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Abstract

The Relationship between Musculoskeletal Symptoms and Job Stress & Intensity of Labor among Shipbuilding Workers

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Objectives: This study aimed to reveal the multiple factors that are related to the work-related musculoskeletal disorders (WMSDs) of shipbuilding workers, and to elucidate the relationship between musculoskeletal symptoms and factors such as the change of working conditions, job stress and physical workload.

Methods: The study sample comprised 1,059 shipbuilding workers. A structured-questionnaire was used to assess the general characteristics, job stress, psychosocial well-being index (PWI), physical workload, change of working conditions and information concerning musculoskeletal symptoms. We estimated the relations of job stress, physical workload and intensity of labour to musculoskeletal symptoms using univariate and multiple logistic regression analyses.

Results: The symptom prevalence of musculoskeletal disorders in any part of the body was 89.5% by ' criteria 1 ' in the order of back (58.6%) and shoulder (56.3%). After adjustment for sociodemographic factors, posture factor (Odds ratio [OR]=1.06, 95% confidence interval [CI]=1.00 ~ 1.12), non-posture factor (OR=1.17, CI=1.05 ~ 1.31), Borg scale (OR=1.15, CI=1.00 ~ 1.32), relative work intensity increase (OR=1.92, CI=1.08 ~ 3.41), labor flexibility increase (OR=2.04, CI=1.04 ~ 4.01), high job demand (OR=2.68, CI=1.48 ~ 4.88), and high risk stress group (OR=13.50, CI=3.15 ~ 57.97) were all found to be significantly associated

with musculoskeletal disorders.

Conclusion: These results suggest that WMSDs have multiple risk factors such as stress, physical workload and change of working conditions. High job demand, increased relative intensification of work and increased flexibility, especially such as subcontract, outsourcing and importing of contingent work, were very important factors associated with increasing WMSDs.

Key Words: Musculoskeletal symptom, Job stress, Work organization, Intensity of labor, Shipbuilding

(Huang , 2002).
 (2003)
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 가
 가가
 NIOSH , , 5가
 가
 (Bernard, 1997). 1999; Sjogaard , 2000; Ariens , 2001).
 가 1998
 (Douillet , 2002)
 Bongers
 1.
 (Bongers , 1993, 2002;
 Bernard, 1997) 1,817
 (Ariens , 2001). 1,135
 1998 54
 22 1,059 (58.3%)
 가
 2.
 가

2.

1,059 30 ~ 39 가

641 (60.9%) 가

757 (73.5%)

가 596 (57.2%),

577 (55.1%),

가 584 (56.1%) 가

가 751 (74.4%)

95%

SAS ver 8.01

918 (89.0%)

639 (62.5%)

1.

가

(Table 1).

7.6 (SD=3.41)

1

가 948 (89.5%)

479

(85.0%)

(45.2%), 596 (56.3%),

337

51.1

(31.8%), 가 451 (42.6%),

(SD=6.01)

2.3 (SD=1.26)

620 (58.6%), 496 (46.8%)

()

가 2

546 (51.6%)

3.

299 (28.2%), 276 (26.1%),

236 (22.3%), 186 (17.6%),

가 183 (17.3%), 140

가 (66.6%)

(43.5%)

(13.2%) (Fig. 1).

2

(46.3%)

(61.3%)

가 (63.0%)

(47.0%)

340

가

가 (59.2%)

가

146

(50.3%)

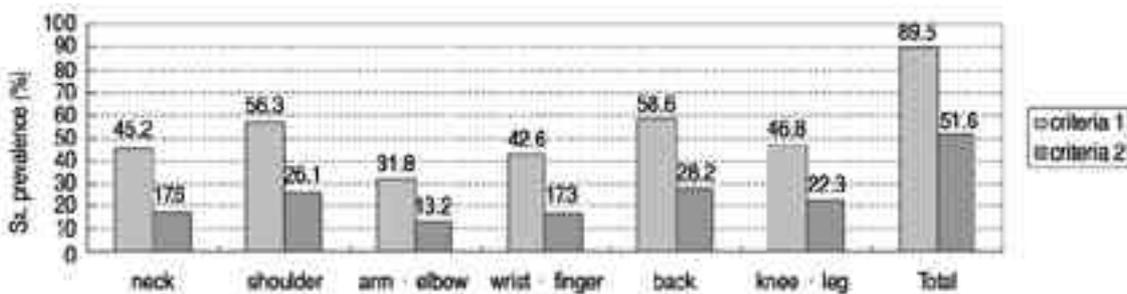


Fig. 1. Symptom prevalence of work-related musculoskeletal symptom.

