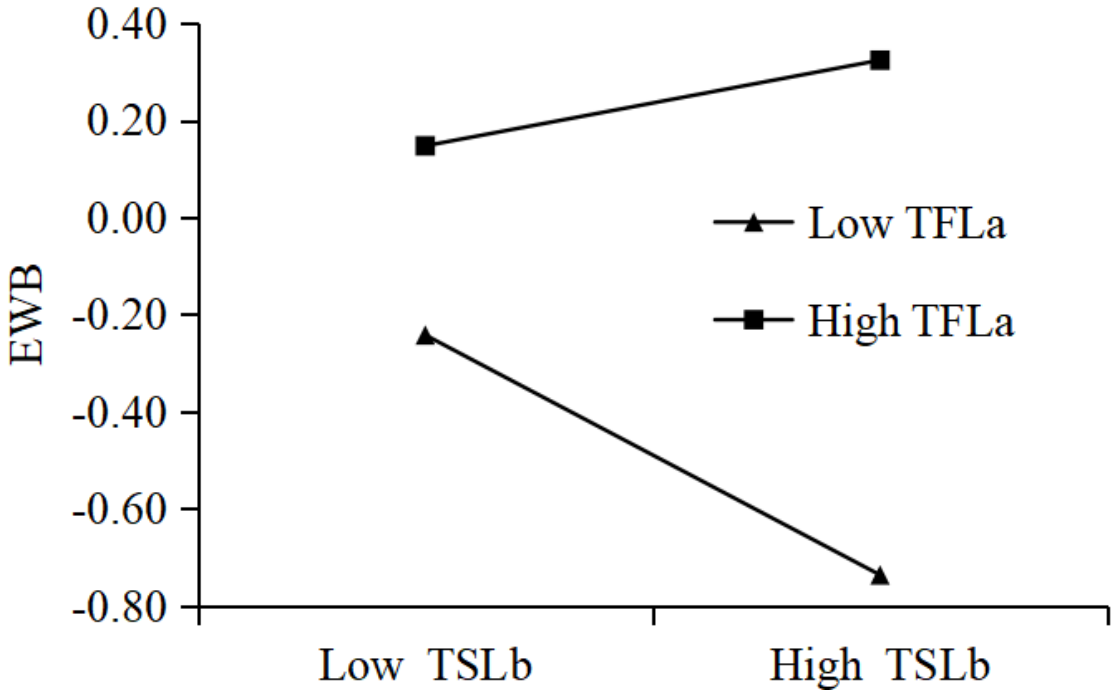


Figure 2

Moderating effects of TSLb on EWB through TFLa.

EWB: employee well-being.

TSLb: contingent leadership.

TFLa: motivational leadership.

