Work-environmental determinants of mass fainting illness among textile factory workers

Development of a screening instrument

Received 18 April 2019
Revised 3 June 2019
7 June 2019
Accepted 13 June 2019

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Abstract

Purpose – The purpose of this paper is to develop a brief screening instrument to identify risk factors of factory workers experiencing mass fainting illness (MFI) due to work-environmental determinants.
Design/methodology/approach – A factory-based cross-sectional study was conducted among 740 workers in October 2017 and was completed with face-to-face interviews. Data analyses included univariate logistic regression, backward stepwise linear regression and multiple logistic regression. Sum scores on significant items and receiver operator characteristic curves were used to compute potential cut-off points and the sensitivity and specificity rates.
Findings – Significant work-environmental factors were identified as working at very high speeds, having less influence on the choice of working partners, perceived high temperature at work, having less opportunity to do their best at work, and concern about losing a job in the next six months. In developing a screening instrument, a 6.5 cut-off point that corresponded to 99.6 percent sensitivity and 92.2 percent specificity was identified.
Originality/value – The study concludes that this MFI-instrument could potentially be used to prevent MFI. By understanding the policy implications, the government body, employers, workers, development partners and stakeholders should work toward preventing MFI. Implementing a preventive measure is therefore warranted due to the health education impact.

Keywords Cambodia, Factory workers, Mass fainting illness, MFI instrument, Sensitivity and specificity, Work-environmental determinants

Paper type Research paper

Introduction

Fainting (or syncope) is a form of unconsciousness due to temporary insufficient cerebral circulation and can occur repeatedly as a consequence of psychological determinants at work, such as life-threatening or very stressful conditions[1]. Mass fainting illness (MFI),

Journal of Health Research
Emerald Publishing Limited
2586-940X
DOI 10.1108/JHR-04-2019-0081

previously known as mass psychogenic illness (MPI) or mass hysteria, has frequently been identified in many settings where large groups of people gather, such as factories, schools, towns/villages, family groups, institutions and hospitals[2–5]. A combination of psychosocial factors and environmental determinants in occupational settings can act as precipitating factors, causing physical symptoms, even fainting from two or more workers working closely within an intragroup and intergroup, without organic pathogens being identified[6–9]. Researchers have found no agreement with risk factors explaining this phenomenon. There are two main reasons for syncope in the medical context, including psychogenic disorders due to life-threatening or very stressful situations[1], and occupational settings, somatoform disorders often occur, accounting for mild to severe physical symptoms but no cause has been identified[10]. Most researchers agree that episodes triggering MPI or mass hysteria are due to existing stressors at work, consisting of two syndromes, mass anxiety manifested by repeated exposure of acute anxiety frequently seen in schoolchildren and mass motor often triggered in groups but found at any age, with existing risk factors in the work environment[11, 12]. A toxic environment has been found in several studies, which is generated by-products, such as chemical odors or gases that may immediately trigger MPI[13, 14]. Previous studies identifying the risks of MPI in which the environmental measurements were confirmed found that no high threshold exposure existed in work environments[15–17]. Additionally, a joint ILO/WHO theory explained that triggering events may result from interacting combinations of risk factors, such as individual capability, working conditions, working environments, including monotonous work, physical stress, personal relations and management practice at work, plus external work factors[18]. Several job stress models discerned that various risk factors found in the workplace might cause adverse health effects. For example, the job demands-job control model underlying the job characteristics and work environments showed that the health outcome (MFI) resulted from unmet working demands (i.e. work overload or time pressure) and poor decision latitude (low job control at work or low social support). Other job stress models have similar concepts, such as the National Institute for Occupational Safety and Health and Person-Environment fit model, in which job characteristics and persons are broken down due to physiological changes. Additionally, job stressors[19], including job demands (workload and job control), organizational factors (workers' role, management practice at work, job security and interpersonal relations) and physical stress (from noise, fire and burns from heat), can be influenced by existing factors, such as individual and context factors, leading to health consequences, such as psychological, physiological and behavioral problems[20]. Psychosocial factors include not only existing work-environmental factors, such as job content, work organization and management plus organizational and environmental conditions, but also external work factors (domestic demands) and individual characteristics (personality and attitudes). If prolonged, factors such as psychological and physical illnesses also induced stress[21]. The Job Content Questionnaire noted that a high level of stress at work would result from unmet needs between the demands of a job and control over the job, which could lead to psychological strain and physical illness[22]. A study on job stress predicting mental strain found high job demands and low job control and low job satisfaction to be important factors[23]. Monotonous tasks, including repetition known as psychosocial work factors, also contributed to health outcomes[24] or psychosocial health complaints, such as headaches, overall fatigue, stomach ache, sleep disturbances, anxiety, muscle strain and even fainting.

