Job Demands, Working Postures, Workstations, and Prevalence of Work-related Musculoskeletal Disorders Among Teachers in Silliman University

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This paper aims to establish the magnitude of work-related musculoskeletal disorders (WMSDs) among 119 randomly selected teachers in Silliman University and to point out the associated risk factors by examining the job demands, workstation and the working postures assumed by teachers as they performed their assigned tasks. The results of the study showed that the conduct of lectures, test preparation, and computer work consumed majority of the teacher's time. The three-month prevalence of musculoskeletal disorders was 82% and majority experienced shoulder pain, lower back pain, upper back pain, and neck pain. The posture analysis showed that neutral postures were observed in the back, arms, and legs except in the neck where combined non-neutral posture is about 59%. Major ergonomic deficiencies were found in the backrest, seat pan, arm rests, seat and work surface heights. Worth noting to both seated and standing workstations is that none of these were adjustable to accommodate the varied tasks of teaching. Therefore, the teachers in the study were at risk to work-related musculoskeletal disorder because the nature of their work demanded them to assume a variety of postures and activities that may be perpetuated by an improperly designed workstation.

Keywords: working postures, work-related musculoskeletal disorders, risk factors, teachers, job demands, non-neutral postures, workstation

INTRODUCTION

Teaching is a challenging and stressful occupation. In a 2005 study, it was identified as one of the most stressful out of the 26 occupations that were examined (Johnson et al., 2005); teachers had attributed this condition to work (Kyriacou, 2001), experienced this stress at work for at least 50% of the time (Blix, et al., 1994), and often or almost always at work (Chalmers, 2004). It's not surprising that for the past decade work-related musculoskeletal disorders (WMSDs) have become increasingly common among teachers worldwide and across all teaching groups. With a prevalence rate of between 12% and 84% affecting predominantly the back, neck and the upper limbs (Erick & Smith, 2014) concurrent with the increasing pressures, technological, curricular changes and demands of teaching, WMSD can become a major cause of many health- and productivity-related problems similarly affecting many occupations worldwide if left unattended. This is alarming since these disorders are chronically painful, incapacitating, career-ending, life-changing, and costly to employers, workers, and society in terms of time lost from work, absenteeism, direct and indirect health expenditures, and productivity losses (Nordin et al., 2011; Cardoso et al., 2009; Maguire & O'Connell, 2007). This is even worse in developing countries where substandard working conditions are prevalent and awareness of ergonomics issues, education and training programs are limited (Sealetsa & Thatcher, 2011).

In Asia, a prevalence rate of 30 - 65% was reported by teachers in Hong Kong, Japan, Malaysia, and China affecting primarily the shoulders, arms, neck, and low back (Masaru & Misako, 2001; Tsuboi et al., 2002; Jin et al, 2004; Chiu & Lam, 2007; Chong & Chan, 2010; Samad et al., 2010). In Europe, teachers had problems in the same body regions (Wiklund & Sundelin, 2003; Nordin et al., 2007) as well as in the Middle East where the prevalence among Saudi Arabian teachers was at 79.17% (Darwish & Al-Zuhair, 2013). The reported figures are conservative and represent only reported cases. Research studies have been dedicated to address the problem ranging from injury prevention to identification of a wide range of risk factors creating musculoskeletal stress. However, risk exposure still continues and is far from being solved. Possible reasons could be the differing work content and methods, workplace characteristics, teaching style and culture, and work organization practices within the teaching profession

making research results inadequate if not ineffective for universal use. This is because interventions of this nature require attention to the individual, organization, and job characteristics (Williams & Westmorland, 1994). Thus, to ensure a continued provision of quality education, suitable intervention programs have to be pursued if these causes of waste of human and financial resources are to be prevented. These however demand evidence to tailor-fit such programs and set priorities for intervention.

In the Philippines, WMSD studies and respondents remain low and limited to high school and college teachers. At the national level, the limited social security coverage and the defective reporting system make it difficult to establish its magnitude and risk factors. Workplace risk factors have not been thoroughly examined particularly the job demands and their associated physical activities, working postures and the impact of workstations on these postures. Although ergonomic interventions have been shown to help improve WMSD symptoms, they are usually non-existent and do not oftentimes form part of any traditional medical or rehabilitative interventions in the academe, let alone in the country. Therefore, this research was undertaken to establish the prevalence of WMSDs among teachers in Silliman University (SU), and the existence of its associated risk factors by examining the job demands, physical activities, working postures, and the workstation of teachers. The information and insights generated are vital in improving the working environment for teachers with similar working conditions, job and demographic characteristics and in building initial ergonomic database for the teaching profession.

THEORETICAL CONSIDERATIONS

The United Nation has declared that education is central in meeting its Millennium Develop Goals (MDG) for it equips learners the necessary core values, behavior, knowledge, and skills in understanding and addressing the prevailing problems of this century (UNESCO, 2010; UNESCO, 2015). Unfortunately, there are work conditions surrounding this sector that continuously expose and predispose its workers to varying amount of musculoskeletal stress that may lead to WMSDs (Erick & Smith, 2011). These disorders are inflammatory and degenerative conditions affecting the muscles, tendons, ligaments, joints, bones, peripheral nerves and a localized blood vessel. They are caused by either a single or cumulative injury leading to

persistent pain, discomfort and disability (Punnet & Wegman, 2004). Several literatures have revealed that WMSDs are the result of various interacting work conditions that a good understanding of each is necessary to provide appropriate and prioritized intervention programs (Boyling, 1994).

One of the work conditions is the job demand of teaching itself. Teachers perform varied tasks ranging from classroom teaching and supervision, administrative, to extension work that imposes static, in some cases dynamic load on the musculoskeletal system. In the classroom, they stand for long hours performing monotonous to repeated activities like overhead board writing with one or two upper limbs elevated, and may stoop, kneel, squat, bend over or twist their trunks and neck while attending to students' questions or needs. In their offices, they bend or twist their trunk and neck, extend their arms outward as they prepare for tests and lessons, mark, type using a computer, and read while seated. If these demands are done for several hours without rest, they become risky because they can cause muscle tendon strain and encourage static muscle contraction which can potentially constrict blood vessels thereby compromising circulation and removal of waste products in the area, eventually causing muscle fatigue, pain and joint soreness and in some cases acute tendonitis (Occupational Safety and Health Agency [OSHA], 2000). A study in China showed that prolonged standing and sitting, static posture and uncomfortable back have been associated to neck, shoulder, and low back pain among teachers (Yue et al., 2012.). Incidentally, these demands and activities have also been known sources of body pains among teachers.

Second condition is the sedentary nature of teaching. Due to lack of physical activity, work problems such as poor posture, poor breathing pattern, sluggish circulation, and diminished physical activity can emerge (Bullock, 2000). Thus, tasks that require minimum muscular effort like teaching can be considerable and potentially risky when they are voluminous, monotonous, and repetitive since they have the potential of overwhelming the body's tolerance and repair capabilities. With computer use, they are not only more exposed to repetitive and monotonous motions of the wrist and hands but also to awkward and sustained postures like "poking chin" during computer operation which have been associated to WMSD development (Fabrizio, 2009; Ayanniyi et al., 2011; Andersen et al., 2008).

