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Shared leadership for Total Worker Health in the construction industry

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Abstract

Objective: The purpose of this study is to investigate the organizational, supervisor, team, and individual factors associated with employee and leader perceptions of shared Total Worker Health (TWH) transformational leadership in teams.

Methods: We conducted a cross-sectional study with 14 teams across 3 construction companies.

Results: Shared TWH transformational leadership in teams was associated with employees and leaders' perceptions of support from co-workers. Other factors were also associated it, but it differed by position.

Conclusions: We found that leaders may be focused on the mechanics of sharing TWH transformational leadership responsibilities and workers may be more focused on their internal cognitive abilities and motivations. Our results suggest the potential ways of promoting shared TWH transformational leadership among construction teams.

Keywords

Safety leadership; health leadership; employee engagement; distributed leadership; occupational health and safety; co-worker support

INTRODUCTION

It is clear that formal leaders can have profound effects on safety and health outcomes including safety climate, safety behaviors, accidents, and injuries[1–3] as well as health outcomes such as stress,[4] depression,[5] sleep,[6] ischemic heart disease,[7] alcohol misuse,[8] and sickness absence.[9] Although effective leadership may be necessary to create an environment that supports safety and health, it is clearly not sufficient as accidents and poor health persists for some workers even amidst effective leadership. Rather than taking a top down

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approach and focusing on leader behavior, alone, empowering workers to take responsibility of their and their team's safety and health can have additional benefits.[10 11] We refer to the idea of empowerment and mutual accountability around health and safety as shared *Total Worker Health*® (TWH) transformational leadership. Thus far, researchers have not examined the factors that predict shared TWH transformational leadership. In this study, we seek to take an initial step in that direction by examining shared TWH transformational leadership in the context of construction workers.

Shared Leadership

In building our conception of shared TWH transformational leadership, we rely on the broader conception of shared leadership. In contrast to vertical or hierarchical leadership, shared leadership reflects the distribution of leadership influence across multiple people.[12] The individual actions of one leader is less important than the actions of multiple people.[13] It is described as the *process of leadership, not just the content (or style) of leadership*.[14] Shared leadership is defined as, "a dynamic, interactive influence process among individuals in groups for which the objective is to lead one another to the achievement of group or organizational goals or both. This influence process often involves peer, or lateral, influence and at other times involves upward or downward hierarchical influence."[11] It is a useful strategy under conditions where there are complex challenges to be solved by interdependent teams and when creative solutions are needed.[15] Indeed, the TWH approach emphasizes breaking down organizational silos and changing organizational practices, all of which require shared leadership. Research shows that shared leadership is associated with better organizational, team, and individual outcomes, such as team performance.[16] Avolio et al.[14] suggested that shared leadership could be qualified by a specific style of leadership, such as transformational leadership.

Transformational Leadership

Focusing on shared leadership in the context of the transformational leadership style makes sense for several reasons. First, transformational leadership is one of the most studied forms of leadership in the workplace. Leaders who exhibit transformational leadership are role models, they encourage employees to go above and beyond, they inspire employees to achieve workplace goals, and they demonstrate respect and personal concern for all employees.[17] Leaders who use this style of leadership are more effective and they influence organizational outcomes such as productivity and turnover.[14] Second, in the context of health at work, transformational leadership is consistently related to important safety and health outcomes.[18, 19] There is relatively little research on the impact of shared transformational leadership, but one recent study of shared transformational leadership in the shipping industry (general and not specific to health at work) found that it is significantly associated with better safety behaviors.[20] Mullen and Kelloway[21] note that general measures of transformational leadership are related to health outcomes, but health-specific measures of transformational leadership may be better predictors of workforce health outcomes. Thus, in the present study, we choose to focus specifically on shared transformational leadership specific to TWH.

Construction Context

We study shared TWH transformational leadership in the context of the construction industry where 20% of all U.S. work-related fatalities occur.[22] Foreman leadership clearly matters in ensuring safety as research shows that interventions to enhance safety leadership improves safety outcomes.[23, 24] But leadership may not be enough to ensure safety in the construction industry as accidents continue to impact workers. Consistent with evidence that interventions aimed at construction workers can also benefit safety outcomes, we believe a shared leadership approach will be more effective at supporting safety and health outcomes.[25] For example, one study showed that a participatory leadership approach used amongst Latino day laborers in construction demonstrated improvements in personal protective equipment use and protective safety behaviors.[26] However, researchers note that methods to develop teamwork for accident prevention are lacking.[27]

Hypotheses

Levels of Influence—In the broader organizational leadership literature, research suggests that leaders engage in leadership practices due to individual, relational, and organizational factors.[28] Research suggests that perceptions that they are leaders (i.e., leader identity)[29] and traits (e.g., empathy[30] and open to experience[31]) and interests they possess (e.g., learning goal orientation)[32] are associated with leadership emergence. At an organizational level, development opportunities within their organization are also related to leadership emergence.[32] One study evaluated the predictors of safety specific transformational leadership in construction using the job demands-resources model.[33] However, there is little research on the reasons why leaders engage in TWH-supportive leadership practices.