In Cambodia, MFI has received an increased attention due to its repeated occurrence among workers throughout factory settings in the country. Most workers have reported forms of MFI, such as dizziness, headache, nausea, hyperventilation and weakness. This illness manifests in intragroup and intergroup settings of workers and may occur once or twice a day and/or the following consecutive days. According to the National Social

Security Fund, from 2015 to 2017, the number of factories and workers that had experienced MFI was 32, 18 and 22 and 1806, 1160 and 1603, respectively, in which garment and footwear factories were observed as high risk. A reliable prediction method for MFI has been difficult to produce, but in this study, the validated questionnaire was freely available from the previous study and was modified and used to determine factors predicting MFI. In occupational settings, the working conditions are consistent with psychosocial factors in terms of identical factors[19]. As an essential evaluation of a screening instrument that is related to health conditions, a receiver operating characteristic (ROC) curve is a pure index of diagnostic accuracy in which a test's ability to highlight a difference between illness and non-illness was applied[25, 26]. In the ROC curve, however, a graph is constructed by plotting sensitivity (representing a true positive) and 1 minus specificity (representing a false positive). A complete range of potential cut-off scores would be accepted and preferably discriminate between the misclassification of disease as non-illness (false negative) and healthy individuals as illness (false positive). The present study developed a concise screening instrument to identify factors predicting MFI regarding work-environmental determinants and determines a potential cut-off point and sensitivity and specificity rates.

Materials and methods

Study design and participants

The factory-based cross-sectional study was conducted among factory workers in October 2017 using face-to-face interviews. The factory workers' ages ranged from 17 to 52 years and were employed in factories that agreed to participate in the study by signing an informed consent form and included workers with MFI who were affected at least one or more times within the last six months. Those who were absent from work on the day of data collection and refused to participate were excluded from the study.

The sample size was calculated using an expected MFI of 8 percent with a 23 percent allowable error and 1.7 precision. A total of 740 workers (659 women, 81 men) were recruited from 4 factories with 36 workers in each operative section (5/12 working operative sections were at high risk of exposure to common health hazards in the workplace). This study reviewed the case of eight factories that had experienced MFI, located in the capital city of Phnom Penh and two provinces in Cambodia. Of these, four factories were recruited into the study settings and were in three different locations: two factories (one garment and one footwear) in Kandal, one garment factory in Kampong Speu and one garment factory in Phnom Penh City. A convenient sampling method was used to recruit the study settings. A two-stage cluster sampling with probability proportional to size was used to recruit workers in each factory into the study population[27].

Measurements

Workers' characteristics included age, gender, material status, education, monthly income, family member's dependent on income, occupations, working duration, previous work history in a factory setting, number of working hours per week, employment contracts, smoking, absence from work and the reasons, and body mass index. Other variables concerning the presence of long-term effects were influenced by the impact of work on workers' health, such as gastritis/stomachache, insomnia, emotional disturbance, back pain/arthritis, lung disease, heart disease, high blood pressure and kidney illness. In this part of the questionnaire, the questions were "Yes-No" and "multiple choice" type questions.

Work-environmental determinants are defined as an interacting combination among/between the job stressors underlying individual factors and contextual factors that may lead to health consequences or physical health illnesses. This term is synonymous with psychosocial work factors regarding working conditions. There are five subscales

consisting of job intensity (2 items), job control ability (7 items), physical work environments (17 items), psychological well-being (5 items) and job satisfaction (8 items). A response format in each question is rated on a five-point Likert scale of 1 (almost always) to 5 (almost never). The scoring of each factor was computed from a total score in each item and then split into two groups: scoring below average or equal to the lowest score was coded as a high-risk condition while low-risk conditions were coded with scores above average. All items in each subscale were computed as Cronbach's α, which was used to measure the internal consistency of the reliability. The overall score was 0.763 (Table I).