Third and last condition is the absence of an ergonomic standard in the academe. School workstations particularly the furniture used may

not be designed to accommodate teacher's physical characteristics and technology (e.g. computers). This creates mismatch that prevents the use of human body efficiently and effectively. As a result, risk exposure increases for it encourages the assumption of unhealthy postures that overload the weight-bearing structures of the musculoskeletal system (Bullock, 2000). This scenario happens when working tables are too low forcing teachers to stoop in order to perform work and when too high they may extend their back and abduct their arms resulting to a greater effort in maintaining the position. Such posture can cause fatigue, strain, discomfort, and eventually lead to WMSDs by increasing the workload and the muscle requirements of the tasks (Khalil et al., 1993; Vedder, 1998). When these postures become habitual, reduced lung capacity, muscular contracture, structural deformity, with a corresponding limitation of motion may also ensue, and WMSD may develop (Khalil et al., 1993; Bullock, 2000). A study among employees who used office tables for computers and adopted a bent and unsupported back postures reported trouble in the shoulder, back, arm, wrist, and the neck (Shikdar & Al-Kindi, 2007). Several studies also showed that the furniture used and the job demands that require prolonged standing and sitting with head down posture during reading, computer use, marking, and writing, have been associated to WMSD development (Chiu & Lam, 2007; Lemoyne et al., 2007; Tissot et al., 2009; Ayanniyi et al., 2011). In our effort to become globally competitive and relevant, studies focusing on the teaching profession must be undertaken to secure the health and productivity of teachers as part of the nation's security and sustainability. Thus, WMSD prevalence and its predisposing factors have to be established so that working conditions, physical workloads, and working postures can be modified and optimized to promote efficiency, safety, and comfort at work (Ong & Kogi, 1992; Richardson, 1994; O'Callaghan & McIntyre, 1995).

METHODS

Observational technique, particularly the work sampling technique, was done to assess participants' risk exposure to WMSDs since it is more appropriate in studying non-repetitive tasks, and in estimating the percentage of time workers spend in certain postures as they perform various tasks (Buchholtz et al. as cited in Capio, 2001). In this study, the participants included teachers of SU from all levels, who are regular employees, have

academic, administrative, extra-curricular, or clinical assignments, have no history of trauma or surgery, no physical deformities and defects, congenital or acquired, or ailment prior to employment. Teachers who were on sick, study, maternity or vacation leave were excluded. A stratified sampling design was used to ensure adequate representation since they were selected from various academic units of SU — a non-stock, non-profit and non-sectarian institution of higher learning that provides early childhood, elementary, high school, and college education located in Dumaguete City, Negros Oriental, Philippines. A sample of 119 teachers was randomly selected from a list distributed as follows: 91 college (76.5%), 28 School of Basic Education (SBE) which is further distributed as 11 high school [HS] (9.2%), and 17 elementary school [ES] and early childhood school [ECS] (14.3%).

The data were collected via direct observation, on-site visitation, and self-administered standardized questionnaire that could be answered in less than ten minutes. The data collection was done in the field covering two semesters. This was done to ensure that working postures and exposures to risk of teachers, and their overall condition at work could be directly observed. The respondents were assured of the confidentiality of their responses and their participation could not affect their current job status. The following were the three data collection tools:

1. A Pilot-tested *Task Analysis Self-administered Questionnaire* was used to gather the demographic profile such as age, marital status, educational attainment, medical and accident history, years of teaching, and the job demands of the respondents. They were asked to indicate the number of hours they spent per week, the frequency performing the various tasks as reflected in their academic load, and specify the dominant task, the essential time element, the workstation, and the physical activities or requirements of each task. The data obtained were used to identify the dominant workstation for the on-site visit using two workstation checklists, and the job demand for Ovako Working Posture Analyzing System (OWAS).

2. A *Modified Nordic Musculoskeletal Questionnaire* was used to establish the prevalence of WMSD and the body parts affected. This self-administered questionnaire was purposely designed to record

work-related musculoskeletal symptoms in working populations (Kuorinka et al., 1997). To determine the prevalence of symptoms defined as "job-related ache, pain, etc.", the respondents were asked whether they had ever experienced work-related pain or discomfort in the past three months in nine different anatomical areas. It had three general questions that deliberately probed on the nature of the complaints, their duration and prevalence in nine areas of the body. Also, had a body picture showing areas of concern to guide respondents. These were the same anatomical areas as those reported by Bork et al. (1998) and Cromie et al. (2000). In addition to questions regarding the prevalence of work-related musculoskeletal symptoms, teachers were asked to indicate whether symptoms in each anatomical area had interfered with work at home or away from home, and whether symptoms had been bothering them during the last seven days. The last three questions were used to determine the perceived relationship of the complaints to work. To get the prevalence, the number of "yes" was divided by the total number of respondents and multiplied by 100%.

3. The *OVAKO Working posture Analyzing System (OWAS)* was used to identify and classify work postures of the back, arms, and legs, and their musculoskeletal loads during various phases of work. It was modified to include the neck for this study. With this fourth tool, a video recording of teachers' working postures in their actual work setting was done after 10 minutes into every work shift (one class period) to make them comfortable until the participant would take a break. The video recorder was positioned strategically and discreetly to reduce obtrusiveness and Hawthorne effect. Videotape frames in the form of posture combinations were recorded at 30-second interval using a five-digit code describing various postures and force combinations, and then compiled in a standardized form. The neck had five postures (straight, bent forward, bent on one side, bent backward, twisted on one side), the arm had three (both arms below shoulder level, one above the shoulder, and both above the shoulder); the trunk had four (straight, bent forward, straight and twisted, bent and twisted); and the leg had seven (standing on both legs, standing

on one leg straight, standing on both legs bent, standing on one leg bent, kneeling on one or both legs, walking, and sitting). Non-neutral postures were described in this study to include postures that were bent, straight but twisted, bent and twisted, one or two arms above shoulder level, standing on one or two legs bent, one or two knees touching the ground.

4. The *Seated and Standing Workstation Checklists* were used to assess the respondents' workstations. The Checklists were used to assess the workstation design of the University of the Philippines teachers in Manila (Gonzaga et al., 2002). The Seated Workstation Checklist contained 34 questions covering basic components like backrest (7), armrest (5), seat pan (11), seat height (4), work surface (7). The Standing Workstation Checklist included 31 questions on work posture (9), work surface (13) and work area (9). Both checklists highlighted orientation of body parts while at work, surface heights, location and accessibility of controls, quality of materials and equipment, and space requirements. Both were answerable by "yes" or "no" where the "no" answer might signify a problem that needed attention. An on-site workstation visit was done using these tools to determine presence of any workstation deficiency and mismatch between the workstation and the teacher.

Meanwhile, descriptive statistics were used to describe the personal variables and essential features of the work condition of the respondents.

RESULTS

Profile of the study participants. Of the 119 respondents, majority of respondents were females (74.8%), married (70.6%) with children (64.7%) and were more than 30 years old (86.6%) where majority belonged to the age group of 31 to 40 years and 41 to 50 years. Among teaching groups, ES and ECS had the most number of married teachers with children (76.5%), who were more than 30 years old (94.1%) and along with HS, had the most number of females (over 80%). Table 1 also shows that majority had more than 10 years teaching experience (66%) and taught in college (66.7%), in

HS (63.6%), and in ES and ECS (64.7%). They worked for 6-8 hours (65.0%), 5-6 days (58.8%) a week where over 70% were from SBE.

