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Associations of Organizational Safety Practices and Culture With Physical Workload, Perceptions About Work, and Work-Related Injury and Symptoms Among Hospital Nurses

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OBJECTIVE: The study aim was to examine the relationships of organizational safety practices with nurses' perceptions about job and risk and experiences of work-related injury and symptoms.

BACKGROUND: Nursing professions report high rates of work-related injuries. Organizational safety practices have been linked to workers' safety outcomes and perceptions about work.

METHODS: This study analyzed data from a random sample of 280 California RNs in a cross-sectional statewide survey. Data were collected by both postal and online surveys.

RESULTS: Higher perceptions of organizational safety practices (safety climate, ergonomic practices, people-oriented culture) were significantly associated with lower physical workload, lower job strain, higher job satisfaction, lower risk perception, and lower work-related injury and symptom experiences. Ergonomic practices and people-oriented culture were associated with less intention of leaving job.

CONCLUSIONS: Organizational safety practices may play a pivotal role in improving positive perceptions about jobs, reducing injury risks, and promoting nurse retention.

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Nursing professions report high rates of work-related injuries and illnesses. Ergonomic risks from patient, equipment, and material handling are the leading occupational health risks that nurses encounter. In 2014, 11 360 RNs sustained work-related musculoskeletal disorders requiring days away from work (median, 9 days), and the incidence rate (55/10 000 full-time workers) was 1.6 times the rate of US workers combined.[1] In a 2011 American Nurses Association Survey, nurses reported musculoskeletal injury and job stress as top 2 health and safety concerns.[2] According to a 2014 California Board of Registered Nursing (BRN) Survey,[3] work-related injury or illness was the reason for leaving job in 8% of RNs who left jobs temporarily, and 18.2% reported job stress as the reason. To ensure safe work environments and to maintain a healthy nursing workforce, organizational policies and practices promoting workers' health and safety are crucial.

Research has shown that organizational safety practices are linked to reduced work-related injuries and increased safe work practices among workers in various industries.[4-11] Safety climate, reflecting organizational safety practices, culture, communication, and management commitment to worker safety,[12,13] has been identified as an important factor for safe work

practices.[7,9,10,14] Better safety climate was shown to be associated with lower work-related injuries or musculoskeletal symptoms among healthcare workers.[6,10,15] Studies have also reported that safety climate moderated the impact of work conditions on employees' safety behaviors[14] and back injuries.[6] In recent years, researchers have expanded their outcome interests in safety climate research. For example, Huang et al[16] explored impacts of safety climate among truck drivers and reported that their safety climate perceptions were linked to job satisfaction, work engagement, and employee turnover rates. Other studies have reported significant associations of safety climate with lower job demand and job strain.[17-19]

The purposes of this study were to describe perceptions about organizational safety practices and culture among California hospital nurses and examine the relationships of perceived organizational safety practices/culture with various outcomes including physical workload, perceptions about work and risk of injury, work-related injuries, and musculoskeletal symptoms.

Methods

Study Design and Sample
This study was a cross-sectional, statewide survey of California RNs using both postal and online surveys. We mailed survey packets to a random sample of 2000 RNs selected from the 2012 California BRN list. The study used a stratified random sampling method, dividing California into 9 regions[3] and selected samples in proportion to the size of the RN population in each region. A total of 526 nurses responded (response rate, 26.3%); 416 returned the paper survey (79.1%), 93 completed the online survey (17.7%), and 17 contacted the researcher about their ineligibility (3.2%) (eg, retirement). Among the respondents, 424 (80.6%) were currently working; of these, 284 (67.0%) were employed in hospital settings. Four respondents were excluded because their surveys were incomplete (<50%). A total of 280 hospital nurses constituted the final sample of this study.

Data Collection Procedure
The study was approved by the institutional review board at the University of California, San Francisco. The survey was conducted from January 2013 to July 2013. The survey packet containing the study invitation letter, the questionnaire, and a return envelope was mailed to all subjects. We also created an online survey using the Qualtrics program (Provo, Utah). The invitation letter provided information about the online response option and unique username and password. We sent survey reminders up to 4 times at 2-week intervals. The 3rd reminder included another copy of the questionnaire. We sent a thank you card to all respondents and a $50 gift certificate to 20 winners drawn randomly.

