

The utility of a safety climate scale among workers with a work-related permanent impairment who have returned to work

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Abstract.

BACKGROUND: Safety climate (SC) is a robust leading indicator of occupational safety outcomes. There is, however, limited research on SC among workers who have returned to work with a work-related permanent impairment.

OBJECTIVE: This study examined three propositions: (1) a two-level model of SC (group-level and organization-level SC) will provide the best fit to the data; (2) antecedent factors such as safety training, job demands, supervisor support, coworker support, and decision latitude will predict SC; and (3) previously reported associations between SC and outcomes such as reinjury, work-family conflict, job performance, and job security will be observed.

METHOD: A representative cross-sectional survey gathered information about experiences during the first year of work reintegration. About one year after claim closure, 599 interviews with workers were conducted (53.8% response rate). Confirmatory factor analyses were conducted to test the factor structure of the SC construct. Further, researchers used correlation analyses to examine the criterion-related validity.

RESULTS: Consistent with general worker populations, our findings suggest the following: (1) the two-factor structure of SC outperformed the single-factor structure in our population of workers with a permanent impairment; (2) correlations demonstrate that workplace safety training, decision latitude, supervisor support, coworker support, and job demands could predict SC; and (3) SC may positively impact reinjury risk, work-family conflict, and may increase job performance and job security.

CONCLUSIONS: Our study validated a two-factor SC scale among workers with a history of disabling workplace injury or permanent impairment who have returned to work. Practical applications of this scale will equip organizations with the necessary data to improve working conditions for this population.

Keywords: Safety climate, injured workers with permanent impairment, return-to-work

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1. Introduction

In 2018 there were 2.8 million nonfatal and 5,250 fatal workplace injuries, and \$55.43 billion spent on disabling workplace injuries and illnesses in the United States (US) [1]. Disabling workplace injuries, those in which workers lost 5 or more days from work, cost the US over \$1 billion per week in direct losses alone [2].

State-based workers' compensation systems provide medical and indemnity (wage replacement) benefits for workers who receive medical treatment and/or are out of work for a defined period of time. The majority of injured workers (~75%) receive only medical benefits, and return to work relatively quickly [3]. Other injured workers have longer periods out of work and receive both medical and indemnity benefits. Roughly 10% of nonfatal workplace injuries and illnesses result in permanent impairment and a permanent partial disability award [3]. These workers may face functional and employment challenges akin to populations with non-work-related disabilities, such as finding sustainable employment, job insecurity, working with residual functional limitations and/or pain, and risk of further injury [4, 5]. It is evident that there is a great need to enhance workplace safety and increase injury prevention efforts. This would reduce the incidence of workplace injuries and related economic burden on employers, workers' compensation systems, workers, their families, and society overall. Senior managers in a company face a number of challenges in the safety area, for example, how much money should be invested in safety programs. In a study, Shirali and colleagues [6] found, through data envelopment analysis, that safety cost indicators would positively affect the performance of decision-making units.

The scientific literature and meta-analytic research suggest that one of the most robust leading indicators of occupational safety outcomes for occupational injuries and behavioral safety is safety climate (SC) [7–9]. SC is defined as workers' shared perceptions of organizational policies, procedures, and practices as they relate to the true or relative value and importance of safety within an organization [10]. The majority of research on SC has focused on shared perceptions of overall worker groups, such as all those employed in a firm or within an industry (e.g., the petrochemical industry: [11]). These groups can be presumed to include workers both with and without a history of workplace injury.

The aim of this study is to highlight the application of SC scales within the population of individuals who have returned to work with a permanent impairment. The implementation of SC evaluations among this population could shed light on safety issues, promote investment in preventative measures, and reduce workplace injuries and accidents to improve employee safety. To date, there is limited research on the SC perceptions of workers who have returned to work with a permanent impairment. In this study, we assess whether previously observed characteristics of SC scales were sustained among individuals that experienced a construct-focal, major life event resulting in a permanent impairment. In particular, we assess three propositions: (1) a two-level model of SC (group-level and organization-level SC) will provide the best fit to the data; (2) antecedent factors such as safety training, job demands, supervisor and coworker support, and decision latitude will predict SC; and (3) previously reported associations between SC and outcomes such as reinjury, work-family conflict, job performance, and job security will be observed.