Furthermore, most respondents spent more than 50% of their daily working time teaching or doing teaching-related task (90.8%) and working exclusively for SU (96%) in which majority were college teachers. More than 50% of teachers had master's degree (52.1%) and less than 10% had doctoral degree in which majority were also from college. A little over 80% considered their symptoms to be work-related, where 24.4% of these were absolutely work-related. In contrast in HS, teachers in ES and ECS reported the highest work-relatedness of symptoms. The other details of the demographic and work profiles are reflected in Table 1.

Table 1. Demographic and Work Profile of Respondents (in percent)

Variables	College (n=91)	SBE		Total (n=119)
		HS (n=11)	ES & ECS (n=17)	
Gender				
Male	27.5	18.2	17.6	25.2
Female	72.5	81.8	82.4	74.8
Age				
20 – 30 years old	15.4	9.1	5.9	13.4
31 – 40 years old	32.9	45.4	41.2	35.3
41 – 50 years old	27.5	18.2	17.6	25.2
51 – 60 years old	19.8	27.3	35.3	22.7
61 – 70 years old	4.4	0.0	0.0	3.4
Marital Status				
Married	70.3	63.6	76.5	70.6
Single	29.7	27.3	23.5	28.6
Widow	0.0	9.1	0.0	0.8
Number of Children				
0	37.4	36.4	23.5	35.3
1 – 2	42.9	18.2	41.2	40.3
3 – 4	17.5	45.4	37.3	22.7
5 or more	2.2	0.0	0.0	1.7
Educational Attainment				
Bachelors	29.7	72.7	82.4	41.2
Masters	61.5	27.3	17.6	52.1

Doctoral	8.8	0.0	0.0	6.7
Length of Service in years				
0 – 5	21.2	18.2	23.5	21.9
6 – 10	12.1	18.2	11.8	12.6
More than 10	66.7	63.6	64.7	65.5
Working Hours per Day				
Less than 5	17.5	18.2	11.8	16.8
6 – 7	22,0	18.2	23.5	22.7
7 – 8	38.5	63.6	52.9	42.0
more than 8	22.0	0.0	11.8	18.5
Number of Times a Task is done Per week				
1 – 2	2.2	0.0	11.8	3.4
3 – 4	40.7	27.3	29.4	37.8
5 – 6	57.4	72.7	58.8	58.8
Perform Task > 50% of Daily Work Hours				
Yes	92.3	81.8	88.2	90.8
No	7.7	18.2	11.8	9.2
Working Exclusively for SU				
Yes	97.8	90.9	88.2	95.8
No	2.2	9.1	11.8	4.2
Perceptions of work-relatedness of WMSDs				
Absolutely work-related	25.3	9.1	29.4	24.4
Partially work-related	56.0	54.5	64.7	57.1
Absolutely not work-related	18.7	36.4	5.9	18.5

Experienced symptoms of WMSDs

Eighty-two percent (82%) of teachers had experienced work-related pain, trouble, ache or discomfort at sometime in their working life in the last three months. Table 2 shows the greatest proportion of this in the shoulder (61.3%), followed by the lower back (54.6%), upper back (51.3%), neck (49.6%), and wrist & hands (44.5%). These are the same body parts commonly reported by college, ES and ECS teachers, while HS teachers had the shoulder, lower back, neck, knees, ankle and foot. The prevalence rates, however, vary across groups with ES and ECS reporting the highest in the neck (70.6%), shoulder (70.6%), upper back (64.7%), wrist and hands (52.3%), hips and

thighs (47.1%). Table 2 also shows symptoms in the upper back (12.6%), lower back (10.9%), ankle and foot (9.2%), hips (8.4%) and shoulders (8.4%) that prevented respondents from doing work. Across groups, the top body parts that prevented college teachers from doing work were: upper back (11%), shoulder, ankle and foot (8.8%); lower back (27.3%) and ankle & foot (27.3%) for HS teachers; and upper and lower back (17.6%) for ES and ECS teachers. In the last seven days, teachers generally had problems in the upper back (34%), lower back (30.2%), shoulders (26.8%), and neck (18.5%). Across teaching groups, the prevalence rate variation in these body parts are considerable except in the lower back. The other details are reflected in Table 2.

Risk factors related to work

Job demands. As shown in Table 3, majority reported conduct of lectures (78.2%), test construction and evaluation of students (68.1%), and computer work (54.6%) as their top three demands that consumed most of their working time per week. By teaching group, college teachers reported the same top three demands (lectures at 83.5%, test construction and evaluation of students at 65.9%, and computer work at 61.5%). Whereas, HS teachers reported test construction and evaluation of students (72.7%), lectures (63.6%), and observe and assist students (45.5%) as their third demand. Likewise, ES and ECS teachers reported test construction and evaluation of students (76.5%), lectures (58.8%), except that paperwork (58.8%) is their third demand.

Job-related physical activities. Table 4 shows that teachers reported standing (94.9%), sitting (89.9%), and walking (89.1%) as dominant physical activities related to do teaching work. By teaching group, over 90% of college and HS teachers reported standing as the prevailing job-related physical activity followed by sitting (90.1% and 81.8%, respectively) and walking (87.9% and 81.8%, respectively). While ES and ECS reported sitting (94.1%) as their dominant physical activity followed by standing (88.2%), walking (82.4%) carrying (76.5%) and trunk bending (64.7%).

Meanwhile, over 80% of teachers in each group ranked the classroom as their dominant workstation. College and HS ranked the laboratory, ES and ECS ranked home as their second workstation, respectively. Home ranked third in workstation where College and HS teachers spent doing their teaching-related work.

Table 2. Reports of WMSD Symptoms Across Groups of Teachers (in percent)

WMSD's symptoms in the last 3 months				
Body Parts	**College (n=91)**	**SBE**		**Total (n=119)**
		HS (n=11)	**ES & ECS (n=17)**	
Shoulder	59.3	63.5	70.6	61.3
Lower back	54.9	54.6	52.3	54.6
Upper back	51.7	27.3	64.7	51.3
Neck	47.2	36.4	70.6	49.6
Wrists &Hands	46.2	18.2	52.3	44.5
Ankle & Foot	34.1	36.4	29.4	33.6
Knees	29.7	36.4	35.3	31.1
Hips & Thighs	26.4	27.3	47.1	29.4
Elbows	18.7	9.1	23.5	18.5
WMSD's symptoms preventing Resondents from Doing Work				
Body Parts	**College (n=91)**	**SBE**		**Total (n=119)**
		HS (n=11)	**ES & ECS (n=17)**	
Shoulder	8.8	18.2	-	8.4
Lower back	7.7	27.3	17.6	10.9
Upper back	11.0	18.2	17.6	12.6
Neck	5.5	18.2	-	5.9
Wrists &Hands	6.7	9.1	-	5.9
Ankle & Foot	8.8	27.3	-	9.2
Knees	6.6	9.1	5.9	6.7
Hips & Thighs	7.7	18.2	5.9	8.4
Elbows	3.3	-	-	2.5
WMSD's symptoms in the last 7 days				
Body Parts	**College (n=91)**	**SBE**		**Total (n=119)**
		HS (n=11)	**ES & ECS (n=17)**	
Shoulder	30.8	9.1	17.6	26.9
Lower back	30.8	27.3	29.4	30.2
Upper back	35.2	9.1	47.1	34.4
Neck	16.5	9.1	35.5	18.5
Wrists &Hands	26.4	9.1	17.6	23.5
Ankle & Foot	12.1	9.1	17.6	12.6
Knees	12.1	9.1	11.8	11.8
Hips & Thighs	11.0	9.1	17.6	11.8
Elbows	7.7	-	5.9	6.7