In the present study, we examine the organizational, supervisor, team, and individual factors that may be associated with perceptions of shared TWH transformational leadership in construction industry teams (see Figure 1). The goal of this study is to increase the understanding of the conditions under which shared TWH transformational leadership is most likely to arise which may lay the foundation for interventions or training to encourage shared TWH transformational leadership. We focus on factors that may be associated with shared TWH transformational leadership at multiple levels of an organization: organization, supervisor, team, and individual and explain why the measures we chose were selected as important theoretically derived factors that may be associated with shared TWH transformational leadership in teams.

At an organizational level, safety climate and health climate perceptions shape safe and healthy work behaviors as they reflect perceptions of whether adherence to safe and healthy policies and work practices are rewarded and supported at work.[34] These climates guide workplace health and safety behaviors. The breadth of safety and health training is also important to ensure workers have adequate knowledge of safe and healthy work practices.[35] We hypothesize that employees who perceive that their organization is committed to their health and safety and provide them the adequate skills to engage in jobsite safety practices will report better sharing of TWH transformational leadership responsibilities in their teams.

From the perspective of the supervisor, supervisory support as well as safety and health leadership practices can also support and empower team members to act to protect and promote health.[2] Indeed, supervisory safety leadership is related to better safety communication, safety climate, and injuries/accidents[36, 37] and health-focused supervisory leadership is related to mental health.[38] Thus, we hypothesize that employees who perceive that their supervisor is supportive of health and safety and empowers their team to engage in jobsite safety and health will report better sharing of TWH transformational leadership responsibilities in their teams.

At a team level, co-workers who support each other and have a shared purpose for health and safety at work may create a team environment that fosters sharing of responsibilities.[12] Furthermore, when there is team psychological safety the team may be more apt to learn and enhance their team's performance.[39] Therefore we focus on shared purpose for TWH, co-worker support, and team psychological safety and hypothesize that these team-level factors are associated with employee reports of better sharing of TWH transformational leadership responsibilities in their teams.

At the individual level, we examine team members' perceptions of their own role in worksite safety. Each employee must feel comfortable voicing their ideas and concerns[12] as well as identify as leaders.[40] When they do so, we hypothesize that employees will report better sharing of TWH transformational leadership responsibilities in their teams.

Formal vs. informal leadership—To date, much of the leadership literature and safety/health-specific leadership literature focuses on employees with designated leadership roles. However, in the context of shared leadership, focusing on the leadership of all, regardless of position, is important. Indeed, research suggest that informal leaders can be helpful under circumstances where formal leadership is lacking.[41] We hypothesize that the ratings of the factors described above will not necessarily be similar amongst leaders and workers. Indeed, prior research in the construction industry demonstrates differences in perceptions of construction site safety between employees and those in leadership roles.[42] Furthermore, the relationship between the factors and shared TWH transformational leadership will not be the same. It is part of leaders' job descriptions to manage and care for their team and thus the factors that drive their engagement in health and safety on the job may be different than employees who may not have a formal designated role for this. Thus, we investigate all hypothesized relationships stratified by position.

METHODS

Study design and population

We conducted a cross-sectional study of shared TWH transformational leadership in the construction industry. We recruited 14 teams from three Colorado specialty construction companies to participate. The specialties represented electrical trades, heavy civil, and a service company for the oil and gas industry. Each company was asked to define their teams. All companies (on their own) decided to group their workforce into teams that represented operational units, such as demolition, utility, and service. The average team size was 12 (range = 2 – 45) and the average number of employees per company was 151 (range = 16 –

350). Once a company agreed to participate, we worked to recruit employees from the teams for the survey via email or in-person presentations. All survey data were collected in May 2022. The average survey response rate by company was 61% (range = 30% - 81%) with the response rate inversely associated with the size of company. Employees were able to enter a gift card drawing as an incentive to participate in the study. The COMIRB IRB approved this project, and all employees gave consent to participate.