Study Variables and Measures
Demographic and Job Characteristics
Variables included age, gender, race/ethnicity, education, country of nursing education, job tenure in nursing, hospital setting (eg, urban), type of hospital, size of hospital (number of patient beds), job title, work status (eg, full time), work schedule, and patient handling duty (yes/no).

Organizational Safety Practices and Culture
Safety climate, ergonomic practices, and people-oriented culture were measured by a modified version of the Organizational Policies and Practices (OPP) questionnaire developed by Amick et al.[15,20,21] The 7-item safety climate scale measures workers' perceptions about the organization's overall safety practices and management commitment to safety. We used a modified 6-item ergonomic practices scale by Dennerlein et al[15] to measure the organization's activities to reduce biomechanical workload and ergonomic risks; the researchers added and modified items for use in patient care settings. We further modified 1 item on patient handling by adding the word "manual." The people-oriented culture scale (4 items) measures the organization's culture, relationship, and communications with employees. The OPP questionnaire uses a 5-point Likert scale (1, strongly disagree, to 5, strongly agree); an average score was computed for each scale. The construct validity, predictive validity, and test-retest reliability of the OPP scales have been demonstrated in the literature.[20,21]

Physical Workload
Physical workload was measured by the 19-item Physical Workload Index Questionnaire.[22,23] The questionnaire asked about the frequency of various body postures and lifting, pushing, pulling, and carrying of weights during work, using a 5-point scale (0, never, to 4, very often). An index was computed as a weighted summation of items following the developers' instruction.[22]

Perceptions About Work
Work perception variables included job demand, job control, job strain, job satisfaction, and intention to leave job measured by the Job Content Questionnaire,[24] a widely used and validated questionnaire. The job demand scale (5 items) measures psychological workload related to work speed, amount, intensity, and time. The job control scale (9 items) measures employees' control over job tasks, required skill types,

and decision making. Job strain was calculated as the ratio of job demand to job control. Job satisfaction was measured by 1 item with 4 response categories (1, not at all satisfied, to 4, very satisfied), and intention to leave job was measured by the question, "How likely is it that you will find a new job in the next year?", with 3 response categories (1, very likely, to 3, not at all likely).

Risk Perception of Injury, Work-related Injury, and Musculoskeletal Symptoms

Risk perception of injury was measured by the Risk Perception of Musculoskeletal Injury scale by Lee et al.[25] This study used 1 item of this scale, "How likely is it that you will experience a musculoskeletal injury within a year related to nursing work in general?" (1, extremely unlikely, to 6, extremely likely). The 3 other items addressed patient handling tasks, and not all participants performed these. Work-related injury was asked by the following: "In the past 12 months, have you had any injury or health problem at work?" Work-related musculoskeletal symptoms were assessed by 3 questions: "During the past 12 months, did you have pain, aching, stiffness, burning, numbness or tingling in the following area of your body (low back, neck, shoulders, and wrists/hands)?" "Do you think that this problem was caused by work?" "Do you think that this problem was made worse by working?" Symptoms caused or made worse by work were defined as work-related symptoms.

Data Analysis

Data analysis was performed using the SPSS 22.0 program (Chicago, Illinois). Study variables were summarized using descriptive statistics. χ^2 tests were used to compare proportions of categorical variables. Student's t tests or analysis of variance were used to compare means of continuous variables. In examining the associations with other variables, we dichotomized safety climate, ergonomic practices, and people-oriented culture at the median point (high vs low) because of their skewed distributions. We also dichotomized job satisfaction (very satisfied vs other), intention to leave job (very/somewhat likely vs not at all likely), and risk perception (moderately/extremely likely vs other), considering the data distributions. In multivariable analysis, we adjusted for a comprehensive set of demographic and job characteristic variables (gender, race/ethnicity, education, country of nursing education, job tenure, hospital setting, hospital type, hospital size, job title, work status, work schedule, and patient handling duty). Age was not included in the model because of its high correlation with job tenure ($r = 0.85$); given possible multicollinearity, we selected job tenure that had stronger

correlations with outcome variables. For continuous outcome variables (physical workload, job demand, job control, and job strain), multiple linear regressions were performed, and β coefficients and 95% confidence intervals (CIs) were obtained. For dichotomous outcome variables (job satisfaction, intention to leave job, risk perception, work-related injury, and work-related musculoskeletal symptoms), multiple logistic regressions were performed, and odds ratios and 95% CIs were obtained.