Table 3. Job Demands Across Groups of Teachers (in percent)

Job Demands	College (n=91)	SBE		Total (n=119)
		HS (n=11)	ES & ECS (n=17)	
Lecture	83.5	63.6	58.8	78.2
Test & evaluation of students	65.9	72.7	76.5	68.1
Computer work	61.5	36.4	29.4	54.6
Lecture and laboratory preparation	56.0	36.4	23.5	49.6
Observe and assist students	35.2	45.5	29.4	35.3
Laboratory activities	39.6	27.3	-	32.8
Paperwork	26.4	36.4	58.8	31.9
Related learning experience	31.9	-	-	26.1
Fieldwork	26.4	18.2	29.4	26.1
Supervisory work	27.5	18.2	11.8	24.4
Debriefing	13.2	9.1	-	10.9
Administrative work	13.2	-	5.88	10.9
Research work	3.3	-	-	2.52

Table 4. Job-Related Physical Activities Across Groups of Teachers (in percent)

Physical Activities	College (n=91)	SBE		Total (n=119)
		HS (n=11)	ES & ECS (n=17)	
Standing	96.7	90.9	88.2	94.9
Sitting	90.1	81.8	94.1	89.9
Walking	87.9	81.8	82.4	89.1
Carrying	42.9	45.5	76.5	47.9
Handling	41.8	36.4	41.2	41.2
Reaching above head	30.1	27.3	47.1	32.8
Trunk bending	25.3	27.3	64.0	31.1
Lifting	23.1	27.3	47.1	26.9
Reaching below head	20.9	36.4	47.1	26.1
Gripping	20.9	45.5	35.3	25.2
Trunk twisting	20.1	9.1	29.4	21.0
Squatting	20.1	9.1	23.5	20.2
Carrying	16.5	27.3	29.4	19.3
Pulling	16.5	27.3	29.4	19.3
Kneeling	8.8	9.1	11.8	9.2
Half kneeling	4.4	9.1	17.7	6.7
Crawling	3.3	-	11.8	4.2

Working posture. Respondents conducting lecture, the job demand commonly performed by all were videotaped for a modified OWAS. From the 24 participants, a total of 3,636 video frames were generated and table 5 shows that college teachers had the most non-neutral posture of the neck (59.4%) while the other body parts were mostly neutral. Teachers in ES and ECS dominated non-neutral postures of the neck at 60.6%.

In the arms, majority of the working time (89.0%) was generally spent with the arms neutral (i.e. arms below the shoulder level). Teachers in HS spent most of their teaching time in this posture at 95.3%. Meanwhile, ES and ECS teachers dominated non-neutral arm postures at 13.7%. As for the back, majority of the working time (85.6%) was generally spent with the back neutral (i.e. straight) and over 85% were assumed by college and HS teachers. Teachers in ES and ECS had the most non-neutral back postures at 25%. In the legs, over 90% was spent in neutral posture across teaching groups.

Table 5. Neutral and Non-neutral Postures Assumed by Teachers Across Groups (in percent)

Body Parts	College (n=17)		SBE				All Teachers (n=24)	
			HS (n=3)		ES & ECS (n=4)			
	Neutral	Non-Neutral	Neutral	Non-Neutral	Neutral	Non-Neutral	Neutral	Non-Neutral
Neck	40.2	59.8	47.5	52.5	39.4	60.6	40.6	59.4
Arms	88.9	11.1	95.3	4.7	86.3	13.7	89.0	11.0
Back	87.4	12.6	86.0	14.0	75.0	25.0	85.6	14.4
Legs	99.7	0.3	98.7	1.3	94.8	5.2	98.9	1.1

Work station quality. The Seated and Standing Work Station Checklists were used to assess the workstations where respondents performed work.

Seated Work Station

Workstations where teaching and teaching-related job demands of sitting were subjected to seated workstation assessment. Sixty (60) seated workstations as representative samples were assessed covering the basic workstation components such as the backrest, armrest, seat pan, seat height, and work surface. Of the 60 workstations that were visited, 83.3% of backrest did not have a porous breathable, rough textured material and none (0.0%)

can be adjusted to any angle, 83.3% cannot be tilted forward and backward, cannot support the upper back, and the lower back. Thirty percent (30%) had armrests and only 1.7% with armrests was fully padded, about 28.3% provided enough support and only 15% provided a comfortable support to the upper limb. None of the armrests was easily adjustable. More than 80% workstations provided adequate support to the buttocks and to body contours. However, only 16.7% were upholstered with ergonomically desired material, 21.7% allowed some degree of backward tilt, only 26.7% had well-rounded edge, 1.7% were adjustable (controls were easy to reach), 33.3% were designed to distribute pressure evenly on the buttocks and thighs. The seat heights of chairs were not adjustable to allow the feet to rest on the floor, 47.7% were found to be 3cm to 5cm below the fold of the knee when a person is standing suggesting that more than 50% of the seat height was set either too high or moderately high relative to the knee fold. Finally, 35.0% of work surface height was designed to provide comfort to the shoulder and none were adjustable.

Standing Work Station

Workstations, where teaching and teaching-related job demands of standing were subjected to standing workstation assessment. Twenty-five (25) standing workstations as representative samples were assessed highlighting the working posture, working surface, and working area. In the 25 standing workstations, working posture category showed head and neck bent down, sideward or backward at 72.2% and twisted at 65.5% along with the trunk. Meanwhile, trunk leaned forward or backward at 69.7%, arms and elbows were extended outward at 41.5% while the forearm, wrists and hands were 23.1% straight and parallel to the floor. Only 35.0% of work surface were at correct height for the type of task and only 38.7% surface height allowed for the performance of tasks with shoulder relaxed. None of the working surface height was adjustable and only 3.8% were designed to reduce reaching above the shoulder. Merely 34.5% of the standing workstations prevented static muscle holding and only 31.5% eliminated full extension of arms. Teachers had enough working area to move about and able to stand naturally with weight on both feet and perform close to and in front of the body. They can easily do alternate sitting and standing during work and all the work areas visited were well lit.

DISCUSSION

In this study, we investigated the existence of WMSDs among teachers in all levels, their work-relatedness, and examined the job demands, physical activities, workstations and working postures that may predispose teachers to these disorders.

Prevalence and perceived work-relatedness of WMSD symptoms

Using a modified Nordic Musculoskeletal Questionnaire, this study established the existence of WMSDs among SU teachers and the 82% prevalence rate was within the range of several international researches. Likewise, the body parts affected and reported specifically the shoulder (61.3%), upper (51.3%) and lower back (54.6%), and neck (49.6%) were generally consistent except that the prevalence rates in this study are either relatively higher or lower than others. Possible reasons incude subject selection and composition, social economics and customs, administrative and individual teaching practices, the limited inclusion of body parts in the investigation, and the non-use of standardized case definition among studies being varied across countries making comparison of prevalence rates in particular impossible in musculoskeletal epidemiology (Campo et al., 2008); nonetheless, it appears that pain in these body regions is common among teachers. It has been observed that nature or type of work determines location and prevalence of these musculoskeletal injuries (Cardoso et al., 2009; Shuai et al., 2014; Bork et al., 1998) suggesting that proper identification of the potential sources of risk exposure is needed for an effective intervention.