MFI (or workers with MFI) refers to workers who have experience of worsening health conditions and experienced unconsciousness (unable to move) or dizziness, at least one time

MFIQ subscales	Items	Cronbach's α
Job intensity	1. Working at very high speed	0.699
	2. Working to tight deadlines	
Job controls and supports	3. You can get assistance from coworkers if you ask for it	0.602
	4. You can get assistance from your supervisors if you ask for it	
	5. You can get external assistance if you ask for it	
	6. You influence the choice of your working partners	
	7. You can take your break when you need	
	8. You have enough time to get the job done	
	9. You are free to decide when taking a holiday or days off	
Physical work environments	10. Tiring or painful position	0.812
	11. Carrying or moving heavy loads	
	12. Standing or walking	
	13. Repetitive hand or arm movements	
	14. Having vibrations from hand tools, machinery, etc.	
	15. Noise so loud that you would have to raise your voice to talk to people	
	16. The high temperature which makes you perspire even when not working	
	17. Low temperature whether indoors or outdoors	
	18. Experience breathing in smoke, fume, dust, toxic agents or strange odor	
	19. Breathing in solvents and thinners	
	20. Handling or being in skin contact with chemical products or substances	
	21. Dangerous equipment	
	22. Dangerous work methods	
	23. Things placed or stored dangerously	
	24. Fire and burns from heat	
	25. Electric shock	
	26. Dirty or poor maintenance	
Psychological well-being	27. At work, you have an opportunity to do what you do best	0.629
	28. You can apply your ideas in your work	
	29. You have the feeling of doing useful work	
	30. You find your job intellectually demanding	
	31. you find your job emotionally demanding	
Job satisfaction	32. I might lose my job in the next six months	0.685
	33. I am well paid for the work I do	
	34. My job offers good prospects for career advancement	
	35. I feel myself at home in this factory	
	36. At work, I have the opportunity to learn and grow	
	37. I have very good friends at work	
	38. Satisfaction with working conditions	
	39. Satisfaction with working environments	
Overall		0.763

Note: MFIQ: Mass Fainting Illness Questionnaire

Table I. Baseline items of MFIQ subscale in relation to work-environmental determinants

within the previous six months prior to the interview. Those who did not report any of the MFI forms were considered healthy workers.

The questionnaire, which was called the MFI questionnaire, was modified based on a validated questionnaire, which is freely available from a previous study[28]. The questionnaire was also prepared bilingually in English and the Khmer languages.

Ethical consideration

Ethics approval was provided by Thammasat University Ethics Committee (COA No. 330/2560) and obtained from the National Ethics Committee for Health Research in Cambodia (Code No. 080 NECHR).

Statistical analysis

Workers who reported MFI due to work-environmental determinants were compared to those who did not report any form of MFI. Descriptive data analyses, such as count, percent, mean, median, mode and standard deviation, were used to describe each variable. For the development of the screening instrument, statistical analyses were subsequently performed. For the logistic regression analysis, the association between items in each subscale was considered as the baseline as having MFI within the last six months. All significant items in these univariate analyses (χ^2 test; p-values < 0.05) were selected for further analysis along with the multivariate logistic regression. Backward stepwise linear regression was aimed at reducing items that were correlated with an increased risk of MFI. All significant items were selected, and the scores were summed for each item for further analysis. A receiver operator characteristic (ROC) analysis was computed to determine the cut-off value that corresponded to the rate of sensitivity and specificity, which was used for predicting factors of MFI. In this study, however, missing data were omitted. The statistical analysis was performed using the Statistical Package for Social Science (IBM SPSS Statistic 23 License Authorization).

Results

Among 740 factory workers, 89 percent were female workers, and 31.8 percent had experienced an MFI incident within the last six months. The study also showed that the average age of factory workers was 26 years (SD = 6.20). Most workers had completed lower education, such as primary school (45.9 percent) and secondary school (40.8 percent). The majority (47.7 percent) were in sewing operations, and 66.3 percent of those employed had a fixed-term contract. Additionally, 75.5 percent reported some absences from work, while 60.5 percent had illness within the past 12 months (Table II).

