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## **Risk factors of sociodemographic and work environment that related to musculoskeletal symptoms among SME workers in Vietnam**

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**Abstract**---According the limited resources and capacity, SMEs are more prone to occupational hazards and risk. This research aimed to determine the socio-demographic and work environment risk factors related to musculoskeletal symptoms among SME workers in Vietnam, especially in the food processing and garment industries. The respondents were 530 SME workers (281 from the garment industry; 249 from the food processing industry). The instruments used were a self-devised questionnaires including lifestyle and work environment factors. The Standardized Nordic Questionnaire (SNQ)

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used to see the musculo-skeletal symptoms. The results showed 45.1% of respondents had chronic MSDs, and 40.2% had experienced acute MSDs. The socio-demographic factors, such as work status, shifts and trip duration to the workplace, significantly influenced the chronic and acute musculo-skeletal symptoms. The symptoms were also induced by work environment factors, especially noise, lighting, heat and humidity, handling loads more than 20 kg, mostly sitting on the floor or mostly standing while working and slippery floors in the workplace. It is crucial to improve the work environment and comply with the standard even SME industries, as well. Moreover, the work posture and load for manual handling need a correction to reduce musculo-skeletal symptoms.

**Keywords**---SME, musculoskeletal symptoms, socio-demographic, work environment.

## **Introduction**

Workers' health, safety, and wellbeing are vital for the working population. These issues are essential and affect the productivity, competitiveness, and sustainability of enterprises and communities, while at the same time, affecting the national, regional and international economies (1). Some of the major occupational morbidities are silicosis, musculo-skeletal injuries, chronic obstructive lung diseases, asbestosis, byssinosis, pesticide poisoning, and noise-induced hearing loss. Such medical conditions are universal in Asian countries, such as Vietnam, Thailand, Indonesia, and Malaysia.

The report of the Association of Southeast Asian Nations (ASEAN) Economic Community on 2015 stated 95% of enterprises ASEAN countries categorized as SME (Small Medium Enterprise). The SME providing 50-95% of working opportunities for the citizens (2). The SME were importance to increase the economic growth and development for the ASEAN nations. However, the current policies and implementation of occupational health among developing countries are still lacking an effort of protecting SME workers

According to an economic census conducted in 2017 by the General Statistics Office (GSO) of Vietnam (3), there were 517 900 companies operating in Vietnam this year. This number showed significant growth, representing as much as 51.6% growth compared with the previous economic census in 2012. Among these companies, only 1.9% (around 10 100) were large enterprises; the rest were small and medium-sized enterprises (SMEs), which accounted for around 507 860 (98.1%) companies. Among these, there were 8500 medium-sized (representing 23.6% growth since 2012), 114 100 small (21.2% growth since 2012) and 385 300 micro-enterprises (65.5% growth since 2012). As a result of the growth of SMEs, the number of employees has significantly increased, representing as much as a 4.1% rise.

Vietnam is a developing country, with 97% of the companies operating in the country comprising SMEs. The SMEs in Vietnam absorb 77% of the total

workforce. In October 2016, it was reported that 590 000 SMEs were actively operating, with 68% micro-enterprises, 30% small firms and only 2% medium-sized companies. These SMEs were dominated by the retail industries and looked like a workshop. The other industries were mainly manufacturing and construction (4). However, due to their limited resources and technical capacity, SMEs are more prone to occupational hazards and risks than large enterprises are. This is exacerbated because occupational health services in the country only have 20% coverage (5,6).

Vietnam has a serious issue with musculo-skeletal disorders (MSDs) (7–9). In 2007–2017, the prevalence of this disability was mainly related to low back pain (7). MSDs in Vietnam have been investigated in many industry sectors. For instance, in the seafood industry, it was found that 80% of the women workers experienced MSD symptoms, especially in the hip, neck and shoulder (8). Another study found that 74.7% of nurses in Vietnam also experienced MSD symptoms, mainly in the lower back and neck (9).

Health in the workplace needs to be addressed, especially in SMEs' factories, in which the working environment is uncondusive to the workers' health. This condition affects the workers' mental and physical health, and ultimately, their overall quality of life. Moreover, a poor working environment and MSDs have been associated with decreased work ability (10), and they will also decrease productivity. Hence, maintaining a healthy working environment for the worker is deemed necessary to prevent employees from sustaining musculo-skeletal injuries. This study aims to identify the socio-demographic and work environment risk factors related to musculo-skeletal symptoms among SME workers, especially in the food processing and garment industries in Vietnam.