In terms of work-relatedness of symptoms, about one-fourth perceived their symptoms to be absolutely work-related and over 50% indicated it to be partially related. Household chores and family/parenting responsibilities such as childcare duties among female teachers may have influenced this perception considering that majority of the respondents were females and married with children (Table 1). A study showed a strong relationship between number of children and musculoskeletal pain at value 0.006 (Darwish & Al-Zuhair, 2013) and it was attributed to more time needed to childcare, higher probability of psychological stress, and demand for more teaching load to augment earnings (de Zwart et al., 1997). There are also

consistent evidences showing greater predisposition of females to WMSDs than males (Erick & Smith, 2014; Yue et al., 2012; Treaster & Burr, 2004; Wu et al., 2011). Possible reasons can range from higher emotional exhaustion (Chang-Jiang et al., 2004), workload, and family pressure (Ihlebæk et al., 2002), lower pain threshold and physical strength among females than males to household tasks and body mass index differentials (Punnet & Herbert, 2000). It seems that their domestic or household duties can potentially limit the chance to rest their body after work thus exposing them to additional stress. Hence, it may help if female teachers are given adequate rest periods in between classes and before going home, priority and consideration when assigning teaching loads to accommodate parenting duties, and early and easy access to treatment and prevention programs.

Nonetheless, those who indicated it to be absolutely related to work perceived it to be exclusively caused by work suggesting that the current symptoms were likely obtained from within their present workstation. This perception is similar to a survey conducted in Great Britain where a total of 40% adults claimed that the onset of their back pain was related to the type of work they did (Dodd, 1997). Meanwhile, those who perceived it to be partially work-related may have recognized the role of work conditions and the length of time they spent as teachers in school in their WMSD development. It was reported that the increasing number of teaching years had been found to have a significant correlation with musculoskeletal pain disorders (Chiu et al., 2006; Darwish & Al-Zuhair, 2013). In this study, over 60% taught for more than 10 years and over 90% are exclusively teaching in SU (Table 1) making it plausible that the cumulative impact of teaching could have taken a toll on their musculoskeletal system and as a result, WMSDs obtained were perceived to be confined too within their present workstation.

Apart from teaching experience, age has been considered a factor to WMSD development and possibly had played a role, too. It is a common knowledge that the body's nutrition and metabolism, physical condition, body tissue composition and integrity, and healing and repair systems change over time making it difficult to withstand the daily musculoskeletal stresses. Studies in Brazil and Turkey revealed that teachers who were above 40 years had a higher chance to develop WMSDs (Cardoso et al., 2009; Korkmaz et al., 2011) and in Botswana, teachers who were 41–50 years were 1.56 times more likely to experience LBP than those who were less than 31 years old (Erick & Smith, 2014). Whereas two Chinese studies reported a higher percentage

of neck and low back pain among 31 – 35 and 30 – 39 years old teachers, respectively (Chiu & Lam, 2007; Jin, et al., 2004). In this study, more than 50% of teachers were more than 40 years old and possibly at the peak of their productivity while over 85% were more than 30 years old (Table 1). They were presumably predisposed due to the aforementioned demographic risk factors. When multiple risk factors are present, it increases risk to WMSDs (Bullock, 2000). Hence, despite respondents' low absolute perception on work-relatedness of symptoms especially from HS, comprehensive measures must be put in place to minimize progression because these disorders, whether exclusively work-related or not, can be possibly aggravated by work and by the effects of the immediate working environment.

Furthermore, teachers have also reported trouble in the back, shoulder, wrist and hand, and neck in the last seven days (Table 2) suggesting presence of acute conditions that may indicate the existence of workplace risk factors. The back, the ankle and foot on one hand were the common body parts preventing the respondents from doing work in the last 3 months. This was expected since standing and repetitive overhead board writing, prolonged sitting resulting from test preparation and marking, lesson preparation and reading, computer and desk work, and walking which are commonly reported in this study are vital teaching postures and activities that are known to cause stress to these structures (Shuai et al., 2014; Chong & Chan, 2010; Ariens et al., 2000; Lemoyne et al., 2007). Therefore, protection of this population is important to allow them to continue working effectively and remain productive given that more than half of the respondents may have already developed the best and time-tested teaching strategies and practices in the performance of their tasks with their long teaching experience.

Prevalence variation and teaching

The study showed varied prevalence rates across teaching groups suggesting that there might be certain factors and aspects in the academe that predispose teachers more to WMSDs than others. In the current study, ES and ECS teachers reported the highest prevalence rate in the neck, shoulder, upper back, and lower limbs compared to college and high school teachers, except the low back which is fairly consistent across groups (Table 2). Parallels can be seen in the study of Chong and Chan (2010) where primary teachers reported higher neck and shoulder pain than secondary teachers at 68.2 vs.

62.0%; $p < .01$ and at 72.8 vs. 65.1%; $p < .001$, respectively. One possible explanation could be that this teaching group had the most number of married teachers with children, females and aging more than 31 years old (Table 1). These profiles have been known to predispose teachers more than the others to WMSDs (Erick & Smith, 2014; Yue, et al., 2012; Chiu & Lam, 2007; Darwish & Al-Zuhair, 2013). It is probable too that higher prevalence rates in this teaching group could be explained by the nature or type of work they perform. Teachers in this group were more pre-occupied with test and evaluation of students, marking, and paperwork than college and HS teachers (Table 3). Almost 90% of them performed these dominant tasks 3-6 times per week, more than 5 hours per day consuming more than 50% of their daily working hours (Table 1). These demands are characterized by sustained activities of sitting resulting from frequent reading, marking and computer work which are known causes of neck, shoulder, and back pain among teachers (Samad et al., 2010; Chiu & Lam, 2007; Ayanniyi et al., 2011; Andersen et al., 2008).

Another possible explanation could be the demographic and physical attributes of students in ES and ECS. Teachers in this group handled 4-12 year old students and were generally smaller than college and HS. The difference merits different postural and classroom managerial demands from teachers where movement combinations had to be employed to keep students engaged, focused, and safe. In the process, this may predisposed them to reach above and below head, carry, bend and twist their trunk, squat, and lift more frequently during class and perhaps even after class. It is not surprising that these physical activities are higher in this teaching group (Table 4). During the conduct of this study, students were seen standing and moving around inside the classroom prompting teachers to stoop and squat to get hold of them. Prior researches among teachers have attributed these activities to musculoskeletal injury to these body regions (Yamamoto et al., 2003; Kumagai et al., 1995; Grant et al., 1995; Punnett & Wegman, 2004). Conversely in college and HS, their top activities were confined to standing, sitting and walking suggesting that their symptoms may be more on these activities than lifting, bending, squatting, or twisting (Table 4). In addition, the behavioral and emotional issues common among young students may have contributed too. Issues like these may not only create physical stress but also psychological stress. A study revealed that those who were under stress had 4.15 and 2.18 susceptibility to LBP than those who were not

experiencing stress (Atlas et al., 2007; Beyen et al., 2013). In a separate study, educating and managing young students are themselves sources of stress among teachers (Mariammal et al., 2012).