Results

Sample Characteristics

The study sample characteristics (N = 280) are presented in Table 1. The mean (SD) age of the sample was 45.9 (12.5) years, and the mean (SD) job tenure in nursing was 17.9 (13.0) years. The sample was predominantly female (87.8%), and 64.1% received bachelor or higher-level education. Most were non-Hispanic white (57.9%), and the sample included a relatively large proportion of Asian (25.0%) and foreign-educated (20.1%) nurses. Most participants were employed in urban areas (55.1%), teaching hospitals (51.2%), and small-/medium-sized hospitals with less than 400 beds (72.0%) and worked full time (73.2%) on day shifts (61.4%) as staff nurses (66.8%). Most nurses (82.9%) performed patient handling.

Perceptions About Organizational Safety Practices and Culture

Perceptions of safety climate, ergonomic practices, and people-oriented culture were compared by demographic and job characteristic variables (Table 1). For safety climate, significant differences were found by race/ethnicity, job tenure, hospital size, and patient handling duty. Perceived safety climate was highest among Asian nurses and lowest among Hispanic nurses ($P = .015$), higher among nurses in large hospitals (≥400 beds) than in small-/medium-sized hospitals ($P = .042$), and lower among nurses who performed patient handling tasks than their counterparts ($P = .047$). For ergonomic practices, differences by race/ethnicity were significant in the same pattern found for safety climate (highest in Asian and lowest in Hispanic, $P = .001$), and foreign-educated nurses reported significantly higher scores than US-educated nurses ($P = .039$). Nurses who performed patient handling reported significantly lower ergonomic practice scores than nurses who did not ($P = .001$). For people-oriented culture, nurses' perceptions were not significantly different by any demographic or job characteristics; however, marginally significant differences were observed for race/ethnicity ($P = .059$) and type of hospital ($P = .085$): teaching

Table 1. Study Sample Characteristics and Perceptions of Organizational Safety Practices and Culture (N = 280)