## **Methods**

Based on a sample size formula and with a prevalence rate of depression of 18.8% among shoe factory workers (11) an estimated sample size of about 500 factory workers, divided 250 from small enterprises which number of employee is less than 50 persons, and 250 from medium-sized enterprises which number of employee is 50 – 200 persons. To overcome the potential problem of incomplete data or information, the researcher added 10% to the total sample. Thus, the response rate is 96% from 550 respondents and after the researcher completed the data-cleaning process, the sample comprised 530 completed questionnaires, which included 281 respondents from the garment industry and 249 respondents from the food processing industry. In addition, the enumerators were trained for one-to-one interviews prior to the fieldwork. A self-devised socio-demographic questionnaire including lifestyle questions and occupational health and safety-related questions was developed based on the literature review. MSD symptoms were measured using the Standardized Nordic Questionnaire (, which asks about acute symptoms (during the last 7 days) and chronic symptoms (during the last 12 months). Various validated standardized questionnaires were utilized and administered on a one-to-one basis (12).

## Results

The results of the study showed the majority of respondents was female (85.3%), graduated from junior high school (44.5%), and married (57%). The characters of work, it found 51.9% as permanent workers, 58.9% had shift work, the average of working hours was 8.2 (SD:0.9) hours/day, and the average of duration work was 9,9 (SD:3.2) years. From 530 respondents, it revealed 239 (45.1%) had chronic MSDs and 213 (40.2%) had experienced acute MSDs (see detail on Table 1).

Most chronic and acute musculo-skeletal complaints were experienced in the shoulder, as reported by 91 (17.2%) and 72 (13.6%) respondents, respectively. Chronic musculo-skeletal complaints were least experienced in the thighs (26 respondents; 4.9%), while acute musculo-skeletal complaints were least experienced in the calves (24 respondents; 4.5%).

Table 1. Socio Demographic of Respondents

<b>Socio-Demographic Variables</b>	<b>n</b>	<b>%</b>
<b>Sex</b>		
Male	78	14.7
Female	452	85.3
<b>Education</b>		
No school	15	2.8
Elementary school	134	25.2
Junior High School	236	44.5
Senior High School	116	21.9
University	29	5.6
<b>Marital Status</b>		
Single	214	40.4
Married	302	57
Widow	14	2.6
<b>Type of Product</b>		
Food	249	47.2
Garment	281	52.8
<b>Employee Status</b>		
Permanent	275	51.9
Non permanent	255	48.1
<b>Shift Work</b>		
Yes	312	58.9
No	218	41.1
<b>Smoking</b>		
Yes	36	6.8
No	494	93.2
<b>Alcohol Consumption</b>		
Yes	120	22.6
No	410	77.4
<b>Physical Exercise</b>		

Yes	284	53.6
No	246	46.4
<b>Sleep hours/ day</b>		
< 8 hours	153	28.9
8 hours	305	57.5
> 8 hours	72	13.6
<b>Chronic MSDs</b>		
Yes	239	45.1
No	291	54.9
<b>Acute MSDs</b>		
Yes	213	40.2
No	317	59.8
Age, mean (SD) years old	30.31 (8.9)	
Working hours/day, mean (SD)	8.21 (0.9)	
Employment duration. Mean (SD) years	9.9 (3.2)	
Overtime hour/day, mean (SD)	3.36 (5.6)	
Duration of transport to work, mean (SD) minutes	17.64 (10.7)	
Monthly income, mean (SD) 1000VDR	67.15 (44.04)	

