Introduction

Teaching is said to be the ‘mother of all professions’ and is also often regarded as a stressful occupation [1]. Teachers are prone to various types of physical and psychological health issues caused by work-related factors. One of the most common physical health complaints in the teaching profession is musculoskeletal disorders (MSDs) [2–4]. The National Institute for Occupational Safety and Health (NIOSH) defines MSDs as a group of conditions that involve the nerves, tendons, muscles and supporting structures of the body [5]. This diagnosis includes a wide range of disorders which can differ in severity from mild, periodic symptoms to severe, chronic, and debilitating conditions. Examples include carpal tunnel syndrome, tension neck syndrome, and lower back pain.

According to the International Labour Organization (ILO), activities and environments with particular risk factors for MSDs include those with rapid or repetitive motion, forceful exertion, concentration of excessive mechanical force, awkward or non-neutral posture, and vibrations [6]. Teachers are exposed to these risk factors, for example when writing on the blackboard with the arms extended, and other awkward postures like bending and stooping when teaching and assisting...
students with learning difficulties. They are also exposed to long hours standing during teaching and prolonged sedentary position when planning lessons and doing paperwork, in particular when recording students’ output. Darwish and Al-Zuhair reported a high prevalence of musculoskeletal pain disorders among 240 secondary school female teachers in Saudi Arabia, with a high percentage of teachers claiming to have disabling pain which may have resulted in their inability to return to work [7]. A 2014 study documented a 55% prevalence of lower back pain among teachers, with 67.1% reporting minimal disability [8].

The effect of MSDs on productivity in the teaching profession among developing countries is vague and often unquantified, but several studies have proved that MSDs lead to ill health at retirement age in many professions, including teaching, in developed countries [9–11] and can result in the inability to return to work [8, 12]. A recent report in Korea among school workers found that the self-reported symptoms of MSDs was 79.6%. Based on that survey, the medical care used over 7 days was 36.4% and sick leave because of musculoskeletal disease was 7.3% [13]. In the US, back pain alone accounted for more than 264 million lost work days in one year [14]. For workers with musculoskeletal conditions (including back and neck pain, arthritis, and others), these lost work days add up quickly to an average of 10 days per worker every year, which is double or triple the cost of treatment, medications, and lost productivity, including lost wages.

According to a recent report from Bone and Joint Initiative [15], MSDs have both direct and indirect costs. The direct costs are within the healthcare system, such as treatments provided in clinics and hospitals, including emergency departments, and the cost of prescription medications. Between 1994 and 2014, the costs of MSDs represented an increased share of gross domestic product (GDP) from 3.44% in 1996 to 5.7% in 2014, exceeding defense spending for that year. Both costs and the impact of MSDs on the economy will increase unless current trends are reversed. In Britain, the estimated number of MSDs cases between the years 2011 and 2015 was 170,000. This was a huge contributor to the total cost of self-reported injuries and ill health in 2016/17, which was GBP 15 billion, in which the individuals bore the majority of the cost (GBP 8.6 billion) [16]. Further, a meta-review of literature from the Global Burden of Disease revealed that musculoskeletal conditions as a group caused 21.3% of the total of living with disability in the world [17], second to mental and behavioral problems. The number of people experiencing conditions of MSDs in low-income and middle-income countries is predicted to increase dramatically over the coming decades.

In the Philippines, Part IV Section 22 to 23 of the Magna Carta for Public School Teachers under Republic Act No. 4670 stipulates the promotion of health and injury benefits of teachers [18]. It also requires them to undergo a medical examination before taking up teaching and at least once a year during their professional life, free of charge. It further states that the effects of physical and nervous strain on the teachers’ health shall be recognized as a compensable occupational disease. Unfortunately, these sections of the law, as well as initiatives of this nature, seem to have eluded public school teachers when it comes to access [19]. Also, seminars related to the promotion of health and well-being of teachers and protection from work-related injuries seem to be less apparent in the Philippines. There is also a dearth of research directed towards investigating the effects of personal and occupational factors (e.g., age, sex, years in service, workload/demands, etc.) related to workers’ health in the teaching profession. Available data regarding the prevalence and risk-factors of different health complaints by teachers in the Philippines are anecdotal. If actions are to be taken into consideration for the improvement of teachers’ working conditions, there should be empirical evidence to substantiate and back up the need for improvement. This study was conducted because MSDs are one of the commonly experienced and widely neglected health complaints among public teachers.