Measurement

All participants completed a survey either online or in-person, depending on company preference. The survey asked participants to first complete demographic questions (e.g., age and gender) followed by four sections regarding dimensions of health and safety in their workplace.

Organization.—The first section asked participants about their organization. Questions pertained to safety climate (6 items, $\alpha = 0.95$, e.g., "My organization reacts quickly to solve the problem when told about safety concerns"),[43] health climate (4 items, $\alpha = 0.93$, e.g., "My organization is committed to employee health and well-being"),[43] and safety and health training (1 item, "Employees receive comprehensive training in health and safety issues at work"). Safety climate and health climate items were taken from Schwatka et al., who developed their measures from based on Lee et al.'s[44] original safety climate measure. The safety and health training question was developed by the authors based on an item created by Brown et al.[45] All were rated on a 1–5 Likert scale from strongly disagree to strongly agree.

Team.—The second section asked about their team. Questions included shared purpose for TWH (2 items, $\alpha = 0.82$, e.g., "My team members and I have a mutual understanding of workplace health and safety goals"), which was created by the authors for this study based on previous measures of shared purpose at work.[12, 46, 47] We also measured co-worker support with the one-item measure evaluated in Fisher et al.[48] (1 item, "People I work with have taken a personal interest in me"). All were rated on a 1–5 Likert scale from strongly disagree to strongly agree. We also asked about team psychological safety using Edmonson's scale[39] (7 items, e.g., "Members of this team are able to bring up problems and tough issues"), which was rated on a 1–5 Likert scale of never to always. Three of the seven-team psychosocial safety items were worded negatively. We chose to create the team psychological safety scale using only the positively worded items as explained in the discussion.

Individual Employee Ratings of Supervisor.—The third section asked about support from their supervisor with the one-item measure evaluated in Fisher et al.[48] (1 item, "I can count on my supervisor/manager for support when I needed it")[48], TWH empowering leadership based on Hoch's measure of team empowering leaderhsip[49] (4 items, $\alpha = 0.76$, e.g., "My team leader urges me to assume workplace health and safety responsibilities on my own"), and TWH transformational leadership based on transformational leadership scales in Hoch[49] and Kelloway et al.[37] (8 items, $\alpha = 0.94$, e.g., "My team leader provides a clear vision for health and safety at work"). All were rated on a 1–5 Likert scale from strongly disagree to strongly agree.

Individual Employee Ratings of Self.—The final section included questions about the employee's role in workplace health and safety. Questions focused on voice around TWH issues based on Liang et al.'s measure of promotive and prohibitive voice[50] (6 items, α = 0.85, e.g., "I raise suggestions to improve workplace health and safety", 1–5 never to always), silence around TWH issues adapted from Detert et al.'s measure of silence at work[51] (5 items, α = 0.92, e.g., "I keep ideas for developing new workplace health and safety policies or programs to myself", 1–5 never to always), and TWH leadership identity based on Day et al.'s measure of leadership identity[40] (4 items, α = 0.91, e.g., "I am a workplace health and safety leader", 1–5 not at all descriptive to extremely descriptive). Silence around TWH issues was measured using negatively worded questions that were reverse coded before analysis and thus reflects non-silence around TWH issues.

Shared TWH Transformational leadership in Teams.—Shared TWH transformational leadership in teams (7 items, α = 0.92, e.g., "My team members behave in a way that displays a commitment to health and safety at work") is our focal dependent variable.[49, 52–55] Responses are given on a 1–5 Likert scale from strongly disagree to strongly agree. The scale was developed by the authors based on Kelloway et al.'s[54] measure of safety-specific transformational leadership as well as Pearce's[55] measure of shared transformational leadership. A confirmatory factor analysis of this measure indicated that the proposed one-factor construct fit the data well. Detail on a confirmatory factor analysis of this measure can be found in the supplementary material.

Analysis

First, we generated descriptive statistics of all demographic and study variables. We compared average scores on each of the variables by position (leader vs. employee) using a t-test. We ran a stratified linear regression analysis by position to evaluate the association between shared TWH transformational leadership (dependent variable) and all variables hypothesized to be associated with it (independent variables). Variables pertaining to supervisors were not included in the leader regression model. All models controlled for ethnicity (Hispanic vs. Non-Hispanic), prior leadership training experience, and tenure with current team. We included a random effect in all models to account for team membership. The significance level was evaluated at the 0.01, 0.05, and 0.10 levels. All analyses were completed in Stata Version 14.2.

