Work-related Musculoskeletal Disorders, Psychosocial Factors, Work Productivity, and Work Ability Among Garment Factory Workers in Myanmar

Tun Win Oo[1], Nutta Taneepanichskul[1*]

[1]College of Public Health Sciences, Chulalongkorn Universiy, Bangkok, Thailand

Email address: *nutta.taneepanichskul(at)gmail.com

Abstract— *The global burden of work-related musculoskeletal disorders (WRMSDs) is the second most common cause of disability worldwide, usually back pain, measured by years lived with disability (YLDs). The magnitude of WRMSDs is worsened by physical and psychological factors in different occupations. Sewing machine operators are occupational workers who commonly encounter a high prevalence of WRMSDs. This study aimed to find the associations among the working ability, productivity status, psychosocial factors, and WRMSDs of sewing machine operators in garment factories in Myanmar. A cross-sectional study enrolled 370 sewing operators from Shwepaukkan Industrial Zone in Myanmar. WRMSDs in at least one part of the body were reported among 347 workers (93.8%). A moderate ability rate was found for 66.5%, followed by poor ability at 18.4%. The logistic regression model showed that gender (AOR = 0.130; 95%CI 0.020–0.969), job stress (AOR = 8.257; 95%CI 1.465– 46.550), physical demand (AOR = 4.702; 95%CI 1.172–18.862), and productivity (AOR = 5.893; 95%CI 1.393–24.920) were significant predictors of WRMSD. This finding can help to guide the improvement of the working situations of sewing operators in garment factories and help to develop regulations for the well-being of workers in occupational health sectors.*

Keywords— *Work-related musculoskeletal disorders, psychosocial factors, work productivity, work ability, garment factory workers.*

I. INTRODUCTION

Work-related musculoskeletal disorders (WRMSDs) are the most common occupational problem worldwide[1, 2]. They comprise "conditions that involve muscles, tendons, nerves, and other soft tissue pain that could be associated with or influenced by work-related factors"[3]. The magnitude of WRMSDs is worsened by physical and psychological factors in different occupations. WRMSDs are also the most economically costly of diseases, and the individual has to carry the cost, losing income that leads to increasing poverty[1, 2]. The global burden of WRMSDs constitutes the second most common cause of disability, most frequently in the form of back pain, measured by years lived with disability (YLDs)[4]. In a study of the global burden of disease between 2007 and 2017, low back pain was the most common cause of the increase in all-age YLDs, at 17.5%. Musculoskeletal disorders were also one of the most common causes of YLDs in the working-age group (20–54 years), accounting for more than 45% of the proportion[5]. In the review study for the 2007–

2017 review, total disability-adjusted life years were also influenced by neck and back pain, at about 17%. In developing countries, the disease burden of WRMSDs is ranked as one of the three most common causes of disability and the non-communicable disease overburden[6, 7].

The setting of productivity is broad; it can be defined as the traditional form of interaction between input (working hours) and output (amount of production)[8]. The cost for workers' impaired well-being as a result of health risks can be regarded as an indirect cost that may impact economic evaluations[9]. Work ability also plays a crucial role in linking productivity and WRMSDs. It can be defined as the capacity of workers to perform jobs that are influenced by job demands, health, and mental resources[10]. It is also influenced by a sum of factors that the workers can use to control their job demands successfully. Impaired work ability is believed to be the outcome of adverse health outcomes, individual resources, and working conditions[11, 12].

Garment factories in Myanmar contribute to the country's economic growth and comprise one of the major sectors of employment. In the recent decade, the Myanmar garment sector has grown, with approximately 350,000 to 450,000 workers, of which 90% are women. More than 60% of owners are foreign. According to research by Oxfam, low wages, a lack of proper safety rules, long working hours, and financial debt are the problems of greatest concern in the garment sector. To solve their financial problem, at least one in four workers reported that overtime sometimes comprises their additional income. Due to poor health and labor regulations, however, overtime can be involuntary and sometimes unpaid. The cycle of poverty and health problems is constant[13, 14].