Proposition 1 – a two-level model of SC (group-level and organization-level SC) will provide the best fit to the data. SC is measured through the implementation of reliable and validated scales and surveys which result in a numerical score that represents an organization's workforce-perceived level of safety at a point in time. There have been many validated SC scales in the literature, but perhaps the most widely used one is the generic 32-item SC scale developed by Zohar and Luria [12]. Following Zohar and Luria, SC has been developed as a multilevel construct with two managerial levels [12]: the employees' perceptions of their company's commitment and prioritization of safety in their (1) top management which is referred to as the "organization-level," and their (2) direct supervisors referred to as "group-level" [13]. The present study seeks to validate the efficacy of the two-factor organization-level and group-level SC model for populations with work-related permanent impairment.

Proposition 2 – antecedent factors of SC such as safety training, job demands, supervisor and coworker support, and decision latitude will predict SC. Training is a critical investment in an organization's human capital and helps companies maintain a competitive advantage [14]. Safety training has been demonstrated to reduce human error and, thus, save lives, as shown by the training developed for health

care workers and air traffic controllers, [15–18]. Research has shown that providing safety training can improve the level of SC [19].

Physical and psychological job demands, supervisor and coworker support, and decision latitude, or autonomy, greatly impact individual and workplace safety and health [20, 21]. Competing job demands, defined as the extent to which organizations value priorities of safety over other demands such as speed, schedules, and profitability, have been found to impact SC [22]. Pressure to meet productivity demands and timelines can result in violations of safety rules due to the pressure on employees to work quickly under time restrictions [23]. Supportive supervisors and coworkers are essential to maintaining a strong SC with leaders having a strong influence on employee safety; Yanar, Lay and Smith [24] found that a lack of supervisor support increased the likelihood of physical injuries. Further, support from management and supervisors can facilitate the transfer of trained knowledge and skills back to the job environment [25]. In addition, coworkers are resources for important safety information or rules and have positive influences on safety outcomes [e.g., 26] and risk-taking behaviors [27]. Decision latitude, also referred to as job autonomy, is linked with proactive work behaviors [28] and has been shown to help mediate the impact of job demands [29]. The present study seeks to confirm that the antecedent factors, or predictors, of SC examined in this study (i.e., safety training, job demands, supervisor and coworker support, and decision latitude) will predict SC among workers who have returned to work with a work-related permanent impairment.

Proposition 3 – previously reported associations between SC and outcomes such as reinjury, work-family conflict, job performance, and job security will be observed. SC has been widely demonstrated to have significant links to safety outcomes such as workplace accidents and injuries across various industries [e.g., 7–9]. While precise reinjury rates for populations with work-related permanent impairments are currently unknown, workers with disabilities are more than twice as likely to incur injuries in the workplace than workers without disabilities [30]. Further, for the first 12 to 18 months after the first injury, injured workers are at increased risk for secondary new injuries or exacerbation of their existing injury [31–34]. Strong SCs reduce the negative impact that job insecurity has on workplace accidents and injuries, safety knowledge, and safety

compliance [35]. The ability to leverage a strong SC to increase job security has implications for potentially lowering the reinjury risks that workers with work-related permanent impairment face.

Work-family conflict occurs when an individual's work requirements make it challenging to fully engage with their family, or when an individual's family requirements make it challenging to fully engage with their work [e.g., 36]. Prior studies have identified the link between SC and work-family conflict [e.g., 37]. Following the Conservation of Resources (COR) theory, Mansour and Tremblay [37] demonstrated psychosocial SC as a resource passageway to alleviate work-family conflict. SC can act as a passageway leading to more resources, which, according to the spiral of gains, leads to acquiring more resources such as supervisor's support leading to less work-family conflict. Greenhaus et al. [38] note that organizations which pay attention to workers' well-being and consider that safety and psychological health as objectives are as important as productivity, will lead managers and supervisors to care about employees' basic human needs, including balance between work and family.

Pennbrant and DÅderman [39] concluded, in their study of relationships between work factors and work-family conflict, that by promoting a positive working climate through listening to and providing nurses with opportunities to develop their skills, managers can gain a better understanding of nurses' resources, knowledge and work situations, thus strengthening nurses' confidence and ability to practice their profession. The present study seeks to confirm the associations between SC and outcomes such as reinjury, work-family conflict, job performance, and job security for workers who have returned to work with a work-related permanent impairment.