The aim of this study was to assess the prevalence and distribution of MSDs among secondary school division teachers in the Philippines, and to determine the risk factors that influence the development of their symptoms.

Materials and Methods

1. Study population and sampling procedure

This cross-sectional study was conducted from Oc-
October to December 2015 in Calbayog City, province of Samar, Philippines. There were ten governmental secondary schools in Calbayog City division, with a total population of 403 permanently employed teachers. Only teachers with at least one year of service and in permanent employment were included in the study. Subjects who had previous or serious forms of musculoskeletal problems prior to the teaching job were excluded. The sample size was determined using Sl- ovin’s formula [20].

2. Instrumentation

Personal and work-related characteristics

Participation in this study was entirely voluntary, and was approved by the Calbayog City school division Research Ethics office. We met the identified respondents and distributed questionnaires after we asked permission from the Schools Division Superintendent and ten School Heads of Calbayog City division. We collected the fielded questionnaires from the study participants a week after the dissemination. They were asked to provide information regarding their age, sex, body mass index (BMI), number of children, and hours of sleep. They also answered questions related to work: years in service, daily working hours, number of classes per day, number of students per class, and salary in Philippine Pesos (PHP).

Musculoskeletal disorders

The English version of the musculoskeletal symptom questionnaire developed by the Korea Occupational Safety and Health Agency (KOSHA) was used as the diagnostic tool [21]. This MSDs diagnostic questionnaire was patterned from the National Institute for Occupational Safety and Health (NIOSH). Although this material had been used in previous studies [14, 22–25], the researchers conducted a pilot survey to test its reliability among Filipino teachers. Particularly, the questionnaire estimated pain in different parts of the body such as the neck, shoulders, arms, elbows, hands, wrists, fingers, waist, legs and feet.

3. Statistical analysis

We treated the data using the Statistical Package for Social Sciences (SPSS) software version 23 (IBM, NY). Descriptive statistics were used to quantify the prevalence of MSDs, presented in percentages, arithmetic mean, and standard deviations (SD). Pearson’s chi-square tests were performed to compare relationships between MSDs across personal and work-related characteristics. Multiple logistic regression analyses were used to estimate the degree of association between personal and occupational variables. All of the independent variables were simultaneously entered in the analyses of the data. The results were controlled for age (20–40 or ≥41), sex (male or female), BMI in kg/m² (underweight <20 kg/m², normal 20–24.9 kg/m², overweight 25–29.9 kg/m², and obese >30 kg/m²), number of children (none, 1–3, and ≥4), hours of sleep (5–8 or ≥9), years in service (<5, 5–15, and ≥16), daily working hours (4–8 or ≥9), number of classes per day (1–5 or ≥6), number of students per class (30–50 or ≥51), and salary in PHP (18,000–20,000 or ≥21,000). The cutoff points used in this study for dividing continuous data were influenced by the small number of samples [3, 7, 14, 24]. An odds ratio (OR) of ≥1 was considered a contributor to MSDs, while an OR of <1 was considered a protective factor. Multicollinearity of some predictor variables was determined through variance inflation factor (VIF). A value greater than 2.50 determined presence of multicollinearity. The alpha was set at 0.05.