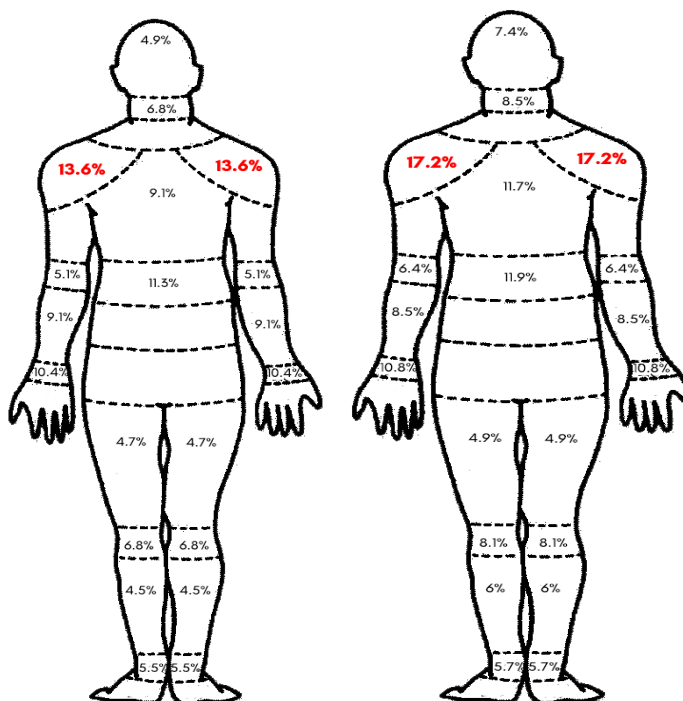


Figure 1. Distribution of MSD Symptoms in body map, chronic symptoms (left) and acute symptoms (right)

The results of environmental condition from table 2, it showed some SME conditions frequently had noise (10.1%), glare (2.1%), lack of lighting (2.1%), hot and humid (11.4%), and cold temperature (3.6%). The work activities in food and garment industries found manual handling task with load more than 20 kg frequently about 7.1%, repeatedly use hand and finger in unnatural postures (50.2%), repeatedly bend and twist body (19.1%), sit or stand on an engine that vibrates (2.4%), Use tools that have vibration (4.5%), mostly sitting on the chair without body movement (40.6%), and mostly standing posture (23.2%). There were also found some bad posture, such as sitting on the floor and squatting. Then, environmental condition data was used for bivariate analysis which categorized into 2 groups, there were "Yes" and "No" categorized that the frequent and seldom data include on "Yes" categorized.

Table 2. Environmental condition

<b>Variables</b>	<b>n</b>	<b>%</b>
<b>Noise (disturb communication)</b>		
Frequent	54	10.1
Seldom	114	21.3
No	366	68.5
<b>Glare/ Lighting</b>		
Frequent	11	2.1
Seldom	20	3.7
No	503	94.2
<b>Lack of Lighting</b>		
Frequent	11	2.1
Seldom	34	6.4
No	489	91.6
<b>Hot and Humid</b>		
Frequent	61	11.4
Seldom	65	12.2
No	408	76.4
<b>Cold Temperature</b>		
Frequent	19	3.6
Seldom	44	8.2
No	471	88.2
<b>Manual Handling (Load &gt; 20kg)</b>		
Frequent	38	7.1
Seldom	52	9.7
No	444	83.1
<b>Repeatedly use hand and finger in unnatural postures</b>		
Frequent	268	50.2
Seldom	71	13.3
No	195	36.5
<b>Repeatedly bend and twist body</b>		
Frequent	102	19.1
Seldom	103	19.3

No	329	61.6
<b>Use tools that have vibration</b>		
Frequent	24	4.5
Seldom	37	6.9
No	473	88.6
<b>Sit or stand on an engine that vibrates</b>		
Frequent	13	2.4
Seldom	11	2.1
No	510	95.5
<b>Mostly sitting on the chair without body movement</b>		
Frequent	217	40.6
Seldom	36	6.7
No	281	52.6
<b>Mostly sitting on the floor without body movement</b>		
Frequent	7	1.3
Seldom	22	4.1
No	505	94.6
<b>Mostly squatting posture</b>		
Frequent	13	2.4
Seldom	30	5.6
No	491	91.9
<b>Mostly standing posture</b>		
Frequent	124	23.2
Seldom	80	15
No	330	61.8
<b>The slippery floor that can cause falling</b>		
Frequent	16	3
Seldom	40	7.5
No	478	89.5
<b>Having the possibility of objects falling</b>		
Frequent	4	0.7
Seldom	16	3
No	514	96.3

Based on the analysis results, the association of chronic musculo-skeletal complaints with socio-demographic factors was significantly influenced by work status, shifts and duration to reach the workplace; the association of chronic musculo-skeletal complaints with work environment factors was significantly affected by noise, heat and humidity, lifting items heavier than 20 kg, sitting on the floor, standing while working and slippery floors in the workspace. Other factors, such as gender, duration of education, monthly income, smoking habits, duration of smoking, alcohol consumption, exercise habits, glare, lack of light, cold temperatures, often using fingers in unusual postures, using vibrating devices, sitting or standing on vibration, sitting on a chair without displacement, squatting during work, and having the possibility of falling objects did not significantly affect acute musculo-skeletal complaints (see table 3).