Results

Participant characteristics by position are displayed in Table 1. Employees, on average, were younger than leaders ($t(129) = 2.63$, $p = 0.01$), had spent less time at their current company ($t(146) = 4.44$, $p < 0.001$), and fewer had prior leadership training experience (X^2 (2, N = 146) = 21.68, $p < 0.001$). Across both positions, most identified as white males and about one-quarter identified as Hispanic. On average, participants reported having worked with their current teams for two years.

The correlations between all study variables by position are displayed in tables 2 and 3. For workers, shared TWH transformational leadership in teams exhibited moderate to strong correlations with most hypothesized variables except for safety climate where it exhibited

a weak correlation ($r = 0.26$). For leaders, shared TWH transformational leadership in teams exhibited low to moderate correlations with most hypothesized variables except for voice around TWH issues ($r = 0.04$), non-silence around TWH issues ($r = 0.16$), and TWH leadership identity ($r = 0.01$) where there was not a significant correlation. It is notable that amongst both positions, safety climate and health climate were highly correlated (workers $r = 0.79$), leaders $r = 0.92$).

The average scores for all study variables by position are displayed in Table 4. Safety climate was rated more positively by both employees (M = 4.46, Standard Deviation (SD) = 0.80) and leaders (M = 4.24, SD = 1.04) as compared to the other variables. TWH leadership identity was rated the lowest for employees (M = 3.10, SD = 1.02) and second lowest for leaders (M = 3.66, SD = 0.85). Leaders reported more positive perceptions of team psychological safety ($t(145) = 1.73$, $p = 0.04$), voice for health and safety ($t(140) = 2.52$, $p = 0.01$), and TWH leadership identity ($t(140) = 3.50$, $p < 0.01$) than employees. However, employees reported significantly better perceptions of safety and health training ($t(144) = -2.50$, $p = 0.01$). Leaders and employees had similar perceptions about all other items of interest including shared TWH transformational leadership.

The results for the stratified regression analysis by position are displayed in Table 5. Shared TWH transformational leadership in teams was associated with co-worker support for both employees ($\beta = 0.15$, 95% Confidence Interval (CI) = 0.06, 0.24) and leaders ($\beta = 0.30$, 95% CI = 0.18, 0.42). However, for employees, perceptions of shared TWH transformational leadership in teams were also associated with health and safety training ($\beta = 0.16$, 95% CI = 0.02, 0.30) and TWH leadership identity ($\beta = 0.16$, 95% CI = 0.07, 0.25). On the other hand, for leaders, perceptions of shared TWH transformational leadership in teams were also associated with shared purpose for TWH and voice around TWH issues ($\beta = 0.39$, 95% CI = 0.24, 0.54). Leaders' perceptions of team psychological safety were also associated with shared TWH transformational leadership in teams albeit in opposite direction than hypothesized ($\beta = -0.27$, 95% CI = −0.44, −0.10).

Discussion

Our study provides insights into the factors that may lead to shared TWH transformational leadership in construction industry teams. Perceptions about whether co-workers took a personal interest in them emerged as a significant factor that was positively associated with both employee and leader sharing of TWH transformational leadership responsibilities. For employees, adequate safety and health training and employees reporting an identity as a TWH leader were also positively associated with sharing of TWH transformational leadership responsibilities. On the other hand, for leaders, a shared purpose for TWH amongst their teams and voice around TWH issues were positively associated with sharing of TWH transformational leadership responsibilities while team psychological safety was negatively associated with it. Future research on the topic should evaluate these findings amongst larger samples using multi-level methods, taking care to evaluate both the antecedents and consequences of shared TWH transformational leadership.

Relationship to supervisor leadership literature

Our findings are consistent with the supervisor safety and health-specific transformational leadership literature. The present study and many other studies demonstrate that employee perceptions of supervisory safety and health-specific transformational leadership is correlated with safety and health climates.[2] Other research also demonstrates its relationship to co-worker support and knowledge of safety and health.[3] Our study adds to this literature by demonstrating that it is also associated with team functioning factors, such as shared purpose for TWH, co-worker support, and team psychological safety. Furthermore, we also demonstrate that supervisor TWH empowering leadership is correlated with supervisor TWH transformational leadership, but not so perfectly that this style of leadership may be distinct enough to warrant future investigation. Relatedly, it is interesting to observe that the correlations for some of the variables are stronger for TWH transformational leadership than for TWH empowering leadership. Future research should investigate which style of leadership is more effective in promoting an environment where workforce health is valued.