Results

General characteristics of study population

The general personal and occupational characteristics of the study population are shown in Table 1. A total of 200 teachers participated, with a 100% response rate. The teachers had a mean age of 36.3 years, 34% were males and 66% were females. The mean BMI was 24.9 kg/m², considered to be within the normal range. The mean number of children was 2, and the mean hours of sleep was 7.2. In terms of occupational factors, the mean years of teaching was 10. The mean daily working hours was 8.3. The teachers had an average of 6 classes per day, with a mean of 55 students per class. The number of students per class was determined through their general weighted average (GWA), resulting in lower attendance in some classes and more in others. Although the standard class size was 45, it should be noted that apart from their GWAs, the popu-
lation of students per class and number of classes per day depended greatly upon the location of the school. For instance, teachers assigned to remote rural high schools had fewer students per class compared to their counterparts teaching in schools along car-lines or near the city proper. Results also show that the average monthly salary of the teachers was PHP 19,852.

Musculoskeletal disorders and associations from Chi-square test

One hundred and forty-nine of the subjects (74.5%) reported total musculoskeletal pain prevalence (Table 2). The body parts with the highest prevalence were the lower back (56%) and leg/foot (56.5%). This was followed by neck (47.5%) and shoulder (45%), hand/wrist (44%), and arm/elbow (33%). Table 3 shows the prevalence of MSDs based on age, sex, BMI, number of children, and hours of sleep. Between the two age groups, teachers aged 41 and above showed a higher prevalence of MSDs (83.6%) than those in their 20s to 40. High prevalences were seen in other personal and work-related groups, such as in the obese (80%), teachers with 4 or

| Table 2. Degree and pattern of musculoskeletal disorders (MSDs) of study participants |
|---------------------------------|-----|-----|
| Musculoskeletal Disorders       | With MSD (%) | Without MSD (%) |
| Overall MSDs                    | 74.5 | 25.5 |
| Site of pain                    |      |     |
| Neck                            | 47.5 | 52.5 |
| Lower back/Waist               | 56.0 | 44.0 |
| Shoulder                       | 45.0 | 55.0 |
| Arm/Elbow                      | 33.0 | 67.0 |
| Hand/Wrist                     | 44.0 | 56.0 |
| Leg/Foot                       | 56.5 | 43.5 |

n = 200
more children (85.2%), 5 to 15 years of service (83%), teachers with higher numbers of working hours per day (77.7%), larger numbers of students in a class (77.9%), and teachers with a monthly salary of PHP 21,000 or more (86%). Statistically significant relationships were found between MSDs and age ($P = 0.032$) and monthly salary ($P = 0.045$), respectively.

Musculoskeletal disorders and associations from logistic regression

A summary of the results of the logistic regression is shown in Table 4. The results show that both personal and occupational variables demonstrated ORs of 1 or with close proximity to 1 for the overall musculoskeletal prevalence and for each body region. However, the overall prevalence of MSDs in terms of sex had ORs of 1.36 (95% CI: 0.64–2.85), which indicates that female teachers were 1.36 times more likely to experience MSDs symptoms than male teachers. In contrast, teachers who worked 4 to 8 hours per day were less likely to develop MSDs (OR=0.80 95% CI: 0.52–1.22) than those who worked 9 hours or more. Moreover, male teachers were less likely to develop MSDs pain in the neck (OR= 0.81 95% CI: 0.43–1.53), lower back (OR= 0.72 95% CI: 0.37–1.42), shoulder (OR= 0.88 95% CI: 0.45–1.71), arm (OR=0.66 95% CI: 0.32–1.35), hand (OR= 0.83 95% CI: 0.43–1.61) and leg (OR= 0.82 95% CI: 0.42–1.62). Those who had 5 to 8 hours sleep were 1.16 more likely to experience shoulder pain (OR= 1.16 95% CI: 0.89–1.52). Teachers who worked 9 hours or more each day had a higher odds of developing lower back pain (OR= 1.20 95% CI: 0.82–1.75), shoulder pain (OR= 1.10 95% CI: 0.75–1.61), arm pain (OR= 1.22 95% CI: 0.80–1.87), and pain in the hand or wrist (OR=1.36 95% CI: 0.92–2.00). The results also show that those who had 6 classes or more each day were more likely to develop neck and shoulder pains (OR=1.14 95% CI: 0.83–1.58; OR=1.22 95% CI: 0.86–1.73). Significant relationships were also found between BMI and lower back pain ($P = 0.046$), age and leg pain ($P = 0.001$), and compensation and wrist pain ($P = 0.019$).