Table 3. Tabel Correlation of Risk Factors with Musculoskeletal Symptoms

Risk Factors	Chronic MSDs				OR (95%CI)	Acute MSDs				OR (95%CI)
	Yes		No			Yes		No		
	n	%	n	%		n	%	n	%	
<b>Sociodemography</b>										
<b>Sex</b>										
Men	28	35.9	50	64.1	0.64 (0.389-1.053)	26	33.3	52	66.7	0.709 (0.427-1.176)
Women	211	46.7	24	53.3		18	41.4	26	58.6	
<b>Duration of education</b>										
< 9 years	61	40.9	88	59.1	0.791 (0.539-1.160)	52	34.9	97	65.1	0.733 (0.494-1.086)
≥ 9 years	178	46.7	20	53.3		16	42.3	22	57.7	
<b>Employment status</b>										
Permanent	161	58.5	11	41.5	<b>3.205*</b> <b>(2.239-4.587)</b>	15	56.4	12	43.6	<b>4.387*</b> <b>(3.008-6.4)</b>
Non-Permanent	78	30.6	17	69.4		58	22.7	19	77.3	
<b>Shift Work</b>										
Yes	162	51.9	15	48.1	<b>1.978*</b> <b>(1.386-2.822)</b>	13	44.2	17	55.8	<b>1.512*</b> <b>(1.057-2.163)</b>
No	77	35.3	14	64.7		75	34.4	14	65.6	
<b>Monthly income (in thousand VDR)</b>										
< means (<67.15)	8	36.4	14	63.6	0.685 (0.283-1.662)	9	40.9	13	59.1	1.032 (0.433-2.458)
≥ means (≥ 67.15)	231	45.5	27	54.5		20	40.2	30	59.8	
<b>Smoking</b>										
Yes	16	44.4	20	55.6	1.029 (0.521-2.032)	19	39.9	29	60.1	0.829 (0.419-1.639)
No	223	45.1	27	54.9		16	44.4	20	55.6	
<b>Duration of smoking (years)</b>										
< means (<7.14)	61	40.9	88	59.1	0.791 (0.539-1.16)	8	30.8	18	69.2	0.111 (0.019-0.645)
≥ means (≥7.14)	178	46.7	20	53.3		8	80.0	2	20.0	
<b>Alcohol consumption</b>										
Yes	60	50.0	60	50.0	1.291 (0.858-1.94)	48	40.0	72	60.0	0.99 (0.654-1.499)
No	179	43.7	23	56.3		16	40.2	24	59.8	
<b>Exercise</b>										
Yes	122	43.0	16	57.0	0.83 (0.589-1.17)	10	38.0	17	62.0	0.824 (0.582-1.167)



No	117	47. 6	12 9	52.4		10 5	42.7	14 1	57. 3	
<b>Duration of transport to work (minutes)</b>					<b>2.104*</b> <b>(1.478-</b> <b>2.995)</b>					<b>2.719*</b> <b>(1.882-</b> <b>3.927)</b>
< means (<17.64 min)	158	53. 0	14 0	47.0		15 0	50.3	14 8	49. 7	
≥ means (≥17.64 min)	81	34. 9	15 1	65.1		63	27.2	16 9	72. 8	
<b>Work environmental</b>										
<b>Noise</b>					<b>1.537*</b> <b>(1.064-</b> <b>2.221)</b>					1.134 (0.782- 1.645)
Yes	88	52. 4	80	47.6		71	42.3	97	57. 7	
No	151	41. 7	21 1	58.3		14 2	39.2	22 0	60. 8	
<b>Glare</b>					1.894 (0.893- 4.015)					<b>2.346*</b> <b>(1.106-</b> <b>4.978)</b>
Yes	18	60. 0	12	40.0		18	60.0	12	40. 0	
No	221	44. 2	27 9	55.8		19 5	39.0	30 5	61. 0	
<b>Lack of Lighting</b>					1.747 (0.942- 3.242)					1.472 (0.798- 2.716)
Yes	26	57. 8	19	42.2		22	48.9	23	51. 1	
No	213	43. 9	27 2	56.1		19 1	39.4	29 4	60. 6	
<b>Hot and Humid</b>					<b>2.878*</b> <b>(1.895-</b> <b>4.371)</b>					<b>2.544*</b> <b>(1.689-</b> <b>3.830)</b>
Yes	81	64. 8	44	35.2		72	57.6	53	42. 4	
No	158	39. 0	24 7	61.0		14 1	34.8	26 4	65. 2	
<b>Cold Temperature</b>					1.345 (0.791- 2.286)					1.170 (0.685- 1.997)
Yes	32	51. 6	30	48.4		27	43.5	35	56. 5	
No	207	44. 2	26 1	55.8		18 6	39.7	28 2	60. 3	
<b>Manual Handling (load &gt;20kg)</b>					<b>1.660*</b> <b>(1.052-</b> <b>2.621)</b>					<b>1.709*</b> <b>(1.083-</b> <b>2.696)</b>
Yes	50	55. 6	40	44.4		46	51.1	44	48. 9	
No	189	43. 0	25 1	57.0		16 7	38.0	27 3	62. 0	
<b>Repeatedly use fingers and hands in unnatural postures</b>					0.937 (0.657- 1.337)					1.019 (0.710- 1.463)
Yes	150	44. 5	18 7	55.5		13 6	40.4	20 1	59. 6	
No	89	46. 1	10 4	53.9		77	39.9	11 6	60. 1	
<b>Repeatedly bend and twist body</b>					1.38 (0.971- 1.961)					1.069 (0.748- 1.527)
Yes	102	50. 0	10 2	50.0		84	41.2	12 0	58. 8	
No	137	42. 0	18 9	58.0		12 9	39.6	19 7	60. 4	