With regard to the quality of life of workers and national productivity, we should understand the occupational hazards and their approach to prevention in this sector. However, there is very little research on the occurrence of WRMSDs in relation to psychosocial factors, work productivity, and work ability in Myanmar. Therefore, this study aimed to identify the associations between working ability, productivity status, psychosocial factors, and WRMSDs among sewing machine operators in garment factories in Myanmar. The research findings in this area support the development of working conditions for those jobs involving sewing operations in

garment factories and help in developing preventive regulation. It also has the prospect of producing proper work practices in similar industrial sectors.

II. METHODOLOGY

A cross-sectional study was conducted in Shwepaukkan Industrial Zone, Yangon, Myanmar, which is one of the most industrialized zones. There are 15 garment factories in this zone. Two factories with more than 1,000 workers agreed to participate in this study. Sample size was estimated according to the equation for prevalence studies[15, 16]. In total, 370 operators participated in this study. In each factory, 185 participants were selected by systematic random sampling by ID number. Inclusion criteria were operators who had worked for at least one year as sewing operators and who were aged 18 years or older. Sewing operators who had suffered from an injury, had an accident, or undergone surgery in the previous three months and who were taking prescribed medicine were excluded from the study.

After obtaining a list of the selected workers, the researchers explained the research, its benefits, and the details of the questionnaire. All participated voluntarily and provided informed consent. Ethical approval was obtained from Chulalongkorn University's research ethics review committee for research involving humans.

The general characteristics of the sewing operators were collected, including age, sex, education, marital status, height and weight, working hours per day, BMI, working experience, and monthly income, along with responses to several scales, using self-reported questionnaires.

WRMSDs were assessed using the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ). This examines the prevalence of musculoskeletal diseases in 20 body parts suffered during the preceding week (the last seven days). The questionnaire includes frequency, discomfort, and interference. CMDQ validity was tested by Erdinc Q[17]. Cross-cultural translation validities and reliability tests were conducted with a satisfactory outcome[18, 19]. The Cronbach's alpha for the three scales (frequency, discomfort, and interference) was 0.711, 0.762, and 0.81, respectively, which indicated high internal consistency[17].

Psychosocial factors were accessed using the Job Content Questionnaire (JCQ). The questionnaire comprises 27 items in five sections: job control, psychological job demand, workplace social support, physical job demand, and job insecurity. Skill discretion (evaluated by six items) and decision authority (evaluated by three items) are summed to measure the job control scale. The psychological job-demand scale comprises five items. Support from supervisors and co-workers (four items each) are combined to evaluate the social support scale. The physical job-demand scale and job security scale are evaluated by three and two items, respectively. The outcome response is recorded for each questionnaire on a four-point Likert-type scale, ranging from 1 (strongly disagree) to 4 (strongly agree)[20]. The Cronbach's alpha for this study was 0.723, above the threshold of 0.7 for reliability.

The Work Productivity and Activity Impairment-General Health Version (WPAI-GH) questionnaire was applied to measure productivity and activity impairment in employees. The WPAI-GH consists of six questions: 1 = current employment; 2 = missed hours due to ill health; 3 = missed hours due to other reasons; 4 = hours worked; 5 = the degree to which health status affected productivity while working; and 6 = the degree to which health status affected productivity in regular unpaid activities. The duration for memory recall for the questions was the past seven days, not including today. There are four main generated outcomes from the WPAI-GH, described in percentages by multiplying the following scores by 100: (1) Absenteeism score = $Q2/(Q2 + Q4)$; (2) Presenteeism score = $Q5/10$, both for those who are currently employed and who have worked in the preceding seven days; (3) Overall work productivity loss = $Q2/(Q2 + Q4) + ((1 - Q2/(Q2 + Q4)) \times (Q5/10)$ for those who are currently employed; (4) and percentage of activity impairment due to health = $Q6/10$ for all respondents. In this study, we excluded activity impairment because all participants were currently working employees. This tool has been translated into different languages, and validity and reliability tests have been conducted, with a Cronbach's alpha score of > 0.7; it was also more than 0.7 in this study[21].

The Work Ability Index (WAI) was used to measure the working ability of the sewing operators using a seven-item questionnaire: current work ability compared with the lifetime best (0–10); work ability concerning the demands of the job (2–10); number of current disease groups diagnosed by a physician (1–7); estimated work impairment due to diseases (1–6); sick leave during the past year (1–5); personal prognosis of work ability for two years from now (1, 4, or 7); and mental resources, referring to the worker's life in general, both at work and during leisure time (1–4) (the numbers in parentheses for each item indicate the scoring range). The total WAI score is calculated by summing the scores of all items and thus ranges from 7 to 49. The total WAI scores are categorized into four levels: poor (7–27), moderate (28–36), good (37–43), and excellent (44–49)[22]. For internal validity, predictive validity, and reliability, the documented subjective assessment of work ability using the WAI questionnaire seems to provide a good instrument and test-retest reliability[23, 24]. Reliability was also tested and was above the 0.7 threshold.