Table 4. Prevalence of MSDs and the adjusted association with personal and work-related characteristics and MSDs

| Variables               | Overall MSDs | Neck | Low back/Waist | Shoulder | Arm/Elbow | Hand/Wrist | Leg/Foot |
|-------------------------|--------------|------|----------------|----------|-----------|------------|----------|
|                         | OR           | 95% CI | OR           | 95% CI | OR          | 95% CI | OR          | 95% CI | OR          | 95% CI | OR          | 95% CI |
| Personal                |              |       |              |          |             |         |             |         |             |         |             |         |
| Age (y)                 | 0.99         | 0.94–1.04 | 1.01 | 0.97–1.05 | 1.03 | 0.99–1.07 | 1.04 | 1.00–1.08 | 1.04 | 1.00–1.08 | 1.02 | 0.98–1.06 | 1.07 | 1.03–1.12 |
| Sex (M/F)               | 1.36         | 0.64–2.85 | 0.81 | 0.43–1.53 | 0.72 | 0.37–1.42 | 0.88 | 0.45–1.71 | 0.66 | 0.32–1.35 | 0.83 | 0.43–1.61 | 0.82 | 0.42–1.62 |
| Body mass index (kg/m²) | 0.98         | 0.93–1.04 | 0.99 | 0.95–1.04 | 0.95 | 0.91–1.00 | 1.01 | 0.97–1.05 | 1.00 | 0.95–1.04 | 0.95 | 0.90–0.99 | 1.00 | 0.96–1.05 |
| Number of children      | 1.01         | 0.80–1.28 | 0.96 | 0.79–1.17 | 0.94 | 0.76–1.16 | 1.01 | 0.82–1.24 | 0.93 | 0.75–1.15 | 0.92 | 0.76–1.13 | 0.83 | 0.67–1.03 |
| Hours of sleep          | 0.92         | 0.68–1.24 | 1.02 | 0.79–1.31 | 1.04 | 0.79–1.35 | 1.16 | 0.89–1.52 | 1.04 | 0.79–1.38 | 0.88 | 0.67–1.15 | 0.97 | 0.74–1.27 |
| Work-related            |              |       |              |          |             |         |             |         |             |         |             |         |       |
| Years in service        | 1.05         | 0.99–1.11 | 0.96 | 0.91–1.01 | 0.90 | 0.85–0.96 | 0.92 | 0.87–0.97 | 0.92 | 0.86–0.97 | 0.97 | 0.92–1.03 | 0.93 | 0.88–0.98 |
| Daily working hours     | 0.80         | 0.52–1.22 | 1.02 | 0.71–1.48 | 1.20 | 0.82–1.75 | 1.10 | 0.75–1.61 | 1.22 | 0.80–1.87 | 1.36 | 0.92–2.00 | 1.11 | 0.76–1.62 |
| Number of classes per day | 1.03       | 0.72–1.46 | 1.14 | 0.83–1.58 | 1.05 | 0.75–1.46 | 1.22 | 0.86–1.73 | 1.05 | 0.70–1.56 | 0.83 | 0.59–1.17 | 1.07 | 0.77–1.49 |
| Number of students per class | 1.00        | 0.91–1.09 | 1.00 | 0.93–1.07 | 1.05 | 0.98–1.13 | 1.04 | 0.96–1.11 | 1.04 | 0.96–1.12 | 0.99 | 0.92–1.06 | 1.02 | 0.95–1.10 |
| Salary (PHP)            | 1.00         | 1.00   | 1.00          | 1.00   | 1.00            | 1.00  | 1.00           | 1.00  | 1.00            | 1.00  | 1.00           | 1.00  | 1.00          |

n=200, OR: odds ratio, 95% CI: confidence interval, MSDs: Musculoskeletal disorders, PHP: Philippine Peso
Logistic regression analysis adjusted with all above variables
Discussion