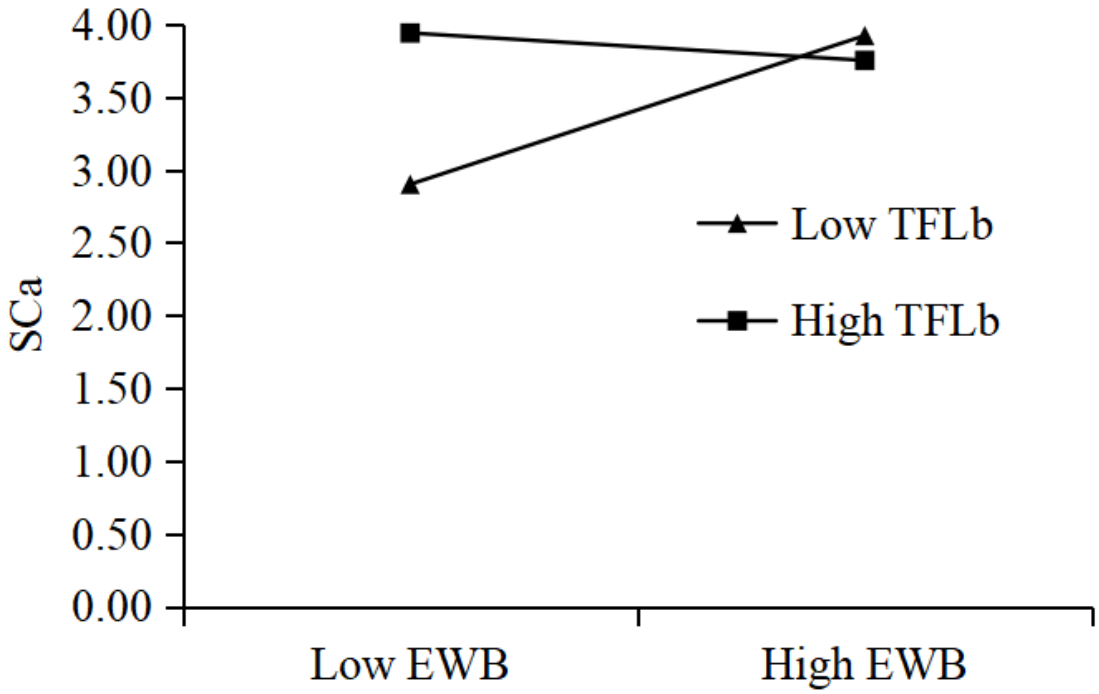


Figure 3

Moderating effects of EWB on SCa through TFLb.

EWB: employee well-being.

TFLb: motivational leadership.

SCa: compliance with safety rules.

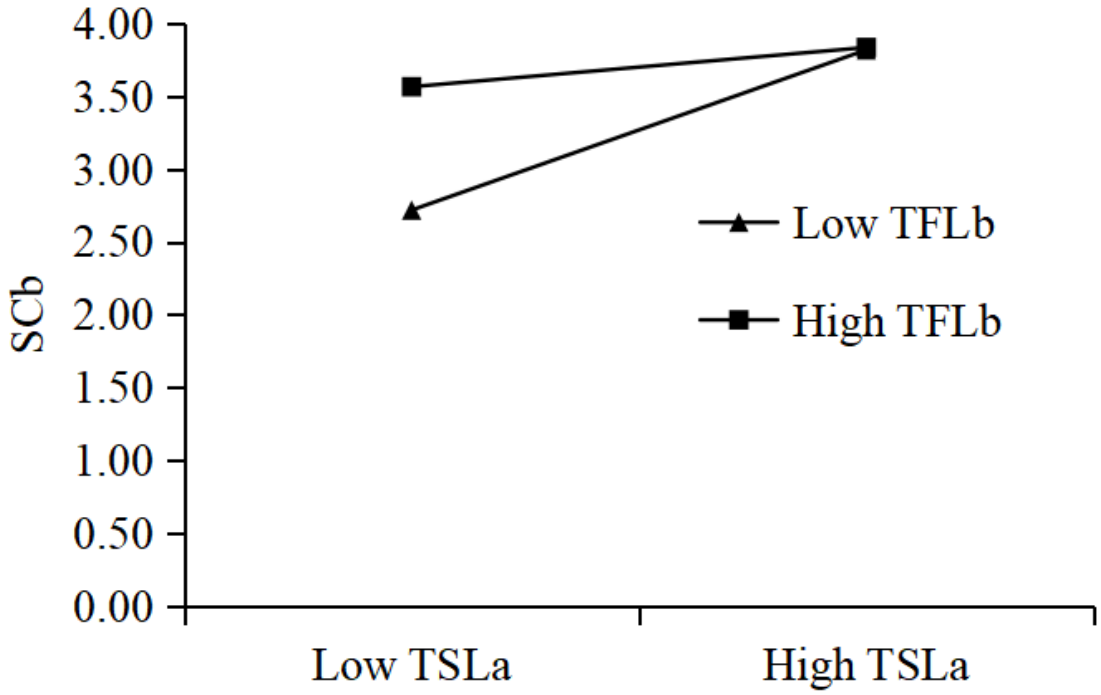


Figure 4

Moderating effects of TFLb on TSLa-SCb link.

TSLa: compliance with safety rules.

TFLb: inspirational leadership.

SCb: occasional deviations.

Supplementary Files

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- processeddata.zip