For the data analysis, the univariate logistic regression analysis was applied for selected baseline items associated with increased risk of MFI due to work-environmental determinants. Significant predictive factors of MFI were as follows: workers working at very high speeds, receiving less assistance from coworkers, perceiving less influence on the choice of working partners, perceiving exposure to vibration from hand tools and machinery, perceiving high temperatures at work, perceiving low temperatures at work, having to breathe in smoke and strange odors, perceiving fire and burns from heat, having less opportunity to do their best at work, allowing less application of their ideas at work, perceiving a concern of losing their job within the next six months, and perceiving low satisfaction with working conditions (Table IV).

Second, backward stepwise linear regression was used to analyze the suppressor effects of factors that were used to predict MFI. Many items were correlated with MFI that were related to work-environmental determinants. Factors correlated with MFI included workers receiving assistance from coworkers, perceiving the influence on choice of working partners,

	Total		MFI		Non-MFI	
	n	(%)	*n*	(%)	*n*	(%)
Factory workers	740	100.0	233	31.8	505	68.2
Age (years)						
17–20	130	17.7	28	21.5	102	20.3
21–25	258	35.1	93	36.0	165	32.9
26–30	156	21.2	53	34.0	103	20.5
31–35	125	17.0	37	29.6	88	17.5
> 35+	66	9.0	22	33.3	44	8.8
Mean = 26.53, SD = 6.20, Min. = 17, Max. = 52						
Gender						
Female	658	89.0	225	34.2	433	85.9
Male	81	11.0	10	12.3	71	14.1
Marital status						
Single	281	38.0	87	37.0	194	38.4
Married/divorced/widowed	459	62.0	148	63.0	311	61.6
Education						
No education	30	4.1	9	3.9	21	4.2
Primary school	337	45.9	117	50.4	220	43.7
Secondary school	300	40.8	89	38.4	211	41.9
High school/college or higher	68	9.3	17	7.3	51	10.1
Monthly income (USD)						
< 200	599	80.9	180	76.9	419	82.8
> 200	141	19.1	54	23.1	87	17.2
Mean = 187.95, SD = 24.81, Min. = 100, Max. = 290						
Number of working hours per week						
48	592	80.0	171	72.8	421	83.4
> 48	148	20.0	64	27.2	84	16.6
Mean = 50.14, SD = 4.43, Min. = 40, Max. = 78						
Types of occupation						
Sewing	353	47.7	135	57.4	218	43.2
Cutting	109	14.7	32	13.6	77	15.2
Assembly line work	81	10.9	20	8.5	61	12.1
QCs	80	10.8	28	11.9	52	10.3
Packaging	48	6.5	9	3.8	39	7.7
Supervisors	26	3.5	5	2.1	21	4.2
Ironing	43	5.8	6	2.6	37	7.3
Employment contracts						
Fixed-term contract	487	66.3	146	62.4	341	68.2
Temporary contract	247	33.4	62	37.6	159	31.8
Worked in a factory before						
No	231	31.3	53	22.9	178	35.3
Yes	508	68.7	182	35.8	326	64.7
Absence from work in the past 12 months						
No	181	24.5	38	21.0	143	28.4
Yes	558	75.5	197	35.3	361	71.6
Illness in the past 12 months						
No	292	39.5	60	25.5	232	45.9
Yes	448	60.5	175	74.5	273	54.1

Table II.
Descriptive statistics of 740 factory workers with MFI

perceiving high temperature at work, having to breathe in smoke or strange odors, having an opportunity to do their best at work, perceiving a feeling of doing useful work, perceiving losing their job within the next six months, being paid well for their job, and perceiving satisfaction with working conditions and working environments (Table III).

Table IV presents the factors associated with MFI. Multivariate logistic regression analyses were performed, in which selected significant items from the univariate analyses were identified (χ^2-test, p-value < 0.05). Predictive factors of MFI included working at very high speeds, perceiving less influence on the choice of working partners, perceiving a high temperature at work, having less opportunity to do their best at work and having a concern for losing a job in the next six months. Fourth, sum scores were found for the significant items from the data that were computed by multiplying and adding the scores, ranging from 5 to 21.