Variable	n (%)	Safety Climate Mean (SD)	P	People-Oriented Culture Mean (SD)	P	Ergonomic Practice Mean (SD)	P
Age, y			.091		.725		.415
<30	28 (10.1)	3.45 (0.83)		3.53 (0.74)		2.99 (0.95)	
30-39	74 (26.7)	3.46 (0.86)		3.31 (0.93)		3.05 (0.98)	
40-49	50 (18.1)	3.46 (0.96)		3.39 (1.03)		3.05 (1.04)	
50-59	83 (30.0)	3.75 (0.92)		3.50 (0.80)		3.22 (1.07)	
≥60	42 (15.2)	3.78 (0.89)		3.43 (0.91)		3.36 (0.94)	
Gender			.466		.462		.429
Female	245 (87.8)	3.61 (0.88)		3.44 (0.90)		3.12 (1.01)	
Male	34 (12.2)	3.50 (0.94)		3.32 (0.96)		3.27 (1.01)	
Race/ethnicity			.015		.059		.001
White, non-Hispanic	162 (57.9)	3.52 (0.84)		3.39 (0.90)		3.01 (1.00)	
Asian	70 (25.0)	3.85 (0.90)		3.59 (0.93)		3.58 (0.90)	
Hispanic	22 (7.9)	3.26 (0.93)		3.02 (0.96)		2.96 (0.98)	
Other	26 (9.3)	3.69 (0.98)		3.57 (0.80)		3.14 (1.13)	
Highest education			.149		.257		.079
Diploma or associate	99 (35.9)	3.72 (0.81)		3.51 (0.95)		3.27 (0.99)	
Bachelor	134 (48.6)	3.49 (0.96)		3.34 (0.91)		3.00 (1.06)	
Master or doctoral	43 (15.6)	3.64 (0.84)		3.54 (0.83)		3.29 (0.87)	
Country of nursing education			.069		.390		.039
United States	223 (79.9)	3.55 (0.88)		3.40 (0.90)		3.08 (1.01)	
Foreign	56 (20.1)	3.79 (0.91)		3.52 (0.93)		3.40 (0.97)	
Job tenure in nursing, y			.084		.167		.369
≤5	57 (20.6)	3.60 (0.88)		3.61 (0.86)		3.14 (1.04)	
6-15	81 (29.2)	3.40 (0.92)		3.23 (0.96)		2.99 (1.02)	
16-25	41 (14.8)	3.55 (0.86)		3.50 (0.85)		3.17 (0.97)	
26-35	67 (24.2)	3.70 (0.88)		3.39 (0.92)		3.14 (0.99)	
>35	31 (11.2)	3.89 (0.79)		3.51 (0.90)		3.43 (1.04)	
Hospital setting			.301		.234		.156
Rural	31 (11.4)	3.39 (0.80)		3.28 (0.91)		3.04 (0.91)	
Suburban	91 (33.5)	3.59 (0.83)		3.34 (0.87)		3.02 (0.99)	
Urban	150 (55.1)	3.66 (0.93)		3.52 (0.94)		3.26 (1.04)	
Type of hospital			.475		.085		.315
Teaching	132 (51.2)	3.66 (0.86)		3.53 (0.84)		3.20 (1.02)	
Nonteaching	126 (48.8)	3.58 (0.87)		3.32 (0.92)		3.08 (0.98)	
Size of hospital			.042		.316		.328
<400 beds	170 (72.0)	3.51 (0.89)		3.37 (0.92)		3.10 (1.04)	
400 beds or more	66 (28.0)	3.77 (0.81)		3.50 (0.86)		3.25 (0.97)	
Job title			.649		.664		.569
Staff nurse	187 (66.8)	3.58 (0.90)		3.41 (0.92)		3.12 (1.01)	
Other	93 (33.2)	3.63 (0.86)		3.46 (0.88)		3.19 (1.02)	
Work status			.520		.408		.773
Full time	205 (73.2)	3.58 (0.91)		3.46 (0.91)		3.15 (1.04)	
Part time or per diem	75 (26.8)	3.66 (0.84)		3.35 (0.91)		3.11 (0.94)	
Work schedule			.167		.892		.857
Days	172 (61.4)	3.66 (0.88)		3.42 (0.93)		3.15 (1.05)	
Other	108 (38.6)	3.51 (0.89)		3.44 (0.88)		3.13 (0.96)	
Patient handling task			.047		.469		.001
Yes	232 (82.9)	3.55 (0.89)		3.41 (0.91)		3.05 (1.02)	
No	48 (17.1)	3.84 (0.85)		3.52 (0.95)		3.62 (0.85)	

Sample sizes for each variable vary because of missing data.

hospital nurses tended to report better people-oriented culture than non–teaching hospital nurses.

Associations of Organizational Safety Practices and Culture With Physical Workload, Perceptions About Work, and Work-related Injury or Symptoms

Table 2 presents bivariate relationships of safety climate, ergonomic practices, and people-oriented culture with main study variables. Higher perceptions of safety climate and ergonomic practices were significantly associated with lower physical workload, lower job demand, higher job control, lower job strain, higher job satisfaction, less intention to leave job, lower perception of risk of musculoskeletal injury, and less experiences of work-related injury and musculoskeletal symptoms. People-oriented culture also showed the same patterns of significant association with all variables, except for physical workload.

Table 2. Physical Workload, Perceptions About Work and Risk, and Work-Related Injury and Musculoskeletal (MS) Symptom Experiences: Comparisons Between Nurses With High Perceptions and Nurses With Low Perceptions of Organizational Safety Practices and Culture