Data analysis was conducted using SPSS 22.0 (SPSS for Windows, version 22.0; SPSS, Inc., Chicago, IL, USA, Chulalongkorn University license). The general characteristics of the sewing operators were reported by scores (percentages) for the category data. For continuous data, the mean and standard deviation were reported. Pearson's chi-square test was used to identify associations between independent variables and WRMSDs. If the assumption of chi-square was not achieved, a Fisher's exact test was performed. Binary logistic regression was performed to evaluate the associations because of the use of dichotomous outcomes in this study. An odds ratio (OR) with a 95% confidence interval (CI) was reported. A p-value of less than 0.05 was considered statistically significant.

III. RESULTS

The general characteristics of the garment factory workers are presented in Table 1. The results showed an average age of

25.6 ± 4.6 years. The majority of the sewing workers (61.9%) were in the age group 22–30 years, with a range of 18–51 years. The majority of sewing operators were female (95.4%). With regard to educational level, 54.6% had attained secondary school level, followed by tertiary level and above (33.8%). With regard to marital status, 83.5% were single. With regard to income, the majority earned more than 20000 MMK (65.9%), with a mean value of 227151 ± 61015 Myanmar kyats. Most of the operators worked more than eight hours a day (60.8%), with a mean of 9.25 ± 1.3 hours. Respondents with more than five years of working experience comprised 26.8% of the total. The mean for working experience was 4.2 ± 3.2 years. Age and education were associated with WMSDs (p < 0.05).

TABLE 1. General characteristics of sewing machine operators related to WRMSD (N = 370)

		Total : n(%)	WMSDs		p-value
			Yes : n(%)	No : n(%)	
Age	<22 years	98 (26.5)	91 (92.9)	7 (7.1)	0.011[f]
	22 to 30 years	229 (61.9)	220 (96.1)	9 (3.9)	
	>30years	43 (11.6)	36 (83.7)	7 (16.3)	
Gender	Female	353 (95.4)	332 (94.1)	21 (5.9)	0.286[f]
	Male	17 (4.6)	15 (88.2)	2 (11.8)	
Education	Primary school	43 (11.6)	42 (97.7)	1 (2.3)	0.001[f]
	Secondary school	202 (54.6)	181 (89.6)	21(10.4)	
	Tertiary and above	125 (33.8)	124 (99.2)	1(0.8)	
Marital Status	Single	309 (83.5)	288 (93.2)	21 (6.8)	0.880[f]
	Married	50 (13.5)	48 (96.0)	2 (4.0)	
	Divorced	5 (1.4)	5 (100)	0 (0)	
	Widowed	6 (1.6)	6 (100)	0 (0)	
Monthly income (Myanmar kyats)	≤200000	126 (34.1)	117 (92.9)	9 (7.1)	0.651
	> 200000	224 (65.9)	230 (94.3)	14 (5.7)	
Working hour per day	≤8 hr	145 (39.2)	135 (93.1)	10 (6.9)	0.665[f]
	>8 hr	225 (60.8)	212 (94.2)	13 (5.8)	
Duration of work as sewing operators	≤5 yrs	271 (73.2)	258 (95.2)	13 (4.8)	0.086
	>5 yrs	99 (26.8)	89 (89.9)	10 (10.1)	
Body Mass Index (BMI)	<18.5	112 (30.3)	6 (5.4)	106 (94.6)	0.661[f]
	18.5 to 24.9	228 (61.6)	17 (7.5)	211 (92.5)	
	25.0 to 29.9	23 (6.2)	0	23 (100)	
	>30	7 (1.9)	0	7 (100)	

[f] Fisher exact test

Table 2 presents the percentage of WRMSDs by body region. A total of 347 (93.8%) sewing operators reported pain in at least one part of the body. The most common symptom areas were the upper back (34.3%), neck (27.6%), right shoulder (24.9%), right lower leg (23.8%), and lower back (21.9%).