Whereas in college, apart from having the most number of single and male teachers, the low prevalence rates reported were probably due to greater academic freedom enjoyed by teachers allowing them to have control over the demands of their teaching load. It has been postulated that high work demands and low authority over decisions may cause WMSDs while feelings of being in command inhibit stress (Eriksson, 1996). Likewise, the number of childless teachers was relatively higher than HS, ES and ECS too, thus they were free from childcare duties and had more rest time, and only a few had 3-4 children (17.5%). A study in Salvador observed that teachers with three or more children were more likely to report MSDs than those with one or two children (Cardoso et al., 2009). Their workload was also relatively lower (Table 1) and it is possible that those teachers with doctoral degrees had graduate school teaching load where students were few and highly independent and motivated. However, the low prevalence rates among HS teachers is surprising when factoring in workload, gender composition, and the number of teachers with 3 – 4 children (Table 1), and the amount of stress they had when dealing with adolescent's behavioral, mental, and emotional issues. It was probable that older HS teachers with longer experience may have already developed mechanisms to cope with these demands and challenges. This may include employing of family members doing the marking or typing, recycling of old test questions on computer, availing of the therapeutic effects of massage and enrolling themselves in health and wellness programs. Overall, the study findings revealed that teachers are exposed to WMSDs, which may pose a serious threat to the quality of teachers and teaching in the years to come if left unattended.

Job demands and job-related physical activities

Another purpose of this study was to determine teaching demands and physical activities predisposing teachers to assume non-neutral postures. Majority of the respondents ranked conducting lectures, test and evaluation of students, and computer work as the top three most common job demands that they performed 3-5 times in a given week and consumed 6-7 hours of their working hours (Table 1), of which majority was spent in standing

followed by sitting, walking, carrying, handling, reaching above head, and trunk bending (Tables 3 and 4). This is expected given the nature of their academic assignment. These demands and physical activities have been known to cause neck, shoulder and back problems among teachers as reported in several studies (Erick & Smith, 2014; Darwish & Al-Zuhair, 2013; Grant et al., 1995; Yue et al., 2012). Incidentally, these were the same body parts affected in this study.

Meanwhile, just as prevalence rates variation existed in this study, so did the job demands suggesting the variability of risk exposure across groups. In contrast to college, SBE teachers ranked test and evaluation of students first while observing and assisting students, and paperwork as additional demands for HS, ES and ECS, respectively. These demands are sedentary, and may involve non-neutral postures such as neck bending and twisting resulting from frequent reading, writing or typing and possibly even trunk bending with arms extended outward for reaching while seated for long periods of time. Prior researches have attributed these demands, activities and postures to musculoskeletal injury to these body regions among teachers. In this study, one possible reason to this variation could be the varying levels of academic freedom in SU as a school of higher learning that allows college teachers more especially a greater degree of autonomy and flexibility. Given their academic expertise in their field of specialization and the nature of their learners, this autonomy provides them with greater professional input and control in designing their syllabus as they work within the limits permitted by their respective departments pursuant to existing academic standards and government regulations. For instance, they can choose oral over written examination including the number of examinations or quizzes in a semester; individual or group graded reporting over pen and paper examinations which would mean less after class marking.

Another reason could be that education in the primary, secondary and tertiary levels is totally different in terms of curricular content, purpose, orientation. The same goes for student composition and characteristics. Just as the needs of students in each group differ, so do the kind of education, assistance, and demands required. Given students' age and level of knowledge and maturity, SBE teachers had to closely supervise and provide assessment-based academic guidance to students to determine if they met the required level of mastery. Given the sequential nature of their curriculum, they had to periodically monitor progress and direction through worksheets and

frequent formative assessments/quizzes. In this study, more than 70% of SBE teachers had test and evaluation of students suggesting they had more assessments in their syllabus or lesson plan than in college which may result to higher observing and assisting of students, and paperwork. They do this for 7-8 hours and more frequently than college teachers (Table 1). In this case, it is possible that SBE had to deal with a higher workload, frequent and longer sitting and neck bending postures, and pressure thus exposing them more to musculoskeletal stress than others and possibly to psychological stress too especially when responding to feedback and complying with grade deadlines. If a task creates more psychological demands, the body is more susceptible to any kind of musculoskeletal disorder affecting body regions (Hestbaek et al., 2004). A study in China mentioned workload, number of examinations, and pressure to graduate students as factors causing higher prevalence rates among senior HS teachers (Yue et al., 2012).

One possible reason for a higher workload in college though is teaching overload, which can be limited administratively or by choice. Another reason is the frequent use of computers, which is the highest in this group at 61.5%. Computer use has been suggested to expose users to shoulder, neck and back injury (Ayanniyi et al., 2011; Andersen et al., 2008). For both SBE and college teachers, the amount of load and number of overloads and students (i.e. oversized class) per class may add up to the load and time they need to spend in their office or at home sitting thereby increasing the likelihood of working beyond the regular office hours compromising the body's ability to repair itself adequately. Previous study in Britain had linked overtime work done after returning home as the most frequently identified risk factors due to work (Dodd, 1997) because workers deprive their bodies of rest and recovery increasing risk of developing WMSDs (Eltayeb et al., 2007; Tornqvist et al., 2009). Overall, the results demonstrate differences in the experience of WMSDs among teaching groups suggesting that risk exposure is varied within the profession and the conditions surrounding them as well as the possibility of demographics dictating their susceptibility to these disorders.

Moreover, the extent of influence of academic policy and culture while taking into account student differences in developmental levels, and the degree of administrative control on work which all translate to varying levels of flexibility and freedom across teaching groups "make and break" teaching demands and WMDS predisposition. With the new K-12 curriculum due for implementation, this scenario may impact college teachers moving to

senior HS who are now faced with the certainty of adapting SBE's academic curriculum, policies and culture; and SBE teachers who are now faced with the possibility of a much higher workload despite of no additional teaching load or hours. With K-12, new teaching aids or materials have to be prepared for the new subjects and several assessments (e.g. self-assessment, formative assessment, summative assessment) have to be done to determine students' interest, strengths, knowledge and mastery of the subject as they move towards a spiral curriculum. Assessment also includes aptitude test, a career assessment examination, and an occupational interest inventory. Senior HS students are also expected to take national and competency certifications (Official Gazette, n.d.), which may add stress to teachers. In total, the results highlight the other stressful side of teaching reinforcing the observation that the differing nature and multiple demands of teaching work, school's academic policies and culture, level of administrative controls, and student characteristics may play an important role in exposing teachers to musculoskeletal injury and thus should be considered in designing appropriate intervention strategies.

Working postures and teaching

The other purpose of this study was to determine if classroom work have predisposed teachers to assume unhealthy working postures. Based on the results, the classroom working posture was generally similar across teaching groups. The neck was in non-neutral posture (i.e. bent forward, backward or sideward and twisted) while the arms (i.e. arms below shoulder level), legs (i.e. standing on one or both legs straight, walking, and sitting) and back (i.e. straight) generally were in neutral posture. The assumption of this posture was obviously influenced by workplace and teaching job characteristics where teachers were expected to bend and rotate their neck to either side, move one or two arms to get their point across, stand, walk, and occasionally sit to address a large group of students in the classroom. Teachers assume this posture to gain and hold students' attention inside the class (Grouws & Cebulla, 2000).