2. Methods

2.1. Participants and procedure

This study relied on data from a representative descriptive cross-sectional survey that was designed to gather information about experiences during the first year of work reintegration. The sample consisted of a retrospective cohort of Washington State workers with a work-related permanent impairment and associated permanent partial disability (PPD) award recorded by the Washington State Department

of Labor and Industries (L&I). Washington State defines impairment as permanent anatomic or functional abnormality or loss of function after maximum medical improvement has been achieved [40]. Workers may be rated with regard to degree of impairment for a PPD award if treatment has been completed and the worker is still able to work, but has suffered a permanent loss of function [40]. Approximately 70% of workers specified by Washington's Industrial Insurance Act [41] are covered by a single payer workers compensation (WC) system (the State Fund) in Washington State. The remaining 30% are covered by self-insured employers. L&I performs the functions of an insurer for State Fund claims and administers the state WC system for both the State Fund and self-insured employers.

Worker eligibility for this study was dependent upon meeting inclusion criteria by having (1) an accepted Washington State WC claim (either State Fund or self-insured) that (2) closed between January 1, 2018 and April 30, 2018 with (3) an associated PPD award. L&I staff applied six exclusion criteria prior to delivering contact information and administrative data for potentially eligible workers to the research team: (1) no valid phone number on record; (2) under age 18 when injured; (3) fatal or total permanent disability claims; (4) residence outside Washington State; (5) L&I employees and other confidentiality exclusions imposed by L&I and (6) deceased workers. The initial sample frame resulted in 2,541 potentially eligible workers who were identified by L&I staff during the specified time period after applying inclusion and exclusion criteria. Researchers attempted to interview all eligible workers in this sample, and no probability sampling was conducted. Two additional exclusion criteria could be determined only during eligibility screening by survey interviewers: (1) language or comprehension barrier; and (2) no return to work since the impairment, as determined by a worker's response to the question, "Have you returned to work since the injury that caused your impairment or disability, even if only very briefly?"

Trained interviewers conducted live telephone interviews using computer-assisted telephone interviewing technology (i.e., automated dialing, software-managed interview script, responses typed into the computer interface by interviewers). Interviews were conducted from February 6 through April 20, 2019, which was about a year (11–15 months) after claim closure (mean: 12.8 months). There were at least 4 to 8 call attempts per worker, which varied by day (weekday/weekend) and time of

day. Interviews averaged 39 minutes each. Advance recruitment letters offered mechanisms to opt-out or schedule an interview. The letter also described the 30 USD gift card offered for participation, which was sent by mail or email after the interview. Respondents contacted by phone were given the option to reschedule the interview at a convenient time. All survey participants gave informed consent. In total, 599 interviews were conducted (582 complete and 17 partial). The adjusted response rate was 53.8%.

After excluding workers found ineligible during screening, survey respondents ($N=599$) were compared to non-respondents ($N=1,573$) using administrative WC data. On average, respondents were about one year younger when surveyed (49.3 years old; $SD=11.6$) compared to non-respondents (50.7 years old; $SD=11.6$); there were no other notable differences. Further details regarding survey development, survey administration, exclusion criteria/counts, response rate calculation, and nonresponse bias assessment are available elsewhere [5]. Among the 599 survey participants, the 558 participants who answered the SC questions were used as the valid sample in this paper.

2.2. Measures

The survey was designed and developed collaboratively with Washington State Department of Labor and Industries experts and stakeholders and was informed by relevant extant research and grey literature. Questions were drawn from existing survey research [42–49] and previous research findings from surveys and qualitative research conducted with workers returning to work after vocational rehabilitation [31, 45, 49]. Expert consultation was provided by the Survey Research Division of the Social Development Research Group, an interdisciplinary research team based in the University of Washington School of Social Work. Survey questions were finalized after internal testing and timing by the Survey Research Division staff.