Table 3 shows the psychosocial risk factors and WRMSDs among the sewing operators. With regard to psychosocial factors assessed according to Karasek's Job-Demand Control Model, 41.4% reported high psychological demand, while 77.0% reported high workplace support. In addition, 75.9% of the respondents had a high score for physical demands, 55.6% had high job control, and 53.8% reported high job insecurity.

For work productivity, there was no significant reported absenteeism score. The presenteeism score was about 33% (average score: 3.3 ± 1.9; minimum–maximum: 0–8), representing low impairment and good productivity. To find the association between work productivity and WRMSDs, the productivity score is categorized into two groups (< 50% and > 50%). There was no significant association between work productivity and WRMSDs.

Table 4 presents the WAI, categorized into four groups. Most of the respondents (55.5%) reported moderate work ability, followed by poor work ability (18.4%). Good work ability was reported for only 12.7%, while only 2.4% reported an excellent ability score. Respondents with poor work ability reported a higher WRMSD percentage (95.6%) than those with moderate work ability (91.9%).

TABLE 2. Work-related musculoskeletal disorders percentage among sewing machine operators (N = 370)

Work-related Musculoskeletal Disorders	Frequency	Percentage
WRMSDs at least one part of body		
Yes	347	93.8
No	23	6.2
WRMSDs by Body Region		
Neck	102	27.6
Shoulder (Right)	92	24.9
Shoulder (Left)	80	21.6
Upper back	127	34.3
Upper arm (Right)	70	18.9
Upper Arm (Left)	56	15.1
Lower back	81	21.9
Forearm (Right)	52	14.1
Forearm (Left)	39	10.5
Wrist (Right)	49	13.2
Wrist (Left)	29	7.8
Hip	68	18.4
Thigh (Right)	68	18.4
Thigh (Left)	49	13.2
Knee (Right)	73	19.7
Knee (Left)	45	12.2
Lower leg (Right)	88	23.8
Lower Leg (Left)	59	15.9
Foot (Right)	66	17.8
Foot (Left)	53	14.3

In addition, there were no reported cases of WRMSDs among those with good work ability. There was no significant association between WRMSDs and work ability (p = 0.166).

TABLE 3. Psychosocial risk factors and WRMSDs (N = 370)

	Total: n (%)	WRMSDs	
		Yes : n(%)	No : n(%)
Psychological job demand			
High	153 (41.4)	140 (91.5)	13(8.5)
Low	217 (58.6)	207 (95.4)	10 (4.6)
Job control			
High	205 (55.4)	191 (93.2)	14 (6.8)
Low	165 (44.6)	156 (94.5)	9 (5.5)
Workplace Social support			
High	285 (77.0)	265 (93.0)	20 (7.0)
Low	85 (23.0)	82 (96.5)	3 (3.5)
Supervisor support			
High	261 (70.5)	245 (93.9)	16 (6.1)
Low	109 (29.5)	102 (93.6)	7 (6.4)
Coworker Support			
High	334 (90.3)	311 (93.1)	23 (6.9)
Low	36 (9.7)	36 (100)	0 (0)
Physical demand			
High	281(75.9)	269(95.7)	12 (4.3)
Low	89 (24.1)	78 (87.6)	11(12.4)
Job insecurity			
High	199 (53.8)	158 (92.4)	13 (7.6)
Low	171 (46.2)	189 (95.0)	10 (5.0)

TABLE 4. Work Ability Index (WAI) of sewing machine operators level (N= 370)

Work Ability Index levels	Total: n (%)	WRMSDs		p-value
		Yes: n (%)	No: n (%)	
Poor (7 – 27)	68(18.4)	65(95.6)	3(4.4)	
Moderate (28 – 36)	246(66.5)	226(91.9)	20 (8.1)	0.116 f
Good (37 – 43)	47(12.7)	47 (100)	0 (0)	
Excellent (44 – 49)	9(2.4)	9 (100)	0 (0)	

f Fisher exact test

TABLE 5. Binary logistic regression analysis of personal factors, psychosocial factors and work ability with WRMSD