Relationship to shared leadership literature

This study adds to the safety and health-specific leadership literature by demonstrating that co-worker support is associated with the *process* of leadership (i.e., shared TWH transformational leadership), regardless of formal leadership role. Similar to studies of construction leaders engagement in safety-specific transformational leadership,[33, 56] we found that leaders reported better sharing of TWH transformational leadership practices within their teams if they had better co-worker support. Co-worker support is also linked to informal leadership emergence as well.[28] Carson et al.[12] observed similar findings while studying non-specific shared leadership with consulting teams. Co-worker support is an important aspect of job site safe practices generally,[57] especially when job demands are high.[58] The importance of co-worker support for shared TWH transformational leadership may stem from the fact that it serves as a source of help and information that reduces role ambiguity, conflict, and overload – all of which may occur when attempts to share leadership responsibilities are made.[58]

However, our findings demonstrate there are some differences between leaders and workers in the factors associated with perceptions of shared TWH transformational leadership. Leaders were more likely to report sharing of TWH transformational leadership if their team had a shared understanding of team goals and objectives (i.e., purpose). Research suggests that purpose increases motivation and commitment.[16] Workers, on the other hand, reported more sharing of TWH transformational leadership responsibilities under conditions where they felt adequately trained in health and safety and had a TWH identity. Thus, we speculate that leaders may be focused on the mechanics of sharing TWH transformational leadership responsibilities and workers may be more focused on their internal cognitive abilities and motivations.

Despite evidence that organizational climates for workplace safety and health are important for worksite health and safety practices, we did not find that health climate was associated with perceptions of shared TWH transformational leadership for either employees or leaders surveyed. Relatedly, safety climate exhibited a weak correlation with shared TWH

transformational leadership as well. There may be a couple of reasons for this finding. First, our measures of health climate and safety climate reflected management commitment generally; however, our results might have been different had we focused on group-level health/safety climate as the focus of shared TWH transformational leadership was on the team. Second, given that the quality of safety and health leadership of formal leaders is often hypothesized to drive climate perceptions, we speculate that shared TWH transformational leadership contributes to health/safety climate rather than the opposite.

Relationship to leadership development literature

Like the broader organizational leadership literature, we demonstrate that leadership emerges due to multiple levels of influence. In our study, we find that team and individual factors are associated with both leader and worker reports of sharing TWH transformational leadership responsibilities. For workers, an organizational factor was associated with it as well. This suggests that team sharing of leadership responsibility for workforce health and safety is not due to one single factor, rather it is multifactorial. The implications for leadership development are that leaders not only need to be trained on how to change their personal practices, but the work environment also needs to be addressed. Indeed, calls have been made to consider the contextual and personal resources of leaders in efforts to enhance the practice of transformational leadership practices.[59]

Limitations & Future Research

This study has several limitations; however, it serves as an important starting point to the study of shared TWH transformational leadership. Our sample was limited to three construction companies and thus the findings may not be generalizable to the broader construction industry. Another limitation was our cross-sectional study design, which limits our ability to determine the causal nature of the findings. Finally, all data were self-reported and thus subject to bias. It is worth noting that the negative relationship we observed between team psychological safety and shared TWH transformational leadership amongst leaders may be due to poor measurement. First, the negatively worded items were not correlated with the positively worded items. Second, the reliability of the seven-item scale was poor ($\alpha = 0.45$). However, it should be noted that the limited scale representing just the four positively worded items was still questionable ($\alpha = 0.53$).

The findings of this study raise several questions for future research. In line with the present study, we believe that there are important factors that may drive sharing of leadership responsibilities and these factors may come from the organization, supervisor, team, and workers. There may also be factors that inhibit sharing of leadership responsibilities, such as abusive leadership. Additionally, we evaluated all the indicators in Figure 1 as antecedents of shared TWH transformational leadership. However, it is possible that some are consequences of it, such as health climate. To build the evidence for why shared TWH transformational leadership matters, we need to conduct predictive validation studies to demonstrate that it is associated with employee engagement in TWH strategies and health and safety outcomes. For example, research is needed to understand the value of a shared leadership approach vs. a supervisory leadership approach in creating healthy, safe, and productive jobsites. Researchers should focus on studying these relationships amongst

larger samples using multi-level, longitudinal methods. Finally, our study found that some indicators of shared TWH transformational leadership are important for both employees and leaders while others are not. Future research should continue to investigate the convergent and divergent indicators of whether employees and leaders share responsibility for TWH. This research can aid in the development of shared TWH leadership development interventions for employees, leaders, and teams.