가
1.55
(CI=1.08 ~ 2.24),
~ 3.28),
(Table 2).

가
2.20(CI=1.48
; 3.88(CI=2.68 ~ 5.61)

4.

Table 1. The relationship between work-related musculoskeletal symptom and sociodemographic factors (N=1,059)

		Criteria 2 [†]		Total
		Negative (%) n=513	Positive (%) n=546	
Age(years)*	<30	92 (56.1)	72 (43.9)	164 (15.6)
	30 ~ 39	308 (48.1)	333 (52.0)	641 (60.9)
	40	108 (43.7)	139 (56.3)	247 (23.5)
BMI	<20	29 (42.0)	40 (58.0)	69 (6.7)
	20 ~ 24	373 (49.3)	384 (50.7)	757 (73.5)
	25	90 (44.1)	114 (55.9)	204 (19.8)
Smoking	yes	291 (48.8)	305 (51.2)	596 (57.2)
	ex-smoker	102 (46.1)	119 (53.9)	221 (21.2)
	never	111 (49.3)	114 (50.7)	225 (21.6)
Drinking	yes	184 (48.0)	199 (52.0)	383 (36.6)
	ex-drinker	285 (49.4)	292 (50.6)	577 (55.1)
	never	38 (43.2)	50 (56.8)	88 (8.4)
Exercise*	regular	77 (52.4)	70 (47.6)	147 (14.1)
	irregular	258 (44.2)	326 (55.8)	584 (56.1)
	never	168 (54.2)	142 (45.8)	310 (29.8)
Marital status	never or divorced	142 (55.0)	116 (45.0)	258 (25.6)
	currently	349 (46.5)	402 (53.5)	751 (74.4)
Education*	junior school	38 (33.6)	75 (66.4)	113 (11.0)
	high school	466 (50.8)	452 (49.2)	918 (89.0)
Tenure(years)*	<5	92 (61.7)	57 (38.3)	149 (14.8)
	5 ~ 9	333 (46.1)	390 (53.9)	723 (71.7)
	10	59 (43.4)	77 (56.6)	136 (13.5)
Grade	forehead	194 (50.5)	190 (49.5)	384 (37.5)
	employee	309 (48.4)	330 (51.6)	639 (62.5)

*; p-value <0.05 by ²-test or ² for trend test

[†]criteria 2; criteria 1 (lasted more than one week or occurred at least once a month within the past year) and symptom severity more than ' moderate '

27.3%
 37.6%,
 (Table 3). 66.7% 가
 (p<0.0001).
 5. 52.0%가
 (Table 5).
 12 (p<0.0001) 7. 가
 (Table 4).
 6. (, , , ,)

Table 2. The relationship between work-related musculoskeletal symptom and job strain

		Criteria 2 [†]		Total
		Negative (%) n=513	Positive (%) n=546	
Job demand*	low	287 (56.5)	221 (43.5)	508 (53.9)
	high	145 (33.4)	289 (66.6)	434 (46.1)
Job control*	low	185 (38.9)	291 (61.1)	476 (52.3)
	high	233 (53.7)	201 (46.3)	434 (47.7)
Social support				
supervisor*	low	149 (37.0)	254 (63.0)	403 (44.5)
	high	266 (53.0)	236 (47.0)	502 (55.5)
colleague	low	204 (45.1)	248 (54.9)	452 (48.5)
	high	226 (47.0)	255 (53.0)	481 (51.6)
total*	low	158 (40.8)	229 (59.2)	387 (43.7)
	high	248 (49.7)	251 (50.3)	499 (56.3)
Job strain model*				OR [‡] (95%CI [§])
	low strain	160 (61.1)	102 (38.9)	1.00
	passive	107 (50.2)	106 (49.8)	1.55 (1.08-2.24)
	active	67 (41.6)	94 (58.4)	2.20 (1.48-3.28)
	high strain	72 (28.8)	178 (71.2)	3.88 (2.68-5.61)

*; p<0.0001 analyzed by ²-test

[†]criteria 2 ; criteria 1 (lasted more than one week or occurred at least once a month within the past year) and symptom severity more than ' moderate '

[‡]OR ; odds ratio by logistic regression

[§]CI ; confidence interval

가 가

Borg Scale(OR=1.15, CI=1.00 ~ 1.32) 1

가 가 가

1 가(OR=1.92, CI=1.08 ~ 3.41) 가

(OR=1.06, CI=1.00 ~ 1.12) (OR=2.04, CI=1.04 ~ 4.01)가

(OR=1.17, CI=1.05 ~ 1.31) 1

Table 3. The relationship between work-related musculoskeletal symptom and intensity of labor