The screening instrument was assessed to discriminate between workers who had MFI and those who did not have MFI that had been influenced by work-environmental determinants. The ability of this screening instrument to discriminate among these health conditions and determine potential cut-off thresholds that correspond to the sensitivity and specificity rates with their confident interval was tested (Table V). An ROC curve could preferably highlight the highest cut-off point that predicts MFI. By definition[25], an AUC of 0.5 means that affected-MFI and non-affected-MFI cannot be distinguished, and an AUC of 1.0 indicates perfect discrimination among the two groups. We used 6.5 as a potential cut-off point, which corresponded to a sensitivity rate of 99.6 percent and a specificity rate of 92.2 percent. The area under the curve (AUC) was 0.615 (95% CI: 0.572–0.658), and the data are shown in detail in Figure 1.

Discussion

This study found factors that were associated with MFI, such as working at very high speeds, perceiving less influence on the choice of working partners, perceiving high temperature at work, having less opportunity to do their best at work (e.g. all handling tasks among textile factory workers are performed to expedite speedily and are dependent on their supervisors) and perceiving concern for losing a job in the next six months. These factors were used to develop a screening instrument. Only a 6.5 cut-off point determined the high sensitivity and specificity rate that is distinctly used for identifying predicting factors of MFI. In this screening instrument, 39 items were modified from validated questions that are freely available from a previous study recognized for its reliability.

In our study, however, methodological features and some limitations are present. First, information about the predictive factors of MFI due to work-environmental determinants was identified throughout the interviewing process and whilst measuring workers' perception. However, the objective data as a baseline were determined by workers who had

	b	SE(b)	95% CI
Received assistance from co-workers if asking for it	0.04***	0.02	(0.01, 0.07)
Influenced the choice of your working partners	0.07***	0.02	(0.03, 0.10)
Perceived high temperature at work	0.08***	0.01	(0.05, 0.11)
Breathing in smoke, fume, dust, toxic agents or strange odor, etc.	0.04***	0.01	(0.01, 0.06)
Having an opportunity to do their best at work	0.04***	0.01	(0.02, 0.07)
Have feeling of doing useful work	−0.02*	0.01	(−0.04, −0.00)
Perceived lost job in the next six months	−0.04***	0.01	(−0.07, −0.01)
Perceived well paid for the job done	−0.09***	0.02	(−0.12, −0.05)
Satisfaction with working conditions	−0.17***	0.04	(−0.24, −0.10)
Satisfaction with working environments	0.11***	0.04	(0.03, 0.18)

Notes: $n = 740$. *$p < 0.05$; ***$p < 0.001$

Table III. Work-environmental determinants correlated with MFI

	Crude analysis		Adjusted analysis	
	cOR[a]	95% CI OR	aOR[b]	95% CI OR
Working at very high speed				
High	Ref.			
Low	2.19	(1.23-3.93)	1.98	(1.10–3.9)
Perceived assistance from co-workers				
High	Ref.			
Low	1.44	(1.06-1.97)	1.17	(0.84–1.64)
Influencing the choice of working partners				
High	Ref.			
Low	1.97	(1.36-2.86)	1.64	(1.03-2.61)
Perceived vibrations from hand tools, machinery				
High	Ref.			
Low	1.44	(1.02-2.02)	1.21	(0.85–1.72)
Perceived high temperature at work				
High	Ref.			
Low	1.98	(1.44-2.72)	2.16	(1.39-3.35)
Perceived low temperature at work				
High	Ref.			
Low	1.41	(1.04-1.93)	0.91	(0.62–1.33)
Breathing in smoke, fume, dust, toxic agents or strange odor				
High	Ref.			
Low	1.64	(1.20-2.25)	1.26	(0.87–1.81)
Perceived fire and burns from heat				
High	Ref.			
Low	1.98	(1.23-3.20)	1.62	(0.99–2.67)
Having an opportunity to do their best at work				
High	Ref.			
Low	1.77	(1.29-2.44)	1.64	(1.14–2.38)
Applying their own ideas at work				
High	Ref.			
Low	1.42	(1.01-1.99)	1.04	(0.70–1.55)
Perceived loss of job in the next six months				
High	Ref.			
Low	1.74	(1.22–2.49)	1.62	(1.10-2.40)
Satisfaction with working conditions				
High	Ref.			
Low	2.93	(1.01–8.55)	0.37	(0.13–1.10)