Practical implications

These findings offer the construction industry insights into the factors that may contribute to a sharing of TWH transformational leadership responsibilities amongst teams. We speculate that, if we want employees to share responsibility and influence for TWH, we need focus on helping employees see themselves as TWH leaders not building the leadership skills of their supervisors. These findings do not imply that supervisor leadership practices are unimportant, rather we need more research on these relationships. Indeed, safety leadership training for those in a formal leadership role is recognized an important component of a construction company's health and safety strategy.[60, 61] Our findings suggest that employees who report sharing leadership responsibilities for TWH in their teams may be doing so for other reasons – namely because they have enough health and safety training, and co-worker support and they see themselves as TWH leaders. These findings suggest that ways to help crew members, not just foremen, identify and act as leaders. In doing so, employees who identify as TWH leaders may deliberately seek out opportunities to practice and serve as a leader and thereby share TWH transformational leadership responsibilities.[40] In the construction industry, research suggests that crew-shared leadership can lead to feelings of autonomy through increased knowledge sharing and ultimately lead to project success.[62] However, our finding that employee perceptions of their health and safety training are related to sharing of leadership responsibilities suggests that efforts to lead for TWH may need to be paired with an adequate level of subject matter expertise.

Conclusions

The TWH approach requires a coordinated effort to evaluate and address complex health and safety challenges. While leadership and employee engagement strategies have historically been promoted as mechanisms to ensure the TWH approach's effectiveness, neither account for the sharing of leadership responsibilities across multiple levels of an organization. This study provides an initial look into shared TWH transformational leadership in construction industry teams. By studying this from the perspective of both the employee and the leader, it offers the construction industry insights into how to align leadership development interventions for employees and leaders. As a first step, our results suggest the potential ways of promoting TWH leadership roles, training, and skills among construction employees, as well as formal leaders.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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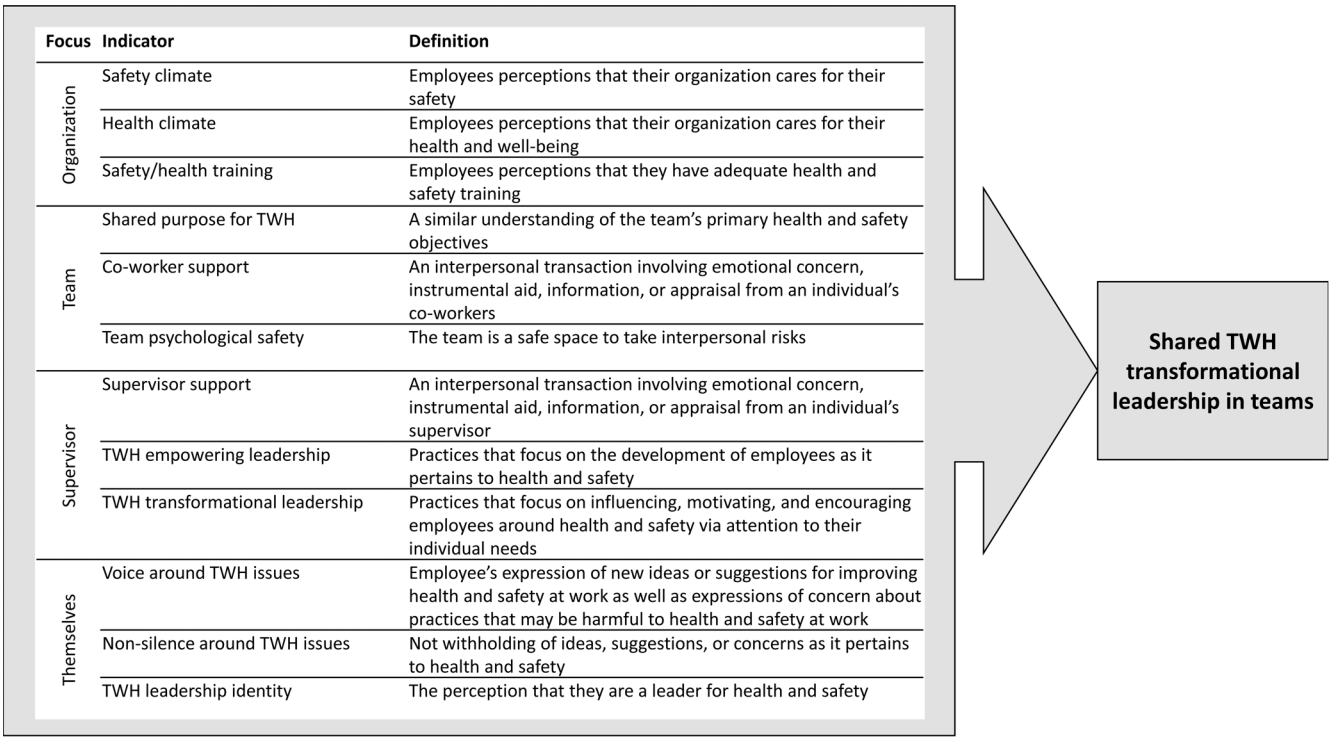
Learning outcomes:

1. Describe shared TWH transformational leadership.
2. Identify the factors that may contribute to a sharing of TWH transformational leadership responsibilities amongst teams.