Variable (Range)	Safety Climate[a]			Ergonomic Practices[a]			People-Oriented Culture[a]		
	High (n = 132)	Low (n = 145)		High (n = 138)	Low (n = 137)		High (n = 128)	Low (n = 148)	
	Mean (SD)	Mean (SD)	P	Mean (SD)	Mean (SD)	P	Mean (SD)	Mean (SD)	P
Physical workload (0-56.17)	35.1 (13.8)	40.8 (12.0)	<.001	34.4 (13.1)	42.1 (11.9)	<.001	36.7 (13.8)	39.2 (12.6)	.126
Job demand (12-48)	33.2 (5.90)	36.7 (5.82)	<.001	33.1 (5.91)	37.0 (5.64)	<.001	33.7 (5.86)	36.3 (6.06)	<.001
Job control (24-96)	74.1 (9.01)	66.5 (8.54)	<.001	73.2 (9.04)	67.0 (9.11)	<.001	74.3 (8.74)	66.5 (8.78)	<.001
Job strain (0.125-2.0)	0.45 (0.09)	0.56 (0.12)	<.001	0.46 (0.10)	0.56 (0.12)	<.001	0.46 (0.09)	0.56 (0.13)	<.001
	%		P	%		P	%		P
Job satisfaction (very satisfied)[b]	64.8	35.2	<.001	68.6	31.4	<.001	70.5	29.5	<.001
Intention to leave job (yes)[c]	34.5	65.5	.002	33.3	66.7	<.001	28.7	71.3	<.001
Risk perception for MS injury (high)[d]	36.0	64.0	.002	32.4	67.6	<.001	33.3	66.7	.001
Work-related injury (yes)	30.6	69.4	.001	27.8	72.2	<.001	31.0	69.0	.003
Work-related MS symptom (yes)	39.7	60.3	<.001	41.2	58.8	<.001	38.3	61.7	<.001

Sample sizes for each variable vary because of missing data.
[a]Variables were dichotomized at the median.
[b]Other categories included not at all/not too/somewhat satisfied.
[c]Yes categories included very or somewhat likely (vs not at all likely).
[d]High-risk perception was defined as perceiving the likelihood of having an injury within a year moderate or extremely likely. Low-risk perception categories included somewhat likely and somewhat/moderately/extremely unlikely.

Table 3 presents multivariable analysis results adjusting for 12 demographic and job characteristic variables. Ergonomic practices and people-oriented culture had significant associations with all of the variables (physical workload, job demand, job control, job strain, job satisfaction, risk perception of musculoskeletal injury, work-related injury, and work-related musculoskeletal symptoms). For safety climate, all variables, except for intention to leave job and work-related musculoskeletal symptoms, remained significant in the multivariable model.

Discussion

This study investigated the impact of organizational safety practices and culture comprehensively and demonstrated significant associations of perceived safety climate, ergonomic practices, and people-oriented culture with physical and psychosocial work experiences and safety outcomes among hospital nurses. We found that higher perceptions about organizational safety practices and culture were linked to lower physical workload, more positive perceptions about work, lower risk perception, and better work-related health outcomes.

For the past 4 decades, researchers have reported the significant role of organizational safety climate on the health and safety of workers.[4,12,13] Our study comprehensively investigated the role of safety climate and found significant associations with various outcomes including physical workload, job demand, job control, job strain, job satisfaction, risk perception of injury, and work-related injuries among hospital nurses. In safety climate research, various measures have been developed and used to measure this concept. Our study used the 7-item safety climate scale of the OPP questionnaire[21] demonstrating a significant relationship between safety climate and injury, consistent with other studies using other measures.[5,6,10,11] Two other studies used a short version of the OPP-safety climate scale (5 items). Dennerlein et al[15] called the variable "safety practices" and found significant associations with musculoskeletal pain and functional limitation among patient care workers. The researchers also investigated work-related injuries and found only bivariate associations between the subdimensions (safety leadership and safety diligence) and lost work time injuries among nurses.[26]

Furthermore, we found inverse relationships of safety climate with job demands and job strain, suggesting the positive role that safety climate may play in reducing job stress factors. Our findings are consistent with reports from other studies that examined these relationships with job demands or job strain using different safety climate measures.[17-19] Moreover, our study found that better safety climate was associated with high job satisfaction, further supporting evidence from previous studies.[16,27] In our study, better safety climate was also linked to lower physical workload and lower risk perception of musculoskeletal injury. In a previous study of critical care nurses,[25] a significant relationship between risk perception and safety climate was found only in their bivariate analysis. In a study by DeJoy et al,[28] safety climate was significantly associated with perceived safety at work among retail industry workers in a multivariable model. With respect to physical workload, our observed inverse relationship is understandable, but to the best of our knowledge, it has not been examined in previous research.