For SC, the present study utilized a shortened version of the Zohar and Luria [12] 32-item scale that was developed by Huang et al. [13] through Item Response Theory (IRT). The shortened generic scale consists of 4 items at the organization level, and 4 items at the group level; both 4-item scales have acceptable reliability (greater than or equal to 0.89) and high correlations (greater than or equal to 0.95) to the original scale developed by Zohar and Luria [12]. The utilization of a shorter SC scale allowed for

Table 1
Survey questions

Scale	Item	Anchors
<i>Antecedents of safety climate</i>		
1. Safety training	In your [current/most recent] job, did you receive adequate training to perform your job safely?	1 = Yes 0 = No
2. Decision latitude	On my job, I am given a lot of freedom to decide how I do my work.	1 = Strongly disagree; 4 = Strongly agree
3. Supervisor support	1) My supervisor is concerned about the welfare of those under him or her. 2) My supervisor pays attention to what I am saying. 3) My supervisor is successful in getting people to work together. 4) My supervisor is helpful in getting the job done.	1 = Strongly disagree; 4 = Strongly agree
4. Coworker support	1) People I work with are competent in doing their jobs. 2) People I work with take a personal interest in me. 3) People I work with are friendly. 4) People I work with are helpful in getting the job done.	1 = Strongly disagree; 4 = Strongly agree
5. Job demands	On a scale from 1 to 10, where 1 is completely unable and 10 is completely able, how able are you to handle the physical demands of your [current/most recent] job?	1 = Completely unable; 10 = Completely able
<i>Outcomes of safety climate</i>		
6. Reinjury	Have you had any work injuries at your [current/most recent] job that resulted in at least one missed day from work?	1 = Yes 0 = No
7. Work-family conflict	1) How often do the demands of your job interfere with your family life? 2) How often do the demands of your family interfere with your work on the job?	1 = Often; 4 = Never
8. Job performance	1) How would you rate your overall job performance? 2) How do you think your supervisor would rate your overall job performance? 3) How do you think your coworkers would rate your overall job performance?	1 = Very poor; 10 = Excellent
9. Job security	My job security is good.	1 = Strongly disagree; 4 = Strongly agree

the pairing of the scale with other measurements to reduce the overall implementation time and improve ease of data collection from participants. Table 1 provides information for additional questions included in the survey that were used to measure workplace safety training, decision latitude, job demands, supervisor support, coworker support, reinjury, job performance, work-family conflict, and job security.

2.3. Data analysis

Confirmatory factor analyses (CFA) were conducted to test the factor structure of the SC construct using maximum-likelihood estimation (MLM) with robust standard errors. Model fit was assessed with the χ^2 statistic, the comparative fit index (CFI), Tucker-Lewis index (TLI), the standardized root

mean square residual (SRMR), and the root mean square error of approximation (RMSEA). Based on recommendations by Hu and Bentler [50], the following cut-offs were used to indicate adequate model fit: CFI and TLI > 0.95 and SRMR and RMSEA < 0.10 [50, 51]. Further, correlation analyses were used to examine the criterion-related validity, i.e., to what extent SC associates with various antecedents (e.g., safety training, supervisor support) and outcomes (e.g., job performance, job security).

3. Results

Table 2 provides demographic information of the participants. The average age of the participants was

Table 2
Demographic variables

<i>Gender (n = 558)</i>	
Men	375 (67.20%)
Women	183 (32.80%)
<i>Educational level (n = 551)</i>	
Not HS graduate/no GED	21 (3.81%)
HS graduate/GED	134 (24.32%)
Some college	284 (51.54%)
College graduate	112 (20.33%)
<i>Race/ethnicity (n = 558)</i>	
White/Caucasian	448 (80.29%)
Black/African American	17 (3.05%)
Asian	15 (2.69%)
American Indian/Alaska Native	7 (1.25%)
Native Hawaiian/Pacific Islander	9 (1.61%)
Latino (any race)	29 (5.20%)
Multiple	20 (3.58%)
Missing/vague	13 (2.33%)

Note: HS = high school; GED = General Educational Development certification.

49.13 (SD = 11.57), ranging from 19 to 73 years old. The average number of years working in the same job was 9.30 years (SD = 10.48) with < 1 to 45.12 years of tenure.