Variable	AOR	95% Confident Interval		P-value
		Lower	Upper	
Age	0.216	0.045	1.031	0.055
Gender	0.130	0.020	0.969	0.046*
Education status	0.588	0.133	2.598	0.483
Duration of work	0.543	0.143	2.058	0.369
Physical demand	4.702	1.172	18.862	0.029*
Job insecurity	3.418	0.601	19.425	0.166
Social support	0.637	0.128	3.177	0.582
Job stress	8.257	1.465	46.550	0.017*
Work productivity percentage (≥50%)	5.893	1.393	24.920	0.016*
WAI score	1.820	0.286	11.588	0.526

Remarks: Reference groups are ≤ 30 years of age, female, primary education, ≤8 hrs of work per day, low physical demand, low job security, low social support, low job stress, < 50% work productivity impairment, poor work ability score.

A binary logistic regression was carried out to determine the predictors of WRMSDs with controlling confounders. Table 5 shows the final logistic regression model. The results show significant differences for gender, physical demands, job stress, and work productivity with WRMSDs. Males were 87% less likely to develop WRMSDs than females, with a p-value of

0.046, 95% CI (0.020–0.969). Those reporting high job stress were 8.2 times more likely to develop WRMSDs than those reporting low stress, with a p-value of 0.017, 95% CI (1.456–46.550). In addition, those reporting high physical demands were 4.7 times more likely to develop WRMSDs than those reporting low physical demands, with a p-value of 0.029, 95% CI (1.172–18.562). A similar situation is seen for work productivity: those reporting ≥ 50% productivity impairment were 5.8 times more likely to develop WRMSDs than those reporting < 50% productivity impairment, with a p-value of 0.016, 95% CI (1.393–24.920). Other variables were not significantly associated with WRMSDs in the regression analysis.

IV. DISCUSSION

Sewing machine operators who reported WRMSDs in at least one part of the body accounted for 93.8% of those interviewed. Most commonly, these disorders were located in the upper back (34.3%), neck (27.6%), and right shoulder (24.9%). Most of the sewing operators reported high workplace support and physical demands. For work ability, the sewing operators reported moderate work ability (55.5%). Male operators were more likely to develop WRMSDs. Sewing operators with high job stress, high physical demands, and high productivity impairment were associated with reports of WRMSDs.

WRMSDs have become a major occupational problem in the last decade due to their increased prevalence and negative impact on the performance of workers, as well as their negative impact on the well-being of workers. The 93.8% finding in this study is similar to that for sewing machine operators in Nigeria, where 92% reported WRMSDs[25], but considerably higher than that found in Sri Lanka (around 81%)[26]. In this study, the most common symptom areas were the upper back (34.3%), neck (27.6%), right shoulder (24.9%), right lower leg (23.8%), and lower back (21.9%). The top three pain areas are consistent with the findings among sewing machine operators in the textile manufacturing industry in Botswana and sewing machine operators in Turkey[27, 28]. The results are also consistent with other studies that have highlighted problems in the shoulder and neck regions[29, 30]. A large study of upper-extremity WRMSDs among sewing machine operators in Los Angeles found that 24% reported neck and shoulder musculoskeletal pain, which is consistent with our findings[31]. However, most of the studies also reported that the lower back was one of the most common locations of pain among sewing machine operators, followed by the neck and shoulders[26, 32]. These three body regions—back, neck, and shoulders—are frequently affected because the sewing operation is characterized by a static sitting posture for a long time, a head-and-trunk-forward inclined posture, and relatively uncomfortable ankle and knee angles[33].

There is a significant relationship between age and WRMSDs, with younger age groups reporting more than older age groups. Sewing tasks require physical effort and repetition, and those of a younger age are more suited to the job of sewing operator. Myanmar is still a developing country, and due to the poverty in the country, the young have to work to contribute to their family's income[14, 34]. This finding is in line with other

studies that also reported that WRMSDs are more prevalent among those of a younger age than older[35-37]. Major contributory factors to this high prevalence may be a lack of skills and knowledge, little work experience, and increased workload[37]. In our study, education is another factor related to WRMSDs. Those with a higher educational attainment are more likely to suffer than those with a low education. Kaka et al.[38] found a significant association between low back pain and high educational attainment. Another study conducted in Japan also revealed that ankle pain is associated with high educational attainment[39]. One study suggested that low education was associated with a lower level of active coping skills for musculoskeletal pain events encountered in the workplace[40].