<b>Use tools that have vibration</b>					1.346 (0.786- 2.306)					1.157 (0.672- 1.992)
Yes	31	51. 7	29	48.3		26	43.3	34	56. 7	
No	208	44. 3	26 2	55.7		18 7	39.8	28 3	60. 2	
<b>Sit or stand on an engine that vibrates</b>					0.519 (0.210- 2.282)					0.639 (0.258- 1.581)
Yes	7	30. 4	16	69.6		7	30.4	16	69. 6	
No	232	45. 8	27 5	54.2		20 6	40.6	30 1	59. 4	
<b>Mostly sitting on the chair without body movement</b>					1.215 (0.862- 1.711)					1.358 (0.959- 1.924)
Yes	120	47. 6	13 2	52.4		11 1	44.0	14 1	56. 0	
No	119	42. 8	15 9	57.2		10 2	36.7	17 6	63. 3	
<b>Mostly sitting on the floor without body movement</b>					<b>2.427*</b> <b>(1.106- 5.325)</b>					<b>2.568*</b> <b>(1.187- 5.553)</b>
Yes	19	65. 5	10	34.5		18	62.1	11	37. 9	
No	220	43. 9	28 1	56.1		19 5	38.9	30 6	61. 1	
<b>Mostly squatting posture</b>					1.443 (0.772- 2.696)					<b>1.992*</b> <b>(1.062- 3.735)</b>
Yes	23	53. 5	20	46.5		24	55.8	19	44. 2	
No	216	44. 4	27 1	55.6		18 9	38.8	29 8	61. 2	
<b>Mostly standing posture</b>					<b>1.425*</b> <b>(1.002- 2.026)</b>					1.392 (0.975- 1.986)
Yes	103	50. 5	10 1	49.5		92	45.1	11 2	54. 9	
No	136	41. 7	19 0	58.3		12 1	37.1	20 5	62. 9	
<b>The slippery floor that can cause falling</b>					<b>2.622*</b> <b>(1.465- 4.694)</b>					<b>2.772*</b> <b>(1.564- 4.911)</b>
Yes	37	66. 1	19	33.9		35	62.5	21	37. 5	
No	202	42. 6	27 2	57.4		17 8	37.6	29 6	62. 4	
<b>Having the possibility of objects falling</b>					1.512 (0.616- 3.711)					1.864 (0.759- 4.577)
Yes	11	55. 0	9	45.0		11	55.0	9	45. 0	
No	228	44. 7	28 2	55.3		20 2	39.6	30 8	60. 4	

The analysis showed that 161 (58.5%) respondents who had permanent employment status experienced chronic complaints and 78 (30.6%) respondents who had non-permanent employment status experienced chronic complaints. Respondents with permanent employment status had 3.2 times higher risk of experiencing chronic complaints compared with respondents with non-permanent employment status. In addition, the association between working shifts and

chronic complaints showed that 162 (51.9%) respondents who did shift work and 77 (35.3%) who worked without shifts experienced chronic complaints. Respondents working in shifts had 1.97 times higher risk of experiencing chronic complaints compared with respondents who did not work in shifts.