The result also showed postural variation across groups in the neck, back, arms, and legs. Teachers in ES and ECS assumed majority of the non-neutral postures of the neck, arms, back, and legs in comparison to those in HS and college. This suggests that non-neutral postures such as neck

bending and twisting, one arm or both arms above shoulder level, trunk bending/twisting, standing on one or both legs bent and kneeling were more commonly adopted by teachers in ES and ECS than in HS and college. Most of these non-neutral postures were reported as physical activities in Table 4, which is consistently higher in this teaching group. A similar case was observed among pre-school teachers where they were seen kneeling, sitting on the floor, lifting, squatting, and bending at the waist while working with smaller children (Grant et al., 1995). There was also a positive association between furniture and adoption of inappropriate body posture among teachers (Cardoso et al., 2009). Thus, it is possible that classroom furniture, age and physical attributes of students have contributed to the variation. Chairs and desk, more especially in ECS, the size of students in both ECS and ES are generally smaller prompting them to adopt non-neutral postures during teaching. Meanwhile, one or both arms raising could be due to differing nature of learners, and availability of resources where class demonstration activities were perceived to be more appropriate and effective over plain lecture-discussion to improve understanding, where using traditional teaching materials (e.g. visuals or flash cards via the board) was preferred over power point, and where arm movement combination was more effective and readily available to help young students learn class activities easily or stay focus and connected over other teaching media (e.g. YouTube). Non-neutral postures in HS and college particularly trunk and neck bending and twisting, and knee bending are probably more on individual teaching style (e.g. board writing while talking), class content (e.g. laboratory class with psychomotor components), and classroom workstation (e.g. textbooks and other teaching materials/aids, overhead projectors or computer placed on low surface height tables during teaching).

Meanwhile, neutral postures are generally high in the legs. This means teachers either stand or walk most of the time inside the class. This is expected in a classroom environment where such postures project teachers as experts and providing facts to students. Despite being neutral, these working postures place loads on the weight-bearing structures of the musculoskeletal system (Ostrom, 1993) and are tiring for they require several muscles to contract in maintaining an upright position. If postural change is infrequent they may lead to WMSDs especially in the ankle and foot – body parts that prevented them from doing work (Table 2). Since prolonged standing without the ability to sit down has been shown to be the

most significant predictive factor for the development of low back pain at work (Tissot et al., 2009), occasional sitting on saddle chair while teaching may help. A saddle chair lowers fatigue by reducing muscular contraction and promotes good spinal alignment (Canadian Centre for Occupational Health and Safety [CCOHS], 2015). As for the non-neutral postures in the legs, majority was assumed by ES and ECS teachers. This is likewise expected since knee bending, squatting, or kneeling allow them to engage and listen to young students at eye level, get their attention while eliminating the intimidating posture of standing in class, and in the process, create a warm and caring environment. It appeares that ES and ECS teachers have more body movements that may help reduce sedentary behavior and improve learning, but if they would go beyond tolerance or repair levels, they might be more prone to physical exhaustion and eventually to WMSDs. Also, prolonged and frequent arm-raising posture is unhealthy for it causes static neck and shoulder contraction leading to muscle fatigue, pain, numbness, and soreness (Bullock, 2000; US Department of Labor, 2011). College and HS teachers possibly see these movements unnecessary, even disrupting at times so they minimize them considering that their students are quite grown-up, more mature, focused, responsible and mindful of their behaviors.

Since these postures and physical activities (e.g. body movements) are indispensable and inevitable components of teaching, they can be minimized in order to protect teachers. For instance, during lesson planning or syllabus-making phase, it may help to include teaching and learning strategies that break up the lecture and for students to engage more in class and incorporate class activities that minimize assumption of a single posture or reduce the time spent in each posture. Postural variation allows overwork body parts to rest and recuperate. This is feasible in teaching because it's not restrictive unlike other professions and so teachers can always change posture anytime. In addition, long duration and large classes with or without heavy board writing should have adequate rest periods in between. Depending on the purpose, a 5-10 minute break is beneficial especially for back discomfort (Van Dieen & OudeVrielink, 1998). To minimize neck twisting, teachers may face and talk to students only after board writing and to help minimize neck and trunk bending, they may use a podium, computer-generated visuals (e.g. power point) and a laser pointer. Teacher's height may be a factor too, so the use of elevated platforms inside classrooms may be considered or reviewed if they encourage non-neutral postures. To

minimize arm raising above shoulder level, teachers can maximize available multimedia resources of the university (e.g. YouTube educational videos that meet intended learning objectives or outcomes) or vary their class activities and if board writing is unavoidable, reach within the point of comfort. If discomfort or soreness persists, then medical or rehabilitative intervention is recommended and should incorporate preventive controls that include but not limited to physical conditioning, proper posture training, and symptoms detection so that rest and posture modification can be done at once. This is especially important in the sciences like Nursing where they have 3-hour classes. Unfortunately, OWAS observation was limited to the conduct of lecture, thus a thorough postural study covering all aspects of teaching is warranted to identify other aspects of tasks and subtasks that may force them to adopt non-neutral postures.

Workstation Quality

Using the guidelines designed by ergonomic experts, the result of the workstation assessment revealed several inadequacies in the present workstation that may have influenced teachers to adopt inappropriate postures. The checklist revealed that more than 50% of workstations were not designed to accommodate the varied tasks of teaching. First, more than 50% of the chairs do not have an armrest. This deficiency exposes the cervical and shoulder muscles to contract continuously causing static muscle contraction, fatigue, and pain in these regions, and even injury in the lower back (Khalil et al., 1993). Likewise, non-adjustable or improperly adjusted armrests may fail to provide adequate support to the upper limbs, and some parts of the upper back and head, and may expose teachers to awkward postures. For instance, armrests that are too low may cause teachers to adopt uneven and awkward postures when leaning over on one side. A too high armrest on the other hand may cause them to raise shoulders. Both can result in muscle tension and fatigue in the neck, shoulders and back. For low armrest, a small pillow may be placed in between the armrest and forearm to comfortably position the upper limb on the armrests with elbow at 90 degrees and shoulders relaxed. A high armrest may be removed if it prevents proper positioning of the chair to allow comfortable reading and typing distance; or restricts sit to stand and turning movements (WorkSafeBC, 2009).

Second, office chairs lacked lumbar support and appropriate material and design. A proper backrest should support the entire back including the lower region and provide a comfortable posture that permits frequent variation in a sitting position (WorkSafeBC, 2009). Majority (83.33%) of the chair had a backrest but the shape provided inadequate support to the back. Hence, teachers may not have sufficient support to their spine while seated doing deskwork or computer work leading to a continuous trunk muscle contraction to maintain it in the upright position. To address this, teachers may place a comfortable pillow between the back and backrest and a rolled-up towel or small pillow to the curve of the lower back as lumbar support and position them until they feel comfortable and relaxed without impeding upper limb and trunk movements. There is also no porous breathable, rough texture material cover to facilitate good heat dissipation and adequate circulation to the area distal to it (Khalil et al., 1993; Hermenau, 1995). This may compromise nutrient delivery to the muscles and possibly create discomfort.

Third, though the seat pan provided secured support to teachers and were mostly adequate to the body's contour, majority were not upholstered with slightly porous and rough material that helps prevent direct contact between pressure points and soft tissues, and ensures proper heat dissipation and adequate circulation in the area (Environmental & Occupational Health & Safety Services [EOHSS], 2008). More than 50% of these were not designed to distribute pressure evenly exposing them to contact stress and less than one-third was found to have well-rounded edge (waterfall design). This means that a greater percentage of teachers were exposed to an increased pressure to the underside of their thigh and leg that may compromise blood circulation to the lower legs (US Department of Labor, 2011), and possibly compress the sciatic nerve (Hermenau, 1995). A soft flat, well-upholstered cushion may be placed in between the buttocks and seat pan. Teachers may also stand and walk whenever they feel uncomfortable.