		Criteria 2 [†]		p-value*
		Negative n=513 (Mean ± SD)	Positive n=546 (Mean ± SD)	
AWI [‡]	daily work time	3.20 ± 0.76	3.41 ± 0.86	<.0001
	resting time for working	3.08 ± 0.53	3.14 ± 0.61	0.0659
	reserve time for working	3.08 ± 0.57	3.22 ± 0.70	0.0007
	sleeping and resting time	3.03 ± 0.61	3.10 ± 0.68	0.0866
	holiday per a month	2.93 ± 0.68	2.97 ± 0.70	0.3324
	overtime work/special duty	2.76 ± 0.87	2.85 ± 0.89	0.1134
	total	18.08 ± 2.22	18.69 ± 2.52	<.0001
RWI [§]	speed of work	3.43 ± 0.68	3.56 ± 0.85	0.011
	amount of work for unit time	3.47 ± 0.71	3.64 ± 0.84	0.001
	number of charged machine	3.17 ± 0.52	3.12 ± 0.50	0.210
	number of task	3.27 ± 0.61	3.28 ± 0.65	0.741
	change of manpower	3.07 ± 0.75	3.15 ± 0.86	0.112
	shift work	3.03 ± 0.33	3.01 ± 0.35	0.567
	automation	3.11 ± 0.44	3.09 ± 0.44	0.339
	new task	3.21 ± 0.49	3.24 ± 0.54	0.371
total	25.73 ± 2.50	26.10 ± 2.52	0.132	
LF	subcontract/outside order	3.21 ± 0.55	3.33 ± 0.59	0.003
	irregular worker	3.19 ± 0.60	3.35 ± 0.75	0.000
	dispatched work	3.06 ± 0.36	3.05 ± 0.32	0.900
	basic wage/pay for welfare	2.87 ± 0.46	2.85 ± 0.53	0.513
	incentive wages	3.07 ± 0.45	3.03 ± 0.49	0.197
total	15.39 ± 1.46	15.56 ± 1.32	0.062	
Total	59.50 ± 4.20	60.10 ± 4.73	0.078	

* ; p-value by t-test

[†]criteria 2 ; criteria 1 (lasted more than one week or occurred at least once a month within the past year) and symptom severity more than ' moderate '

[‡]AWI ; absolute work intensity increase

[§]RWI ; relative work intensity increase

LF; labor flexibility increase

(OR=2.68, CI=1.48 ~ 4.88)가

가

2

(OR=1.09, CI=1.04 ~ 1.13)

가 13.50 (CI=3.15 ~ 57.97)

(OR=1.20, CI=1.13 ~ 1.28)

Table 4. The relationship between work-related musculoskeletal symptom and physical workload

		Criteria 2*	
		Negative n=513 (Mean ± SD)	Positive n=546 (Mean ± SD)
Posture factors	hands above shoulder level [†]	2.58 ± 1.26	3.14 ± 1.30
	trunk bent [†]	3.59 ± 1.11	4.12 ± 1.01
	awkward posture [†]	3.14 ± 1.13	3.72 ± 1.11
	sitting work posture [†]	3.26 ± 1.29	3.71 ± 1.19
	repetitive movement [†]	3.89 ± 1.13	4.39 ± 0.91
	static posture [†]	2.93 ± 1.25	3.32 ± 1.26
	total load 1 [†]	19.38 ± 4.90	22.41 ± 4.50
Non-posture factors	general work form [†]	2.89 ± 1.16	3.56 ± 1.10
	heavy work [†]	2.43 ± 1.23	2.88 ± 1.25
	finished quickly [†]	3.64 ± 0.85	3.93 ± 0.83
	tiredness after work [†]	3.65 ± 0.81	4.27 ± 0.80
	sweating after work [†]	3.30 ± 0.98	3.72 ± 0.96
	total load 2 [†]	15.96 ± 3.29	18.47 ± 3.31
Total [†]	35.50 ± 6.86	40.94 ± 6.68	
Work hardening (Borg scale) [†]	12.32 ± 2.60	14.03 ± 2.93	

* criteria 2 ; criteria 1 (lasted more than one week or occurred at least once a month within the past year) and symptom severity more than ' moderate '

[†]; p<0.0001 analyzed by t-test

Table 5. The relationship between work-related musculoskeletal symptom and psychosocial well-being index