Focus	Indicator	Definition
Organization	Safety climate	Employees perceptions that their organization cares for their safety
	Health climate	Employees perceptions that their organization cares for their health and well-being
	Safety/health training	Employees perceptions that they have adequate health and safety training
Team	Shared purpose for TWH	A similar understanding of the team's primary health and safety objectives
	Co-worker support	An interpersonal transaction involving emotional concern, instrumental aid, information, or appraisal from an individual's co-workers
	Team psychological safety	The team is a safe space to take interpersonal risks
Supervisor	Supervisor support	An interpersonal transaction involving emotional concern, instrumental aid, information, or appraisal from an individual's supervisor
	TWH empowering leadership	Practices that focus on the development of employees as it pertains to health and safety
	TWH transformational leadership	Practices that focus on influencing, motivating, and encouraging employees around health and safety via attention to their individual needs
Themselves	Voice around TWH issues	Employee's expression of new ideas or suggestions for improving health and safety at work as well as expressions of concern about practices that may be harmful to health and safety at work
	Non-silence around TWH issues	Not withholding of ideas, suggestions, or concerns as it pertains to health and safety
	TWH leadership identity	The perception that they are a leader for health and safety

Figure 1.
Hypothesized indicators that may be associated with shared TWH transformational leadership

Table 1.

Participant demographics by position

	Employee	**Leader**
	N (%) / M (SD)	**N (%) / M (SD)**
Age (mean) *	36 (12)	42 (12)
Gender		
Male	74 (82%)	54 (90%)
Female	15 (17%)	6 (10%)
Other	1 (1%)	0 (0%)
Race		
White	71 (85%)	50 (93%)
Black or African American	6 (7%)	0 (0%)
Asian	0 (0%)	1 (1%)
Multi-race	2 (3%)	3 (4%)
Other	3 (4%)	1 (2%)
Ethnicity		
Hispanic	18 (21%)	15 (26%)
Tenure, company (mean years) *	3 (4)	7 (7)
Tenure, team (mean years)	2 (3)	2 (3)
Leadership training experience *	31 (36%)	45 (75%)

* $p<0.001$

Table 2.

Correlations between all study variables – Employees only (n = 81)

		Organization			Supervisor			Team				Individual		
Level	**Variable**	**Safety climate**	**Health climate**	**Safety and health training**	**Supervisor support**	**TWH empowering leadership**	**TWH transformational leadership**	**Shared TWH leadership**	**Shared purpose for TWH**	**Co-worker support**	**Team psych safety**	**Voice around TWH issues**	**Non-silence around TWH issues**	**TWH leadership identity**
Organization	Safety climate	1												
	Health climate	0.79***	1											
	Safety and health training	0.32**	0.47***	1										
Supervisor	Supervisor support	0.09	0.24*	0.14	1									
	TWH empowering leadership	0.23*	0.35**	0.40***	0.60***	1								
	TWH transformational leadership	0.24*	0.41***	0.40***	0.78***	0.74***	1							
Team	Shared TWH leadership	0.26*	0.41***	0.54***	0.56***	0.62***	0.76***	1						
	Shared purpose for TWH	0.39***	0.53***	0.55***	0.36**	0.38***	0.59***	0.64***	1					
	Co-worker support	0.35**	0.26*	0.34**	0.36***	0.27*	0.40***	0.52***	0.32**	1				
	Team psych safety	0.27*	0.31**	0.30**	0.30**	0.33**	0.35**	0.39***	0.33**	0.37***	1			
Individual	Voice around TWH issues	0.12	0.30**	0.26*	0.53***	0.56***	0.65***	0.56***	0.37***	0.26*	0.23*	1		
	Non-silence around TWH issues	0.24*	0.34**	0.27*	0.33**	0.27*	0.43***	0.43***	0.50***	0.32**	0.18	0.28*	1	
	TWH leadership identity	−0.04	0.06	−0.01	0.27*	0.2	0.32**	0.30**	0.16	−0.04	0.11	0.42***	−0.05	1

*p<0.05,

**p<0.01,

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***p<0.001

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Table 3.