It found the significant association between trip duration to the workplace with chronic complaints. The average trip duration to the workplace on this result is 17.64 minutes, respondents who had a duration to reach the workplace that was above average (34.9%) experienced chronic complaints 2.1 times compared with respondents who had less than the average trip duration to the workplace.

The analysis of the association between noise in the work environment and chronic complaints showed that 88 (52.4%) respondents who worked in noisy work environments and 151 (41.7%) respondents who worked in non-noisy work environments experienced chronic complaints. The results showed the significant result that respondents who worked in noisy environments had a 1.53 times greater risk of chronic complaints compared with respondents who worked in a non-noisy environment.

Analysis of the association between a hot and humid work environment and chronic complaints showed that 81 (64.8%) respondents who worked in hot and humid working environments and 158 (39.0%) who did not work in hot and humid working environments experienced chronic complaints. Respondents working in hot and humid work environments had a 2.87 times greater risk having chronic complaints compared with respondents working in environments that are not hot and humid.

In terms of the association between the working habit of lifting items weighing more than 20 kg and chronic complaints, the analysis showed that 50 (55.6%) respondents who habitually worked with items heavier than 20 kg and 189 (43.0%) who did not often work with lifting items more than 20 kg experienced chronic complaints. In addition, respondents who had a habit of working with items more than 20 kg had a 1.66 times greater risk of having chronic complaints compared with respondents who did not habitually work with items weighing less than 20 kg.

The association between working habits of sitting on the floor without displacement and chronic complaints showed that 19 (65.5%) respondents who had the habit of working by sitting on the floor without displacement and 220 (43.9%) respondents who did not have the habit of sitting on the floor while working had chronic complaints. Respondents who had the habit of sitting on the floor without displacement had a 2.42 times greater risk of having chronic complaints compared with respondents who did not have that habit. In contrast, based on the analysis result of the association between standing habits during work and chronic complaints, it was found that 103 (50.5%) respondents who had a habit of standing during work compared with 136 (41.7%) who did not habitually stand during work experienced chronic complaints. Further, respondents who stood during work had a 1.425 times higher risk of having chronic complaints compared with respondents who did not have the habit of standing while they were working.

The association between slippery floors in the work environment and chronic complaints showed that 37 (66.1%) respondents who worked on slippery floors and 202 (42.6%) who did not work on slippery floors experienced chronic complaints. The chi-square test results showed that respondents who worked on slippery floors had a 2.622 times higher risk of chronic complaints compared with respondents who did not work on slippery floors.

Based on the results of the analysis, the association between acute musculo-skeletal complaints and socio-demographic factors was significantly influenced by work status, shifts and travel duration to the workplace; in contrast, the association between chronic musculo-skeletal complaints and work environment factors was significantly affected by noise, heat and moisture, lifting items weighing more than 20 kg, sitting on the floor, standing posture, and slippery floors in the working environment. Other factors, such as gender, duration of education, monthly income, smoking habits, duration of smoking, alcohol consumption, exercise habits, noise, lack of light, cold temperatures, often using the fingers in unusual postures, using a vibrating device, sitting or standing on a vibrating surface, sitting on a chair without displacement, standing during work, and the possibility of falling objects did not significantly affect acute musculo-skeletal complaints.

The analysis also showed that 155 (56.4%) respondents who had permanent employment status and 58 (22.7%) who had non-permanent employment status experienced acute complaints. Respondents with permanent employment status had a 4.38 times greater risk of experiencing acute complaints compared with respondents who had non-permanent employment status. Furthermore, the association between working with shifts and acute complaints showed that 138 (44.2%) respondents who worked in shifts and 75 (34.4%) who did not work in shifts experienced acute complaints. Respondents who worked in shifts had a 1.51 times greater risk of experiencing acute complaints compared with respondents who did not do shift work. However, in terms of the association between travel duration to the workplace and acute complaints, 150 (50.3%) respondents with a travel duration to the workplace that was less than the average and 63 (27.2%) with a travel duration to work that was above average experienced acute complaints. Further, respondents who had a travel duration to the workplace that was less than the average had a 2.71 times greater risk of experiencing acute complaints compared with respondents who had a less than average travel duration to the workplace.