3.1. One- vs. two-factor model

We compared two CFA models: a one-factor model, where all items loaded on one common latent factor – overall SC; and a two-factor model, in which we differentiated group- and organization-level SC scores. The results are presented in Tables 3 and 4. The results revealed that a two-factor model had the best fit with the observed data ($\chi^2(19) = 157.92, p < 0.001, RMSEA = 0.11, SRMR = 0.04, CFI = 0.97, TLI = 0.95$).

3.2. Antecedents of SC

Descriptive statistics and correlations among the SC antecedents and SC are presented in Table 5. The correlations for organization-level SC indicated that workplace safety training, decision latitude, supervisor support, and coworker support were posi-

Table 4
Factor loadings for the Two-factor model

	Item number	Factor loadings
Organization-level safety climate	Item 1	0.89
	Item 2	0.90
	Item 3	0.91
	Item 4	0.81
Group-level safety climate	Item 1	0.89
	Item 2	0.90
	Item 3	0.91
	Item 4	0.81

tively associated with organization-level SC ($r = 0.36, p < 0.05; r = 0.31, p < 0.05; r = 0.58, p < 0.05; r = 0.33, p < 0.05$, respectively). Job demands were negatively associated with organization-level SC ($r = -0.30, p < 0.05$). Regarding group-level SC, workplace safety training, decision latitude, supervisor support, and coworker support were positively associated with organization-level SC ($r = 0.27, p < 0.05; r = 0.29, p < 0.05; r = 0.70, p < 0.05; r = 0.32, p < 0.05$, respectively). Job demands were negatively associated with group-level SC ($r = -0.24, p < 0.05$).

3.3. Outcomes of SC

Descriptive statistics and correlations among the SC outcomes and SC are presented in Table 6. Organization-level SC correlations indicated that organization-level SC was negatively associated with reinjury and work-family conflict ($r = -0.16, p < 0.05; r = -0.28, p < 0.05$, respectively). Organization-level SC was positively associated with job performance and job security ($r = 0.17, p < 0.05; r = 0.32, p < 0.05$, respectively).

Group-level SC correlations indicated that group-level SC was negatively associated with reinjury and work-family conflict ($r = -0.11, p < 0.05; r = -0.25, p < 0.05$, respectively). Group-level SC was positively associated with job performance and job security ($r = 0.13, p < 0.05; r = 0.33, p < 0.05$, respectively).

Table 3
Fit statistics for confirmatory factor analysis

Model	X ²	Df	CFI	TLI	SRMR	RMSEA	RMSEA 90% CI
One-factor model	955.376	20	0.78	0.69	0.10	0.29	[0.28, 0.31]
Two-factor model	157.92	19	0.97	0.95	0.04	0.11	[0.10, 0.13]

Note: Df = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; CI = confidence interval.

Table 5
Correlations between safety climate (SC) and safety climate antecedents

	1.	2.	3.	4.	5.	6.	7.
1. Organization SC	0.93						
2. Group SC	0.69*	0.94					
3. Workplace safety training	0.36*	0.27*	–				
4. Decision latitude	0.31*	0.29*	0.13*	0.69			
5. Job demands	–0.30*	–0.24*	–0.16*	–0.09*	–		
6. Supervisor support	0.58*	0.70*	0.27*	0.38*	–0.28*	0.91	
7. Coworker support	0.33*	0.32*	0.22*	0.40*	–0.09*	0.44*	0.82

Note: Reliabilities (i.e., coefficient alphas) appear on the diagonal. * $p < 0.05$.

Table 6
Correlations between safety climate (SC) and safety climate outcomes

	1.	2.	3.	4.	5.	6.
1. Organization SC	0.93					
2. Group SC	0.69*	0.94				
3. Reinjury	–0.16*	–0.11*	–			
4. Job performance	0.17*	0.13*	–0.05	–		
5. Work-family conflict	–0.28*	–0.25*	0.04	–0.20*	0.59	
6. Job security	0.32*	0.33*	–0.06	0.23*	–0.33*	–

Note: Reliabilities (i.e., coefficient alphas) appear on the diagonal. * $p < 0.05$.

4. Discussion

This study is one of the first to investigate organizational SC scores among the specific population of workers with a work-related permanent impairment. This analysis validates the reliability of using SC to investigate and gather information about the perceptions of persons with a physical impairment resulting from a work-related injury who have returned to work.