To our knowledge, this is one of the few studies, if not the first, to examine the prevalence and risk factors of work-related MSDs among teachers in the Philippines. Despite the drive and initiative of the government’s Department of Labor and Employment (DOLE) through its Occupational Safety and Health Centers (OSHC) to promote a healthy and safe working environment for workers, there has not been much research aimed at measuring work-related musculoskeletal problems among workers from different occupations, like those in the public schools.

The overall prevalence of MSDs in the present study was 74.5% among secondary public school teachers (Table 2). This high prevalence is not uncommon among teachers, as reported in recent literature [26-30]. Lower back and leg were the body parts with the highest prevalence of MSDs, followed by the neck and shoulder. Most of the personal and occupational variables were not related with MSDs complaints, except for age and salary, which were significantly related. These findings are in agreement with literature reports among school teachers in other countries such as Malaysia, Taiwan and Thailand [2, 3, 30, 31].

There was a significant relationship between age and MSDs in this study (P = 0.032). More than 80% of teachers aged 41 and above reported MSDs symptoms (Table 3). The results of our study agree with the findings of previous reports among Asian teachers [3, 4]. Age is a known risk factor for MSDs. Although research findings are inconsistent, a number of studies have reported a positive relationship between age and MSDs [32-35], finding that teachers who were 40 years old or above were more likely to develop the symptoms. Accumulated physical stress is a suspected reason for the association between age and MSDs in this study. The duties of the teachers do not decrease but increase as they age. For instance, the number of teaching hours and the amount of time spent in lesson planning, report making, and checking and recording students’ output are the same as newly-employed teachers. Older teachers are also required to perform supervisory tasks on top of their usual responsibilities in the classroom. The accumulated time standing, stooping or sitting throughout their career can pose a significant risk for the development of musculoskeletal symptoms. This, as well, agrees with a previous report that found work postures were related to MSDs in the teaching profession, and that awkward [36], repetitive and improper postures were known risk factors. It has also been suggested that the likely reason for a higher prevalence in older teachers is that as people age, there is gradual decline in muscle mass and they lose connective tissue elasticity and undergo a thinning of the cartilage between joints [37].

Our findings from univariate analyses showed no association between sex and prevalence of MSDs (P = 0.570). This contradicts a report among female Ethiopian teachers [34] that suggested an association with sex, with female teachers being at a higher risk of developing MSDs due to lifestyle. Female teachers in that region were less likely to be involved in regular physical exercise compared to their male counterparts. They also reported that female teachers had higher BMI compared to males. Among Filipino teachers, there seems to be no difference between male and female teachers in the amount of physical activity in school. Apart from the usual teaching and clerical work, female teachers are equally involved as their male colleagues in school activities such as training and coaching for sports and academic competitions. Aside from that, they are also more involved in domestic chores after work than their male colleagues. Hence, the lack of association between MSDs and sex in this study can be accounted for by the similarity of tasks performed by the teachers from both groups.

As to BMI groups, 36% of the subjects were in the normal category, while 17.5% were obese. Although the highest prevalence of MSDs was seen among teachers in the obese group, the differences across other BMI categories were small. Although BMI is an established determinant of MSDs, Karakaya and his team explained that conflicting findings with regard to this variable are thought to be due to different analysis methods used [4].