In terms of the work environment, the association between light (glare) in the work environment and acute complaints showed that 18 (60.0%) respondents employed in a work environment with glare and 195 (39.0%) who were not employed in a work environment with glare experienced complaints. The chi-square test results showed that respondents who worked in an environment with glare had a 2.34 times greater risk of experiencing acute complaints compared with respondents who worked in a glare-free environment.

The association between a hot and humid work environment and acute complaints showed that 72 (57.6%) respondents who worked in hot and humid working environments and 141 (34.8%) who did not work in hot and humid

working environments experienced acute complaints. Respondents who worked in hot and humid working environments had a 2.54 times greater risk of experiencing acute complaints compared with respondents whose work environment was not hot and humid. Moreover, the association between regular lifting of items weighing more than 20 kg and acute complaints showed that 46 (51.1%) respondents who regularly lifted items heavier than 20 kg and 186 (39.7%) who did not habitually lift items more than 20 kg experienced acute complaints. In addition, respondents who regularly lifted items weighing more than 20 kg were at a 1.7 times greater risk of experiencing acute complaints compared with respondents who did not habitually lift heavy items.

The association between working sitting on the floor without displacement and acute complaints showed that 18 (62.1%) respondents who habitually sat on the floor without displacement and 195 people (38.9%) who did not routinely sit on the floor without displacement experienced acute complaints. Respondents who habitually sat on the floor without displacement during work had a 2.56 times greater risk of experiencing acute complaints compared with respondents who did not regularly sit on the floor without displacement while working.

Analysis of the association between squatting habits during work and acute complaints showed that 24 (55.8%) respondents who habitually squatted during work and 189 (38.8%) who did not regularly squat while working experienced acute complaints. The chi-square test results showed that respondents who squatted habitually during work had a 1.99 times greater risk of experiencing acute complaints compared with those who did not have a habit of squatting during work.

The association between slippery floors in the work environment and acute complaints was analysed, and the results showed that 35 (62.5%) respondents who worked on slippery floors and 178 (37.6%) who did not work on slippery floors experienced acute complaints. The chi-square test results showed that respondents who worked on slippery floors had a 2.77 times greater risk of experiencing acute complaints compared with respondents who worked on non-slippery floors.

## **Discussion**

### **Employee Status**

Both chronic and acute MSDs were more experienced by permanent workers in this study. Some research also has shown that employee status is one variable contributing to occupational health problems in SME workers. It correlates with quality of life (13), stress (14), and as shown in this study, MSD symptoms. Similar results were reported from a study performed in Bangladesh, where most of the workers had suffered from some kind of MSD, but these disorders were more common among permanent employees who worked in the sewing and finishing sectors (15). Among Bangladeshi garment workers, 6 of every 10 respondents suffered from MSDs, where pain and muscle weakness were the main complaints (16).

Otherwise, Foley (2017) showed that temporary workers had higher symptoms than their permanent peers did for both categories (17). Temporary workers reported lower hazard exposures than their permanent counterparts did, but they were less protected by such work experienced, safety training and schedule control to cope with the hazards they faced (17). Some studies performed in Washington state also found that time-loss symptom rates were higher for temporary workers than they were for permanent workers, even after controlling for occupation and industry (18,19). Similar results have been shown in other settings (20,21).

### **Shift Work**

This study also proved that shift work affects the level of risk for MSDs. Research in the hospitals of Zhengzhou in Henan, China showed that night shifts were associated with MSDs in nurses. Moreover, a lack of exercise, night shifts and a tendency to stay up late significantly increased the risk of WMSDs ( $p < 0.05$ ) (22). The circadian clock plays an important role in human health; its disruption is associated with many adverse health effects (23). The night-shift system leads to interrupting workers' circadian clock, thereby affecting their sleep, diet, family life, social activities and so on, as well as altering the endocrine system. These changes have been shown in association with MSDs (24). Another study illustrated that the combination of extended shifts and long working hours was linked to self-reported symptoms of the neck, shoulder and back while controlling for age (25); workers who did shift work and who were employed in workplaces where the number of employees was under 50 tended to experience upper and lower limb pain more frequently compared with the workers who did not do shift work and those working in larger workplaces for both genders (26).

### **Trip Duration**

This study illustrated that trip duration influenced MSD symptoms. One previous study showed that the trip duration to the workplace contributed to fatigue (27), while the severity of musculo-skeletal discomfort/pain in different body regions was correlated with fatigue in another study (28). The findings of the research by Chavalitsakulchai and Shahnavaz (1991) indicated a close association between musculo-skeletal discomfort/pain and fatigue among workers (29). Another study demonstrated that the prevalence of discomfort/pain in the lower back and neck was higher in supermarket cashiers; in this study, the subjects reported perception of high fatigue levels after work days (30).