Proposition 1 was supported and the two-factor structure of SC (i.e., group- and organization-level SC) outperformed the single-factor structure in our population of workers with permanent impairment who had returned to work. This is consistent with the findings of the literature for general worker populations [12]. The multilevel construct consisting of top management or “organization-level” and direct supervisors or “group-level” highlights the distinction of hierarchical levels of organizational leadership and how they interact with employees’ perceptions of their company’s commitment and prioritization of safety.

Correlations with SC antecedents were also consistent with the SC literature on general worker populations [e.g., 9] which supported proposition 2. In both organization-level SC and group-level SC, descriptive statistics among the SC antecedents and SC scores indicated that workplace safety training, decision latitude, supervisor support, and coworker support were positively associated with organization-

level SC; job demands were negatively associated with organization-level SC (see Table 5). Thus, workplace safety training, decision latitude, supervisor support, coworker support, and job demands could predict group- and organization-level SC among workers who have returned to work with a permanent impairment.

Similarly, the findings for SC outcomes were consistent with previous SC literature which supported proposition 3. This demonstrates that correlations between outcome factors of SC and SC scores are consistent and held among a population of workers who have returned to work with a permanent impairment. Both organization-level SC and group-level SC correlations were found to be negatively associated with reinjury and work-family conflict and positively associated with job performance and job security (see Table 6). Thus, group- and organization-level SC may positively impact reinjury risk, work-family conflict, and increase job performance and job security [e.g., 7, 8]. This empirical evidence supports the practice of utilizing SC scales in various populations, such as injured persons who have returned to work.

The SC score can serve as a reference for interpreting employees’ safety behaviors and the employees’ expected responses from supervisors and management. The true priority of safety compared to productivity is evident in leadership reactions to employee behaviors, and reinforced by social interactions over time [52]. An accumulation of research findings have suggested that management

commitment is the most important aspect and key requirement for improving workplace health and safety [52].

4.1. *Strengths and limitations*

A substantial number of injured workers return to the workplace with lingering or permanent disability [5]. We examined the performance of a validated SC scale among workers with a history of disabling workplace injury who have returned to work and examined the SC perceptions of injured workers with permanent impairment. The results demonstrate that the selected SC scale is psychometrically sound in the current context. Hence, this scale may be used in future research focusing on this special and vulnerable population of workers. Such research could, in turn, identify opportunities for better interventions to improve the SC for workers who have returned to work after a disabling workplace injury. Our inclusion of workers with any type and degree of permanent partial impairment enhances generalizability to a broad range of injuries and conditions, and indications of response bias were minimal.

Though representative, the survey was relatively small-scale and exploratory. It may have involved some recall bias due to the inclusion of retrospective questions. As a cross-sectional study, the temporal sequence of SC antecedents and outcomes could not be confirmed as observed in prior longitudinal SC studies. However, strong correlations between these factors and SC remained, suggesting that future research in this and similar populations will yield important insights on the role SC plays in the journey of workers who return to work with impairment.

Self-reported outcome measures were utilized in this study, rather than outcome measures originating from administrative sources such as workers' compensation data, human resources data, or the Bureau of Labor Statistics. In addition, the data used in the present study do not include company or organization SC scores or information. Future studies could extend these findings by linking SC scores to objective outcome measures and to specific employers.

5. Conclusions

The present study demonstrates the applicability of SC assessment in workers who returned to work after incurring a work-related permanent impairment. In this study, we extended validation of the short-

ened generic scale developed by Huang et al. [13] to this additional worker population and addressed several related research questions. First, confirmatory factor analysis results indicated that a two-factor model was the best fit. Second, antecedents or factors that historically have been found to predict SC in the general population, such as safety training, job demands, supervisor and coworker support, and decision latitude, were found to predict SC for this sample of workers with permanent impairment. Third, SC was found to predict hypothesized outcomes of SC, such as reinjury, work-family conflict, job performance, and job security. All three of the propositions were found to be supported and findings were consistent with the preceding SC literature of the general population. The application of this scale will equip organizations with the necessary data to support the occupational safety and health of workers with a physical disability resulting from work-related injury who have returned to work.

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Conflict of interest

None to report.

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