Our study found that 21% reported high-strain jobs and 79% reported non-high-strain jobs. A study of psychological stress in Korean workers using a job-strain model found that 20% reported high strain, close to the figure in this study[41]. In the European Union, between 22% and 28% suffer at least one psychosocial risk factor that may affect mental health[42]. Our finding is in line with the finding of work-organizational and personal factors associated with upper-body musculoskeletal disorders, except for psychological demands[31]. In the final model, our study found that those in jobs with high physical demands are 3.1 times more likely to develop WRMSDs, and most studies have found an association between physical demands and WRMSDs. Increases in physical exertion are more likely to cause WRMSDs than low physical demands[43–45]. Job strain was found to have no association with WRMSDs, which is not consistent with many studies[31, 46]. However, many researchers have claimed that job strain is related to certain parts of the body, such as the back, and not associated with whole-body pain, as shown by a meta-analysis[47].

In our study, the mean work ability score was 34.3, which can be regarded as moderate ability. There is limited research on the work ability of sewing machine operators using WAI scores. However, a comparison can be done with other types of worker. One study achieved a similar finding, with a score of 35[48]. Another study of the WAI among Slovenian hospital nurses also came near, with a mean score of 36[49]. Work ability was not associated with WRMSDs in this study. This finding is consistent with that of a large study of a variety of professionals in the UK, where no significant association was found between self-rated work performance ability and physical health, including musculoskeletal symptoms. Physical factors can be strong predictors of work ability. One possible explanation is that there is a strong relationship between psychological health and physical health, so that musculoskeletal pain indirectly affects work ability through mental well-being[50, 51]. Even so, many studies have reported a significant association between work ability and musculoskeletal disorders[52–54].

Although there is no association between WRMSDs and work productivity, the logistic regression analysis showed that decreased productivity is a strong predictor of WRMSDs. A possible explanation may be the chronic nonspecific musculoskeletal pain (CNMP) experienced by sewing operators. The work nature of sewing operations involves long hours and static work, and heavy pain cannot be endured. Workers may report their musculoskeletal pain as nonspecific.

Some studies have stated that workers can perform well with CNMP in work even though they have presenteeism[55, 56]. Working with pain may be regarded as a healthy coping behavior, which will help stabilize the workers' quality of life and participation in work.

Several limitations to our study should be noted. The data used in this study were collected from a cross-sectional study, and the causality of the associations cannot be elaborated, so that interpretation is limited to associations. Recall bias and response bias could affect the results because the survey relied exclusively on self-administered questionnaires, which can lead to misunderstandings and misleading responses. Other workplace physical factors, such as heat, noise, light, and environmental factors, are not included in the study. The findings may not be representative of male workers because 95.4% of respondents were female. Moreover, the focus only on sewing machine operators means that the study cannot represent the whole garment factory and limits it generalizability.

V. STUDY IMPLICATIONS

Since WRMSDs are common among sewing machine operators, the prevention of WRMSDs in these workers is important. This study revealed different levels of evidence in supporting significant associations between some physical or psychosocial factors and WRMSDs in sewing operators, such as job stress and high physical demands. Some important steps should be taken to effectively utilize resources to prevent WRMSDs. First, future studies should provide real-time measurements of physical or mental stress and physical workloads in order to develop proactive preventive measures and minimize physical or psychosocial risk factors, thereby reducing the incidence/prevalence of WRMSDs. Second, working hours should be regulated by the relevant authorities. Third, this study used self-administered questionnaires and may have featured some bias. Therefore, other studies should be conducted with different interview types to reduce bias. Longitudinal studies should also be carried out to address the cause-and-effect relationships of WRMSDs among sewing machine operators.

VI. RECOMMENDATIONS

The findings of the study can help government and other related social welfare organizations to promote the well-being of workers physically, mentally, and socially, and can help in the development of occupational health law, which is still underdeveloped in Myanmar. Moreover, sustainable actions are needed to address the overall issue of workers' health.

VII. CONCLUSION

This study found that 93.8% of sewing machine operators experienced WRMSDs. The prevalence rate is far higher than that reported in other studies. Moreover, WRMSDs were associated with age, education, and physical demands. In the regression analysis, gender, job stress, physical demands, and work productivity were significant predictors of WRMSDs, with a high OR; other factors were not significantly related.

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