Finally, seat height should be adjustable to accommodate the desk height requirements consistent with office tasks. The seat height in this study was not adjustable and more than 50% was set either too high or moderately high relative to the knee fold. A seat that is set too high can cause teachers to lean forward to place the feet on the floor thereby depriving them of the backrest for support. This is risky since it increases static muscle work to the back muscles and makes it more difficult to maintain the S-shape

of the spine (Hermenau, 1995). In this unsupported position, mechanical stress on the lumbar spine increases by 35% that when exceeding the body's tolerance and repair capabilities, the effects manifest in the form of neck, and shoulder pain, upper and lower back discomfort, muscle fatigue, restricted circulation, and even headache (Khalil et al., 1993; Leggat & Smith, 2006). A desirable seat height in a seated workstation is when the upper extremities rest comfortably on the desk, the forearms are angled between horizontal to 20 degrees up, elbows are between 90 and 120 degrees, and the trunk within 30 degrees of upright position (Canadian Center for Occupational Safety and Health [CCOHS], 2015). This allows teachers to load their musculoskeletal system properly and position themselves comfortably and favorably in relation to the working table/desk as they sit for several hours in their offices reading or preparing examinations/quizzes or lectures, doing word processing, marking, researching in front of computers. Unfortunately, the present workstation has poorly designed chairs, which can lead instead to poor sitting habits, and place undue stress to the musculoskeletal system (Khalil et al., 1993). To help address these deficiencies, a good ergonomic chair in all academic offices is beneficial for it securely supports the weight of the body, provides comfort and is adjustable (Keyserling, 1986). It can provide varied, but appropriate body postures that ensure adequate blood circulation, reduce load on the back, and allow freedom of movement (Khalil et al., 1993; Keyserling, 1986). A study conducted by Rempel et al., in 2007 demonstrated that an adjustable height task chair with a curved seat pan can reduce neck and shoulder pain severity among sewing machine operators.

Meanwhile, in a standing workstation, the work surface (i.e. table) should be designed to keep it optimally compatible with the physical characteristics of the user and requirements of the tasks (Hermenau, 1995; Khalil et al., 1993; Ostrom, 1993). Adjustability is important because when tasks are executed in work surfaces that were designed either excessively high or low over time without adequate rest, they can create discomfort, fatigue, and stress to the neck, shoulders, and back musculoskeletal structures (Richardson, 1994; Ong & Kogi, 1992; Hermenau, 1995; Ostrom, 1993). In the present study, working tables were too low for a standing posture during lecture and sometimes were used for computers, books, and overhead projectors. This forces teachers to bend their trunk, and possibly their knees too and twist their neck every time they glance or read a line

from a book or to operate a projector or change slides. This is not only unhealthy but also disrupting to students. For a standing workstation, surface heights should be 5 cm above elbow height to keep trunk upright (CCOHS, 2015). A podium and use of a laser pointer may help. If it is too high, a platform to step on is needed to help maintain a good posture.

CONCLUSION AND RECOMMENDATION

The results showed that an overwhelming number of teachers reported pain or trouble in the last three months and the most prevalent body part affected was situated in the shoulder followed by the back and neck. Majority of the respondents perceived their symptoms to be partially and absolutely work-related suggesting their awareness of the role of work situations in WMSD development. Incidentally, the matter must have not been seriously looked into or was not considerably alarming to cause personal or institutional attention. Although the present study had inherent limitations because both exposures and outcomes were based on self-report, which may be influenced by participants' biases, certain procedures were however adopted to minimize these. All respondents were informed that their privacy was assured and reports were treated with utmost confidentiality. Nevertheless, this study was an important initial step in minimizing WMSD prevalence for it provided a picture into the kind of risk teachers are exposed to in the academe. Particularly, the job demands and the workstation deficiencies which had predisposed them to assume working postures, that if maintained over time without rest and postural change, are unhealthy to their musculoskeletal system. Under these circumstances, it is reasonable to suspect that teachers with similar working conditions are at risk of developing the disorder and may pose a serious threat to their health, economic stability, educational quality and productivity if left unattended. The results also demonstrated differences in the experience of WMSDs among teachers, where SBE teachers appeared to be more susceptible suggesting that risk factors and exposure were varied within the profession and across teaching levels. In this light, the present prevalence of symptoms and demographic profile of teachers stress the importance of having a range of strategies or opportunities at their disposal to reduce risks posed by their work and avoid injury. Therefore, all stakeholders need to be mindful when making administrative and personal decisions and initiate plans to improve

teacher's physical working conditions and help promote a safe workplace and a healthy workforce based on the following recommendations:

1) There should be ergonomics education and training programs for all stakeholders especially on WMSD risk factors, signs and symptoms. These programs should highlight the role of risk factor awareness and identification in early detection or recognition of WMSDs so that symptoms experienced can be immediately addressed either or both medically and ergonomically before they become disabling injuries. It should also include instructions on proper body mechanics, healthy working postures, and timely postural or activity change/breaks to avoid monotonous, repetitive activities. It should be long-term and integrated into the daily work tasks in and out of campus, and thus should be institutionalized;

2) There should be health and wellness programs that promote healthy lifestyle and active living through regular fitness and strength conditioning activities. A free gym membership or gym for employees may be considered in the campus. Educational flyers or posters showing simple office exercises and proper body mechanics should be posted in strategic places on campus;

3) There should be a multidisciplinary occupational health and safety unit (OHSU) that is tasked to investigate high-risk workstations or situations associated with WMSDs, and implement controls to prevent its development. For this to be successful, teachers are encouraged to report unhealthy practices or harmful workplaces and to recommend practical solutions. Absences or hospitalizations due to work or related to WMSDs should be reported too and all reports/investigations should be kept and maintained as ergonomic database for research, surveillance, and other purposes;

4) The administration should invest in modifying existing risky workstations to accommodate the varied tasks of teaching in both standing and seating by providing height-adjustable work

surface in the classroom and functional ergonomic chairs in faculty offices to allow proper body positioning and placement of computers, books, and other teaching aid/materials. It should also invest on new technologies that can aid teaching and install them in classrooms and faculty offices;

5) The administration should prioritize the needs of female teachers especially those with children by consulting them during teaching load preparation and assignment. This will allow them to have control over their tasks as they balance teaching activities and parenting responsibilities over each working day. Meanwhile, to minimize mental and physical exhaustion, the use of break times in order to regain vigor or unload stressed structures must be ensured by institutionalizing breaks and stretching or short exercise as a class activity; and

6) Since this study cannot provide information in predicting injuries, longitudinal and cohort study should be done in future researches. Studies exploring the statistical interaction and precise relationship between other factors like psychosocial demands and other aspects of the physical, socio- demographic, organizational environment, and WMSD occurrence have to be done as well.

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NOTE SECTION

Impact of the 2011 Typhoon "Sendong" (Washi) on the Coral Reef of Apo Island Marine Reserve, Dauin, Negros Oriental, Philippines

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On December 16, 2011, a severe Tropical Storm 'Sendong' (International name: Washi) hit Negros Oriental. The typhoon caused strong wave surges in Apo Island and the coastline of Negros. The typhoon damaged the eastern section of the island where the marine reserve is located. Survey of the protected area showed live hard coral to be 0.53± 0.68%.

INTRODUCTION

On December 16, 2011 super typhoon "Sendong" (International name: 'Washi') hit Negros Oriental resulting in great damage to life and properties. The typhoon also hit the eastern section of Apo Island where the 22-ha marine reserve is situated.

The marine reserve was established in 1984 and in 1994, the whole island was declared a protected landscape and seascape by Pres. Proc. No. 438