Table IV. Association between work-environmental determinants and MFI

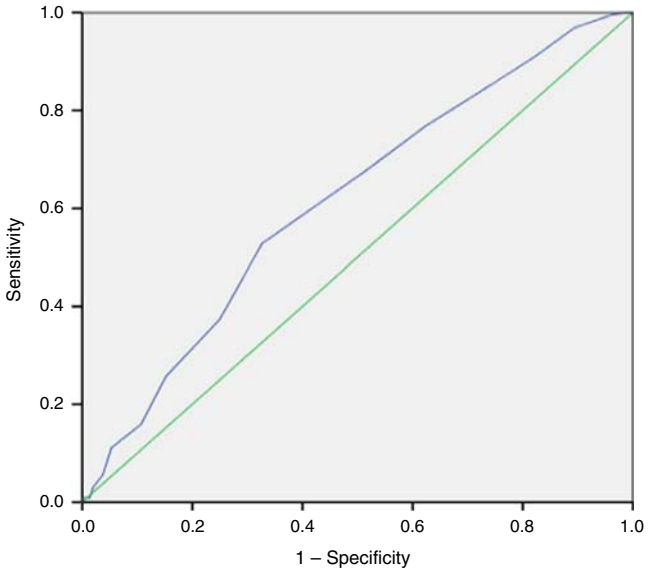
Notes: $n = 740$. [a]Crude estimate OR; [b]adjusted estimated OR (adjusted for factors with p-values < 0.05 of the χ^2-test)

MFI and those who did not have MFI. Workers were diagnosed with MFI by the ICD-10 guideline (e.g. somatoform disorders), which is rather subjective. Second, factors predicting MFI are caused by a single risk factor unless diverse factors, known as work-environmental determinants, could be clearly observed from factory to factory or from country to country. Third, factory byproducts, such as toxic environments, existed (e.g. smoke or smelling odors) that are more likely to trigger an episode of MFI. In this study, a questionnaire was used to assess factors that predicted MFI, so the results would draw less attention from the

public's perspective. However, numerous past studies have conducted environmental measurements, but threshold exposure levels may not have been considered, and the other tests did not find ample air-born contaminants[6, 15, 29]. Fourth, the cut-off point in developing screening instruments frequently determines the sensitivity and specificity rates. If the cut-off point is remarkable, the number of false negatives and false positives is restricted. Additionally, the screening instrument is directed at workers underlying health conditions. If the result had a low sensitivity and specificity rate, the misclassification among those groups would have determined affected MFI or vice versa. However, no such cut-off threshold value was found in developing the screening instrument. Therefore, the study suggests that the testing MFI instrument has practical usability and efficient performance that can be used not only in this study setting but could also be applied in other

Table V. Cut-off point (CP), and sensitivity and specificity rates (%) with an estimated 95% confident interval (CI) for determined development of the screening instrument

Cut-off points	MFI instrument	
	Sensitivity (CI)	Specificity (CI)
6.5	99.6 (98.8–100.0)	92.2 (89.8–94.6)
7.5	97.0 (94.8–99.2)	89.5 (86.8–92.2)
8.5	91.0 (87.3–94.7)	82.2 (78.5–85.9)
9.5	84.1 (79.0–89.2)	72.7 (68.2–77.2)
10.5	76.8 (70.7–82.9)	62.4 (57.1–67.7)
11.5	67.8 (60.5–75.1)	51.7 (45.6–57.8)
12.5	52.8 (44.0–61.6)	32.7 (25.4–40.0)



Notes: Receiver operator characteristic (ROC) curve for the development of the screening instrument for identifying factors predicting MFI as result of the area under the curve (AUC) of 0.615 (95% CI: 0. 0.572–0.658); by definition, an AUC of 0.5 shows no discrimination above chance and an AUC of 1.0 shows perfect discrimination

Figure 1. Distinguished ability of the predicting factors

similar patterns of work characteristics. The sensitivity rate is extremely high, and the specificity is slightly low, However, if this screening instrument is available, it could be used towards effective interventions.

Conclusion

There are factors helping us to predict MFI occurrences, and a screening instrument used for identifying risk factors of MFI was developed. If this screening instrument is available, its practical use can work towards helping to prevent MFI. Based on the policy implications, the government, employers, development partners and other stakeholders should work towards identifying the common work-environmental determinants as a step towards improving the situation. The study suggests that further study in other settings will increase the effectiveness and validation of this screening instrument.

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