		Criteria 2 [†]		
		Negative n=513	Positive n=546	Total
PWI* [†]	healthy	8 (72.7)	3 (27.3)	11 (1.2)
	potential risk	266 (62.4)	160 (37.6)	426 (46.8)
	high risk	158 (33.3)	316 (66.7)	474 (52.0)

* PWI ; psychosocial well-being index

[†]; p<0.0001 analyzed by ²-test for trend

[‡]criteria 2; criteria 1 (lasted more than one week or occurred at least once a month within the past year) and symptom severity more than ' moderate '

가 1
가 Borg scale 2
(Table 6).
(OR=1.34, CI=0.95~1.88)
가 (OR=2.29, 89.5% 가 1
CI=1.67~3.14) 가 (OR=0.61, 2 51.6% 340
CI=0.44~0.84) 2 146
1 가

Table 6. The association of work-related musculoskeletal symptom and job stress & intensity of labor

			Criteria 1*	Criteria 2 [†]
			Adjusted OR [‡] (95%CI)	Adjusted OR [‡] (95%CI)
Physical workload [§]	posture factor		1.06 (1.00-1.12)	1.09 (1.04-1.13)
	non-posture factor		1.17 (1.05-1.31)	1.20 (1.13-1.28)
	work hardening (Borg scale)		1.15 (1.00-1.32)	1.02 (0.94-1.10)
Intensity of labor	AWI	no	1.00	1.00
		yes	1.23 (0.65-2.34)	1.15 (0.81-1.62)
	RWI [¶]	no	1.00	1.00
		yes	1.92 (1.08-3.41)	0.92 (0.65-1.30)
	LF ^{**}	no	1.00	1.00
		yes	2.04 (1.04-4.01)	1.34 (0.95-1.88)
Job stress	job demand	low	1.00	1.00
		high	2.68 (1.48-4.88)	2.29 (1.67-3.14)
	job control	low	1.00	1.00
		high	0.77 (0.44-1.32)	0.61 (0.44-0.84)
	social support	low	1.00	1.00
		high	0.78 (0.44-1.36)	0.73 (0.53-1.01)
Psychosocial well-being index	healthy		1.00	1.00
	potential risk		4.77 (1.15-19.74)	4.72 (0.56-40.00)
	high risk		13.50 (3.15-57.97)	15.87 (1.87-134.46)

* criteria 1 ; lasted more than one week or occurred at least once a month within the past year

[†] criteria 2 ; criteria 1 (lasted more than one week or occurred at least once a month within the past year) and symptom severity more than 'moderate'

[‡]; odds ratio adjusted by age, exercise, marital status, education, tenure analysed by multiple logistic regression

[§]; odds ratio according to increase of one score

AWI ; absolute work intensity increase

[¶]RWI ; relative work intensity increase

** LF ; labor flexibility increase

(2003) (2003) , 가가

77.2% 88.0%

가 가 가 가 가 1
1.92(CI=1.08 ~ 3.41) 2.04(CI=1.04 ~ 4.01)

가 2 1 2가

1,817 58.3% 가
1,059 가

가 가 가가

가 가 가 (Douillet Schweitzer, 2002).
(just-in-time),

(densification of work)

(OR=3.88, CI=2.68 ~ 5.61) 가 4 가가 (Paoli Miellie, 2000).

가 (Bongers , 1993, 2000; (organizational downsizing),
Ariens , 2001; , 1998) 가 (reengineering), (lean)
(overtime work), (contingent or
temporary work),
(machine-paced work),
(overload)

(Job Content Questionnaire)

(Myers , 1999; Huang 2002)

(Sauter , 2002; Landsbergis, 2003; Huang , 2003)

가

가

가 가

가 (Hoogendoorn , 가

2000; Ariens , 2001) 97
(1997)

가 . 99 가

7,139 가 99 10 2,765

. 2 1 1 1

가
2,031
2,307
734 3,043 2,309

가
가 2003 2 276
8
89.5% (58.6%),
(56.3%)

(2003)

: 1
(OR=1.06, CI=1.00~1.12),
(OR=1.17, CI=1.05~1.31), Borg scale
(OR=1.15, CI=1.00
~1.32), 가 가 (OR=1.92,
CI=1.08~3.41), 가 (OR=2.04, CI=1.
04~4.01),
~4.88), (OR=13.50, CI=3.15~
57.59) 가

가

가

가

2003;36(1):71-6.

가

31

2003.

1996. pp 72-84.

2003;15(4):401-10.

2003;15(4):373-87.

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2003;15(4):388-400.

1,059

- . 2000. pp 92-143.
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1998;10(4):463-75.
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