Our study showed that hospital nurses' perceptions of ergonomic practices and people-oriented culture had significant associations with all outcome variables examined. In particular, more positive perceptions of ergonomic practices and people-oriented culture were significantly associated with less intention to leave one's job. These findings suggest that organizational practices, better ergonomically designed work environments, and employee-oriented cultures are important in nurse retention. Consistent with our findings, Dennerlein et al[15] showed that both ergonomic practices and people-oriented culture were significantly associated with musculoskeletal pain and functional limitation among patient care workers. In Tveito et al's[26] study, ergonomic practices had significant associations with work-related injuries among RNs, but people-oriented culture showed only a marginally significant relationship with lost work time injuries.

Our study has the strength of using a statewide random sample including nurses working in various types of hospital units. A further strength is the large proportion of racial and ethnic minority nurses (42.1%) in our sample. Our study also has several methodological limitations. First, we cannot determine the causal relationships between study variables using cross-sectional data. In addition, our study relied on self-reported data. The observed relationships could be bidirectional, and the study variables on perceptions about work are subject to reporting bias. Finally, potential selection bias from the low response rate and nonresponse bias could threaten the internal validity of our study findings and limit the external validity.

In conclusion, our study underscores the importance of organizational safety practices and culture in creating and maintaining positive and safe work environments, improving job satisfaction, and retaining healthy nursing workforces. Nursing leaders and occupational health and safety professionals should assess organizational safety climate, practices, and

Table 3. *Associations of Organizational Safety Practices and Culture With Physical Workload, Perceptions About Work and Risk, and Work-Related Injuries and Musculoskeletal (MS) Symptoms Among Nurses: Multivariable Analysis[a] (N = 280)*

Variable	Safety Climate (Low)[b]			Ergonomic Practices (Low)[b]			People-Oriented Culture (Low)[b]		
	Coefficient	(95% CI)	P	Coefficient	(95% CI)	P	Coefficient	(95% CI)	P
Physical workload	4.67	(1.42-7.93)	.005	6.05	(2.78-9.32)	<.001	3.46	(1.56-6.77)	.040
Job demand	2.69	(1.07-4.32)	.001	2.61	(0.96-4.26)	.002	2.01	(0.36-3.66)	.017
Job control	−8.76	(−11.2 to −6.28)	<.001	−7.19	(−9.81 to −4.57)	<.001	−7.78	(−10.3 to −5.23)	<.001
Job strain	0.11	(0.08-0.14)	<.001	0.09	(0.06-0.12)	<.001	0.09	(0.06-0.12)	<.001
	Adj OR	(95% CI)	P	Adj OR	(95% CI)	P	Adj OR	(95% CI)	P
Job satisfaction (very satisfied)[c]	0.23	(0.12-0.44)	<.001	0.21	(0.11-0.41)	<.001	0.11	(0.05-0.22)	<.001
Intention to leave job (yes)[d]	1.84	(0.90-3.73)	.093	2.76	(1.35-5.65)	.006	4.42	(2.06-9.50)	<.001
Risk perception for MS injury (high)[e]	2.07	(1.09-3.95)	.027	3.26	(1.68-6.31)	<.001	2.85	(1.49-5.46)	.002
Work-related injury	2.45	(1.18-5.09)	.016	2.89	(1.37-6.10)	.005	2.48	(1.19-5.15)	.015
Work-related MS symptom	1.91	(1.00-3.66)	.051	2.35	(1.20-4.62)	.013	2.19	(1.14-4.23)	.019

Abbreviation: CI, confidence interval.
[a]Multivariate analyses adjusted for gender, race/ethnicity, education, country of nursing education, job tenure, hospital setting, hospital type, hospital size, job title, work status, work schedule, and patient handling duty. Sample sizes for each analysis vary because of missing data.
[b]Variables were dichotomized at the median. Linear regression coefficients and odd ratios (ORs) represent estimates for low-perception groups, compared with high-perception groups.
[c]Other categories included not at all/not too/somewhat satisfied.
[d]Yes categories included very or somewhat likely (vs not at all likely).
[e]High-risk perception was defined as perceiving the likelihood of having an injury within a year moderate or extremely likely. Low-risk perception categories included somewhat likely and somewhat/moderately/extremely unlikely.

culture, addressing these issues in workplace policies and programs to improve communication and employee involvement in workplace and work design.

Future research using a prospective design and a larger and more representative sample is needed to validate our important study findings.

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