### **Noise, Heat and Humidity**

Shikdar (2001) observed small manufacturing companies in Oman and stated that there were poor environmental conditions, especially in terms of noise and hot temperature, and this was common to most of the small industries. In this research, 78% of the companies had excessive noise ( $>90$  dBA) and 63% of the companies reported a hot environment (31). The researcher concluded that most of the small manufacturing industries either did not have knowledge of ergonomics or access to ergonomics information; alternatively, they simply ignored this issue due to resource constraints and costs. However, worker

complaints of fatigue, back pain, headache and upper body pain were reported in 52%, 41%, 41% and 33% of the companies, respectively. Sain and Meena (2016) summarized some research about contributing factors to MSDs in small industry in some countries; in the carpet industry in Iran, they showed that 50% of the weavers were unsatisfied with working environment conditions, such as the thermal conditions, noise level and cleanliness of the air. In a sawmill plant process in northern Karnataka State, Iran most workers are male. The noise level was found to be above OSHA's safe limits for a prolonged time. In the food and bakery industry in Iran, the nature of the working process is dusty, and the work is performed under high humidity and temperature. Humidity may condense flour dust and increase exposure to it in the workplace.

### **Handling Heavy Loads**

The results showed that carrying heavy loads influenced MSD symptoms. Previously, epidemiological data have demonstrated that occupational risk factors like awkward postures, highly repetitive activities or handling heavy loads are among the risk factors for damage to the bones, joints, muscles, tendons, ligaments, nerves and blood vessels, leading to fatigue, pain and MSDs (32). A study about low back pain in tea pickers in Indonesia showed that tea pickers have a high risk of low back pain due to activities like bending, lifting and carrying heavy loads; thus, WMSDs are influenced by carrying loads, and lifting heavy weights is associated with low back pain ( $p < 0.05$ ) (33).

### **Work Posture: Sitting and Standing**

Work posture contributes to MSD symptoms; especially, the work sitting position can put pressure on the lower back, which is quite heavy, and cause low back pain in workers. Moreover, sitting too long can cause an excessive burden on the lumbar spine, resulting in pain in the lower back (30).

Sitting or standing were both found to affect MSD symptoms in this study. This result was similar to that of Messing et al. (2015), who showed that prolonged standing is common in North America: Almost half (45%) of Québec workers spend more than three-quarters of their working time on their feet. This posture is linked to chronic back pain and MSDs in the lower limbs. However, at the same time, many health professionals suggest workers should stand rather than sit at work to avoid sedentary work.

Another study showed that long sitting times were associated with exhaustion during the working day, decreased job satisfaction, hypertension and MSD symptoms in the shoulders, lower back, thighs and knees of office workers (34). Similar results were shown in a study about workers in India, where the dominant postures adopted by the workers were sitting on the floor with stretched legs, sitting on the floor with folded knees and kneeling (35).

A study on adopting a standing posture while working and MSDs in workers in the plastic manufacturing industry revealed that women had greater exposure to repetitive hand movement and working in a static posture (standing). It was found that such practices may lead to higher MSD prevalence in women (36).

## **Slippery Floors**

There are several factors related to the working environment that can make the situation even worse and constitute additional potential dangers contributing to MSDs. Such factors can be insufficient space in the workplace and slippery floors. A study on dairy farming showed that such work, especially milking, is physically demanding; it is associated with difficult working postures and movements, repetitive and monotonous work tasks and injuries caused by slips, trips and falls on slippery floors or barn fittings, which constitutes a risk factor for MSD development (37,38). In addition, slippery floors limit an individual's movement by causing fear of falling when walking and affecting quality of life (39). The results of this study confirm that work ability in Vietnam countries was similar to that in European countries, and that the socio-demographic factors, work environment and ergonomic condition and MSDs were associated with work ability.

## **Conclusion**

This research found that Vietnamese SME workers reported experiencing both acute and chronic MSDs. If individuals do not receive treatment, the symptoms will increase, and pain could develop into a disorder in the near future. It is important to control environmental factors that affect MSD symptoms, especially slippery floors, noise, glare and heat and humidity in the workstation. Moreover, SMEs should improve the work activity, such as by decreasing the following: the load of manual handling, sitting on the floor, squatting and standing for a long time.

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The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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