Correlations between all study variables – Leaders only (n = 54)

		Organization			Team				Individual		
Level	**Variable**	**Safety climate**	**Health climate**	**Safety and health training**	**Shared TWH leadership**	**Shared purpose for TWH**	**Co-worker support**	**Team psych safety**	**Voice around TWH issues**	**Non-silence around TWH issues**	**TWH leadership identity**
Organization	Safety climate										
	Health climate	0.92***	1								
	Safety and health training	0.48***	0.49***	1							
Team	Shared TWH leadership	0.31*	0.30*	0.2	1						
	Shared purpose for TWH	0.70***	0.69***	0.33*	0.62***	1					
	Co-worker support	0.19	0.30*	0.04	0.67***	0.46***	1				
	Team psych safety	0.39**	0.44***	0.11	0.37**	0.56***	0.49***	1			
Individual	Voice around TWH issues	−0.07	−0.04	−0.08	0.19	0.04	0.16	0.16	1		
	Non-silence around TWH issues	0.14	0.07	−0.04	0.21	0.16	0.11	0.09	0.18	1	
	TWH leadership identity	−0.11	−0.03	−0.03	0.21	0.01	0.15	0.02	0.53***	0.09	1

* p<0.05,

** p<0.01,

*** p<0.001

This variable was measured using negatively worded questions that were reverse coded before analysis.

Table 4.

Employee and Leader perceptions of the organization, supervisor, team and individual by position

		Employee (n = 81)		Leader (n = 54)	
Level	**Variable**	**Mean**	**SD**	**Mean**	**SD**
Organization	Safety climate	4.46	0.80	4.27	1.04
	Health climate	4.40	0.78	4.23	1.01
	Safety and health training ***	4.38	0.80	3.87	1.13
Supervisor	Supervisor support	4.43	0.74	n/a	n/a
	TWH empowering leadership	4.11	0.68	n/a	n/a
	TWH transformational leadership	4.32	0.64	n/a	n/a
Team	Shared TWH transformational leadership	4.26	0.64	4.12	0.67
	Shared purpose for TWH *	4.38	0.67	4.09	1.02
	Co-worker support	3.86	1.02	3.80	1.00
	Team psychological safety *	3.20	0.80	3.50	0.76
Individual	Voice around TWH issues ***	3.79	0.76	4.09	0.65
	Non-silence around TWH issues	4.05	0.98	4.26	0.82
	TWH leadership identity ***	3.10	1.02	3.66	0.85

*** $p<0.01$,

** $p<0.05$,

* $p<0.10$

Table 5.

Regression analysis for the association between shared TWH transformational leadership in teams (dependent variable) and organizational, supervisor (employee model only), team, and individual variables (independent variables) by position

		Employee (n = 68)					Leader (n = 45)				
Level	**Variable**	**Coef.**	**SE**	**95% CI**		**p-value**	**Coef.**	**SE**	**95% CI**		**p-value**
Organization	Health climate	−0.07	0.06	−0.18	0.04	0.22	−0.14	0.09	−0.31	0.04	0.13
	Safety and health training	0.16	0.07	0.02	0.30	0.02	0.06	0.07	−0.07	0.20	0.36
Supervisor	Supervisor support	0.07	0.12	−0.15	0.30	0.52	n/a				
	TWH empowering leadership	0.11	0.09	−0.06	0.28	0.20	n/a				
	TWH transformational leadership	0.23	0.16	−0.09	0.55	0.17	n/a				
Team	Shared purpose for TWH	0.13	0.10	−0.06	0.31	0.18	0.39	0.08	0.24	0.54	0.00
	Co-worker support	0.15	0.05	0.06	0.24	0.00	0.30	0.06	0.18	0.42	0.00
	Team psychological safety	−0.01	0.05	−0.11	0.09	0.82	−0.27	0.09	−0.44	−0.10	0.00
Individual	Voice around TWH issues	0.09	0.07	−0.04	0.22	0.16	0.20	0.09	0.03	0.37	0.02
	Non-silence around TWH issues	0.07	0.05	−0.01	0.17	0.09	−0.01	0.06	−0.12	0.11	0.91
	TWH leadership identity	0.16	0.44	0.07	0.25	0.00	−0.02	0.07	−0.16	0.13	0.83

Note. All models controlled for ethnicity, team tenure, and prior leadership training experience. Safety climate was removed from the final model due to high collinearity with health climate.