Most of our respondents had a salary between 18 and 20 thousand pesos (n=157). Those who received a salary of PHP 21,000 or more showed a higher prevalence of MSDs (86%). This variable showed a significant relationship with prevalence of MSDs, with an alpha of 0.045. As mentioned above, the basic tasks
of a newly hired teacher do not differ from their seniors, although as a teacher’s career progresses, compensation also increases. This is mostly true of those who qualify for promotion. Salary is directly related to years in service, qualifications and age. With an increase in salary come pressures and stress. That is to say, the correlation shown between salary and MSDs can be attributed to the effect of aging as teachers’ careers progress.

Length of service had a positive correlation with MSDs in several studies among Asian teachers [37–39], but we found no such association in the results of our univariate analyses. However, although the odds ratios from the regression analyses for the length of service and all body regions were close to 1, the $P$ values for this variable in relation to lower back, shoulder, elbow, and leg pain were statistically significant. This disagrees with the results found in the studies of Mohan et al and Karakaya et al among Malaysians and Turkish teachers [3, 4]. The distribution of the prevalence of MSDs across the groupings of teachers who were in the profession for less than 5, 5 to 15, and 16 or more years was similar to the present study, but since years in service is directly related to age, those who worked longer than their colleagues were more prone to develop MSDs symptoms, as previously discussed.

This study had a few limitations. The number of samples employed was small compared to previously published studies of MSDs in school teachers, which may have affected the results of association by confounding the abilities of socio-demographic and occupational factors with the prevalence of MSDs. For future studies, the researchers suggest to integrate a larger sample size, including both provincial and metropolitan teachers, for a wider scope and in-depth understanding of the status and prevalence of MSDs among Filipino teachers. The grouping of the population samples according to age, number of children, hours of sleep, years in service, daily working hours, number of students per class, and salary were collapsed in the present study because of the small number of participants. Some of these variables and their sub-groups may have affected the distribution of the prevalence of MSDs. Lifetime prevalence may also be of future interest, as well as the odds of acquiring disabling pain, its duration, severity, and other factors with the use of other standardized MSDs diagnostic tools.

The cross-sectional design of this study does not necessarily determine cause and effect; only correlations can be established. Lastly, although the instrument used is validated both internationally and locally, there is still a possibility of recall bias since the instruments were self-administered and responses can be subjective.

In conclusion, a high overall prevalence of musculoskeletal disorders was documented. Lower back, leg, and neck pain were also recorded as the most common complaints of the teacher-respondents. This study, one of the few MSDs studies in the Philippines, can arouse public awareness that, aside from common health complaints of teachers, MSDs merit concern. The findings of this research could also be a substantial reference for government agencies in the Philippines responsible for formulating and implementing policies, strategies and reforms that would alleviate the ill-health and increase the well-being of educators.

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Conflict of Interest

The authors declare no conflict of interest.

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フィリピンの州立高校教師における筋骨格障害の有病率およびそのリスク要因

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要  旨：筋肉および腱の痛みは教師にもっともよくみられる訴えのひとつである。本研究はフィリピンの公立学校教師における筋骨格系障害（MSDs）の有病率およびそのリスク要因を調査することを目的とした。フィリピンのサマル州カルバヨグ市地区の200名の公立中等学校の教師を対象とし、筋骨格系症状の分析には韓国産業安全衛生公社（KOSHA）のMSDs質問票（英語版）を使用した。回答者のMSDs有病率の確認には、度数および割合を計算した。カイ二乗検定およびロジスティック回帰を用いて、社会人口統計学的プロフィール、教育に関する変数およびMSDs有病率の相関関係を計算した。MSDsの全体の有病率は74.5%で、中でも脚（56.5%）、腰（56%）がもっとも高かった。年齢群（P = 0.032）と賃金群（P = 0.045）にMSDs有病率の有意差がみられた。フィリピンの公立中等学校において、MSDsを有する教師は非常に多く存在しており、学校管理者、カリキュラムおよび方針の立案者、その他の利害関係者は、教師の労働環境を改善すべきである。

キーワード：筋骨格障害、腰痛、リスク要因、教師、フィリピン。